

NO: R021

COUNCIL DATE: February 11, 2019

REGULAR COUNCIL

TO:	Mayor & Council	DATE:	February 6, 2019
FROM:	General Manager, Engineering	FILE:	4816-706
		XC:	5225-23
SUBJECT:	Development of a Surrey Coastal Flood Adaptation Strategy 2018 Year End Update and Disaster Mitigation Adaptation Fund Status		

RECOMMENDATION

The Engineering Department recommends that Council receive this report for information.

INTENT

The purpose of this report is to update Council on the development of the Surrey Coastal Flood Adaptation Strategy (“CFAS”) and the status of the City’s application to the Federal Government’s Disaster Mitigation Adaptation Fund (“DMAF”).

BACKGROUND

At its Regular Meeting on December 19, 2017, Council received Corporate Report No. R246; 2017 Development of a Surrey Coastal Flood Adaptation Strategy 2017 Year End Update. The purpose of that report was to update Council on the progress made in 2017 in developing CFAS. A five-phase approach to developing a strategy to address current flood hazards and proactively plan for long-term flood protection needs is underway and is currently in Phase 4 shown in Figure 1.

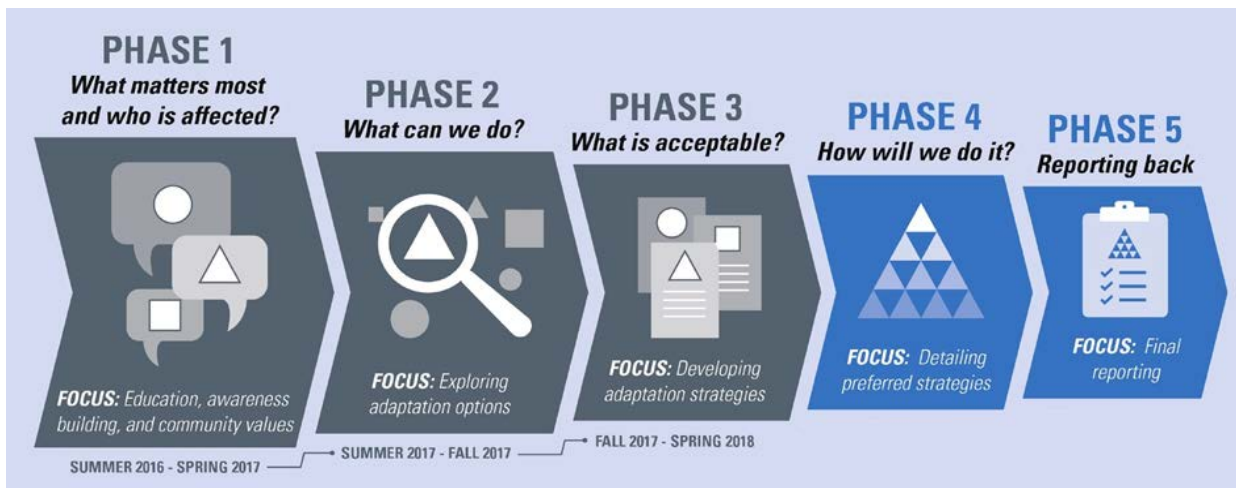


Figure 1. Phases of CFAS

The report also outlined the extensive consultation and engagement conducted to short-list preferred options for long-term flood management. Since that time, additional technical input and review has been completed, and the project team has received extensive public and stakeholder input on the short-listed options as part of CFAS Phase 3 to understand “What is acceptable?”

DISCUSSION

The actions required to adapt to coastal flooding may impact a range of sectors, stakeholders and partners throughout Surrey, and as such, staff have undertaken significant consultation. The information and feedback obtained from this consultation has been linked and integrated into the project’s overarching, participatory decision-making process. A high level of engagement in the project and decision-making process has been achieved to date. An iterative process of two-way information exchange has been established to guide development of the CFAS with stakeholders.

Phases 2 and 3: What Can We Do and What is Acceptable?

Having completed Phase 1 in 2017, the focus in 2018 was to understand “what can we do and what is acceptable?” Over 5,000 face-to-face participation hours took place through CFAS workshops as well as thousands of online engagement hours through online videos and interactive online surveys. A Phase 1 to 3 Engagement Summary Report has been prepared and attached as Appendix “1”, which summarizes the input received and details the project approach to incorporate public participation in developing long-term solutions.

A summary of Phase 2 and 3 activities, including key engagement events and activities that have taken place in 2018, are listed in Table 1.

Engagement Event/Activity	Dates	Overall Participants
Queen Elizabeth Secondary In-class Exercises	January 10, 2018	25
BC Hydro Meeting on CFAS	January 18, 2018	10+
University of Fraser Valley GEOG 304 In-class Exercises	January 15, 2018	20+
Water Talks organized by Canadian Water Resources Association	January 25, 2018	40+
Getting Climate Ready organized by Fraser Basin Council	January 25, 2018	50+
Public Survey on Crescent Beach with University of Fraser Valley	February 3, 2018	100+
CFAS Steering Committee	February 9 and March 26, 2018	12+
Panorama Ridge Secondary In-class Exercise	February 14, 2018	25
CitySpeaks Panel Survey and Open Community Survey on Mud Bay	February 14 to March 30, 2018	482
Crescent Beach Options Prioritization Workshop	February 21, 2018	35+
Semiahmoo Secondary In-Class Exercises	February 28, 2018	25

Engagement Event/Activity	Dates	Overall Participants
CFAS Advisory Group	March 9, 2018	20+
CitySpeaks Panel Survey and Open Community Survey on Crescent Beach	March 13 to April 6, 2018	609
CFAS Public Open House	April 9, 2018	40+
Surrey Council Committee presentations to ESAC, TIC, DAC, SHAC, AFSAC	April through July, 2018	50+
Classrooms to Communities Blackie Spit Park	May 4, 2018	50+
Earth Day Event (Blackie Spit)	June 3, 2018	30+
Envisioning a Resilient Delta hosted by Consulate General of the Netherlands	June 25, 2018	50+
Clayton Heights Secondary In-Class Exercises	June 5, 2018	25
Living Dike Roundtable meeting convened by Lower Fraser Fisheries Alliance	June 6, July 5 and July 18, 2018	15+
Semiahmoo First Nation Meetings	June 11 and July 23, 2018	5
Crescent Beach Property Owners Association Meetings	June 30 and July 4, 2018	120+
Planning Institute of BC	August 1, 2018	35+
BC Stewardship Roundtable	August 24, 2018	50+
Ministry of Transportation and Infrastructure Meeting	November 19, 2018	5
Ecosystem Vulnerability Workshop	November 27, 2018	25

Table 1: 2018 CFAS Engagement Events and Activities

A shortlisting process was developed to understand what types of approaches stakeholders and partners are in support of for year 2100, should one metre of sea level rise occur. No decision on long-range approaches is anticipated through the CFAS process. A spectrum of long-range options developed through the participatory planning process is helping to guide shorter term recommendations as part of Phase 4. Three study areas were established for CFAS, and an update is provided below on the long-range options for each of the areas.

Crescent Beach Feedback

Previous updates to Council identified that consultation involving the Crescent Beach area had identified the following options:

- Expanded Edge;
- Barrier Island;
- Mud Bay Barrier; and
- Managed Retreat.

Since that time, additional consultation has taken place, and with the agreement of the Crescent Beach Property Owners' Association, Managed Retreat has been taken off the table. No further analysis will be conducted on this option under CFAS.

The City will continue to evaluate the Crescent Beach community's preferred option of an Expanded Edge, and its second preferred option of a Barrier Island/Spit. Additional monitoring will be collected to inform future coastal flood management and adaptation plans, such as sea level changes, ground subsidence, long-term beach erosion, storm surge and wave damage, and seasonal water pooling.

For the foreseeable future, implementation of storm sewer upgrades, as set out in the Crescent Beach Climate Adaptation Study completed in 2009, will continue to be constructed in phases to better manage groundwater in the community.

Mud Bay Feedback

Previous updates to Council identified that consultation involving the Mud Bay area had identified the following options:

- Mud Bay Barrier;
- Current Conventions;
- Highway 99 Realignment; and
- Managed Retreat.

Since that time, additional consultation has taken place with directly impacted stakeholders on an as-requested basis. Based on discussion with the Ministry of Transportation and Infrastructure, Highway 99 Realignment will be renamed in the next phase.

For the foreseeable future, implementation of dyke upgrades, as set out in Corporate Report Ro47; 2016 on the Colebrook Dyking District, will be constructed in phases to reduce the likelihood of dyke overtopping. An adaptive approach that preserves a range of long-term options will be considered in CFAS.

Semiahmoo Bay Feedback

Previous updates to Council identified that consultation involving the Semiahmoo Bay area had identified the following options:

- Expanded Edge;
- Road & Land Raising; and
- No Adaptation.

Since that time, additional consultation has taken place with Semiahmoo First Nation. Semiahmoo First Nation's preferences of the options for Semiahmoo Bay are as follows: Expanded Edge, Road & Land Raising, and then No Adaptation. Since the Expanded Edge is not within the authority of Semiahmoo First Nation nor the City of Surrey, and would require relocation of the BNSF Railway, this option is beyond the scope of CFAS at this time.

CFAS Phase 4, How will we do it?

CFAS is focusing on the investments needed to improve infrastructure and increase flood safety over the next 10 years.

During development of CFAS Phase 4, the Federal Government announced the DMAF which aligned well with the objectives of CFAS and other City priorities for infrastructure upgrades.

At its Regular Council Meeting on July 23, 2018, Council endorsed Corporate Report No. R168; 2018 Expression of Interest and Application to Infrastructure Canada's Disaster Mitigation and Adaptation Fund that identified the core projects included in an expression of interest to Infrastructure Canada's DMAF in an effort to secure an average of 40% Federal funding.

Staff have worked closely with Infrastructure Canada to develop a suite of eligible projects that advance CFAS priority actions while meeting the DMAF program requirements. The City's expression of interest to DMAF titled Reducing Coastal Flood Vulnerability in the Coastal Lowlands of City of Surrey, City of Delta and Semiahmoo First Nation in British Columbia, through structural and nature based infrastructure works was short listed on October 12, 2018.

The suite of 13 eligible projects is summarized in the project map and table included as Appendix "II" and will improve community safety, address infrastructure deficiencies, and support long-term resilience to coastal flooding. Updated information on several aspects are provided below, based on the additional analysis and consultation completed during development of the DMAF Proposal.

- 1) 152 Street Increased Flood Control (\$19.7M)
As part of the 152 Street widening project, this scope is necessary to establish a flood resilient connection between North and South Surrey.
- 2) 152 Street FortisBC Gas Relocation (\$15M)
As part of the 152 Street widening project, it is anticipated that the relocation of two gas mains along the length of the City's road improvements will be required for safety. The City's estimated contribution is 10%.
- 3) 152 Street Local Water Main Relocation (\$1M)
As part of the 152 Street widening project, a provision to replace the City's local water main over the length of the road upgrades has been included in the Federal funding application. The scope will be reduced, if feasible, during detailed design.
- 4) Nicomekl Sea Dam Metro Vancouver Water Main Relocation (\$12M)
As part of the replacement of the Nicomekl Sea Dam, a large diameter water main connecting reservoirs in South Surrey with those in North Surrey needs to be relocated. The water main relocation is necessary for improved resilience and will accommodate future growth. No City of Surrey funding is required.

In addition to the City identified priority projects for Federal funding, the following four projects address either specific City infrastructure vulnerabilities or are entirely externally funded and submitted by the City on behalf of another organization. In discussion with Infrastructure Canada, it was established that projects involving partnerships with multiple organizations aligned best with the merit criteria of the funding program.

- 1) Campbell River Pedestrian/Emergency Access Bridge at 160 Street (\$3.8M)
The replacement of this structure is a priority for Semiahmoo First Nation. 75% of the cost is eligible under the DMAF program, and negotiations with Indigenous Services Canada and Semiahmoo First Nation are underway to secure a commitment to cover the remaining 25% of the investment.
- 2) City of Delta Dyke Upgrades (\$1.5M)
This project provides economies of scale and is complementary to the City's Colebrook Dyke project that abuts to the City of Delta's dyking system. The City of Delta have confirmed the non-federal portion of the budget required for the project, and no additional funding is anticipated from the City of Surrey.
- 3) Burrows Pump Station (\$1.4M)
This project is currently in the City's 10-year capital budget and provides structural upgrades to extend the service life of the existing drainage station and improve agricultural drainage for food security.
- 4) Stewart Farm Sanitary Pump Station (\$0.6M)
This project is currently in the City's 10-year capital budget and provides structural upgrades to reduce the vulnerability of the City's sanitary sewer system to coastal flooding.

As part of the DMAF funding application, several non-project specific cost allocations have been provided for. Once the funding agreement is established, the City cannot exceed the value provided and provision of the following general cost allowances that have been made:

- 1) Provincial environmental assessment and Federal reporting requirements (\$1.1M); and
- 2) Inflationary allowance for construction cost escalation over nine years (\$9M).

The total application value, including contingency, is \$187M, of which the Federal component is \$76.6M. The total third party funding is estimated at \$49.1M. This leaves the remaining contribution as \$61.3M to be covered by the City. Not all of these projects are included in the City's Five-Year Financial Plan.

At its Regular Council Meeting on December 15, 2018, Council endorsed Corporate Report No. R256; 2018 Infrastructure Projects – Federal and Provincial Funding Update that finalized the priority projects, as summarized above, for submission interest to Infrastructure Canada's DMAF. As part of the application, staff have worked to secure support to demonstrate the importance of the Federal Government's funding commitment to differentiate the City's application from other jurisdictions that are competing for limited funds. Where possible, credible outside groups have assisted in substantiating merit criteria applied by the Federal Government to evaluate submissions. The letters of support received to date include:

- Gordie Hogg, MP;
- Carla Qualtrough, MP;
- Stephanie Cadieux, MLA;
- Tracy Redies, MLA;
- Semiahmoo First Nation;
- City of Delta;

- City of White Rock;
- Metro Vancouver – Water Services Department;
- Ministry of Forests, Lands, Natural Resource Operations and Rural Development;
- Bird Studies Canada;
- Canadian Wildlife Service of Environment and Climate Change Canada;
- Consulate General of the Netherlands;
- Lower Fraser Fisheries Alliance;
- Municipal Natural Assets Initiative;
- Pacific Birds Habitat Joint Venture;
- South Coast Conservation Lands Management Program;
- Southern Railway of British Columbia Limited;
- University of British Columbia – Department of Geography; and
- West Coast Environmental Law.

A copy of each letter of support is included in Appendix “III”.

Infrastructure Canada has indicated that funding decisions will be made this Spring, 2019.

Lower Mainland Flood Management Strategy

In parallel to the City’s CFAS process and DMAF application, development of a Lower Mainland Flood Management Strategy (“LMFMS”) for the Fraser River floodplain is underway, facilitated by the Fraser Basin Council. Phase 1 of the LMFMS took place between 2014 and 2016 and has concluded. The risks, vulnerabilities and consequences of a large flood event, including the effects of sea level rise, have been published to www.FloodStrategy.ca for the region. Phase 2 of the LMFMS is underway, with a view towards completion in 2020. The process and results of developing the Surrey CFAS continues to influence the LMFMS and be complementary. The goal for the LMFMS is to secure consensus among partners about regional priorities, cost-sharing and funding commitments for flood management.

Next Steps

The CFAS Engagement Summary Report included as Appendix “I” will be published on the City website shortly and circulated to CFAS stakeholders. A final Project Advisory Committee meeting is anticipated for Spring 2019. The intent is to prepare a draft CFAS in time to roughly coincide with the Federal funding decision.

Developing financial partnerships to support implementation of CFAS is underway through the DMAF and through the LMFMS. Staff are active in the development of the LMFMS, facilitated by the Fraser Basin Council, which seeks to develop regional level funding commitments for Flood Management. There is considerable interest among various conference organizations in the work being done under CFAS. City staff continue to present CFAS work to assist in building support for future funding opportunities and support for implementation.

The CFAS consulting team is now undertaking analysis of medium-term options for a suite of coastal flood adaptation approaches that build on the works set out in the City’s DMAF application and that are consistent with stakeholder values for long term approaches.

SUSTAINABILITY CONSIDERATIONS

The process of developing the CFAS supports the objectives of the City's Sustainability Charter 2.0. In particular, the CFAS and DMAF works relate to the Sustainability Charter 2.0 themes of Infrastructure, Built Environment and Neighbourhoods, Ecosystems, and Public Safety. Specifically, the CFAS development and DMAF works support the following Desired Outcomes ("DO") and Strategic Directions ("SD"):

- Energy and Climate DO6: The City anticipates changing weather patterns and sea level rise as a result of climate change, and implements appropriate infrastructure, land use planning and emergency response solutions that will be resilient over the long term;
- Neighbourhoods and Urban Design SD8: Strengthen and promote community engagement and programming in public spaces;
- Green Infrastructure DO12: Surrey protects ecosystem services and manages natural assets in order to create resiliency to adapt and thrive in a changing climate; and
- Emergency Preparedness and Prevention SD6: Promote development types and locations that will be minimally impacted by natural disasters.

CONCLUSION

Based on the above discussion, it is recommended that Council receive this report as information and have staff report back to Council with a draft Coastal Flood Adaptation Strategy and the Infrastructure Canada decision on the City's Disaster Mitigation Adaptation Fund application.

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General Manager, Engineering

JA/MO/cc

Appendix "I" – Surrey CFAS Engagement Summary Phase 1-3
Appendix "II" - Project Map
Appendix "III" - DMAF Letters of Support

SURREY COASTAL FLOOD ADAPTATION STRATEGY (CFAS)

ENGAGEMENT SUMMARY

PHASES 1-3

September 2018



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Project Overview

Global sea level is rising and coastal communities like Surrey, face a significant challenge. City of Surrey is developing a Coastal Flood Adaptation Strategy (CFAS) to help prepare for a changing climate and to make its coastal communities more resilient. To be completed in winter 2018/9, the final strategy will outline the potential future impacts of climate change on Surrey's coastline and the preferred adaptation options available to address them over the short-, medium-, and longer-terms.

Launched in 2016, the project is taking a community-based, participatory approach and has engaged residents, stakeholders, and other partners throughout project, including First Nations, community and environmental organizations, business associations and groups, senior levels of government, farmers and the agricultural community, and neighbouring jurisdictions.

“The complexity and cost of coastal flood protection issues are significant. By getting ahead of the issue, and setting a direction now for where we want to be in 100 years, we are positioning Surrey to make smarter investments in the protection of residential neighbourhoods, businesses, significant habitat areas and provincially critical infrastructure.”

Mayor Linda Hepner

Unique in the depth of its engagement, community involvement was a significant component of both developing flood management options for the three CFAS study areas — Mud Bay, Crescent Beach, Semiahmoo Bay – and in their evaluation and eventual shortlisting. The project included two rounds of assessment and engagement where potential flood management options were reviewed against several technical criteria and seven community-developed “values criteria.” The technical analysis included input from project engineers and City of Surrey staff, and with input through a partnership with University of British Columbia School of Architecture and Landscape Architecture and Dutch flood management experts, landscape architects and engineers.

The participatory values assessment analyzed how each option performed against seven values criteria, which captured what people and partners in the study area care about most. The values criteria were co-developed with area residents, business owners, farmers, stakeholders, and partner organizations (Semiahmoo First Nation) through a series of workshops and focus groups (refer to Appendix B for details). The seven values criteria were:

- **Residents:** Number of people permanently displaced by the option and anticipated health and safety impacts
- **Agriculture:** Amount of agricultural land permanently lost due to the option
- **Environment:** Anticipated impact (positive and negative) to wetland habitats, freshwater fish habitat and riparian areas that could be expected from the option
- **Infrastructure:** Transportation and utilities service disruptions that could be expected from the option
- **Economy:** Permanent loss of businesses that could be expected from the option
- **Recreation:** The diversity of recreation opportunities (positive and negative) that could be expected from the option
- **Culture:** Semiahmoo First Nation cultural impacts that could be expected from the option

Climate Change and Surrey's Coastal Floodplain

Surrey's coastal floodplain makes up about 20% of Surrey's entire land area. This large, low-lying area stretches from Boundary Bay and Mud Bay along the Nicomekl and Serpentine Rivers towards Cloverdale and Newton. The floodplain also includes the Campbell River/Semiahmoo Bay area near White Rock and Semiahmoo First Nation.

As a natural floodplain, the area has regularly experienced some coastal flooding over the years from high tides and storm surges, and river floods which are typically caused by rain storms and rapid snow melt. River flooding can also be influenced by high tides and storm surges. Over the last century, flood-control infrastructure has been put in place to enable the land to be used by the community.

The changing climate means that the historic controls (e.g., dykes, pumps, drainage ditches) put in place by the City of Surrey to limit flood damages will be ineffective in limiting future flood damage as sea levels continue to rise. Today, Surrey maintains the largest dyking network in BC. Sea level rise is forecast to significantly increase dyke vulnerability and expose low-lying infrastructure along the shoreline to flooding. By 2040, dyke infrastructure nearly 10km inland is expected to become vulnerable.

In the short-term, Surrey can expect more nuisance flooding and more frequent and severe flooding from storm surges, while over the longer-term we can expect even greater challenges. Projected impacts for Surrey's coastal area include higher sea levels, increased frequency and intensity of storms and storm surges (when water is pushed ashore by wind and waves), more erosion of the coastline, impacts on infrastructure, loss of beaches and coastal ecosystems, soil salinization, and groundwater pooling.

CFAS Study Area Snapshot

Communities and People

- Many residential areas and neighbourhoods
- Semiahmoo First Nation
- 2,500+ residents
- Approximately 20% of Surrey's land area

Local and Regional Economy

- Over 60 sq. km of Agriculture Land
- 3,500+ direct employment
- Over \$100 million in annual farm gate revenue
- Over \$1.5 billion in assessed property value
- Almost \$25 billion annual truck and rail freight traffic
- About 10% of the Agricultural Land Reserve in Metro Vancouver

Parks and Environment

- Regional and City parks, beaches and recreation areas, including Surrey's only public ocean beach
- Significant natural areas with very high biodiversity values, including foreshore, riparian and coastal areas
- Internationally important migratory bird habitat

Infrastructure

- 13km of Provincial Highways
- Over 200,000 vehicle trips a day
- 31km of railway (freight and passenger)
- Regional sewer and water lines
- Major power transmission lines
- Natural gas pipelines

Project Engagement Strategy

Given the complexity of the issues the project addresses, the planning process was designed to be adaptive and flexible, and has accommodated new stakeholders and information (project learning) as it moved forward over the past two and a half years.

Strong engagement with internal and external stakeholders and partners was a core project objective for the City, and has been paramount to the success of this Project' public discussion, awareness, and acceptance/support of emerging directions as well as the difficult trade-offs they entail.

At Project outset, three linked frameworks were produced: a *Decision Support Framework*, a *Stakeholder Engagement Framework* and an integrated *Communications and Media Framework*. The Decision Support Framework detailed the Project's overall participatory, community values-based planning approach, methods, data needs, and decision points.. It was closely integrated with a *Stakeholder Engagement Framework*, which guided the consultant team's work in gathering input and feedback for CFAS, and a *Media and Communications Framework*, which laid out a process to inform the local community and stakeholders, and support productive change management given the significant challenges posed by sea level rise.

Figure: CFAS supporting and integrated engagement and collaborative decision-making frameworks



The broad goals of the *Stakeholder Engagement Framework* were to:

- Ensure engagement was linked to, and integrated with the project's overarching, participatory, decision-making process and *Decision Support Framework*
- Ensure engagement was consistent with City of Surrey's guiding *Consultation Principles*.
- Ensure that a broad range of stakeholders were meaningfully engaged, and able to participate at key decision points through the process.
- Set out clear goals and objectives for project engagement and communications at each phase of work so that stakeholders and partners understood how they could participate and how their input was incorporated at key project decision points.
- Achieve higher IAP2 participation standards (i.e., involve, collaborate, empower).
- Educate stakeholders, partners and the public on coastal flood hazards, climate change and sea level rise, and adaptation pathways.

Engagement Principles

CFAS engagement was based on the City of Surrey's guiding *Consultation Principles*. The following principles were of particular importance:

- **Two-Way Communication:** Communication between the project planning team and stakeholders will be timely, responsive, transparent, collaborative, and provide opportunities for the engagement of the community, stakeholder groups, and the community at large at each of the five project phases.
- **Respectful Partnership:** The project planning team and stakeholders will work to build and maintain relationships that reflect constructive, respectful, meaningful, inclusive, and compassionate partnerships aimed at achieving outcomes built upon all voices.
- **Inclusive Public Process:** Working with the City, the project planning team will work to ensure that public process is accessible to the broad community via many communication modes, will encourage the equal involvement of stakeholder groups who wish to be heard, and will acknowledge the value of all participant views.
- **Balance:** The project planning team and stakeholders will work to acknowledge and understand the diverse needs and priorities that exist within the communities, and as partners shall commit to balancing these with the interests of the wider community.
- **Early Involvement:** Working with the City, the project planning team will work to ensure that various input options are in place to enable stakeholder involvement through all project phases. Multiple methods of participation will be provided to help ensure that stakeholders who cannot attend project meetings or workshops can provide feedback through other methods.
- **Transparency:** The CFAS process will provide substantive opportunities for input and feedback through all project phases, and include robust participation opportunities at key decision points.
- **Knowledge and Education:** Coastal flooding and climate change are serious and important (and inter-related) issues that demand informed input from stakeholders. Community education and learning will be a part of most project phases.

- ✓ The application of IAP2 (International Association for Public Participation) Best Practices of Engagement also helped implement and achieve City Consultation Principles, and meet Surrey’s broader CFAS goals: Increase awareness and understanding of climate change and coastal flooding;
- ✓ Build adaptive capacity and coastal community resilience; and
- ✓ Strengthen relationships with implementation partners and stakeholders.

This table illustrates the various levels of engagement employed throughout our process.

Table: CFAS Engagement – IAP2 levels

Level of Engagement:	Goals of Engagement:	Methods of Engagement:
EMPOWER	Potential partners in working group; direct dialogue with proponent and government	Role in decision-making / planning
COLLABORATE	Co-generation of ideas, development of alternatives and identifying preferred solutions	Technical workshops / review meetings
INVOLVE	Consistent, direct engagement throughout process to ensure needs are well understood and considered	Sub-group workshops
CONSULT	Provide feedback to specific items to be incorporated into synthesis / final reporting documents	CitySpeaks surveys, Town Hall meetings, Focus groups
INFORM	One-way communication	Print & e-newsletters / online bulletins, website, social media

Stakeholders and Partners

The CFAS project engaged a range of stakeholder groups and partners using various avenues and approaches. Project stakeholder groups included the following:

- **CFAS Steering Committee:** An internal, inter-department City of Surrey project working group made up of senior staff from Engineering (project lead; Drainage, Utilities, Transportation, Communications), Planning & Development (Community Planning), Parks, Recreation & Culture (Parks Planning, Sustainability Office), and Finance & Technology (Risk Management, Finance).
- **CFAS Advisory Group:** A volunteer group of representatives from key partner and stakeholder organizations and agencies. The group met several times over the course of the project and were an integral part of the decision-making process. Members included:
 - **Local governments:** Semiahmoo First Nation, City of White Rock, City of Delta, Metro Vancouver
 - **Agencies & Ministries:** Department of Fisheries and Oceans (DFO), Ministry of Transportation and Infrastructure (MoTI), Ministry of Forest, Lands and Natural Resource Operations and Rural Development (FLNRORD), Fraser Basin Council, BC Climate Action Secretariat, Emergency Management BC (EMBC), Provincial Agricultural Land Commission (ALC)
 - **Environment & Recreation:** Ducks Unlimited Canada, Friends of Semiahmoo Bay Society, Stewardship Council of BC (Green Shores), Little Campbell Watershed Society, Nicomekl Enhancement Society,, Surrey Environmental Partners, Ducks Unlimited Canada, Bird Study Canada
 - **Utilities & Transportation:** BC Hydro, Ministry of Transportation and Infrastructure
 - **Agricultural:** Ministry of Agriculture, Delta Farmers' Institute, Hopkins Berry Farm, Kooldale Farms, Lindrian Farms, M&M Pacific Coast Farms, Mud Bay Dyking District, Winners Holstein Ltd.
 - **Residents & Business:** Crescent Beach Property Owners Association, Surrey Board of Trade, Fraser Valley Real Estate Board, Anderson Walk Strata, Surrey Heritage Advisory Commission, Westland Insurance Group, Insurance Bureau of Canada, residents at large.
 - **Academic/Other:** UBC SALA (School of Architecture and Landscape Architecture), Engineers and Geoscientists BC
- **City of Surrey Committees and Stakeholder Groups:** Project staff made introductory presentations and follow up presentations as requested to existing City of Surrey committees and stakeholder working groups at regularly scheduled meetings and special presentations. These standing committees included:
 - Transportation and Infrastructure Committee (TIC)
 - Lowland Dyking Stakeholder Group (LDSG)
 - Agriculture and Food Security Advisory Committee (AFSAC)
 - Environment Sustainability Advisory Committee (ESAC)
 - Parks, Recreation and Sport Tourism Committee (PRSCTC)
 - Development Advisory Committee (DAC)
 - Public Art Advisory Committee (PAAC)
 - Surrey Heritage Advisory Commission (SHAC)
- **Semiahmoo First Nation:** With its principal Reserve occupying the majority of one study area, and cultural, traditional use and archeological sites found throughout the other two CFAS study

areas, Semiahmoo First Nation was a core project partner who was engaged through a parallel process, in addition to participating on the Advisory Group. Meeting minutes are included in appendix G.

- **CFAS Focus Groups:** Themed focus groups for the farming and agricultural community, residents and businesses, and environmental and community organizations were organized to support the community values elicitation phase of CFAS. These were supported by directed engagement sessions with strata councils from the area.
- **CFAS Workshops:** Workshop were held with Land Stewardship Groups, Coastal Regulators, Infrastructure Owners/Operators, and Emergency Responders that included additional input from many of the organizations involved in the CFAS Advisory Group, but also included: BC Agriculture and Food Climate Action Initiative, Vancouver Fraser Port Authority, Delta Farmland & Wildlife Trust, West Coast Environmental Law, Engineers Canada, BC Ambulance Services, RCMP, Canadian Coast Guard, BC Climate Action Secretariat, FortisBC, Surrey Fire Services, Burlington Northern Santa Fe Railway, A Rocha Canada, Surrey Search and Rescue, Shaw, Ministry of Environment, SRY Rail Link, and Telus.
- **General Public:** Broader-scale engagement involving general outreach activities and events in both in-person and digital formats, project open houses, pop-up events in the study areas, a travelling community road show (featuring a 6 metre sea level rise banner that illustrated the anticipated height for dykes by 2100), and exhibits at community events and festivals throughout Surrey (e.g., Party for the Planet). Special emphasis was placed on engaging with younger generations. While children and youth are often not involved or specifically targeted in many municipal outreach activities, project organizers recognized that younger generations will be significantly influenced by the CFAS decisions being made today. Elementary and secondary school students were engaged through classroom sessions an activities on sea level rise and CFAS adaptation options, while university students (University of British Columbia and University of the Fraser Valley) were invited to collaborate with the CFAS team to gain valuable experience in the fields of human geography, community planning and landscape architecture, as well as to provide their own feedback on the CFAS project.

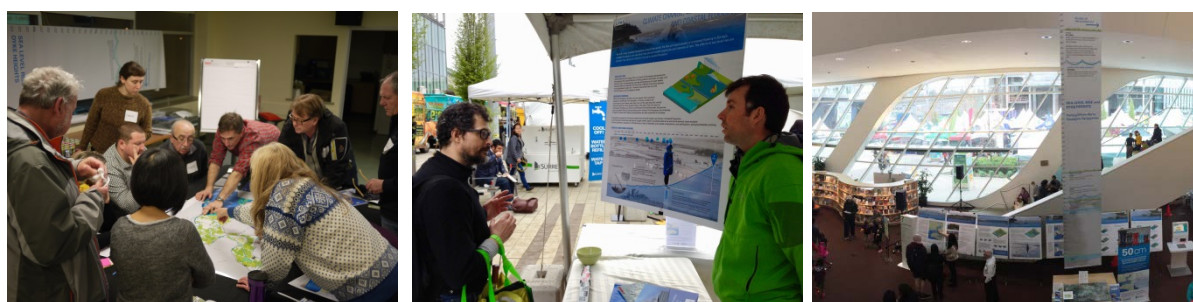


Figure: (left to right) CFAS residential focus group, CFAS community outreach (Party for the Planet), CFAS community roadshow and sea level rise banner at the Surrey Central public library

Methods

A range of stakeholder engagement activities (e.g., surveys, focus groups, strategy sessions, workshops, open houses), visual materials (e.g., 2D and 3D simulations, project videos, process graphics and illustrations), and communication channels (e.g., project website, on-line surveys, project post cards and door hangers, social media) were used. Table 1 summarizes general engagement and outreach avenues and tools and Appendix A includes samples of the materials developed to support the project engagement and consultation.

You Engagement was conducted and summarized in Appendix E through direct engagement in a number of classrooms and events.

Through the multi-year consultation, the CFAS Team actively sought to meet the needs of participants and monitored feedback on the engagement through workshop exit surveys summarized in Appendix D.

Additional consultation and engagement was completed through parallel processes that described in Appendix H for specific sectors with financial support through the Federation of Canadian Municipalities (FCM) Municipalities for Climate Innovation Program.

Based on stakeholder input that the project incorporate approaches and expertise developed in the Netherlands, a delegation of experts attended met with stakeholders, participated in technical knowledge exchange and prepared a research report. This process is described in Appendix I and was supported by the Dutch Creative Industries Fund with assistance from University of British Columbia's School of Architecture and Landscape Architecture, through Dr Kees Lokman.

Reporting on project activities to City of Surrey Council is included in Appendix J.

Table 1: CFAS Engagement Avenues and Tools

TOOL/AVENUE	DESCRIPTION
Project Webpage	All project materials were posted on a comprehensive project website (www.surrey.ca/coastal) that functioned as the principal information portal for CFAS and provided opportunities for ongoing public feedback and engagement.
City E-news	City Speaks (market research) and e-newsletter email marketing tools such as Sustainability, Public Participation, and Inside Your City reaching thousands of subscribers.
Social Media	From surveys and videos to event advertising, CFAS used Surrey's established social media channels (Twitter, Instagram, Facebook) throughout the project. Over 100,000 social media impressions were made during the first three phases of work. Additional details are available in Appendix F.
Traditional Media	Traditional media coverage of the project was extensive with coverage on CBC's Early Edition, The Current (national) and On the Coast, Radio Canada's L'heure du Monde, and articles in the Surrey Now Leader, Peace Arch News, Vancouver Sun, The Province, Globe and Mail (BC Edition), Vancouver Courier, Western Producer and 24 Hours Newspaper, reaching over 100,000+ Metro Vancouver residents.
Open Houses	Two Open Houses were held during the first three phases of the project. The drop-in style events included activity stations for participants to provide information on coastal flooding issues, values, and preliminary adaptation options.
Community	Over the course of the first three phases of work, the CFAS project took advantage of

Events and Meetings	opportunities to present at community events (e.g., lowland dyking meetings and irrigation meetings,) and ongoing community meetings, including dyking annual general meetings, property owner association annual meetings and through information kiosks at community events (e.g., neighbourhood house anniversary celebrations, Party for the Planet, Youth Fest, World Oceans Day, teachers’ professional development days). Additionally, CFAS-specific pop-up events were organized, (e.g., info booths at SFU Surrey, Surrey libraries and Crescent Beach).
ESRI Story Maps	<p>Three Story Maps were developed by City staff on the three study areas. The story maps were available on the City website, through social media, and at community venues using stand-alone kiosk with a project iPad. The links are:</p> <ul style="list-style-type: none"> • <u>From Rivers to Rails: How Flooding and Transportation Infrastructure Interact in the Surrey Lowlands</u> • <u>Crescent Beach: Dynamic, Beautiful, and Ever Changing</u> • <u>From Salt Marsh to Farmland: How Flood Control Supports Surrey's Agricultural Heart</u>
3D Models	Table size and small hand held models of the coastal floodplain were developed using Open Data and printed using a 3D printer. The models assisted participants at workshops understand the terrain in a more tangible way. The table size model was incorporated in the temporary project outreach station.
Outreach Station	A project outreach station consisting of various materials supported pop up project information tents that were staffed in the community, as well as supporting temporary information kiosks rotated through various civic facilities in Surrey. Spacing permitting, materials included a 6 metre tall banner depicting sea levels and storm surges, a free standing banner with a project map, a table size 3D Model and various paper materials (Project Primers and rack cards) and an iPad with project ESRI Story Maps on display.
Project Videos	Three project videos were produced over the first three phases of project work. The first video (which has been viewed 1,200 times on YouTube) provided an overview of the project and the challenge it addresses. A second video provided an overview of Surrey’s current flood management system. And a third video was used to help support an “Options Survey” and illustrated shortlisted options.
Project Primers	A set of two printed Primers were developed for the project. The graphically-rich documents were developed to introduce the project and provide a clear overview of Surrey’s coastal flooding and sea level rise management challenge, as well as the community, stakeholder and partner values at stake. The second series were used to present the shortlisted options for the three study areas and to provide an overview of both the decision/evaluation process and the performance of the flood adaptation options.

Results

The graphic on the following page provides a summary of engagement and outreach highlights during the Project’s first three phases. Detailed results of engagement and outreach are summarized in Appendix B for Phase 1 and Appendix C for Phases 2 and 3.



COMMUNITY, STAKEHOLDER & PARTNER ENGAGEMENT

Developing a direction for coastal adaptation with the community

4

MEETINGS AND SITE VISITS
with Semiahmoo First Nation

3

FOCUS GROUPS
(Agriculture & Farming, Community & Residential, Environment & Recreation)
60+ participants

7

TECHNICAL WORKSHOPS
2 Greenshores™ Shoreline Design workshops, 2 PIEVC™ infrastructure operators workshops, 2 Design workshops with Dutch engineering design experts and UBC researchers, Coastal regulators, Coastal stewards

3

CFAS ADVISORY GROUP WORKSHOPS
With project stakeholders and partners, including local governments, infrastructure operators, provincial agencies, organizations, residents and farmers

5

CRESCENT BEACH COMMUNITY WORKSHOPS
140+ attendees



BUS TOURS
Site tour and "walk-shops" around the CFAS study area
70+ participants



SURREY YOUTH ENGAGED
5 sessions with high school students, 2 youth events at City Hall, and 80 CFAS postcards completed by elementary school students



COMMUNITY CONVERSATIONS
at Crescent Beach pop-up event hosted with 40+ University of the Fraser Valley Geography and Environment students



POP-UP PROJECT OUTREACH STATIONS
Crescent Beach, Blackie Spit, SFU Surrey, Surrey Centre/Ocean Park/Semiahmoo Public Libraries, Surrey City Hall, Alexandra House (Crescent Beach)



WORKSHEETS COMPLETED
At various engagement events and workshops

100,000+

SOCIAL MEDIA IMPRESSIONS
Instagram & Twitter (200+ #SurreyCoastal mentions), Facebook (100+ CFAS comments), LinkedIn, YouTube (1,000+ hours of CFAS video views), CFAS website and StoryMaps (10,000+ views)



1,000+
COMMUNITY MEMBERS
directly involved to date



#SURREYCOASTAL PHOTO CONTEST
200+ submissions on Facebook, Twitter, and Instagram with winners in three categories



1,000+ SURVEYS
Completed online, at CFAS workshops, at community events, and by CitySpeaks Members



ORGANIZATIONS, AGENCIES, LOCAL GOVERNMENT PARTNERS, CITY OF SURREY COMMITTEES, AND COMMUNITY GROUPS INVOLVED
Keeping partners and stakeholders engaged



CFAS DOOR HANGERS
Hung on Crescent Beach doors



10,000 COMMUNITY MAILERS
Sent to Surrey residents in the CFAS study area and beyond



PROJECT VIDEOS
Available on-line and shown at community events



BIG MEDIA HITS
CBC Early Edition and The Current (national), articles in the Vancouver Sun, The Province, Globe and Mail, and 24 Hours newspaper reaching over 100,000+ Metro Vancouver residents

THANK YOU EVERYONE FOR YOUR TIME AND THOUGHTFULNESS IN CONTRIBUTING TO THE CFAS PROJECT

Lessons Learned and Challenges

Throughout the engagement process, the project team heard from many directly affected residents, farmers and stakeholders. Their feedback helped develop the criteria with which options were short-listed and evaluated. Community and stakeholder input also raised important, and often difficult, questions for the project team to consider and include in the overall options development and assessment.

From this feedback and additional technical analysis, fairly clear directions began to emerge around the short-listed adaptation options Surrey could pursue (refer to Appendix C). Furthermore, underlying these directions, a few critical and shared understandings emerged:

- Climate change and sea level rise demands a dramatic change in approach to coastal flood management over the medium-term and long-term.
- No adaptation is not an option over the medium- and long-terms.
- All adaptation options involve serious and difficult trade-offs; there are no “silver bullets.”

Another equally important understanding that emerged is that all of the short-listed options would be phased in over time based on observed sea level rise. While there is no avoiding an eventual 1 metre increase in sea levels in the future, today, the rate and pace of sea level is still uncertain. Recognizing this, over the coming years or decades, current conventions (i.e., maintaining existing dykes) will be appropriate and a carefully considered phasing approach to transition into a more sustainable long term approach. However, the flood risk will increase over time and investment and land use decisions will increasingly need to align with the longer-term approach and option selected.

The short-listed options that resulted from the process are all are far from easy. They are all very difficult, complex and costly options where some stakeholders are clearly more impacted than others. With few precedents to look to, the City of Surrey is amongst the first to ask these hard questions. Nonetheless, it is committed to continuing to work with those impacted as the CFAS project goes forward into the next phases with the final preferred options and future implementation.

At project outset the *Stakeholder Engagement Framework* identified some potential psychological challenges, or barriers, that could be expected as a result of the scale and scope of the complex challenges posed by climate change and coastal flooding, including:

- **Protection motivation:** The concept that stakeholders and partners may need to feel a certain degree of personal threat before they are motivated to make behavioural changes and/or trade-off decisions around CFAS options. The behavioural challenge may also support stakeholders and partners in having an anchor bias in protection-based adaptation pathways versus other pathways (i.e., accommodate, retreat).
- **Psychological distancing:** The concept that stakeholders and partners may distance themselves from large scale, long-term challenges like climate change and coastal sea level rise by disconnecting themselves from its implications. For CFAS, stakeholders and partners may want to underestimate the coastal flood risk they face as a means of psychologically managing the challenge.
- **Displacing risk:** The concept that stakeholders, particularly people living and working in vulnerable, at-risk areas will tend to direct their attention towards the most immediate concerns

(e.g., winter storm protection works) while ignoring the longer-term climate and coastal flooding risks and hazards perceived to be either happening too far in the future or with associated uncertainties.

Additionally, a fourth challenge - **Expectations Management** - was identified while refining the planning process for the broader CFAS. This challenge emerged from the initial work to study and engage the community on sea level rise in Crescent Beach through a series of community meetings that took place in the principal residential area in the study area and a highly valued heritage neighbourhood that provides access to Surrey's only coastal beaches.

- **Crescent Beach residents expectations management:** Project outreach started with the Crescent Beach community meeting Series which included a design charrette, which focused on the "protection" adaptation pathway. The charrette series provided initial dialogue with the community and the values and input received shaped the overall CFAS workplan. While facilitators and City staff were careful to let participants know that their work was purely exploratory in one of several adaptation pathways, it resulted in a bias towards protection for the community. The design charrette served to provide meaningful input into the CFAS project. A particular insight from this work was the development of the 'Barrier Island' concept that was possible through a research by design approach that allowed participants to work through the challenges of structural adaptation approaches with City staff. During Phase 1 of CFAS efforts were made to more broadly frame the project and clearly establish project expectations at the outset, including the range of adaptation options to be explored and the process by which they will be evaluated. In addition, to provide better alignment with the project's overarching strategy (Surrey Climate Adaptation Strategy) and to help overcome the "protection bias", the CFAS project itself was renamed, from Coastal Flood Protection Strategy to Coastal Flood Adaptation Strategy.

Each of these challenges did emerge through the first three project phases. However, each was effectively managed through project engagement and outreach. Other key lessons that emerged from the first phases of CFAS engagement include:

- **Create and foster relationships as early as possible.** CFAS is addressing a serious challenge with equally serious trade-offs. Effectively engaging the community in such value-laden and difficult discussions requires trust and a good relationship with partners and stakeholders. Building these relationships takes time and cannot be rushed. This is also vital to continue through the entire planning process, particularly with key landowners and stakeholders. Prior to commencing the project, relationships were developed with key organizations. This included organizing a peer learning exchange with the Urban Sustainability Directors Sustainability Network (a peer-to-peer network of local government professionals from cities across the United States and Canada) which brought together other local governments in BC and Washington as well as external groups such as the UBC Collaborative for Advanced Landscape Planning and the Fraser Basin Council.
- **Support the project with adequate budgets.** Engagement is time consuming and expensive. Communicating complex information requires a variety of visual aids that can be costly to produce. For this comprehensive engagement process, most of the visual aids developed were either utilized for multiple events, refined over time with participant feedback to become more effective, or modified slightly for a different audience resulting in significant

economies of scope (i.e. similar graphics developed for the Primers were utilized with in the CFAS online videos).

- **Be transparent, honest and don't hide from the real issues.** Use language that adequately conveys the serious of the topic at hand without creating doom and gloom scenarios or using excessive jargon. Do not promise what cannot be delivered .From the outset, CFAS clearly stated that there were no pre-conceived answers, directions or solutions and no “silver bullet” to accommodating or managing sea level rise and coastal flooding.
- **Find community champions.** It is important to have the community, stakeholders and partners take ownership of the project and outcomes; this will make it easier for Council to make decisions supporting difficult actions that arise out of the planning process.

Appendix A: Sample Materials

The following worksheets and project materials provide offer some highlights of the range of materials produced and used to support community, stakeholder and partner engagement.

- [CFAS Primer Part I](http://www.surrey.ca/files/CFAS-primerpart1.pdf): Project overview, Surrey's floodplain, and coastal flooding hazards: available at <http://www.surrey.ca/files/CFAS-primerpart1.pdf>
- [CFAS Primer Part II](http://www.surrey.ca/files/CFAS-primerpart2.pdf): Chapter 1 Mud Bay: available at <http://www.surrey.ca/files/CFAS-primerpart2.pdf>
- [CFAS Primer Part II](http://www.surrey.ca/files/CFAS-primerpart2CB.pdf): Chapter 2 Crescent Beach: available at <http://www.surrey.ca/files/CFAS-primerpart2CB.pdf>
- [CFAS Primer Part II](http://www.surrey.ca/files/CFAS-primerpart2SB.pdf): Chapter 3 Semiahmoo Bay: available at <http://www.surrey.ca/files/CFAS-primerpart2SB.pdf>
- Project Postcard (included below)
- Project door hanger (included on the following page)
- Option Evaluation worksheet (included on page 18)








Figure: CFAS Project Postcard (front and back)



Figure: CFAS Project Door Hanger (front)

PRELIMINARY OPTION:
MUD BAY BARRIER

PARTICIPANT NAME: _____

VALUES CRITERIA <i>Do you agree/disagree with the scoring and why?</i>	Comments		
	Agree	Disagree	Not Sure
 <p>RESIDENTS <i>Number of people permanently displaced by the option</i></p>			
 <p>ENVIRONMENT <i>Anticipated impact to wetland habitats, freshwater fish habitat and riparian areas that could be expected from the option</i></p>			
 <p>INFRASTRUCTURE <i>Anticipated service/ transportation infrastructure made vulnerable by the option</i></p>			
 <p>ECONOMY <i>Permanent loss of businesses that could be expected from the option</i></p>			
 <p>RECREATION <i>The diversity of recreation opportunities that could be expected from the option</i></p>			

OPTION IMPROVEMENT

How could the option be improved to score better when measured against the values criteria?

TECHNICAL CRITERIA

Do you have any comments on any technical criteria scoring? Please note them here with the technical criteria you have questions about.

Figure: Option Evaluation Worksheet

Appendix B: Phase 1 Consultation

As part of Phase 1 a CitySpeaks Omni Panel survey was conducted to better understand Surrey resident's level of awareness of sea level rise and flooding issues and risk perception. The results of the survey were presented to the City of Surrey Council and included in the CFAS Annual Council Report 2017, Appendix "II", available at http://www.surrey.ca/bylawsandcouncillibrary/CR_2017-R246.pdf

Listing of relevant CFAS concerns

This list was developed from CFAS Phase 1 consultation including an online survey on values and the sector based Focus Groups. This information was used to develop indicators to compare potential adaptation options against.

Note 1: the order of concerns listed does not suggest anything about priorities or ranking of concerns.

Note 2: the column direction of preference indicates preferred numerical direction

Areas of Concern	Stakeholders Concerns	Measures	Direction of Preference
Residents / Community	Adverse impacts to Semiahmoo First Nation	Constructed scale using SFN input	Lower
	People permanently displaced	# of people permanently displaced	Lower
	People temporarily displaced	# of people temporarily displaced in severe flooding events	Lower
	Damages to homes	\$M of damages to homes	Lower
	Loss of property value	\$M lost in residential property values	Lower
	'At risk' people adversely impacted (e.g. seniors)	Social Vulnerability Index (SVI) weighted displacement	Lower
Health, well-being & public safety	Public safety	Loss of life or injury	Lower
	Emergency service disruption	Constructed scale	Lower
	Well water adversely impacted	Constructed scale of likelihood of adverse impacts to drinking water	Lower
	Adverse community impacts	Constructed scale	Lower
	Adverse aesthetic impacts	Constructed scale of loss of views and streetscape	Lower
	Adverse impacts to heritage buildings, historic sites & Semiahmoo cultural sites	Constructed scale	Lower
Recreation	Impacts on parks & open spaces	# hectares of parks & open spaces	Higher
	Diversity of recreational opportunities	Constructed scale	Higher
	Access to trail network	# of trail access points	Higher
	Access to water (river & ocean)	# of water access points	Higher
	Impacts to beach area	# ha of beach area	Higher
	Impacts to recreational amenities (marina, swim club, etc.)	Constructed scale	Lower
Environment	Impacts to estuarine marsh, intertidal mud flats, shallow water	# hectares of estuarine marsh/intertidal mud flats/shallow water	Higher

Areas of Concern	Stakeholders Concerns	Measures	Direction of Preference
	Impacts to wetlands, riparian areas (natural areas within 30m of freshwater), freshwater fish habitat (freshwater river, freshwater lake)	# hectares of wetlands, riparian areas, freshwater fish habitat	Higher
	Impacts to natural forested areas that are greater than 1ha	# hectares of forested areas greater than 1 ha	Higher
	Impacts to natural shrub/old field habitat areas	# hectares of natural shrub/old field habitat	Higher
	Impacts to biodiversity	Biodiversity index of habitats	Higher
	Contaminants released into environment	# of sites with potential contaminants released	Lower
	Barriers to fish migration	# of fish barriers on major rivers	Lower
Infrastructure	Damage to services infrastructure	\$M	Lower
	Damage to transportation infrastructure	\$M	Lower
	Disruptions to transportation	Constructed scale	Lower
	Disruptions of services	Constructed scale	Lower
	Recovery time of transportation corridors	Weighted scale of time it takes to restore transportation corridors	Lower
	Recovery time of services	Weighted scale of time it takes to restore services	Lower
Agriculture	Permanent loss of agriculture land	# hectares lost of designated agricultural lands	Lower
	Loss of agricultural productivity (soil salinization)	Constructed scale	Lower
	Damage to agriculture assets	\$M of damages to agriculture assets (buildings, machinery, inventory, animals, plants)	Lower
	Impacts of flooding on crops	% land meeting ARDSA standard	Higher
	Impacts of flooding on livestock	% livestock impacted/lost	Lower
	Regional and local food security	Constructed scale	Higher
Local Economy	Economic losses to agricultural sector	\$M	Lower
	Adverse employment impacts	# of jobs from baseline	Lower
	Permanent loss of businesses	# of businesses permanently closed	Lower
	Business interruptions	\$M	Lower
	Damages to business assets (buildings, inventory, etc.)	\$M	Lower
	Regional Economy	Disruption of goods movement	\$M
Disruption of regional services		\$M	Lower
Disruption of international services (electricity sold to USA)		\$M	Lower
Regional and provincial economic losses (indirect & multiplier)		\$M	Lower

Areas of Concern	Stakeholders Concerns	Measures	Direction of Preference
Flood Management Options	Robustness to unknown future	Constructed scale of option robustness	Higher
	Public support/acceptability	Constructed scale of option acceptability	Higher
	Public awareness of risks and options	# of ppl engaged in planning process	Higher
	Capital cost of flood management option	\$M (discounted present day value for full lifecycle of option)	Lower
	Operational cost of flood management option	\$M (discounted present day value for full lifecycle of option)	Lower

Considerations:

- Several objectives are dependent on the transportation and service objectives. For example, business interruptions, emergency service disruptions and employment impacts are dependent on services and transportation access.
- Several indicators are temporal and we need to define how we are defining this. For example, business interruptions or people temporarily displaced
- In the infrastructure category recovery time and disruption need to be better define to ensure they are independent
- Mark Robbins to review agriculture category
- Lifecycle accounting. Ensure that if an option is last for 50 years and another 80 years. That the lifecycle accounting is able to capture this to make comparable judgements

Appendix C: Phase 2 and 3 Options Selection and Prioritization

Appendix C summarizes the adaptation options selection and prioritization process, together with the feedback received through the engagement process of Phase 2 (*What Can We Do?*) and 3 (*What Is Acceptable?*). It is organized in five sections representing one for each of the three CFAS study areas (Crescent Beach, Mud Bay, Semiahmoo Bay), Overall findings and Community Associations responses.

Through Phase 2, *What Can We Do*, over 20 concepts were co-developed with community and professional stakeholders, followed by high-level feasibility analysis, further community review, and refinement and technical analysis. This process of co-developing, refining and shortlisting the full suite of options that had potential viability is depicted in Figure 1.

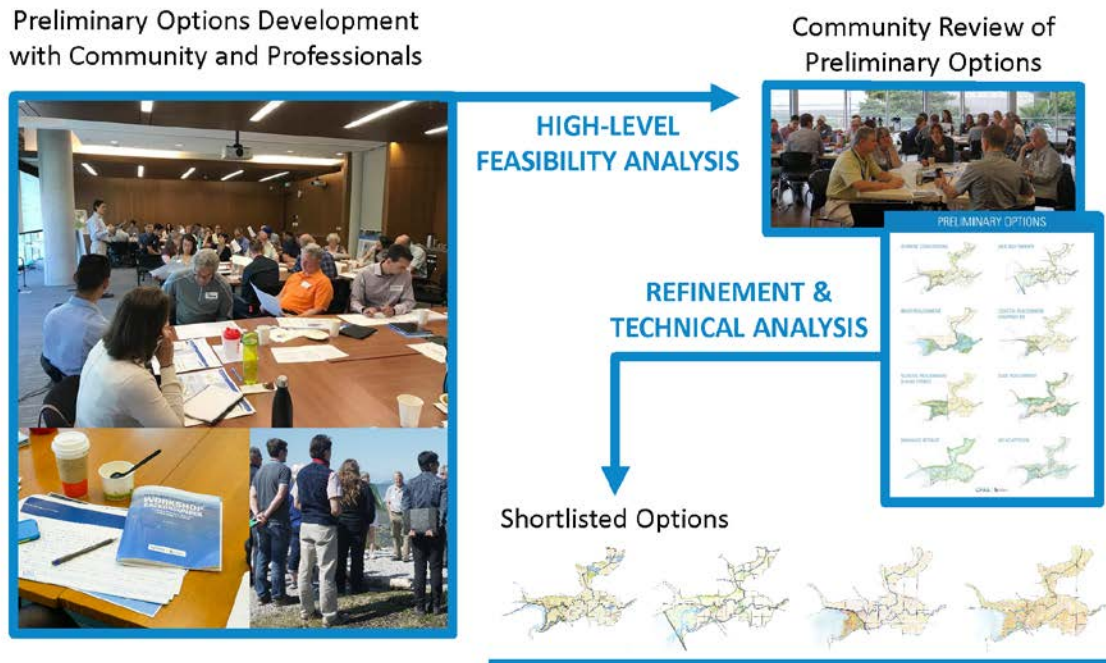


Figure 1 CFAS option development and short-listing process.

The feasibility analysis utilized the criteria developed in Phase 1, *What Matters Most and Who Is Affected*, depicted in Appendix B. A single representative indicator for each of the thematic areas was used in the evaluation. No weightings were applied to the evaluation, but rather a summarizing heat map format was presented to assist participants in developing their option preferences. Evaluations were presented to participants through a Draft Preliminary Options Primer. The Draft Preliminary Options Primer was updated with each round of workshops with technical refinement and to include the additional stakeholder input from the previous workshop.

Workshops were held focusing on each of the three CFAS Study Areas - Mud Bay, Crescent Beach, Semiahmoo Bay - to refine the analysis, improve options and explore whether any viable options were missing. Real time response technology was used at each workshop to provide all participants the opportunity to be heard and stay engaged in the process, with results summarized in the appropriate section of this Appendix. Based on this input, the options list was reduced to a maximum of four options for each study area and a further round of workshops was conducted. The details of the workshops focusing on each of the study areas are summarized below.

Crescent Beach

On February 21st, 2018 a Crescent Beach options prioritization workshop was held in Crescent Beach at Beecher Place. The 3.5 hr long workshop involved 46 participants who undertook a series of prioritization activities regarding each of the shortlisted adaptation options for Crescent Beach:

- No Adaptation (baseline)
- Expanded Edge
- Barrier Island
- Mud Bay Barrier
- Managed Retreat

More detail about these options can be found in the CFAS Primer Part II: Chapter 2 Crescent Beach, available at <http://www.surrey.ca/files/CFASprimerpart2CB.pdf>.

An Open Community Survey was launched on March 13, 2018 and closed on April 6 utilizing the City's online survey platforms and was publicized through various City communication channels including e-newsletters, social media platforms, and multiple locations on the City of Surrey website. External email lists, including the Crescent Beach Property Owners Association, were leveraged to invite their members to complete the survey as well. For a portion of the survey period, the same survey was available to the CitySpeaks Community Panel. A total of **609 responses** were received online, referred to as the "Surrey Survey". A similar in-person in-field survey was completed on February 3, 2018 by University of the Fraser Valley Geography and Environment students, who collected 82 surveys to support a class assignment and to inform the City's work. Many respondents requested that an online version be made available to be more inclusive. While the results of the in-person survey were similar to the online survey, as the technique was different, the results are not included here and are available upon request.

Awareness of coastal flooding risks in Surrey

The chart below shows the varying levels of awareness of Surrey's coastal flooding risk by Crescent Beach participants. The responses are segregated by those who own property in Crescent Beach and those who do not.

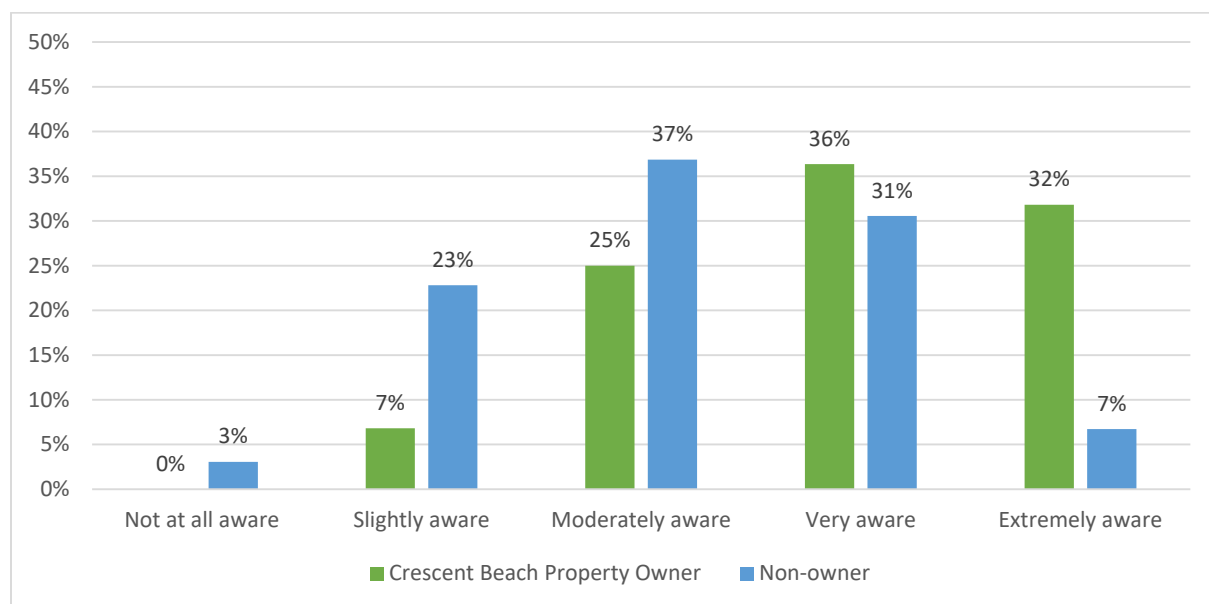


Figure 2. Awareness of coastal flooding risks in Surrey. Crescent Beach survey responses segregated.

Results indicated that approximately two-thirds (68%) of Crescent Beach property owners are highly aware (either “very” or “extremely” aware), while non-property owners are mostly somewhat aware (either “slightly” or “moderately” aware; 60% in total) and 38% indicate that they have a high level of awareness of flooding risks (either “very” or “extremely” aware).

Importance of sea level rise and coastal flooding

Participants were asked “By comparison to other issues Surrey is facing, how important is the issue of sea level rise and coastal flooding?” Again, responses are segregated by those who own property in Crescent Beach and those who do not in Figure 3. Although the total percentage of responses indicating equal or greater concern is similar between the two groups (75% of property owners and 68% of non-owners), there is considerably more polarization among Property Owners. The percentage of Property Owners indicating the issue to be either much more important, or not at all important, is nearly double that of the non-owners.

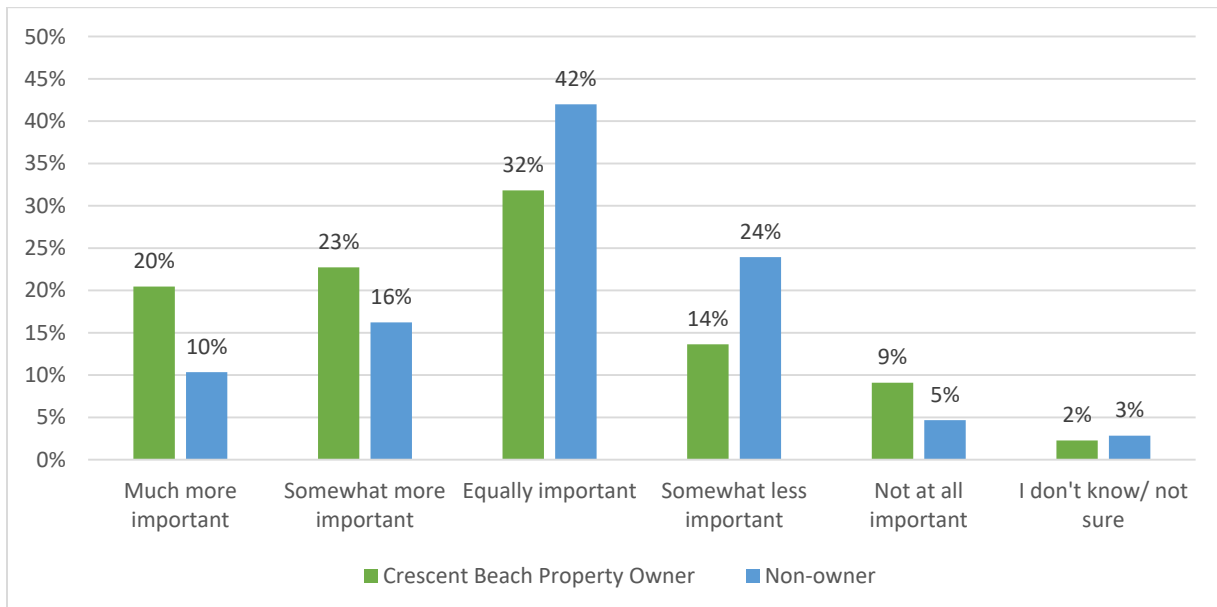


Figure 3. Importance of sea level rise and coastal flooding. Crescent Beach survey responses.

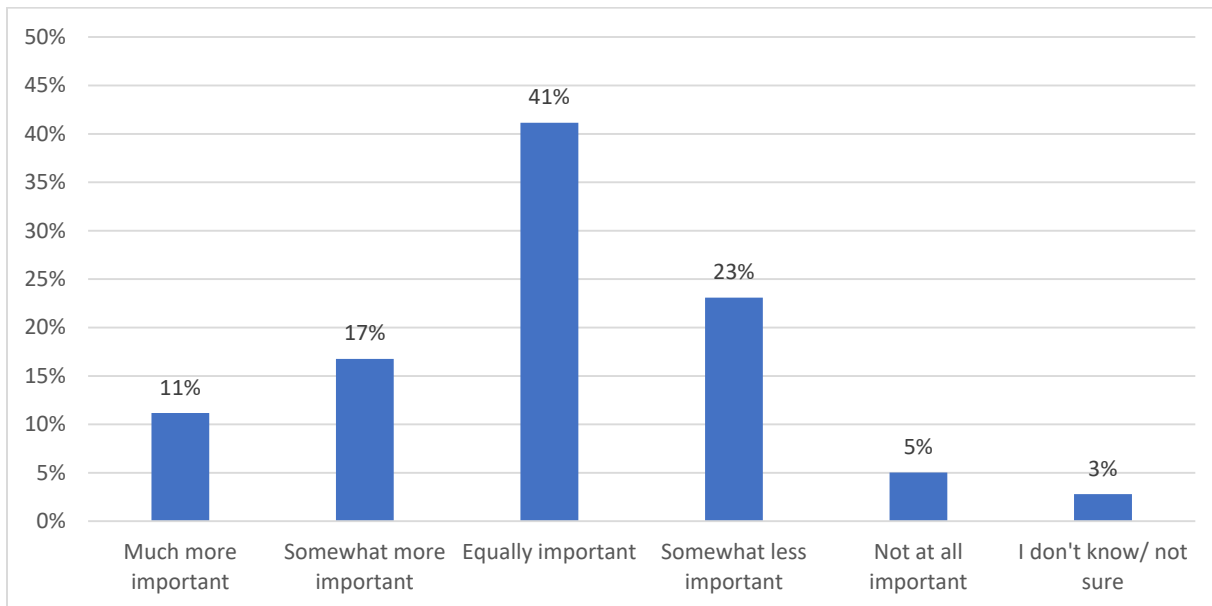


Figure 4. Importance of sea level rise and coastal flooding. Crescent Beach survey responses combined.

Overall both groups agree that issues stemming from sea level rise and coastal flooding are equally or more important than other issues Surrey is facing, with three-quarters of Crescent Beach property owners, and approximately two thirds of non-owners, indicating the issue to be of equal or greater importance than other issues Surrey is facing.

Preferred adaptation option

The chart below shows the preferred adaptation option for both Crescent Beach workshop participants (both Crescent Beach property owners and non-owners), as well the wider participants of the Surrey Survey.

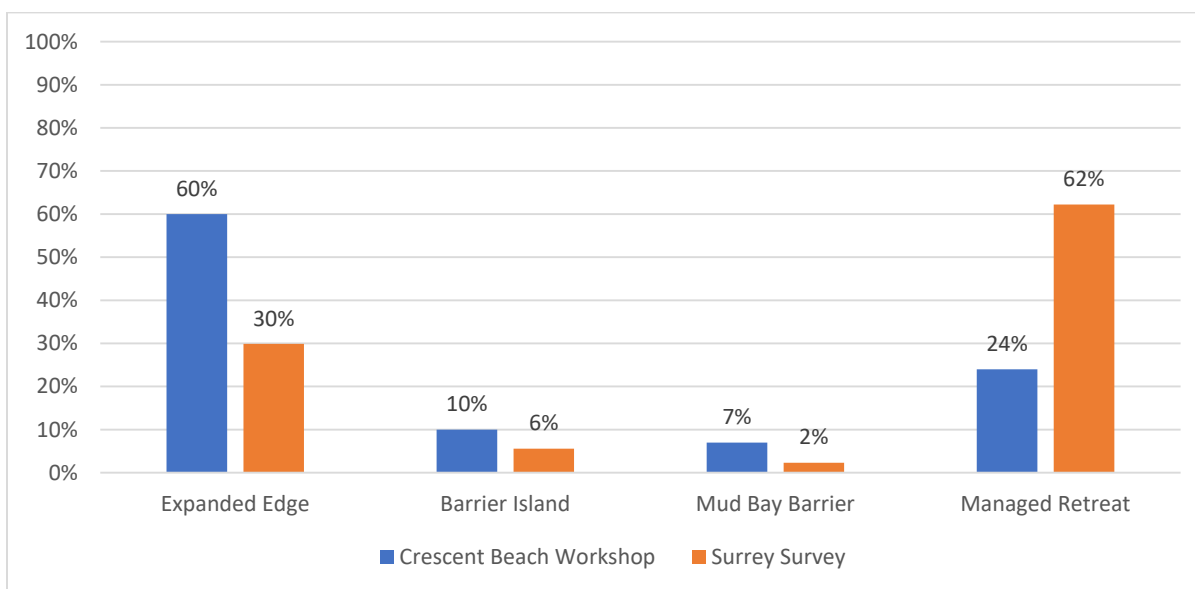


Figure 5. Preferred adaptation option for Crescent Beach

The chart indicates a clear difference in preference for the top adaptation option. Crescent Beach Workshop participants (owners and non-owners) preferred the Expanded Edge option (60%, compared to 30% of Surrey Survey respondents) and the wider Surrey Survey respondents preferred the Managed Retreat option (62%, compared to 24% of Crescent Beach Workshop participants). In general, there was more convergence in option preference among the Surrey Survey responses than for the workshop.

Preferred option for Crescent Beach property owners

The chart below shows the preferred option results from the workshop and survey for Crescent Beach property owners **only**.

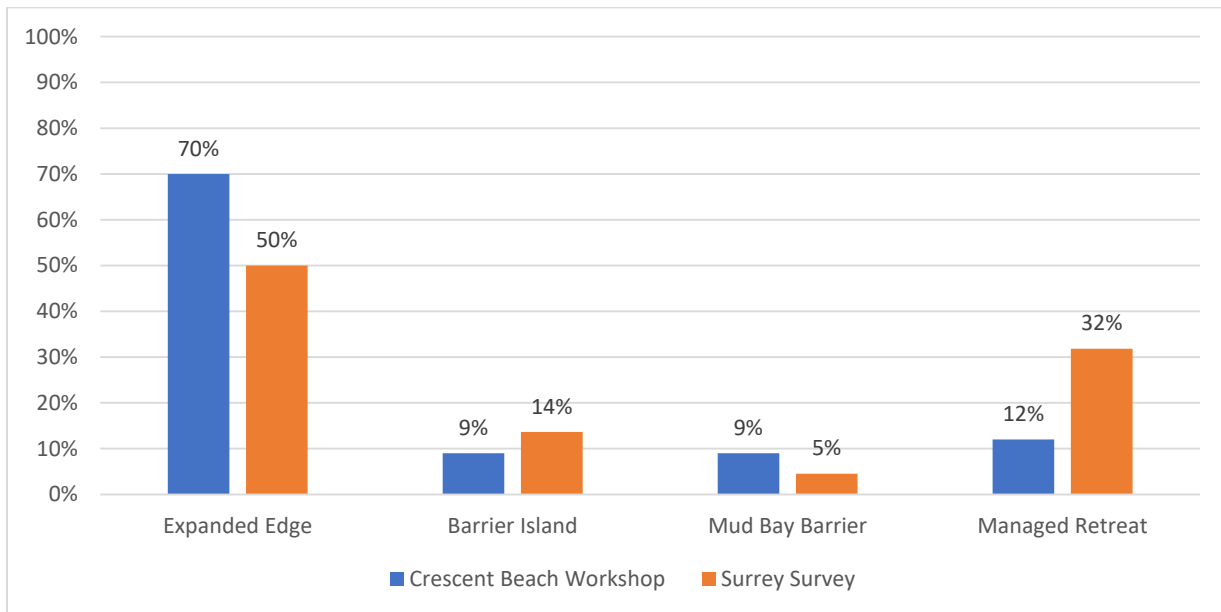


Figure 6. Preferred option for only Crescent Beach property owners

What is clear from the above chart is that most Crescent Beach property owners prefer some form of protection option (e.g. Expanded Edge, Barrier Island, Mud Bay Barrier). However, we can also see that between one eighth and one third of property owners (32% of Surrey Survey respondents, 12% of Crescent Beach Workshop participants) believe that Managed Retreat is the best option.

Cumulative support for Managed Retreat from property owners

While Managed Retreat had considerable support among the online surveys overall, there is a considerable difference between participants who attended the Crescent Beach Workshop and those who responded online. The chart below (Figure 7) shows the cumulative support from the workshop and survey for Managed Retreat from Crescent Beach property owners. The cumulative support graph indicates the percentage of respondents that indicated Managed Retreat as follows: 1st choice (12% to 32%) are the first choice votes for Managed Retreat, 2nd choice is the total votes of first and second choice (30% to 43%) for Managed Retreat, and 3rd choice is the total votes for first, second and third choice votes (36% to 59%).

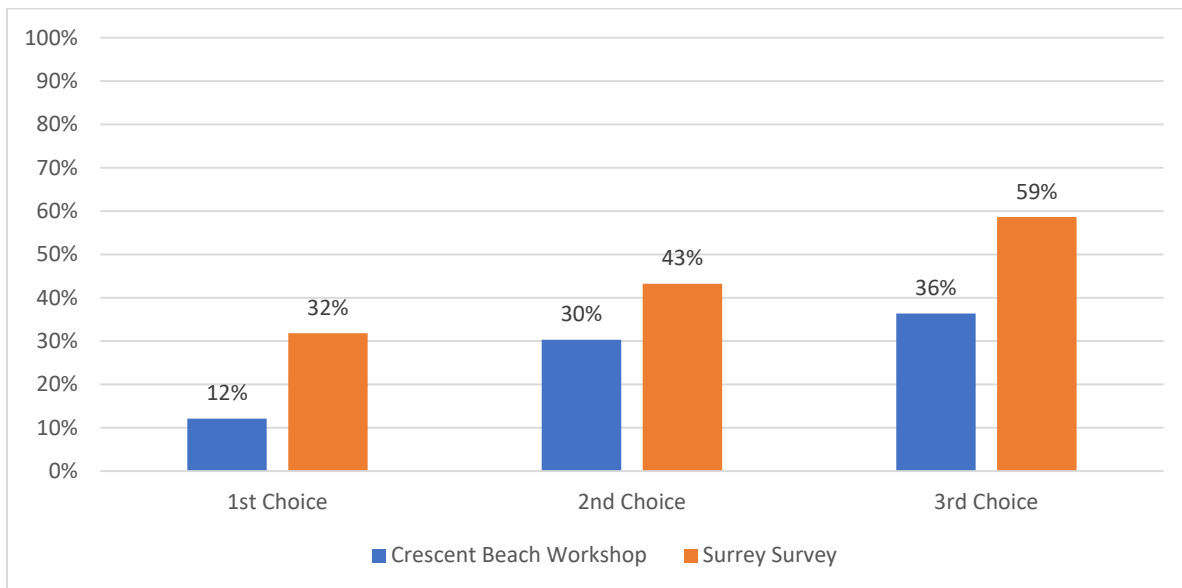


Figure 7. Cumulative support for Managed Retreat from property owners

Cumulative support for Expanded Edge from property owners

The cumulative support for the Expanded Edge Option is depicted in Figure 8, showing all responses alongside the property owner only responses. Although a significant gap exists between the property owners and all respondents for first choice votes (20% difference), there is convergence when considering the top two and top three choices (a 5% or less difference between all responses and the property owner only responses). From this perspective, Expanded Edge is a reasonable compromise of the concerns of the directly affected stakeholders with the interests of the broader community.

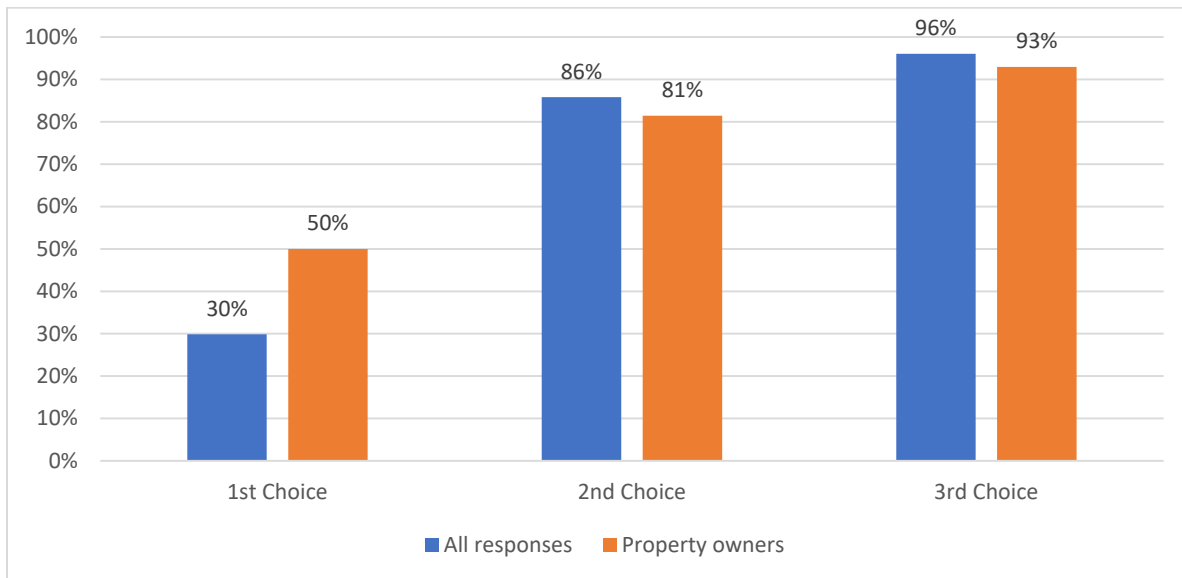


Figure 8. Cumulative support for Expanded Edge from Surrey Survey, comparing all responses with property owners

Financial responsibility for implementing adaptation options

Figure 9 and Figure 10 on the following page depict the difference in beliefs between property owners and non-owners about who should bear the financial responsibility to help Crescent Beach adapt to sea level rise. The breadth of the potential tax base increases from left to right. As the methodology to collect the data in the charts below was slightly different between the workshop and online survey, separate figures have been created to depict the results.

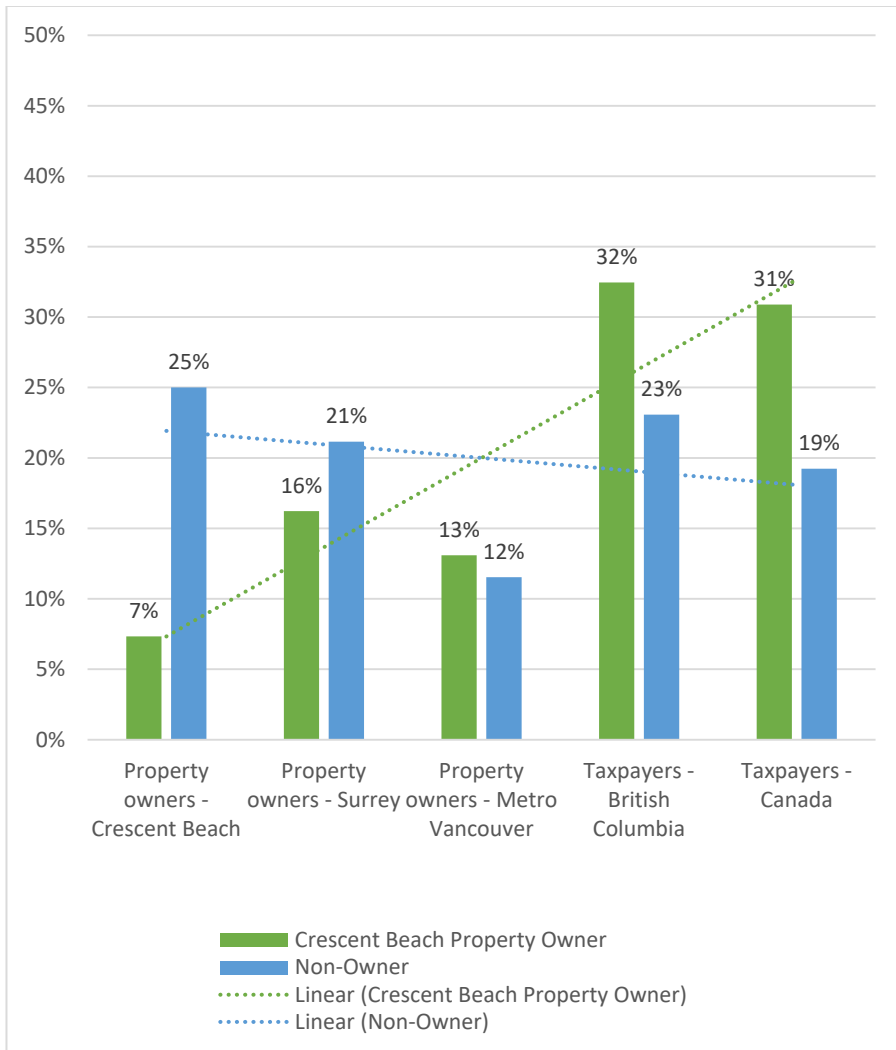


Figure 9. Who should bear the cost of adaptation? Crescent Beach Workshop results.

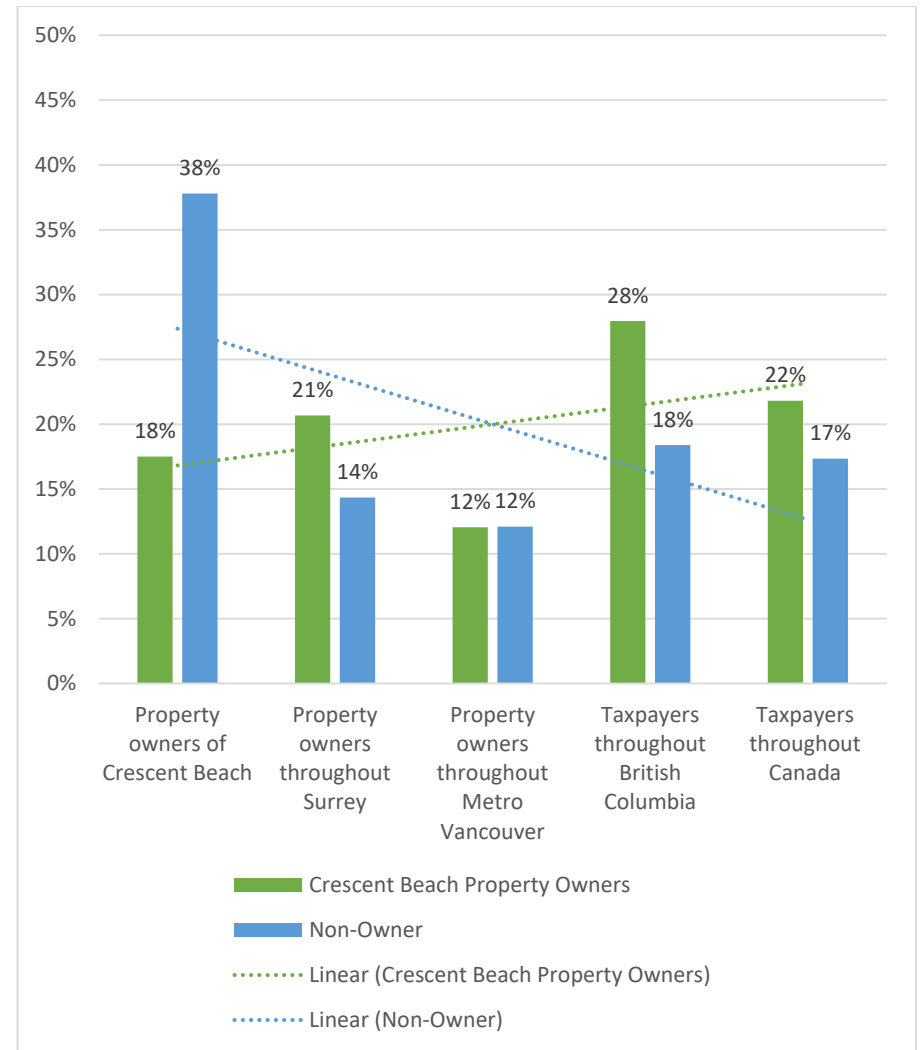


Figure 10. Who should bear the cost of adaptation? Surrey Survey results.

Although the results from these two charts are slightly different, we see the similar trend in both figures where Crescent Beach Property Owners believe that most of the cost to help Crescent Beach adapt to sea level rise should be borne by taxpayers of British Columbia and Canada (with 7% to 18% of the cost borne by the Property Owners). Conversely, non-owners of Crescent Beach property believe that Crescent Beach property owners should bear a large amount (from 25% to 38%) of the adaptation cost. While these results did not influence the option prioritization, it does highlight the challenge in securing financial support for costly adaptive measures that will need to be resolved in the future.

Property-level adaptation measures

If one of the protection strategies is implemented in Crescent Beach, the risk of flooding behind the dikes will continue to increase with sea level rise. Survey participants were asked if they would accept a series of property level adaptation measures to reduce the risk. Below are the results of **only** Crescent Beach property owners.

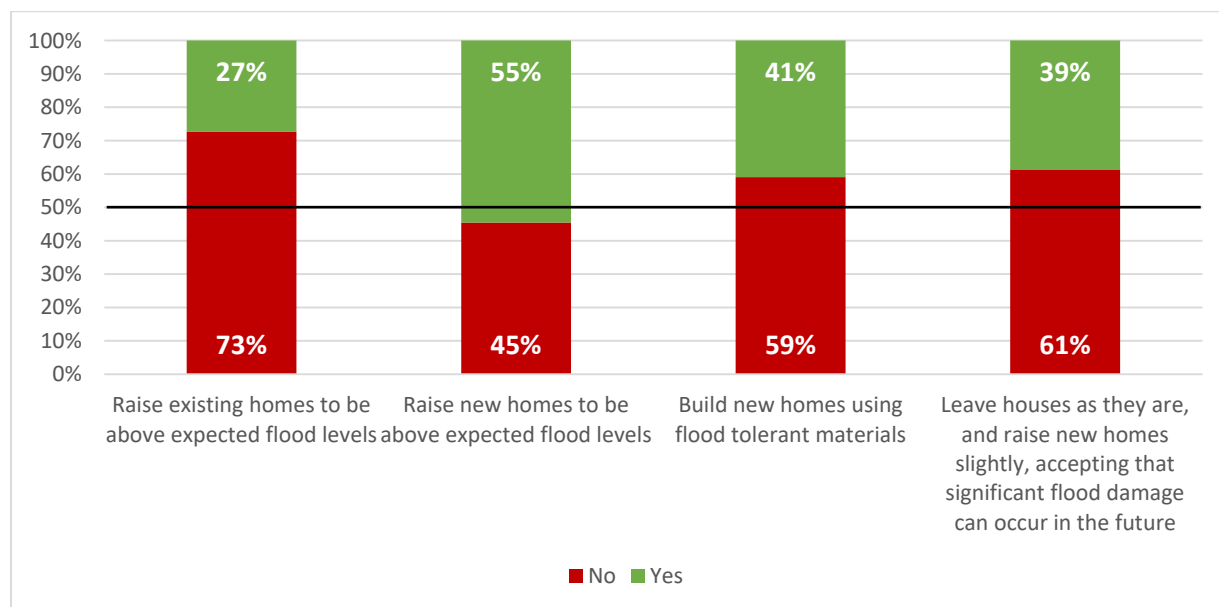


Figure 11. Support from Crescent Beach property owners for property level adaptation measures

From the above, a majority (55%) of Crescent Beach property owners support raising new homes to above expected flood levels. The other approaches presented do not have the support of the majority. A surprising insight from the above results is that despite increasing flooding risks, property owners are overall reluctant to support property-level adaptation measures.

Mud Bay

On March 9th, 2018 a Mud Bay options prioritization workshop was held at City Hall. The 3.5 hr long workshop was attended by 25 participants from the CFAS Advisory Group who undertook a series of prioritization activities regarding the shortlisted adaptation options for Mud Bay:

- Mud Bay Barrier
- Current Conventions
- Highway 99 Realignment
- Managed Retreat
- No Adaptation (baseline)

More detail about these options can be found in the CFAS Primer Part II: Chapter 1 Mud Bay: available at <http://www.surrey.ca/files/CFASprimerpart2.pdf>

An Open Community Survey was launched on February 14, 2018 using the City’s online survey platforms, and closed on March 30, 2018 and was publicized through various City communication channels including e-newsletters, social media platforms, and multiple locations on the City of Surrey website. For a portion of the survey period, the same survey was available to the CitySpeaks Community Panel. A total of **482 responses** focused on Mud Bay adaptation options were received online, referred to herein as the “Surrey Survey”. The results from both the CFAS Advisory Group workshop and the Surrey Survey prioritization activities are captured below.

Awareness of coastal flooding risks in Surrey

The chart below shows the varying levels of awareness of coastal flooding risk in Surrey for those who participated in the Surrey Survey, focused on Mud Bay.

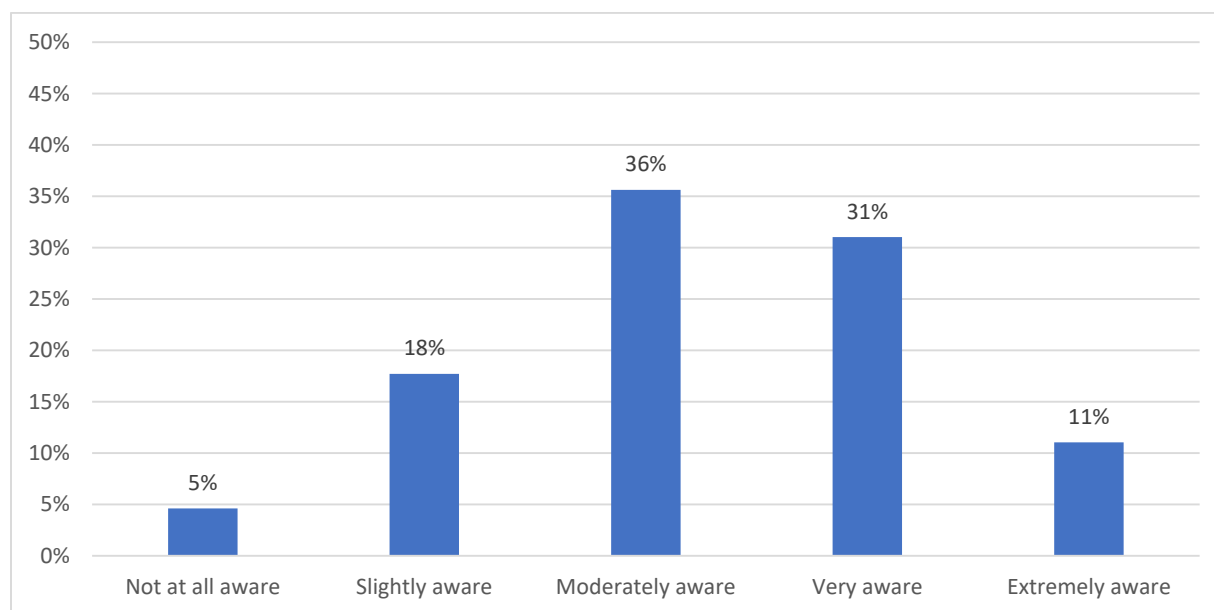


Figure 12. Awareness of coastal flooding risks in Surrey. Mud Bay survey responses.

The chart above shows that almost half (42%) of respondents are highly aware (either “very” or “extremely” aware) of flooding risks in Surrey.

Importance of sea level rise and coastal flooding

Participants were asked “By comparison to other issues Surrey is facing, how important is the issue of sea level rise and coastal flooding?”. The chart below shows a summary of the responses.

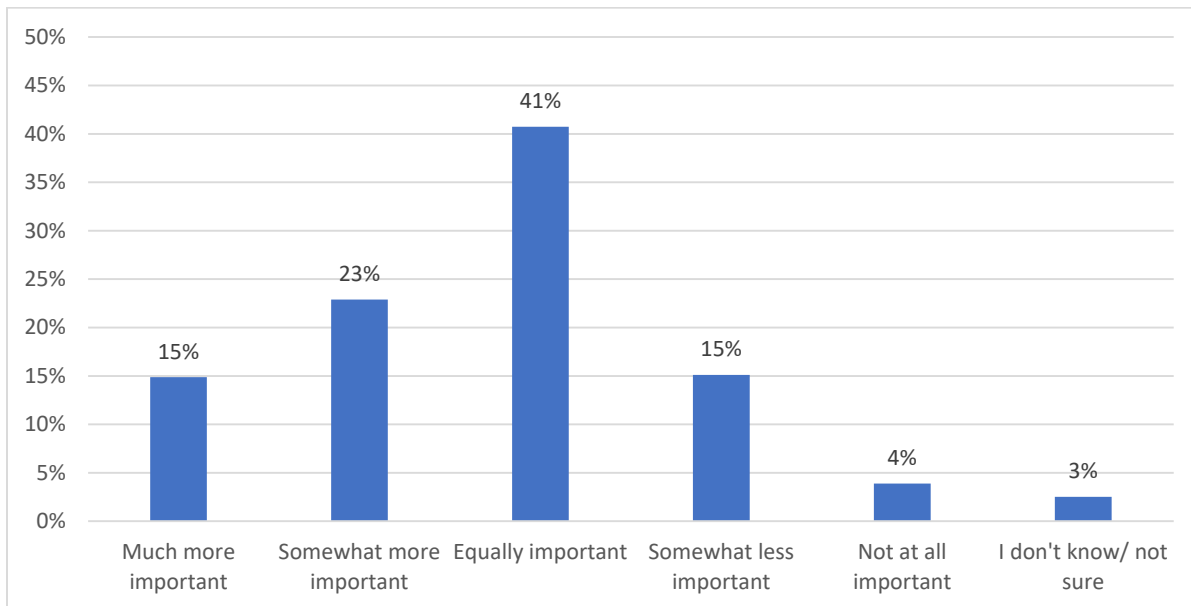


Figure 13. Importance of sea level rise and coastal flooding. Mud Bay survey responses.

Figure 13 shows that over three quarters (79%) of respondents believe sea level rise and coastal flooding are equally or more important than other issues Surrey is facing.

Preferred adaptation options for Mud Bay

The chart below shows the preferred adaptation option for the Mud Bay Advisory group and the broader group of participants of the Surrey Survey.

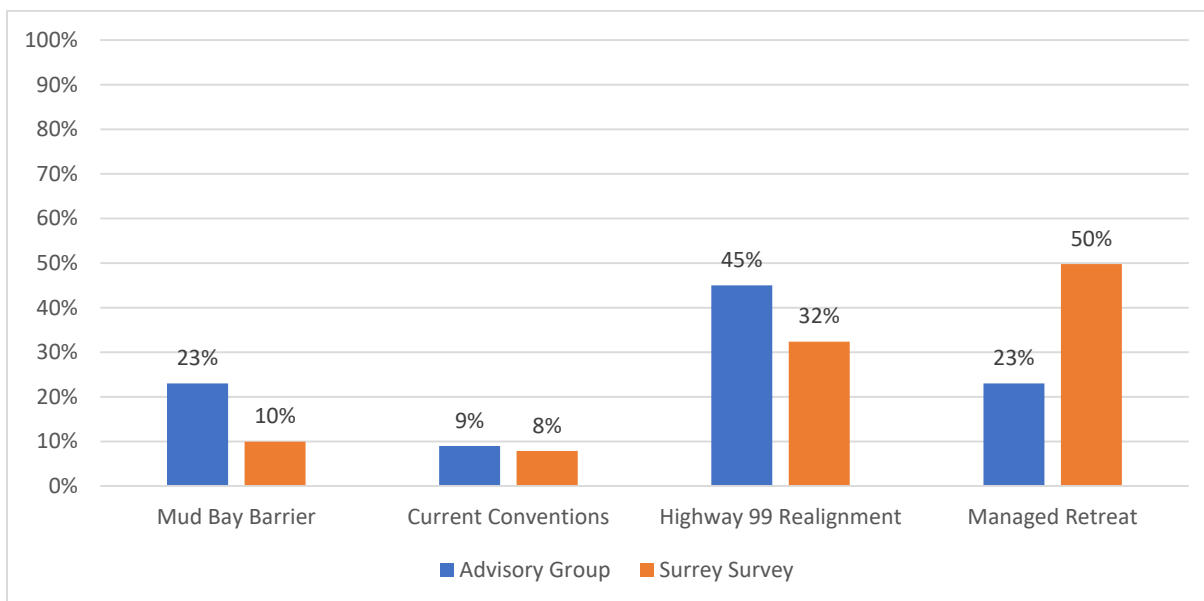


Figure 14. Preferred adaptation options for Mud Bay.

The majority of both groups prefer options involving pulling back from the current dyke alignment. Advisory Group members believe that the dyke should be realigned with Highway 99 (45% indicated the option as their first choice); whereas the wider Surrey Survey response indicates a belief that Managed Retreat is a better option (50% indicated the option as their first choice).

Preferred option for Farmers of Mud Bay

Given that adaptation options for Mud Bay will have direct impacts to farmers in the area, the figure below shows the preferred adaptation option results from the Advisory Group and Surrey Survey only those who farm in the Mud Bay study area.

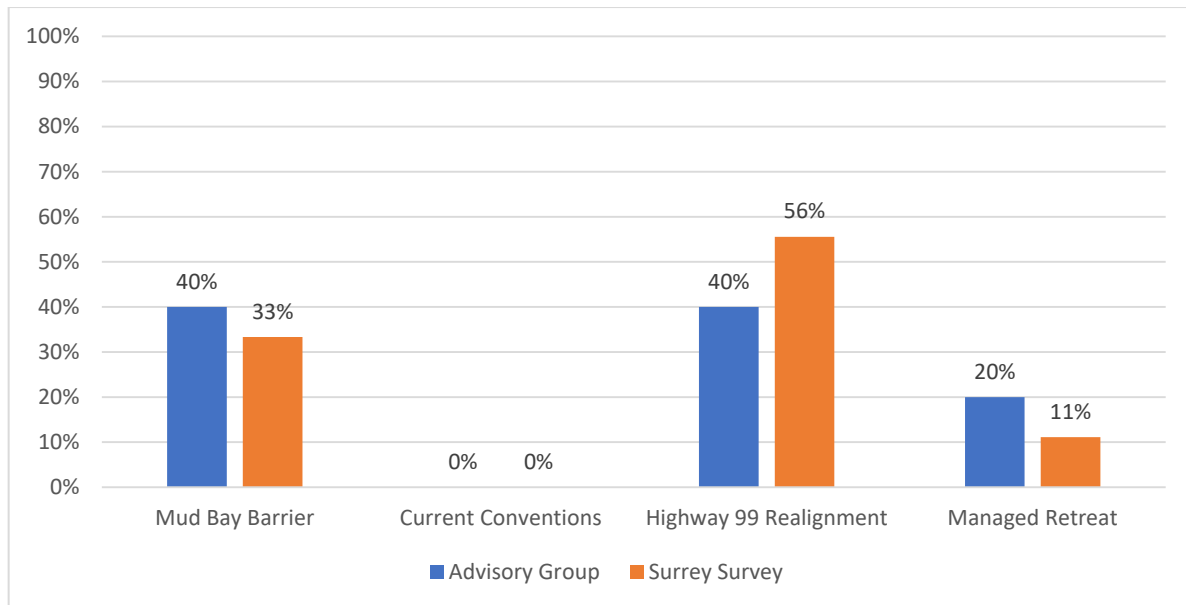


Figure 15. Preferred adaptation option for farmers of Mud Bay.

These results indicate that farmers are quite split regarding the preferred adaptation option. The majority prefer some form of pull back from the current dyke alignment, either to Highway 99 or Managed Retreat (60% to 67% indicated either Hwy 99 Realignment or Managed Retreat as their first choice). The option of Mud Bay Barrier received more support among farmers in the Mud Bay Study Area, than among non-farmers with between 33% and 40% of farmers in the Mud Bay study area indicating the Mud Bay Barrier as their preference, compared to 10% to 23% of the overall Surrey Survey and Advisory Group respondents.

Cumulative support for Highway 99 Realignment

The chart below shows the cumulative support for Highway 99 Realignment. The cumulative support graph indicates the percentage of respondents that indicated Highway 99 Realignment as follows: 1st choice (45% to 32%) are the first choice votes for Highway 99 Realignment, 2nd choice is the total votes of first and second choice (91% to 83%) for Managed Retreat, and 3rd choice is the total votes for first, second and third choice votes (100% to 94%). The Advisory Group showed a higher level of support for Highway 99 Realignment as compared to the Surrey Survey respondents.

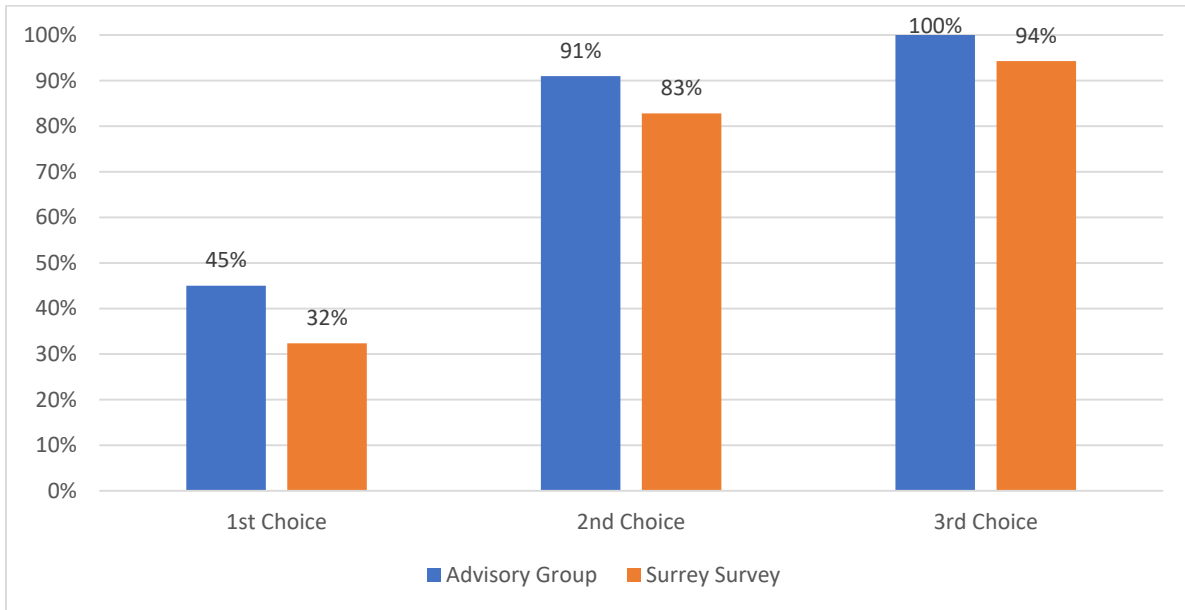


Figure 16. Cumulative support for Highway 99 Realignment.

Financial responsibility for implementing adaptation options

The chart below shows how the two groups view who should bear the financial responsibility for implementing adaptation options for Mud Bay, with the breadth of the potential tax base increasing from left to right.

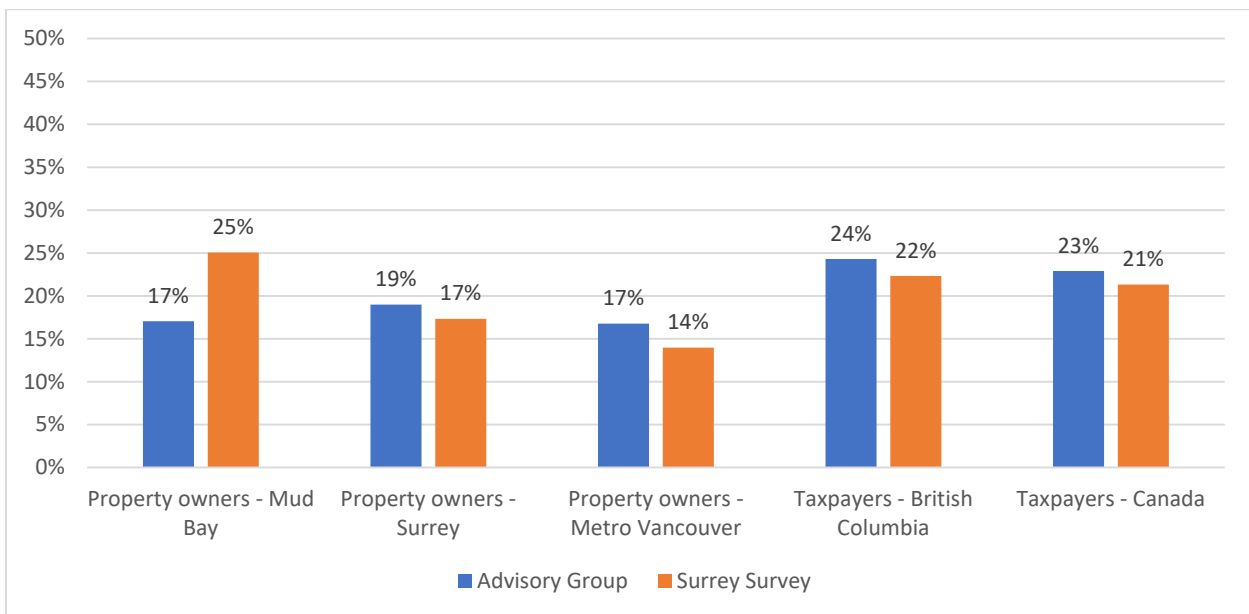


Figure 17. Who should bear the cost of adaptation?

The chart above depicts significant agreement between the Advisory Group and wider Surrey Survey participants. In essence, both groups agree that the cost for implementing adaptation measures in Mud Bay should be somewhat equally distributed across the five subgroups identified in the chart.

Semiahmoo Bay

The CFAS area for Semiahmoo Bay is largely within the jurisdiction of the Federal Government and Semiahmoo First Nation. A series of meetings were held with Semiahmoo First Nation, meeting minutes are included in Appendix G. Chief Harley Chappell ranked his preferences of the options for Semiahmoo Bay as: first choice Expanded Edge, second Choice Road & Land Raising, and third choice No Adaptation. However, as Expanded Edge is not within the authority of neither the Semiahmoo First Nation nor the City of Surrey, the requirement to relocate the BNSF Railway is beyond the scope of CFAS. If such opportunity is presented in the future, the Land & Raising option could be adapted to become the Expanded Edge option as part of Railway Relocation phasing.

Overall

Beyond the insights gained on the specific studies areas, several comparisons in survey results are possible to better understand the differences between study areas and how perceptions have changed over the course of the CFAS process so far.

Differences between Mud Bay and Crescent Beach Study Areas

In comparing the beliefs of who should bear the cost of adaptation, we see a much higher degree of divergence between the directly impacted stakeholders and the broader public on who should bear the cost of adaptation in the case of Crescent Beach, with an average 20% difference between the level of investment indicated for directly impacted stakeholders, as indicated by the directly impacted stakeholders, versus the overall respondents to the online survey (18% versus 38% shown in Figure 10 for percentage borne by Crescent Beach property owners). In the case of Mud Bay, the difference in belief for bearing the cost of adaptation is only 8% (an average allocation of 17% of costs among workshop attendees versus 25% among online responses, shown in Figure 17 for percentage of costs borne by Mud Bay property owners).

In comparing Figure 5 and Figure 14, it is evident that there is a higher degree of convergence on a preferred option within the Mud Bay Study Area (Highway 99 Realignment difference of 13% percent between the workshop and online survey respondents) than within the Crescent Beach Study Area (Expanded Edge difference of 30% between workshop and the online survey respondents).

In terms of the overall importance of a study area, participants have a higher level of concern for Mud Bay, with 79% of respondents (shown in Figure 13) believing sea level rise and coastal flooding to be of equal or greater level of concern than other issues in Surrey, as opposed to 69% (shown in Figure 4) for the Crescent Beach study area. Among property owners in Crescent Beach, the level of concern (75% shown in Figure 3) is closer to the overall level of concern for Mud Bay.

Growing Levels of Awareness

Throughout the engagement process of developing and prioritizing options for long-term Coastal Flood Adaptation, the recognition level of the importance of sea level rise and coastal flooding has increased significantly. In Phase 1 of CFAS, CitySpeaks community panel members¹ (total of 608 participants) where asked the question “By comparison to other issues Surrey is facing, how important is the issue of sea level rise and coastal flooding?”. This question was repeated in the online survey of Phase 2 & 3

¹ As reported in https://www.surrey.ca/bylawsandcouncilibrary/CR_2017-R246.pdf

(total of 1,091 responses). The chart below shows a comparison of Phase 1 and Phase 2 & 3 results where a clear increase of concern around sea level rise and coastal flooding is evident. In Phase 1, 53% of participants indicated that sea level rise and coastal flooding was of equal or greater importance than other issues facing Surrey, which increased to an average of 73% in the Phase 2 and 3 surveys. The overall level of awareness of coastal flooding was similar between the two study areas.

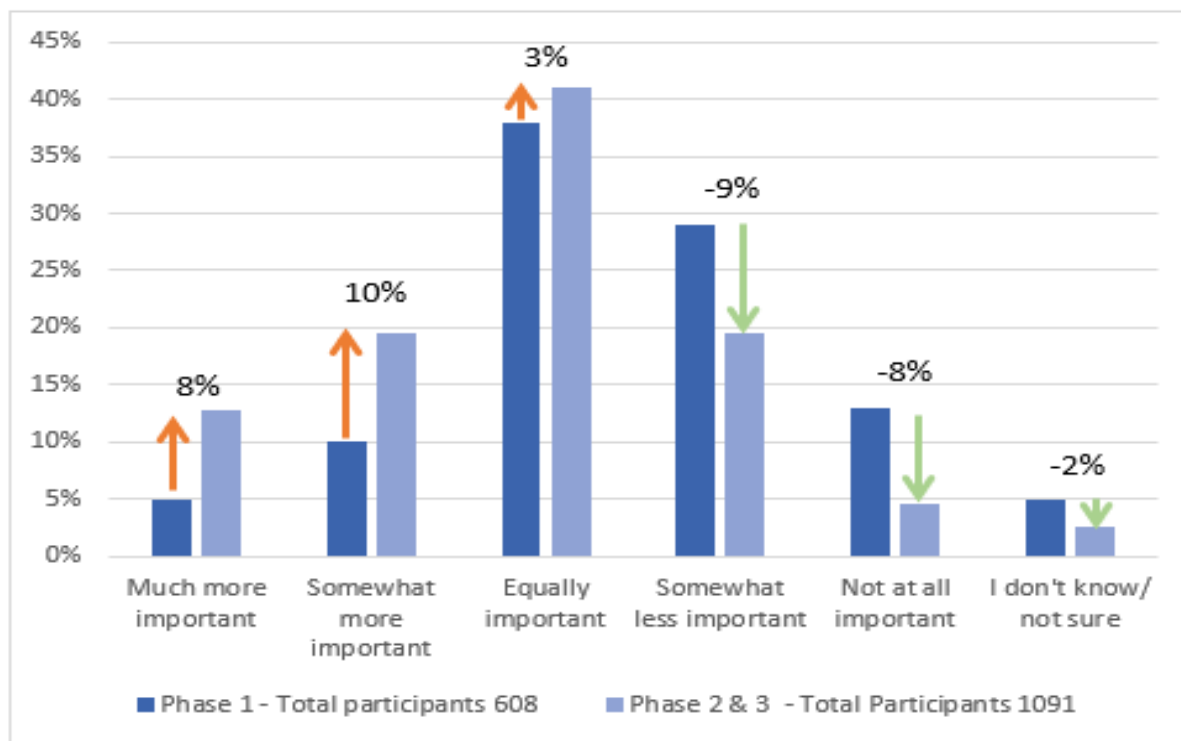


Figure 18. Changes in level of concern around sea level rise and coastal flooding.

Analysis of Data

The CFAS team summarized the input received from the surveys, workshops and technical evaluation and developed presentations boards for a CFAS Open House that were reviewed with the City’s internal CFAS steering committee for all three study areas.

Open House Results

In an attempt to evaluate whether broad consensus was reached through the option selection and prioritization process, the CFAS Open House Phases 2 and 3 was held at the Rotary Field House on April 10, 2018. City Staff and the CFAS Project Team were available to discuss the project and a draft Emerging Direction (as a result of consultation received to date) was presented for each study area that included technical and public input received to-date. All residents within the Mud Bay and Crescent Beach study area were invited to participate through the e-mail lists, direct mail and newspaper advertising. (<https://www.surrey.ca/files/CFASOpenHouseApril%2718.pdf>)

Over fifty community members attended. A series of presentation boards and a project video were used to summarize the initial findings of the two phases. Separate questionnaires for Crescent Beach and Mud Bay were made available to participants to provide their comments on the initial findings. A total of 45 completed questionnaires were submitted.

As depicted in Figure 19, the overall level of support for the draft Emerging Directions amongst Open House Participants were: 86% of respondents agree with Coastal Realignment to Hwy 99 for Mud Bay by 2100; and 70% of respondents agree with Managed Retreat for Crescent Beach by 2100.

Do you agree with the emerging direction by 2100?

■ No - Do Not Agree at all ■ Somewhat disagree ■ Somewhat Agree ■ Agree ■ Yes -Strongly Agree ⦿ Blank ▨ Don't know

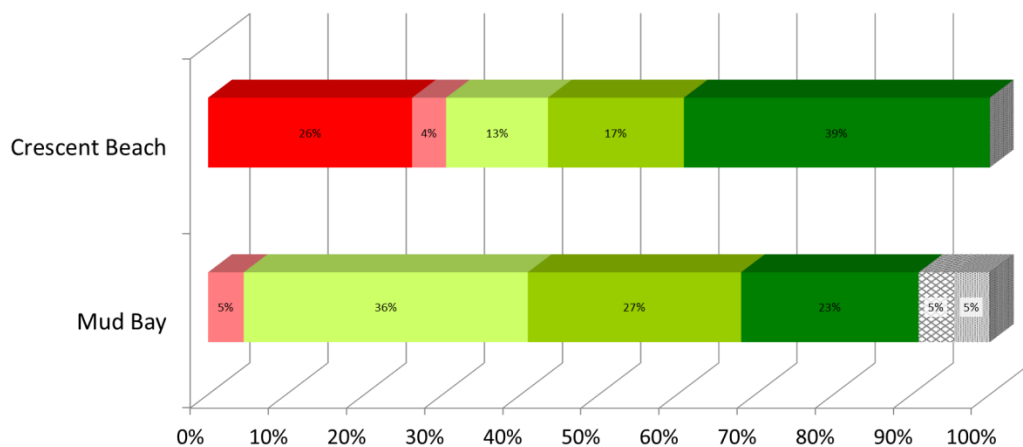


Figure 19. April 10, 2018 Open House Feedback for Crescent Beach and Mud Bay

To better understand the lower level of support for the Crescent Beach study area (70% of respondents agreeing, versus 86% for the Mud Bay study area), Figure 20 has segregated the level of support among Crescent Beach residents from that among non-Crescent Beach residents for the option of Managed Retreat. While there was strong support among non-Crescent Beach residents (93% agreeing with the option), two-thirds (67%) of the directly impacted stakeholders responding at the Open House disagree with the option of Managed Retreat. It is evident that there is polarization on the option, with the majority of Non-Crescent Beach Residents (57%) answering “strongly agree”, while the majority of Crescent Beach Residents (56%) answering “do not agree at all”.

Do you agree with the emerging direction by 2100?

■ No - Do Not Agree at all ■ Somewhat disagree ■ Somewhat Agree ■ Agree ■ Yes -Strongly Agree

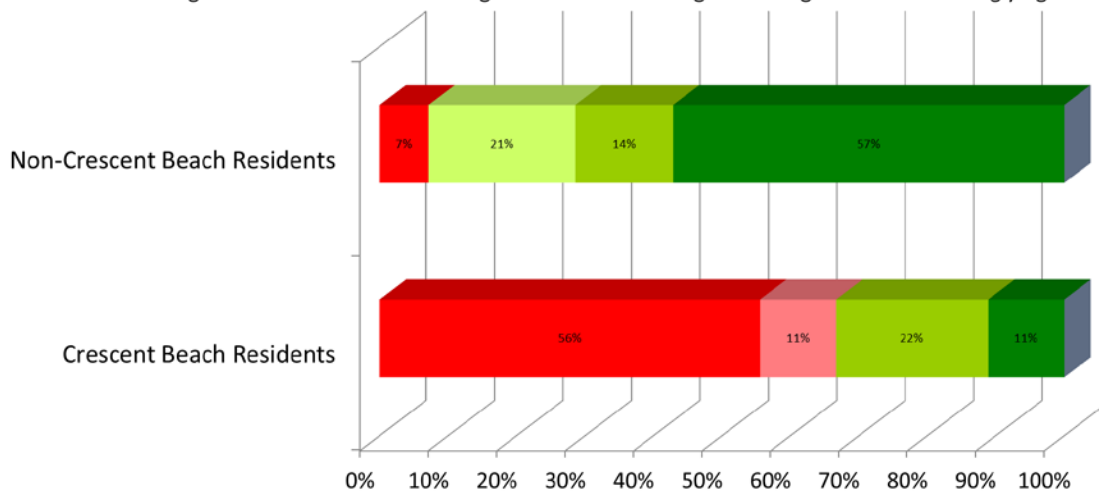


Figure 20. April 10, 2018 Open House Feedback for Crescent Beach

In addition to participants indicating their level of support for the Emerging Direction for each area, Table 1 on next page includes the 23 comments received for Crescent Beach and Table 2 includes the 20 comments received for Mud Bay at the Open House.

Table 1. Comments received for Crescent Beach at Open House

Let nature do her thing
-Expanded Edge is less expensive (up front) and less impactful on residents (full disclosure - I am one) -Very hard to imagine a workable plan to expropriate/relocate 1,400 residents -Regardless of the final recommendations, please be careful with announcements as they will have a big impact on psyche of residents and property values
What will become of the rocky and gravelly shoreline that currently supports intertidal life? Building out from the dyke could increase wildlife values.
-Too much history/heritage/recreation to abandon Crescent Beach -Build up the entire Beach village over time -future projections of sea level rise are Too variable to make an accurate prediction and decision
In the strong belief, that these measures are not going far enough. It's my concern that required level of security/protection will not be achieved. From my point of view it's inevitable to build a barrier similar to what Dutch People performed in the Netherlands. The Lower Mainland is already limited by Three sides Pacific/Mountains/US Border. We Cannot afford to put drastic measures in place to avoid the worst.
Downside is the other options have been overplayed. Especially re: risks of failure. Scaremongering.
It makes the most sense in the long term.
Most realistic long term option
the area has not only been home to my family for over 100 years but has provided the community I grew up in and plan to build our new family home to raise my family.
Trying to King Canute is very expensive Suggestion - plant spartina to raise level of flats.
Short-term - Expanded Edge Long-term - Managed Retreat
With rising water lands and concerns about effects from major earth quakes - this just seems prudent -in preparation - stop issuing building permits
Need to get the actuaries and seismologists involved before going further!
The uncertainty of actual sea level rise, water table rise and how soon levels [illegible] to believe managed retreat is the long term solution. The environment, marine, estuarine habitats are essential for life, people can move.
Many parts of Crescent Beach is already below sea level - Gilley St for Example: You cannot stop the water, expenditures will be costly. Take action in time and move is the best all round safe solution.
OK
Residents most definitely should have their opinions considered and managed retreat was NOT the choice they made. I highly doubt Surrey, BC or Canadian government would give home owners FAIR market value for their home and what and where would be a comparable?
There is uncertainty as to how long it will take Crescent Beach to no longer be habitable. Therefore it is prudent to start the process NOW of stopping development and relocating people so that we gradually reduce the expense and urgency once the area is flooded. Other options like dykes etc. are expensive and subject to failure in storms more severe than anticipated. Or in an earthquake they could be destroyed and all that money and time to construct them was wasted.
Without actual risk percentages spending monies on mitigation strategies that may or may not be effective doesn't seem wise

Table 2. Comments Received for Mud Bay at Open House

This is the second best option of the four originally presented
Remove the BN Railway and build up dykes along the tracks to improve the flood protection
Your info says Highway 99 was either 1st or 2nd preferred option "next to managed retreat" and considering "current" water/flooding already happening plus the ongoing costs for Hwy 99 this option seems wrong.
OK
To raise the 99 to become a barrier of water inland solves min. 2 problems. Well thought out curtail water from heading inland. Upgrade dykes and ocean locks to control flow. Costly but best results
Need to get the actuaries and seismologists involved before going further!
Most sensible, cost effective option in the long-term.
Hwy 99 + other infrastructure is important locally, regionally and internationally. Managed treat just doesn't seem rational. Barriers - affected by mega earthquakes? In the long long term who can say - so realignment seems like the prudent thing to do in the medium (100 year) term.
The Mud Bay barrier would be the optimal adaptation strategy. Otherwise, a nuanced retreat/yielding to the sea should be the focus. The Highway 99 Coastal Realignment by 2100 is in my opinion, a necessary initial stop as the Highway would have to be raised anyway as a protective measure in case any accident/accident with a [illegible]
Acceptable as an additional measure on top of Mud Bay Barrier. Hint: 1) Most of the time it is enough to have either a belt or suspenders. In rare circumstances it is a major advantage to have both! 2) Think ahead! 3) It's twenty first century. A lot people did not recognize that so far!
Seems like a very practical solution. It is thought that the silt from the rivers will flow out and add to the mud flat/wetlands that are flooded?

Community Associations

In accordance with the City's Consultation Principles, the City seeks involvement from community associations representing residents potentially impacted by City planning projects. The Crescent Beach Property Owners Associations has been involved in CFAS since the project outset.

The Crescent Beach Property Owners Association reviewed the content of the Open House materials at their May General Meeting and in response to concerns raised by several members, their directors met with the City staff in June. The Association's general meeting on July 4, 2018 included a presentation from Surrey staff to approximately 120 members. Following the meeting, the Association's directors requested that the Managed Retreat option be removed from the shortlist of long-term options for Crescent Beach.

City staff reviewed this request and have had additional discussion with the Association's directors to better understand the concerns of the stakeholders. On July 31st, 2018 an open meeting was hosted by the CBPOA to discuss CFAS next steps and the City agreed to remove both the Managed Retreat option and the Mud Bay Barrier from the shortlist of long-term options for the Crescent Beach Study Area as described in this media release: <https://www.surrey.ca/city-government/27496.aspx>. No further analysis will be conducted on this option and it will not be recommended by staff in the draft Coastal Flood Adaption Strategy to be brought forward in 2019 to Surrey Council.

The City will continue to evaluate the Crescent Beach community's preferred option of an Expanded Edge and its second preferred option of a Barrier Island/Spit. Additional monitoring will be collected to inform future coastal flooding and adaptation plans, such as sea level changes, ground subsidence, long-term beach erosion, storm surge and wave damage and seasonal water pooling.

Appendix D: Workshop Exit Surveys

Each CFAS workshop was concluded with an exit survey. The summary table on the next page presents the aggregate results of the exit surveys, followed by a summary table of any additional comments received through the exit surveys.

Additionally, workshop feedback spreadsheets are included for the following workshops: Environmental Stewards Workshop and Coastal Regulators Workshop. For supplementary information on Coastal Regulators feedback see Chapter 6 of Prioritizing Infrastructure and Ecosystem Risk Phase 1 Report, available at <http://www.surrey.ca/files/CFASPIERPhase1Report31Mar2018.pdf>

Workshop Exit Surveys – Summary Table

		To what extent is coastal flooding a concern for you and your family/organization			Do you feel that your top concerns about coastal flooding were captured today		You understood the information that was presented					The logistics (location, time) of the Workshop were suitable:					You felt your opinion was heard					You will like to continue to be involved in the CFAS planning process:					The length of the workshop was:					
		Low	Medium	High	Yes	No	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Much too short	Too short	Just right	Too long	Much too long	
Agriculture	03-Feb-17	1	11	14	24	3	13	12	1	0	0	10	16	1	0	0	9	16	2	0	0	16	9	1	0	0	0	1	25	1	0	
Residential	08-Feb-17	2	5	6	13	0	6	5	0	0	0	5	6	0	0	0	4	7	0	0	0	3	6	2	0	0	0	0	11	0	0	
Infrastructure	28-Mar-17	4	15	20	37	4	12	21	0	0	0	13	18	1	1	0	11	21	0	1	0	7	13	12	0	0	0	27	6	0		
Env & Rec	08-Mar-17	1	6	7	13	0	8	4	0	0	0	6	6	0	0	0	5	6	1	0	0	6	6	0	0	0	0	9	3	0		
Advisory Group 1	25-Jul-17						11	16	0	0	0	12	12	0	3	0	12	15	0	0	0	14	12	1	0	0	0	1	24	2	0	
Crescent Beach 1	31-Aug-17						12	9	0	0	0	14	7	0	0	0	11	10	0	0	0	13	6	1	0	1	0	0	21	0	0	
Green Shores 2	11-Jul-17	5	9	3	16	1	9	8	0	0	0	9	8	0	0	0	7	9	1	0	0	5	7	5	0	0	0	0	17	0	0	
Regulators	17-Oct-17	0	0	10	10	0																										
ICFAA	10-Oct-17	1	4	20	25	4	8	14	1	0	0	15	8	0	0	0	14	7	2	0	0	12	9	2	0	0	0	0	22	1	0	
Semiahmoo Bay	02-Nov-17	1	0	8			3	6	0	0	0	3	5	1	0	0	3	6	0	0	0	5	2	1	0	0	0	1	7	0	0	
Stewards	17-Nov-17	4	1	5	9	1																										
Crescent Beach 2	21-Feb-18						19	14	0	0	0	19	13	0	1	0	16	14	3	0	0	18	15	0	0	0	0	2	31	0	0	
Advisory Group 2	09-Mar-18						14	7	0	0	0	15	6	0	0	0	12	9	0	0	0	0	2	18	1	0	11	8	2	0	0	
Total		19	51	93	147	13	115	116	2	0	0	121	105	3	5	0	104	120	9	1	0	99	87	43	1	1	11	13	196	13	0	
<i>As percentage</i>																																
Agriculture	03-Feb-17	4%	42%	54%	89%	11%	50%	46%	4%	0%	0%	37%	59%	4%	0%	0%	33%	59%	7%	0%	0%	62%	35%	4%	0%	0%	0%	4%	93%	4%	0%	
Residential	08-Feb-17	15%	38%	46%	100%	0%	55%	45%	0%	0%	0%	45%	55%	0%	0%	0%	36%	64%	0%	0%	0%	27%	55%	18%	0%	0%	0%	0%	100%	0%	0%	
Infrastructure	08-Mar-17	10%	38%	51%	90%	10%	36%	64%	0%	0%	0%	39%	55%	3%	3%	0%	33%	64%	0%	3%	0%	22%	41%	38%	0%	0%	0%	0%	82%	18%	0%	
Env & Rec	08-Mar-17	7%	43%	50%	100%	0%	67%	33%	0%	0%	0%	50%	50%	0%	0%	0%	42%	50%	8%	0%	0%	50%	50%	0%	0%	0%	0%	0%	75%	25%	0%	
Advisory Group 1	25-Jul-17						41%	59%	0%	0%	0%	44%	44%	0%	11%	0%	44%	56%	0%	0%	0%	52%	44%	4%	0%	0%	0%	4%	89%	7%	0%	
Crescent Beach 1	31-Aug-17						57%	43%	0%	0%	0%	67%	33%	0%	0%	0%	52%	48%	0%	0%	0%	62%	29%	5%	0%	5%	0%	0%	100%	0%	0%	
Green Shores 2	11-Jul-17	29%	53%	18%	94%	6%	53%	47%	0%	0%	0%	53%	47%	0%	0%	0%	41%	53%	6%	0%	0%	29%	41%	29%	0%	0%	0%	0%	100%	0%	0%	
Regulators	17-Oct-17	0%	0%	100%	100%	0%																										
ICFAA	10-Oct-17	4%	16%	80%	86%	14%	35%	61%	4%	0%	0%	65%	35%	0%	0%	0%	61%	30%	9%	0%	0%	52%	39%	9%	0%	0%	0%	0%	96%	4%	0%	
Semiahmoo Bay	02-Nov-17	11%	0%	89%			33%	67%	0%	0%	0%	33%	56%	11%	0%	0%	33%	67%	0%	0%	0%	63%	25%	13%	0%	0%	0%	13%	88%	0%	0%	
Stewards	17-Nov-17	40%	10%	50%	90%	10%																										
Crescent Beach 2	21-Feb-18						58%	42%	0%	0%	0%	58%	39%	0%	3%	0%	48%	42%	9%	0%	0%	55%	45%	0%	0%	0%	0%	6%	94%	0%	0%	
Advisory Group 2	09-Mar-18						67%	33%	0%	0%	0%	71%	29%	0%	0%	0%	57%	43%	0%	0%	0%	0%	10%	86%	5%	0%	52%	38%	10%	0%	0%	
Total		12%	31%	57%	92%	8%	49%	50%	1%	0%	0%	52%	45%	1%	2%	0%	44%	51%	4%	0%	0%	43%	38%	19%	0%	0%	5%	6%	84%	6%	0%	

Feedback and Comments Collected With Workshop Exit Surveys

Workshop	Feedback/Comments
Agriculture Feb 3, 2017	Please provide more info on meetings & events
	Need to make us aware of big options
	Lunch was great thanks
	Good representation from the city of surrey
	Consideration for reclaiming land behind offshore dyke for industrial/commercial/farming and possible housing use
	Very well done. Well organized
	Thanks for inviting our input. Consider asking participants in other workshops how much they value food & agriculture
	Some of my concerns were alleviated
	I do not feel that all options are being treated equally
	Build the wall
Residential Mar 8, 2017	Facilitators made sure everyone was heard, especially those participants who were on the quiet side.
	John was great at prompting and getting people involved. Great presentation
	Well done, I very much enjoyed
Infrastructure Mar 28, 2017	As a federal response agency, I did not have much input other than to make aware the Coast Guard as a response option. Thank you for including us in the discussion
	Too slow developing and running through scenarios
	Great presentations - very informative
	Good cross section of stakeholder representations for awareness and future engagement on this subject matter...thank you
	Well put together
	Very practical workshop but few more presentations would have been more helpful
	Job well done
	Great facilitation by associated engineering
	Environmental impacts: I didn't see much info on this in the workshop
	Could have been accomplished in 3/4 of a day
Very good timely discussion, need Langley to come to the table. Delta should have remained after lunch	
Env & Rec Mar 8, 2017	Thank you
	Well handled. Thanks for the food
	Well done
	Well done. Good info. I'll be back
	Some concrete data on BCS, we know that much of our natural habitat has disappeared how many species in the area identified are at risk, what ecological systems are identified?
	More background on calculation methodology
	1. Addressing first nations issues require that the federal government be involved. 2. This is complex (and interesting)
	People get hung up on picking ideas. More emphasis on this being preliminary. A place to start. You can begin to explore options and understand them without narrowing the focus and build from there.
	Thanks for inviting me
Advisory Group 1 July 25, 2017	Very well done. Could use Some more regional: global context. Mention regional flood management strategy and temp scenarios

Workshop	Feedback/Comments
	<p>More time should have been set aside for group discussion of the options.</p> <p>Definitely great, right timing, right presentations and to the point</p> <p>Great to be fun, I had fun!</p> <p>Julian did a great job keeping all on track. Maybe more food.</p> <p>Great timeline. Forces people to stay focused and be productive.</p> <p>8:30 am is really early</p> <p>Just a small possible improvement- when new written materials are handed out, just to get even 2 minutes to read them and digest, while the room is silent</p> <p>Well organized and run. Would have been nice to have an agenda before the meeting</p> <p>Location in the community would be better</p> <p>Look forward to seeing if there are combinations and scenarios from A to H (well, not H really) that could be considered when funding is sought</p> <p>a central location would be great</p> <p>Well presented. Could spend less on handouts and stay with power presentation</p>
Crescent Beach 1 Aug 31, 2017	<p>Very good to see the cost discussion. The participants are distressed by serious nature of the topic. Help w/ stress be option.</p> <p>Great presentation, people, food but depressing end.</p> <p>I wonder why 36% of participants were not from crescent beach</p> <p>Huge work/research has gone into this. I appreciate the experts informing us & the desire to get community input.</p> <p>Great Job!</p> <p>Learn something new everyday</p> <p>Well managed and delivered. Implications not well understood yet. Thank you</p> <p>Great setup!</p> <p>Very comprehensive workshop. I learned a lot!</p> <p>Great to be involved and understanding (hopefully) the options</p> <p>Thanks!</p> <p>time/location - great for me, but limited the attendance of younger people. Well run, informative meeting.</p> <p>Really well presented: Thorough. Table members a good variety of interests & perceptions & viewpoints.</p> <p>Retain sheets for late additions of ideas.</p> <p>Very well organized for today. Thank you</p> <p>Well done!</p> <p>No styrofoam plates please</p> <p>All good!</p> <p>Thank you to surrey city planners for your forward thinking!</p>
Semiahmoo Bay Nov 3, 2017	<p>It was very useful to review the options in a comprehensive manner at the outset of the exercise. This consultation process is extremely well done.</p> <p>Need to consider increase water running down into estuary</p> <p>Thank you for all your great work</p> <p>Enjoyed the presentation and participation desktop exercise with dialog. Thank you.</p>
Crescent Beach 2 Feb 21, 2018	<p>the information, graphics and Julian were well organized and well-presented good work</p> <p>it is wishful thinking that we can actually contain the oceans!! Let's concentrate on slowing global warming, if we can, none of these options will be necessary, but I don't believe humans will change their polluting ways. A good workshop!</p>

Workshop	Feedback/Comments
	<p>I feel strongly that we should do something but it should be sensible and realistic. For example, I would agree to raise the dyke 1.5 feet but the other options will ruin crescent beach. It is better to raise dykes</p> <p>the richness of the Crescent beach community was not discussed. It is unique and worthy of preservation hence the long term value of the mud bay barrier becomes important also it keeps agriculture and environment of Nicomekl and serpentine values. (1111 O'Hare lane)</p> <p>excellent facilitator, the best! Lunch was lovely, lively group!</p> <p>Earthquakes make all options vulnerable including existing structure. Would like to see a community supply all sand and sandbags for citizens to use when city workers can't make it</p> <p>I am so impressed with how the information is presented and the city of surrey staff, especially Matt and Carrie</p> <p>well done!</p> <p>I am not sure if I have been enlightened or disillusioned</p> <p>very well organized, presented and food provided, above and beyond! Thank you</p> <p>I would like to see more information on ground water management for all given options. A change in building heights. Raising ground levels foundations. Etc.</p> <p>discouraging for an oceanfront owner. \$ responsibility has to be settled FIRST</p> <p>very well engineered thank you!</p> <p>thank you! More participation of Crescent beach residents and less of those relatively unaffected</p> <p>Thank you, well done, great lunch, great conversation</p> <p>too early to get to (less than 2) option</p> <p>this is a huge challenge on many fronts</p> <p>this session was attended by an older demographic and no doubt the results reflect this. Similar sessions are needed for the younger demographic (19-35) CoS they will bear the cost and concerns</p>
<p>Advisory Group 2 Mar 9, 2018</p>	<p>need to add private sector payment options</p> <p>change up presenter periodically</p> <p>Fantastic visuals and hand outs to support the lesson</p> <p>Thank you</p> <p>Residents and landowners seem to be a distinct minority</p> <p>Thanks! Great job of community engagement tricky bit. Very low representation of people who live, work and farm in the affected area</p> <p>Well done- very organized</p> <p>Please involve utilities is you need costs to replace/relocate infrastructures as part of your option analysis</p> <p>Impressed with the city's work. This is a serious and challenging conversation the city is playing a real leadership role</p> <p>well done</p> <p>Good format, materials were very clear and helpful</p> <p>Well Done!</p> <p>Great process and well presented. The evolution process was well prepared.</p>

Coastal Regulators Workshop, October 17, 2017

Organization	Applicable Legislation	Concerns/Impacts	Significance of Concern	Comments
PRELIMINARY OPTION: MANAGED RETREAT				
Ministry of Agriculture	ALC	Loss of native soil for agriculture. Food prices will go up.	H	Greenhouse opportunities (floating) is not real agriculture (not practical) Higher O+M cost. Food prices will rise
Ministry of Agriculture	Fisheries Act	Fish can get spilled into flooded areas and not able to return to their habitat	H	
MFLNRO	Environmental Protection Act	Decommissioned infrastructure & potential contaminated sites		Phosphorous legacy in flooded agricultural soils.
MFLNRO/ DUC	ALC Act	Loss of ALR lands.	H	
MFLNRO/ DUC	Lands Act, Wildlife Act, MBCA, Fisheries act, SARA	Expensive to convert land. Pollution sources: nutrient spike from agriculture soil. New WMA- expensive to manage	L	
ALC	ALC Act	Elimination of agricultural land	H	Application to ALC for flooded land Is there potential to designate other land for Agriculture? Potential impacts to agriculture in Langley Potential impacts to agriculture land in Delta; option for potential dyking.
Project Biologist	Fisheries Act (DFO) SARA Water Sustainability Act Migrant Bird Act		L	Huge gain in habitat for salmonids Gain in habitat for SARA Net gain of stream area Net gain in wetland habitat Unsure on eelgrass habitat
City of Surrey	ALC Act, Fisheries (prov/fed)	Apply for exclusions (ALC) Better fish habitat/migration etc.	H	High impacts- loss almost total of agricultural land in Surrey. No application for rerouting infrastructure
City of Surrey	Water sustainable Act, Navigation Protection Act, SARA, Contaminated Sites, Weed Act -> Integrated Pest Management	Loss of water licenses Change in navigation Removal of Dykes Better habitat approval to remove old tanks/pesticides/ bldg. materials + wood chips from around blueberry plants invasive species and the management of them	H	** Ag. Opportunity --> "floating greenhouses" sources for soil will be challenging. More expensive for farming. Loss of Agricultural Land = \$\$ increase for food to Lower Mainland. Need to consider how livestock would be impacted.
ALC	ALCA regulations	Exclusion application required for exclusion of ALR- huge amount of ALR lost	H	Not sure what percent of ALR land would be left in Surrey.
City of Surrey	Environmental Management Act Environmental Protection Act			Managed retreat will highlight contamination concerns
Ministry of Agriculture		Would like to see fair compensation. Not only based on land value but on true impact of industry		
IoD	Dyke management act	Will the dikes be left in place or removed?	L	Some temporary works might needed as retreat goes on to protect land from flooding

Organization	Applicable Legislation	Concerns/Impacts	Significance of Concern	Comments
City of Surrey	Right to Farm Milk Industry Act	Viability of Agriculture (non-dairy), existing policies may not be sufficient to preserve continuity of business under relocation. Supply management and barriers to entry (dairy industry) may result in dairy industry consolidation under relocation, possibly outside of Surrey.	H	Big homes with leased lands to farmers: business needs to make minimum profit to earn a tax credit. Thus often an established farm leases lands from other parcels. Reverse leasers result in compensation to land owner not reaching the actual farmer of the land who will have a significant business disruption. In some cases a farm owned on one side of a river or highway is leased to another farmer who is dependent on the use of that land to have a viable business, thus potential for a cascading impact to the farm leasing the land facing retreat. Decouple the issue: Need to keep farmers not land. Land speculation driving values up and resulting in un used lands. need to apply pressure on non-farm use on ALR land.
Preliminary Option: RIVER REALIGNMENT				
Ministry of Agriculture:	Farm protection practices Act (Right to Farm) Environmental Management Act ALCA	Flooded areas reduce the number of crops that can be grown. forage land is also part of an environmental sustainable of nutrients + waste.	H	Compensation; many operations are part of a bigger operation making the whole operation not viable. forage land is also part of an environmental sustainable of nutrients + waste.
MFLNO WMA manager	Wildlife Act	impacts to serpentine WMA	H	Overall there appears to be a net increase of habitat but it isn't clear what habitat or their extent would be formed. There appears to be an overall trade off of salt marsh/marine habitat for fresh water habitat. It isn't clear whether the proposed freshwater lake would be freshwater or brackish
Metro Vancouver	Metro 2040	Impacts to Boundary Bay WMA including the Nicomekl river section	H	As per the coastal realignment needs to relocate the farms and enhance tools to protect existing agricultural land for farming.
City of Surrey	-Wildlife Act		M	-Environmental impact is positive over the short term. -Depending on depth of water during high tide, needs to allow for estuary & eel grass depth/shallow. -lake could become an Environmental asset. Need to address the potential contamination of some sites. -Need to manage decommissioning of homes and businesses. -WSA: Irrigation uses of Lake--requires Water Licenses -depending upon draw of fresh water
	-Species at risk act,		M	
	-Obligatory Bird convention Act;		M	
	-Fisheries Act;		M	
	-Environmental Management Act		M	
	-Environmental Protection Act		M	
	-Water sustainability Act		H	
IOD	Dyke Maintenance Act	Might run into ownership issues by having a highway on a dyke dyke would be significantly higher(sea dike) Rest of dike would be upgraded to higher standard and must meet seismic.	M	Could be mitigated with large structure --> section considered the clip out of highway corridor. could be mitigated with appropriate investment

Organization	Applicable Legislation	Concerns/Impacts	Significance of Concern	Comments
City of Surrey	Dyke Management Act ARDSA agreement precedence, and future funding agreements may require irrigation upgrades as part of drainage improvements ALCA	What organization monitoring Hwy 99 if it starts to act as a dyke when not designed as one? Allows and encourages increasing resilience of remaining dyking to reflect the increase in flood hazard and consequences of urban areas of risk like Cloverdale by reducing the length of dyking currently maintained. Past Province and Fed requirements linked both drainage and irrigation in making investments in the late 80's through to mid '90's. Is that going to be the case in future agricultural investments? Also consider nutrient management	M	-Existing dykes non-standard and may warrant becoming standard to reflect increased hazard and new urban vulnerabilities Should the issues drainage and irrigation be linked? There is a risk future funding programs will. Regardless of programming, for agricultural viability they probably should be considered at the same time. -Significant dairy and livestock are impacted (Poultry operations)
City of Surrey	ALCA	Ensure restrictions are placed on newly created lands to permit appropriate crops and Not just "anything" - to permit relocation of a river		Must deal with endangered species protection requirements To ensure new environmental concerns were not created
MFLNRO-	Water sustainable act, DFO	Realignment of both rivers will have an impact on the waterways with significant opportunities for restoration and increase potential irrigation source through flow allocation	H	Doable with significant design/management details regarding lake design
Project Biologist	SARA, Migratory bird act, Water sustainability	Addition of high value habitat Changes to channel to Nicomekl and Serpentine Changes to habitat for commercial species	L	Changes to fish habitat and fish passage
Ministry of Agriculture:	WSA	Lost connectivity of streams. Will have to buy out dairy farms.		May give some ducks unlimited wetland to farmers loss of agricultural land Dyke stops at 184st. would need to build dykes eastern to supply ag. With irrigation water
City of Surrey	Navigation Fisheries (fed/prov) Water sustainability act ALC Inspection of Dykes Langley Approvals WMA	Loss of navigation channels loss of river. Tough for fish to find stream north of new channel -change to water paths loss of agricultural land new dyke/ loss of old ones transfer of lands	H	This option will be harder to win people over. *mud bay option will also impact sturgeon habitat which will be a huge loss.
MFLNRO/ DUC South Coast Coordinator	BC Lands Act SARA Fisheries Act Wildlife Act Water Sustainability Act	Removal of serpentine WMA this will affect salmon migration water flows will change due to new dam.	H	Will the serpentine and Nicomekl new flood plan be added to WMA? New habitat will be created which is good. Will animals be stranded behind sea dam?
ALC	ALCA; Right to farm legislation vs. riparian areas. How that may impact property owners ability to farm near fresh water lake area.	Elimination of agricultural land Consider: water withdrawal allowance based on habitat vs. water requirements for farmers, and will it be satisfactory for water availability?	H	application to ALC for flooded land application to ALC for renewing infrastructure do abandoned channels become private property?
NHC	WMA	Nicomekl lake- should be additional land to WMA. This lake could still be used as irrigation but needs to be in agreements		Concerned about Sturgeon habitat in Boundary Bay Skepticism that unless the land is cleaned up/restored (ditches/dyking) near Nicomekl lake area would not be optimal.

Organization	Applicable Legislation	Concerns/Impacts	Significance of Concern	Comments
ALC	ALCA regulations	Exclusion and transportation/utility corridor applications to the ALC would be required. concern that loss of ALR is proposed and that the proposal may also negatively impact adjacent ALR lands belonging to neighbouring local governments	H	Will Surrey propose a 2 for 1 exchange of ALR land (2ha included for every 1 ha excluded?) this question applies to the 152nd option as well. Description says that a portion of the land would be retained for ag. Purposes but from previous workshops this option results in the same 16m ² loss of ag. Land as the 152nd st proposal. Is this the case? The fresh water lake, even if available for irrigation is not an agricultural land use although it could benefit agriculture.
Preliminary Option: COASTAL REALIGNMENT (152ND STREET)				
MFLNRO/WMA	wildlife Act WMA	Estimated habitat gains are too simplistic	H	More detailed work will be necessary to determine the amount and type of habitat to be formed and the time required for it to develop abandoned infrastructure & land elevations may have to be modified to ensure optimal development of salt marshes
Metro Vancouver	Metro Van 2040	Loss of agricultural land and equally important is the loss of farms and FARMERS. No farmers, no farmland need to change Metro 2040 (Board decision)	H	We need a farm relocation policy. Today we can start with stronger tools to protect existing agricultural land and reduce speculation to make relocation a more viable option. This is a good option as it builds resilience and adaptability
ALC	ALCA regulations	Exclusion and transportation/utility corridor applications to ALC are <u>required</u>	H	SERIOUS concerns with the loss of ALR
City of Surrey	EPA	Decommissioning of businesses and residents		Contamination concerns with decommissioning of infrastructure. Environmentally there are no issues of legislation
Ministry of Agriculture	Farm Practices, ALCA EMA	The land is also needed for nutrient management and environmental sustainable waste management		More pressure on remaining land
IoD	Dike Maintenance Act	Dike being used as a major transport corridor Depending on maybe other entitles to be viable	L	
City of Surrey	ALCA	Would have to be adjusted fairly significantly to be able to: a) Allow the municipality to reduce this land from ALR b) Eliminate the ALC land for environmental purposes first and ag. Second c) Permit easier development of the 152nd street super dyke		
City of Surrey	ALCA	This option could set a negative precedent for loss of ag land from flooding (death by a thousand)	M	
Ministry of Agriculture	WSA	Most water licenses will be lost food production/security will be reduced	H	Compensation can be discussed to provide additional water to agricultural lands in other parts of Surrey where there is insufficient or lack of water access.
MFLNRO	BC land act; BC water act		H	
NHC	WMA ALCA WSA	land gained to WMA would need to apply to exclude the land from ALC and additional approval for HWY re-routing etc.. Loss of water licenses		Land would need to be committed to be cleaned up and restored (planting, etc.) Is compensation needed? Not displacing land for development but for resilience. Going to lose that land eventually so is it an issue? The City does not have a duty to protect this land.

Organization	Applicable Legislation	Concerns/Impacts	Significance of Concern	Comments
no name	fisheries, WSA, SARA Migrant bird act	Change to quality of habitat change to Nicomekl and Serpentine channels Additional habitat		
MFLNRO/DUC	BC land act; fisheries act	Will additional land be added to WMA. Serpentine WMA will have to be modified		Will this result in a new barrier to salmon migration? Both sea damn and former agriculture land has made it easier for fish
ALC	ALCA	Elimination of agricultural land Re-routing of infrastructure over agricultural land and consequently decreasing land for agriculture. agricultural land accounted for elsewhere in surrey?	H	Application to ALC to consider flooding agricultural land. Application to ALC to re rout infrastructure if it's on ALR land. There is potential to include other land to ALR and designated it as agricultural? ALC doesn't have a set policy of no net loss to agricultural land. Application to include land into ALR
City of Surrey	Water sus. Act Fisheries (Fed + Prov) Navigable waters ALCA Insp. Of Dyke approval SARA	Loss of irrigation water and water licenses Salmon & fish passages Change to navigation (good) New habitat	H	Need to look at where to give approval- special set up to deal with process need to apply to exclude land from ALC then rerouting infrastructure if moved to ALR land. Do this as a whole strategy. Are other lands improved?
Preliminary Option: MUD BAY BARRIER				
NHC	SARA WMA/BC land act Migratory Bird Act Navigable Water Act Water Act Fisheries Act	Province is looking at introducing western painted turtle to serpentine doesn't allow pedestrian/recreation uses but WMA being revised so maybe could include resilience there could be lot lease issues water licences and irrigation issues	H	
MFLNRO	SARA BC Land Act Migratory Birds Navigable Water BC lands Act	Impact to residential orcas, habitat and food source. -Boundary bay wildlife management areas	H	Unprecedented situation with environmental impacts. Mostly federal legislation applies. Aquatic impacts. There are potential for compensation projects present but poor.
Ministry of Agriculture	WSA	Work in and about a stream change of water flow irrigation licences if the new area will be partially new agricultural land beneficial water use for agriculture	M	Water Sustainability Plan (WSP) supported by WSA can incorporate this option to manage water for all sectors including agriculture. Beneficial water use will need to be discussed under WSA to designate the specific use of the newly created area.
MFLNRO/DUO south Coast corridor	BC lands Act SARA Fisheries Act Navigable Water WSA	Fit into management plants of BB and Serpentine WMAs large impacts on pacific salmon w/ indirect impact on Orcas Water licenses		expropriation of WMA unprecedented? opportunity for collaboration in province large compensation required difficult to convert WMA land to agricultural SLR resilience
City of Surrey	Fisheries fed/prov SARA Migratory bird act BC land Act Navigable Water act WSA WMA	potential issues with Salmon habitat and migration change is species in area loss of habitat limit river movement need water licences- limited water for WMA area		Potential loss of WMA
ALC	ALCA	potential for increases of agriculture land minimal impact to agriculture;	L	Would agricultural land reserve be extended to include the new area? New investigation requirements for inland area If new land area continued to agricultural use, consider if ALR boundary extended to include then subject to ALCA
IoD	DMA	Potential impact to neighbouring community feasibility meeting seismic standard +cost	M	this project would have to be coordinated with other municipalities and jurisdiction which could be problematic

Organization	Applicable Legislation	Concerns/Impacts	Significance of Concern	Comments
				Funding would have to be secured to ensure that all standards are met.
ALC	ALCA + regulation	minimal impact to ALR ALC would have few concerns no application to the ALC would be required	L	However.. in this case of catastrophic breach, impact to ALR would be significant. Would protocol be developed to help minimize the effects of a breach? -If additional agricultural land is made available as a result of this option, the ALC suggests Surrey consider an inclusion application to include the land within the ALR as part of a land swap
City of Surrey	Prov Wildlife act Migratory bird (fed) Convention act Fisheries Act	Boundary bay Wildlife management area could affect critical bird foraging area negatively affect forage fish and juvenile salmon habitat impacts to eel grass and species dependant on eel grass		WMA would be impacted. Major overwintering bird area. Habitat would be negatively affected Boundary Bay is important salmonid and forage fish habitat area of Nic and Serp. affect eel grass and dungeons crab nursery areas
Metro Vancouver	Regional growth Strategy Metro Van	The “perceived” protection of the barrier may encourage population growth and development outside the urban containment boundary	L	urban sprawl adds costs stronger tools to resist “development” of agriculture land for residential and non-farm use No ability for adaptation management
Project Biologist	Fisheries act Navigable waters act SARA Migratory birds act WSA	Reduction in habitat for commercial fish species ability for boars to travel direct impacts to species loss of migratory habitat change to Serp and Nic		
MFLNRO WMA manager	Wildlife Act (WMA)	Impact on habitat		unclear what impacts or benefits to habitat in the WMA are predicted to be behind the barrier or in front of the barrier infill of area behind barrier to allow agriculture would be most detrimental more information needed regarding water levels behind barrier and elevation predicted what type of habitat would persist there likely less damaging if door only closed during high surge events but less useful over time to address rising sea levels
Ministry of Agriculture	Farm practices protection EMA	Who would have ownership of new land		
City of Surrey	LGA Any legislation involving the environment ALCA	Don’t think here would be affected that much as these deal with land issues and municipal process. -would need to be adjusted to allow for these types of leasing/signing intrusions -if additional ag. Land is actually created it would be imperative that legislation was specific on weak is doable so that we don’t get land owners planting inappropriate crops in any “newly” aerated ag. areas	H	Cannot leave crop types solely up to land owners - need to provide limits in these areas to reduce expectations of being “helped” to protect crops and investments leads Should Not be made. Municipality would need provincial support for that, Cannot be on going.
City of Surrey	-Delta/Surrey boundary jurisdiction complicated with MoTI -Fisheries Act -Navigable Waters Act	tie into coastal ground and dyking erosion in front of barrier from wave reflection dredging required.	M	Possible with land or right of way acquisition and engineering. complication crossing BNSF, HWY 99 & 91 Rip rap will mitigate but increase in footprint of works and trigger habitat compensation Dredging already scheduled

Environmental Stewards Workshop and Coastal Regulators Workshop, November 17, 2017

Gaps		Partnership Opportunities		Implementation Challenges	Additional Notes
1. Are there any co-benefits that have not yet been identified?	2. How can the option be refined to improve the co-benefits identified?	3. Within this option do you see any opportunities that overlap with the mandate of your organization or responsibility?	4. Given the large scale and high cost of implementing the option, do you see any partnership opportunities for implementing and/or maintenance on the option	What challenges do you see in implementing this option (e.g. regulatory and legislative constraints technical and environmental, large scale etc.)?	Explain:
Preliminary Option: RIVER REALIGNMENT					
	mix of public access and isolated area for habitat	Increased parkland and recreation area, improved habitat and increased connectivity, increased ecosystem services	Land acquisition for parks and greenways. Regional planning advice/assistance		
	create opening in dykes throughout low elevation areas to increase # of f/w wetland habitat. Can be opportunities w purchase of ag. Land. Less impact, smaller scale projects, rather than moving entire river, include islands with wetland areas.			purchase cost of land. Impact on fisheries? And salmon habitat? Increase in water temperature due to shallow water	
	Can ensure a densely-vegetated riparian area along re-aligned river.	yes- WMAs	WMA management	loss of river connection to serpentine WMA, perhaps the province trades the serpentine WMA for a WMA in newly flooded land?	
	create island pockets (diversity)	yes, large opportunities for wetland restoration	yes	political, loss of Cloverdale town?/people. Regulatory less than other options as all within	would be worthwhile to incorporate ecosystem values of nature into next step of cost.
	could do these retreat areas in pockets as land becomes available. Enhanced riparian corridors	yes, create island pockets for habitat complexing		difficult sells specifically with loss of private land	
see previous comments design for aquaculture	design towards the above option from the start		design of aquaculture	compensation habits of remaining land, sustainable management of remaining land.	
	compartmentalized spillways, use space as forage fields for agriculture, water storage device (floating), doubles as wave barrier, bass habitat, sealed off, for recreation opportunities, cooling riverways (Shade) to protect fish				
	Use combined river as high flow bypass, leave existing serpentine river as base flow	Increase spatial quality	irrigation districts	water temperature	

Gaps		Partnership Opportunities		Implementation Challenges	Additional Notes
ground water recharge and salinity management. Assisted migration option. Was combined engineering system can bring in new species. Also potential to create salmon spawning and rearing habitat.	map out aquifer, look at 5 year cells that function as pasture. recreational fisheries	yes if inclusion of habitat diversity included		ban on inter-basin transfer	
				need to clearly identify the benefit/losses to current wildlife and the impacts such a drastic modification of the landscape would have on the region ability to provide equivalent habitat. Displacement of forage fields will have a large impact on water found grazing pressure across delta/Richmond	
					loss of good ag. Land. Breaching and freshwater pockets overtime. More corridor for river will be better for fish. Open water body could affect overall temp of the area. Good recreation options. Look at BCS to make sure of the connectivity.
lake in the winter, some are dry in the summer. Increase flood control. Provides irrigation water	maintain a min. flow serpentine river is a high flow to Nicomekl to maintain fish river habitat		Aquaculture- fish rearing		
Preliminary Option: COASTAL REALIGNMENT (HWY99)					
	Design of dyke to facilitate wetland migration to more green shores type. Diversity of features e.g.. Pillings, sediment buildup	yes, much more than mud bay barrier on status quo	yes, stronger	some regulatory, still uncertainties of what will occur tidal, US salt marsh, high political barriers e.g.. Loss ag. And houses	consider dyke tradition design vs. green shores
					Discussion on how to keep sediments and also how to build up the lands. What looking for?
	work with ecosystem/conservation organizations/agencies/academia to determine best restoration alternative regarding channels excavated and filling to create more elevated areas for complexing of habitat	yes, there as opportunities for land conservation agriculture to work with government agencies/academia to secure land			
increased habitat protection, increased recreation potential, increased connecting of habitat on the landscape,	expand regional park and trails. Promote habitat complexing and sediment deposition to increase coastal mudflat habitat and reduce coastal squeeze impacts		yes, land acquisition for park land. Remediation and natural resource management, regional planning advisory, air		infrastructure movement costs and feasibility

Gaps		Partnership Opportunities		Implementation Challenges	Additional Notes
storm surge/erosion /flood protection			quality and climate group advising		
high tide-area underwater clam beds? Salt marshes? Tidal power?	create a large green shore				improve wildlife viewing, enhance fishing, nature based recreation/kayaking/ hiking etc. work with fish hatcheries to enhance salmon population
use for aquaculture + ostreiculture		compensation	no	compensation etc. see also precious comments on impact of land loss an viability of aquaculture. Increase water pressure on remaining area.	
	artificially create a large marsh, create habitat , create a big green shore, bringing back oyster and clam beds (erosion control)	no	no	displacement of current perennial forage fields and the high quality of waterfowl foraging habitat they do provide will most likely result in an increase in pressure on remaining farmland in delta and surrey. this will increase the costs of farming as well as undermine the viability of the local farming sector. unless this landscape change results in an equivalent type of habitat for water fowl	
		new coastal multi use trail/pathway and aquaculture		water fowl many further up Fraser valley	
	artificially create a large marsh, create habitat. Create a big green shore. Bringing back oysters and clam beds (Erosion Control)				
	create opening at HWY 99 dykes to enable mud flat habitat/salt marsh inland	yes, increased marine tidal flats, increased habitat for biodiversity		cooperation with MOT and railway, purchase of land costs, loss of farm land	
Preliminary Option: MUD BAY BARRIER					
		yes, WMA. Yes, effecting serpentine WMA	Yes, if land becomes WMA. Maybe consider experiments breaking and flooding areas to get an idea of how land may transition in advance of the larger retreat	effect WMA, need to coordinate/communicate in province	
I see a gigantic park.				modify use of Colebrook park	
increase recreation opportunities (but not with environmental damage) decrease recreational	retain marine mudflat habitat at all costs	it may improve or decrease recreation opportunity. It will decrease wildlife habitat and environmental benefits	possibly for the dyke train		

Gaps		Partnership Opportunities		Implementation Challenges	Additional Notes
opportunities					
	could create more opening in dyke	working with government an offset opportunities. Working with government on destruction/rehab		Huge complex jurisdiction and legislative/regulatory challenges. Address the cumulative impacts and trade-offs. Need significant \$/resources.	big negative to habitat and environment
	would need multiple openings in earth barrier to improve alternate. Look @ freshwater restoration upstream from marginal uploads	some on restoration side but still net loss of wetlands	some/maybe still less than other options	maintenance: sediment build up, huge traditional for mud bay likely be unstable. Regulatory. Large maintenance cost	
rerouting of BNSF out of crescent beach and along dyke.	per above will remove trains from crescent beach and mud bay and Colebrook leading to fewer conflicts with crossing. Crescent beach can currently be cut off from emerging response as well as danger of hazardous waste spills	yes, recreation access along the barrier	BNSF pay the bill. May also help in approvals	crescent beach would suffer with poor water quality. Big concerns with loss of estuarine habitat	
					Net loss of mud flats. Discussion of whether any enviro benefits vs. just let go ag. More freshwater possibly as marginal farm land. Good park for metro. Could be smelly in the transition due to veg. changes, could be made a long time- will not stabilize. huge loss of brackish environment
if the area changes to more marsh/terrestrial. Could be more habitat for water fowl. Increase rearing habitat for salmon? Increased ability for drainage/irrigation central upstream. Ag. Benefit, reduce soil salination	WQ treatment?	yes, tie into dyke/pump station area		loss of marine habitat. Look @ options to increase or provide compensation by doing different unknown on the marine side ei. Slope	
	would need multiple openings in earth barrier to improve alternate. Look @ freshwater restoration upstream from marginal uploads	some on restoration side but still net loss of wetlands	some/maybe still less than other options	maintenance: sediment build up, huge traditional for mud bay likely be unstable. Regulatory. Large maintenance cost	
	water quality in boundary bay, use area of mud bay barrier to capture contaminants		no.	big environment impact, loss of scarce Mud flats vs. large economic benefit on natural scale	

Gaps		Partnership Opportunities		Implementation Challenges	Additional Notes
depending on the use allowed the land can be used for agriculture,	a design with future use in mind. Crop management and aquaculture	yes. The design towards future agriculture uses.		ownership of the land. Access to land. It may be a trap for nutrients which will require some regulation regarding nutrient management in the watershed area,	
create space for migratory birds. Increase capacity to manage succession, manage what comes into the landscape overtime. More room for storing food and water. Sources of phosphorous. Reduce soil salination -> benefit for agriculture.	manage/trap pollutants to improve water quality in boundary bay				Haida Gwaii case = speed up of succession, tress coming in, increase in fresh water
			irrigation district. Lagoon for nutrient mgt.	erosion on ocean side. Overcome water quality issues behind barring or turn into terrestrial environment. Elgin example of marine to terrestrial.	
		increase in farmland provides opportunities to implement land management practices that provide wildlife (primarily bird species) habitat. Also supports overall viability of local farming industry overall benefit for ag.			
		large overlap with WMAs. Requires permission of province/feds. Must be incorporated into management of WMAs	if the "green addition" remains part of the WMA the SCCLMP will continue to manage this land.	unsure what type of ecosystem will be created. How to offset loss of Mudflats. Will this promote spartina anglica? Ecosystem may be in Flux for a long time. Possible negative effects on the rest of the BB WMAs	
Preliminary Option: CURRENT CONVENTIONS					
with change in slope profile there could be opportunity to reduce coastal squeeze effect and maintain same intertidal areas	change in side slope? Innovative dyke design/profile	yes, dyking/flood control etc.	fed/prov government	regulation for change and impacts to WMA. Land cost to get land from land owners.	
		drainage, wildlife management, new crops, use of dyke for farming infrastructure irrigation. Compensation for farm land loss.		compensation for land loss -> loss needs to include indirect impacts.	

Gaps		Partnership Opportunities		Implementation Challenges	Additional Notes
recreation space/pathways on the top of dikes, space for social gathering. Environment education -> city-led dyke tours on coastal protection. Evaluate alternative dyke options than current standard (e.g. best practices from Europe), flatter and wider dykes. bike pathways on dyke system.		lower mainland flood management strategy. Regional table to evaluate this option against the dike expansion/upgrade plans of other municipalities. Salmon Safe: evaluate that the dyke expansion and infrastructure upgrades do not negatively impact salmon habitat or migratory routes.			
	create a complete terrestrial habitat network and public recreation amenity on top of the dyke network. Design new dykes to provide more habitat	yes, enabling public access on the dyking is a priority for parks. Yes, promoting habitat connecting across the city a priority.	Translink funding for greenways? Federal recreation infrastructure grants.	Land impacts from expanding width of dykes.	
	flatter grade dyke to minimize loss of farmland and the associated wildlife habitat it provides.	preservation of most amount of farmland as possible provides an opportunity to support the viability of farming and the wildlife habitat it provides.		relevant to all options: reduction in ag. Land and specifically forage fields will most likely result in greater waterfowl grazing. Which will only add to the cost and pressure after current land management practices that are less supportive of waterfowl	
					Discussion on salinity/mudflats. Wildlife movement. Could transition scene poor quality farm land to be better for birds. So limited benefits. So similar as expansion of ducks. Pay farms for bird food habitat.
	perhaps consider deposition of Fraser river sediments to elevate intertidal seaward of dyke to enable marsh growth	Yes, I manage the boundary bay and serpentine WMA's	Yes, big overlap with WMA's but we do not have \$ to contribute. Need to collaborate on implementation and maintenance	need authorization to modify land in WMA (e.g. dyke footprint) works may not be compatible with WMA management plans. May need to update these management plans to encourage ecological resilience to SLR	
maintenance of dyke trail system using a green shore approach		helps to maintain the dyke trail recreation connections for parks and greenways	these would likely be needed for collaboration on dyke trails	environmental damage. Loss of park space and habitat. Relocation of existing park facilities and MVRD infrastructure. Loss of future parks, lands and public.	

Gaps		Partnership Opportunities		Implementation Challenges	Additional Notes
					Green shores initiatives for Dyke upgrades. Building wave barriers to trap sediment and protect existing salt marshes. Manage invasive with province. Improve forage opportunities for ALR lands. Install perches for birds of preg.
Add pollinators to ecosystem services		Work with local government in creating offset habitat from area taken from increased dyke height and habitat from "squeeze" area		Money/resources needed for offset, cumulative effects need to be addressed	
Common Species		yes-> wetland/ag. Restore/enhance	Likely won't have partnership & environment	This status quo will be a significant challenge. A) cost will be high B) motivated people change. Less partners wil NGO/Environment	
	use green shore approach			Cooperation with railway/MOTI	
	Use oyster reefs on seaweed side to slow storm surge	Tourism infrastructure review that BSC could undertake	Might be inclusive lands and gateway associated with this.	DFO- fish habitat. Mudflat - migratory bird Act	
	explore options to vegetate dykes? Improve fish-friendly access/features	look at modification of dike to allow greener options for fishes	no	Would be subject to a provincial environmental assessment. Mid-century, does it keep up? How high can this function property.	

CFAS Youth and Children Engagement Report

The young generations of today are expected to see substantial changes in the environment over the course of their lifetimes, and yet this demographic segment is often not well represented in general public engagement events. The CFAS Team recognized the importance of initiating additional efforts to involve this demographic group into the CFAS planning process, as the direction of CFAS will have a big impact on today's youth in the following decades. Today, approximately 31 per cent of Surrey's population is under the age of 25. We reached out to Surrey youth to speak with them about the predicted impacts of climate change (especially as they apply to the coastal floodplains of Surrey), inform the youth about the CFAS process and seek their feedback on previously identified community values and a selection of proposed adaptation options.

Engagement Outline

CFAS Presentations and Exercises

We engaged with over 200 Surrey secondary school students at various events. The majority of these events were carried out in a format of in-class presentations and feedback exercises led by a CFAS Team member. Table 1 below provides a summary of the various engagement events.

Table 3. Summary of Surrey youth engagement events at which students were engaged on the topic of sea level rise and CFAS

School/Event/Group	Date	Class	Student Estimate
Youth Speak Up Forum	Oct 27, 2017	N/A	35
Queen Elizabeth Secondary In-Class	Dec 6, 2017	Social Studies 10	25
Surrey Youth Sustainability Network	Dec 13, 2017	N/A	10
Kwantlen Park Secondary City Hall Visit	Dec 20, 2017	Social Justice 11	25
Queen Elizabeth Secondary In-Class	Jan 10, 2018	Humanities Co-op 11	25
Panorama Ridge Secondary In-Class	Feb 14, 2018	Science Co-op 11	25
Semiahmoo Secondary In-Class	Feb 28, 2018	Biology 11	25
Clayton Heights Secondary In-Class	Jun 5, 2018	Urban Studies 11	25
			Total: 200

The format of in-class presentations was organized as follows:

1. Introduction to the topic of urban/regional/climate change adaptation planning and the predicted climate change impacts in the context of Surrey floodplains;
2. overview of the existing flood infrastructure network in Surrey and risks associated with sea level rise and climate change;
3. summary of CFAS study area characteristics, climate change impacts on different sectors, and the CFAS process up to date;
4. feedback exercise asking students about their own values as they apply to CFAS; and
5. feedback exercise that sought student's input on a selection of proposed CFAS adaptation options.

CFAS Postcards

Additionally, as part of a teachers' development day event, CFAS postcards were distributed to primary school teachers to initiate climate change related talks with Surrey children of various ages. The postcards provided an opportunity to students to think about what they can do to help fight climate change, as well as to learn about the concept of being active citizens by providing feedback to the government.

The postcards were distributed to interested teachers who framed their lessons around environmental issues and climate change and incorporated the postcard activity in the lesson. These postcards were then anonymized and sent to the CFAS Team who summarized the feedback. And finally, the postcards were returned to children, so that they could take them home and include their families in conversations about fighting climate change.



Figure 21. CFAS postcard used at various engagement events, including with Surrey primary school students (front and back side shown).

Game of Floods Activity

During the teachers' development day event, several physical copies of the Game of Floods were made available to secondary school teachers to frame their lessons around the complex societal, economic and environmental challenges associated with sea level rise. Game of Floods is a board game developed by County of Marin as public education activity on sea level rise adaptation. The game is available [online](#). Some Surrey teachers incorporated the game into their lesson plans and included a reflection exercise—some examples of responses were then forwarded to the CFAS Team to better understand how youth perceive and approach balancing the multiple interests and factors when adapting to sea level rise.

Engagement Results

CFAS Presentations and Exercises

When asked about their values, secondary school students identified agriculture, environment and residents as their most important values (see Figure 2). Relating to agriculture, students commonly brought up the role farming plays in food security (availability and cost of food) and providing livelihoods for farmers. The environmental values were brought up by many students—they were concerned about protecting and improving important habitats to keep animal (especially bird) and plant species thriving, and also prevent their extinction and the negative consequences this would have on the animal food chains. Students also expressed that protecting human lives and ensuring safety of all Surrey residents was very important.

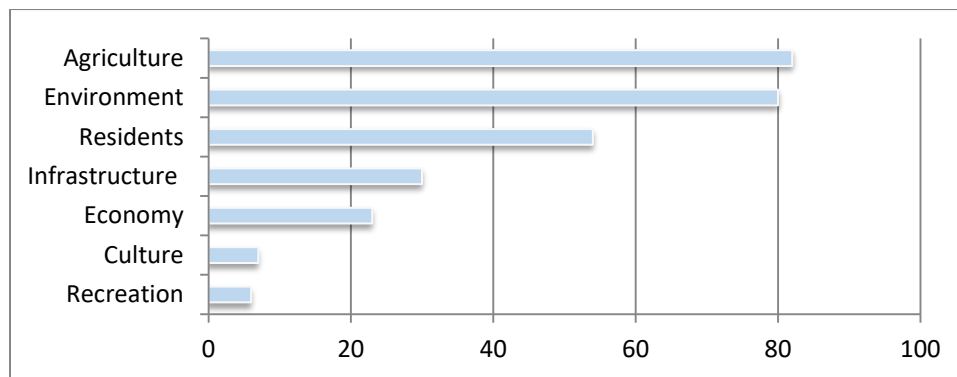


Figure 22. Secondary school students ranked their top three values: accordingly each vote was assigned a numerical value from 1 (lowest) to 3 (highest) and summarized in this figure.

Secondary school students showed clear preference for the Coastal Realignment (Hwy 99) option, 44% of students chose it as their most preferred option. Managed Retreat and Mud Bay Barrier were second most preferred with 25% of students voting for each option. Current Conventions were the least desirable option for students, with only 7% selecting it as their preferred choice.

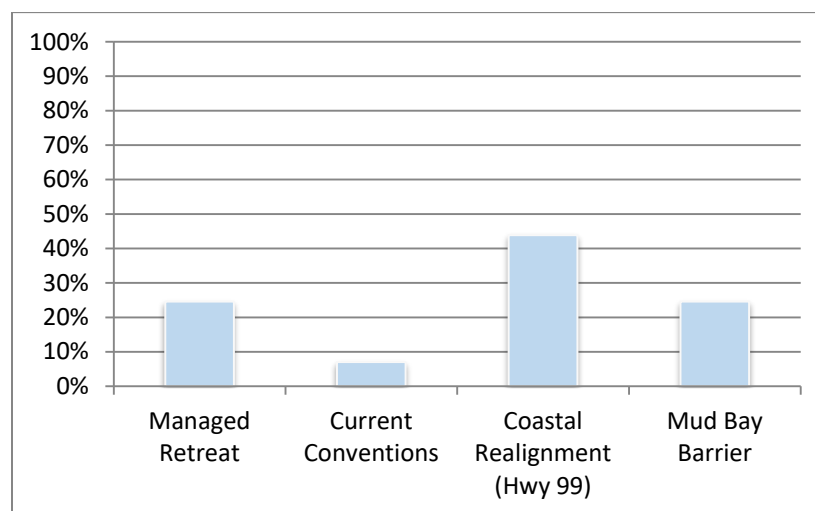


Figure 23. Secondary school students were asked to identify their preferred adaptation option; this figure shows the percentage of students that chose each of the four presented options.

CFAS Postcards

When asked to think about ways primary school students can help fight climate change, several themes were brought up frequently. These themes are summarized in Figure 4.

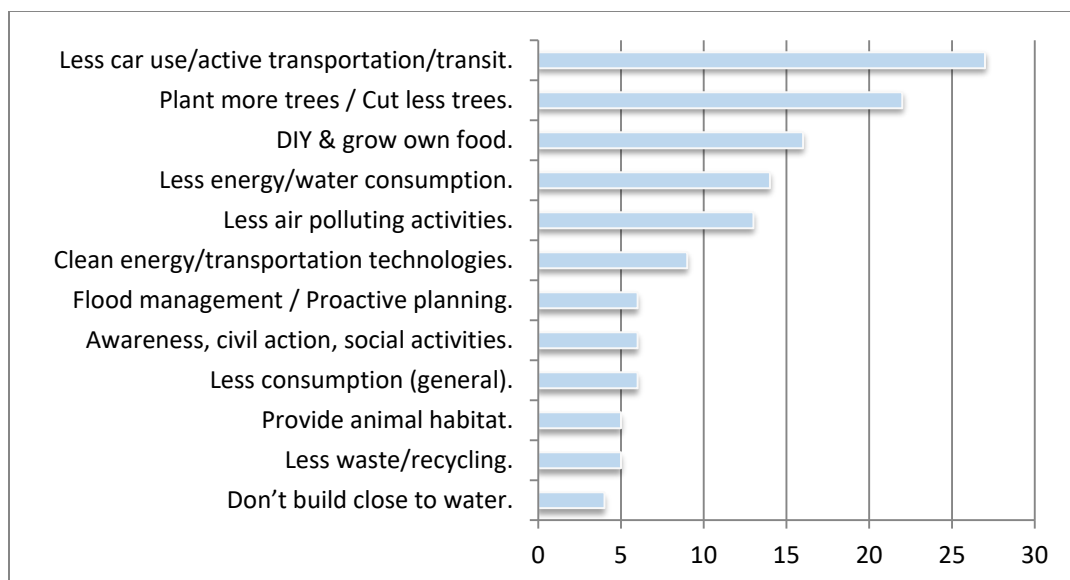


Figure 24. Counts of recurring themes mentioned in the postcards written by primary school students (n = 77).

Quotes from Youth (In-class Exercises)

Community Values Comments

Agriculture Examples

- Important to protect agriculture because if this land is destroyed then it affects the most amount of people, not just people living in the study area. It also affects the economy.
- Agriculture matters to me the most because all the food we eat comes from farmers. Also the farmers' main income is impacted.
- If the farms are flooded then vegetables will be more expensive. In the future I want this area to be growing lots of food and prices not to rise.
- Not protecting the agriculture will destroy so much more. Such as the economy. We need to protect produce.

Environment Examples

- The most valuable thing to protect is the environment because then the extinction of the animals/habitats won't increase and the fish in the water won't get eaten by sea lions. The environment matters most to me because the environment is the main source to everything. The environment needs to be protected in order for people to live in peace and have food to eat. You need a good healthy environment in order to maintain the clean atmosphere. I would choose to protect the bird habitat because birds are beautiful living creatures. You can replace a park, but you cannot replace a bird. Birds should be protected because they are a part of the food chain.

- Environment is the most important thing to protect because wildlife should be preserved and prevents loss of habitat. I want it to be sustainable for the upcoming years.
- Would also like to protect the wildlife habitats—salmon, birds, fish etc. because even though we may think that we don't need it, wildlife plays an enormous role in our everyday lives.
- Protect environment over buildings and such. Gives us our resources.
- I believe it is most important to protect the environment from further destruction from agriculture, housing, infrastructure, and other selfish human exploitation of what they believe is required, when it should be returned to its natural state.
- It is important to maintain the environment/habitats that have always been there. In one way or another it will affect us.
- I would like to see this area filled with wildlife, and I would also like to see it as an influential spot as it shows how significant this issue is, and how we should all pitch in to protect the wildlife and other people.
- Future decision makers should consider trying best to protect the environment that's been here as mostly it's our fault global warming or climate change is happening so why destroy the habitats that we already damaged due to pollution and make it even harder for them to survive.

Residents Examples

- Residents because where we live is important to be sheltered and have somewhere to sleep and feel safe.
- I want to see this area protected (all of it) as people live on this land and they work and live in this area.
- I think the most important area to protect is the residence area because if houses near the waterways are flooded, many people lose money, their belongings and their land. Since the prices for housing are increasing every year, it will be even more difficult to buy new homes.
- Residents is the most important value to me because this sea level increase is flooding people's homes and it is destroying it. It is most important to me because I guess I identify to it the most, it is most relevant to me.
- If roads get flooded people lose business and must detour, which would be loss of time and money. Residents matter most because life is more precious than money

Infrastructure Examples

- I want the locations that allow our everyday life to function to be protected. As well as locations that make BC unique from all other provinces.
- Also infrastructure because it would be the most expensive to repair and rebuild or move. It also affects more people than just the people in the study area. Good infrastructure is the foundation of a stable city and a good economy. Nature adapts and people can move so we should preserve the things that are difficult to rebuild or move. This way of thinking would not be supported by the people that would need to move but it's more valuable in the long run.
- While I'd like a solution that's best for everyone, if crisis strikes I'd like to prioritize regions that affect more than the flooded area.
- I would like there to be more barriers built from the water and infrastructure on higher ground, our money spent wisely and people around the area safe.

Economy Examples

- For me, maintaining the economy would be important because most households and taxes are dependent on things in that area and the loss of jobs/other things could affect many. Protect the residents and the environment because without them the economy could be put in a more rough spot.

Culture Examples

- Culture is important, like the environment it was there before us and it's important to protect them.
- First Nations culture has been a large historical influence on Semiahmoo and has been around for centuries, so it should, ideally, be protected.
- What matters most to me is the protection of heritage sites including the Historic Stewart Farm and nature parks.

Recreation Examples

- The most important thing to me is to have parks/beaches in the future that are still safe to use.

Options Comments

Managed Retreat

- No matter how much money we spend building walls and trying to control where the water goes, the water will find a way in one way or another. The people may not like it, but it is the only sustainable long term option.
- Brings habitats to natural/original state; wildlife left untouched; people are not harmed.
- It costs the least and is beneficial for the environment. Although residents and agriculture will be displaced, this option will save more money and restore the area to its natural state.
- I think managed retreat is the best option because even though we build dikes, the water level will go up even higher in the future and it will be very costly to keep maintaining it or building new ones. If the city could help the farmers and other citizens relocate, then no one would be at risk of losing anything and the city can spend that money on keeping the area safe so people can access it without being at risk.
- I believe that trying to restore the land is a good idea, better than taking the risk of having floods - risking people's lives and even people's valuable items/houses. Take all aspects of Earth into consideration and don't leave things out.
- In my eyes, it is best for the environment, as well it is cheaper (the City should not give compensation to the rich people in Crescent Beach who know they bought a property in a flood zone).
- Let the land go back to how it was. Spending billions is too much, use the money to build and remake the things lost. Pay people to move as consolation.
- The other options only postpone the inevitable flood while this embraces it. Also, sounds cheaper.
- The other options just have more issues.
- It might cause people to move and for us to lose land but this will result in the most natural one. This might cause the future generations to pay less because if the sea levels to rise 1.2m by 2100 but what about after? What if the sea levels rise more? The opposite side to this could

be that if the sea levels go down the land will come back but there will be dikes and everything there.

- A little sad. I think that Mother Nature will win and we'll have to do it sooner or later anyways. Why do tomorrow what you can do today?
- We are sacrificing lots of houses.

Current Conventions

- This type of coastal flood adaptation averagely dealt with the problems that potentially would be caused by the flood.
- We already put the time to do this so why leave it. We should trust the process.
- We should stick with it because it just works and it makes things a bit less complicated.
- In the picture where they make the highway if they can move it a little bit to the left side on corner, then farmers can farm easily.
- Too expensive.

Coastal Realignment (Hwy 99)

- I think it is the best idea because the agriculture lands turn normal again.
- I recognize the importance of infrastructure such as Fortis BC and BC Hydro.
- The dike acts as 2 different things. It acts as dike and highway. To improve it, I think we have to tackle the global warming problem rather than the by-product. We could move the dike so the infrastructure could be on it.
- It helps preserve wildlife.
- It will help preserve the wildlife and will also protect the residents. This will bring back Mud Bay as its normal, previous self.
- It helps with the creation of habitats.
- It seems most logical solution.
- It only damages the left side of the sea dam. If we don't have the sea dam, everything would be damaged.
- If we build sea dams beside the highway, it protects all the area that is on the right side. All the options are safe but dikes will eventually get damaged so we will have to keep building them over and over again. How long are we going to keep building them?
- It will only cover up less than half of the portion. This decision will affect the farmers the most, however there will be sea dam alignment in Hwy99 to protect from the sea rise.
- Only a portion of the land will be affected by it and the rest would be completely safe. The Mud Bay Barrier's disadvantage is that it can't be changed much in the future that could be a problem.
- Less money, seems more efficient, farms could relocate (are there other areas the farmers can relocate?).
- In Coastal Realignment and Managed Retreat I think we lose too much land that we could use.
- That way they won't build a wall in Crescent Beach and ruin it.
- Not fair for farmers.
- I like this one.

- Still has agriculture but not near the ocean. Of course families will be affected, but it would be better if we can manage where it is happening.
- Yes, you are losing agriculture but you are losing it for a good cause. Going towards more tide pool areas and habitats vs. trying to move people away or doing what we have been doing is very expensive and time consuming and this choice is the best suited option. It benefits us in a good way and it is the best option to save our land from high tides. Has a better chance at working vs the others. I believe it's the smarter option and more affordable. More beneficial.
- I believe it is the most sensible option, the option that makes most sense. I think that it would be the cheaper option, the less hassle offer and quickest option.
- I support, although it's not my first option it does have its benefits.
- It is better than any other.
- It'll block the flooding.
- I support, but if it fails we may not have a lot of options to use as backup.

Mud Bay Barrier

- Businesses and farms are uninterrupted; residents don't need to search for new homes.
- It has the intention to stop flooding from reaching houses.
- It is good for farmers and farmers supply food.
- Because farmland.
- More expensive but Surrey loses less land and we need lots of land for the expanding population.
- Everyone can't be pleased so this is at the rich people's expense on Crescent Beach's view, which they can live with. No land will be lost, but in return the cost will be higher.
- It won't ruin the farmers.
- Too risky (unstable soil).
- More farm lands will be caved and the farmers are the ones who provide our food. It will help everyone except some residents by the water. They have spent millions for their homes due to the good views and if the view is blocked their house values will drop and they will lose a lot of money.
- It keeps most of our land.
- It protects our farmland which is our food source.
- Although it is costly, it's a one-time investment. After it's built we won't have to spend lots of money each year like we do for the current conventions.
- Slows down flooding to allow for greater future planning.

Quotes from Children (CFAS Postcards)

- I can plant more seeds, don't smoke, walk places, don't do BBQ, buy less stuff.
- I can tell my parents that I can walk to the corner store. Not in a car.
- Plant wildlife trees in the intertidal zones so animals have somewhere to go.

- Make more drains. There are plenty in our washrooms at school.
- Walk to work every day. Spread awareness! Grow a garden.
- If we're going to hurt the Earth, the Earth will hurt us back.
- Care of others.
- My ideas: drive less; reuse containers; plant more trees; don't build close to water; develop solar cars; buy electric cars; use less stuff; dome; build fewer factories.
- Spread awareness!
- If you cut down a tree, you plant one.
- Read picture books like Tidy by Emily Gravett, so grownups and kids understand how to work together with the environment.
- Stop building apartments in squishy places. Leave nature.
- Build a floating school!
- Stop taking our nature away. Don't keep cutting down so many trees.
- Give people a prize if they use less electricity. (I'd be fine if it was just a thank you note.)
- Accept that sea level rise is coming and start building for that future.
- Be realistic about what is going to happen AND have a plan for when it does.
- Hello. How would people move if something happened to cause a flood around their homes? Would a flood happen gradually? What should people do if a massive earthquake happens from which a tsunami occurs? Just a few questions that were on my mind. Thanks.
- We could all learn more together about climate change and sea level rising. Maybe make us all more aware how much this could affect our lives. That way we can all find ways to help our city adjust to the new sea levels.
- Less driving, more transit!
- Act also to actively work and advocate to phase out fossil fuels, and to start a transition to clean energy immediately. Reject projects as the Trans Mountain Pipeline, LNG (it's not natural gas, it's fracked!) and Site C Dam. Very destructive for the environment and for us! Leave the fossil fuel in the ground! Yes to: solar, wind, geothermal!!!

Appendix F: Social Media Engagement

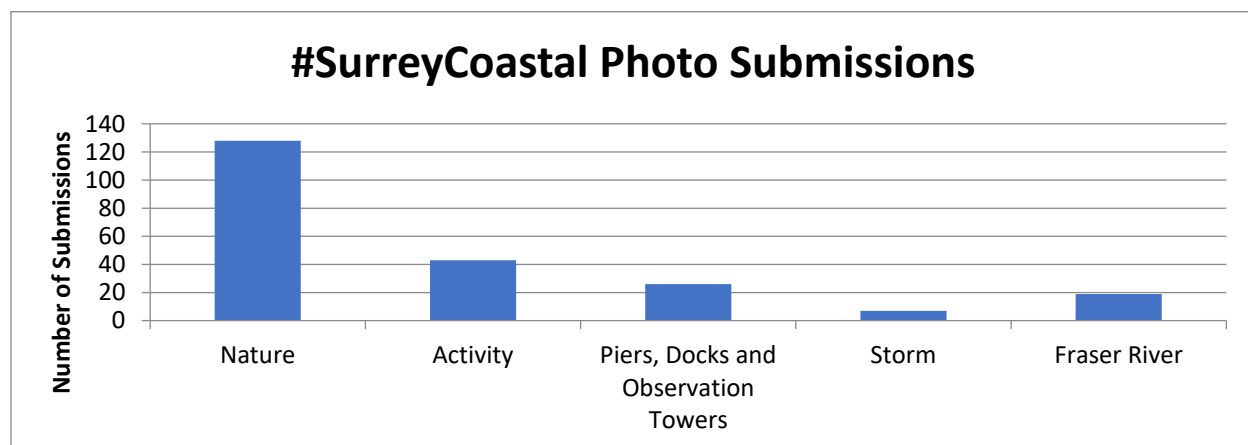
To support overall awareness about the Coastal Flood Adaptation Project including the project webpage (www.surrey.ca/coastal) and to promote upcoming project events and activities (online surveys, presentations, workshops and pop up events) a multi-platform social media campaign. Overall, over 250,000 impressions were generated as summarized below for Phase 2 and 3.

YouTube	Twitter	Facebook	Instagram
Total views: 25,354 Impressions: 103,331 View rate: 24.54% In Stream Impressions: 42,979 Views: 24,265 View rate: 56.59% In Display Impressions: 60,453 Views: 1,089 View rate: 1.90%	# of posts: 19 Impressions: 27,790 Engagement: 407 Engagement rate: 0.25% Hashtag use: 116 URL clicks: 116 Likes: 19 Retweets: 45 Replies: 4 Impressions: 28,574 Clicks: 163	# of posts: 9 Reach: 143,656 Post Clicks: 3405 Engagement: 490 Impressions (from ads): 163,464	# of posts: 6 Likes: 613 Comments: 10 Impressions: 9,551

Notes:

- Video posts had higher reach
- Instagram had the least click through rate (due to hyperlink limitations)
- Facebook was the most effective platform for CFAS
- The In Stream YouTube format was more effective than the In Display

In Phase 1 of the Coastal Flood Adaptation project, to help understand *What Matters Most? and Who is Affected?*, as well as to build overall awareness in the project and photo contest was organized. Three contest categories were offered (Nature, Activity and Storm). The majority of submissions were nature photos. Activity photos were the second most common and very few storm photos were submitted. The distribution of submissions is shown below. Most of the submissions were received through Instagram by users adding the project hashtag #SurreyCoastal to previously uploaded photos. Over 220 entries were received by over 60 people.



Contestants were encouraged to indicate what they love about Surrey's coastal area. A selection of quotes received through the Photo Contest are listed below.

- *Where you can be in the mountains smelling snow with a hint of ocean on the breeze close to heaven*
- *I love the stillness and tranquility of Crescent Beach*
- *I love the coast for its endless beauty and importance to our society. Being close to the life of nature really makes one happy*
- *Crescent Beach, Surrey is one of the most beautiful places to visit, stay and play. With a shoreline filled with families, picnics, sand castles, swimming, paddling, sailing, lounging or walking, there is something for everyone. Come see for yourself!*
- *Surrey's coastline is so important to all the lovely sea birds that are so peaceful to watch. Over 15 blue herons enjoying a sunny day at Crescent Beach in this one photo*
- *Surrey's coastline is a true wonder to be around near sunset days, something that we don't have to worry about but see and relax and enjoy the view along with precious nature, the wonder of Beautiful B.C. To the people that live just near the waters' edge gets to be around this incredible scene. Protect what we have that makes us happy.*
- *The walkway at Crescent Beach gives a place for people (and their dogs) to get their daily exercise.*
- *Remarkable and majestic scenery. Very sunset is a reminder of the beauty we are blessed with in the place we live.*
- *Sometimes sitting under the pier has a better view than standing on it! Finally starting to feel like Spring.... YES.*
- *I love the contrasts of living by the coast--the reflection of the ocean, the wind in the trees, the eagles soaring above me, and the ever-changing drama of the sky*
- *Elgin Park, leading towards Crescent Beach is a sanctuary for birds, and a little piece of paradise for those who love watching them.*
- *Sunset paddles are just spectacular. Read a Peaceful Paddle.*
- *Everyone has that one place in the world that they go to for relaxation and to find a peace of mind. What I love about the coast of Surrey is that a 15 minute drive away from my home provides me with peace and serenity.*
- *Elgin Park, leading towards Crescent Beach is a sanctuary for birds, and a little piece of paradise for those who love watching them.*
- *Love the beach walks in the winter too!*
- *A windy walk at Crescent Beach a few nights ago. Even stormy skies are beautiful around here.*
- *Living by the coast brings a feeling of calm, peacefulness and serenity. Living in the moment and appreciating each detail around me.*
- *Under the crescent beach pier.... Great place to take a long exposure any time of year!*
- *One of the reasons I love Surrey's coast is that we have so many choices when it comes to activities. Swimming, going for walks or drives along the coast, boating, bird watching, sailing, paddle boarding, cycling, and many other activities await us here. The sky is different every night, so it's like going to a new destination every time.*
- *Thankful for these secret spots on the Surrey coastline*

Appendix G: Semiahmoo First Nation Meeting Minutes

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CFAS Semiahmoo Meeting and Site Tour 2017-04-25

Attending:

- Harley Chappell, Chief, Semiahmoo First Nation
- Joanne Charles, Councillor, Semiahmoo First Nation
- Carrie Barron, City of Surrey
- Matt Osler, City of Surrey
- Charlene Menezes, NHC
- John Ingram, EcoPlan

Notes

- Mouth of Campbell River being chocked off – not sure if it's material (sand) coming from the ocean or coming downstream
- Spit has tripled in size in the last few years
- Past 10-15 years, significant and observable changes in river and along coastline. Impacts appear to be accelerating
- Some changes may be dredging related – dredging happening around Point Roberts (Lily Point—northwest corner of Point Roberts)
- New trestle at Campbell River – new deck only, no upgrades to pilings, no new pilings
- Historic Semiahmoo Mill caused many problems, 5 to 8 blocks of dyking shoreline with railway.
- Recent BNSF railway upgrade over Campbell River didn't change piles, just deck
 - o Sea worms in the wooden piles
 - o Cement pilings stayed, but just used wooden wedges to raise
 - o Low point across from Peace Arch Park
- Spit used to form long feature. Rail cut into island when came through
 - o Lumber transport route (escalator belt) to process logs from the North West
- Used to have pier longer than White Rock's
 - o Where they loaded lumber onto boats
 - o Then rail came and diked up river
 - o 5-6 blks of diking over time
 - o Previously natural islands
- Current pedestrian bridge built in '84/85 and suffering from structural issues
- Recent bridge assessment indicates 2-year lifespan remaining
- Current bridge is the third pedestrian bridge to be built over the years
- Water volumes coming down the river is increasing
- Road at 8th Avenue floods in high water situations and king tides
- Beach Road also floods during high water situations and king tides
- During king tide, water comes up to deck of pedestrian bridge
- Beach Road floods around marsh right beside river

- River turns 90 degrees east when exiting the mouth – never used to
- Old Habgood sewage treatment plant issues – wood system is rotting in situ and former outflows now function as inflows and safety issues
 - o Effluent came out near bridge
 - o Outfall never decommissioned
 - o Become an intake for water from river
- Recent event (?)
 - o Crested over to White Rock
 - o Goes into drain & comes back down
- Pipes draining tennis court, parking lot
 - o No flapgates, so floods parking lot at high tide
- Ponds off Marine Drive crest onto sidewalk and street edge during flooding events – first time this year
- Flooding with outfalls needing flap gates
- Working with Friends of Semiahmoo and Lower Fraser Fisheries Alliance (LFFA) to do an inventory of habitat areas
 - o Enhance productivity of Little Campbell River, e.g. deal with creosote wooden piles
- Nicomekl and Serpentine restoration and banking projects
- Shoring put around island at mouth of LC River, wooden banks collapsing & flowing in river
- On their agenda to dredge silt
- Working with A Rocha Canada on restoration
- Banks of islands in Campbell River are collapsing where they were formerly shored up and now rotting
- MoTI looking at raising Beach Road
 - o Floods reach lock block in high tide
 - o If build up, need to build out
 - o Also services go under there, not ideal if road gets flooded
- Semiahmoo looking at different road and service alignments through ongoing Comprehensive Community Plan (CCP) project
- CCP needs to be completed in advance of further funding to support new sewer and water from Surrey
- Lots of pressure to complete it in the next few months in advance of terminal date for water/sewer service cut-off with White Rock.
- Beach Road is being returned to Semiahmoo once rehabilitated – suffering from contamination when oil was used to suppress dust when road was gravel
- Concerned about wave action, spray because vertical face of shoreline, sea level rise, rail continuing to dump riprap
- Grassy portions along shoreline have sand colonizing, where no riprap. Rose bush in some places.

- Comprehensive Community Plan (CCP) for climate change – Phase 1 was just technical, not community consultative
- Vulnerability/climate change adaptation
 - o Map from Cosmos shows floodplain area is large (but check source: riverine vs. coastal)
- If road raised to act as dike,
 - o If SLR occurs, is road going to get eroded?
- Also considering alternate road alignment through forest to bypass low point of Beach Rd
- Important to protect and maintain only untouched estuary
 - o Balance with protecting development
- Would be great to have fishing (for food), it is salmon-bearing
 - o There is hatchery somewhere – 184th & 12th
 - o Nicomekl Enhancement Society gave up hatchery b/c would release fish & warm effluent impacts them in Langley
 - o Seals like Nicomekl better so predation impacts
 - o Serpentine hatchery 96th in Tynehead Park
- Adaptation Plan, first phase, completed in 2012 (Counterflow Planning) – Joanne will provide
- CCP is next. INAC funding.
- Semiahmoo wants to protect their portions of the estuary that are untouched – “protecting estuary is as important as protecting homes”
- Natural environment is reason for SFN’s location
- River is salmon bearing and some decent returns
- Community Core – 79 acres
- Economic Development Zone (south) – 22 acres
- Economic Development Zone (west) – 16 acres
- Natural environmental Area – 100 acres

Notes from Site Tour around Semiahmoo FN

- Noted gas service across Campbell River
- Old A&W Restaurant 8th Ave subjected to flooding
- Once 8,000 aboriginal people trading along coast
- Crab Shack Road built on horizontal timbers
- Values/Assets
 - o Untouched estuary
 - o Duck pond
 - o Sea asparagus (edible)
 - o Ironweed (to make tools)
 - o Middens
 - o Eagles nests – no rookery
 - o Water main and gas pipeline run below pedestrian bridge

- Semiahmoo PS across 8th Ave
- Hand pump on S side of 8th Ave
- Remediated garbage dump further along 8th Ave → potential future land development
- Access to water—difficult to launch canoes on Campbell River unless very high tide

Geomorphology Questions

- Where did all the sediment (gravel & sand) come from? Did BNSF rail bridge/line contribute to it?
 - Bay or downstream along river
 - Used to be able to jump off bridge into water
 - River alignment has shifted relative to bridge deck
- Where did the “craters” in the river bed mud come from? How did they form?
 - After 2007 storm
- Erosion along bend along left bank about ~200 m u/s of bridge
- More silt in backchannel along back side of BNSF rail
- What are impacts to saltmarsh between Beach Rd & Old Mill Road?

Current Flooding concerns

- Low spot along Beach Road, nearly floods from ocean
- Duck pond area backwaters in flood
- Low spot along 8th Ave, north of Campbell River



Floods to top of yellow concrete block during king tides and high water events



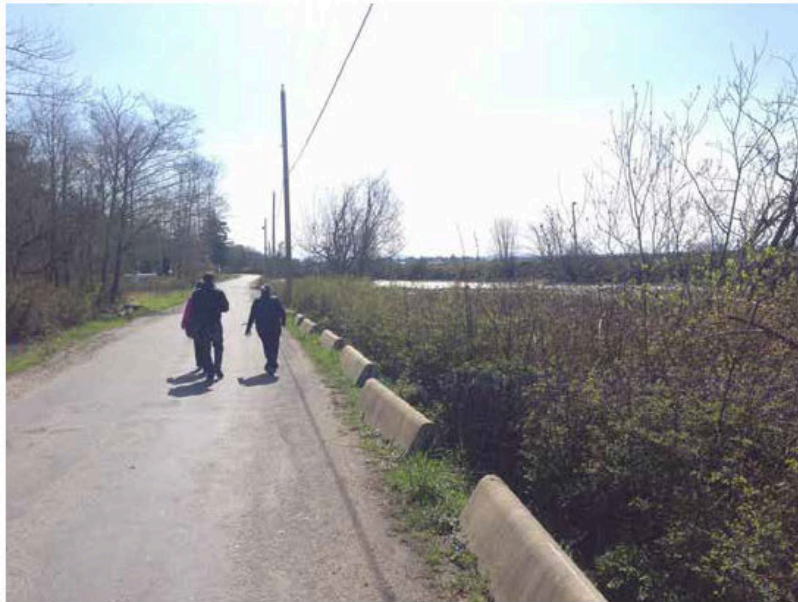
Campbell River Estuary



8th Avenue and river



Looking to mouth of river and rail trestle



Beach Road



River mouth and new sand/gravel bar



Railway Trestle, Old mill pier pilings in background



End of Crab Shack Road looking up river and to Semiahmoo



Island in estuary

CFAS Semiahmoo Meeting and Site Visit

2017-08-10

Attending:

- Joanne Charles, Councillor, Semiahmoo First Nation
- Samantha, CCP coordinator, Semiahmoo First Nation
- Leanne, CCP coordinator, Semiahmoo First Nation
- Carrie Baron, City of Surrey
- Matt Osler, City of Surrey
- Charlene Menezes, NHC
- Julian Gonzalez, EPI

Notes

General notes on values and options

Economy

- The primer needs to include economic loss/gain for SFN for each option
 - Parcels of land to consider are the park (northwest corner) and maybe the swamp area (southeast corner)
 - Potential for real estate development on both sites
 - Currently, the old mill building is being leased
 - Parking revenue is generated by the park and corner store parking
 - Seeking to preserve number of viable revenue streams. Exploring options to increase in future
 - Land area between railway tracks and cliff adjacent to Peace Arch Park floods
 - Review of LiDAR elevation data suggests up to 1,500 sq m between the railway and the adjacent hillside is below el. 5m. See attached map. One area is approximate 150m long around 4m el., and another smaller area is around 3.5m el.

Environment

- Beach road contains some contamination that would leach in a flood event
- Testing has been done showing creosote contamination to 30cm depth from previous dust control prior to road paving
- Concern of septic field leaching in flood
- The environment indicator for “No Adaptation” should be -1

Recreation

- What are the impacts to the park of the different options?
- What are the impacts to ocean access?
- Ability to access ocean impeded by river sediment. Over a generation, observed river sand become silty

- River mouth constrained by railway opening. Previously dredged but now silting in and impeding canoe access. Saw mill previously was able to get log booms up river by boat
- Park lands (western extent of lands, up to where trees were visible) were raised, previously very swampy. Approximately 3 ft of fill added between large trees and bank of river

Cultural

- SFN cemetery in the park (northwest corner)
- Access to medicinal and food plants (skunk cabbage and cattail)
- On the “Phased flooding” option, the cemetery would need to be relocated

Agriculture/Aquaculture

- Fishing, shell fish harvesting
- Maybe add access to medicinal and food plants on Crab Shack Rd under this indicator
- Need shallow water for shellfish harvesting

Infrastructure

- Footbridge has water and gas utilities under it. Only 2-year lifespan (note: would need to raise 8th Ave road before replacing footbridge). Revise previous meeting notes
- Bridge requires upgrades before additional utilities can be added
- Concern of pedestrian bridge damage in flood
- Concern of septic fields damage
- Emergency access route across bridge, prefer not to have open for vehicles but may want emergency access provisions in future
- Change image of “Beach road & 8th ave raising” option. Make it look like a 2 lane road
- Revise sewage pump reference in primer (this is Surrey PS)
- Low point in railway falls between Campbell River Crossing and US border. Review of LiDAR shows a section of track about 1 km long, commencing 300m east of the Campbell River Bridge, where track is approximately 0.5m below bridge elevation. Railway generally above 4.3m geodetic. This is lower than the section of railway around the Semiahmoo Peninsula in Surrey, where railway is generally 5.0m. Higher than the embankment low point between Nicomekl and Serpentine River, where the railway is at el. 3.7m
- White Rock drainage pump on SFN lands and discharges to Campbell River. White Rock exploring options to relocate further east

Residents

- It does not seem that any permanent structure is vulnerable
- Revise captures on “Beach road & 8th Ave raising” map

Other Semiahmoo Bay options:

Replace “Beach road & 8th Ave raising” for two options

- Raise land?

- Sea dams + dyke?
 - Previously small dam/weir on mouth of Campbell River. Not clear if purpose was for community potable water\irrigation source or strictly for saw mill\logging operations to control water level
- NHC to explore additional flood adaptation options incorporating Semiahmoo values. Evaluating Sea Dam

Open up river mouth

- If the railway moves, another option would be to open up river mouth (straighten the river)
- Would we need a dyke? Green Shores?

Beach road re-alignment

- Move Beach road to back of properties and run utilities with it (better protected)
- Waterfront would be homes with shoreline protection in this option
- Add another entrance to the reserve at the roundabout between 8th ave and Hwy 99 on ramp historically filled. May require a new bridge or extending existing culverts

SFN has looked at 164 Street as an alternative access, but bridge span would be 1km unless filled. Active floodplain provides benefit to leave as floodplain and not fill to avoid increasing water level.

Other study areas:

FN Cultural value

- Add an indicator of land disturbance as a proxy to cultural impacts
- Crescent Beach has thousands of years of artifacts intact in shell midden
- SFN respects that through time their people have adapted to different times and thus different areas are sensitive to disturbance from different periods of time. Strong preference is to leave human remains undisturbed and only relocate with burial ceremony if no other option.
- Shoreline is changing from erosion and from human disturbance. Artifacts come to the surface. Particularly on coastal islands which were frequently used as burial sites
- CFAS team to follow up with SFN Archeologist in next two weeks

**CFAS Semiahmoo Archeology Meeting
2017-08-15**

Attending:

- Don Welsh, Semiahmoo Archeology
- Julian Gonzalez, EcoPlan
- Matt Osler, City of Surrey

NOTES

General

- Reviewed range of adaptation options for study area
- Discussed history of beach disturbance
- Draft copy of Options will be revised based on feedback received and circulated to SFN

Historical background

- Petroglyphs along shore of Semiahmoo Peninsula
- Archeological evidence around Boundary Bay
- Historic village site in City of White Rock
- Gravel deposits overlay sand in last 1,000 years
- Nicomekl-Serpentine valley had a large lake previously (around 152 St)
- Valley used for foraging and as a resource area
- Mud Bay has changed, previously a large lake/intertidal area was prevalent
- Use of portaging from Nicomekl to Salmon river likely not common. More practical route involved leaving canoes at Nicomekl River headwaters at the western edge of Langley Prairies and walking to Fort Langley. Although overland a short cut, using tides to canoe around ocean and up the Fraser perhaps easier
- Evidence of Smoke and Net technique used to hunt ducks in Semiahmoo Bay, possibly Crescent Beach as well
- Down from Ducks was mixed with wool and very valuable for clothing circa 1936
- Nicomekl Serpentine Valley previously had elk herds

Evidence of climate change and sea level rise

- Evidence in area indicate that sea levels have fluctuated +/- 1m in the area.
- One theory is that an earthquake in the region resulted in ground sinking 1m relative to the ocean around 2,000 years ago. Evidence of 1m of silt found on top of a shell midden supports this
- Landscape has visibly changed. Example of birch trees forming due to drainage that would not otherwise have been possible in areas such as Burns Bog

Relationship with other Nations

- Multiple overlapping territories Study Area. Semiahmoo First Nation Primary territory
- CFAS Study area includes traditional territories from different eras of Semiahmoo, Kwantlen, Stlo:lo, Tsawwassen Qayqayt & Katzie people. Through marriage many overlaps in family lineage. Semiahmoo has ancestral connections to Lummi people, Katzie and Kwantlen people.
- The study area is Semiahmoo's core territory

Options primer suggested changes

- Introduced land disturbance as a proxy for cultural values
- Reviewed current conventions of construction in Crescent Beach. Preference is to build home foundations on 20-40cm soil disturbance and backfilled with 2 feet of fill to minimize ground disturbance
- Traditional foods and medicines are important and have been declining over the years. Feed lot e. coli concerns in run off, as well as other contaminants in run-off
- Options that improve the environment will likely foster more abundance of traditional foods and medicines, and therefore have a positive cultural impact
- No known spiritual sites in the area, more common to be in higher ground
- No extensive archeological assessment has been conducted throughout the Nicomekl-Serpentine Lowlands. Recent isolated pits were dug as part of Colebrook Road/Roberts Bank Railway project however results may not be representative of the larger area
- Many artifacts in study area have rotten due to acidity on the soil. Crescent Beach is of special cultural/archaeological importance as the shells buffer the acidity and preserve artifacts

CFAS Semiahmoo Meeting

2017-12-06

Attending:

- Harley Chappell, Chief, Semiahmoo First Nation
- Joanne Charles, Councillor, Semiahmoo First Nation
- Carrie Baron, City of Surrey
- Matt Osler, City of Surrey
- Julian Gonzalez, EPI

Notes

Planning support

SFN needs support on:

- Environmental assessment and mitigation assessment for filling land on North West corner
- How to address salt water marsh where current outflow is
- Road elevation assessment and share technical reports

See attached NHC December 15, 2017 report with technical input

Engaging other FNs

- Use the Lower Fraser Fisheries Alliance (LFFA) as a platform
- SFN to reach out to Janson regarding potential meeting in January to discuss short term works
- NRCan proposal for multi-year round table to look at broader issues in Boundary Bay
- Tsawwassen FN is treaty nation so SFN believes they are of low concern. That said, CoS should consult with its lawyers regarding their duty to consult with a treaty nation.
- Kwantlen First Nation likely has strong interest in the study area and should be consulted with

Changes to road raising option

- A number of changes to the sketch were identified and will be included in the next revision of the primer. (see attached document SketchChanges.pdf)
- A number of questions regarding erosion concerns were raised that are addressed in the attached NHC December 15, 2017 report

Changes to cultural indicator of options primer

- Suggested changes will be incorporated in the next revision of the options primer

Preferred options of Harley

- Mud Bay: 1) Current Conventions, 2) Hwy 99, 3) Barrier, 4) Managed retreat

File: 0440-20
XC: 4816-706

- Crescent Beach: 1) Managed Retreat, 2) Expanded Edge, 3) Mud Bay Barrier, 4) Current Conventions, 5) Barrier Island

Advisory group meeting

- SFN wants to continue to be invited to advisory group meetings



This land will be filled and the sketch needs to show it as viable land

The marsh does not flow all the way back. The land actually rises steeply where the marsh meets the rail. It is unclear still if this piece of land would be raised or not

SketchChanges.pdf

NHC Ref. No. 3001880

15 December 2017

City of Surrey

Attention: Matt Osler, P.Eng
Project Engineer

Via email: mfosler@surrey.ca

Re: CFAS
Answers to Semiahmoo Erosion Questions (Attached at end)

The original trestle south of 8th Ave was backfilled with a steam shovel and replaced with a bridge across the Campbell River between 1920 and 1921 (Railway By the Bay).

Dear Matt:

The delta of Campbell River has a man-made configuration, governed by the location and size of the opening in the railway embankment (Figure 1). The railroad acts as a breakwater, protecting the FN lands from direct wave action and wave run-up. ~~It appears a trestle was planned at one time but not constructed~~ (Figure 2). The historic sawmill site also altered the natural layout (Figure 3).



Figure 1. Google 2017

water resource specialists

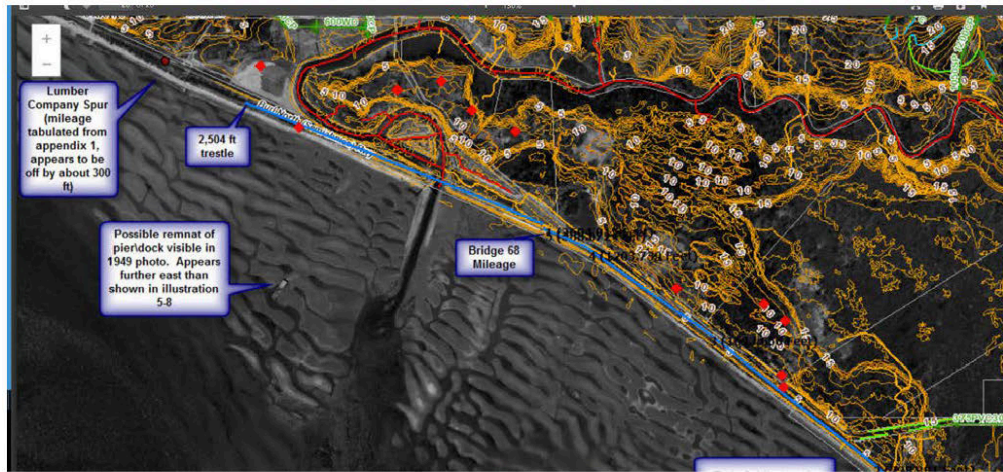
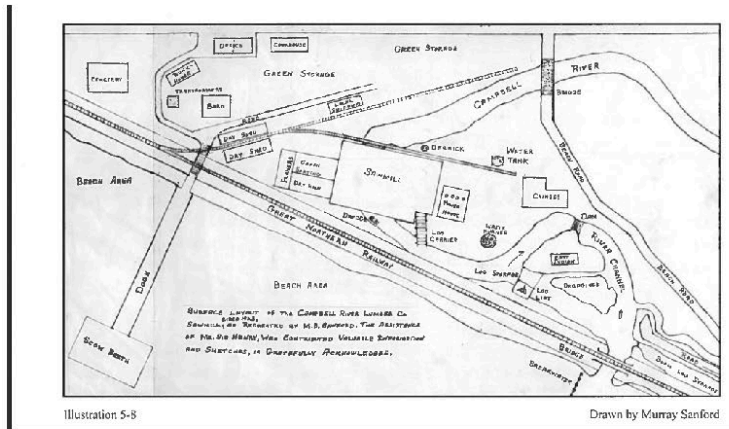


Figure 2. From SFN material on Asana – Planned 2,504 ft trestle(?).
 interpretation of Railway on the Bay, Sanford, 2009,



The sketch on the left showing the Campbell River Lumber Company mill layout was drawn by the author’s father, who walked over the millsite during the early 1940s when he arrived at White Rock. Fellow long-time resident Sid Henry assisted in preparing the plan.

Figure 3. Saw mill layout.

Answer 1:

It is not surprising sediment is accumulating here. This is the inside of a bend and flow is being pushed to the outside of the bend (to the north-east). The side-channel directly to the north has gradually filled in (Figure 1), contributing to the build-up at the bend (less water flowing straight). A number of measures could be taken to reduce the aggradation, such as guide-banks/ spurs. Consideration must be given to

the stability of the railroad bridge abutments and any potential degradation resulting in gradual head-cutting (lowering of the channel in the upstream direction).

Flood levels in this reach of the Campbell River are a function of backwater from the ocean. Increasing the capacity of the channel would not reduce flood levels. It would simply mean the channel would drain slightly faster as the tide goes out.

Answer 2:

The area to the east is likely excellent habitat and blocking it or filling it would have negative impacts. There are a number of drainage channels into the area and culverts/flood-boxes would be required, otherwise there could be local flooding. Blocking this area is not advantageous for flood protection.

Answer 3:

Flow in this area is mainly tidal (very low flow velocities). Risk of erosion is therefore low unless the soils are highly susceptible to weathering and erosion. The area should not be cleared of vegetation, garbage should not be placed here and development should be prevented. As water levels rise, some localized slumping of the bank is likely. If undercutting were to occur, the best solution would be to move the road.

Answer 4:

Same as Answer 3. The ocean side of the railroad is much more prone to erosion. (This is a BNSF problem.)

Answer 5:

The fill should be set back from the river bank to give the river space. This being the outside of a bend there is likely to be some erosion when tides are low and river flows are high. The bank protection does not have to be riprap. NHC has successfully used Large Woody Debris (LWD) designs but over time, these require maintenance / rebuilding.

Answer 6:

With SLR, water levels in the river channel will rise. There will be more deposition and the gradient of the channel will become gentler, reducing flow velocities and the erosion potential. Water levels will be higher and more land will be inundated. The process of wetting and drying may result in localized erosion. Future development should be restricted in this area.

Sincerely,

Northwest Hydraulic Consultants Ltd.

Prepared by:

Monica Mannerström, P.Eng.



CFAS Semiahmoo Bay DMAF Meeting
Surrey City Hall
2018-06-11

Attending:

- Harley Chappell, Chief, Semiahmoo First Nation
- Carrie Baron, City of Surrey
- Matt Osler, City of Surrey
- Tjasa Demsar, City of Surrey

Notes

- There is a man-made salt-marsh on the south side of 8th Ave across from Stevens St that used to contain old, now inundated, sewer infrastructure – the area would need to be filled if the 8th Ave road is raised – need to investigate what would be the effect of filling up this area
 - If it needs to remain protected, how to protect 8th Ave from flooding?
 - Is that a protected area? Need for environmental study: environmental assessment, drainage, impact on stakeholders
 - Would the filling take up the entire site? How to manage the river bank on site?
 - Need to assess the cost
 - Willing to work in partnership
- Little Campbell River is changing the area around the BNSF railway crossing and contributing to further deterioration of the trestle
 - Drastic change in sediment spit at the mouth of the river (on the land-side of the trestles)
 - The river is eating at the last curve at the mouth and the man-made islands are being eroded, need to study and develop options and phasing (potentially need to install rip-rap to protect from further erosion)
 - Need to dredge the inlet due to sea level rise and sediment accretion
 - Need to study and manage sediment transport and water flow in the river and how it's going to change with increased development upstream
 - Potential to link with living-dyke pilot (e.g., use the dredged materials from the river outlet to build dikes)
- 8th Ave optimization project/assessment for improved drainage on the way (some developments around it are too low, how will raising the road impact them?)
- Beach Rd is getting raised to the level of protective road (not dike-level) – backfilled and raised; working with MoTI; then returned to SFN
- Landfill area still a test site – needs to be closed before filling it in
 - White Rock infrastructure still at the site next to the landfill, it might be abandoned in the future

- Plan is to protect and develop the area; phase 2 will refill the parking, protect the gravesite
- There is a very low point on BNSF railway close to Peace Arch Park
- Culverts under the Hwy 99 on Little Campbell River
- Rivers in the CFAS study area cross the border with Langley – need to include Langley in discussions
- Bridge that connects SFN to 8th Ave due to be changed (2015 study) and ownership sorted out (the sub-structure is owned by Surrey, could leave the entire asset to SFN)
 - Bridge to be updated from pedestrian-only to also allow for emergency vehicle access (need for alternative access due to main access often being blocked by traffic at the border)
 - Need to tie-in with 8th Ave and however it will be changed/updated/raised
 - Gas-line might be relocated to under the river (currently under the bridge)

CFAS Semiahmoo Bay DMAF Follow-up Meeting
Surrey City Hall
2018-07-23

Attending:

- Harley Chappell, Chief, Semiahmoo First Nation
- Joanne Charles, Councillor, Semiahmoo First Nation
- Matt Osler, City of Surrey
- Mickella Sjoquist, City of Surrey
- Tjasa Demsar, City of Surrey

Notes

- There is still interest from both sides to study the BNSF railway impact to the coastline, including climate change considerations – landslides, flooding and coastal erosion – and the safety impacts of it (sediment movement also of interest) – need to look at the coastal system as a whole, so important to include the BNSF railway as one of the components (most of Surrey coastline occupied by it)
- SFN suggested contacting the Vancouver Fraser Port Authority for potential to partnering on shore-related works – they have done work on saltmarsh reclamation before – they could be engaged at a later stage once funding is confirmed to expand the scope
- SFN supports studies of sediment movement, interested in how does it affect the E side of Boundary Bay and how does Port’s work influence the Little Campbell River
- Need to study how pieces playing together: LCR, raising 8th Ave, storm-sewer runoff (what outfalls go into the river); need to know how the water is moving
- Pedestrian bridge:
 - There have been some challenges with the right of way for the current bridge
 - There are 6-10in gas/water lines under the bridge
 - Water level in LCR rising, trees falling and getting stuck at the bridge and compromising its integrity, other impacts related to water level/movement changes
 - Substructure Surrey’s, unknown whose is the top part → the idea is that the new one will be transferred to SFN
 - Need to raise the foundations on both the N and S sides, replace wooden piles (which could cause the bridge to float in high water)
 - In relation to strengthening the future bridge, important to analyse the movement of raising waters in the area, including the man-made saltmarsh with old sewer infrastructure still in → develop a phased approach this as a joint issue – would protect the 8th Ave
 - The new bridge is to be approx. 20ft wide, concrete, with no utilities running under, simple and functional, making sure is built high enough for SLR

- Old estimate was \$2M
- Nooksack Nation did a study on storm drain effluent movement
- SFN currently in negotiation with DFO on reclassifying Semiahmoo/Boundary Bay (now it is “closed”) – it will enable to do more water monitoring in the future & for shellfish / fishing in the W side of the Bay
- Need to study 1 km strip of the N bank of LCR – low area E of bridge as well – the impact on 8th Ave – the area floods 5-6x times per year, used to be only once – possibly put in a retaining wall
- The plan is to raise the entire area where the parking lot is
- SFN location on LCR – important for them to protect the salmon, working with DFO/hatcheries to bring salmon back (warm industrial effluent has been eradicating the fish that the hatchery is releasing)

Appendix H: Other consultation

Concurrent with CFAS, other projects related to the challenge of coastal flooding in Surrey have been implemented or are ongoing. As part of those projects workshops with various stakeholder groups have been conducted. Reports summarizing these conversations have been prepared and those relevant to CFAS work are provided below.

Infrastructure Stakeholders

- Mud Bay Infrastructure Flood Vulnerability Assessment PIEVC Workshop: Summary and Outcomes – June 2017, available at <http://www.surrey.ca/files/CFAS-PIEVC-Workshop.pdf>
- Final Report: Improving Coastal Flood Adaptation Approaches – March 2018, available at <http://www.surrey.ca/files/CFAS-ICFAA-FinalReport-29032018.pdf>

Coastal Regulators and Environmental Stakeholders

- Prioritizing Infrastructure and Ecosystem Risk Phase 1 Report – March 2018, available at <http://www.surrey.ca/files/CFASPIERPhase1Report31Mar2018.pdf>

Appendix I: Input Received from Dutch Experts

CFAS also benefited from input received from Dutch flood-management and landscape architecture experts with years of experience in the field. These experts collaborated with the UBC School of Architecture and Landscape architecture to produce an adaptation design concept report, available at http://www.surrey.ca/files/CFAS_LINT_UBC_Draft_MudBaySurreyDesignResearchReport_2017.pdf

Interviews with Alexander Herrebout of LINT Middelburg and Ric Huting of Royal Haskoning DHV were performed during their visit to Surrey; the transcriptions of the interviews are provided below.

Interview with Ric Huting

Ric: My name is Ric, I am from RHDHV, that's a company from the Netherlands, and I'm from the Netherlands too.

Interviewer: Now that you've seen a few presentations on Mud Bay, what issues do you see, what challenges do you see for sea level rise and climate change in Mud Bay?

Ric: Today I've seen a lot of concerns, constraints. Also opportunities, as well. I think, what I've seen ... there was this, today we had this session with, they weren't stakeholders, but people who were engaged in the project, and they had all this idea, this awareness that something needs to be done. So this is a pro one. Because if you haven't got the awareness, people will not have the willingness to change something. And then, what I think, when you see the area, there's a lot to gain here. There's a probability to restore old natural systems, to create value, not to say that the current land use is not value, but it's a single value, it's simple, and maybe this is not the only side where you can do farming, you can do a lot more. And I think this is what today's sessions indicated to me, everyone sees the possibilities that you can create something unique here.

Interviewer: Do you see any similarities in what you see in Mud Bay and the work that you've done in the Netherlands?

Ric: Yes, a lot, a lot. And I just saw a presentation with some photographs from a project in the Netherlands, I also presented this [lunch], from something, also a [depowering] project. So a land that used to be within a dyke for over 1000 years and people now finally came up with the idea—it's maybe not so necessary to protect this land and can be more beneficiary to give it back, give it back—to open it to the sea, to the river and the people who live there can remain there, but on elevated houses, and they will have water flowing around their house far more often than they had before. But it's in the end far more safer and much nicer surrounding, much more natural and less cultivated. So I see a lot of similarities with this project. So this is just one type of project in the Netherlands, but we have more of them.

Interviewer: So how, in the scenario that you just mentioned, how did you get the community to see the benefit of that, of that new way of looking at the land?

Ric: I think stakeholder involvement at the beginning of the process is vital, is key. And because in this typical project these people were involved from the beginning, as I think is happening right here as well. So what are your concerns, what are your ideas, what do you think is an opportunity, what not. If you have an idea and maybe some stakeholder will think it's a good idea, but if you push it there

automatically is resistance. But if you create good circumstances and you let people think for themselves, they will come up with nice solutions as well. And if you integrate it, and you have a few things that need to be done, so if you say, yes, there will be sea level rise, we can't maintain the current situation, not at low cost, then people will think for themselves and come up with good ideas, and you can integrate them in a good project. So I think that's key, to have a good solution in the end.

Interviewer: Do you have any final words of advice, any tips for us—this is a big project for us, it's the first one for the City of Surrey, any final words?

Ric: Final words... Well, please, learn from the Netherlands, do not make the same mistakes we did, maybe some 100 years ago, and maybe we weren't aware by then that it wouldn't be smart. But do not put yourself in a position that you will regret a hundred years ahead.

Interview with Alexander Herrebout

Alexander: I'm Alex Herrebout from Lint, I'm from the Netherlands.

Interviewer: I know you've only been here a couple of days, but based on what you've seen so far, what kind of issues or concerns do you see with Mud Bay?

Alexander: What I see is that Mud Bay is part of different landscape, so you have different areas of different things popping up. What I like to think about from the quality of the area, [inaudible] and the natural areas and I enjoyed the kayak trip and all these kinds of things, so it's a beautiful area, but it's just coping with the water. And I guess, to find a smart way to cope with the water and a way that it's, a lot of stakeholders or teams can be combined and can even get better through this kind of challenge of climate change.

Interviewer: And what kind of opportunities do you see, based on your experiences that you could think about for Mud Bay?

Alexander: I think especially, I think right now it's agricultural use, and then you have the dyke and then you have the water. Maybe there are some opportunities to think about different uses, in a way that it's agricultural, or maybe it's about food but in a different way, with more water. Or maybe intertidal lands or uses, so I think about more of layout use, like you can use it for agricultural and enjoy [defuse]. This could be something, this you could do some research on. The other thing is sometimes there's really a need to do something now, so if you think about within 10 years you need to do something, so then find a way, how do you say ... For instance Crescent Beach, what kind of things you can do, maybe you can even improve, you can get a nice walk around of [inaudible], enjoy the water itself and then a nice [fuse] along the bay, so that's things, so yeah, I would recommend to think of in a way.

Interviewer: Okay, and do you see any similarities between the work that you've done in the Netherlands and anything that you've seen in Mud Bay?

Alexander: Yes, of course. Especially, I guess, the systems that are producing some gradients, intertidal zones. It's called Mud Bay, so you should do something with sediments or at least think about it. What we heard a lot about, nature of course, but ... The old system was that the river is going to the sea and it was a branch and you could enjoy this kind of thing. We are really interested in the zone in between the lands and the water, what you can do there...

Appendix J: City of Surrey Council Reporting

Reporting to City of Surrey Council has been accomplished through staff delegation presentations to various Committees of Council, as well as an annual corporate report to the Council and a memo including a phase-end update. A Surrey Councillor chairs the meetings and minutes taken from the presentations, questions, comments and responses are provided to Surrey Council. Meeting minutes are published on the City of Surrey website.

The presentations made in Phase 2 and 3 have included presentations to:

- Agriculture and Food Security Advisory Committee (AFSAC)
- Environmental Sustainability Advisory Committee (ESAC)
- Parks, Recreation and Sport Tourism Committee (PRSTC)
- Development Advisory Committee (DAC)
- Public Art Advisory Committee (PAAC)
- Surrey Heritage Advisory Commission (SHAC)

A presentation to the Transportation and Infrastructure Committee (TIC) that focused on a related FCM MCIP project was also given.

The Annual Update Reports to Council have included:

- Report to Council dated December 1, 2016 is available online at http://www.surrey.ca/bylawsandcouncilibrary/CR_2016-R263.pdf
- Report to Council dated December 13, 2017 is available online at http://www.surrey.ca/bylawsandcouncilibrary/CR_2017-R246.pdf

DMAF PROJECT OVERVIEW



* Second Location in Delta between 88 and 96 St on Boundary Bay

#	Name	Asset Type	Hazard Mitigation	Community Co-benefits	Values Protected	Project Partners
1	Colebrook Dyke Upgrades	Coastal Dyke		Recreation, bird watching, food security		
2	Colebrook Drainage Pump Station Replacement	Drainage Pump Station		Increased agricultural productivity and food security		
3	Sea Dam – Serpentine River	Sea Dam (drainage and irrigation)		Agriculture irrigation, fish passage, worker safety		
4	152 St Road Upgrades and Raising	Integrity of Transportation Network and Asset		Congestion relief, transportation safety, accommodate growth, cycling, pedestrian		
5	Nicomekl Riverfront Park - Phase 1	Flood storage alternative to riverine dyking		Recreation (blue way), nature trails, wetlands, culture, open space		
6	King George Boulevard Bridge and Nicomekl River Sea Dam Replacement	Arterial Bridge (integrated with one sea dam) Integrity of Transportation Network and Asset		Congestion relief, transportation safety, accommodate growth, cycling, pedestrian, integrated to Nicomekl Park, fish passage, agriculture irrigation		
7	Crescent Beach Storm Sewer System Upgrades - Perforated Piping	Flood Protection increases transportation resilience		Street beautification/ road improvements, transportation safety		
8	Dyking - Lower reaches of Nicomekl and Serpentine	Flood Protection (nuisance and extreme event)		Food security and transportation flood safety		
9	Serpentine SRY Rail Link Bridge Replacement and Dyking	Flood Protection (nuisance and extreme event)		Economy (freight and heritage railway), worker safety and goods movement		 (Southern Railway of BC)
10	Burrows Drainage Pump Station Upgrade	Drainage Pump Station		Increased agricultural productivity and food security		
11	Stewart Farm Sanitary Pump Station Coastal Flood Proofing	Integrity of Sanitary Sewer Network		Sanitation, worker safety and water quality		
12	Campbell River Pedestrian and Emergency Access Bridge Replacement	Integrity of Transportation Network		Emergency access, Multi Use Path		
13	Foreshore Enhancements	Structural and nature based flood control and environmental enhancements		Wetlands (birds, fish, clams) and food security		

Hazard Mitigation
 = flood = seismic = drought

Values Protected
 = economy = infrastructure = environment = communities



HOUSE OF COMMONS
CHAMBRE DES COMMUNES
CANADA

Gordie Hogg

APPENDIX "III"

Member of Parliament—South Surrey—White Rock

January 7, 2019

Infrastructure Canada
Communications
180 Kent Street
Suite 1100
Ottawa, Ontario K1P 0B6

Re: City of Surrey D-1675 DMAF Application

To Whom It May Concern:

I am pleased to offer this letter of support for the City of Surrey's Federal Disaster Mitigation and Adaptation Fund (DMAF) to reduce coastal flood vulnerability and other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands.

City of Surrey has a vision to be a thriving, green, inclusive city and to that end has diligently engaged with a wide cross section of my constituents and has been proactive in enhancing the safety of our community for a number of years. The DMAF submission includes a variety of shovel ready works to bring existing infrastructure into a state of good repair today, while preparing the City for the future.

While the projects represent an integrated, comprehensive approach to reducing disaster risk, there are a number of aspects that I would like to highlight:

- 1) **Innovative nature based solutions.** These have been integrated into plans for a new Park (Nicomekl Riverfront Park) as well as through enhancements to an existing Park (Mud Bay Park). This park will provide important community

Constituency Office: 15355 - 24th Avenue, Suite 595, Surrey, BC V4A 2H9 — Phone: 604.542.9495

Ottawa Office: Room 209 Justice Building, House of Commons, Ottawa, ON K1A 0A6 — Phone 613.947.4497

Gordie.Hogg@parl.gc.ca

recreation while enhancing and preserving the natural environment. The park links with transportation upgrades proposed on 152 St and King George Boulevard necessary to improve multi-modal transportation in South Surrey. Support for this proposal is endorsed by important local conservation groups.

- 2) **Campbell River Pedestrian\Emergency Access Bridge:** This bridge provides an important connection between City of Surrey, City of White Rock and Semiahmoo First Nation. The existing timber boardwalk is in poor condition, is vulnerable to coastal flooding and does not provide safe emergency access. With support of Indigenous Services Canada, this investment will be a tangible example of the federal government's commitment to reconciliation in our community. The proposed bridge is urgently required - and would be most welcome - according to officials with the Semiahmoo First Nation.

Should you have any questions about the importance of these investments, please contact the undersigned.

Sincerely,



Gordie Hogg, MP

Ottawa

Room 540N, Centre Block
Ottawa, Ontario K1A 0A6
Tel.: 613-992-2957
Fax.: 613-992-3192



HOUSE OF COMMONS
CHAMBRE DES COMMUNES
CANADA

Carla Qualtrough

Member of Parliament / Députée
Delta

Ottawa

Pièce 540N, Édifice du Centre
Ottawa (Ontario) K1A 0A6
Tél. : 613-992-2957
Télééc. : 613-992-3192

Constituency

7511 120th Street, Suite 104
Delta, British Columbia V4C 0C1
Tel.: 778-593-4007
Fax.: 778-593-4008

Circonscription

7511, rue120^{ème}, bureau 104
Delta (Colombie-Britannique) V4C 0C1
Tél. : 778-593-4007
Télééc. : 778-593-4008

January 09, 2019

Infrastructure Canada
Communications
180 Kent Street, Suite 1100
Ottawa, Ontario
K1P 0B6

Re: City of Surrey D-1675 DMAF Application

To Whom it May Concern:

I am pleased to offer this letter of support for the Cities of Surrey and Delta's project application to the Disaster Mitigation and Adaptation Fund to reduce coastal flood vulnerability and other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands.

Delta and Surrey are located on the flood plain at the mouth of the Fraser River, requiring these communities to be the first line of defense against both sea and river flooding due to freshet, earthquake or eventual sea level rising as a consequence of climate change. Delta alone, has over 67 km of aged dike protecting not only the community but also major infrastructure necessary to the economy of the province of BC and the entire country. These dikes are responsible for protecting infrastructure leading to and associated with Vancouver Port Authority-Deltaport, Highway 99 (the major trade corridor connecting BC to the United States), Boundary Bay Airport (the 5th busiest airport in Canada) and Highway 17 (the connecting route to BC Ferries and Vancouver Island).

City of Surrey has been working closely with staff at City of Delta to share knowledge and develop integrated solutions to reduce coastal flood risk. One aspect of the application that I would like to highlight is the **innovative nature based solutions** developed through collaboration with the Lower Fraser Fisheries Alliance and West Coast Environmental Law. This approach of restoring coastal wetlands will help protect the residents of Delta and Surrey, as well as the environment, and has been integrated into flood control works proposed in both Delta and Surrey. As a result of sea level rise, it is important that nature be part of the solution and that investments be made to safeguard the health of the Pacific Flyway and the marine environment.

Thank you for your consideration of this proposal.

Sincerely,

A handwritten signature in black ink, appearing to read 'Carla', with a large, stylized flourish extending to the right.

Carla Qualtrough
Member of Parliament for Delta



LEGISLATIVE ASSEMBLY
of BRITISH COLUMBIA



Stephanie Cadieux
MLA

December, 2018

Infrastructure Canada
Communications
180 Kent Street
Suite 1100
Ottawa, Ontario K1P 0B6

Re: City of Surrey D-1675 DMAF Application

To Whom It May Concern:

I am pleased to offer this letter of support for the City of Surrey's Federal Disaster Mitigation and Adaptation Fund (DMAF). Reducing coastal flood risk and other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands is of utmost importance.

The City of Surrey has been taking the initiative to enhance the safety of our community for a number of years. The city's DMAF submission includes a variety of shovel ready works to both bring existing infrastructure into a state of good repair and prepare for the future.

While the projects represent an integrated, comprehensive approach to reducing disaster risk, I believe the innovative, nature-based solutions that the application would implement for residents in my constituency are worth highlighting.

There are integrated plans for a new Park (**Nicomekl Riverfront Park**) as well as through enhancements to an existing Park (**Mud Bay Park**). This new park will provide important community recreation while enhancing and preserving the natural environment. The park links with transportation upgrades proposed on 152 St and King George Boulevard necessary to improve multi-modal transportation in South Surrey.

Once again, I am in complete support of the City of Surrey's full application. Should you have any questions about the importance of these investments, please do contact me.

Sincerely,

Stephanie Cadieux, MLA
Surrey South

South Surrey Constituency Office

206- 15850 24th Avenue

Surrey BC V3Z 0G1

T 604-541-4556

Stephanie.Cadieux.MLA@leg.bc.ca



LEGISLATIVE ASSEMBLY

Tracy Redies MLA
Surrey-White Rock

December, 2018

Infrastructure Canada
Communications
180 Kent Street
Suite 1100
Ottawa, Ontario K1P 0B6

Re: City of Surrey D-1675 DMAF Application

To Whom It May Concern:

I am pleased to offer this letter of support for the City of Surrey's Federal Disaster Mitigation and Adaptation Fund (DMAF) to reduce coastal flood vulnerability and other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands.

City of Surrey has a vision to be a thriving, green, inclusive city and to that end has diligently engaged with a wide cross section of my constituents and has been proactive in enhancing the safety of our community for a number of years. The DMAF submission includes a variety of shovel ready works to bring existing infrastructure into a state of good repair today, while preparing the City for the future.

While the projects represent an integrated, comprehensive approach to reducing disaster risk, I would like to highlight a component of the application that would have a meaning positive impact on the safety of residents in my constituency.

The Campbell River Pedestrian\Emergency Access Bridge: This bridge provides an important connection between City of Surrey, City of White Rock and Semiahmoo First Nation. The existing timber boardwalk is in poor condition, is vulnerable to coastal flooding and does not provide safe emergency access. With support of Indigenous Services Canada, this investment will be a tangible example of the federal government's commitment to reconciliation in our community.

Once again, I am in complete support of the City of Surrey's full application. Should you have any questions about the importance of these investments, please contact the undersigned.

Sincerely,

cc - Mayor McCallum via email to Doug.McCallum@surrey.ca
-General Manager, Engineering via email to FSmith@surrey.ca



SEMIAHMOO FIRST NATION

January 9, 2019

Infrastructure Canada

Dear Sir/Madam:

SUBJECT: SUPPORT LETTER FOR DISASTER MITIGATION ADAPTATION FUND

Semiahmoo First Nation Council is writing in support of the City of Surrey's application to Infrastructure Canada's Disaster Mitigation Adaptation Fund titled "Reducing Coastal Flood Vulnerability in the Coastal Lowlands of City of Surrey, City of Delta and Semiahmoo First Nation in British Columbia, through structural and nature based infrastructure works."

Semiahmoo First Nation has been working with the City of Surrey on the City of Surrey's Coastal Flood Adaptation Strategy over the past few years. Part of the funding application includes a replacement of the Semiahmoo Footbridge that crosses the Little Campbell River at Marine Drive and Stayte Road (crossroads of White Rock, Surrey, and Semiahmoo Boundaries). The old wood structured footbridge was designed in early 1980's and is the near the end of its life span.

The proposed new bridge crossing, designed for seismic resilience would provide resilience to coastal flooding, and also provide additional access to the Community for Emergency responder vehicles. These infrastructure improvements will provide improved health and safety concerns for the local community while providing the only other access to the community, a new emergency first responder access route (that is capable access for emergency first responder vehicles) for improvement to the Public Health and Safety of the Semiahmoo First Nation Community.

Semiahmoo First Nation believes that funding for this project is critical for the long term, with investment in critical infrastructure and improving future environmental sustainability which will build resiliency for our local communities and economies in preparation for the Climate Change, flood surges and sea level rises. Semiahmoo will work collaboratively with City of Surrey in securing additional funding required for this project.

Semiahmoo respectfully requests your full and fair consideration of the funding application put forth by the City of Surrey for the benefit of the City of Surrey, City of Delta and the Semiahmoo First Nation. If you should have any questions, please do not hesitate to contact me at semiahmoojoanne@gmail.com or at the Band Administration office at 604-536-3101.

Respectfully yours,

Councillor Joanne Charles



Engineering

July 26, 2018

Disaster Mitigation and Adaptation Fund (DMAF)
Infrastructure Canada
#100-180 Kent Street
Ottawa, ON K1P 0B6

Dear DMAF Evaluation Committee,

Subject: Boundary Bay Flood Risk Adaptation & Mitigation Project

The City of Delta is pleased to support the above proposal as put forward by the partnership of City of Surrey, City of Delta, West Coast Environmental Law, BC Ministry of Forest, Lands, Natural Resources Operations and Rural Development, South Coast Conservation Land Management Program, and the Lower Fraser Fisheries Alliance.

This project will enhance our knowledge and provide an opportunity to test concepts towards continued exploration of adaptation and mitigation options for flood risk reduction in Boundary Bay, including the Living Dike Concept. Attachment A provides details of the proposed project. Exploration of green infrastructure adaptation options for flood risk in Boundary Bay not only benefits upland jurisdictions but also benefits the environment in the bay. Boundary Bay is an important migration stop for various birds. Works that explore alternative or green flood risk mitigation and adaptation options is important to help sustain migratory bird populations into the future.

Delta is proposing to include the Boundary Bay Foreshore Upgrade project that is fully funded by the Union of B.C. Municipalities' Structural Flood Mitigation Fund as part of this coalition. Delta is also pleased to commit to in-kind contributions in the form of staff participation in meetings and other sessions with project staff; advise on ecological restoration issues and processes; and share information and knowledge when available. Delta understands that this Expression of Interest (EOI) to the DMAF is led by City of Surrey. Should the EOI be successful and enters the application phase, Delta and City of Surrey will develop an agreement on project delivery, financial contributions, and other arrangements related to the works.

The City of Delta looks forward to working with the partners on this initiative.

Steven Lan, P.Eng Director of Engineering

CC: Karl Preuss, Acting City Manager
Sean McGill, Director of Corporate Services
Mike Brotherston, Manager of Climate Action & Environment
Harald Fograscher, P.Eng, Manager of Utilities

Attachment: Boundary Bay Foreshore Enhancements

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City of Delta
4500 Clarence Taylor Crescent
Delta, BC V4K 3E2
604.946.4141

www.delta.ca

Infrastructure Canada
Communications
180 Kent Street
Suite 1100
Ottawa, Ontario K1P 0B6

Re: City of Surrey D-1675 DMAF Application

To Whom It May Concern:

City of White Rock understands that City of Surrey is submitting an application to the Federal Disaster Mitigation and Adaptation Fund to reduce coastal flood vulnerability and other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands. The application will address infrastructure vulnerabilities identified through the consultation completed under the Surrey Coastal Flood Adaptation Strategy that City of White Rock has participated in.

As the work being led by City of Surrey will support long-range planning for natural hazard risk reduction and climate adaptation along the City of Surrey, White Rock and Semiahmoo First Nation shoreline and coastal lowlands, City of White Rock is able to offer the following support:

- 1) Commit staff time to be involved in project meetings and advisory groups as appropriate;
- 2) Commit up to \$75,000 towards shoreline risk assessment. We understand the scope of this will be developed at a later date.

Sincerely,



Jim Gordon P.Eng.
Director of Engineering and Operations,
City of White Rock
877 Keil Street, White Rock, BC V4B 4V6
Tel: 604.541.2181 | www.whiterockcity.ca

WHITE ROCK
My City by the Sea!

cc

-Surrey Transportation Manager, via email JABoan@surrey.ca

December 19, 2018

Communications
Infrastructure Canada
180 Kent Street
Suite 1100
Ottawa, Ontario K1P 0B5

To Whom It May Concern:

Re: City of Surrey DMAF Application D1675

Metro Vancouver is aware that the City of Surrey has applied for grants and has been shortlisted under Canada's 'Disaster Mitigation and Adaptation Fund' (DMAF) which was launched by Infrastructure Canada in May 2018 to support hazard mitigation and climate change adaptation. One of the projects proposed by the City of Surrey in their DMAF application is the replacement of the Nicomekl Sea Dam, which is currently over one hundred years old.

Metro Vancouver, a regional wholesaler of potable water to the City of Surrey, has an existing 750 mm diameter watermain, installed in 1976, which uses the existing sea dam to cross the Nicomekl River. This watermain serves a critical water supply function for large areas of South Surrey and is at risk due to both the vulnerability of the existing sea dam to overtopping from coastal flooding and the compromised structural integrity of the dam in withstanding seismic events.

Metro Vancouver supports the City of Surrey replacing the Nicomekl Sea Dam with a new facility that is resilient to changing climate and seismic events. This also aligns with Metro Vancouver's Climate 2050 Strategic Framework to take action to make the region more resilient to climate change.

The replacement of the City of Surrey's Nicomekl Sea Dam also presents an opportunity for Metro Vancouver to co-locate a new watermain, within the new sea dam, at a lower cost as compared with a separate watermain crossing. On this basis, Metro Vancouver supports the City of Surrey in its DMAF application.

If you have any questions, please contact Inder Singh at 604-436-6891.

Sincerely,



Tim Jervis, P. Eng.
General Manager, Water Services

TJ/bb

cc: Matt Osler, Project Engineer, City of Surrey
Inder Singh, Director, Policy, Planning & Analysis, Metro Vancouver
Brent Burton, Lead Senior Engineer, Policy, Planning & Analysis, Metro Vancouver



July 30, 2018

File: 39580-20 WMA

Infrastructure Canada
Communications
180 Kent Street
Suite 1100
Ottawa, Ontario K1P 0B6

To Whom It May Concern:

**Re: City of Surrey's D-1675 Federal Disaster Mitigation and Adaptation Fund
(DMAF) Application**

The Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) supports the City of Surrey's DMAF application, which describes a novel approach to mitigating the increased risk of flooding due to anticipated sea level rise (SLR), while mitigating risks of SLR to high value intertidal habitat for fish and wildlife and enhancing the additional contribution of intertidal marshes to coastal defenses.

The Fraser River delta contains habitat that supports internationally significant populations of fish and wildlife. It is designated as one of Canada's Important Bird Areas, a Ramsar Site under the Ramsar Convention, and part of the Western Hemisphere Shorebird Reserve Network. It is arguably one of Canada's most important areas for migrating and wintering birds. The Fraser River is also one of the most productive salmon-bearing rivers in the world. Over 26,000 hectares of the delta is protected in five provincially designated Wildlife Management Areas (WMAs) and one federal Migratory Bird Sanctuary.

All of the intertidal mudflats and marshes that provide habitat for the abundant and diverse fish and wildlife populations are at risk from SLR. These intertidal habitats are found in a narrow band between the subtidal zone and the primary dykes. The area of habitat will be reduced as it is 'squeezed' between rising sea level and the dykes. Research predicts that half of the intertidal marsh will be lost from the delta if sea level increases by 1 m by 2100 as forecasted.

To prevent this loss, either the dykes must be moved landward to allow intertidal habitats to migrate (i.e. planned retreat) or, more realistically, the elevation of the marsh must be increased at the same rate as SLR. In some parts of the estuary the natural delivery of sediment by the Fraser River may be sufficient to mitigate the risk of SLR. In other areas, innovative solutions ranging from passive action to increase deposition of naturally available sediment to sediment nourishment to active placement may be necessary to avoid habitat loss.

.../2

The benefits of mitigating loss of intertidal marshes are not solely environmental. A growing body of scientific research is demonstrating coastlines that retain natural habitats are at less risk from flooding during storm events. One benefit is that marshes attenuate wave energy and reduce wave run-up height, thus providing additional protection or reducing the need to increase the height of dykes. The 'Living Dyke' approach views dykes and intertidal habitat as an integrated, and interdependent, system to provide opportunities to build natural infrastructure that provides societal, economic and environmental benefits.

FLNRORD will work with the City of Surrey, the Corporation of Delta, First Nations, federal agencies and ENGOs to convert the Colebrook Dyke, which lies adjacent to Boundary Bay WMA, into a Living Dyke. The province supports the proposed works to mitigate the impacts of SLR within the WMA and will work with these partners to resolve regulatory requirements and mitigate environmental impacts. Although affected First Nations are full partners in this initiative, formal First Nations consultation will be required and the legal duty to consult will be with the Fish and Wildlife Regional Manager, South Coast Resource Region, FLNRORD.

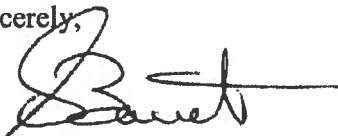
To support this innovative project, FLNRORD is able to contribute data and provide technical input, regulatory support and staff involvement.

Intertidal habitat in the WMA is likely at high risk to impacts from SLR as there are few sources of sediment in the Bay. Consequently, this project supports the overall goal of the Boundary Bay WMA Management Plan to 'sustain and enhance the ecological integrity of wildlife and their habitats encompassing the intertidal and subtidal areas of Boundary Bay.'

Over the ten year DMAF program period, there will likely be opportunities to build upon the scope of work through complementary studies and policy development. I expect that the initiation of the foreshore works included in the Surrey DMAF application will become a catalyst for others to initiate related foreshore enhancement projects elsewhere in the Fraser River delta and beyond. FLNRORD looks forward to exploring additional opportunities in more detail should the DMAF application be approved.

I strongly encourage Infrastructure Canada to support this innovative project.

Sincerely,



Scott Barrett, R.P Bio,
Regional Fish and Wildlife Manager,
Director, Resource Management
South Coast Resource Region
Scott.Barrett@gov.bc.ca
604-586-2889



BIRD STUDIES
ÉTUDES D'OISEAUX CANADA

understand appreciate conserve
comprendre apprécier conserver

Disaster Mitigation Adaptation Fund
Infrastructure Canada

December 17, 2018

To Whom It May Concern,

Re Letter of support for City of Surrey DMAF application

The Fraser estuary including Boundary Bay has been designated as an [Important Bird Area](#) by BirdLife International, and a Hemispheric Site under the [Western Hemisphere Shorebird Reserve Network](#) due to its importance as a stopover for a range of migratory birds including shorebirds and waterfowl, and the fact that the area supports Canada's largest population of over-wintering raptors, many of which feed along the coastal marshes. The health of coastal systems such as salt marshes and eelgrass beds are critical to the continued use of the region by migratory birds.

The Government of Canada has, through the [Migratory Bird Convention Act](#) committed to maintaining populations of migratory birds across Canada. In the [2016-19 Federal Sustainable Development Strategy](#) targets have been set for maintaining migratory bird populations. The Government of BC has designated the coastal portion of [Boundary Bay as a Wildlife Management Area](#) with acknowledgement of the importance of the region for migratory birds. The Boundary Bay area offers world class bird values that are at risk unless innovative green infrastructure solutions can be found to maintain the health and function of intertidal habitat while still allowing communities to adapt.

The project being proposed by the City of Surrey is the type of innovative project needed if coastal wetland habitat and associated bird populations are to be preserved across the Pacific Flyway. Therefore Bird Studies Canada is pleased to offer this letter of support to those bringing this application forward.

Sincerely,

James Casey
Fraser Estuary IBA Program Manager
Bird Studies Canada



January 8, 2019

Infrastructure Canada
Communications
180 Kent Street
Ottawa, Ontario K1P 0P6

To Whom It May Concern:

Re: City of Surrey's D-1675 Federal Disaster Mitigation and Adaptation Fund (DMAF) Application

The Canadian Wildlife Service (CWS) of Environment and Climate Change Canada (ECCC), has been working with the South Coast Conservation Land Management Program (SCCLMP) on its steering committee, and has provided guidance to SCCLMP to participate on the technical advisory team for this project. ECCC has provided technical expertise to workshops and is supportive of activities to conserve the marshes within the Fraser River Delta. Canada, represented by ECCC, is a signatory to the Ramsar Convention, and the Boundary Bay Wildlife Management Area is part of the Fraser River Delta Ramsar Site. Canada is also a signatory to the North American Waterfowl Management Plan, which identifies the Fraser River Delta as a continentally significant area for waterfowl, as well as a co-chair of the Pacific Birds Habitat Joint Venture, which has recognized the Fraser River Delta as the most important estuary in its Joint Venture as well as Canada for its waterfowl values. Conserving this habitat from loss due to sea level rise and development contributes to CWS's mandate for the protection and regulation of migratory birds.

The project as it is designed has the opportunity to mitigate impacts from sea level rise without losing additional habitat for waterfowl and shorebirds; it also has the potential to create and enhance habitat by reducing the need to heighten existing dykes. To support this project, ECCC is able to contribute data and provide technical support where required and able.

If you have questions regarding CWS's support for this project, please email ian.parnell@canada.ca.

Sincerely,

Ian Parnell
A/Regional Director
Canadian Wildlife Service of Environment and Climate Change Canada



Kingdom of the Netherlands

Infrastructure Canada
Communications
180 Kent Street
Suite 1100
Ottawa, ON K1P 0B6

Consulate General of the Netherlands
883-595 Burrard Street
PO Box 49068
Vancouver, BC V7X 1C4

www.netherlandsandyou.nl
Contact

H.A. Snoeken

T + 1 604 697 5530

van-cz@minbuza.nl

Date 10-01-2019
Re City of Surrey D-1675 DMAF Application

To Whom It May Concern,

I am pleased to offer this letter of support for the City of Surrey's Federal Disaster Mitigation and Adaptation Fund (DMAF) to reduce coastal flood vulnerability and to increase resilience to other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands.

The City of Surrey has a vision to be a thriving, green, inclusive City and to that end has diligently engaged with a wide cross section of their constituents and has been proactive in enhancing the safety of our community for a number of years.

As Consulate General of the Netherlands in Vancouver, we commend the City for their innovative approach in developing long term solutions to climate change.

The Consulate General of the Netherlands in Vancouver has been involved in several outreach events in the field of Urban Resilience and Flood Management. Together with Canadian partners, such as the City of Surrey, we have facilitated knowledge exchange between experts from the Netherlands and their Canadian counterparts. These experts have included coastal engineers and Landscape design specialists. We are pleased to see the City of Surrey including international best practices in disaster risk reduction. Two examples that highlight Surrey's work include:

- 1) **Consideration of community co-benefits.** Through Surrey's innovative Coastal Flood Adaptation Strategy planning process, community values have been reflected in the solutions proposed. This has been exemplified in the Nicomekl Riverfront Park that integrates wetlands with community amenities to provide flood control to protect the City's residents and infrastructure.
- 2) **Lifecycle thinking:** City of Surrey is a rapidly developing City necessitating new infrastructure to meet the needs of the community and the regional economy. Surrey's leadership in planning new infrastructure to be more resilient will improve the community's safety and economy for decades to come in a cost effective manner.

The Netherlands has been a leader in the field of Flood management for a long time, in the past years we have seen many new innovative approaches to make our cities more resilient and to reduce coastal flood vulnerability. We actively encourage international collaboration in this field and continue to look for ways to increase collaboration between Canada and the Netherlands.

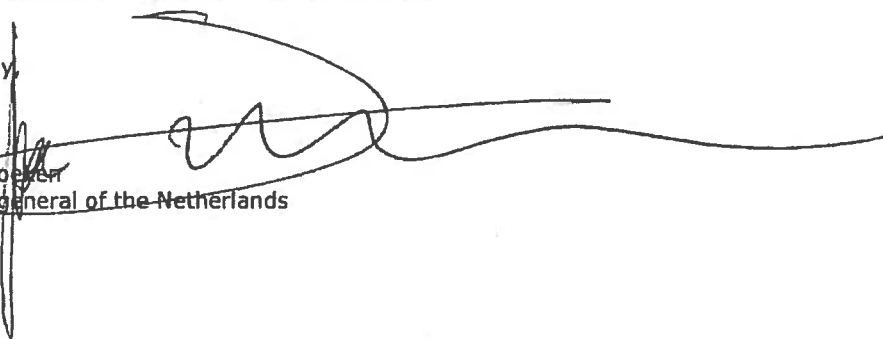
Date
10-01-2019

Our reference VAN/19-001

We are impressed with the work of the City of Surrey in applying international best practices and showing a leadership role in this field.

We hope that the City of Surrey will continue their work, with support of the Federal Disaster Mitigation and Adaptation Fund,

Sincerely,



H.A. Snoeyink
Consul-General of the Netherlands

Cc Minister Champagne via email to infcm.inistre-ministre.infcm@canada.ca
Mayor McCallum via email to Doug.McCallum@surrey.ca
General Manager, Engineering, City of Surrey via email to FSmith@surrey.ca



September 24, 2018

Infrastructure Canada
180 Kent Street
Suite 1100, Ottawa, ON
K1P 0B6

Re: Letter of Support for the City of Surrey's Disaster Mitigation and Adaptation Fund
Application – D-1675

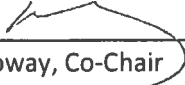
The Lower Fraser Fisheries Alliance (LFFA) is a voice for the First Nations of the Lower Fraser River from Tsawwassen to Yale, BC. We work collaboratively and holistically to manage our fishery and to support cultural and spiritual traditions for future generations. We are pleased to be writing this letter in support of the City of Surrey's Disaster Mitigation and Adaptation Fund (DMAF) Expression of Interest to reduce coastal flood vulnerability and other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands, including funding for a "Living Dike".

The Living Dike is an innovative nature-based approach that enhances biodiversity, reduces wave energy, and offsets the negative ecosystem impacts of coastal squeeze caused by traditional flood control infrastructure. The proposed location of the living dike is within the traditional territories of Semiahmoo First Nation and Tsawwassen First Nation. Due to declining fish stocks, many indigenous communities have a strong desire to act as environmental stewards, restoring habitat and protecting ecosystem functions that support healthy fish populations.

We understand that over the ten-year DMAF program period there will likely be opportunities to build upon the scope of work to layer on complementary studies and policy development. We are also optimistic that the initiation of the foreshore works included in the Surrey DMAF Application will be a catalyst for others to initiate related foreshore enhancement projects elsewhere in the Lower Fraser River and Fraser River Delta, such as Roberts Bank, Sturgeon Bank, and the South Arm Marshes, located in Lower Fraser First Nations' traditional territories. We look forward to exploring additional opportunities in more detail should the DMAF funding be approved.

The LFFA will provide support to the project proposed by the City of Surrey by liaising with First Nation groups, promoting the project through community events, and providing staff time to help build capacity for First Nations community members through a variety of opportunities. We look forward to participating in delivering this project.

Sincerely,



Ken Malloway, Co-Chair
Lower Fraser Fisheries Alliance



Sally Hope, Co-Chair
Lower Fraser Fisheries Alliance

Cc:
Matt Osler, Project Engineer, City of Surrey



Disaster Mitigation and Adaptation Fund
Infrastructure Canada

January 8, 2019

To Whom It May Concern,

Re: Letter of support for City of Surrey DMAF application

The Municipal Natural Assets Initiative Society (MNAI) is pleased to support the City of Surrey's DMAF application. Climate change impacts, such as sea level rise, floods, storm surges, droughts, and warmer temperatures are a growing concern in British Columbia and coastal communities across Canada. These challenges require new, innovative and proactive solutions to ensure our communities can reduce their vulnerability to these challenges. The Living Dike project outlined in the City of Surrey's expression of interest would advance understanding of the role of coastal natural infrastructure to protect coastal habitats and would add to the growing body of evidence related to the value and effectiveness of natural infrastructure. MNAI will support this project by sharing information on opportunities, challenges and key findings from our research on coastal natural infrastructure, as well as our experience in measuring the economic value of natural assets/infrastructure.

While some of the benefits provided by coastal natural infrastructure are relevant on a global scale (e.g. carbon uptake by a kelp forest), many of the benefits are realized more locally and can complement engineered infrastructure investments (e.g. barriers or breakwaters to prevent flooding from storm surges). Beyond mimicking the function of grey-infrastructure, natural infrastructure also provides co-benefits to surrounding communities. For example, salt marshes can significantly decrease wave height, thus limiting erosion and flooding while also providing habitat that supports biodiversity and serving as a recreation area. If the economic value of these benefits could be quantified, it would facilitate inclusion of natural assets in the more traditional asset management planning processes that all cities engage in, ensuring the protection of coastal ecosystems through recognition of their true worth to society.

MNAI was developed to foster the relationship between humans and nature by developing tools and approaches for municipalities to use in measuring and managing the contribution natural systems make to communities. We support and guide local governments in identifying, valuing, accounting for and managing natural infrastructure in core financial planning and asset management programs, and in developing leading-edge, sustainable and climate-resilient



infrastructure. Our approach has been tested in six communities in Ontario and British Columbia. We have recently expanded to New Brunswick through a second national cohort of projects, and have launched watershed-scale projects in Ontario and British Columbia. The latter has received support from Natural Resources Canada.

We understand that over the ten year DMAF program period there will likely be opportunities for knowledge exchange. MNAI's Coastal Ecosystem Service Valuation Framework is developing and piloting a standardized approach for cities to assign a credible economic value to their coastal natural capital in the context of their asset management processes. The project proposed by the City of Surrey would be a strong case study from which generalized findings could be identified to catalyze proactive approaches elsewhere. We look forward to exploring such opportunities should the DMAF funding be approved.

I strongly encourage Infrastructure Canada to support this innovative project.

Sincerely,

A handwritten signature in black ink, appearing to read 'Michelle', followed by a horizontal line.

Michelle Molnar
Technical Director
Municipal Natural Assets Initiative



PACIFIC BIRDS

HABITAT JOINT VENTURE

January 8, 2019

Infrastructure Canada
Communications
180 Kent Street
Ottawa, Ontario K1P 0P6

To Whom It May Concern:

Re: City of Surrey's D-1675 Federal Disaster Mitigation and Adaptation Fund (DMAF) Application

The Pacific Birds Habitat Joint Venture (PBHJV) would like to express its support for the above application to Infrastructure Canada.

PBHJV is an international partnership of government non-government partners, and is one of 22 Habitat Joint Ventures across North America implementing the North American Waterfowl Management Plan (NAWMP) and other international bird plans regionally. The PBHJV was created in 1986, and through its partners has conserved tens of thousands of acres of bird habitat, and invested hundreds of millions of dollars in habitat conservation along the Pacific Coastline from California to Alaska.

In 2017, the PBHJV declared the Fraser River Estuary as a priority for conservation. The estuary is the most important estuary in Canada for waterfowl: its marshes and waterfowl-friendly agricultural crops providing critical forage for over-wintering and migrating birds; the mudflats provide essential stopover habitat for several species of shorebirds on their journey across multiple continents. It is listed as a continentally significant area for waterfowl in the NAWMP, is an internationally recognized Wetland of International Significance (Ramsar Site), and is also an Important Bird Area (IBA), another internationally recognized designation. It is also under tremendous pressure from habitat loss due to development, intensive agriculture, and sea level rise.

The PBHJV supports the innovative "Living Dyke" approach to addressing sea level rise in the Fraser Delta, and encourages Infrastructure Canada to support this very important project. This approach not only conserves habitat that will be lost to sea level rise through inundation and the creation of dykes, but creates and enhances habitat that is beneficial for many species of birds, other wildlife, and aquatic species.

If you have any questions related to the support of the PBHJV, please contact Tasha Sargent (Canada) at Tasha.sargent@canada.ca, or Bradley Bales (US) at Bradley_bales@pacificbirds.org.

Sincerely,

Tasha Sargent
Coordinator, PBHJV (Canada)

Bradley Bales
Coordinator, PBHJV (US)

South Coast Conservation Land Management Program

July 27, 2018

Infrastructure Canada
Communications
180 Kent Street
Suite 1100
Ottawa, Ontario K1P 0B6

Re: City of Surrey DMAF Application

To Whom It May Concern:

The South Coast Conservation Land Management Program (SCCLMP) understands that City of Surrey is submitting an Expression of Interest to the Federal Disaster Mitigation and Adaptation Fund (DMAF) to reduce coastal flood vulnerability and other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands.

The SCCLMP is a new partnership between the B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), Ducks Unlimited Canada, The Nature Trust of British Columbia, and the Canadian Wildlife Service / Environment and Climate Change Canada. The goal of the program is to provide a more collaborative and integrated approach to the management of conservation lands owned and managed by the partners for the benefit of fish, wildlife, and habitats, including species at risk and related ecosystems. The SCCLMP manages a portfolio of Provincially-designated conservation lands throughout the B.C. south coast, including the [Boundary Bay Wildlife Management Area](#) (WMA).

Part of City of Surrey's DMAF submission will include an innovative nature based approach to conducting foreshore enhancements using an approach called the "Living Dike", described in Appendix "I". We have had technical dialogue around the Living Dike concept with City of Surrey, the Province, First Nations, stakeholders, and technical experts. The precedent value of this approach to flood control is of considerable value to us in order to mitigate negative environmental impacts of climate adaptation within the Boundary Bay WMA and other WMAs throughout the Fraser River Delta.

This work supports the overall goal of the Boundary Bay WMA Management Plan "to sustain and enhance the ecological integrity of Boundary Bay." Sea level in Boundary Bay is predicted to rise up to 1 meter by the year 2100. The tidal salt marsh in Boundary Bay cannot migrate shoreward due to the presence of dikes; if the rate of sedimentation within the Bay will be insufficient to offset the anticipated rise in sea level, management action will be necessary to ensure the persistence of the marsh within this Provincially-designated conservation land. The SCCLMP views the "Living Dike" foreshore enhancements as a propitious opportunity to possibly increase the resilience of the salt marsh into the twenty-second century and teach us lessons to apply this technique to similar tidal ecosystems in the Fraser River Delta WMAs.

To support this important initiative, as the land manager of the Boundary Bay WMA our organization is able to continue to provide staff involvement in the planning, execution, and monitoring of the proposed foreshore enhancements. This includes providing regulatory support and technical input related to the ecology of the WMA and ecological response to the foreshore enhancements.

We understand that over the ten-year DMAF program period there will likely be opportunities to build upon the scope of work to layer on complementary studies and policy development. We are also optimistic that the initiation of the foreshore works included in the Surrey DMAF Application may become a catalyst for others to initiate related foreshore enhancement projects elsewhere in the [five Wildlife Management Areas of the Fraser River Delta](#). We look forward to exploring additional opportunities in more detail should the DMAF funding be approved.

We look forward to being involved in this project should the Infrastructure Canada funding become available.

Sincerely,



Eric Balke, MSc
Coordinator
South Coast Conservation Land Management Program
Email: Eric.Balke@gov.bc.ca
Telephone: (604) 586-5643



Southern Railway of British Columbia Limited
2102 River Drive, New Westminster, BC V3M 6S3 Canada
604-527-6329 | 604-526-0914 fax
emak@sryrailink.com
www.sryrailink.com

December 24, 2018

City of Surrey
Engineering Department
13450 – 104 Avenue
Surrey, BC V3T 1V8

Attention: Matt Osler, P.Eng.
Senior Project Engineer – Utilities Drainage

Dear Sirs/Mesdames:

Re: Serpentine River Rail Bridge Economic Activity

Southern Railway of British Columbia (SRY) is a short-line railway that operates as a member of the global supply chain. Our services are directed to providing access to the North American rail network for local businesses, in addition to being the entry/exit point for many international trade corporations in the Port of Vancouver. SRY is often described as the rail service provider that operates the first and last mile for the major Class 1 railways (CN, CP, Union Pacific, and BNSF). The value of the products we handle daily are a dynamic contribution to the local economy and are an essential component to Canadian industry. The Serpentine River Rail bridge project is a replacement program designed to ensure that Canadian industries can continue to rely on railway service in Surrey, BC during periods of increasingly inclement weather. The Serpentine River water volume is heavily influenced by rainwater and tide events, which can force the river water to overflow into low lying agricultural surroundings. One of the low points in the dyke system is located at the existing SRY timber trestle over the Serpentine River. Upon successful completion of the project, the new steel and concrete railway bridge will tie directly into the dyke system and significantly reduce the flood risk to industry, agriculture and the community.

Currently, the Serpentine River Rail Bridge is at risk of being severely impacted through severe weather events; however, this was not always the case. The railbed was originally constructed at an elevation that was much higher than the surrounding regional flooding levels. Local demands from urbanization and agriculture have forced the City of Surrey to raise their dyke system for added protection. This allows the Serpentine River to reach a higher elevation during heavy rainfall, and thus poses a problem should such an event synchronise with a high tide. Flood risk alarms are now triggered several times per year and the regional economy could be negatively impacted if the bridge suffered any flood damage. Many businesses in Surrey, BC

rely on SRY's railway service to export Canadian agriculture via the Port of Vancouver or to domestically supply businesses with product. The following table is an estimate of the commodity type and value that each customer receives on an annual basis. It should be noted that this is only the direct value of the product that the customer receives and does not include any down-stream employment effects or indirect costs/values that the product brings to the region.

Table 1: Estimated Value of Goods Moved Annually

Customer	Commodity	Carloads	Landing Value
Parrish & Heimbecker	Export Grain	[REDACTED]	[REDACTED]
Ipex	Polyvinyl chloride	[REDACTED]	[REDACTED]
CKF	Polystyrene	[REDACTED]	[REDACTED]
Otter Co-op	Domestic Grain	[REDACTED]	[REDACTED]
Vision Plastics	Polyethylene	[REDACTED]	[REDACTED]
KCS Plastics	Polyethylene	[REDACTED]	[REDACTED]
Dryco	Wallboard	[REDACTED]	[REDACTED]
Total		3,460	\$187 M

These products are shipped on a regular schedule from SRY's main yard in New Westminster, BC. Typically, the customers beyond the Serpentine River Rail Bridge order approximately 13 railcars, 5 times per week (the bridge will be loaded 10 times per week including return passage). Some product is seasonal and will warrant increased frequency and number of railcars in a train. Export grain is a prime example of a product that has very high demand in autumn and winter as the product moves from the prairies to the Port of Vancouver. This important trade commodity coincides with the months that have the highest chances of extreme rainfall and high tide events. It is difficult to estimate how much economic disruption would occur if the Serpentine River Rail bridge was impassable during a flood event; a more detailed study would have to be commissioned by an economist. However, some of the products listed above are only economically feasible if delivered by train and are only able to be serviced by SRY over the Serpentine River Rail Bridge.

The bridge is also used by the Fraser Valley Heritage Railway Society for passenger outings during operating summer months. They use the line approximately 10 times per week, including return passage. The bridge itself has little interest for the society; the society is mostly concerned about operating historic rolling stock between Cloverdale and Sullivan and wants to ensure that they have continued use between these two stations. A new bridge would allow them to continue their service to the community.

Please let me know if you have any questions related to the project or to the information provided above. We trust that you already have the relevant material regarding the bridge project; however, please do not hesitate to ask for further information if necessary.

Yours truly,

Southern Railway of British Columbia



Richard Foth, P.Eng.
Senior Manager of Engineering Services



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Department of Geography
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December 19, 2018

Disaster Mitigation and Adaptation Fund
Infrastructure Canada

Subject: City of Surrey DMAF application, D-1675

To Whom it May Concern,

I am writing to express my support for the City of Surrey DMAF application, D-1675. Coastal ecosystems, including tidal marshes, are among the strongest carbon sinks in the biosphere. This coupled with their potential for low methane emissions, has generated widespread interest in these ecosystems for climate change mitigation and adaption, including protecting coastal communities from a rising sea. However, accelerating rates of sea-level rise threaten the long-term sustainability of these valuable ecosystems, requiring the need to build additional resilience into tidal wetland ecosystems through wetland restoration or enhancement.

As a new faculty member at the University of British Columbia, my future research program aims to measure carbon and greenhouse gas budgets of tidal marshes in Boundary Bay to quantify their potential for climate change mitigation and adaptation. The marsh enhancement projects in Boundary Bay provide a unique opportunity for my research group to study the effects of marsh management on carbon storage and sequestration. My research group will collect and analyze year-round measurements of carbon dioxide and methane fluxes at salt marshes in Boundary Bay to quantify their net warming or cooling effect on climate. These will be the first ecosystem-scale measurements of greenhouse gas fluxes from tidal marshes in Canada. Similar to other tidal marshes across the world, we expect that the tidal marshes in Boundary Bay will have a net cooling effect on climate as a result of low methane emissions and high carbon uptake.

I look forward to partnering with the City of Surrey to investigate how marsh enhancement can help existing salt marshes persist as sea levels rise and maintain their potential for carbon storage and sequestration.

Sincerely,

A handwritten signature in cursive script that reads 'Sara Knox'.

Sara Knox, PhD
Assistant Professor
Department of Geography
University of British Columbia

July 30, 2018

Infrastructure Canada
Communications
180 Kent Street
Suite 1100
Ottawa, Ontario K1P 0B6

Re: City of Surrey D-1675 DMAF Application

To Whom It May Concern:

West Coast Environmental Law Association understands that City of Surrey is submitting an expression of interest (EOI) to the federal Disaster Mitigation and Adaptation Fund (DMAF) to reduce vulnerability to coastal floods and other natural hazards along the Boundary Bay and Semiahmoo Bay shoreline and coastal lowlands.

We are advised that City of Surrey's DMAF EOI will include an innovative, nature-based approach to reduce coastal flood risk, referred to as the "Living Dike" and described in Appendix "I" of the City of Surrey's EOI. The Living Dike involves enhancing the natural habitat (primarily saltmarsh) of the foreshore area to achieve flood regulation benefits for coastal development. Over the past 18 months, and in cooperation with the Lower Fraser Fisheries Alliance, we have supported a technical dialogue with representatives from First Nations, provincial, federal and local governments as well as local stewardship groups to explore the Living Dike concept and its possible application in Boundary Bay. We also commissioned an expert report on the Living Dike concept (prepared by SNC Lavalin Inc., available online at: https://www.wcel.org/sites/default/files/2017_wcel_designbasisforlivingdike_latest.pdf) We have also supported engagement with experts from other parts of BC and North America to learn more about design and implementation of similar projects, and City of Surrey and Delta staff have participated, as well as provincial and federal representatives.

From our perspective, the Living Dike project outlined in the City of Surrey's EOI would be a significant advance in using coastal green infrastructure to protect coastal diked areas on the West Coast. This project would help mitigate the otherwise negative environmental impacts of conventional coastal flood infrastructure in Boundary Bay. It would also be a valuable precedent for undertaking similar projects elsewhere in Boundary Bay and the Fraser River Estuary, as well as in other West Coast locations (and quite possibly in East Coast locations as well). This project is also in the traditional territories of Semiahmoo First Nation and Tsawwassen First Nation and we are committed to work with the Lower Fraser Fisheries Alliance to support design and implementation that respects the priorities and objectives of the Nations.

To support this important initiative, West Coast Environmental Law Association is able to provide:

- Continued support in convening and facilitating technical dialogue among policymakers and rightsholders; and
- Complementary research capacity related to regulatory and environmental issues.

It also appears likely that over the ten-year DMAF program period there will be opportunities to develop complementary initiatives related to research and policy development. For example, we are currently exploring blue carbon aspects of coastal green infrastructure and its ability to sequester and store carbon.

We note that this Living Dike project supports the stated federal policy of strengthening natural infrastructure to reduce the impacts of climate change, and in particular protecting natural shorelines, as set out in *Federal Actions for a Clean Growth Economy, Delivering on the Pan-Canadian Framework on Clean Growth and Climate Change*.

We would look forward to being involved in this project as described above.

Yours truly,

A handwritten signature in black ink, appearing to read 'DCQ' followed by a stylized flourish.

Deborah Carlson
Staff Lawyer