British Columbia Conservation Foundation

Cowichan Lake Erosion Assessment

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CONSULTING ENGINEERS

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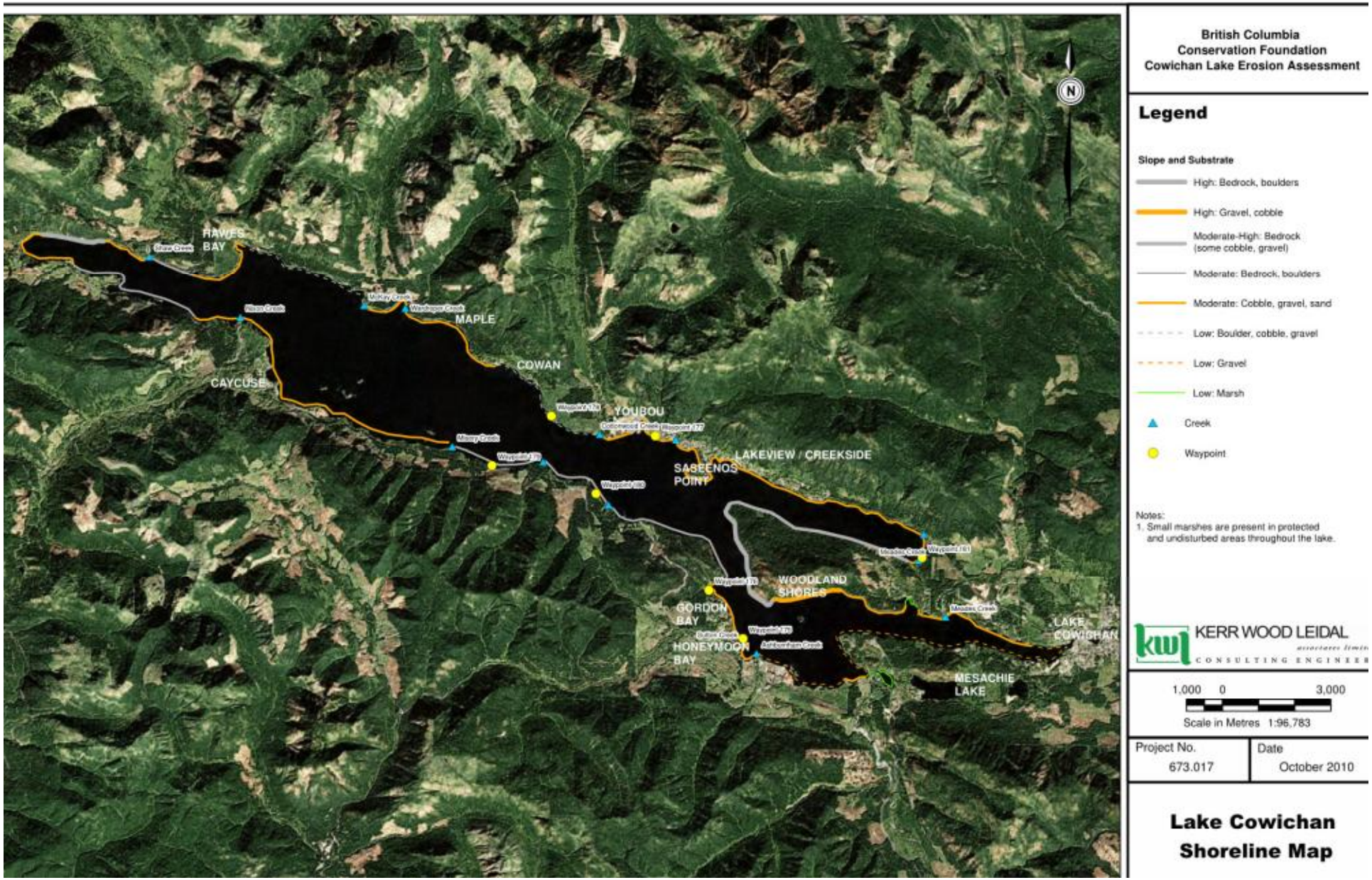
Scope of Study

1. Gather Site Data
2. Collect and Analyze Wind and Water Level Data
3. Determine Wave Climate
4. Assess Existing Erosion and Causes
5. Assess Potential Future Erosion and Causes (primarily Weir Raising)

Not in Scope of Study

- Inundation mapping
- Effects of water level changes on Sewer and Septic systems
- Biological impacts of water level changes

Field Work- Day 1



Field Work – Shoreline Types

- **Bedrock**

Field Work – Shoreline Types

- Sand, gravel and cobble (with vegetation in some areas)

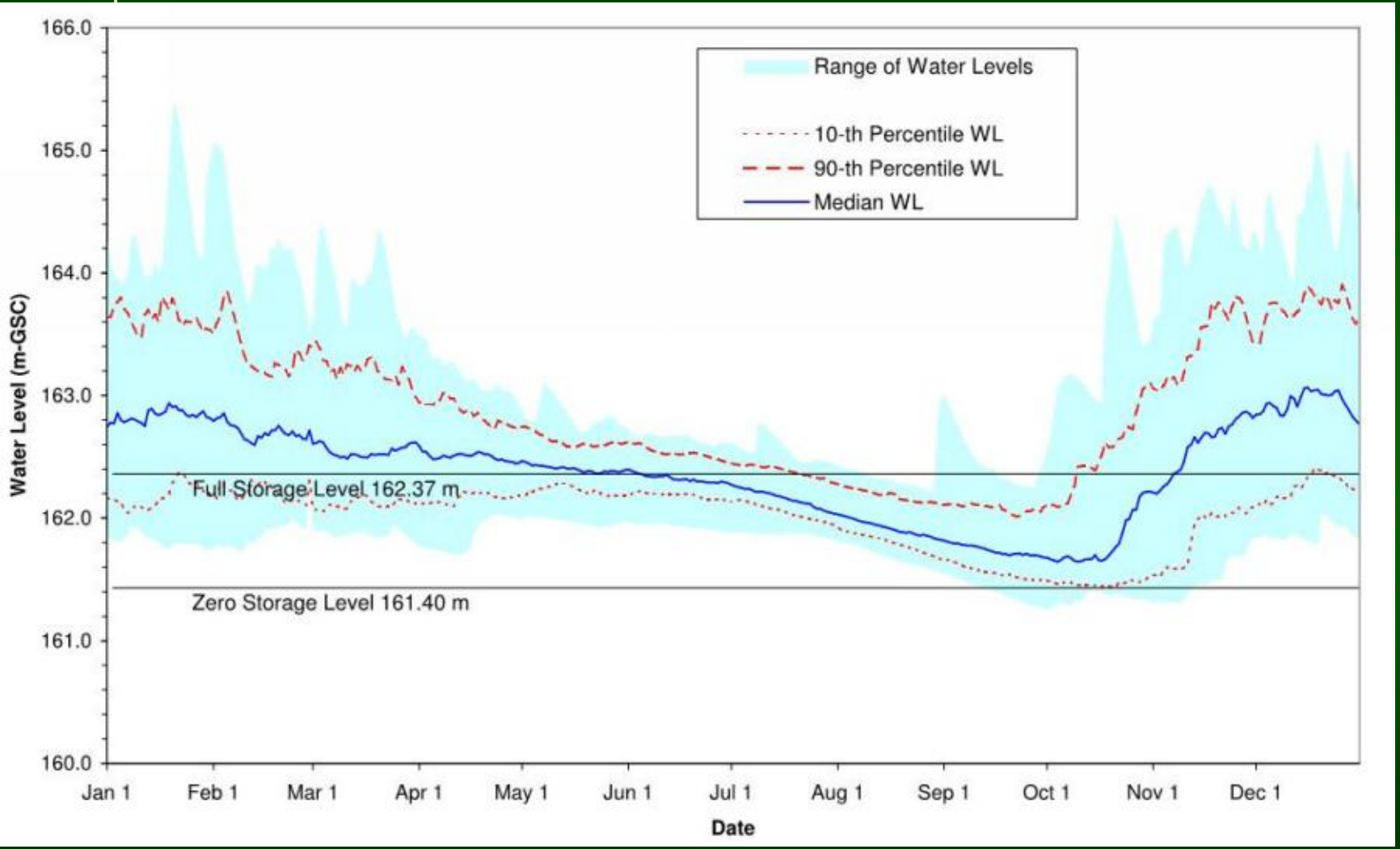
Field Work- Shoreline Types

- **Marsh**

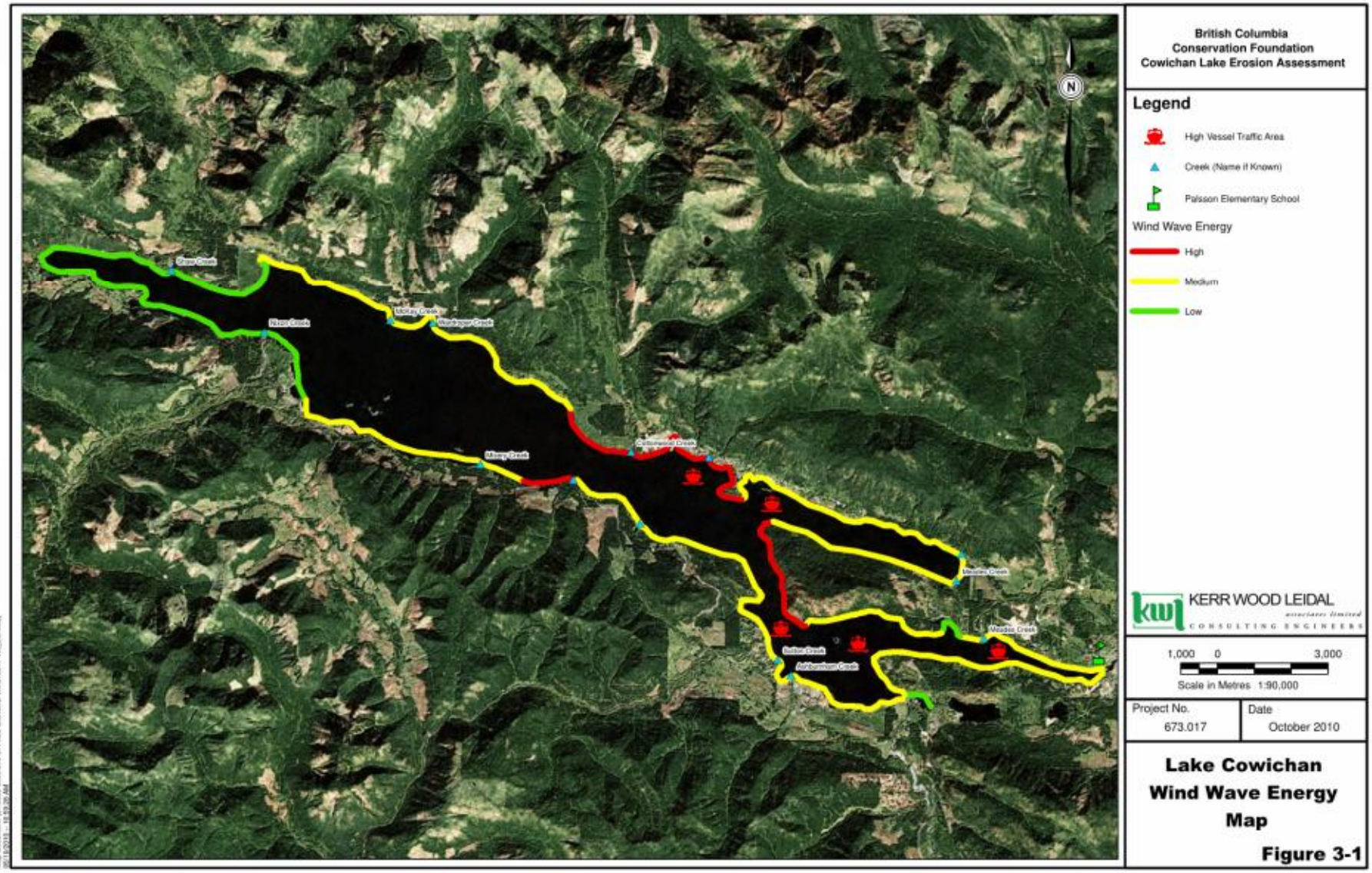
Field Work- Shoreline Types

- **Manmade Structures**

Water Levels



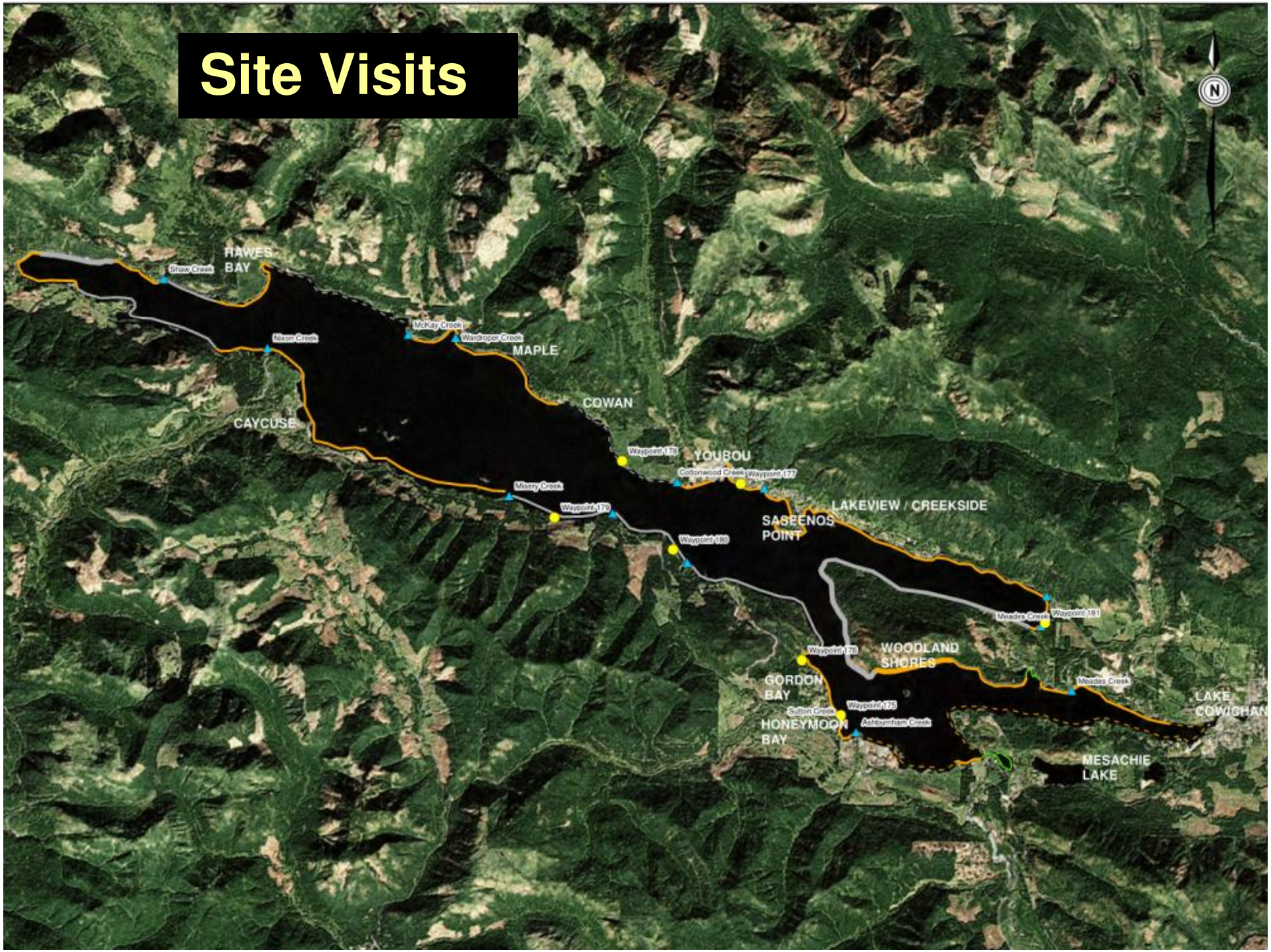
Wind and Wave Climate



Field Work – Site Visits

Sites chosen with varying:

- **Wind wave exposure**
- **Vessel wake wave exposure**
- **Manmade structures**
- **Vegetation disturbance**


Site Visits
HAWES BAY
Shaw Creek
McKay Creek
Wardroper Creek
Nixon Creek
MAPLE
COWAN
CAYCUSE
Waypoint 176
YOUBOU
Cottonwood Creek
Waypoint 177
Mossy Creek
Waypoint 178
LAKEVIEW / CREEKSIDE
SAHEENOS POINT
Waypoint 180
Meades Creek
Waypoint 181
Waypoint 174
WOODLAND SHORES
GORDON BAY
Meades Creek
Sutton Creek
Waypoint 175
HONEYMOON BAY
Ashburnham Creek
LAKE COWICHAN
MESACHIE LAKE
N

Sites

1) Honeymoon Bay Recreation Assoc.	
Wind Waves	Medium
Vessel Waves	High
Manmade Structures	Seawalls, Groynes
Vegetation Disturbance	High

Sites

2) Gordon Bay Provincial Park	
Wind Waves	Medium
Vessel Waves	High
Manmade Structures	None
Vegetation Disturbance	Medium

Sites

3) Youbou	
Wind Waves	High
Vessel Waves	Medium
Manmade Structures	Seawalls, Groynes
Vegetation Disturbance	High

Sites

4) Youbou Lands	
Wind Waves	High
Vessel Waves	Low
Manmade Structures	None
Vegetation Disturbance	Low

Sites

5) South Shore Across from Youbou Lands	
Wind Waves	High
Vessel Waves	Low
Manmade Structures	None
Vegetation Disturbance	Low

Sites

6) South Shore Across from Youbou Lands (Sheltered)	
Wind Waves	Low
Vessel Waves	Low
Manmade Structures	None
Vegetation Disturbance	Low

Sites

7) Spring Beach	
Wind Waves	Medium
Vessel Waves	Medium
Manmade Structures	None
Vegetation Disturbance	None

Field Work- Findings

Locally Eroded Slopes

Youbou

South Shore Across from Youbou Lands

Field Work- Findings

Seawall Toe Scour

Honeymoon Bay Recreation Association

Youbou

Field Work- Findings

Tree Root Erosion

Gordon Bay

Sheltered South Shore

Existing Erosion- Potential Causes

- Seasonal Beach Profile Changes
- Seawall and Groyne Construction
- Climate Change (Wind, Waves, Inflows)
- Cowichan Lake Weir (1961)
- Subsea Landslide at Youbou due to 1946 Earthquake
- Shoreline Vegetation Removal
- Log Boom Installation and Removal
- Vessel Traffic

Shoreline Equilibrium

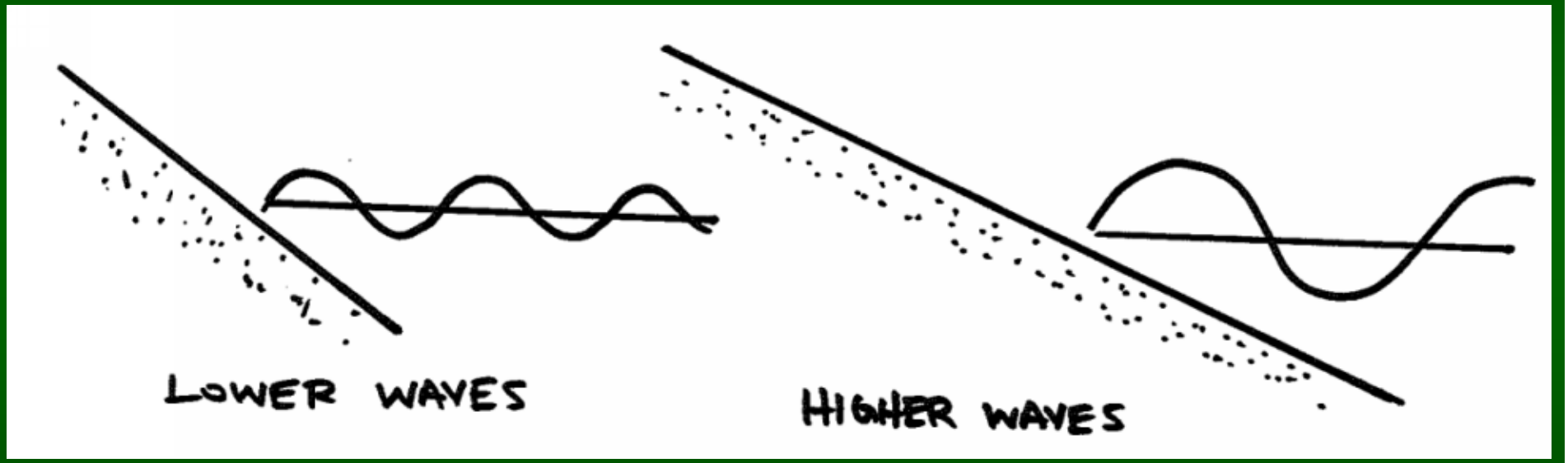
Natural shorelines are in dynamic equilibrium

Equilibrium depends on:

- wave height (seasonal)
- sediment size
- vegetation
- water levels (seasonal)
- sediment budget (flow in, flow out)

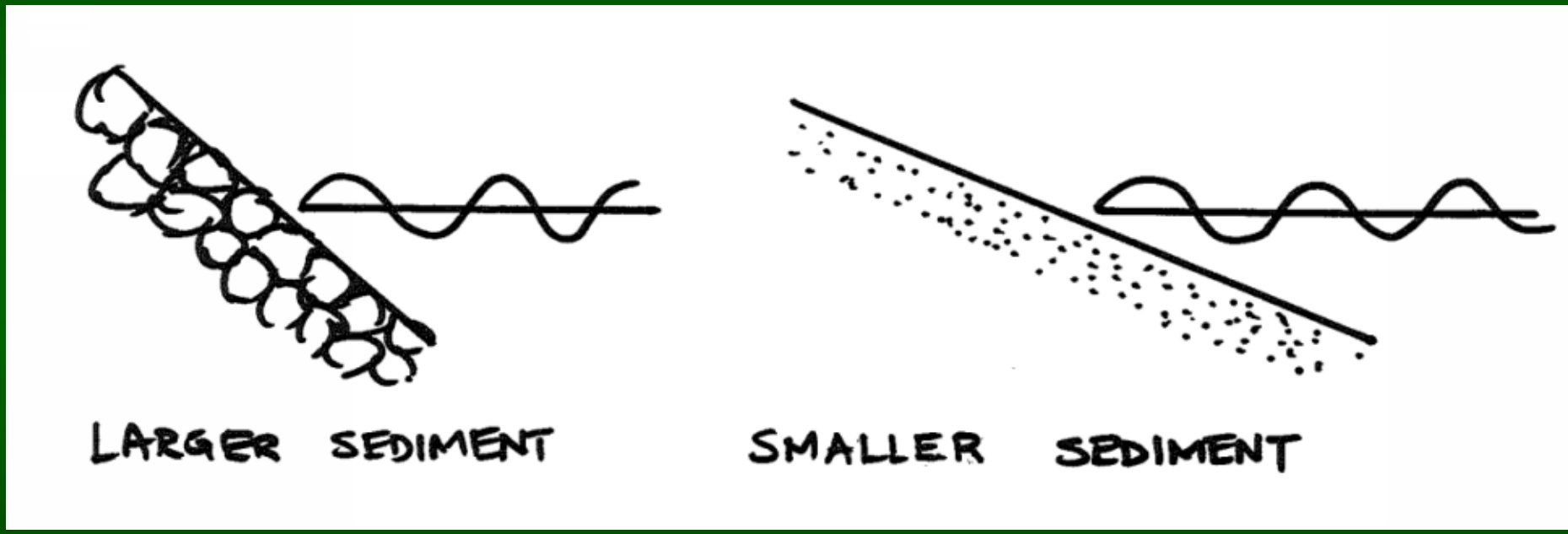
Shoreline Equilibrium

Change in Wave Height



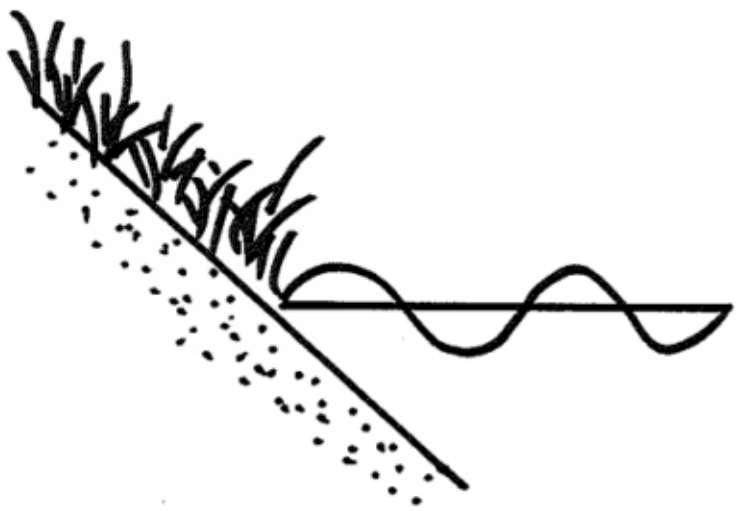
Shoreline Equilibrium

Different Sediment Sizes

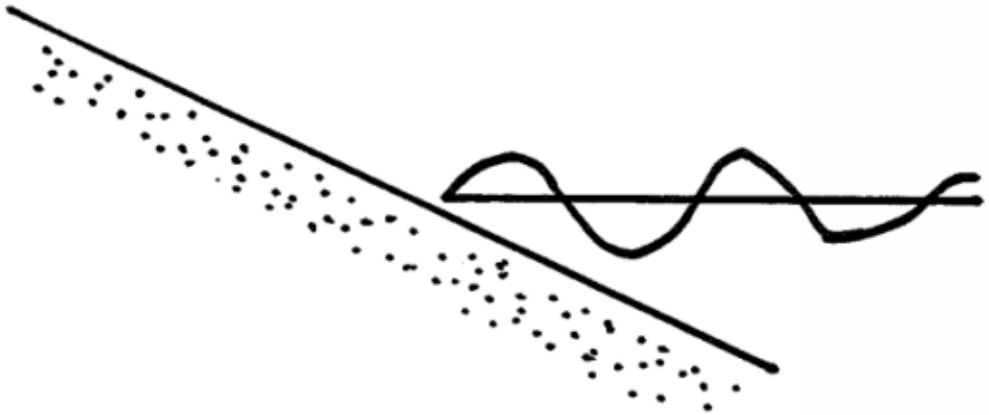


Shoreline Equilibrium

Vegetation Removal



VEGETATED SHORELINE



UNVEGETATED SHORELINE

Shoreline Equilibrium- Sediment Budget

- Erosion Occurs when Sediment Budget is not Balanced

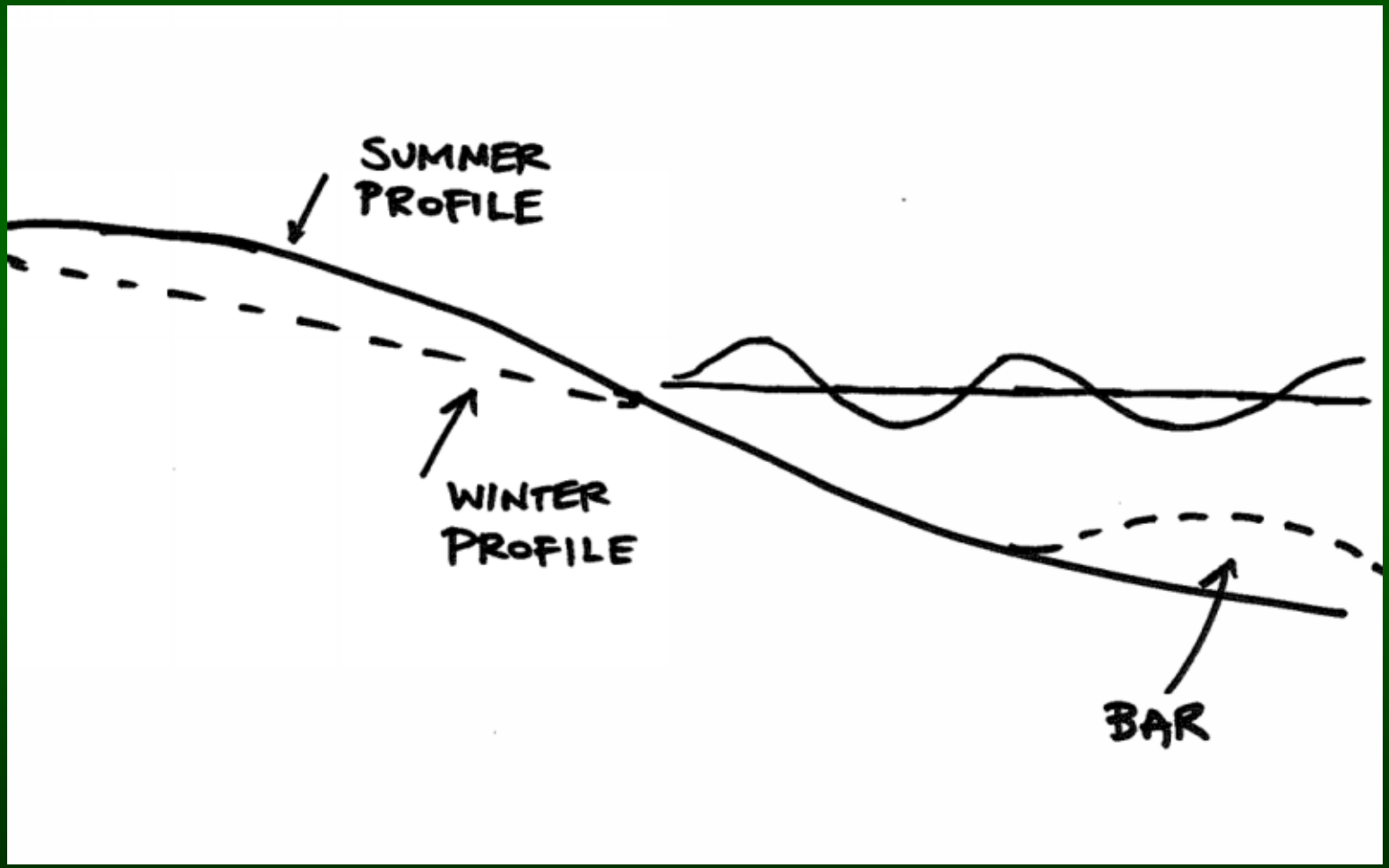
  i.e. Sediment In < Sediment Out

- Major Sediment Transport Mechanisms:

  1. Cross-Shore Transport
  2. Longshore Transport

Sediment Budget

Cross Shore Sediment Transport



Sediment Budget

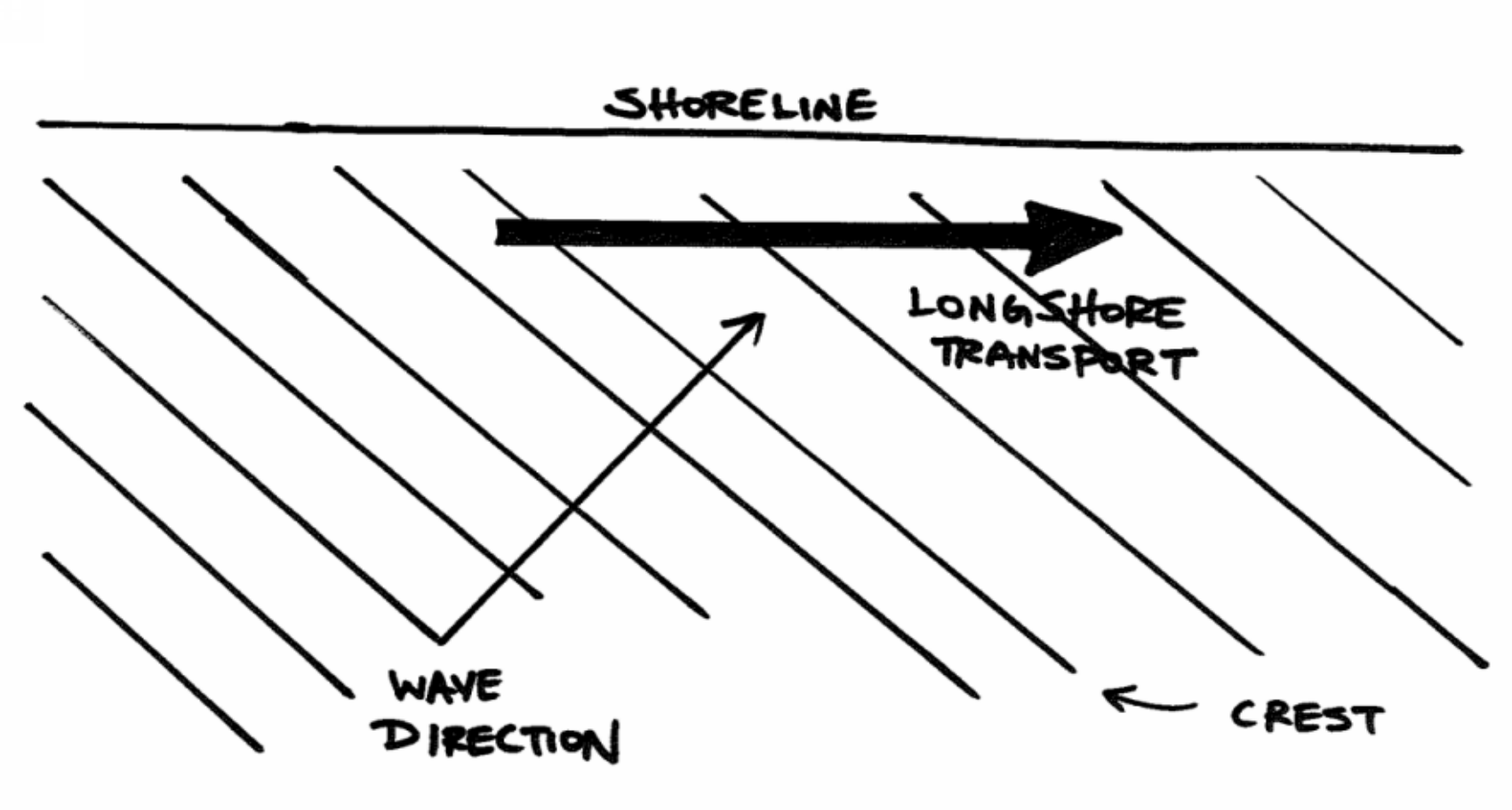
La Jolla, California

Winter

Summer

Sediment Budget

Longshore Sediment Transport

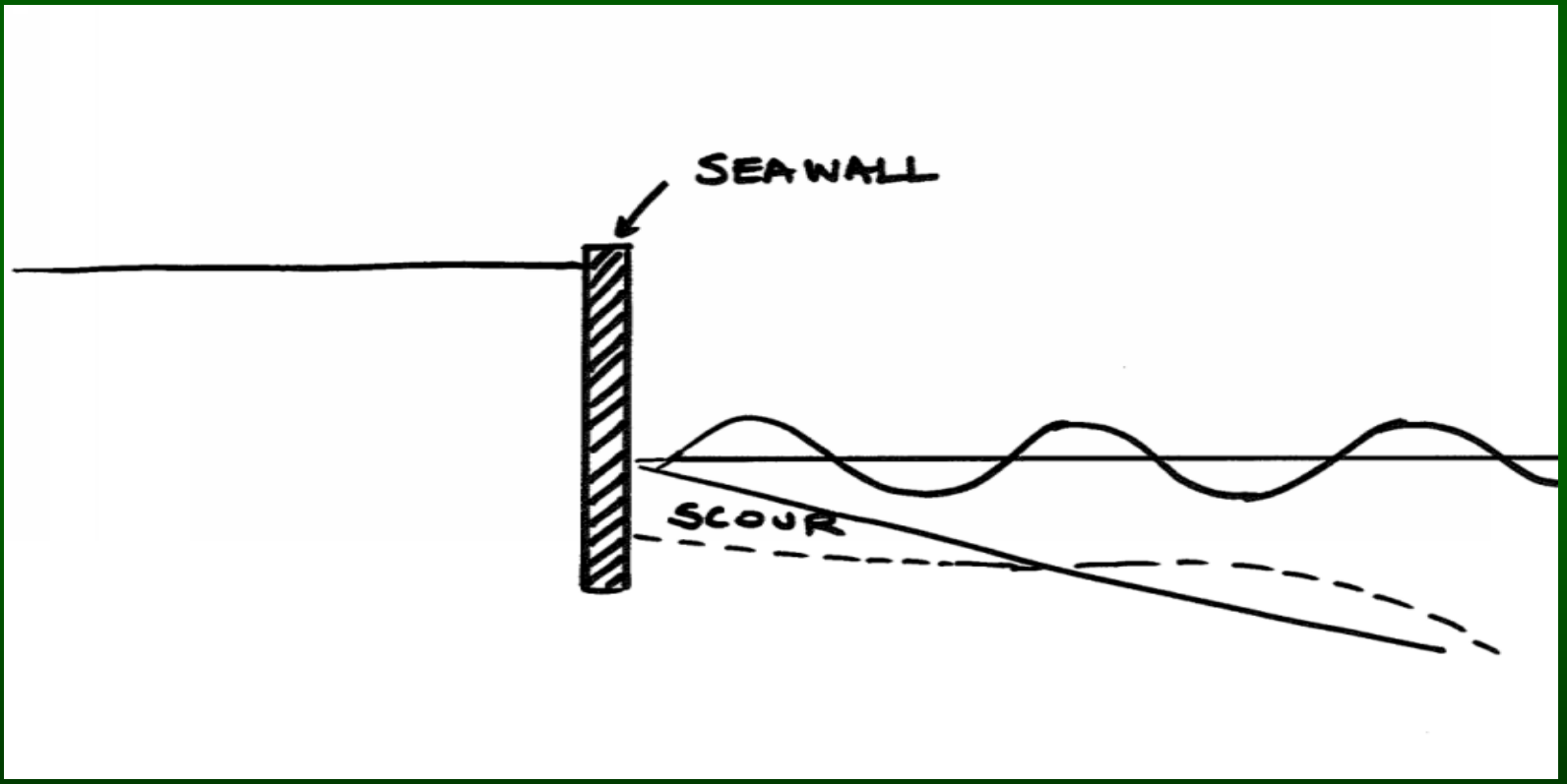


Sediment Budget

Longshore Transport- Ash Shihr, Yemen

Disturbing the Equilibrium

Effect of a Seawall

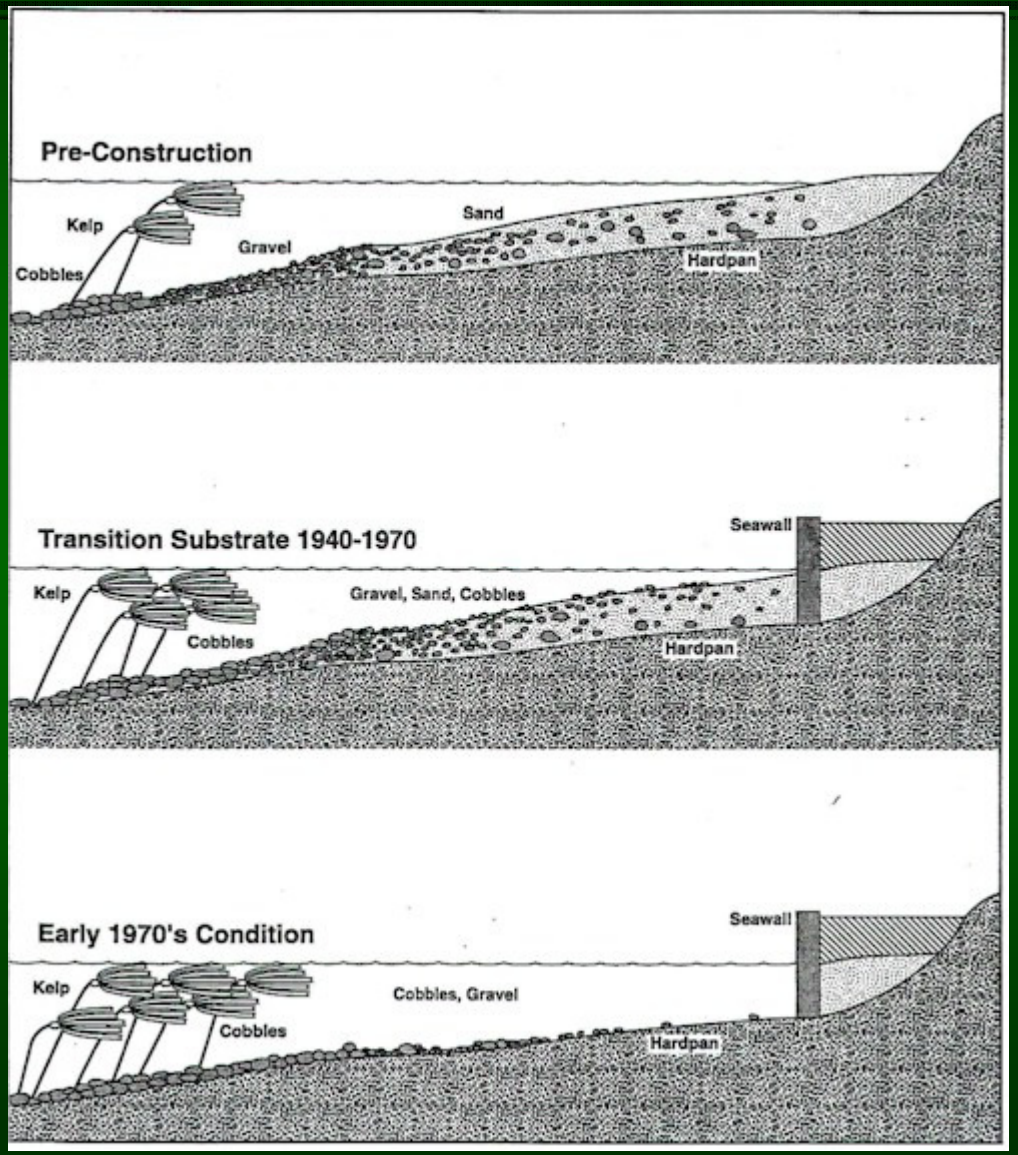


Disturbing the Equilibrium

Seawall

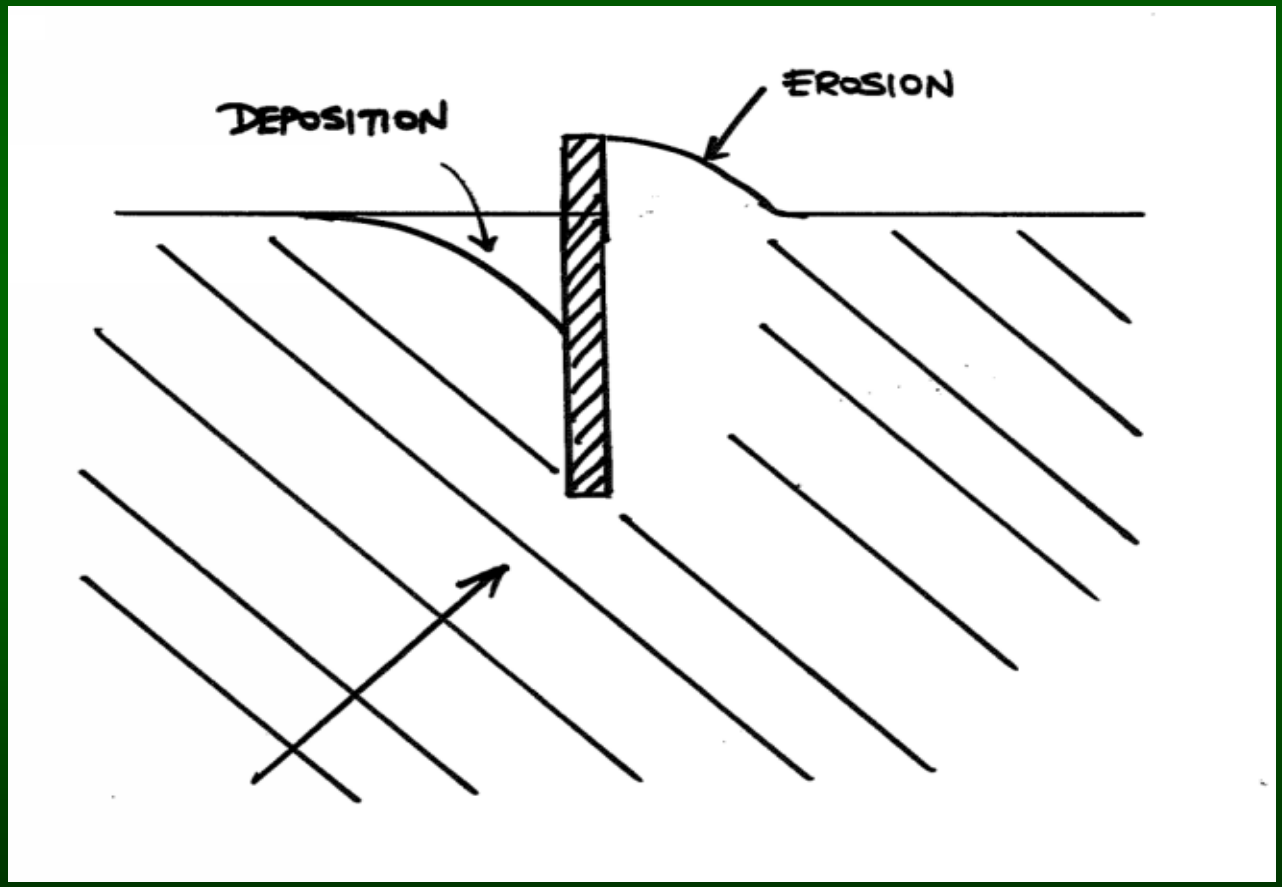
Case Study

Seattle, WA



Disturbing the Equilibrium

Effect of a Groyne

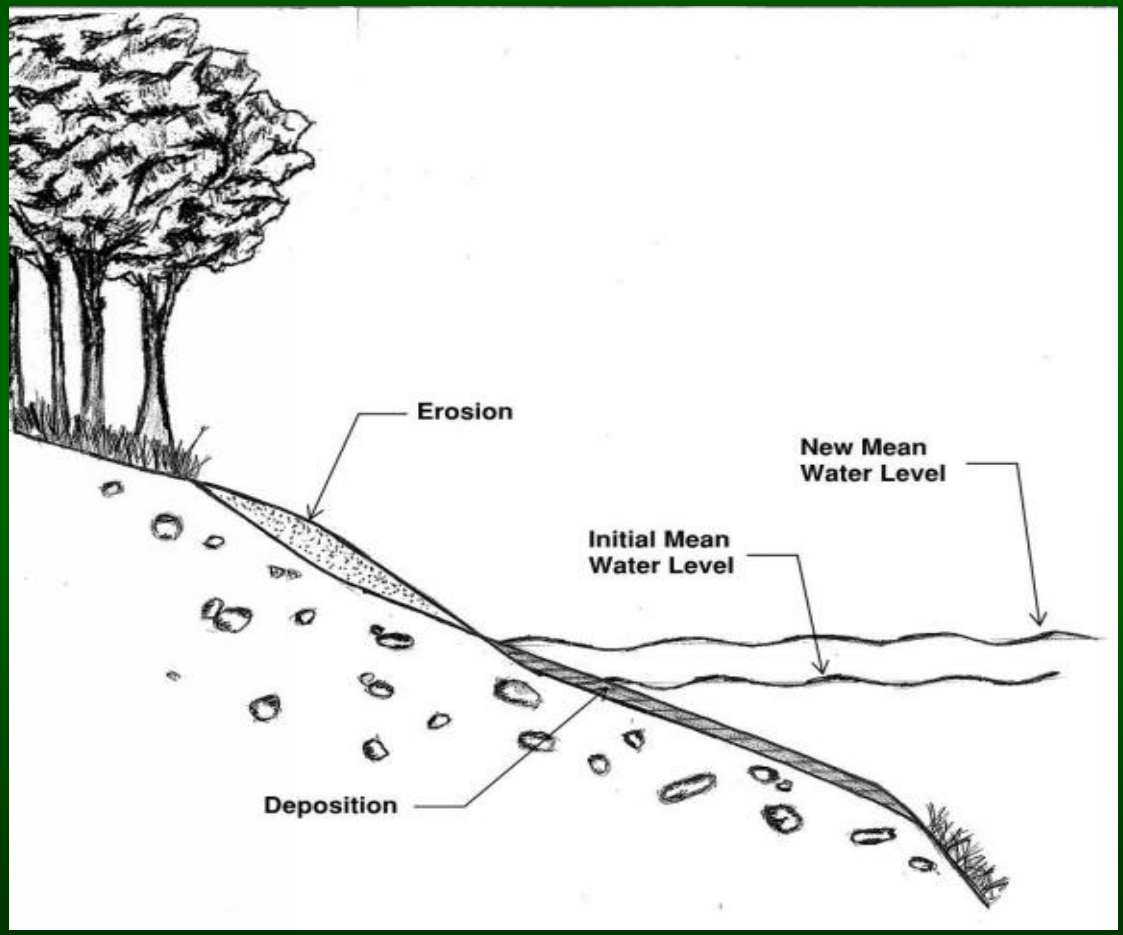


Disturbing the Equilibrium

Groynes- Chicago, Illinois

Disturbing the Equilibrium

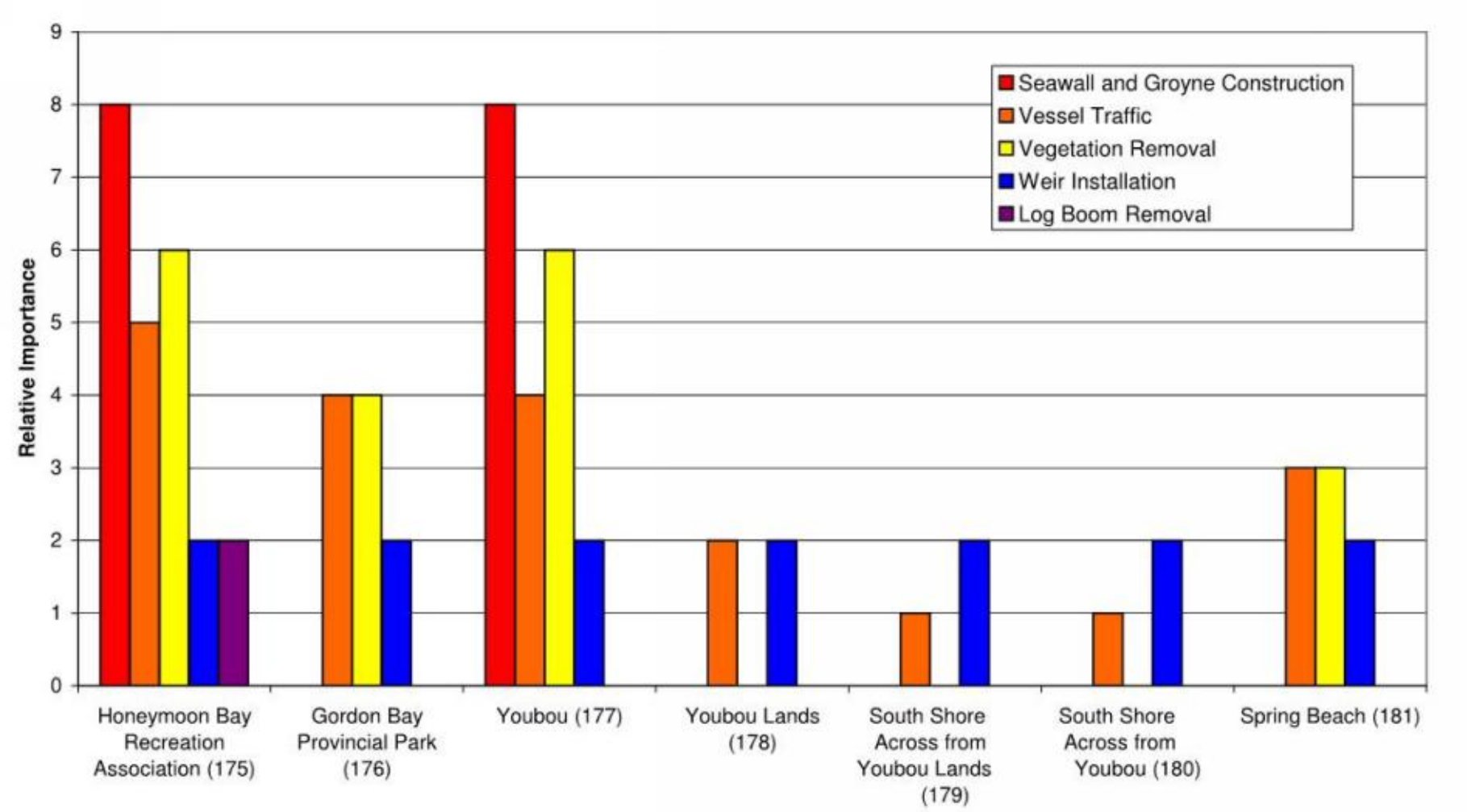
Effect of Water Level Change (Bruun's Rule)



Existing Erosion - Potential Causes

- Seasonal Beach Profile Changes
- Seawall and Groyne Construction
- Climate Change (wind, waves, inflows)
- Cowichan Lake Weir
- Subsea Landslide at Youbou due to 1946 Earthquake
- Shoreline Vegetation Removal
- Log Boom Removal
- Vessel Traffic

Ranking the Causes

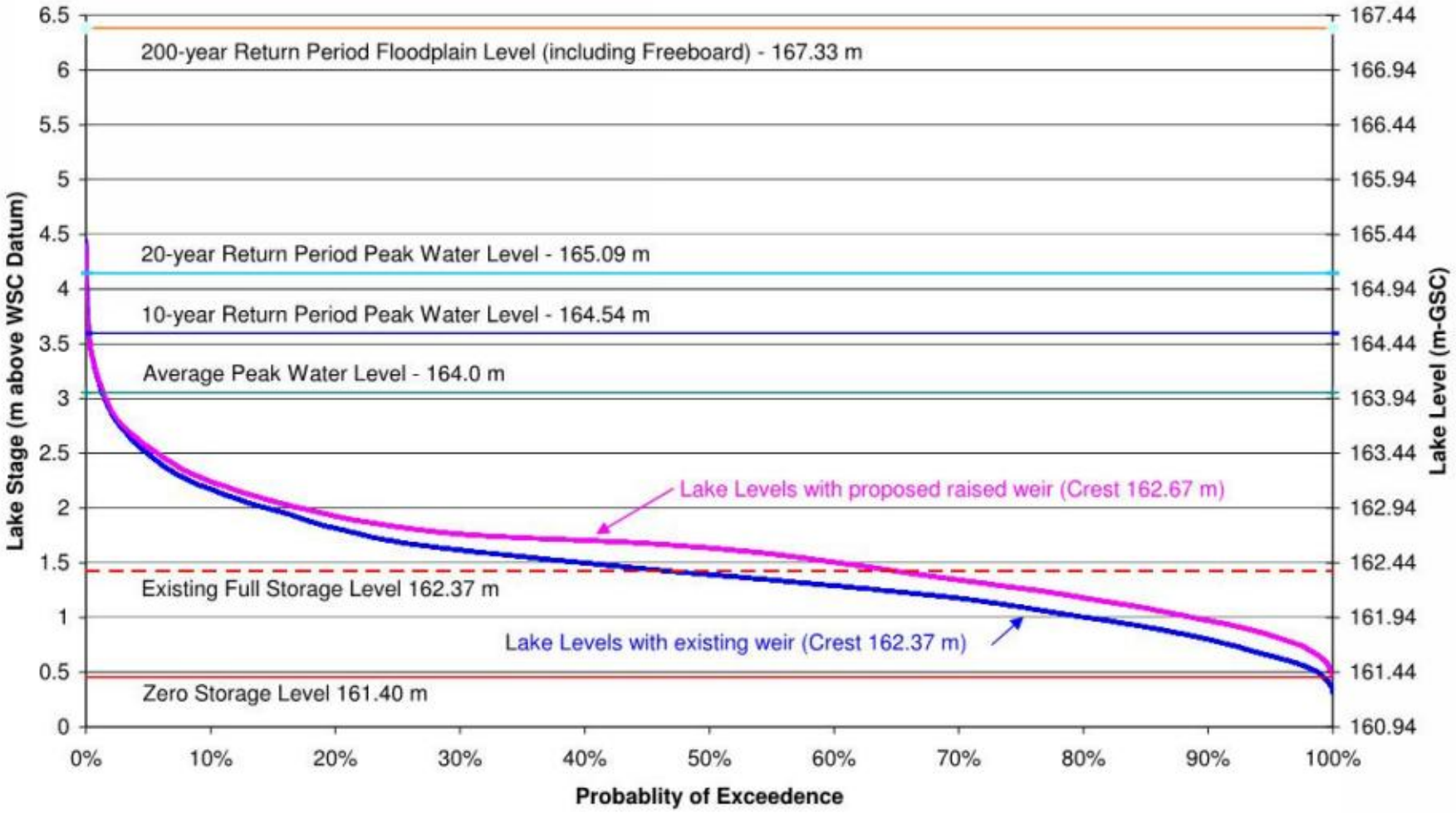


Future Erosion

Potential Causes of Future Erosion:

- Raising the Cowichan Lake Weir
- Increasing Vessel Traffic
- Increasing Shoreline Vegetation Removal
- More seawalls and groynes
- Climate Change

Raising the Weir



Raising the Weir

Table 6-1: Key Water Levels Before and After Weir Raising

Water Level	Elevation (m GD)		Difference (m) (Raised – Existing)
	Existing	Raised Weir	
200-year RP Floodplain (with Freeboard)	167.33	167.33	0.00
20-year RP Extreme	165.09	165.09	0.00
10-year RP Extreme	164.54	164.54	0.00
Average Annual Extreme	164.00	164.00	0.00
Full Storage	162.37	162.67	0.30
Median	162.33	162.58	0.25
Zero Storage	161.40	161.40	0.00

Notes:
1. RP = Return Period
2. "Extreme" is synonymous with maximum.

Raising the Weir

Table 6-2: Duration of Exposure Under Existing and Proposed Weir Heights

Elevation Band (m GD)	Duration of Exposure (%)		
	Existing	Raised Weir	Difference (Raised – Existing)
163.94 to 164.44	1	1	0
163.44 to 163.94	3	4	1
162.94 to 163.44	10	12	2
162.44 to 162.94	26	43	17
161.94 to 162.44	40	28	-12
161.44 to 161.94	18	11	-7

Note: elevation bands with a notable difference between existing and raised weir duration of exposure have been shaded.

Raising the Weir

Conclusions:

- Elevation range affected small compared to total
- There will be some long term shoreline reshaping- small compared to initial weir installation and raising
- Seawalls in 162.44 m to 162.94 m band will see more toe scour
- Seawalls in < 162.44 m band will see less toe scour
- Tree root erosion area could rise by +/- 0.3 m

Future Erosion- Other Effects

- Increasing Vessel Traffic
- Increasing Shoreline Vegetation Removal
- More Seawalls and Groynes
- Climate Change

Recommendations

- Many potential future erosion mechanisms
- Establish monitoring sites to determine baseline conditions
- Monitor on an annual basis
- Chose at least one relatively undisturbed, sheltered site to isolate weir effect