

Notes to User

1. Study Area
- The study area includes selected shorelines within the City of Nanaimo. The associated report should be read and understood prior to use of the maps:
Northwest Hydraulic Consultants Ltd. (2026). City of Nanaimo's Sea Level Rise Management Plan. Technical Report
2. Vertical Datum
- All elevations are in metres referenced to the Canadian Geodetic Vertical Datum of 2013 (CGVD2013), consistent with provincial LiDAR datasets. Previous floodplain mapping completed for the City of Nanaimo in 2018 also used CGVD2013. Some City datasets and records reference elevations in CGVD1928. Where comparison between datums is required, elevations in CGVD2013 should be converted to CGVD1928 by subtracting 0.16 for the study area.
3. Design Flood Event
- The design event used in the Flood Construction Level (FCL) maps represent the combined effect of a 0.5% AEP (1-in-200-year) joint tide, storm surge, and wave run-up ($R_2\%$) with sea level rise.
4. FCL Mapping
- Floodplain maps present the FCL and delineated FCL extents under the design flood conditions.
- a. FCLs were calculated as the sum of the design still water level, 1.0 m sea level rise, wave run-up ($R_2\%$), and the applicable freeboard allowance.

b. The freeboard allowance accounts for uncertainty and localized variation in water level, including shoreline conditions and data accuracy. A 0.6 m freeboard was applied in all mapped areas.

c. A Joint probability analysis combing waves and water levels was used to determine the critical wave conditions for each study area. Potential critical conditions were first screened using offshore spectral wave model results and empirical wave run-up equations to identify combinations producing the largest total water level, defined as the design still water level plus wave effects. These conditions were then simulated using the nearshore XBeach model to refine wave run-up estimates for FCL mapping. In a few cases, the combined wave run-up and joint probability water level resulted in a lower elevation than the design still water level without wave effects. Where this occurred, the design still water level was applied as the controlling elevation to avoid underestimation of flood levels.

d. Wave run-up heights were calculated using simulated wind-generated waves, with $R_2\%$ defined as the elevation exceeded by 2% of waves, equivalent to one in fifty waves. These estimates account for shoreline slope, profile, roughness, and incident wave conditions.

e. The wave-effect zone was delineated by extending wave run-up inland from the design still water level plus freeboard contour until it intersected with the ground surface. Within this zone, FCLs reflect the combined effect of design still water level, sea level rise, wave run-up, and freeboard. Outside this zone, FCLs are based on still water level plus sea level rise and freeboard only, with no wave effects included.

f. Where a property or development site lies between two adjacent FCL isolines, the higher of the two values should be applied.

g. How to read the maps:
 - The light blue line shows the design still water level plus freeboard, excluding wave effects.
 - The dark purple line shows the wave runoff zone.
 - Numbers along isolines indicate the recommended FCL elevation at that location.
 - Coloured shading represents wave run-up height categories for $R_2\%$, defined as less than 1 m, 1 to 2 m, 2 to 3 m, and greater than 3 m.

h. A site-specific wave run-up assessment by a Qualified Professional may be warranted where:
 - mapped results show a wide range in run-up values,
 - shoreline conditions are highly dynamic or differ substantially within the generalized segment or from adjacent areas, including slope, depth, or roughness,
 - the project involves high-consequence infrastructure or multi-lot development
5. Limitations of Mapping
- The FCL and wave effects mapping results are based on BC floodplain mapping guideline design scenarios. Flood events more extreme than the design event are possible but are expected to occur less frequently. Design values are based on historic water level conditions, present shoreline conditions, and projected sea level rise, using a combination of metocean analysis and numerical wave and wave run-up modelling. While this and similar approaches are commonly used to characterize future hazards, actual future conditions may differ from those represented. Additional hazards from other sources may exist, and local conditions may change over time. The analysis assumes present-day shoreline conditions and does not account for future erosion, sediment transport processes, or construction of coastal protection works. Localized stormwater, tributary flooding, or groundwater conditions may influence flood extents.
6. Accuracy
- The accuracy of simulated flood levels is limited by the reliability of historic tide and surge records, wind data, wave data, and available elevation data. In some locations, localized topographic or hydraulic features may be generalized in the floodplain mapping. The map should therefore be considered an administrative planning tool that illustrates expected flood elevations and floodplain boundaries for the design event, rather than a definitive representation of any specific future flood. A Qualified Professional should be consulted for site-specific hazard assessment and mitigation, particularly for high-consequence developments such as subdivisions or critical infrastructure.
7. Residual Risk
- Industry standard methods and best practices were applied in the preparation of the floodplain maps. However, actual flood levels and extents may differ from those shown. Residual flood risk exists beyond the mapped limits, particularly during events more extreme than the design event. Northwest Hydraulic Consultants Ltd. and City of Nanaimo do not assume liability for variations in flood levels or extents relative to those depicted on the maps.
8. Coastal Flooding Diagram
- The diagram shown on the index map provides a simplified explanation of the drivers of coastal flooding. In addition to reviewing the diagram, map users should refer to and understand these map notes prior to using the maps.
9. Future Design Water Level Extent
- The design flood inundation extent (or future design water level extent), at 3.97 m elevation, is the combined 0.5% AEP (1-in-200-year) joint tide, storm surge and sea level rise elevation. It excludes waves and freeboard.
10. Protection Island Specific Map Notes
- For map notes specific to Protection Island, refer to map sheet two.

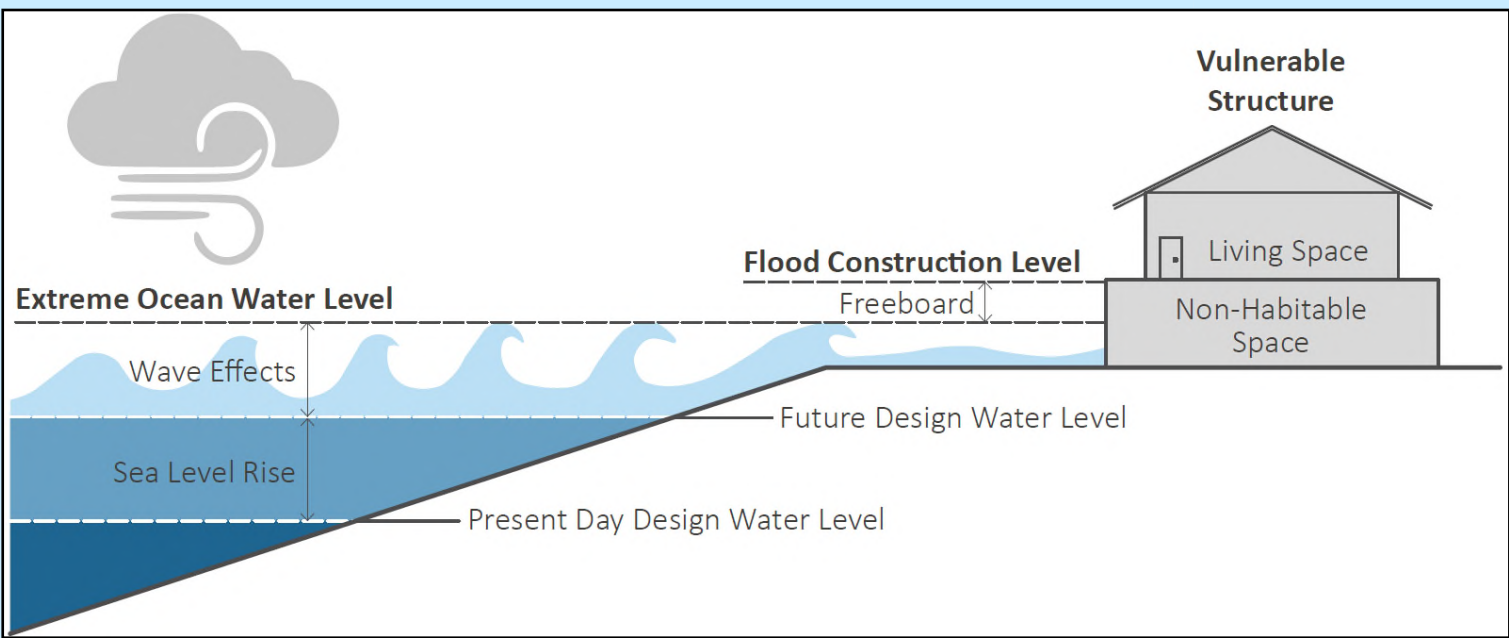
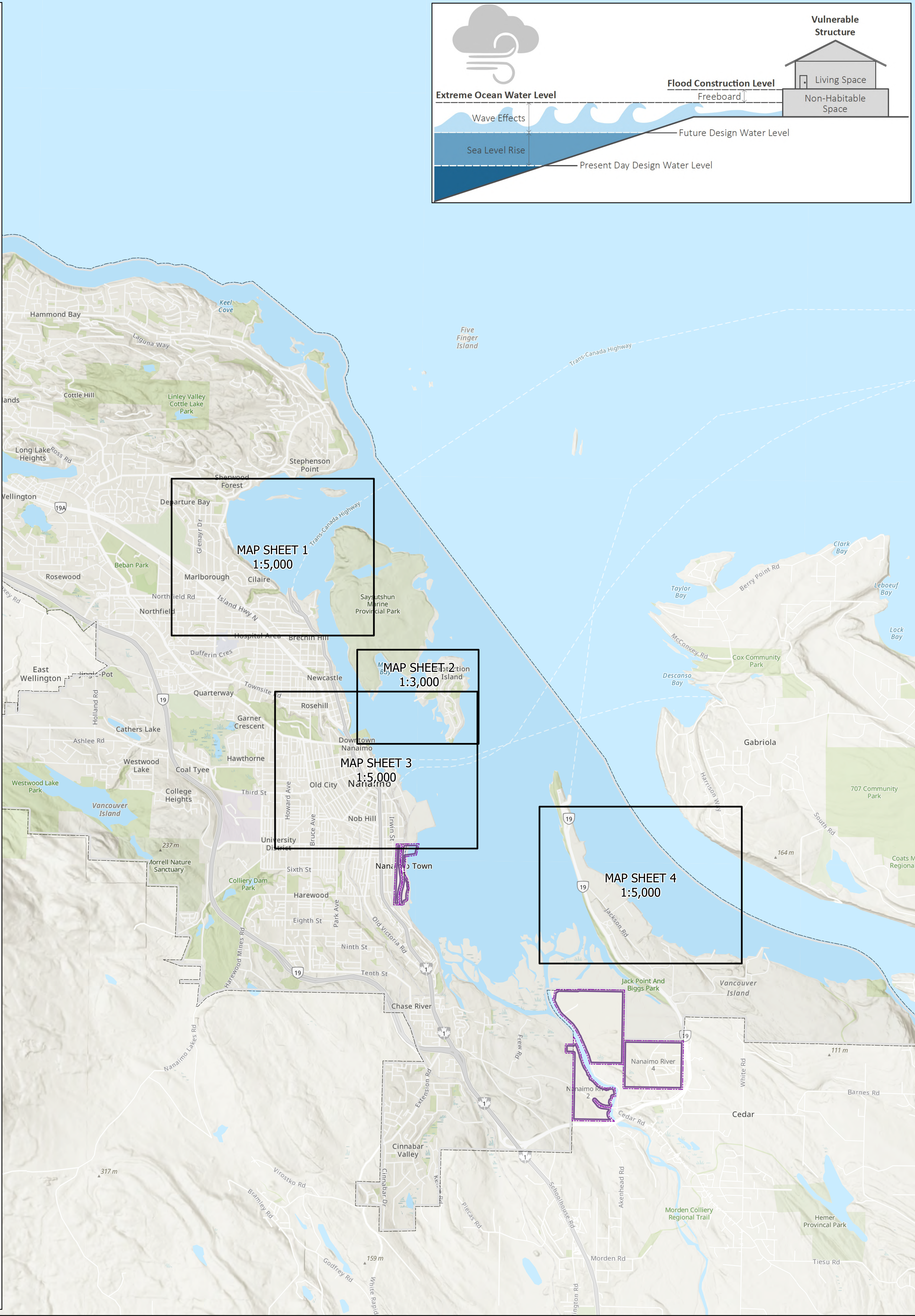
Data Sources

1. Design still water levels are based on and Extreme Value Analysis of Canadian Hydrographic Service tide gauge records, primarily Point Atkinson (CHS ID 7795), with local adjustments derived from Nanaimo Harbour (CHS ID 7917). Joint probability analysis of tide and storm surge was used to estimate 0.5% AEP (1-in-200-year) design still water levels.
2. Joint Probability of water levels and winds, using Entrance Island (Climate ID 1022689), was used to model nearshore wave climate with spectral wave model SWAN.
3. The digital elevation model (DEM) used for mapping was developed from the following datasets to produce a continuous bare-earth surface referenced to CGVD2013:
 - 2019 Provincial LiDAR from GeoBC.
 - Canadian Hydrographic Service NONNA10 bathymetry.
4. Orthophoto Imagery
- Orthophotos were obtained from City of Nanaimo (2024) and were used to provide contextual reference for shoreline features and land use.
5. GIS Data
- Parcel boundaries, road networks, streams, and lakes were compiled from municipal provincial and federal open data sources, including the City of Nanaimo, BC Data Catalogue, Natural Resources Canada.

Disclaimer

This coastal flood hazard mapping has been prepared by **Northwest Hydraulic Consultants Ltd.** for the **City of Nanaimo**. The information and data contained herein represent Northwest Hydraulic Consultants Ltd.'s professional judgment in light of the knowledge and information available at the time of preparation. The work was carried out in accordance with generally accepted engineering and geoscience practices and applicable professional guidelines.

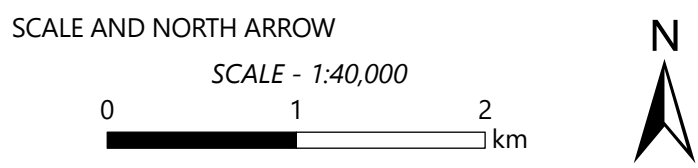
The mapping products are intended to inform land use planning, floodplain management, emergency preparedness, and climate adaptation in the **City of Nanaimo**. They should be interpreted as planning-level information. A Qualified Professional should be consulted to confirm local conditions and undertake site-specific hazard assessment prior to development.



- MAP SHEET
- FIRST NATIONS ADMINISTRATIVE AREA
- CITY OF NANAIMO

DATA SOURCES
Basemaps from Esri. Reference data from GeoBC

ENGINEER VCCM	GIS BLH	REVIEWER PDO
NHC PROJECT No. 3010048		DATE 26-AUG-2026
COORD SYS. AND DATUM HORIZ: NAD 1983 CSRS UTM ZONE 10N VERT: CGVD2013 UNITS: METRES		



CITY OF NANAIMO
SEA LEVEL RISE MANAGEMENT PLAN

FLOOD CONSTRUCTION LEVEL
INDEX MAP

1. Study Area

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Northwest Hydraulic Consultants Ltd. (2026). City of Nanaimo's Sea Level Rise Management Plan. Technical Report

All elevations are in metres referenced to the Canadian Geodetic Vertical Datum of 2013 (CGVD2013), consistent with provincial LiDAR datasets. Previous floodplain mapping completed for the City of Nanaimo in 2018 also used CGVD2013. Some City datasets and records reference elevations in CGVD1928. Where comparison between datums is required, elevations in CGVD2013 should be converted to CGVD1928 by subtracting 0.16 for the study area.

The design event used in the Flood Construction Level (FCL) maps represent the combined effect of a 0.5% AEP (1-in-200-year) joint tide, storm surge, and wave run-up ($R_2\%$) with sea level rise..

Floodplain maps present the FCL and delineated FCL extents under the design flood.

- a. FCLs were calculated as the sum of the design still water level, 1.0 m sea level rise, wave run-up, and the applicable freeboard allowance.
- b. The freeboard allowance accounts for uncertainty and localized variation in water level, including shoreline conditions and data accuracy. A default freeboard of 0.6 m was applied in all areas. In wave exposed areas where calculated wave run-up exceeded 0.3 m, freeboard was reduced to as low as 0.3 m to avoid double counting uncertainty already inherent in the empirical run-up methods, while maintaining a minimum combined allowance of wave run-up plus freeboard of 0.6 m.
- c. Wave run-up heights were estimated at shoreline transects using empirical methods. The empirical calculations use nearshore wave conditions derived from spectral wave model together with local foreshore slope, roughness, and water depth during the design event. Wave run-up is defined by $R_{2\%}$, the elevation exceeded by 2% of waves, equivalent to one in fifty.
- d. The wave effect zone was delineated by extending wave run-up inland from the design still water level plus freeboard contour until it intersected with the ground surface, to a maximum inland extent of 30 m. Within this zone, FCLs reflect the combined effects of design still water level, sea level rise, wave run-up, and freeboard. Outside this zone, FCLs are based on still water level plus sea level rise and freeboard only, with no wave effects included.
- e. Where a property or development site lies between two adjacent FCL isolines, the higher of the two values should be applied.
- f. How to read the maps:
 - The light blue line shows the design still water level plus freeboard, excluding wave effects.
 - The dark purple line shows the wave runoff zone.
 - Numbers along isolines indicate the recommended FCL elevation at that location.
 - Coloured shading represents wave run-up height categories for $R_{2\%}$, defined as less than 1 m, 1 to 2 m, 2 to 3 m, and greater than 3 m.

5. Limitations of Mapping

The FCL and wave effects mapping results are based on guideline design scenarios. Flood events more extreme than the design event are possible but are less frequent and less likely. Design values are based on historic water level conditions, present shoreline conditions, and projected sea level rise using a combination of meteorological analysis, numerical wave modelling, and empirical run-up equations. While these approaches are commonly used to characterize future hazards, actual future conditions may differ from those represented. Additional hazards from other sources may exist, and local characteristics may change over time. The analysis assumes present day shoreline conditions and does not account for future shoreline erosion, sediment transport processes, or the construction of coastal protection works. Localized stormwater, tributary flooding, or groundwater effects may also influence flood extents.

The accuracy of simulated flood levels is limited by the reliability of historic tide and storm surge records, wind data, empirical run-up equations, and available elevation data. In some locations, localized topographic or hydrologic features may be generalized in the floodplain mapping. The maps should therefore be considered an administrative planning tool that illustrates expected flood elevations and floodplain boundaries for the design event, rather than a definitive representation of any specific future flood. A Qualified Professional should be consulted for site-specific hazard assessment and mitigation, particularly for high-consequence developments such as subdivisions or critical infrastructure.

Industry standard methods and best practices were applied in the preparation of the floodplain maps. However, actual flood levels and extents may differ from those shown. Residual flood risk exists beyond the mapped limits, particularly during events more extreme than the design event. Northwest Hydraulic Consultants Ltd. and the City of Nanaimo do not assume any liability for variations in flood levels or extents relative to those depicted on the maps.

The diagram shown on the index map provides a simplified explanation of the drivers of coastal flooding. In addition to reviewing the diagram, map users should refer to and understand these map notes prior to using the maps.

The design flood inundation extent (or future design water level extent), at 3.97 m elevation, is the combined 0.5% AEP (1-in-200-year) joint tide, storm surge and sea level rise elevation. It excludes waves and freeboard.

For map notes specific to Downtown, Departure Bay and Duke Point, please see index map sheet.

Refer to index map for the project mapping disclaimer.

1. Design still water levels are based on and extreme value analysis of Canadian Hydrographic Service tide gauge records, primarily Point Atkinson (CHS ID 7957), with local adjustments derived from Nanaimo Harbour (CHS ID 7917). Joint probability analysis of tide and storm surge was used to estimate 0.5% AEP (1-in-200-year) design still water levels.

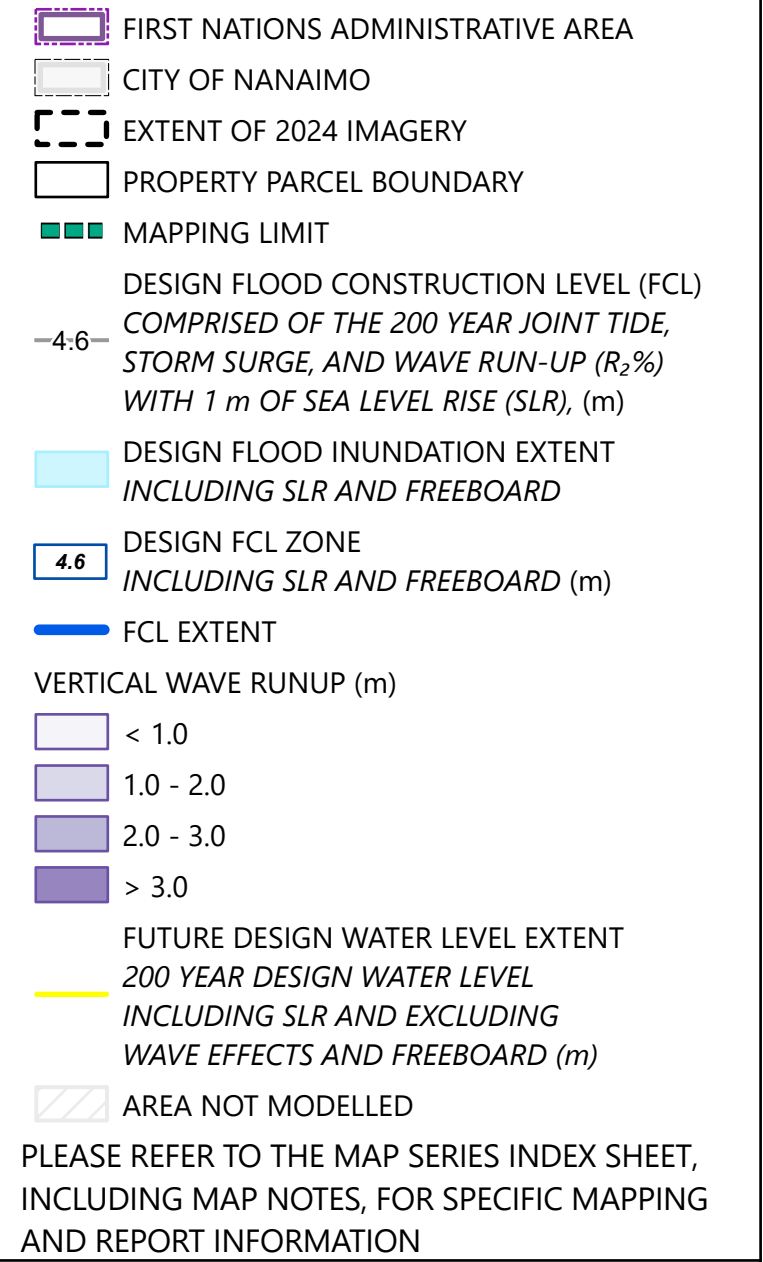
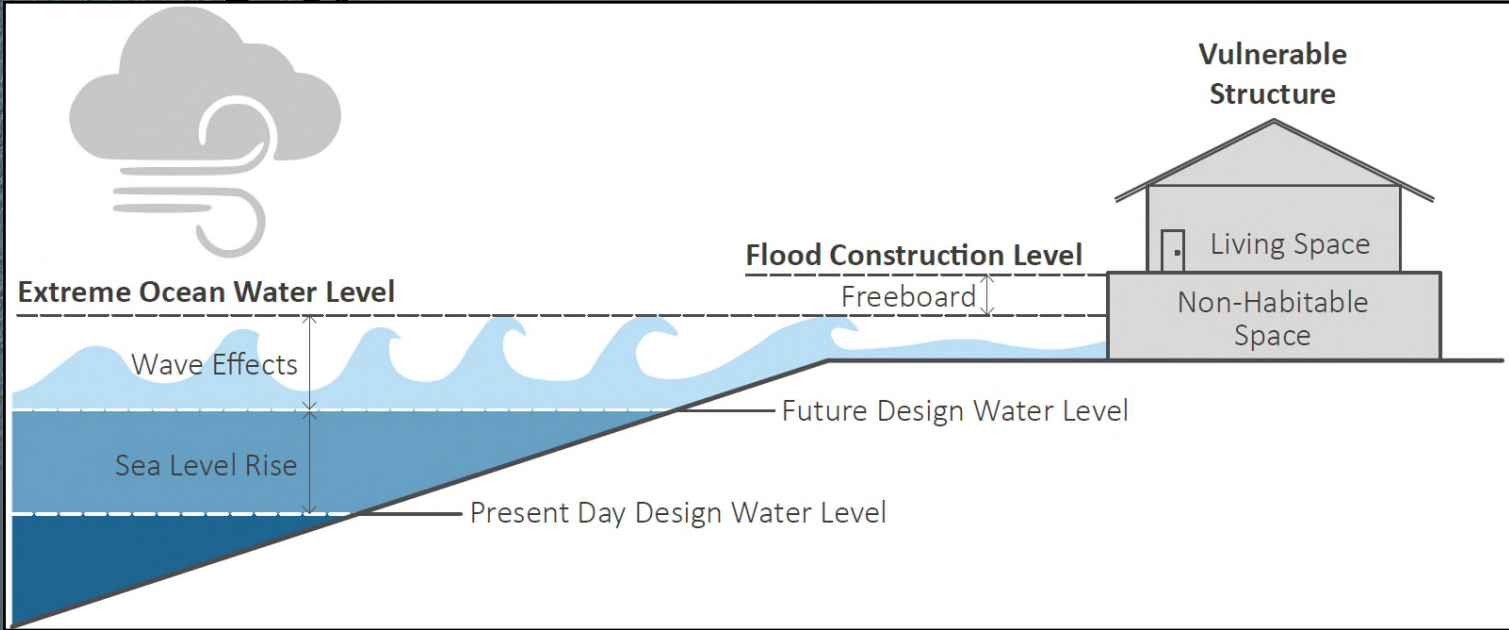
2. Joint Probability of water levels and winds, using Entrance Island (Climate ID 1022689), was used to model nearshore wave climate with spectral wave model SWAN.

3. Wave effects on shoreline FCLs are based on numerical wave modelling using SWAN and empirical wave run-up analysis. Wave run-up was estimated using $R_2\%$ exceedance values calculated with EurOtop (2018) and Stockdon et al. (2006) methods applied to cross-shore transects along the shoreline.

4. The digital elevation model (DEM) used for mapping was developed from the following datasets to produce a continuous bare-earth surface referenced to CGVD2013:
- 2019 Provincial LiDAR from GeoBC.
 - Canadian Hydrographic Service NONNA10 bathymetry.

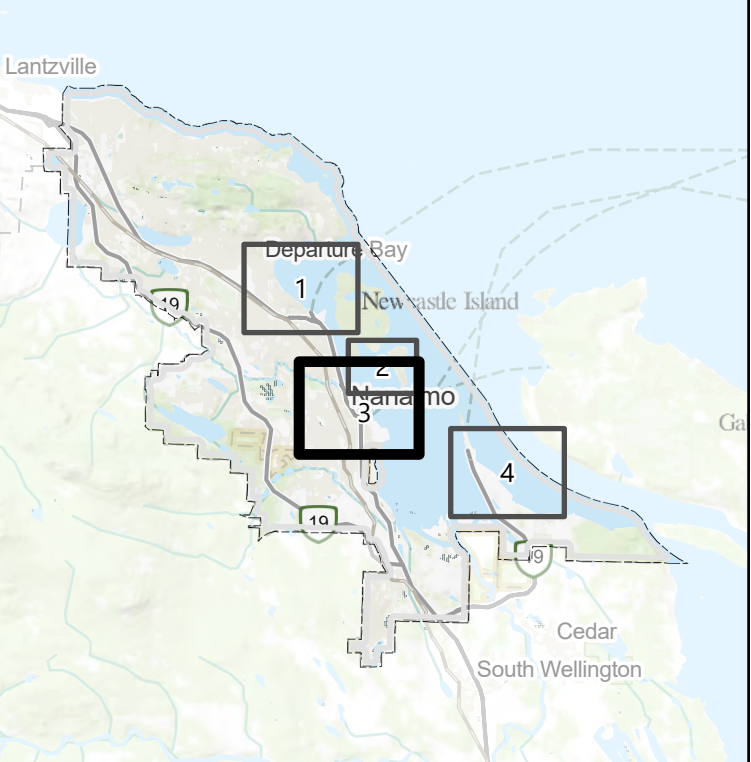
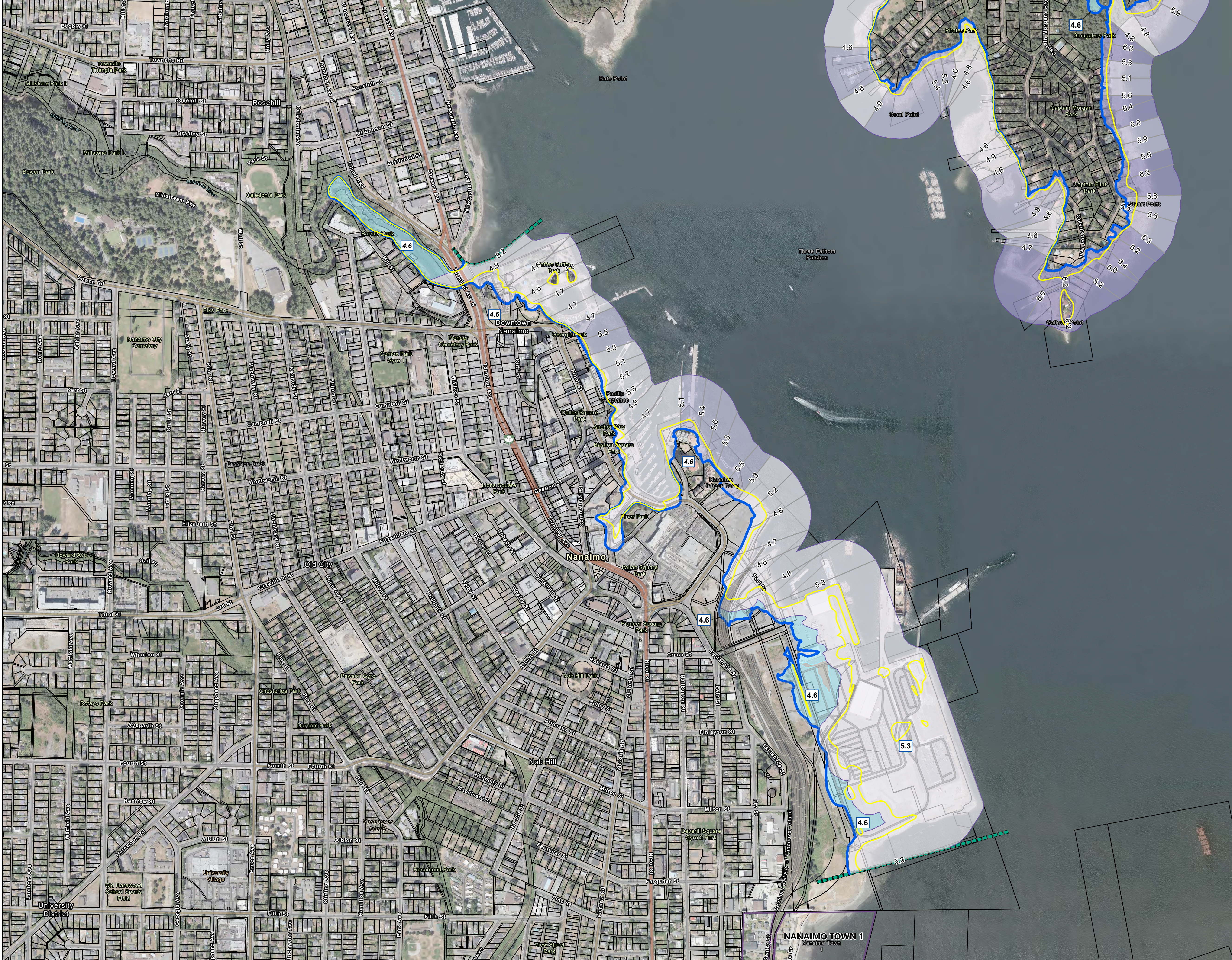
Orthophotos were obtained from City of Nanaimo (2024) and were used to provide contextual reference for shoreline features and land use.

Parcel boundaries, road networks, streams, and lakes were compiled from municipal provincial and federal open data sources, including the City of Nanaimo, BC Data Catalogue, Natural Resources Canada.



COORD SYS. AND DATUM
HORIZ: NAD 1983 CSRS UTM ZONE 10N
VERT: CGVD2013
UNITS: METRES





FIRST NATIONS ADMINISTRATIVE AREA

CITY OF NANAIMO

EXTENT OF 2024 IMAGERY

PROPERTY PARCEL BOUNDARY

MAPPING LIMIT

**DESIGN FLOOD CONSTRUCTION LEVEL (FCL)
COMPRISED OF THE 200 YEAR JOINT TIDE,
STORM SURGE, AND WAVE RUN-UP (R₂%)
WITH 1 m OF SEA LEVEL RISE (SLR), (m)**

**DESIGN FLOOD INUNDATION EXTENT
INCLUDING SLR AND FREEBOARD**

**DESIGN FCL ZONE
INCLUDING SLR AND FREEBOARD (m)**

FCL EXTENT

VERTICAL WAVE RUNUP (m)

- < 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- > 3.0

**FUTURE DESIGN WATER LEVEL EXTENT
200 YEAR DESIGN WATER LEVEL
INCLUDING SLR AND EXCLUDING
WAVE EFFECTS AND FREEBOARD (m)**

AREA NOT MODELLED

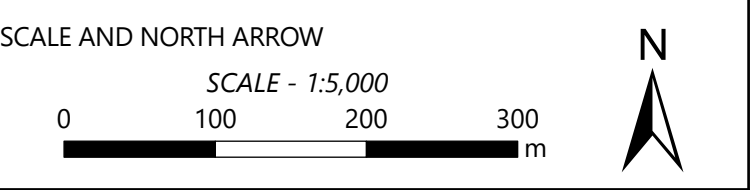
**PLEASE REFER TO THE MAP SERIES INDEX SHEET,
INCLUDING MAP NOTES, FOR SPECIFIC MAPPING
AND REPORT INFORMATION**

DATA SOURCES
2024 imagery from City of Nanaimo within data extents, and Esri elsewhere;
Basemap labels from Esri; Inset basemap from Esri; Reference data from
GeoBC

ENGINEER VCCM	GIS BLH	REVIEWER PDO
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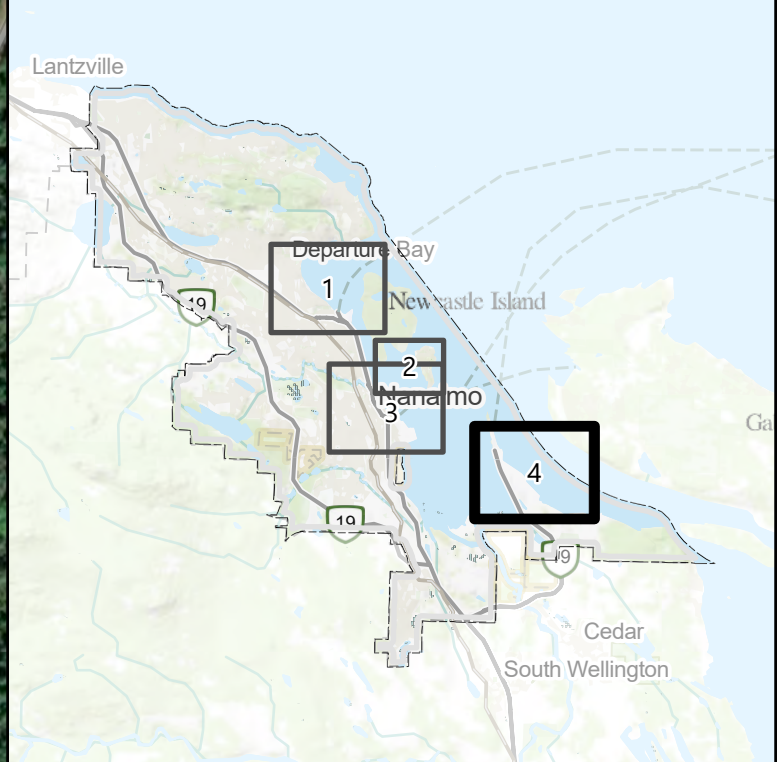
NHC PROJECT No. 3010048	DATE 26-AUG-2026
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COORD SYS. AND DATUM
HORIZ: NAD 1983 CSRS UTM ZONE 10N
VERT: CGVD2013
UNITS: METRES



**CITY OF NANAIMO
SEA LEVEL RISE MANAGEMENT PLAN**

**FLOOD CONSTRUCTION LEVEL MAP
SHEET 3 OF 4**



FIRST NATIONS ADMINISTRATIVE AREA

CITY OF NANAIMO

EXTENT OF 2024 IMAGERY

PROPERTY PARCEL BOUNDARY

MAPPING LIMIT

**DESIGN FLOOD CONSTRUCTION LEVEL (FCL)
COMPRISED OF THE 200 YEAR JOINT TIDE,
STORM SURGE, AND WAVE RUN-UP (R_s%)
WITH 1 m OF SEA LEVEL RISE (SLR), (m)**

**DESIGN FLOOD INUNDATION EXTENT
INCLUDING SLR AND FREEBOARD**

**DESIGN FCL ZONE
INCLUDING SLR AND FREEBOARD (m)**

FCL EXTENT

VERTICAL WAVE RUNUP (m)

- < 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- > 3.0

**FUTURE DESIGN WATER LEVEL EXTENT
200 YEAR DESIGN WATER LEVEL
INCLUDING SLR AND EXCLUDING
WAVE EFFECTS AND FREEBOARD (m)**

AREA NOT MODELLED

PLEASE REFER TO THE MAP SERIES INDEX SHEET,
INCLUDING MAP NOTES, FOR SPECIFIC MAPPING
AND REPORT INFORMATION

DATA SOURCES

2024 imagery from City of Nanaimo within data extents, and Esri elsewhere;
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ENGINEER VCCM	GIS BLH	REVIEWER PDO
NHC PROJECT No. 3010048		DATE 26-AUG-2026
COORD SYS. AND DATUM HORIZ: NAD 1983 CSRS UTM ZONE 10N VERT: CGVD2013 UNITS: METRES		
SCALE AND NORTH ARROW SCALE - 1:5,000 0 100 200 300 m		



**CITY OF NANAIMO
SEA LEVEL RISE MANAGEMENT PLAN**

**FLOOD CONSTRUCTION LEVEL MAP
SHEET 4 OF 4**