# PREMIUM COASTAL SCREENING ASSESSMENT

*Preliminary Environmental Data Compilation*

## Willows Beach

---

Location: 48.4334°N, -123.3038°W • British Columbia

Beach ID: UQDhpCH7i5WWWv3SEUYX

## ⚠ IMPORTANT NOTICE ⚠

**This is a PRELIMINARY SCREENING TOOL ONLY**
**NOT a professional engineering or geoscience report**
**Site-specific assessment by licensed professionals (P.Eng/P.Geo)**
**is required for development or regulatory decisions**
**See page 2 for complete limitations and disclaimer**

## Report Information

Generated: December 05, 2025 at 06:24

Type: Preliminary Coastal Screening Assessment

*Satellite Imagery: 2500px • Terrain Maps: 3000px • Coverage: 250m²*

**Nimpact Environmental Ltd.**

*Coastal Screening & Environmental Data Services*

info@nimpact.ca • My BeachBook Platform

## Report Purpose and Limitations

IMPORTANT NOTICE: LIMITATIONS OF THIS REPORT

This report is a preliminary environmental assessment and data compilation prepared by Nimpact Environmental Ltd.
It is intended as a screening tool and information resource only.

DATA SOURCES & LIMITATIONS:
• Satellite imagery analysis uses publicly available NASA/USGS Landsat and ESA Sentinel-2 data
• Shoreline Risk Proxy represents statistical variability of the waterline over time, not a direct measurement of erosion rate
• Community observations are crowd-sourced and not professionally verified
• Terrain data is derived from SRTM with ±6m vertical accuracy

THIS REPORT DOES NOT CONSTITUTE:
• Professional engineering assessment
• Geotechnical investigation
• Site-specific hazard evaluation suitable for building permit applications
• Legal opinion on development suitability or coastal setback requirements

PROFESSIONAL ASSESSMENT REQUIRED:
Any development, infrastructure planning, or regulatory decision should be supported by site-specific assessment
conducted by licensed professionals including, as appropriate:
• Professional Engineer (P.Eng) - for coastal engineering and infrastructure
• Professional Geoscientist (P.Geo) - for geological hazard assessment
• Professional Biologist (P.Biol) - for environmental impact assessment

CLIENT RESPONSIBILITY:
The client acknowledges that this report provides comparative environmental data and preliminary risk indicators.
The client is responsible for obtaining appropriate professional engineering, geoscience, or other required assessments
before making development or regulatory decisions.

LIABILITY LIMITATION:
Nimpact Environmental Ltd. shall not be liable for decisions made based on this report without appropriate professional
engineering or geoscience review. This report is valid only for the date of generation and may become outdated as
conditions change or new data becomes available.

## Executive Summary

This report provides a preliminary screening assessment of coastal conditions using satellite imagery analysis and community observations. The following scores represent comparative rankings across similar beaches in the database.

## Location Details

**Coordinates:** 48.433365°N, -123.303817°W
**Province/State:** British Columbia
**Municipality:** Oak Bay
**Beach ID:** UQDhpCH7i5WWWv3SEUYX

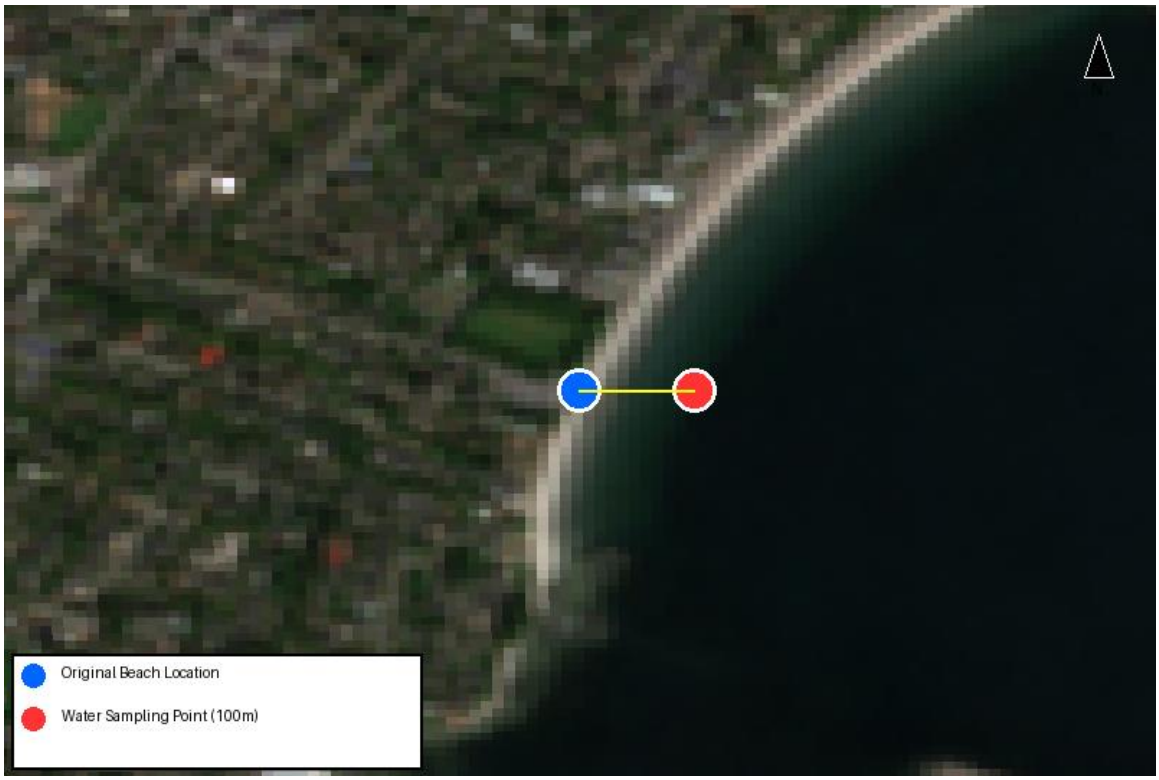
## Assessment Scores

| Category | Score | Rating |
|---|---|---|
| **Recreation** | 70/100 | Good |
| **Marine Ecology** | 18/100 | Poor |
| **Beach Quality** | 78/100 | Excellent |
| **Natural Features** | 50/100 | Fair |

## 1. Satellite Environmental Metrics

The following metrics are derived from satellite imagery analysis (2020-2025) and compared against regional and global beach databases.

### Sampling Locations Map




*Satellite image showing original beach location and water sampling point*

*This map shows the original beach pin location (blue) and the adjusted water sampling location (red) used for satellite-based water quality measurements. If the original pin is on land or in the intertidal zone, the system automatically adjusts the sampling point offshore to ensure accurate water measurements.*

**Note:** Sampling location was adjusted 100m offshore from the original pin. Reason: adjusted_tidal_100m

### 1.1 Water Temperature

| Metric | Value |
|---|---|
| **Average Temperature** | 13.7°C |
| **Maximum Temperature** | 20.0°C |

| | |
|---|---|
| **Minimum Temperature** | 5.7°C |
| **Temperature Range** | 14.3°C |
| **Images Analyzed** | 115 |

**Note:** *Extreme values filtered - likely land pixel contamination*

*Original unfiltered range: -16.4°C to 24.0°C included land/ice pixels.*

## 1.2 Water Clarity

| Metric | Value |
|---|---|
| **Clarity Score** | 7.5/10 |
| **Secchi Depth** | 2.8m |
| **Turbidity** | 0.51 |
| **Images Analyzed** | 98 |

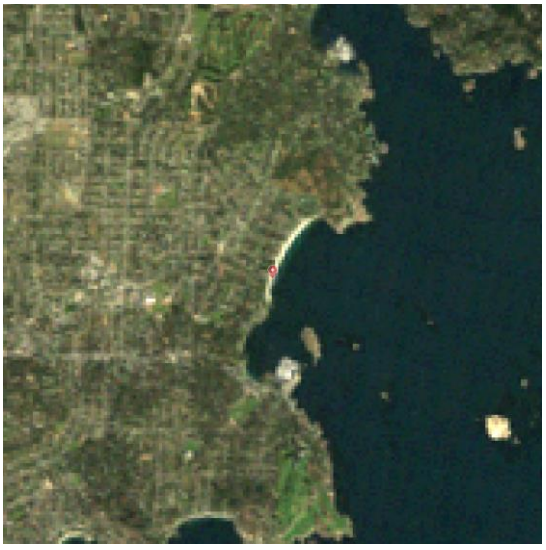
## 1.3 Water Index (NDWI)

| Metric | This Beach | Regional Avg | Global Avg |
|---|---|---|---|
| **Value** | 0.55 | -0.04 | -0.03 |
| **Maximum** | | 1.0 | 1.0 |
| **Percentile** | 99.4% | | |
| **Global Range** | -0.62 - 0.70 | | |

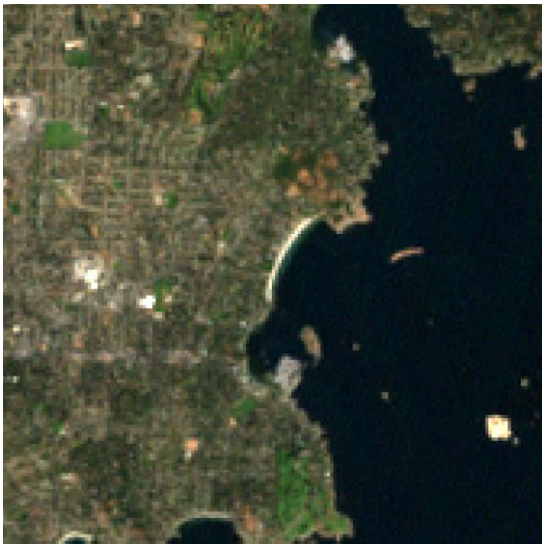
***Interpretation:*** Higher values indicate clearer water boundaries. Lower values suggest mixed land-water zones or shallow areas.

## 2. Satellite Imagery Analysis

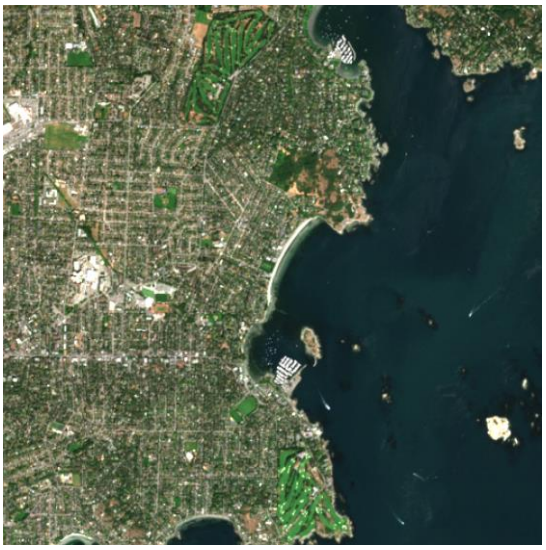
Multi-temporal satellite analysis showing coastal changes from 1984-2025. 4 representative images selected from different time periods.



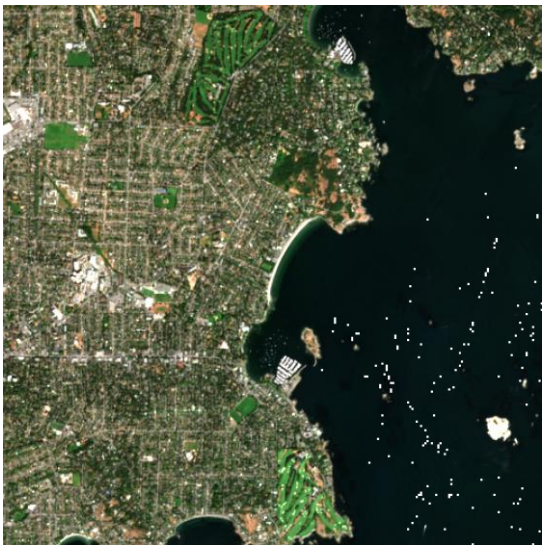
**1984-1999**



**2000-2009**



**2015-2019**

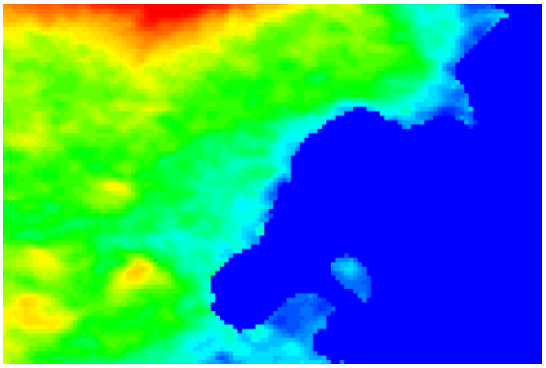


**2020-2025**

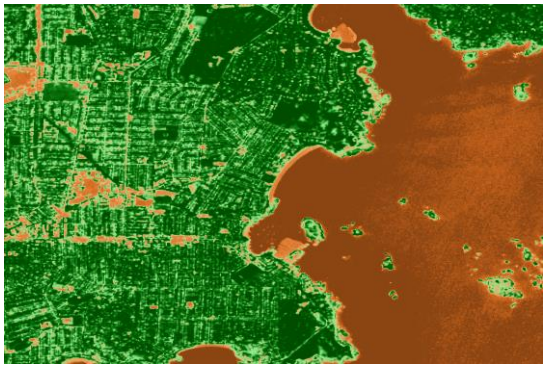
*Source: Landsat 5/7/8/9 and Sentinel-2 imagery, 1984-2022. True color RGB composite, 250m$^2$ coverage area. 4 of 4 periods with cloud-free imagery.*

## 3. Environmental Analysis Maps

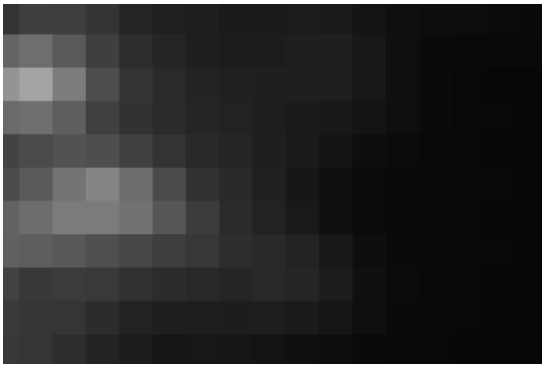
Comprehensive environmental mapping including terrain elevation, land cover, nighttime lighting (development proxy), and population density.



**Terrain Elevation (SRTM)**

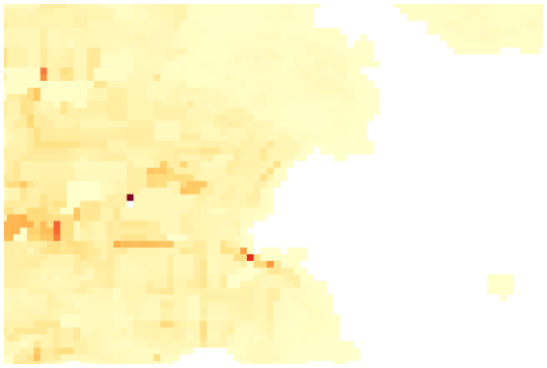


**Land Cover (NDVI)**



**Night Lights (VIIRS)**

*(Dark/sparse areas appear black/light - this is correct)*



**Population Density**

*(Dark/sparse areas appear black/light - this is correct)*

*Sources: SRTM elevation (±6m accuracy), Sentinel-2 NDVI (10m), VIIRS night lights 2022-2024 (500m), WorldPop population (100m). 250m² coverage area.*

## 4. Coastal Environmental Analysis

### 4.1 Beach Width Variability

| Metric | Value |
|---|---|
| **Width Change** | -7.9m |
| **Annual Rate** | -0.40m/year |
| **Trend** | Narrowing (erosion) |

### 4.2 Coastal Vegetation Health

| Metric | Value |
|---|---|
| **NDVI Score** | 0.100 |
| **Vegetation Health** | Poor |
| **Health Score** | 37.5/100 |

### 4.3 Water Quality Indicators

| Metric | Value |
|---|---|
| **Overall Score** | 85.0/100 |
| **Quality Level** | Excellent |
| **Turbidity Index** | 0.584 |
| **Turbidity Level** | Excellent |
| **Chlorophyll Index** | -0.061 |
| **Chlorophyll Level** | Good |

### 4.4 Land Surface Temperature

| Metric | Value |
|---|---|
| **Temperature Class** | Warm |

### 4.5 Light Pollution Assessment

| Metric | Value |
|---|---|
| **Mean Radiance** | 7.52 $nW/cm^2/sr$ |
| **Light Pollution** | Low Development |

### 4.6 Urban Development Assessment

| Metric | Value |
|---|---|
| **Development Index** | -0.008 |
| **Development Class** | Moderate |
| **Built Area** | 28.8% |

## 4.7 Storm Impact Assessment

Storm resilience assessment considers multiple factors including elevation, vegetation buffer, coastal exposure, and historical storm patterns. This preliminary assessment indicates vulnerability to storm surge and coastal flooding.

| Metric | Value |
|---|---|
| **Resilience Class** | Low |

**Note:** *Low resilience suggests increased vulnerability to storm surge or flooding. Professional coastal engineering assessment recommended for structures near shoreline.*

## 5. Advanced Coastal Analytics

*This section provides advanced coastal metrics derived from multi-year satellite analysis. These indicators supplement standard assessments but do not replace site-specific professional evaluation.*

### 5.1 Suspended Sediment Analysis

| Metric | Value |
|---|---|
| **Sediment Index** | 0.677 |
| **Sediment Level** | Low |
| **Images Analyzed** | 26 |

*Suspended sediment affects water clarity and can indicate erosion or runoff. High values may suggest upstream disturbance or natural turbidity.*

### 5.2 Development Pressure Index

| Metric | Value |
|---|---|
| **Pressure Score** | 100.0/100 |
| **Pressure Level** | High |
| **Night Lights (1km)** | 6.772 |
| **Night Lights (5km)** | 10.790 |

*Night lights serve as proxy for population density and development. Higher values indicate greater human activity and potential anthropogenic impacts.*

### 5.3 Marine Debris Assessment

| Metric | Value |
|---|---|
| **Debris Index** | 0.0818 |
| **Risk Level** | High |
| **Maximum Detected** | 0.5281 |

*Debris index estimates accumulation potential based on optical signatures. Field verification recommended for beaches with elevated indices.*

### 5.4 Kelp Forest Presence

| Metric | Value |
|---|---|
| **Coverage Score** | 45.6% |
| **Kelp Presence** | Abundant |

*Kelp forests provide important marine habitat and indicate healthy nearshore ecosystems. Coverage estimates derived from multispectral analysis.*

## 5.5 Wave Energy Exposure

| Metric | Value |
|---|---|
| **Exposure Score** | 10.6/100 |
| **Exposure Level** | Sheltered |
| **Mean Slope** | 1.53° |
| **Mean Elevation** | 14.99m |

*Wave exposure influences coastal erosion and intertidal habitat. Score considers topographic exposure and fetch. Coastal engineering assessment required for structures in high-exposure areas.*

## 6. Community Observations & Beach Assessment

*The following data was contributed by beach visitors via the My BeachBook platform. These observations provide valuable local knowledge and are compared against similar beaches in the region to provide context.*

### 6.1 Beach Assessment Overview

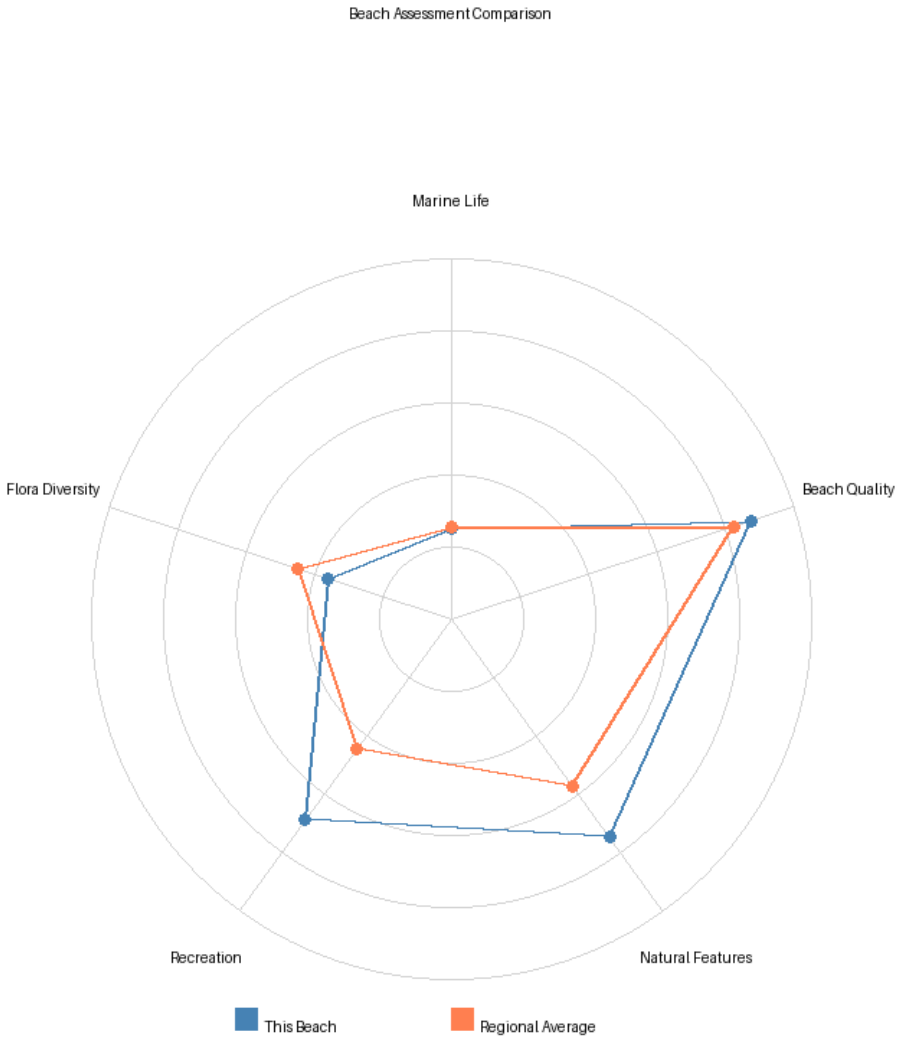



*Figure: Multi-dimensional beach assessment compared to regional average*

## 6.2 Marine Life Diversity

| Species | Abundance | Regional Avg | Rating |
|---|---|---|---|
| **Clams** | Low (3/7) | 2.5/7 | Average |

## 6.3 Beach Composition & Substrate

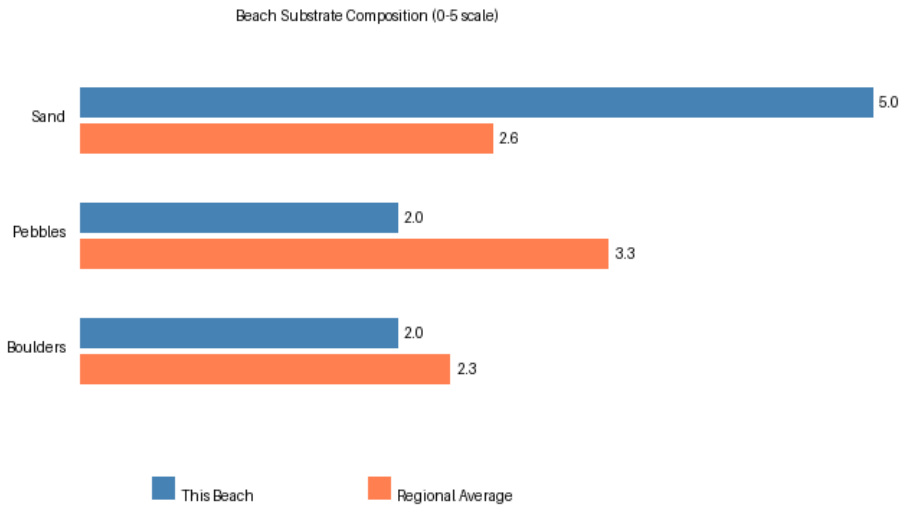



*Figure: Beach substrate composition compared to regional average*

### Physical Characteristics

| Measurement | Value |
|---|---|
| **Width** | 20m |
| **Length** | 1628m |
| **Bluff Height** | 1m |
| **Bluff Grade** | Not recorded |

## 6.4 Beach Features & Conditions

| Feature | Present | Feature | Present |
|---|---|---|---|
| Boats on Shore | ✗ | Lookout Point | ✗ |
| Caves | ✗ | Private Access | ✗ |
| Patio Nearby | ✗ | Odor Issues | ✗ |
| Gold Panning | ✗ | Wind Exposed | ✓ |

### Environmental Quality

| Indicator | Level | Assessment |
|---|---|---|
| **Litter/Debris** | Minimal | Clean |
| **Crowding** | Abundant | Busy |

## 6.5 Visitor Information

| Information | Details |
|---|---|
| **Best Tide** | Not specified |
| **Parking Distance** | Not specified |
| **Beach Shape** | Not specified |
| **Rock Type** | Not specified |
| **Shade Available** | Not specified |

### Facilities & Infrastructure

- Seawall
- Walkway
- Garbage Cans

### Shell Types Observed

- Tiny
- Dime Size
- Quarter Size

## 7. Shoreline Variability Analysis

*Shoreline variability measures how much the waterline position changes over time. Higher values indicate greater shoreline movement, which may reflect erosion, accretion, or natural tidal/seasonal variations.*

### 7.1 This Beach

| Metric | Value |
|---|---|
| **Shoreline Risk Proxy** | 0.2656 |
| **Variability Level** | High |
| **Water Body Type** | Tidal |

*Tidal beaches with values >0.030 suggest exposure to wave action and coastal processes.*

### 7.2 Comparison to Nearest Beaches

| Beach Name | Distance (km) | Risk Proxy | Level |
|---|---|---|---|
| **Willows Beach ★** | 0.0 | 0.2656 | High |
| Oak Bay Marina | 1.1 | 0.1532 | High |
| Kyla Beach | 1.2 | 0.1173 | High |
| Oak Bay South | 1.6 | 0.1946 | High |
| Mcneill Bay | 2.3 | 0.1724 | High |
| Kitty Islet | 2.5 | 0.2527 | High |

**Local Area Statistics:** Average = 0.1926, Range = 0.1173 to 0.2656

*This beach ranks #1 out of 6 beaches in the immediate area (highest variability).*

### 7.3 Regional Context

Compared to 225 tidal beaches globally, this beach's variability ranks at the 81th percentile. The average tidal beach has a risk proxy of 0.2136.

## 8. Preliminary Screening Guidance

**Note:** This section provides general guidance based on industry standards. *Site-specific assessment by licensed professionals (P.Eng, P.Geo) is required for development decisions.*

### 8.1 Tidal Beach Considerations

Coastal areas experience tidal action, wave energy, and storm surge.

High variability suggests exposure to wave action and coastal processes. Coastal engineering assessment required.

### 8.2 Additional Considerations

No specific concerns identified in preliminary screening. Standard due diligence recommended for any development.

## 9. About This Report

**Data Sources:**

- Landsat 5/7/8/9 & Sentinel-2 satellite imagery (1984-2025) - 2500px resolution, 250m coverage
- SRTM elevation data - 3000px resolution, 250m coverage (±6m vertical accuracy)
- My BeachBook community observations (crowd-sourced, not professionally verified)
- Google Earth Engine analysis platform

**Report prepared by:**
Nimpact Environmental Ltd.
Email: info@nimpact.ca
Platform: myBeachBook (Android only currently)

**Report Type:** Preliminary Coastal Screening Assessment
Generated: December 05, 2025 at 06:26

## LEGAL DISCLAIMER

IMPORTANT NOTICE: LIMITATIONS OF THIS REPORT

This report is a preliminary environmental assessment and data compilation prepared by Nimpact Environmental Ltd.
It is intended as a screening tool and information resource only.

DATA SOURCES & LIMITATIONS:
• Satellite imagery analysis uses publicly available NASA/USGS Landsat and ESA Sentinel-2 data
• Shoreline Risk Proxy represents statistical variability of the waterline over time, not a direct measurement of erosion rate
• Community observations are crowd-sourced and not professionally verified
• Terrain data is derived from SRTM with ±6m vertical accuracy

THIS REPORT DOES NOT CONSTITUTE:
• Professional engineering assessment
• Geotechnical investigation
• Site-specific hazard evaluation suitable for building permit applications
• Legal opinion on development suitability or coastal setback requirements

PROFESSIONAL ASSESSMENT REQUIRED:
Any development, infrastructure planning, or regulatory decision should be supported by site-specific assessment
conducted by licensed professionals including, as appropriate:
• Professional Engineer (P.Eng) - for coastal engineering and infrastructure
• Professional Geoscientist (P.Geo) - for geological hazard assessment
• Professional Biologist (P.Biol) - for environmental impact assessment

CLIENT RESPONSIBILITY:
The client acknowledges that this report provides comparative environmental data and preliminary risk indicators.
The client is responsible for obtaining appropriate professional engineering, geoscience, or other required assessments
before making development or regulatory decisions.

LIABILITY LIMITATION:
Nimpact Environmental Ltd. shall not be liable for decisions made based on this report without appropriate professional
engineering or geoscience review. This report is valid only for the date of generation and may become outdated as
conditions change or new data becomes available.