



Coastal Flood Adaptation Strategy Phase 2: Flood Risk and Options Assessments Appendix C: Risk Assessment Maps

25 January 2022

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Suggested report citation: Ebbwater Consulting Inc. and Shift Collaborative (2021). Coastal Flood Adaptation Strategy Phase 2: Flood Risk and Options Assessments (Appendix C: Risk Assessment Maps). Prepared for the Comox Valley Regional District.

Acknowledgement

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The authors wish to acknowledge the support of the Comox Valley Regional District (CVRD) team, and especially Robyn Holme (Project Manager, Long Range Planner) and Alana Mullaly (General Manager, Planning and Development Services), who provided guidance throughout the project.

Ebbwater is also grateful to the many participants of the CVRD Stakeholders and Partners workshops. The input and feedback obtained through the process was critical to the success of this phase of work.

Ebbwater would like to acknowledge that this report was written at the Ebbwater Consulting Inc. office (and home offices), which are located primarily on the unceded and traditional Territory of the Coast Salish Peoples.

The maps were created by the as follows:

- Yinlue Wang, M.Sc., conducted spatial processing, technical analyses, and mapping.
- Nikoletta Stamatatou, M.S., M.Eng., EIT, provided specialist support to the risk assessment and mapping.
- Robert Larson, M.S., P.Ag., reviewed and coordinated the deliverables.
- Tamsin Lyle, M.Eng., MRM, P.Eng. (Principal of Ebbwater), identified the mapping needs and conducted a general review of deliverables.

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Maps Overview

Ebbwater assessed the impacts from 3 coastal flood hazard extents (short-, mid-, and long-term planning range scenarios) within the electoral areas of the CVRD, for 6 consequence indicators. Table 1 summarizes the risk assessment maps contained in this document. Note that there is no map for the mortality indicator, as it is directly correlated to the spatial data used for the affected people indicator map. In addition to the regional scale assessment, the consequence data was assessed for four focus areas (Saratoga Beach, Comox Road, Goose Spit, and Union Bay). The project detailed scope, methods, and results are found in the main report and appendices (Ebbwater Consulting Inc. and Shift Collaborative, 2021).

Table 1: Risk assessment maps.

Map Type	Scales Shown	Map	Information Shown
Hazard	Regional scale	1	Short-, mid-, and long-term planning range scenario coastal flood hazard extents
Risk ¹	Regional scale plus focus area insets	2	Affected people indicator
		3	Economy indicator
		4	Environment indicator
		5	Culture indicator
		6	Critical Infrastructure indicator

Note 1: All risk maps show the hazard layers shown in Map 1.

Printing and Document Navigation

All maps are designed and scaled to be printed in 'ANSI D' format.

Maps are linked and can be navigated through by clicking within the following:

- Document Index line items on page 3.
- Maps Overview Table on page 4 (Table 1 above).
- PDF bookmarks.

Summary of Notes to User

These notes aggregate all the notes shown in the left-hand side of the risk maps for each indicator.

Map Notes:

1. The maps were produced by Ebbwater Consulting Inc.
2. The maps include coastal flood hazard extents sourced from a different study (KWL, 2021). Ebbwater Consulting Inc. does not assume any liability for the accuracy of the flood areas on this map.
3. The maps are intended to support an understanding of risk and prioritisation of studies and mitigative actions. The maps should not be relied upon for engineering design or regulatory controls.
4. The locations of the potentially exposed assets shown for each indicator are based on the long-term planning range flood extent.

Data Sources:

1. Lakes, watercourses, roads, and environment layers: BC Data Catalogue.
2. Flood hazard extents were received from KWL.
3. First Nation Reserve Lands (also known as Indian Reserve Lands) layer was downloaded from BC Data Catalogue. The other civic

boundary layers were provided by the Comox Valley Regional District (CVRD).

4. Land parcel and building footprint data were obtained from CVRD.
5. Culture layers were obtained from BC Data Catalogue, BC Assessment, and the Archaeology Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.
6. Critical infrastructure layers were downloaded from BC Data Catalogue, BC Assessment, and Integrated Cadastral Information (ICI) Society (via CVRD).
7. Base Layer: OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA) and hillshade created using CDEM and USGM GMTED2010.

References:

1. KWL (2021). Final Report – Coastal Flood Mapping Project. Prepared for the CVRD.
2. Ebbwater Consulting Inc. and Shift Collaborative (2022). Coastal Flood Adaptation Strategy Phase 2: Flood Risk and Options Assessments. Prepared for the Comox Valley Regional District.

ebbwater

CONSULTING

Comox Valley

REGIONAL DISTRICT

Scale

1:60,000

0

2

4

6

8 km

Legend

CVRD Electoral Areas

Focus Area Jurisdictional Boundary

Areas not Included in Project Scope

First Nation Reserve Lands

Buildings

Streams

BC Major and Secondary Roads

Flood Extents

Short-term planning range - 0.0 m SLR, 10% AEP

Mid-term planning range - 0.5 m SLR, 0.5% AEP

Long-term planning range - 1.0 m SLR, 0.5% AEP

Date:

17 Dec 2021

Produced by:

Ebbwater Consulting Inc.

Comox Valley Regional District

Coastal Flood Adaptation Strategy Phase 2

Flood Hazard Areas with Climate Change

ANSI D - Map No. 1

Map Notes:

1. The map includes coastal flood hazard extents sourced from a different study (KWL, 2021). Ebbwater Consulting Inc. does not assume any liability for the accuracy of the flood areas on this map.
2. The map is intended to support an understanding of risk and prioritisation of studies and mitigative actions. This map should not be relied upon for engineering design or regulatory controls.

Data Sources:

1. Lakes, Watercourses, and Roads: BC Data Catalogue.
2. Flood Hazard extents were received on 28 April 2021 from KWL.
3. First Nation Reserve Lands (also known as Indian Reserve Lands) layer was downloaded from BC Data Catalogue. The other civic boundary layers were provided by the Comox Valley Regional District (CVRD).
4. Building footprint data were obtained from CVRD.
5. Base Layer: OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA) and hillshade created using CDEM and USGM GMTED2010.

References:

1. KWL (2021). Final Report – Coastal Flood Mapping Project. Prepared for the CVRD.

Scale
1:90,000
0 2 4 6 8 km

Legend

Background

- CVRD Electoral Areas
- Focus Area
- Jurisdictional Boundary
- Areas not Included in Project Scope
- First Nation Reserve Lands
- Buildings
- Streams
- BC Major and Secondary Roads

Exposure

- Affected People

Flood Extent Planning Ranges

- Short-term
- Mid-term
- Long-term

Date: 25 Jan 2022
Produced by: Ebbwater Consulting Inc.

Comox Valley Regional District Coastal Flood Adaptation Strategy Phase 2 Risk Map - Affected People

ANSI D - Map No. 2

Map Notes:

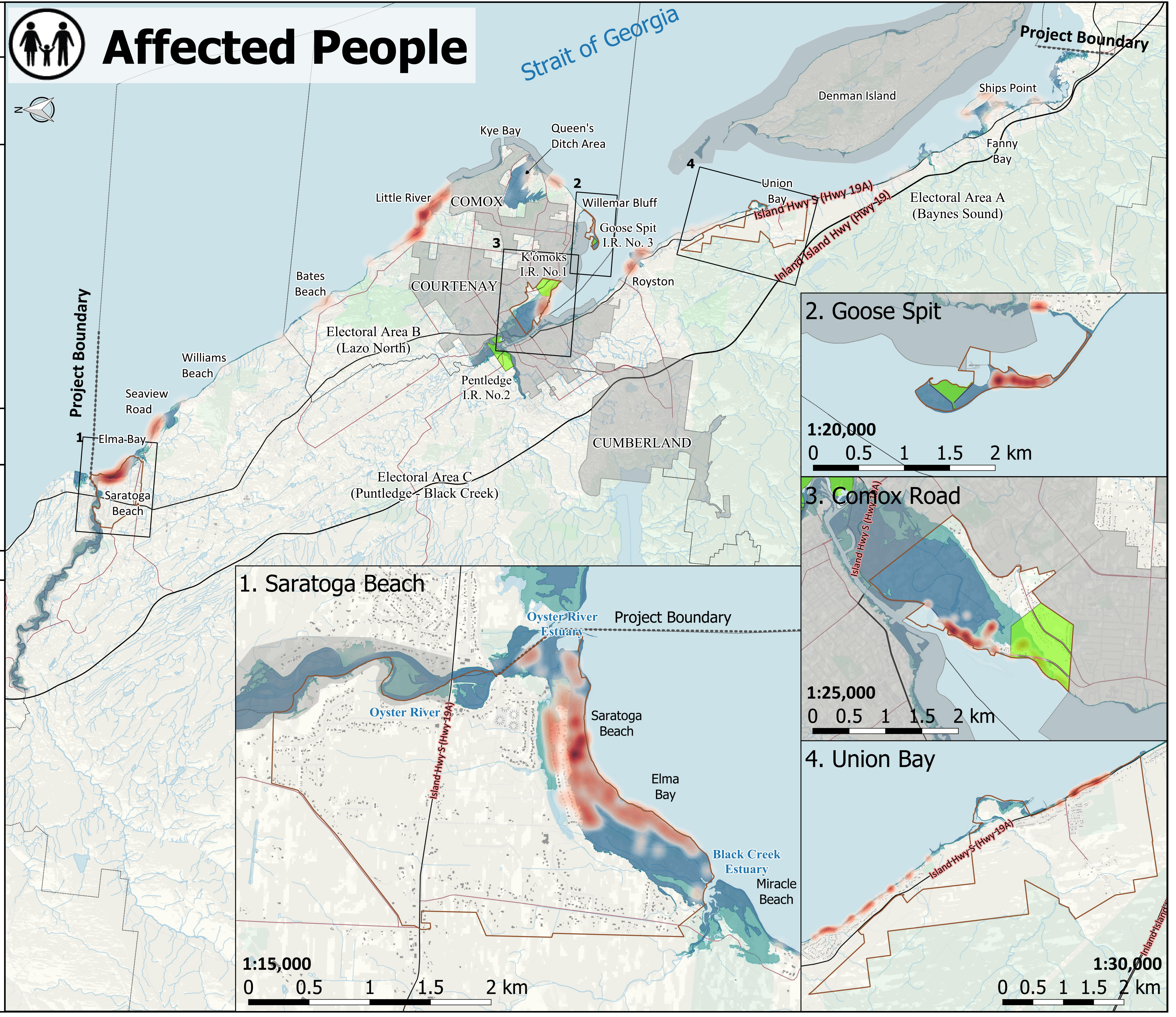
1. The map includes coastal flood hazard extents sourced from a different study (KWL, 2021). Ebbwater Consulting Inc. does not assume any liability for the accuracy of the flood on this map.
2. Refer to the main report (Ebbwater Consulting Inc. and Shift Collaborative, 2022) and appendices for details on methods and limitations.
3. The number of potentially affected people shown on this map is estimated based on the long-term planning range flood extent.
4. The map is intended to support an understanding of risk and prioritisation of studies and mitigative actions. This map should not be relied upon for engineering design or regulatory controls.

Data Sources:

1. Lakes, Watercourses, and Roads: BC Data Catalogue.
2. Flood hazard extents were received on 28 April 2021 from KWL.
3. First Nation Reserve Lands (also known as Indian Reserve Lands) layer was downloaded from BC Data Catalogue. The other civic boundary layers were provided by the Comox Valley Regional District (CVRD).
4. Building footprint data were obtained from CVRD.
5. Base Layer: OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA) and hillshade created using CDEM and USGM GMTED2010.

References:

1. KWL (2021). Final Report – Coastal Flood Mapping Project. Prepared for the CVRD.
2. Ebbwater Consulting Inc. and Shift Collaborative (2022). Coastal Flood Adaptation Strategy Phase 2: Flood Risk and Options Assessments. Prepared for the Comox Valley Regional District.



Scale
1:90,000
0 2 4 6 8 km

Legend

Background	Building Values in \$ (000)
CVRD Electoral Areas	<40
Focus Area	40-100
Jurisdictional Boundary	100-200
Areas not Included in Project Scope	200-1000
First Nation Reserve Lands	1000-10000
Buildings	Flood Extent Planning Ranges
Streams	Short-term
BC Major and Secondary Roads	Mid-term
	Long-term

Date: 25 Jan 2022
Produced by: Ebbwater Consulting Inc.

Comox Valley Regional District Coastal Flood Adaptation Strategy Phase 2 Risk Map - Economy

ANSI D - Map No. 3

Map Notes:

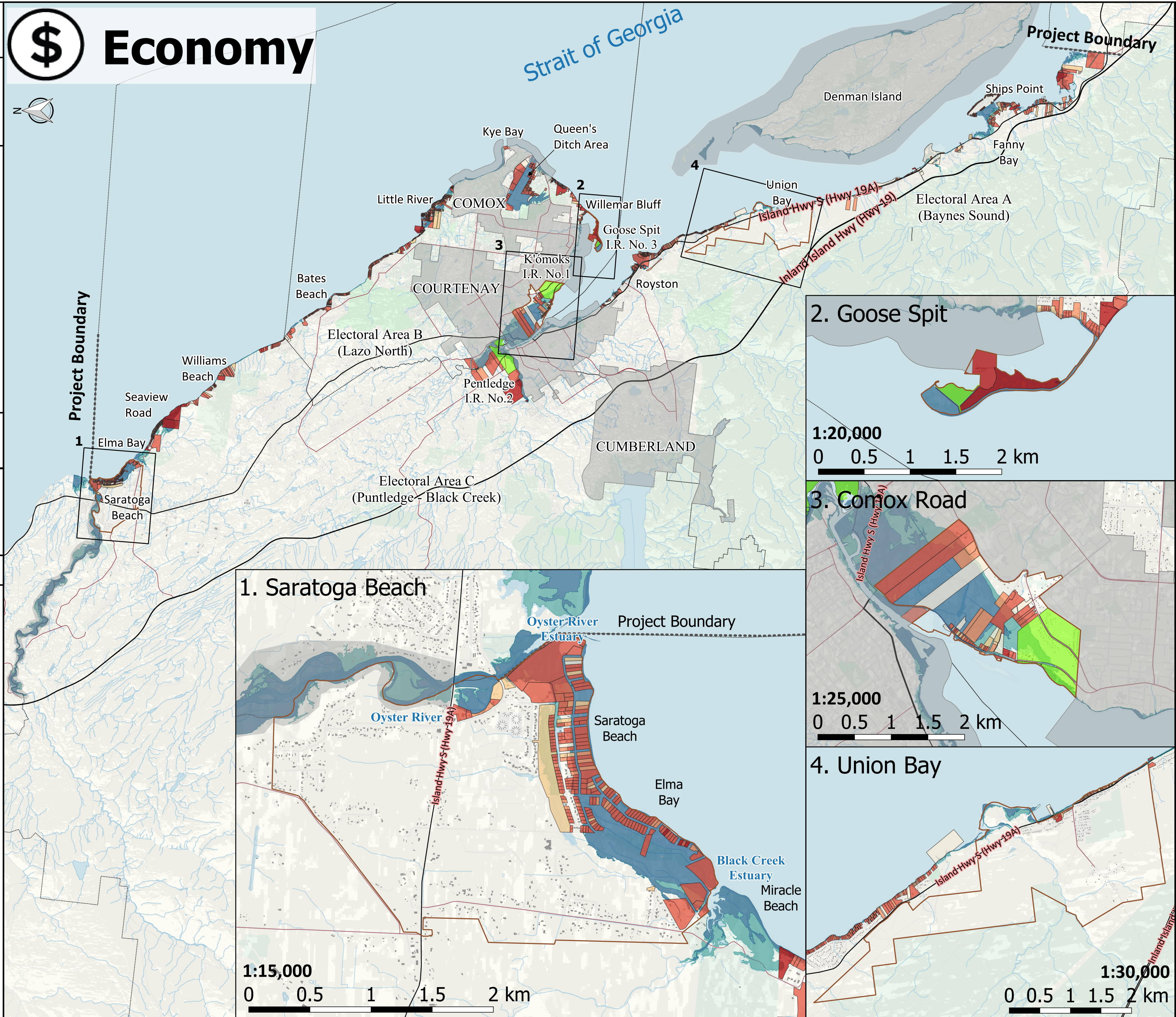
1. The map includes coastal flood hazard extents sourced from a different study (KWL, 2021). Ebbwater Consulting Inc. does not assume any liability for the accuracy of the flood on this map.
2. Refer to the main report (Ebbwater Consulting Inc. and Shift Collaborative, 2022) and appendices for details on methods and limitations.
3. The values of the potentially affected buildings shown on this map is estimated based on the long-term planning range flood extent.
4. The map is intended to support an understanding of risk and prioritisation of studies and mitigative actions. This map should not be relied upon for engineering design or regulatory controls.

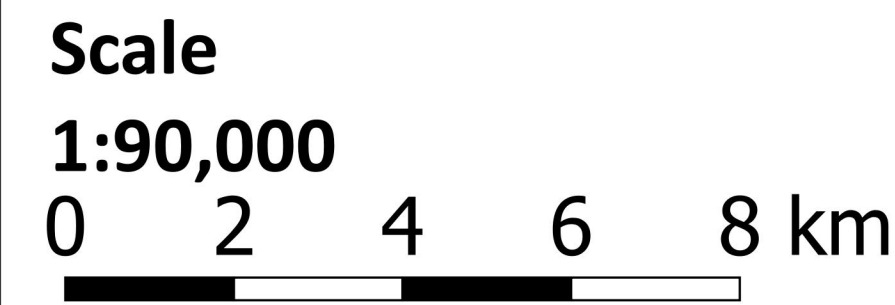
Data Sources:

1. Lakes, Watercourses, and Roads: BC Data Catalogue.
2. Flood Hazard extents were received on 28 April 2021 from KWL.
3. First Nation Reserve Lands (also known as Indian Reserve Lands) layer was downloaded from BC Data Catalogue. The other civic boundary layers were provided by the Comox Valley Regional District (CVRD).
4. Land parcel and building footprint data were obtained from CVRD.
5. Base Layer: OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA) and hillshade created using CDEM and USGM GMTED2010.

References:

1. KWL (2021). Final Report – Coastal Flood Mapping Project. Prepared for the CVRD.
2. Ebbwater Consulting Inc. and Shift Collaborative (2022). Coastal Flood Adaptation Strategy Phase 2: Flood Risk and Options Assessments. Prepared for the Comox Valley Regional District.





Legend

Background	Exposure
CVRD Electoral Areas	Contamination Sources
Focus Area	Conservation Lands
Jurisdictional Boundary	EcoReserves
Areas not Included in Project Scope	Green Space
First Nation Reserve Lands	Species at Risk
Buildings	Flood Extent Planning Ranges
Streams	Short-term
BC Major and Secondary Roads	Mid-term
	Long-term

Date: 25 Jan 2022

Produced by: Ebbwater Consulting Inc.

Comox Valley Regional District

Coastal Flood Adaptation Strategy Phase 2

Risk Map - Environment

ANSI D - Map No. 4

Map Notes:

1. The map includes coastal flood hazard extents sourced from a different study (KWL, 2021). Ebbwater Consulting Inc. does not assume any liability for the accuracy of the flood on this map.

2. Refer to the main report (Ebbwater Consulting Inc. and Shift Collaborative, 2022) and appendices for details on methods and limitations.

3. The potential contamination sources and environmentally sensitive areas shown are based on the long-term planning range flood extent.

4. The map is intended to support an understanding of risk and prioritisation of studies and mitigative actions. This map should not be relied upon for engineering design or regulatory controls.

Data Sources:

1. Lakes, Watercourses, and Roads: BC Data Catalogue.

2. Flood hazard extents were received on 28 April 2021 from KWL.

3. First Nation Reserve Lands (also known as Indian Reserve Lands) layer was downloaded from BC Data Catalogue. The other civic boundary layers were provided by the Comox Valley Regional District (CVRD).

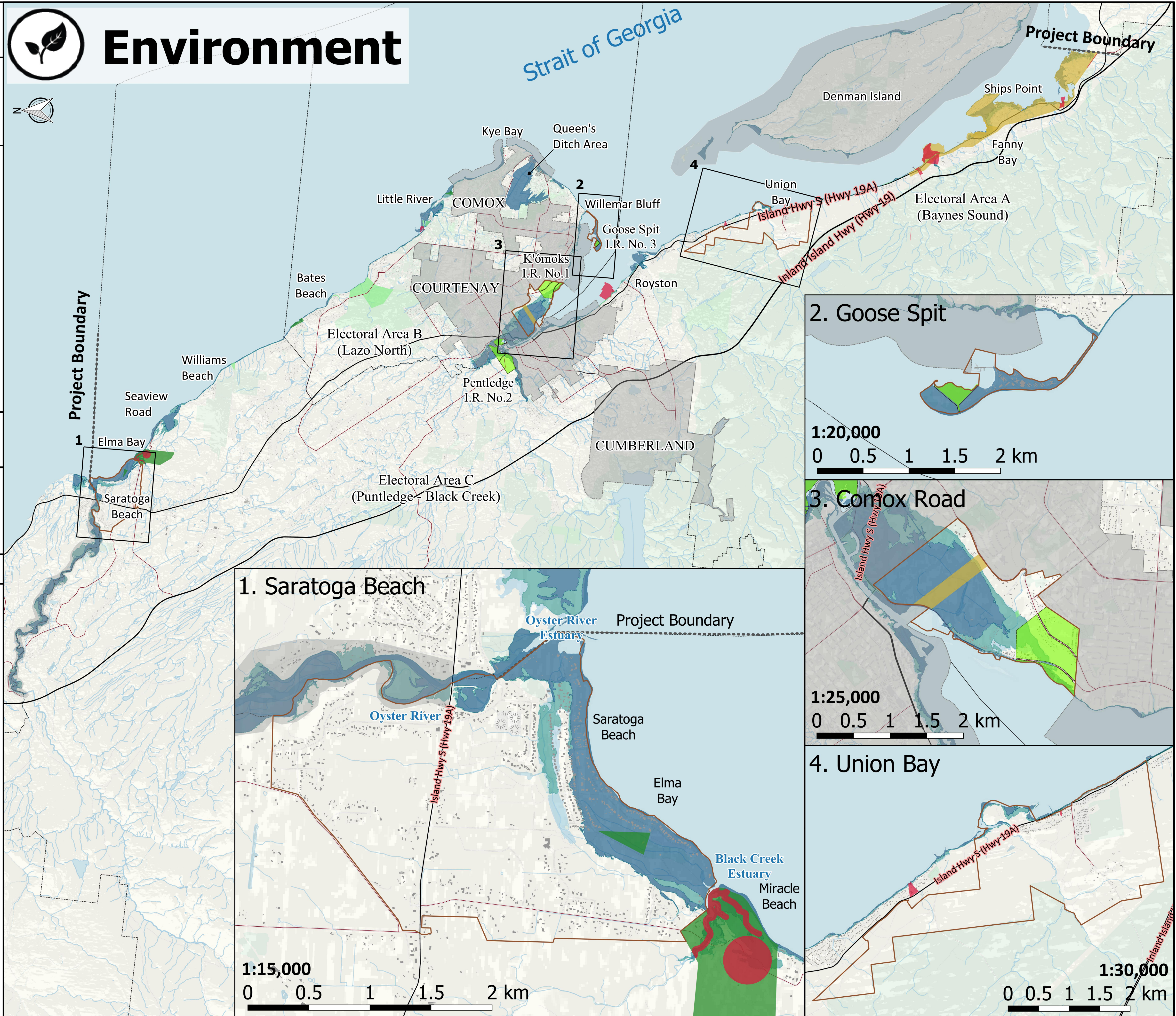
4. Environment layers were obtained from BC Assessment and BC Data Catalogue.

5. Base Layer: OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA) and hillshade created using CDEM and USGM GMTED2010.

References:

1. KWL (2021). Final Report – Coastal Flood Mapping Project. Prepared for the CVRD.

2. Ebbwater Consulting Inc. and Shift Collaborative (2022). Coastal Flood Adaptation Strategy Phase 2: Flood Risk and Options Assessments. Prepared for the Comox Valley Regional District.



Scale
1:90,000
0 2 4 6 8 km

Legend

Background

-  CVRD Electoral Areas
-  Focus Area
-  Jurisdictional Boundary
-  Areas not Included in Project Scope
-  First Nation Reserve Lands
-  Buildings
-  Streams
-  BC Major and Secondary Roads

Exposure

-  Cultural Sites from BC Assessment Data
 Archaeological and Heritage Sites

Flood Extent Planning Ranges

- Short-term
- Mid-term
- Long-term

Date: 25 Jan 2022
Produced by: Ebbwater Consulting Inc.

Comox Valley Regional District Coastal Flood Adaptation Strategy Phase 2 Risk Map - Culture

ANSI D - Map No. 5

Map Notes:

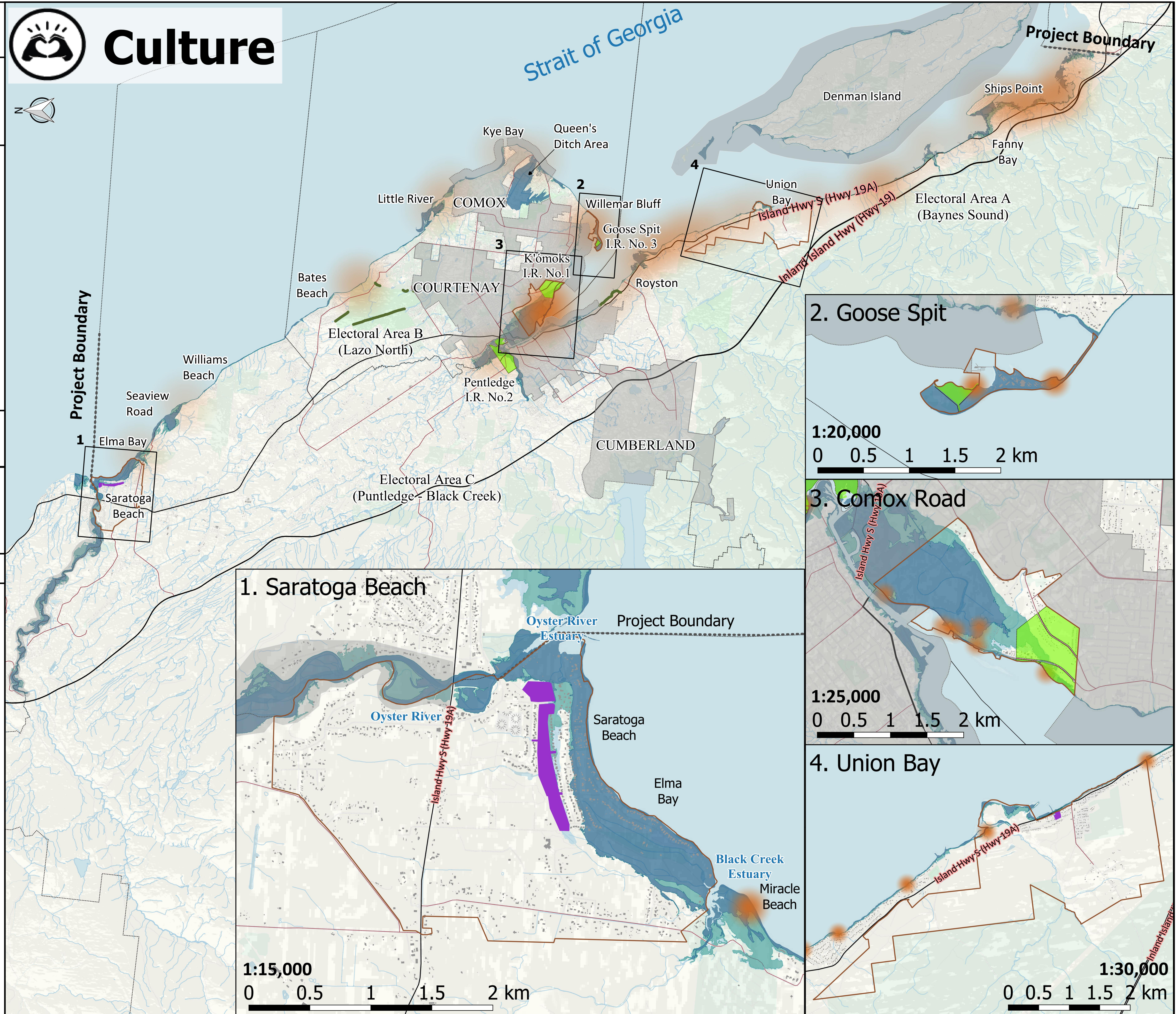
1. The map includes coastal flood hazard extents sourced from a different study (KWL, 2021). Ebbwater Consulting Inc. does not assume any liability for the accuracy of the flood on this map.
2. Refer to the main report (Ebbwater Consulting Inc. and Shift Collaborative, 2022) and appendices for details on methods and limitations.
3. The potentially exposed sites shown are based on the long-term planning range flood extent.
4. The map is intended to support an understanding of risk and prioritisation of studies and mitigative actions. This map should not be relied upon for engineering design or regulatory controls.

Data Sources:

1. Lakes, Watercourses, and Roads: BC Data Catalogue.
2. Flood hazard extents were received on 28 April 2021 from KWL.
3. First Nation Reserve Lands (also known as Indian Reserve Lands) layer was downloaded from BC Data Catalogue. The other civic boundary layers were provided by the Comox Valley Regional District (CVRD).
4. Culture layers were obtained from BC Data Catalogue, BC Assessment, and the Archaeology Branch of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.
5. Base Layer: OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA) and hillshade created using CDEM and USGM GMTED2010.

References:

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2. Ebbwater Consulting Inc. and Shift Collaborative (2022). Coastal Flood Adaptation Strategy Phase 2: Flood Risk and Options Assessments. Prepared for the Comox Valley Regional District.



Scale
1:90,000
0 2 4 6 8 km

Legend

- Background**

 - CVRD Electoral Areas
 - Focus Area
 - Jurisdictional Boundary
 - Areas not Included in Project Scope
 - First Nation Reserve Lands
 - Buildings
 - Streams
 - BC Major and Secondary Roads
- Exposure**

 - Critical Infrastructure Facilities
 - Telcommunication Facilities
 - Energy Distribution
 - Impacted Primary Roads
 - Railways

Flood Extent Planning Ranges

 - Short-term
 - Mid-term
 - Long-term

Date: 25 Jan 2022
Produced by: Ebbwater Consulting Inc.

Comox Valley Regional District
Coastal Flood Adaptation Strategy Phase 2
Risk Map - Critical Infrastructure

ANSI D - Map No. 6

Map Notes:

1. The map includes coastal flood hazard extents sourced from a different study (KWL, 2021). Ebbwater Consulting Inc. does not assume any liability for the accuracy of the flood on this map.
2. Refer to the main report (Ebbwater Consulting Inc. and Shift Collaborative, 2022) and appendices for details on methods and limitations.
3. The potentially exposed critical infrastructure shown is based on the long-term planning range flood extent.
4. The map is intended to support an understanding of risk and prioritisation of studies and mitigative actions. This map should not be relied upon for engineering design or regulatory controls.

Data Sources:

1. Lakes, Watercourses, and Roads: BC Data Catalogue.
2. Flood hazard extents were received on 28 April 2021 from KWL.
3. First Nation Reserve Lands (also known as Indian Reserve Lands) layer was downloaded from BC Data Catalogue. The other civic boundary layers were provided by the Comox Valley Regional District (CVRD).
4. Critical infrastructure layers were downloaded from BC Data Catalogue, BC Assessment, and Integrated Cadastral Information (ICI) Society (via CVRD).
5. Base Layer: OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA) and hillshade created using CDEM and USGM GMTED2010.

References:

1. KWL (2021). Final Report – Coastal Flood Mapping Project. Prepared for the CVRD.
2. Ebbwater Consulting Inc. and Shift Collaborative (2022). Coastal Flood Adaptation Strategy Phase 2: Flood Risk and Options Assessments. Prepared for the Comox Valley Regional District.

