McKinley Beach Study

Draft Final

SEH

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HYDROGRAPHIC • GEOPHYSICAL • ENVIRONMENTAL

LimnoTech

GESTRA

Coastal & Environmental Consultants

Purpose and Scope

The purpose of this study is to identify measures necessary to improve swim safety, beach sustainability and water quality at McKinley Beach.

Key Considerations

- Can design mitigate the challenges faced by McKinley Beach?
- How can swim safety be improved and encouraged?
- How is water quality impacted?
- Are high water levels, similar to 2020, likely to cause future damage to McKinley Beach or adjacent infrastructure such as Lincoln Memorial Drive?

Report Approach

- Review of Existing & Historic Data
- Field Study
  - On-Site Buoy
  - Dye Testing
- Wind & Wave Analysis
- Hydrodynamic Modeling
- Solutions & Alternatives
  - Viability
  - Feasibility
  - Preferability

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Review of Existing & Historic Data

- McKinley Beach Through Time

1937

1963

1980

1990

2010

2020

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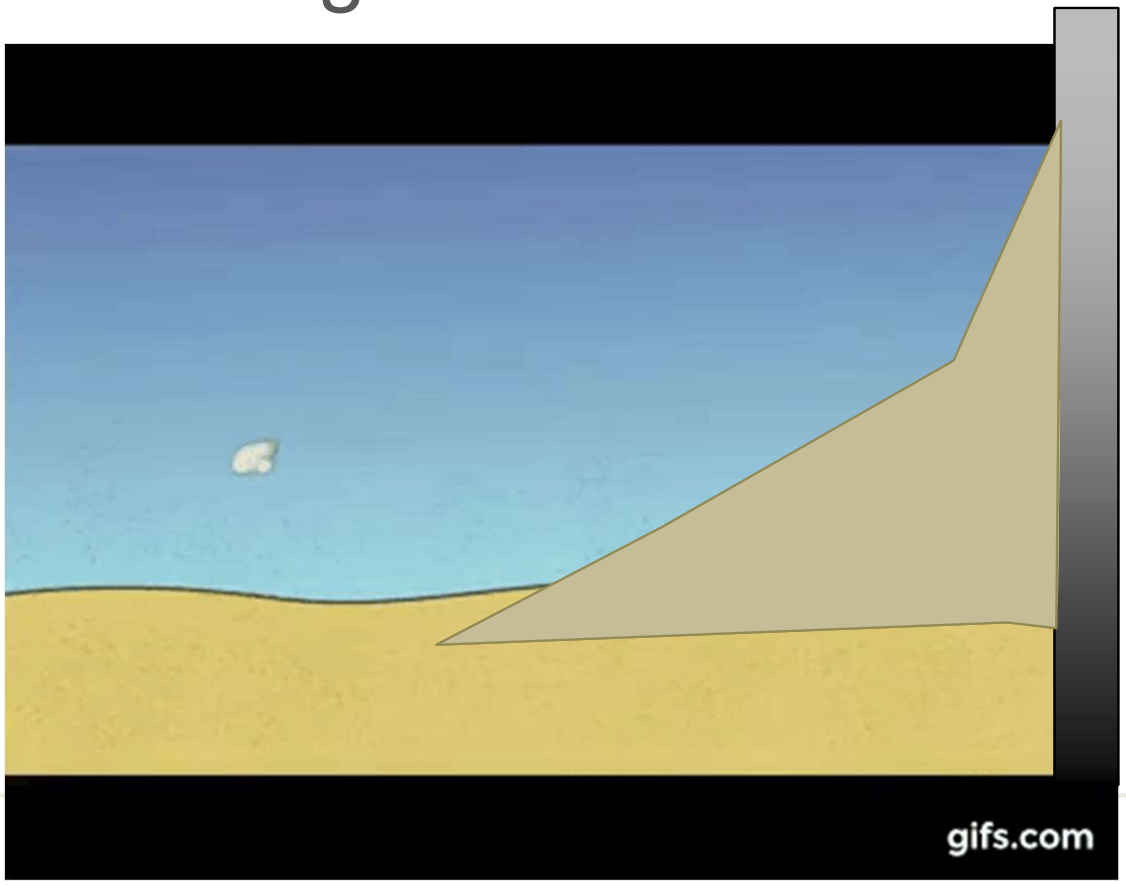
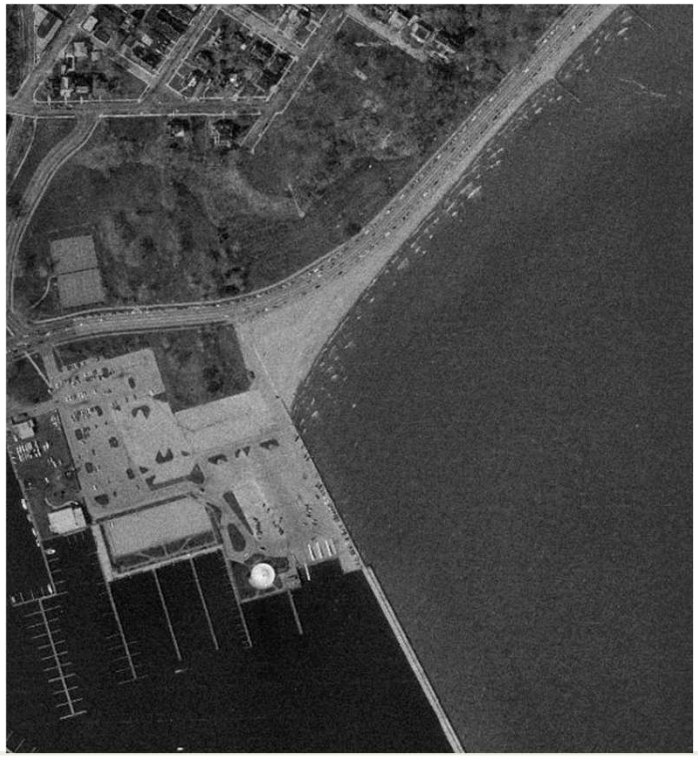
Review of Existing & Historic Data

- McKinley Beach began to form in 1937 when the construction of Government Pier interrupted the “Longshore Currents” which carry sand along the coast.



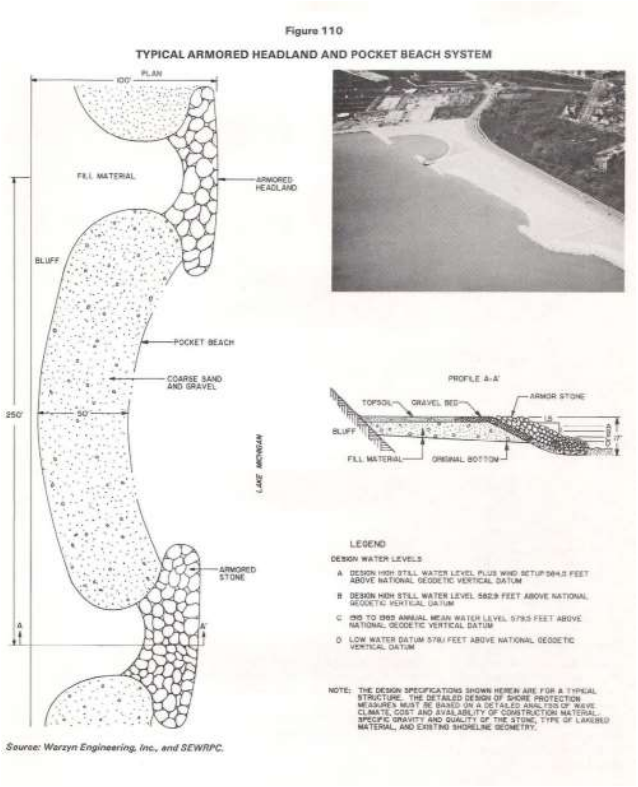
Review of Existing & Historic Data

- McKinley Beach began to form in 1937 when the construction of Government Pier interrupted the “Longshore Currents” which carry sand along the coast.



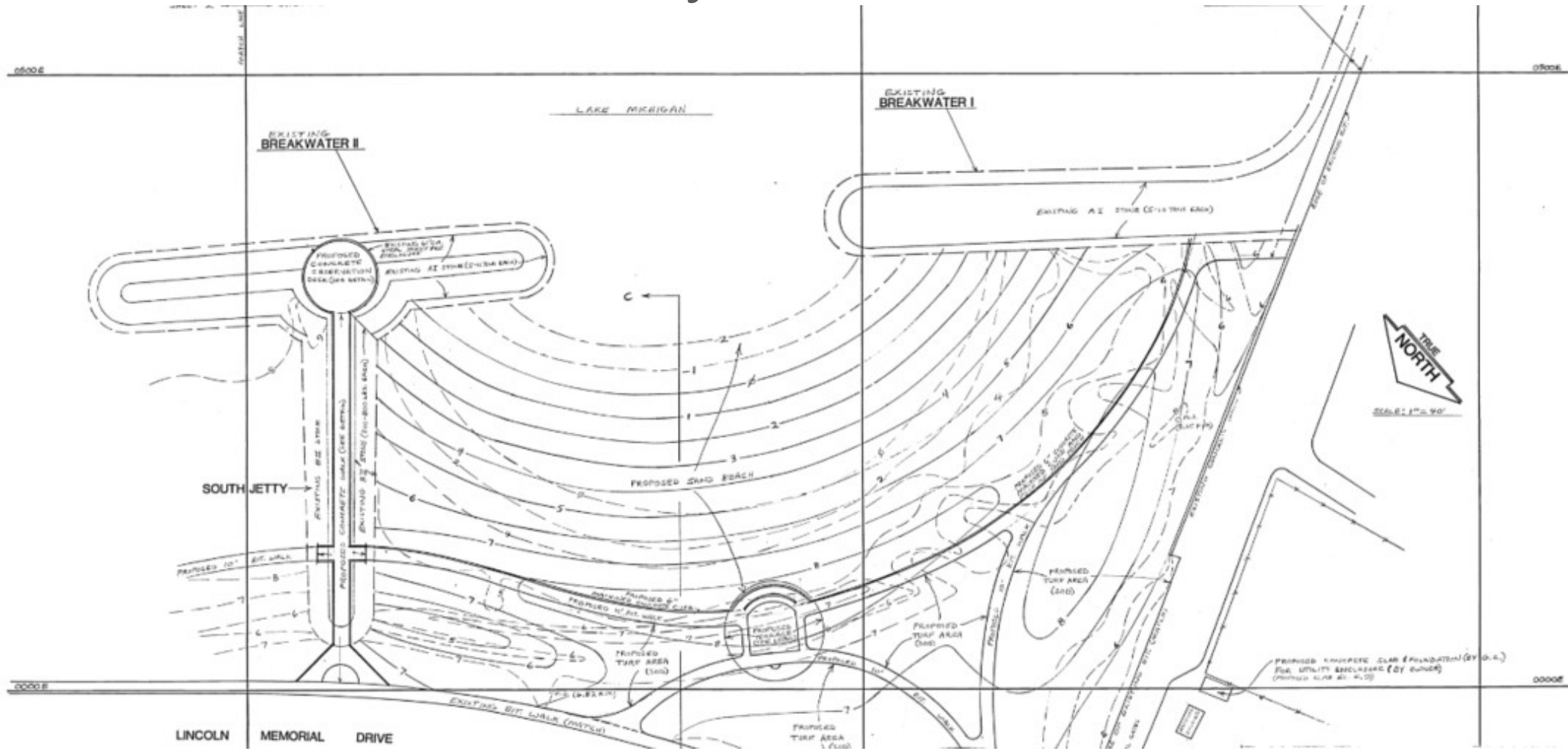
Review of Existing & Historic Data

- SEWRPC Guidance Contemporary to Construction



Review of Existing & Historic Data

- Plans for McKinley



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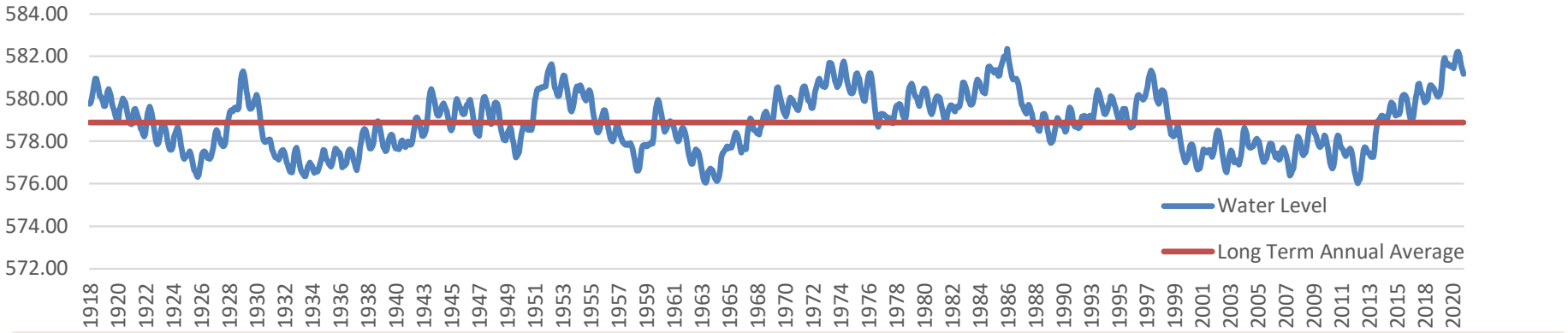
Review of Existing & Historic Data

- Historic Water & Waves

Top Ten Mean Monthly Water Levels Since 1918		
Year	Month	Water Level
1986	October	582.35'
2020	July	582.22'
2020	June	582.19'
2020	August	582.09'
1986	July	581.99'
1986	August	581.99'
1986	September	581.96'
1986	November	581.96'
2020	May	581.96'
2019	July	581.92'



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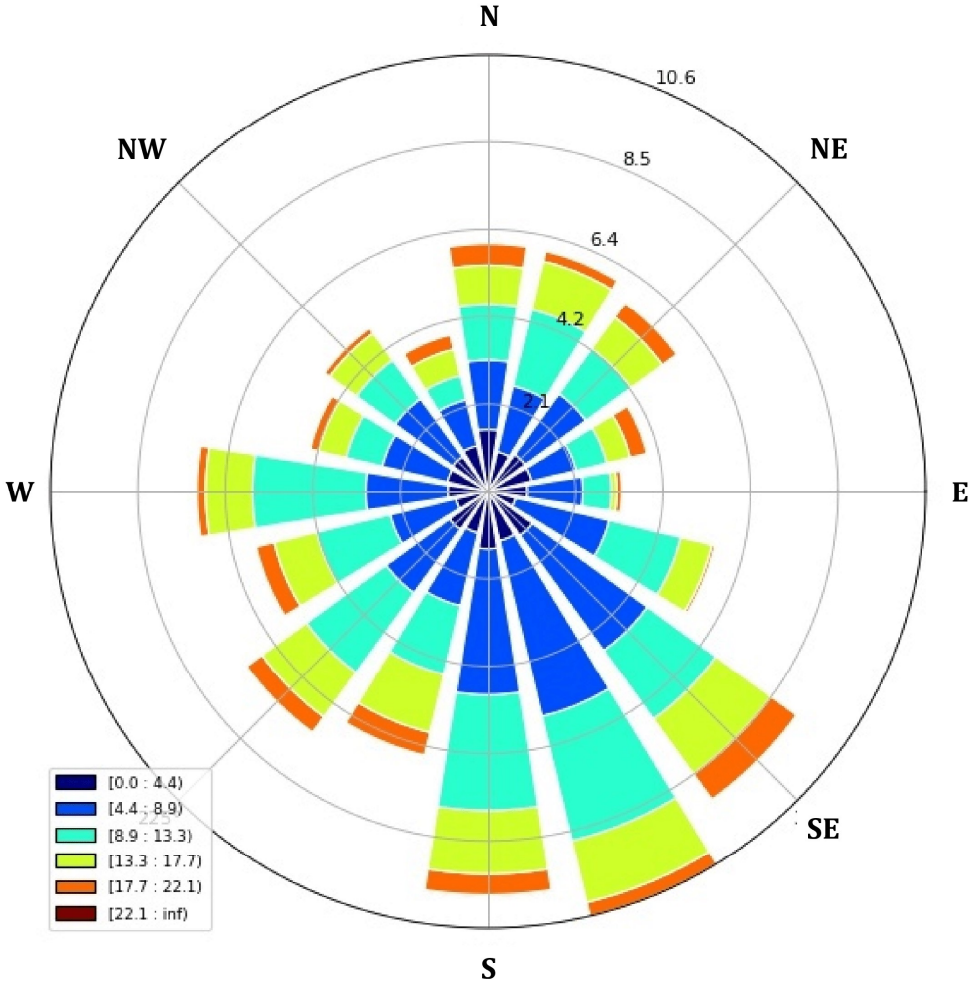
Review of Existing & Historic Data

- Historic Wind



May 27 – Oct. 28
2020 Wind
at
Atwater Beach

NOAA Buoy #45013

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Review of Existing & Historic Data

- 2020 Incidents

Date	Time	Peak Wind Speed (mph)	Wind Directional Range (degrees nautical)	Wave Height (feet)
3-Jun-20	Before 7:00 AM	16	180-360	2
18-Jul-20	Before 8:30 PM	23	130-210	2
8-Aug-20	Before 6:30 PM	17	130-210	2

- Identification of Trends
  - Wind Direction
  - Wave Magnitude
  - Incident Location

    >>>Use observed trends to direct field & modeling.

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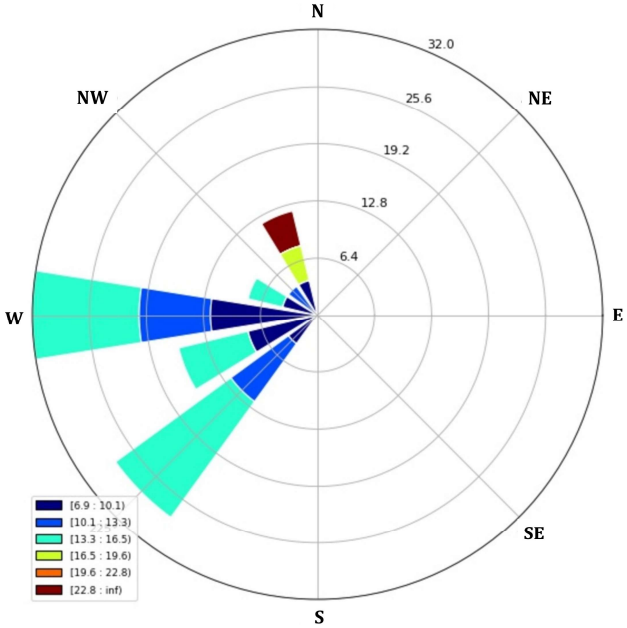
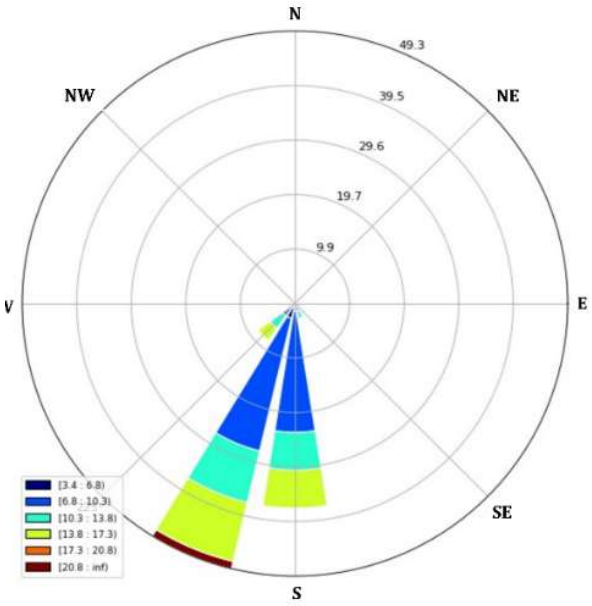
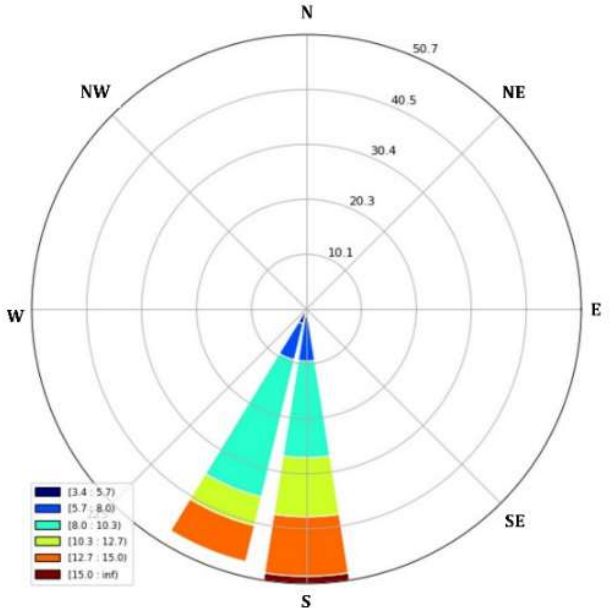
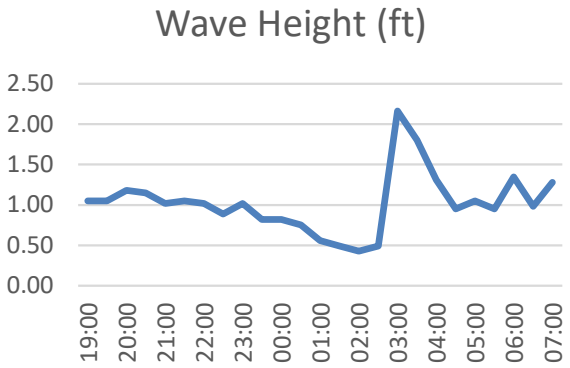
Review of Existing & Historic Data

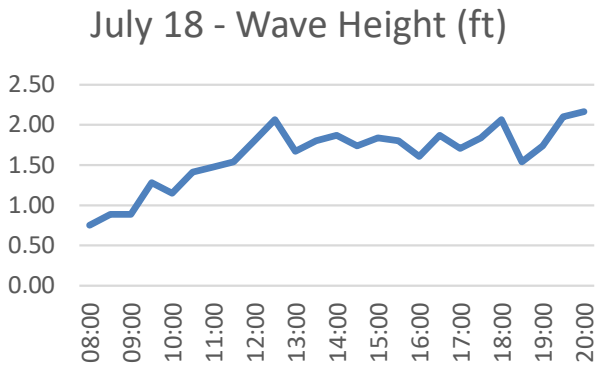
- June 3, July 18 and August 8 Incidents

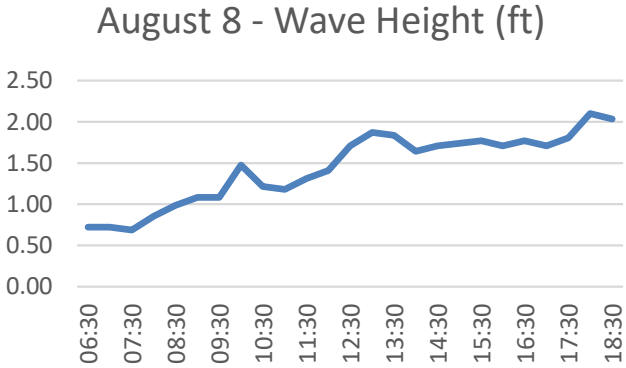












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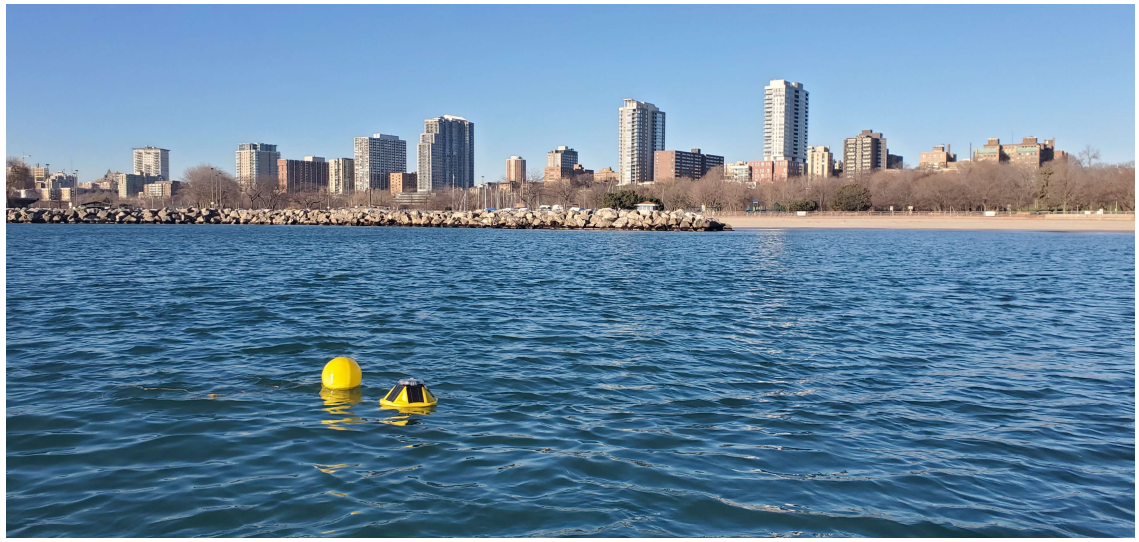
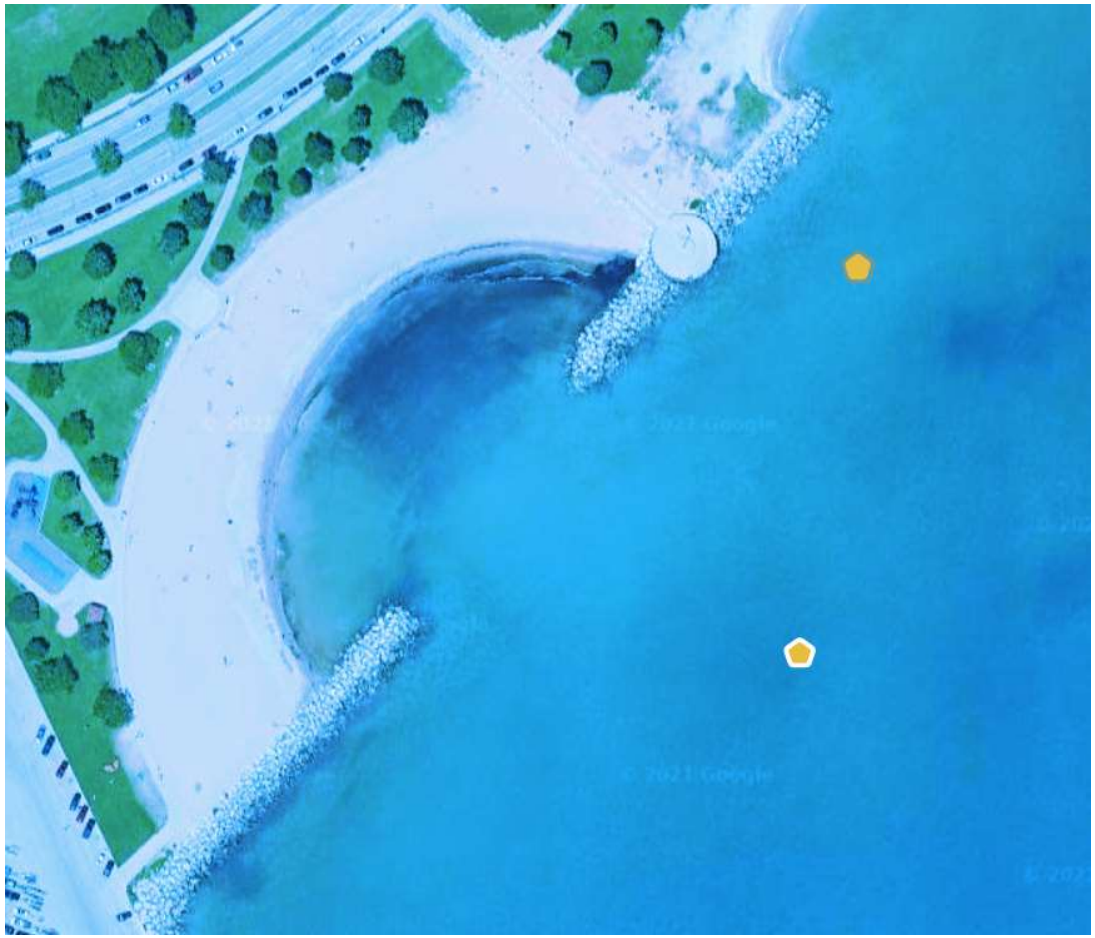
Field Data Collection

- Wave Buoy
  - RealTime & Logged Data
  - Wave
    - Frequency
    - Magnitude
    - Period
    - Direction
  - Wind
    - Magnitude
    - Direction



Field Data Collection

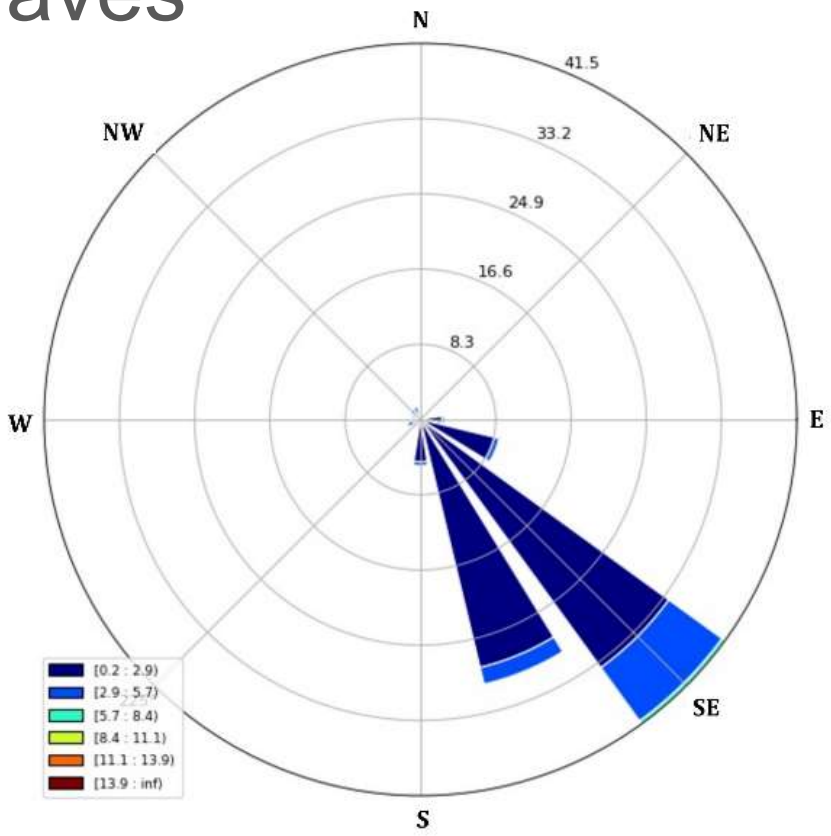
- SOFAR Spotter Buoy



Field Data Collection

- Spotter Buoy Data Waves

Buoy	Significant Wave Height
	(ft)
Minimum	0.16
Q1	0.52
Median	1.05
Q3	2.26
Maximum	14.30
Average	1.59

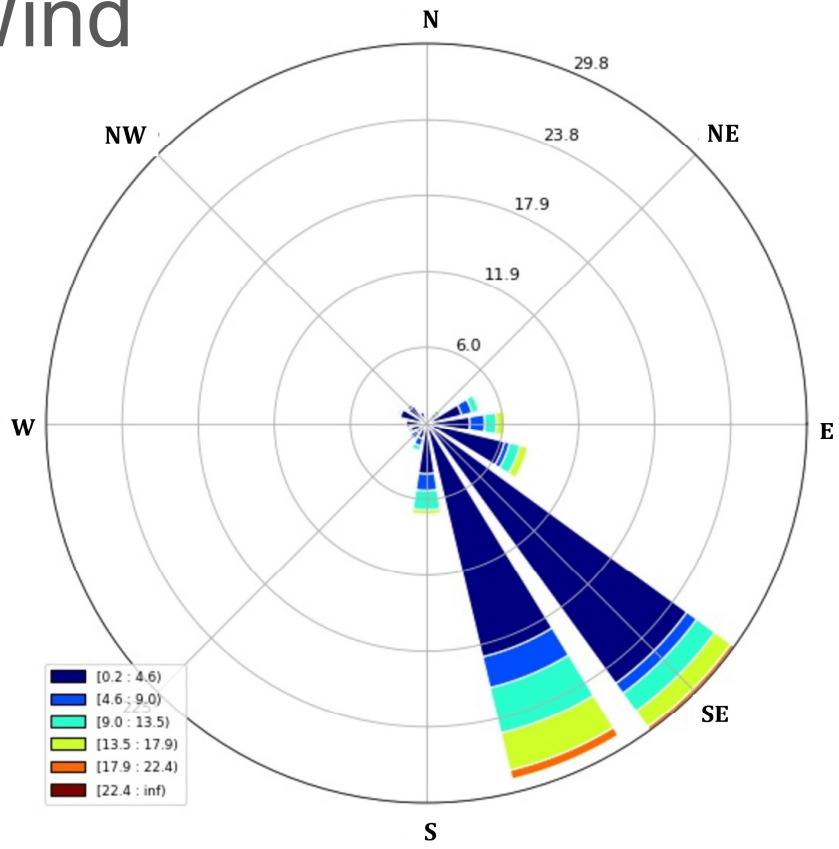


Buoy Wave Rose

Field Data Collection

- Spotter Buoy Data Wind

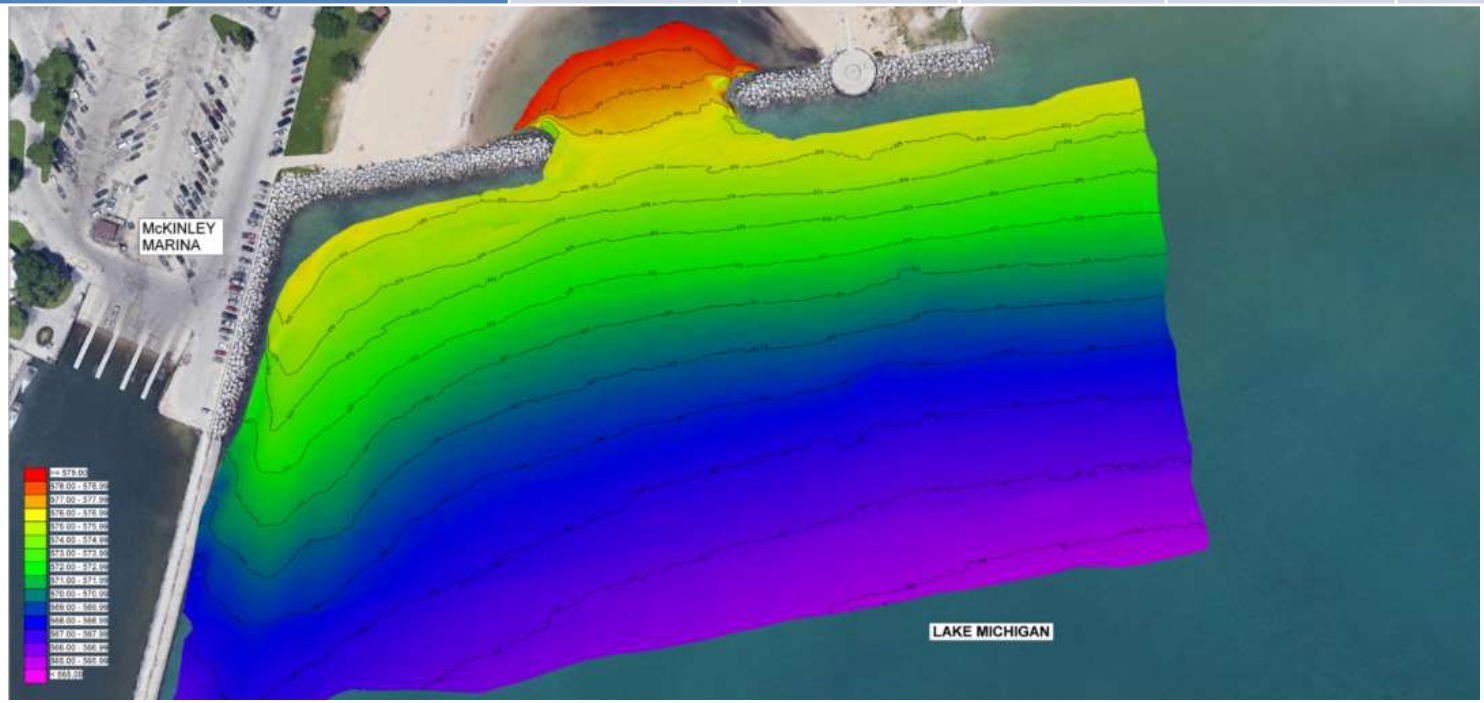
Buoy	Wind
	(mph)
Minimum	0.16
Q1	0.85
Median	1.79
Q3	6.26
Maximum	22.37
Average	4.29



Buoy Wind Rose

Field Data Collection

Water Depths at Bathymetric Survey Extents & Critical Points					
	March 1989	June 2020	July 2020	August 2020	January 2022
Mean Water Elevation:	578.5'	582.2'	582.2'	582.1'	579.6'
High Contour (578') Depth:	0.5'	4.2'	4.2'	4.1'	1.6'
Between Breakwater Contour (576') Depth:	2.5'	6.2'	6.2'	6.1'	3.6'
Low Contour (566') Depth:	12.5'	16.2'	16.2'	16.1'	13.6'



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Field Data Collection

- Dye Testing & Observation
- Meteorological Data and Spotter Buoy data used to identify key timeframes for experimentation
- Fluorescent Red, Bio-degradable dye
- Four tests, each with common results that were replicated by hydrodynamic modeling. *(2 Shown)*

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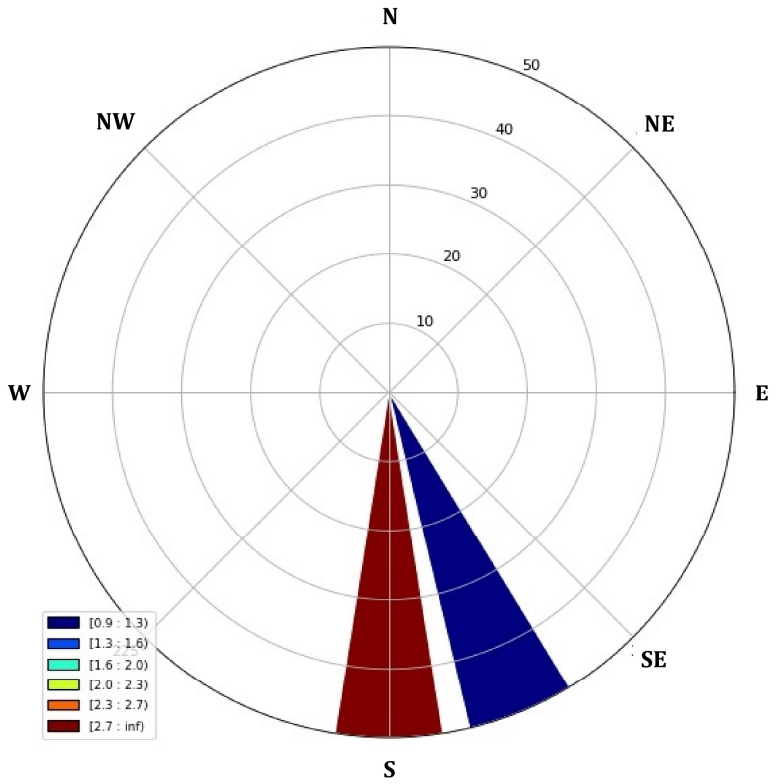
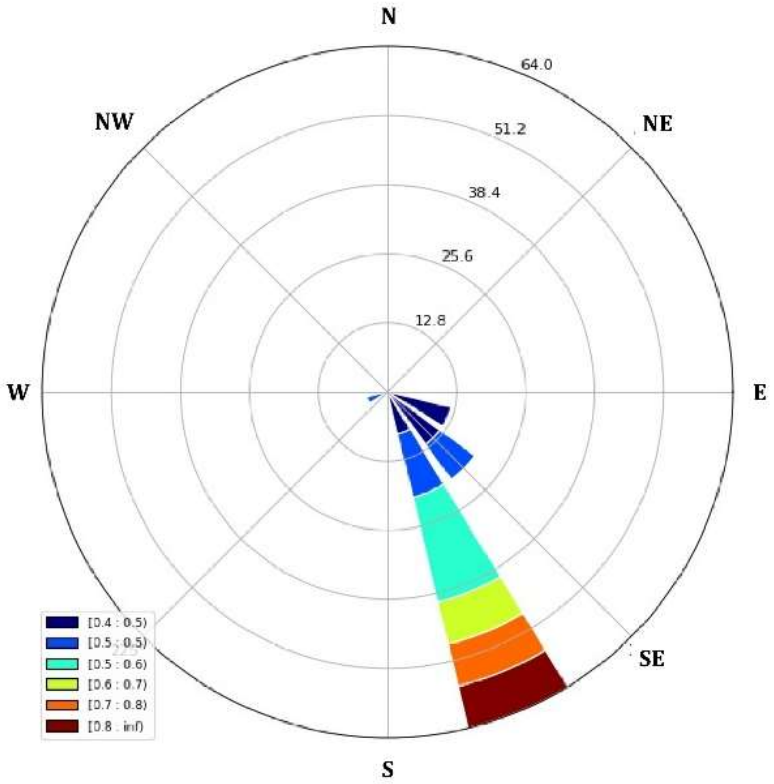
Field Data Collection

- Dye Test #2 - December 17, 2021 – 10:00 AM

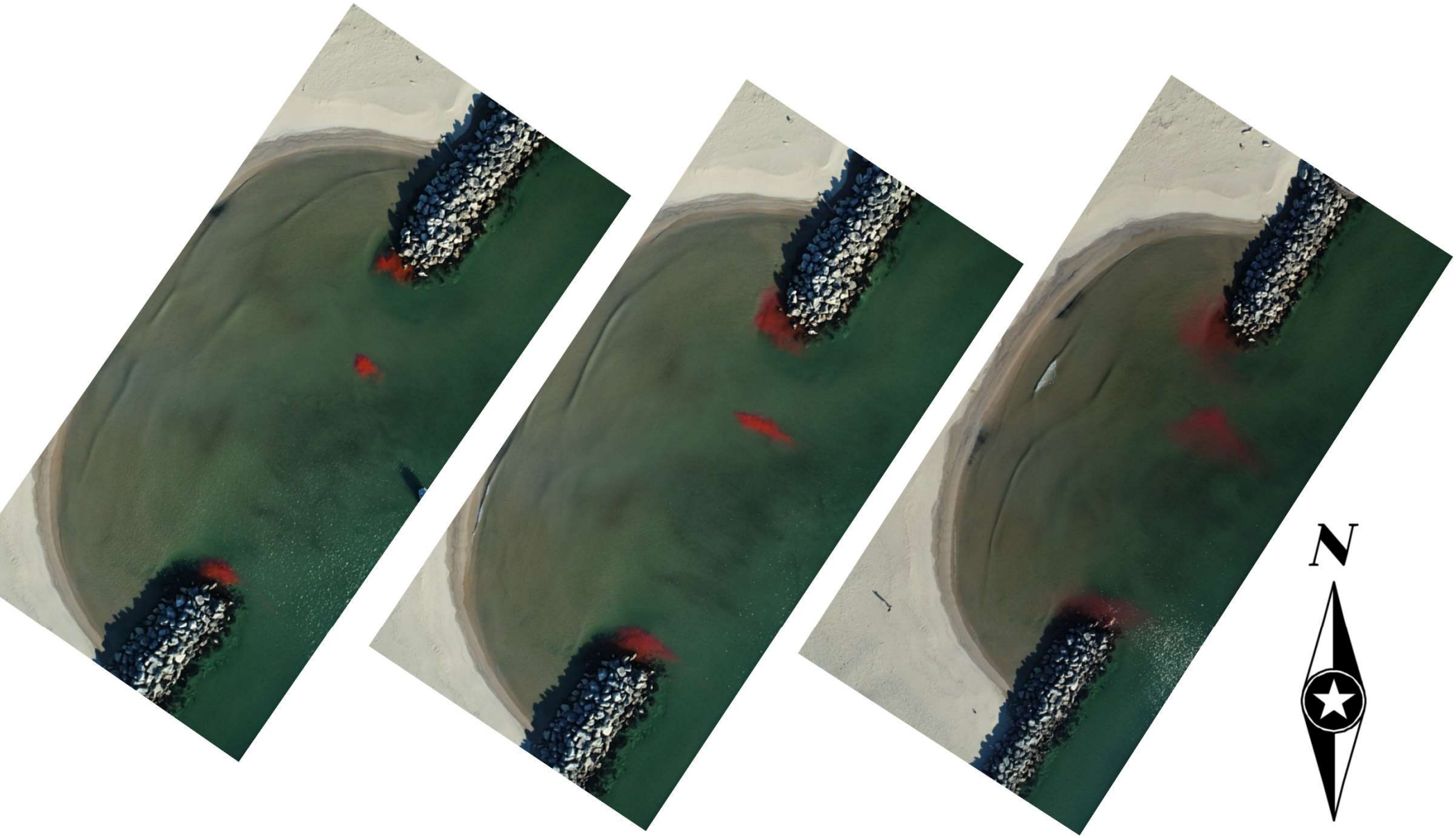


Wind Data 12 Hour Lead-up (Spotter Buoy)



Wave Data 12 Hour Lead-up (Spotter Buoy)

Field Data Collection



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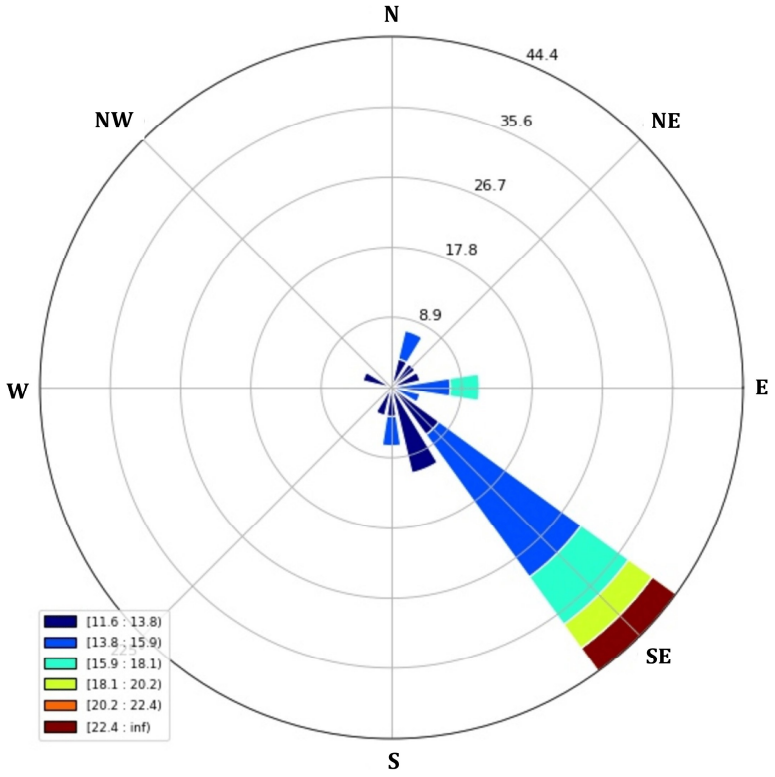
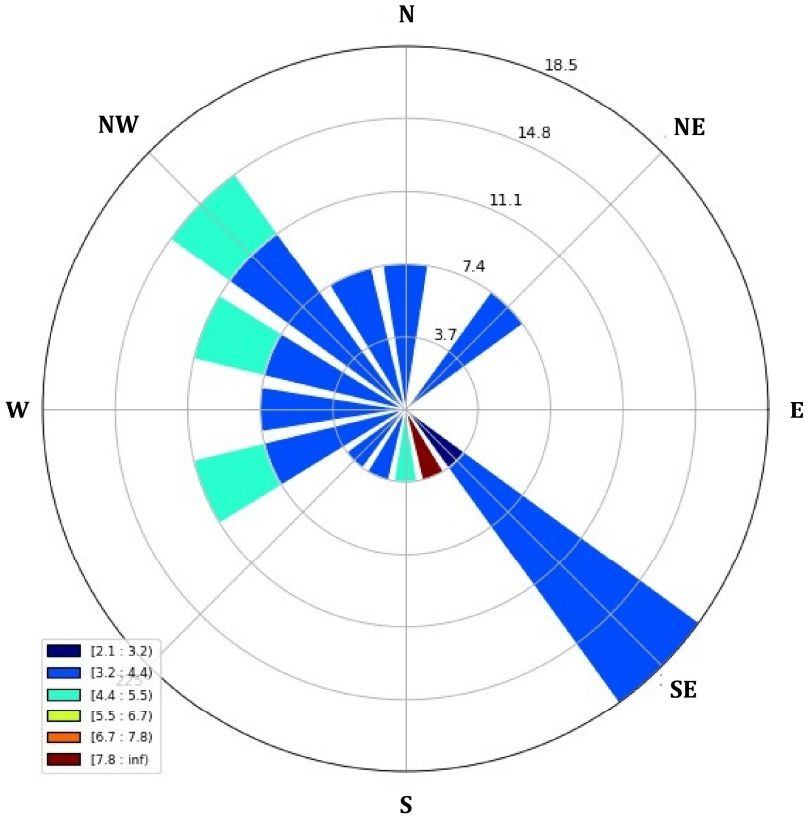
Field Data Collection

- Dye Test #3 - December 27. 2021 – 10:00 AM



Wind Data 12 Hour Lead-up (Spotter Buoy)



Wave Data 12 Hour Lead-up (Spotter Buoy)

Field Data Collection

The dye front is moving from Southest to Northeast at a speed of approximately 1.76 ft/s.

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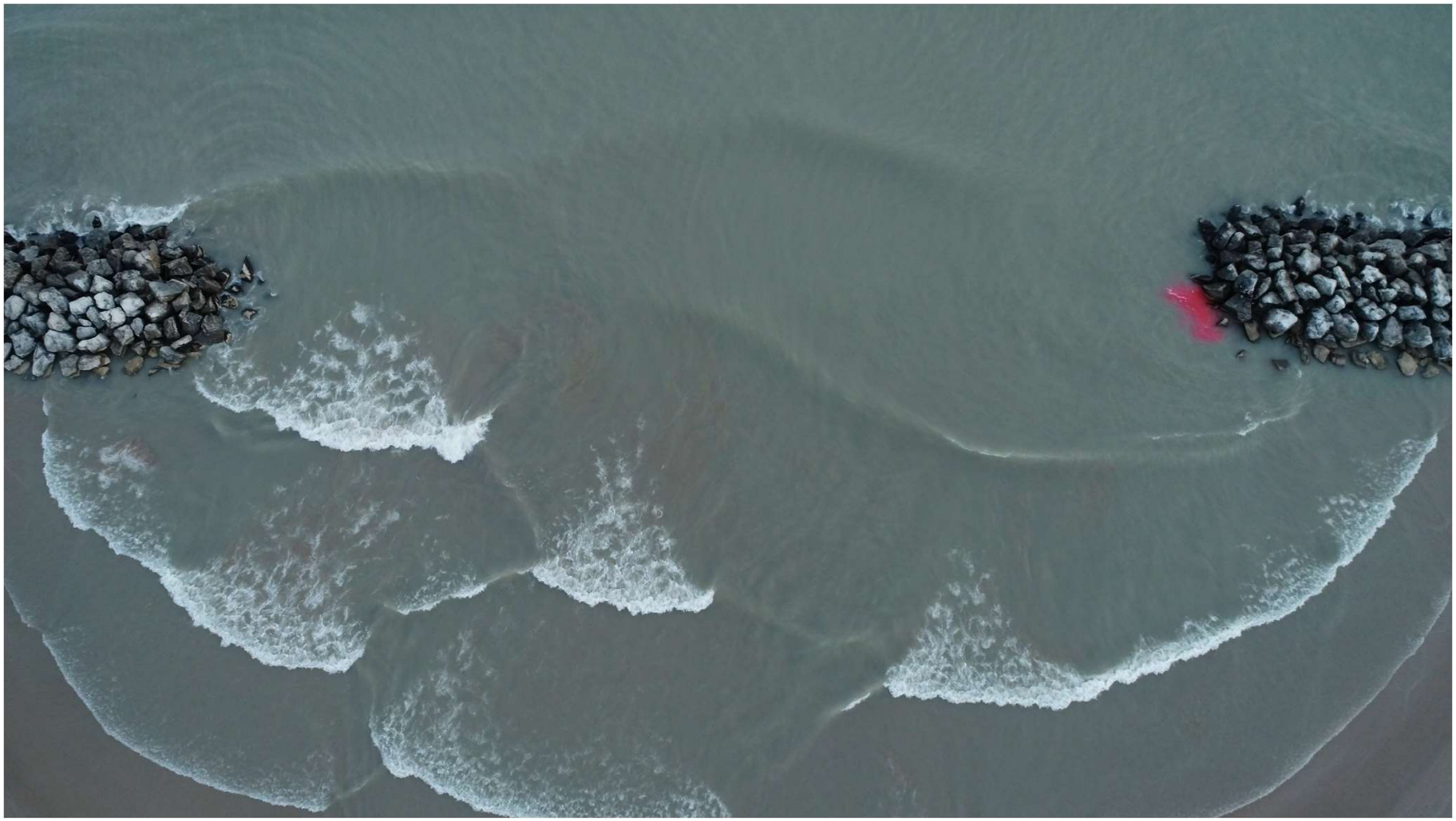
Field Data Collection



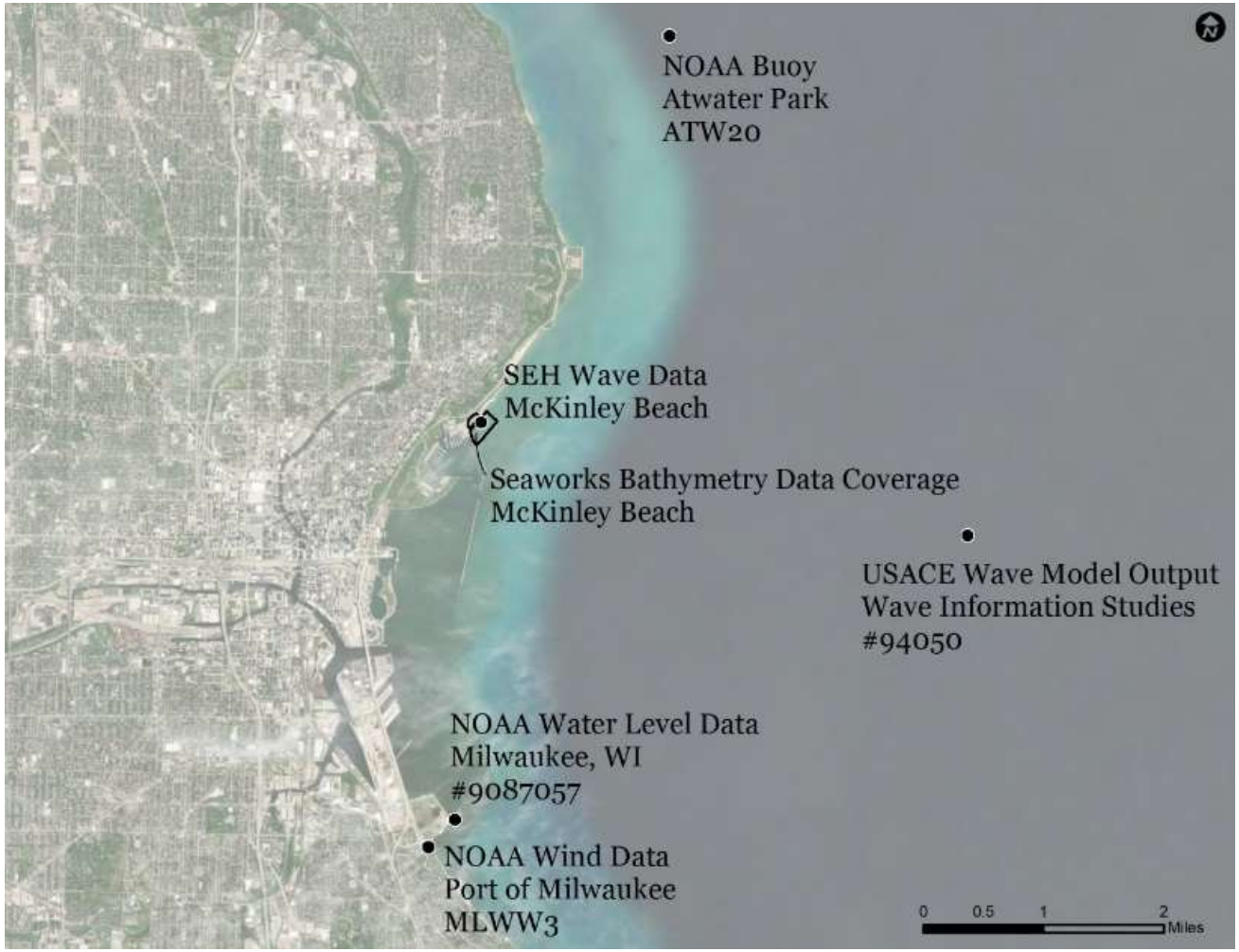
Field Data Collection

- Wave Reflection and Superimposition

Field Data Collection

- Beach Condition & Mechanics
  - Erosion
  - Stagnant Water

Hydrodynamic Analysis



Key Observed Data Locations Supporting the Wave Model

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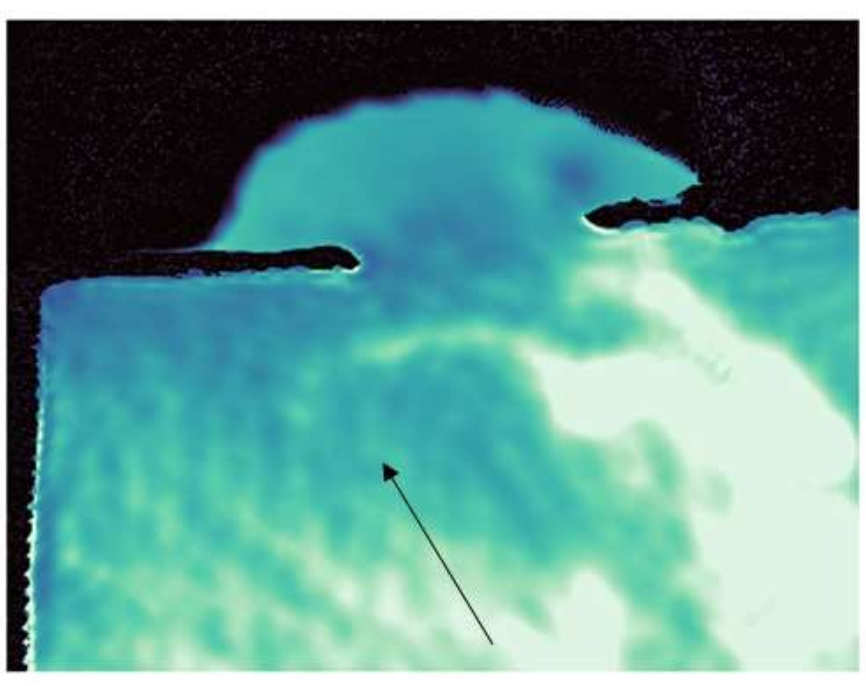
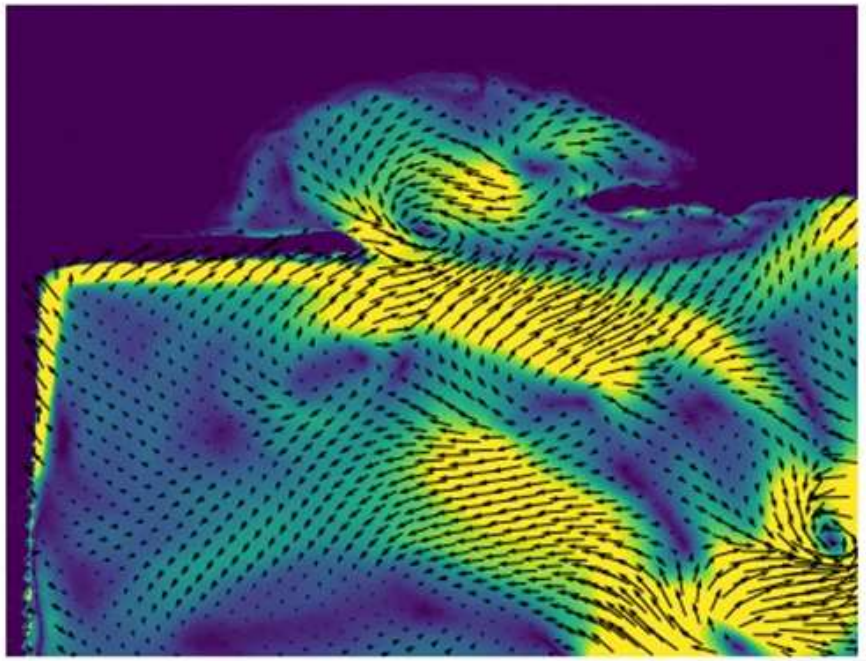
Hydrodynamic Analysis

Significant Wave Height (ft)



Current Speed (ft/s)



Simulated Wave Heights and Current Speeds, 2-foot Waves, 100-deg direction (out of east-southeast) as indicated by the black arrow

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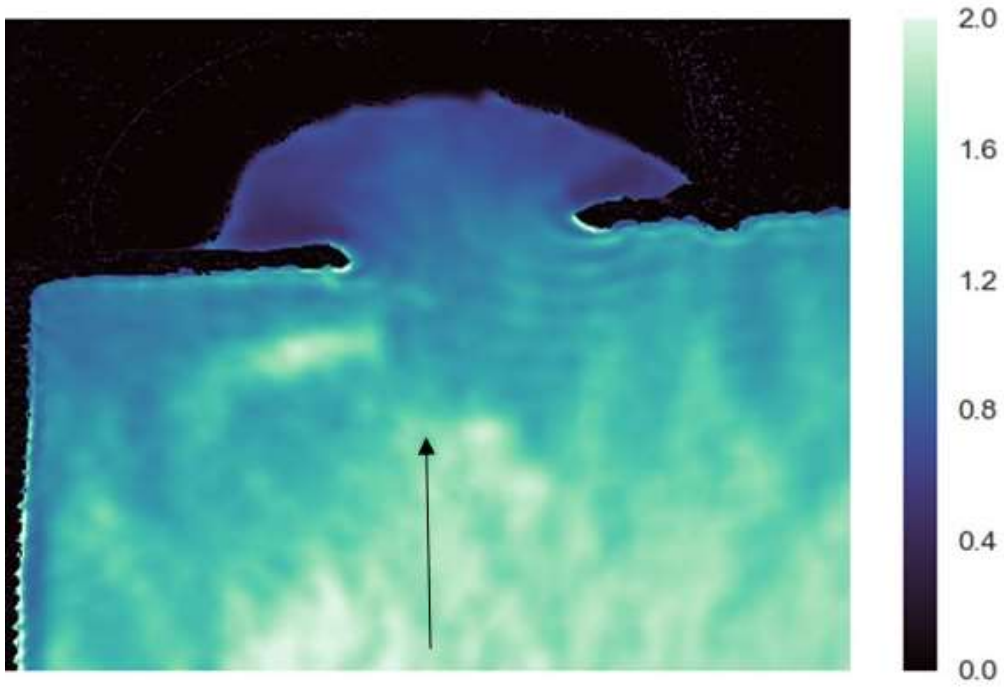
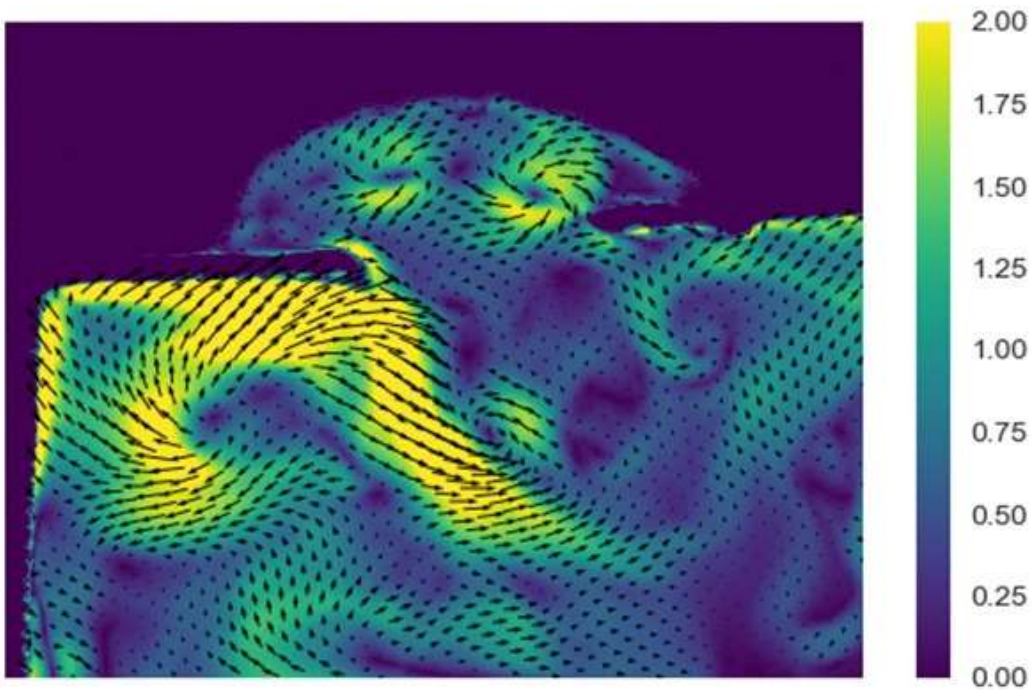
Hydrodynamic Analysis

Significant Wave Height (ft)



Current Speed (ft/s)



Simulated Wave Heights and Current Speeds, 2-foot Waves, 130-deg direction (out of southeast) as indicated by the black arrow

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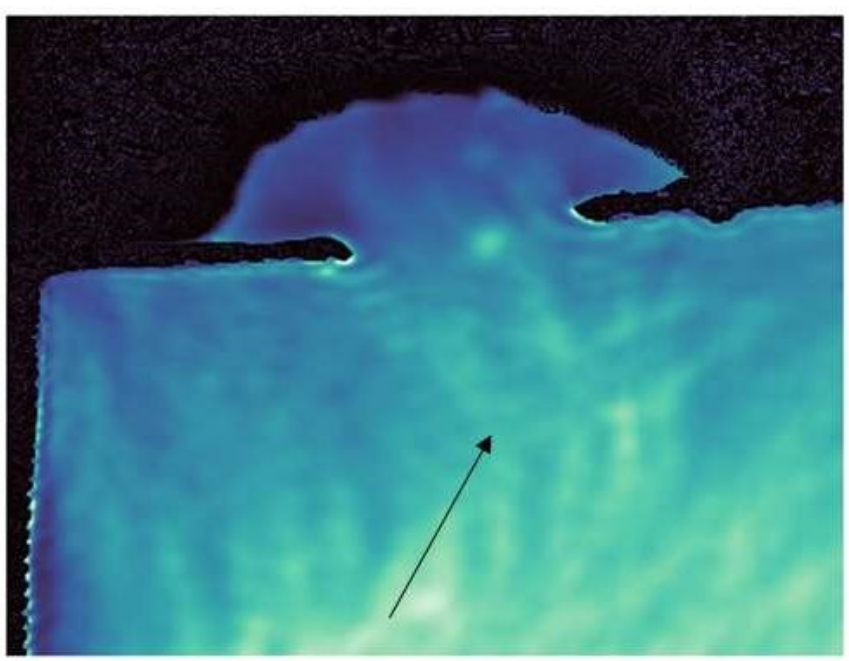
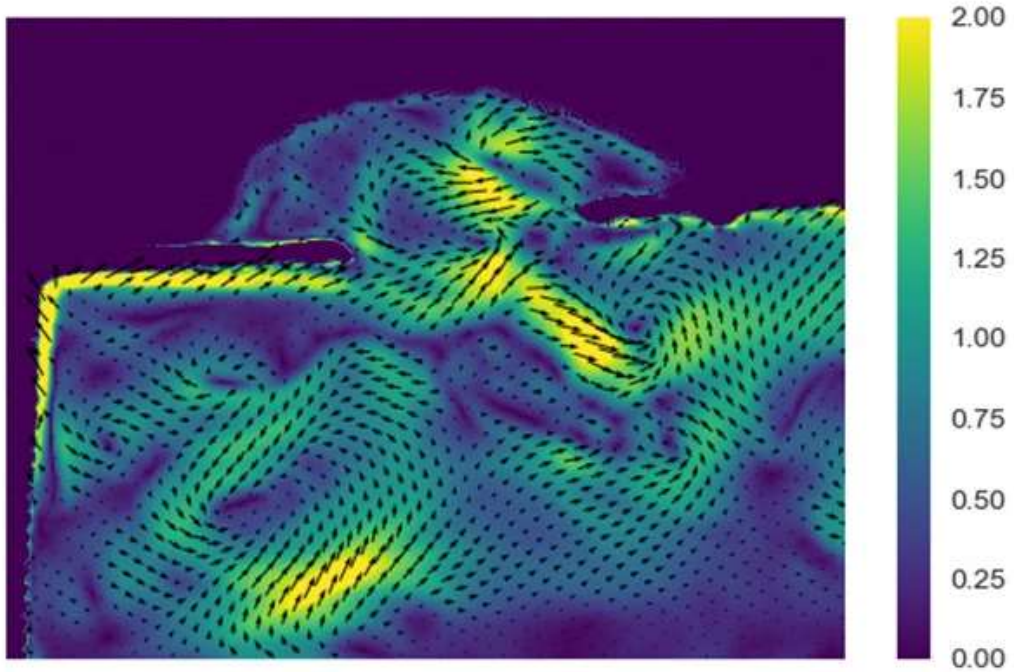
Hydrodynamic Analysis

Significant Wave Height (ft)



Current Speed (ft/s)



Simulated Wave Heights and Current Speeds, 2-foot Waves, 160-deg direction (out of south-southeast) as indicated by the black arrow

(Most representative of July 18)

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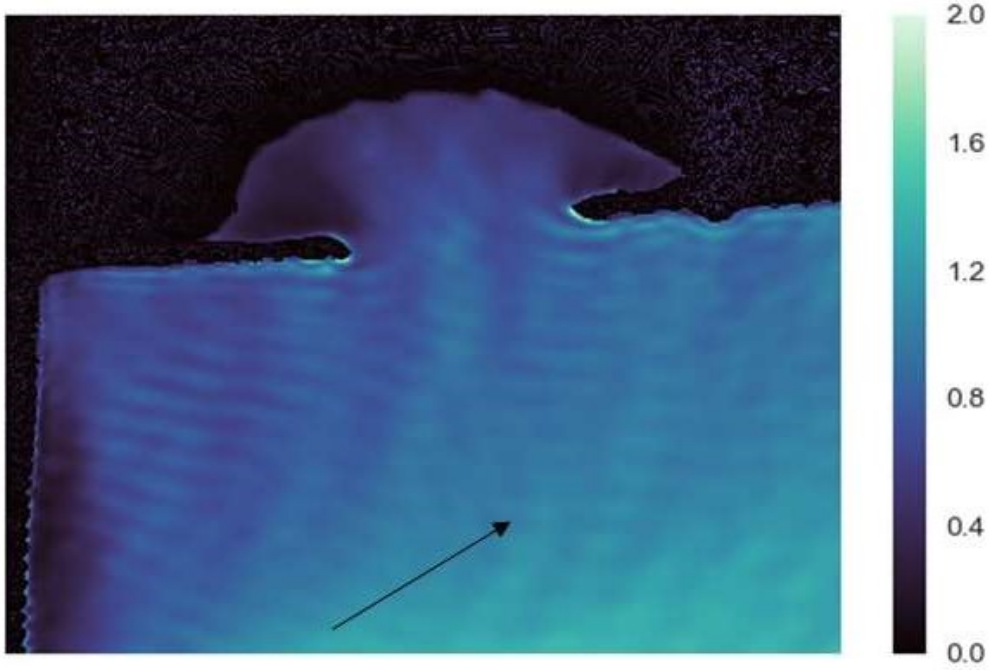
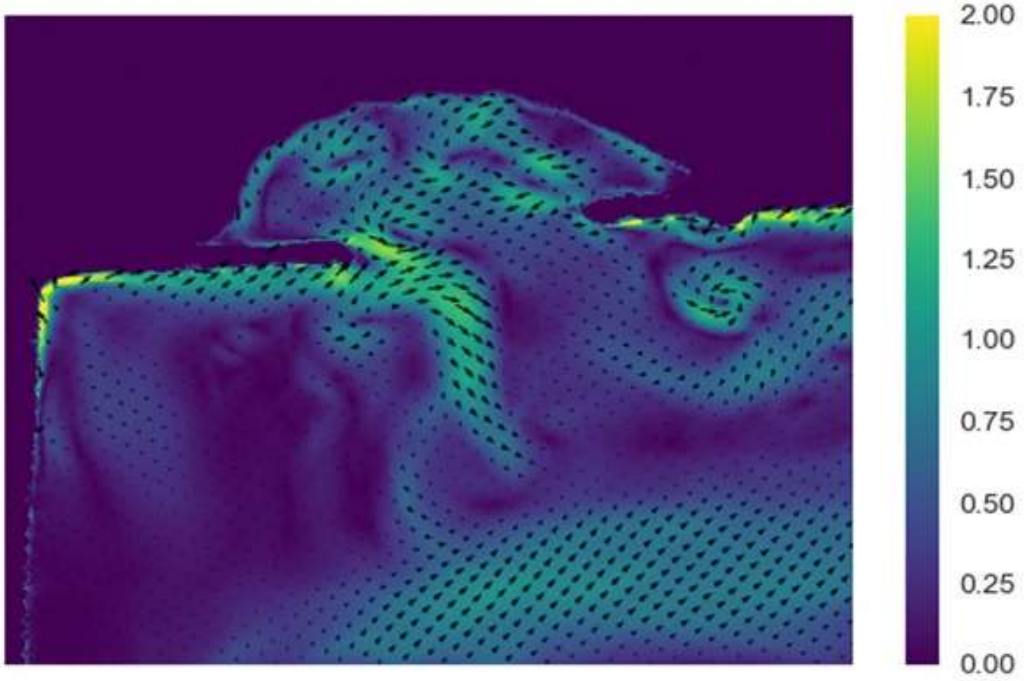
Hydrodynamic Analysis

Significant Wave Height (ft)



Current Speed (ft/s)



Simulated Wave Heights and Current Speeds, 2-foot Waves, 190-deg direction (out of south) as indicated by the black arrow

(Most representative of June 3)

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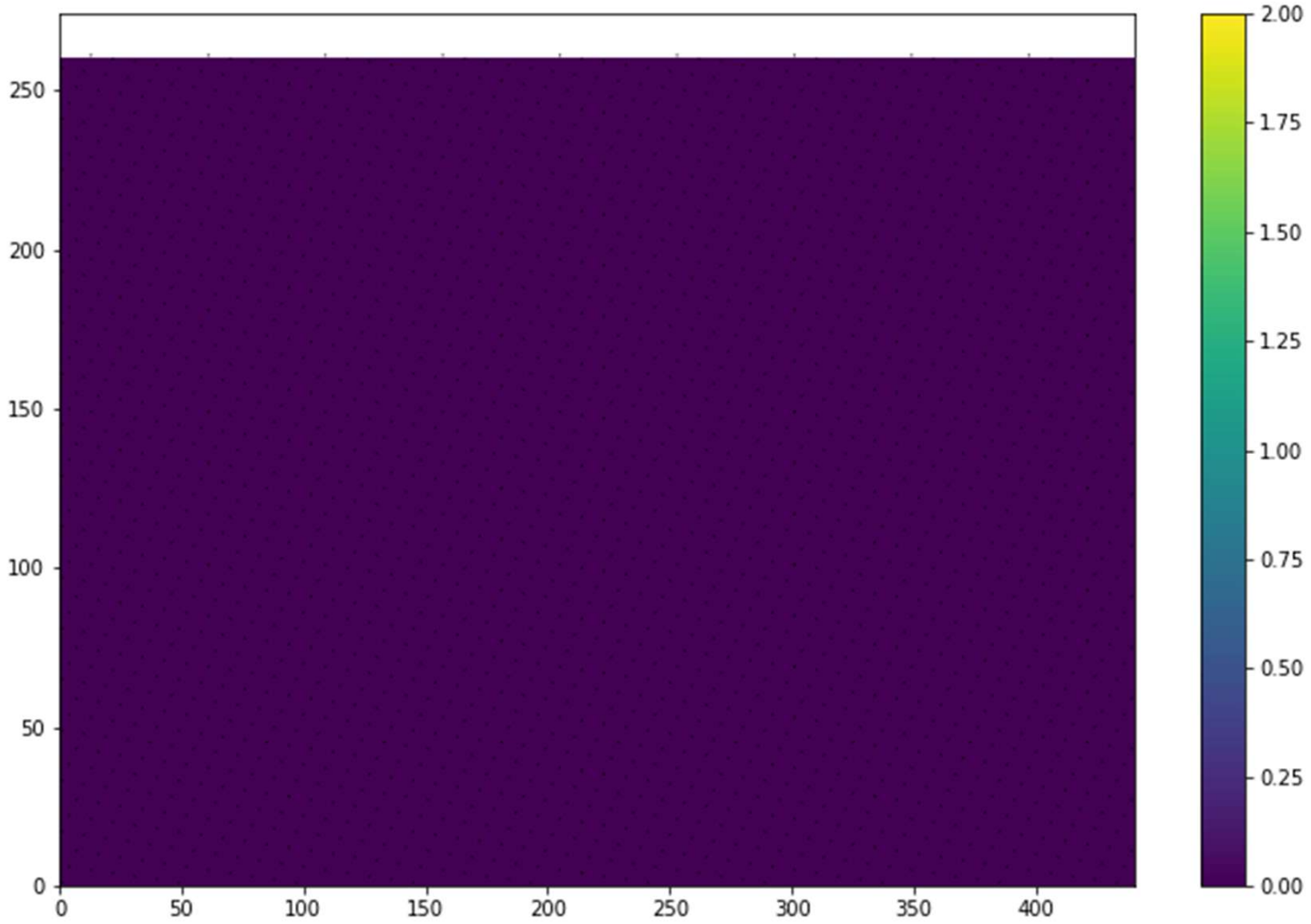
Hydrodynamic Analysis



18 Minute Simulation from Zero Wave Condition to Steady Wave Condition

Simple Representaiton of July & August Events

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Considerations

- Viability, Feasibility & Preferability
- Impacts
  - Existing Infrastructure
    - LMD
    - Jetty With Flagpole
    - McKinley Walks & Playground
  - Use & Utilization
  - Swim Safety
  - Beach Sustainability
- Supplemental Funding & Initiatives

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Solutions

- Hard Solutions
  - Modifications to Breakwater
  - Submerged Stone Reef
  - Sandbar/Pebblebar
- Soft Solutions
  - Swim Warning System
  - Public Outreach & Education
  - Beach Closure
- Temporary Solutions
  - Buoy Rope Between Breakwaters

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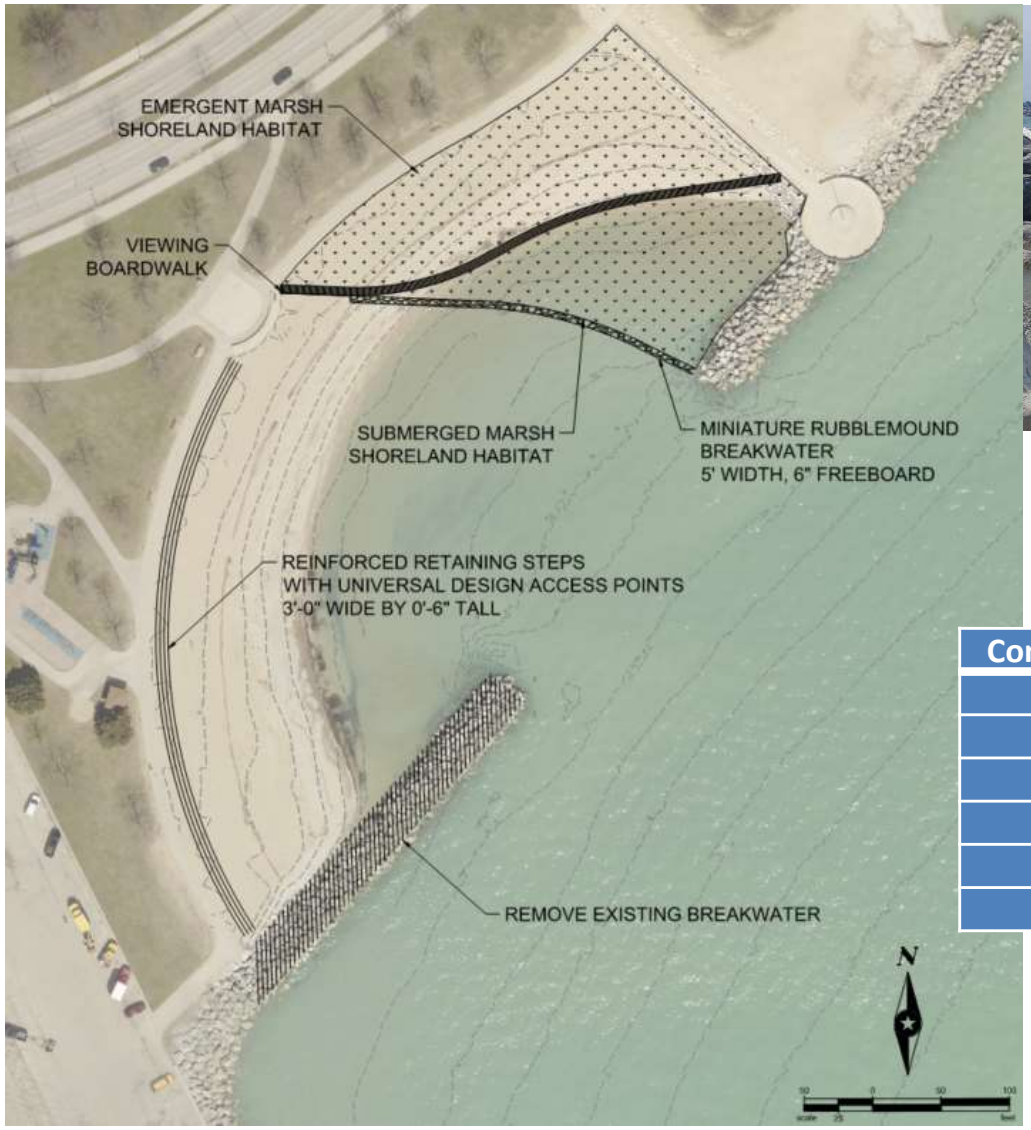
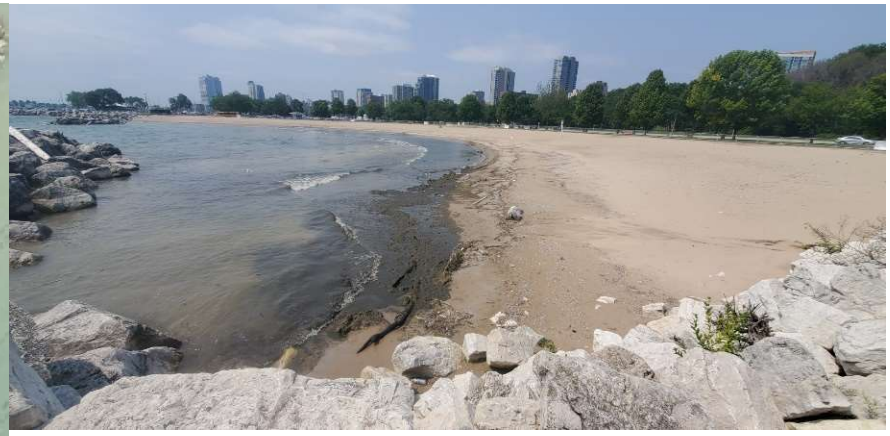
Concept 1 – Natural/Hard Hybrid





Concept 1 - Nature-Based Design / Hard Infrastructure Hybrid	
Miniature Rubblemound Breakwater	$400,000
Natural Areas Restoration	$130,000
Stepped Retaining Wall	$405,000
South Breakwater Removal	$200,000
Boardwalk	$170,000
Total:	$1,305,000

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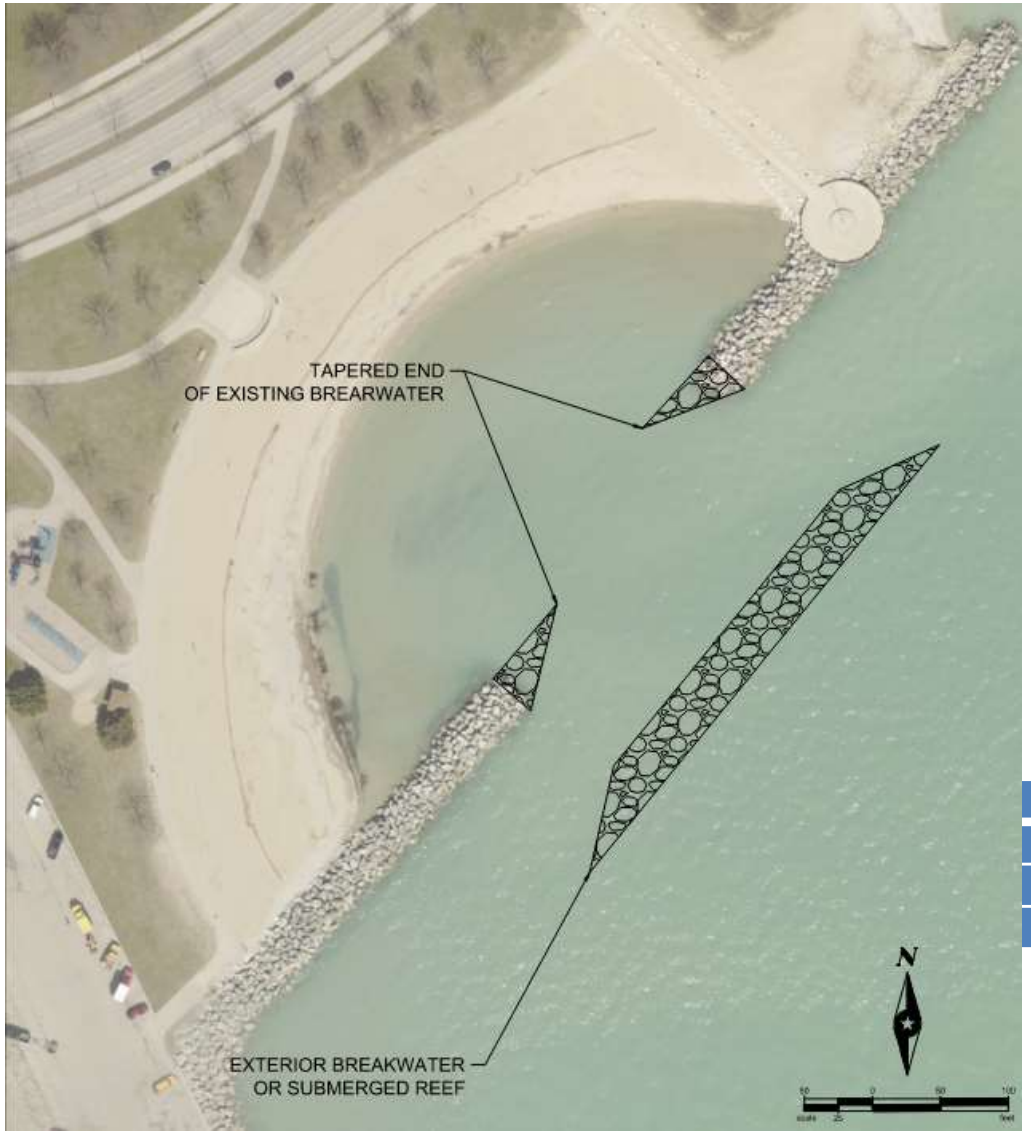
Concept 2 – Offshore Breakwater



Concept 2 - Offshore Breakwater & Modifications to Existing	
Offshore Breakwater	$2,200,000
Natural Areas Restoration	$1,500,000
Total:	$3,700,000

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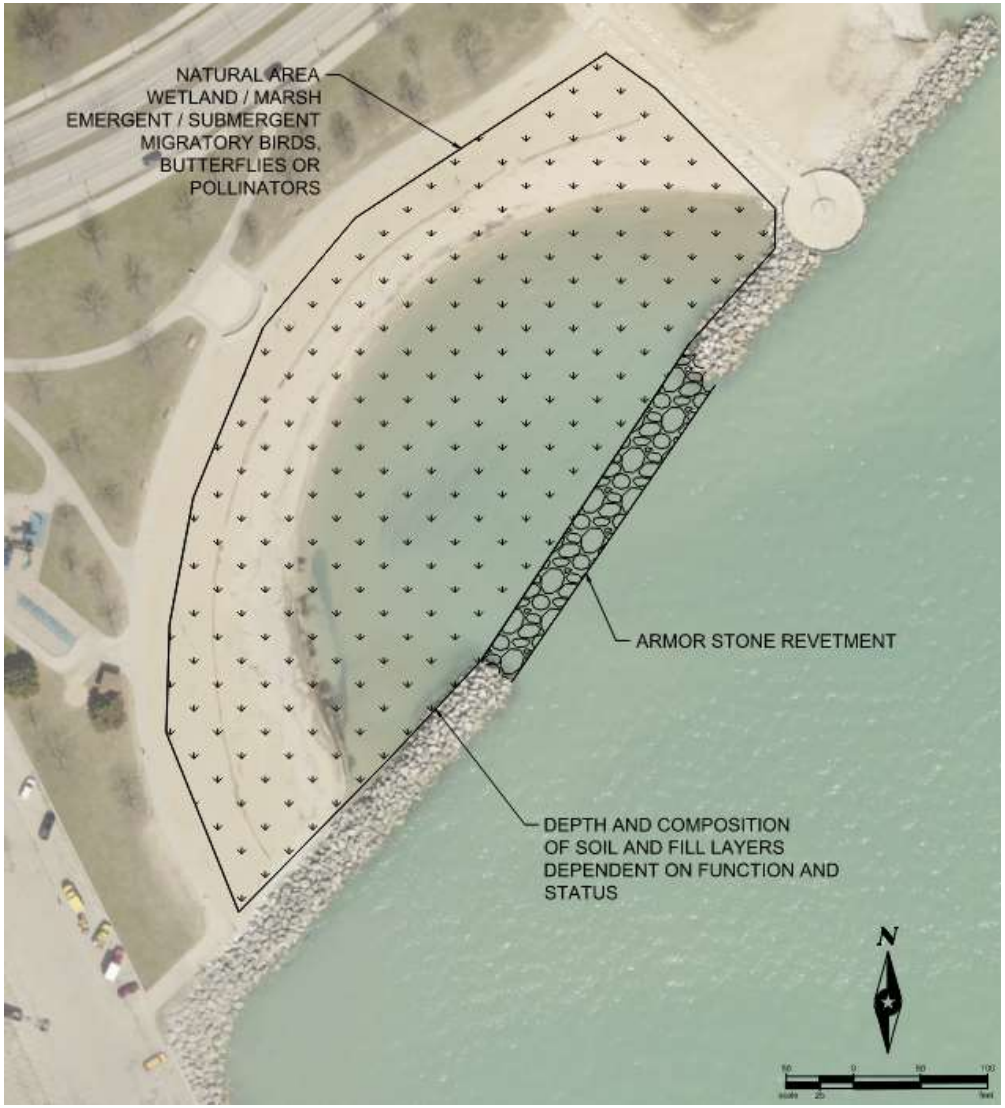
Concept 3 – Connected Breakwater



Concept 3 – Connected Breakwater and Natural Restoration	
Connected Breakwater	$1,900,000
Natural Areas Restoration	$210,000
Beach Fill	$200,000
Total:	$2,310,000

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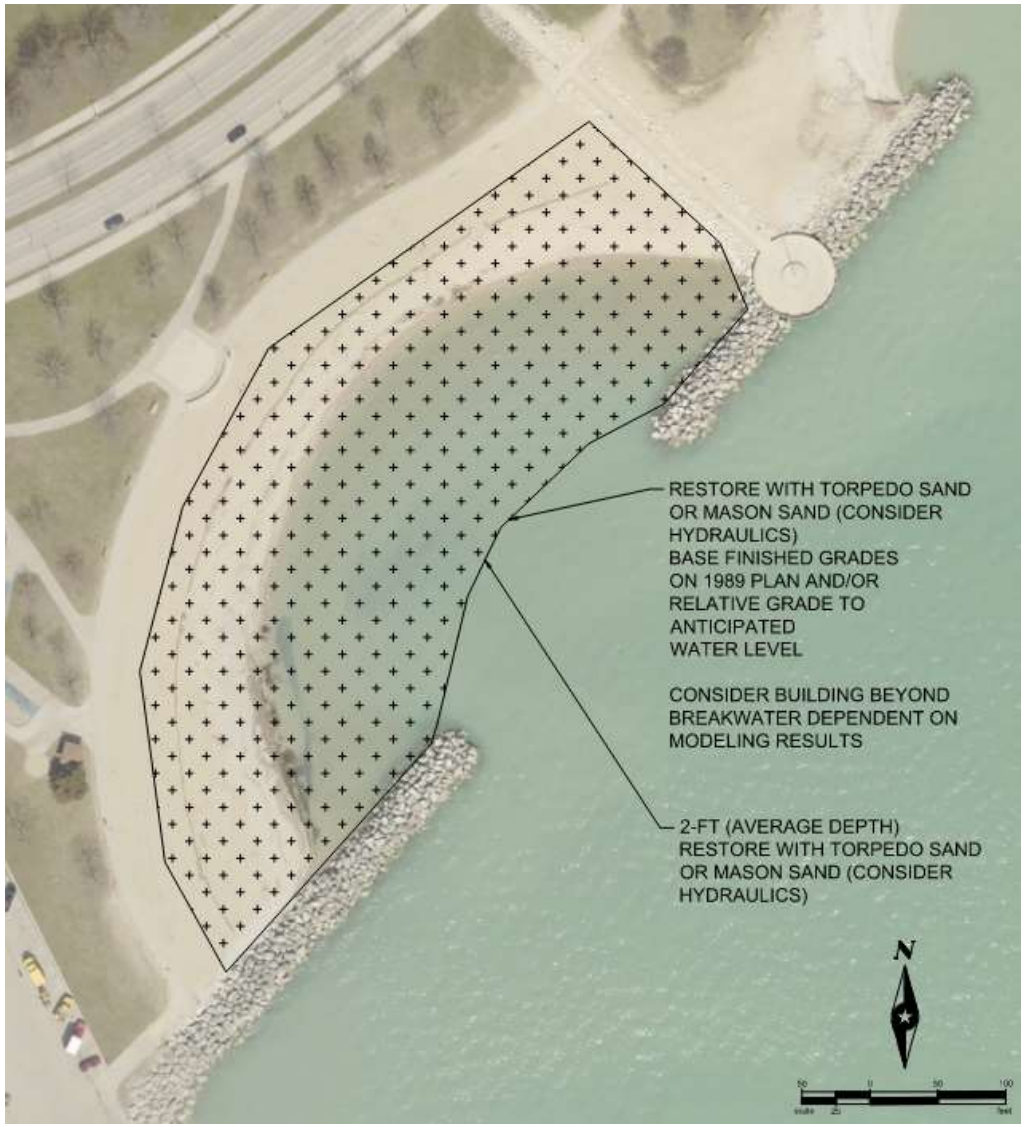
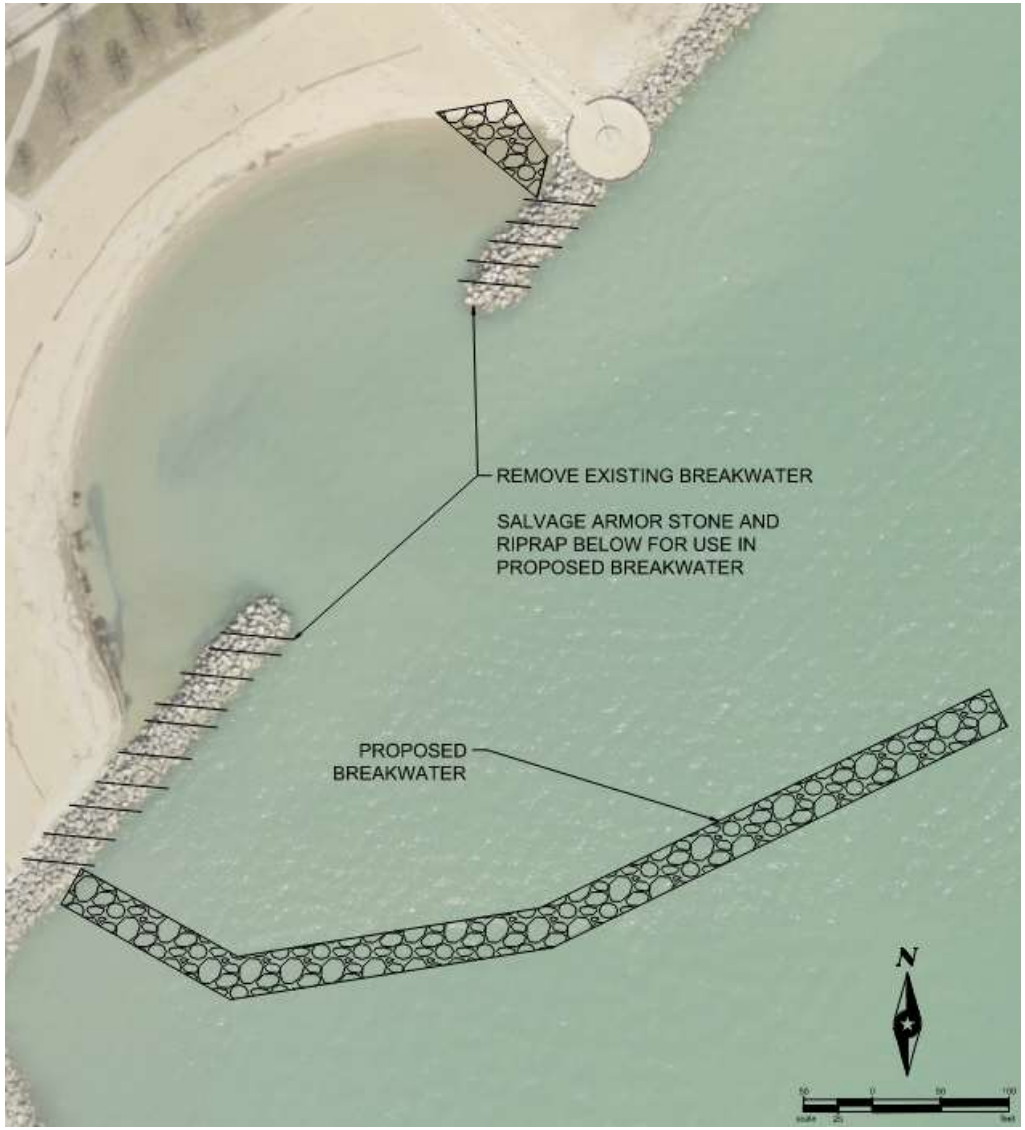
Concept 4 – Beach Restoration



Concept 4 - Beach Restoration to Intended Design	
Torpedo Sand Fill	$200,000
Structural Fill Scour Holes	$50,000
Total:	$250,000

Concept 5 – Breakwater Pool



LaJolla Children's Pool as Precedent

Concept 5 – Offshore Breakwater, Re-Orient Opening	
Remove Existing Breakwater	$760,000
Construct New Breakwater	$4,140,000
Total:	$4,900,000

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