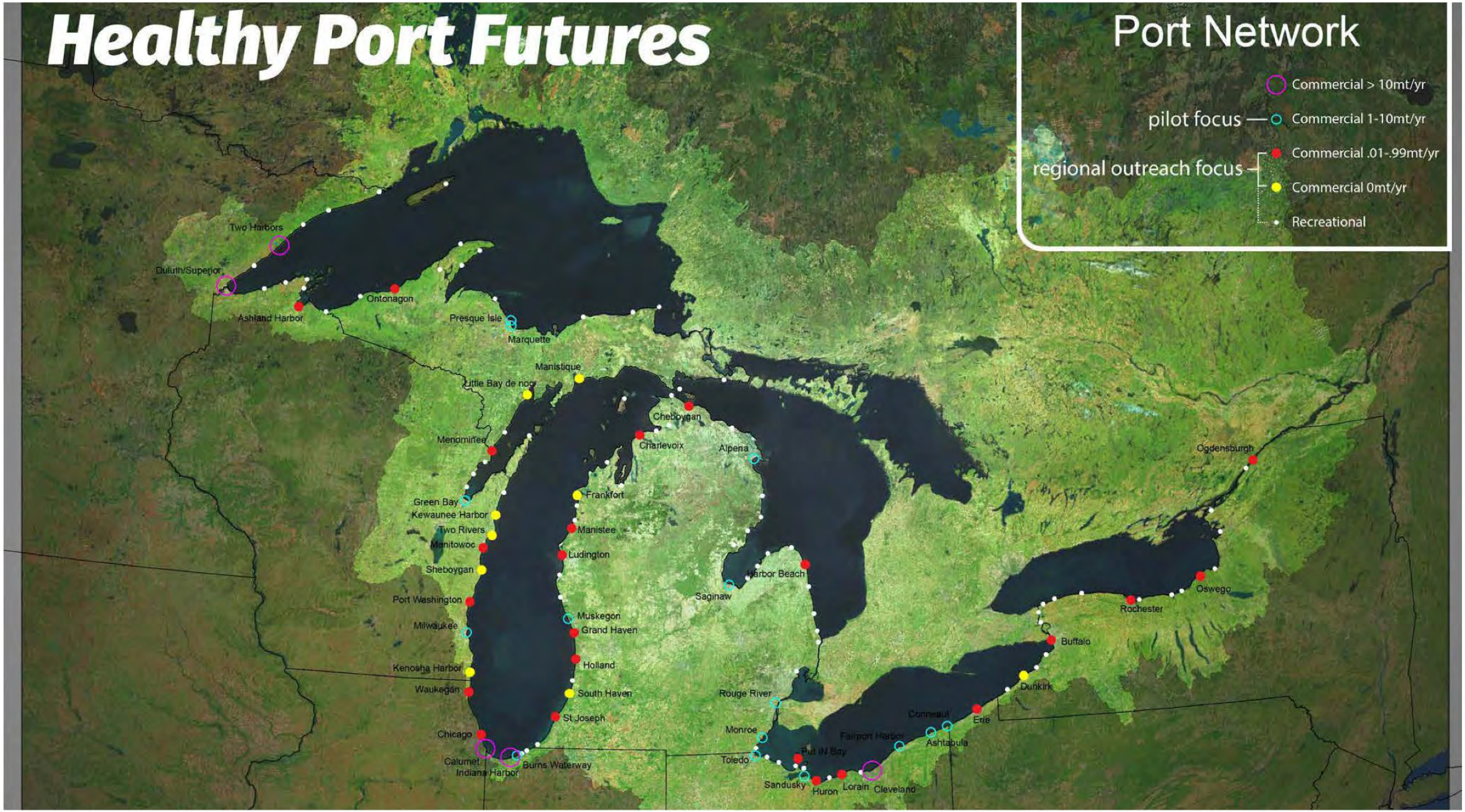
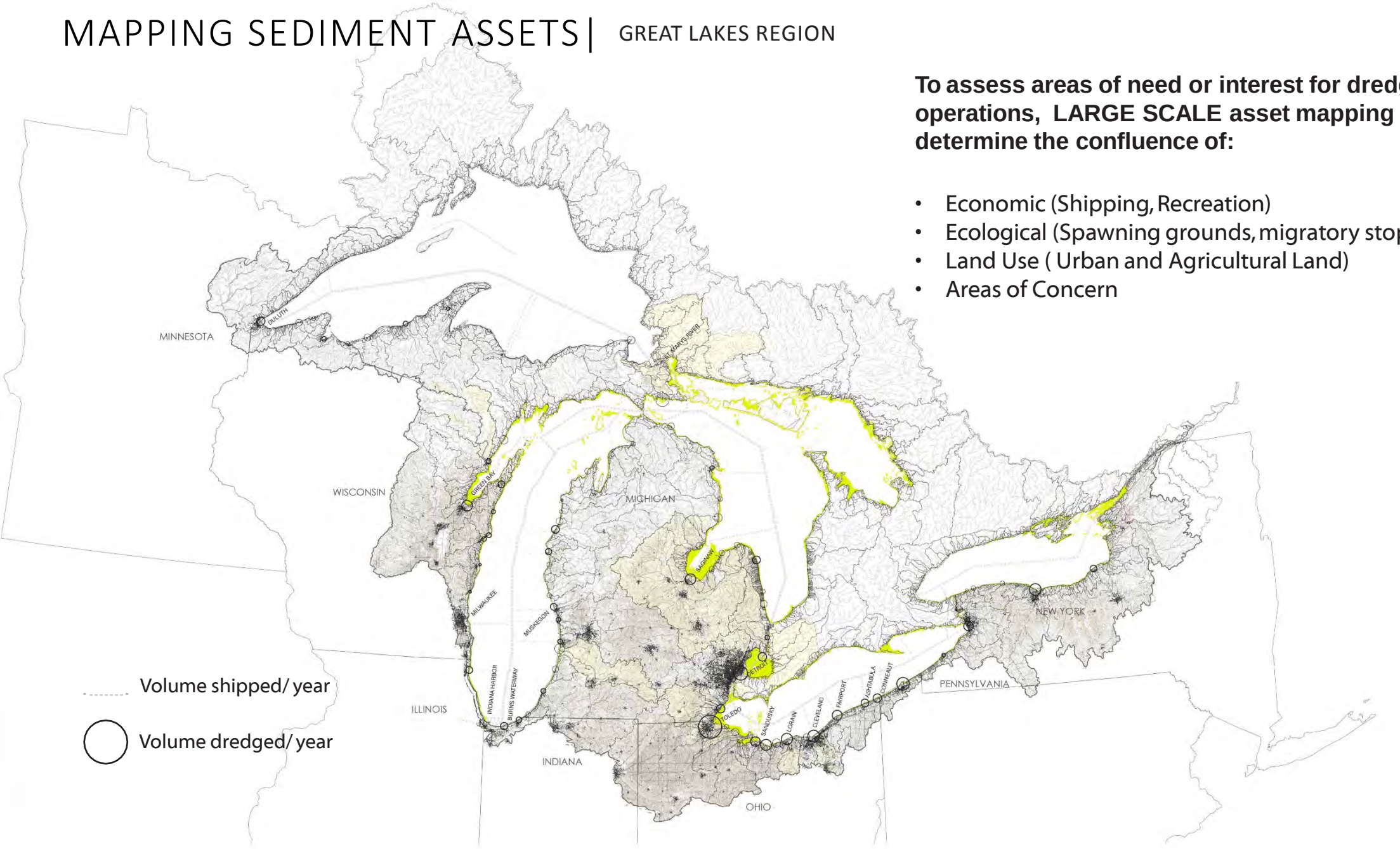
HEALTHY PORT FUTURES

WEDA | JUNE 4-9 2019
CORNELL UNIVERSITY | UNIVERSITY OF PENNSYLVANIA | ANCHORQEA
OHIO EPA | ACE BUFFALO DISTRICT


Healthy Port Futures
Port Network
Commercial > 10mt/yr
pilot focus
Commercial 1-10mt/yr
Commercial .01-.99mt/yr
regional outreach focus
Commercial 0mt/yr
Recreational
Two Harbors
Duluth/Superior
Ontonagon
Ashland Harbor
Presque Isle
Marquette
Manistique
Little Bay de noc
Cheboygan
Menominee
Charlevoix
Alpena
Ogdensburgh
Green Bay
Frankfort
Kewaunee Harbor
Manistee
Two Rivers
Manitowoc
Ludington
Sheboygan
Harbor Beach
Saginaw
Oswego
Port Washington
Rochester
Muskegon
Milwaukee
Grand Haven
Buffalo
Holland
Kenosha Harbor
Dunkirk
Waukegan
South Haven
Rouge River
St Joseph
Erie
Monroe
Fairport Harbor
Ashtabula
Chicago
Put-N-Bay
Toledo
Calumet
Indiana Harbor
Burns Waterway
Sandusky
Huron
Lorain
Cleveland

MAPPING SEDIMENT ASSETS| GREAT LAKES REGION



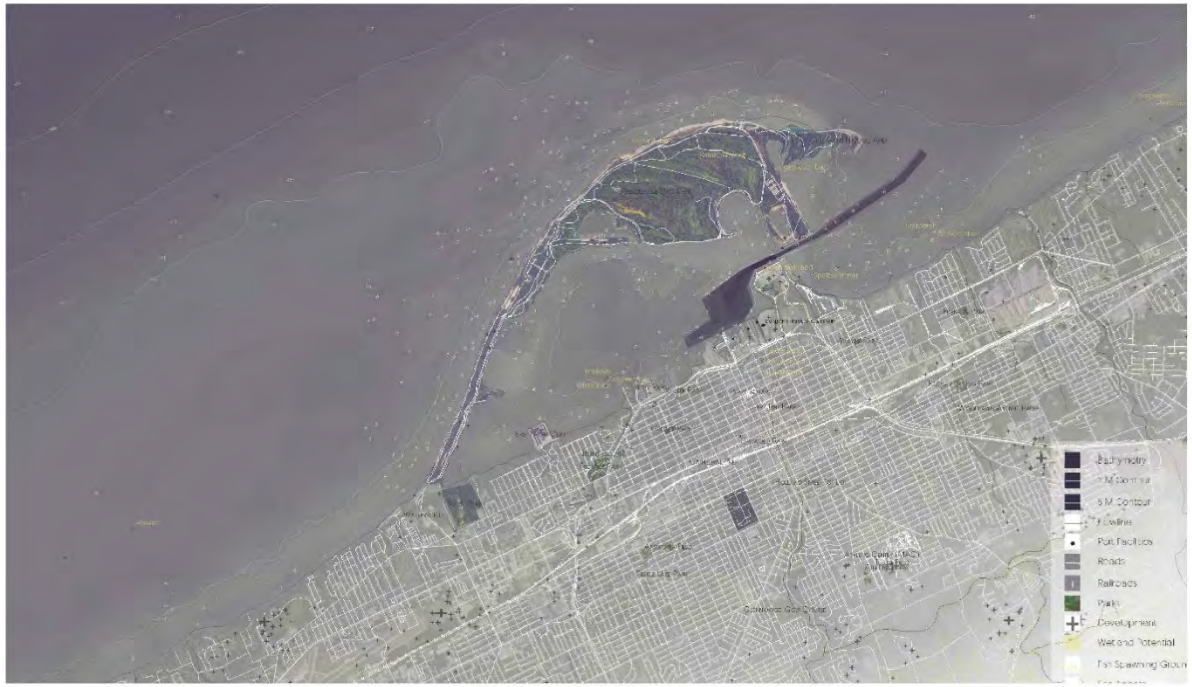
To assess areas of need or interest for dredging operations, LARGE SCALE asset mapping to determine the confluence of:

- Economic (Shipping, Recreation)
- Ecological (Spawning grounds, migratory stopvers)
- Land Use (Urban and Agricultural Land)
- Areas of Concern

MAPPING SEDIMENT ASSETS| PORT CIITES

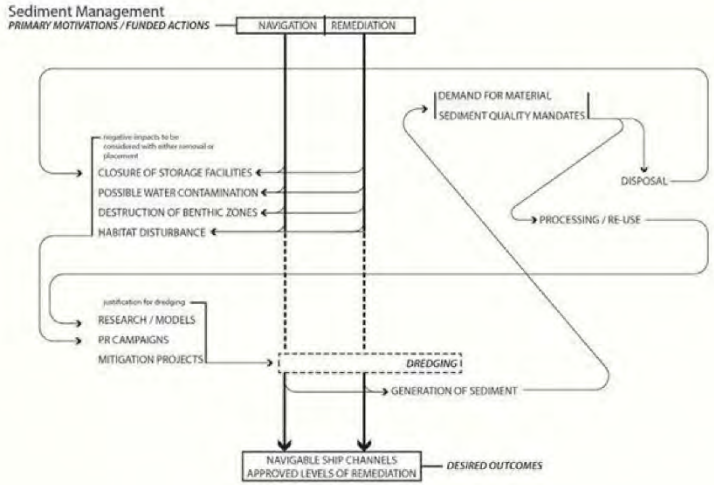
To assess areas of need or interest for dredging operations, SMALL SCALE asset mapping to determine the confluence of:

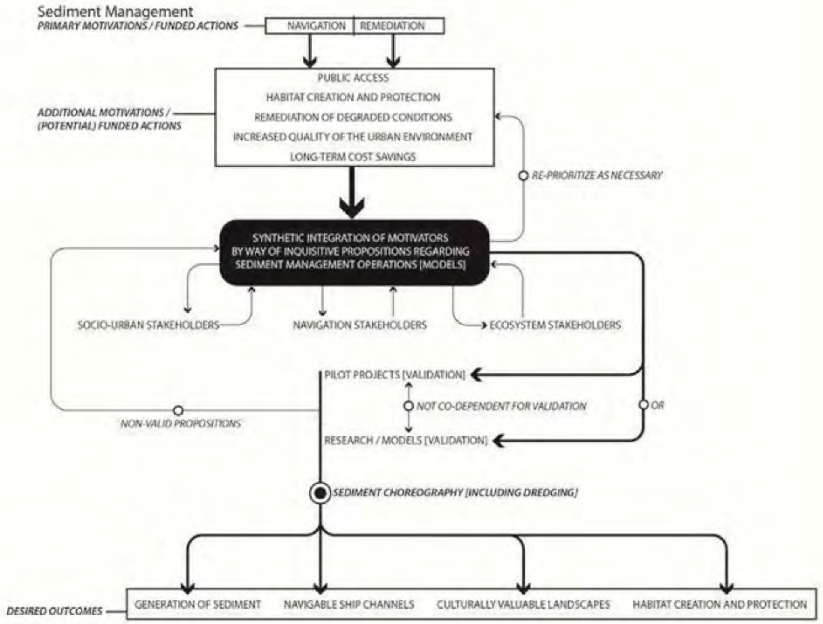
- Economic (Port lands, industrial lands)
- Ecological (Spawning grounds, Migratory Stopover habitat)
- Hydrological (Tributaries, bathymetry)
- Social Factors (Parks, trails, housing, schools)



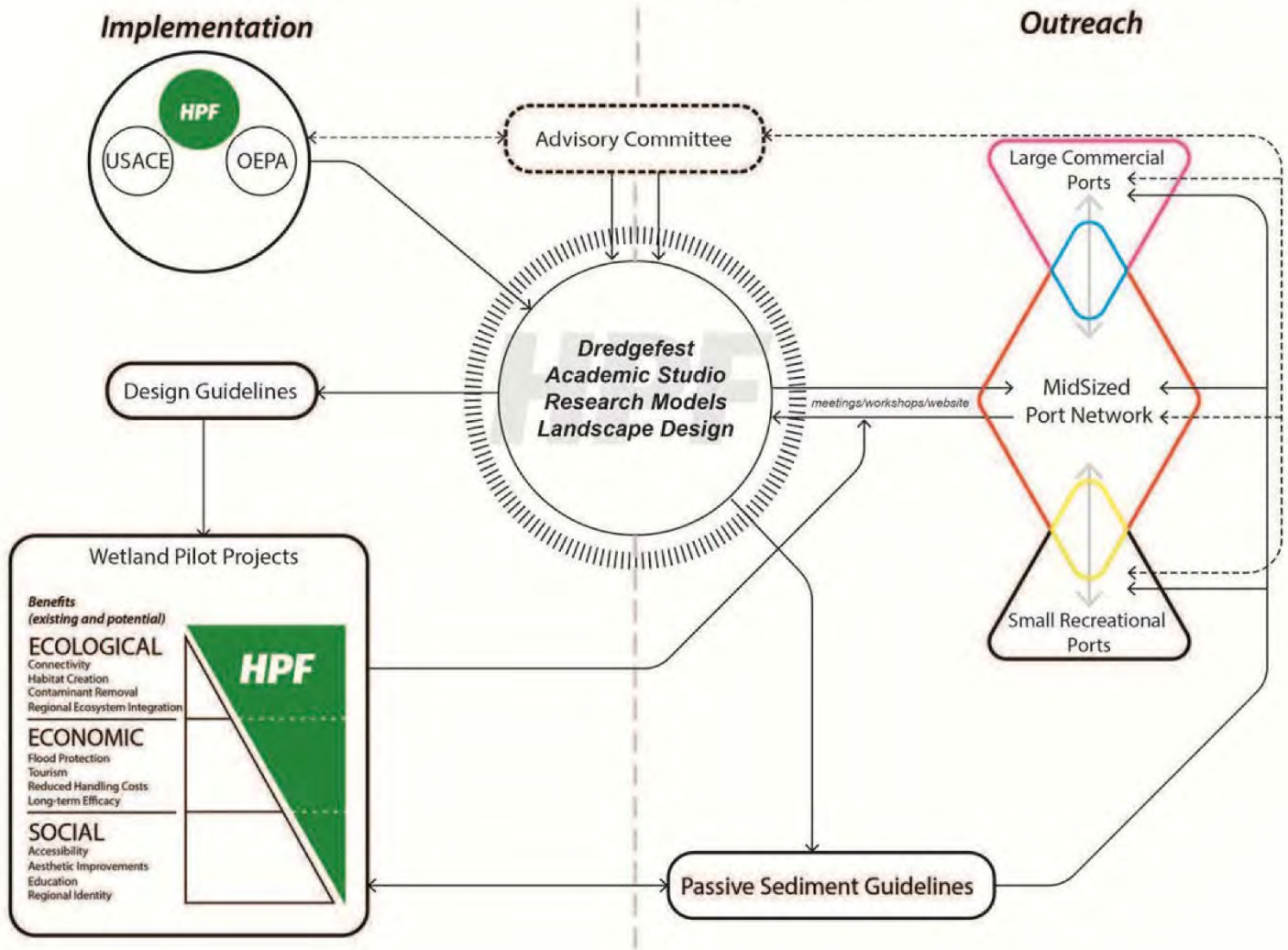
Erie,
Ohio

Muskegon,
Michigan



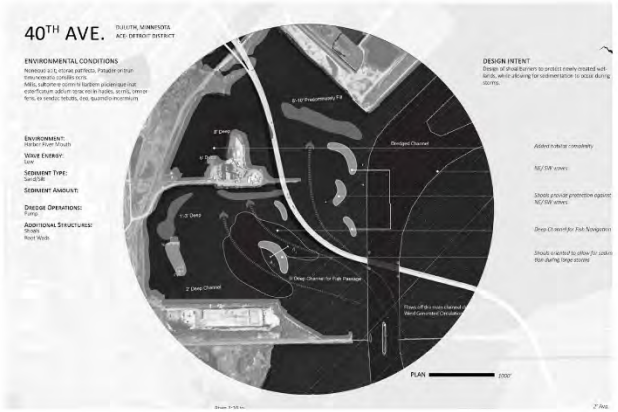


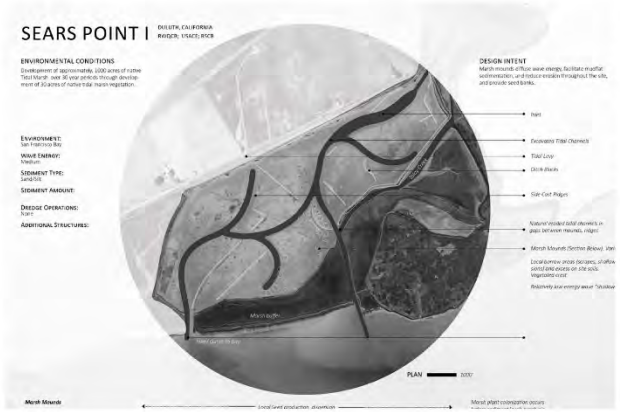
Healthy Port Futures - Project Organization Chart

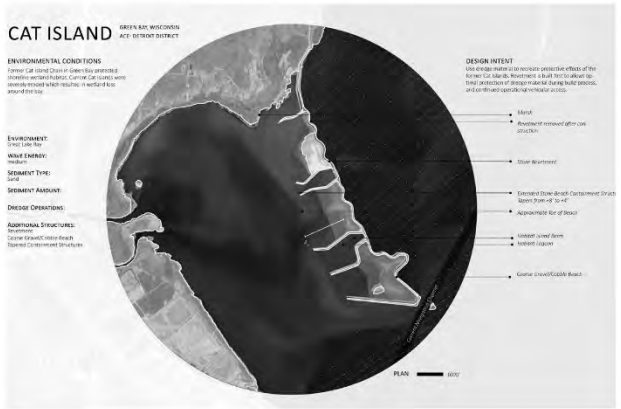


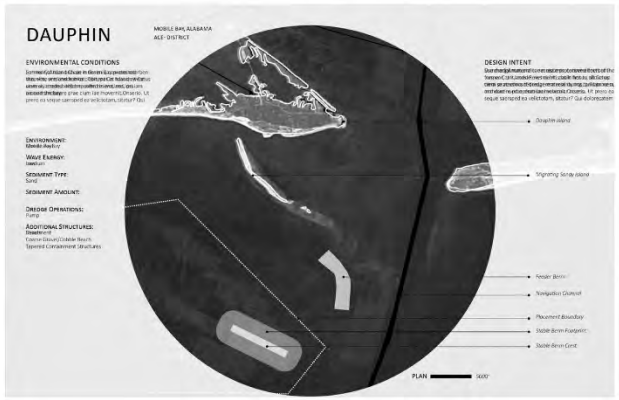
PRECEDENT STUDIES

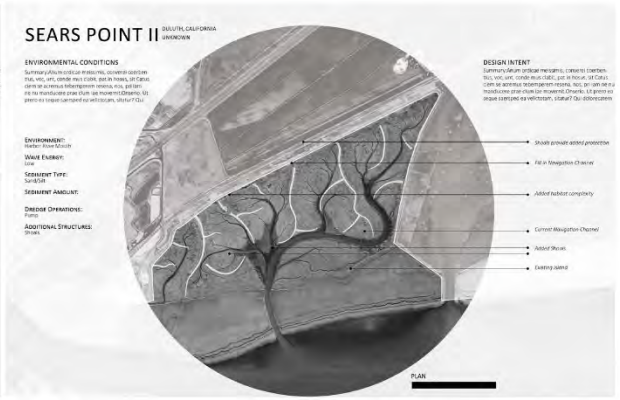
To examine material composition, type of placement, environmental conditions, supporting structures, and hydrological features inform design

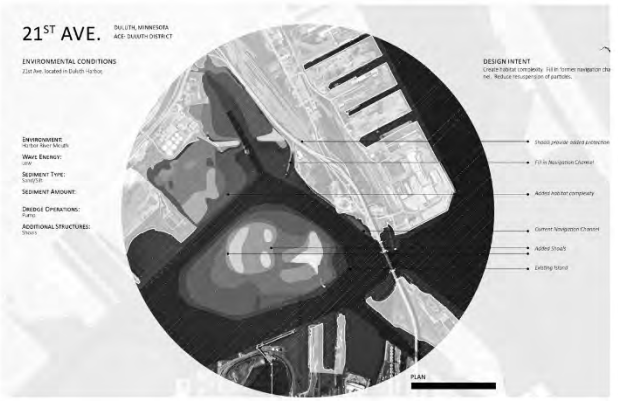






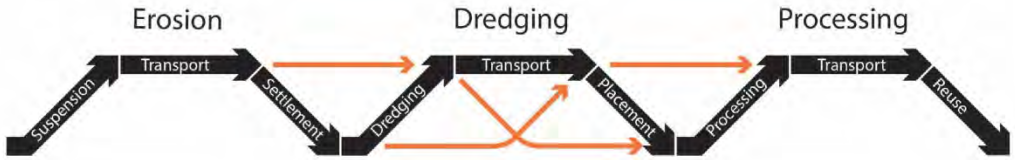


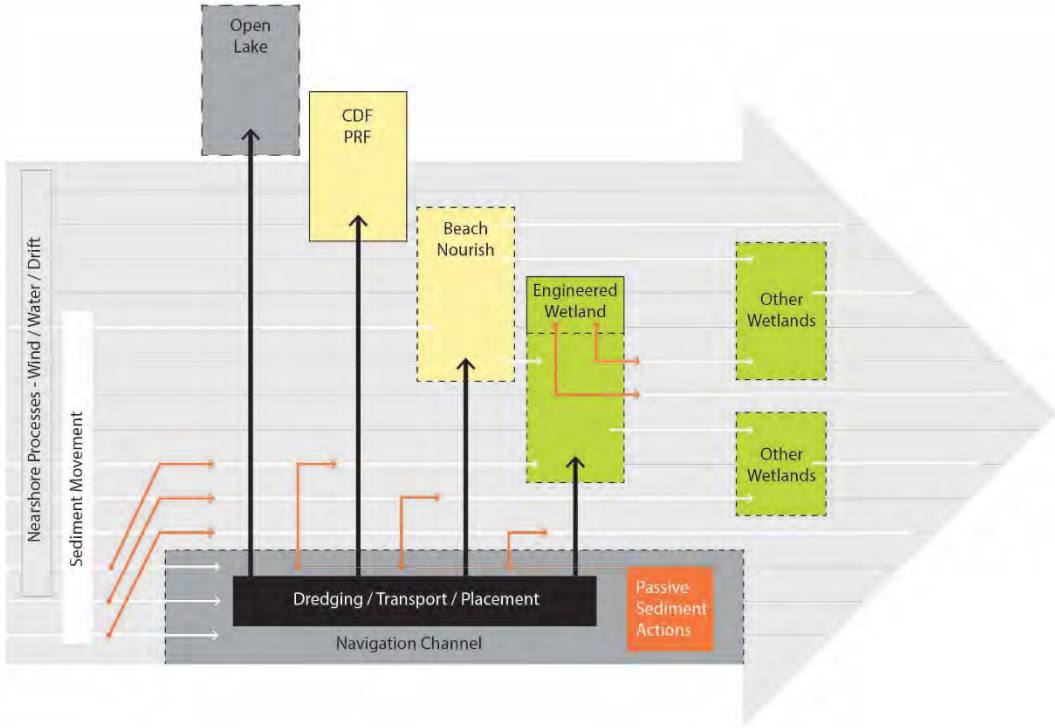




PASSIVE SEDIMENT MANAGEMENT

The use of natural forces (e.g. water, wind, waves) to replace or augment one of the require steps of sediment management (uplift, transport, placement)





LORAIN | INITAL EVALUATION

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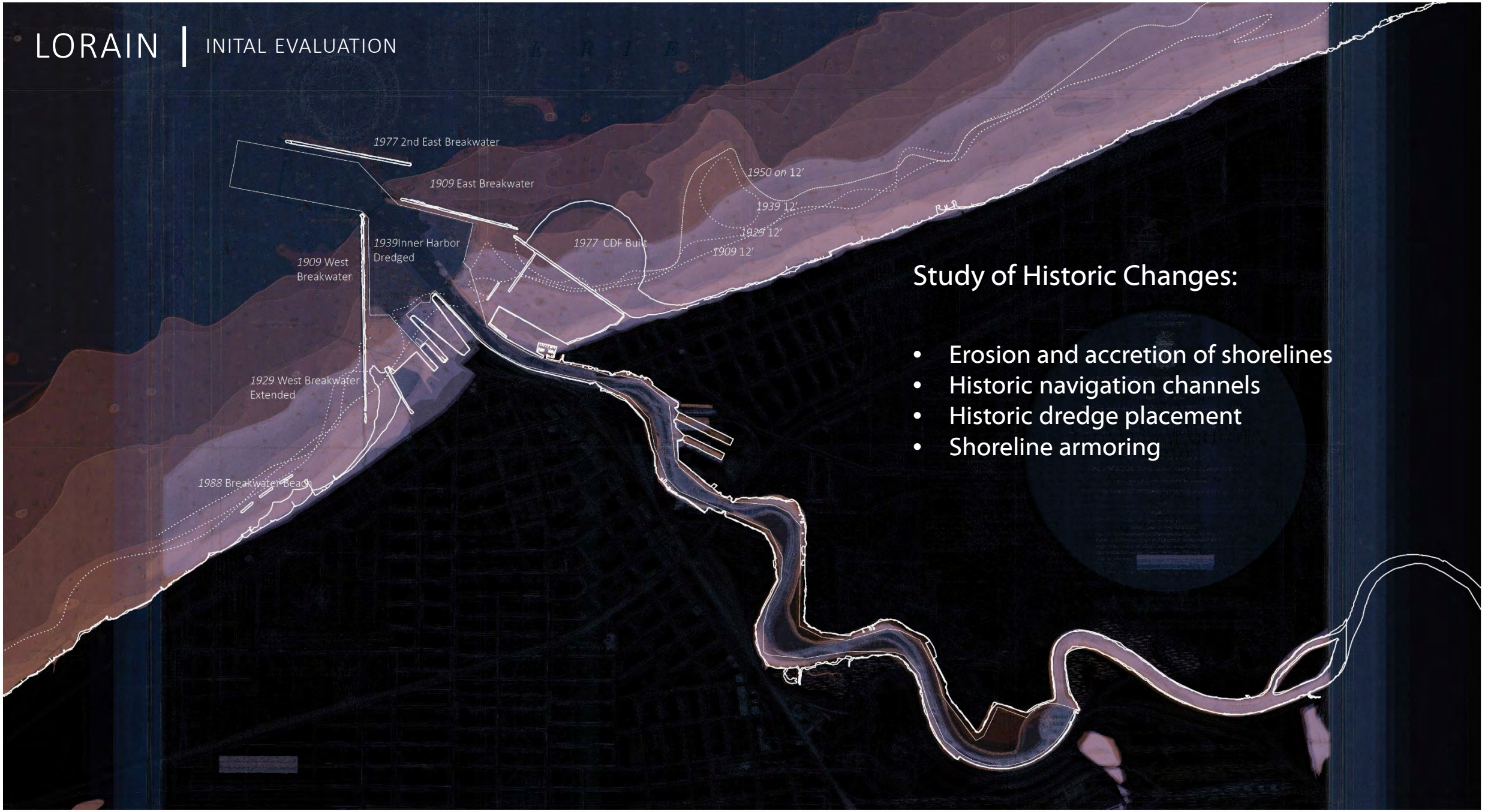
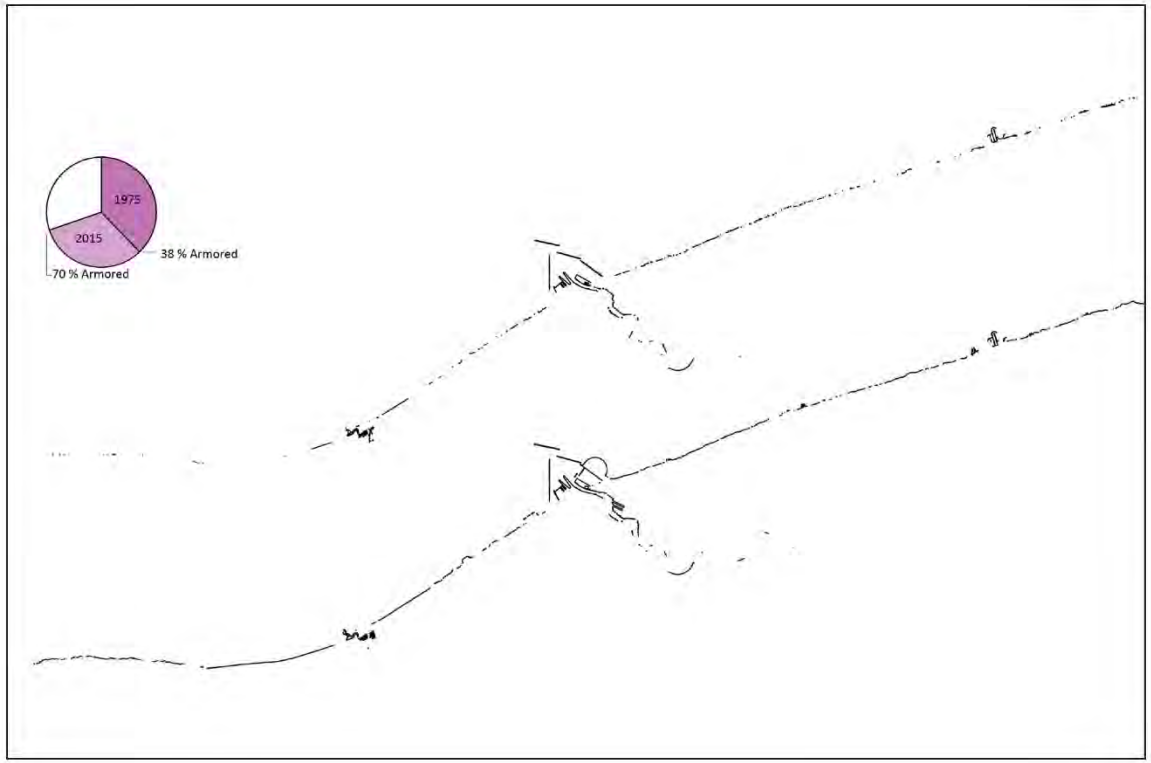
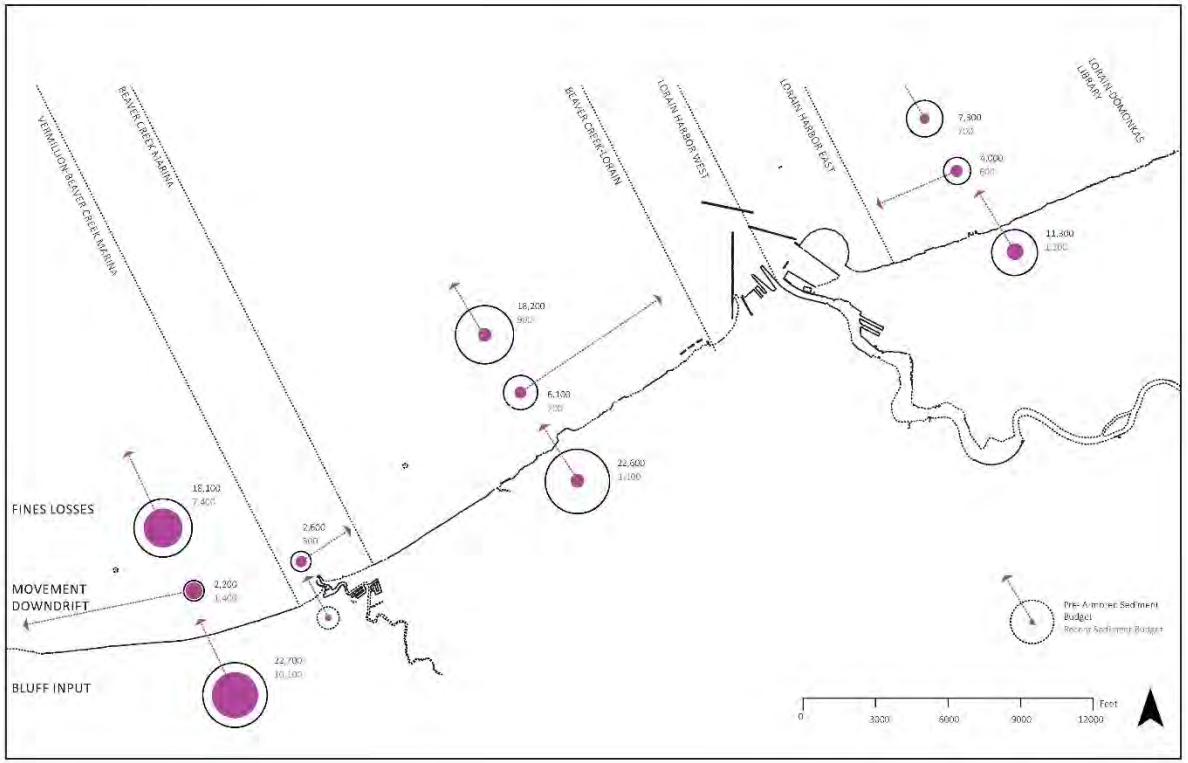


Study of Historic Changes:

- Erosion and accretion of shorelines
- Historic navigation channels
- Historic dredge placement
- Shoreline armoring

SEDIMENT CHANGES | LOSS OF SEDIMENT INPUT INTO LAKE THROUGH SHORELINE ARMORING

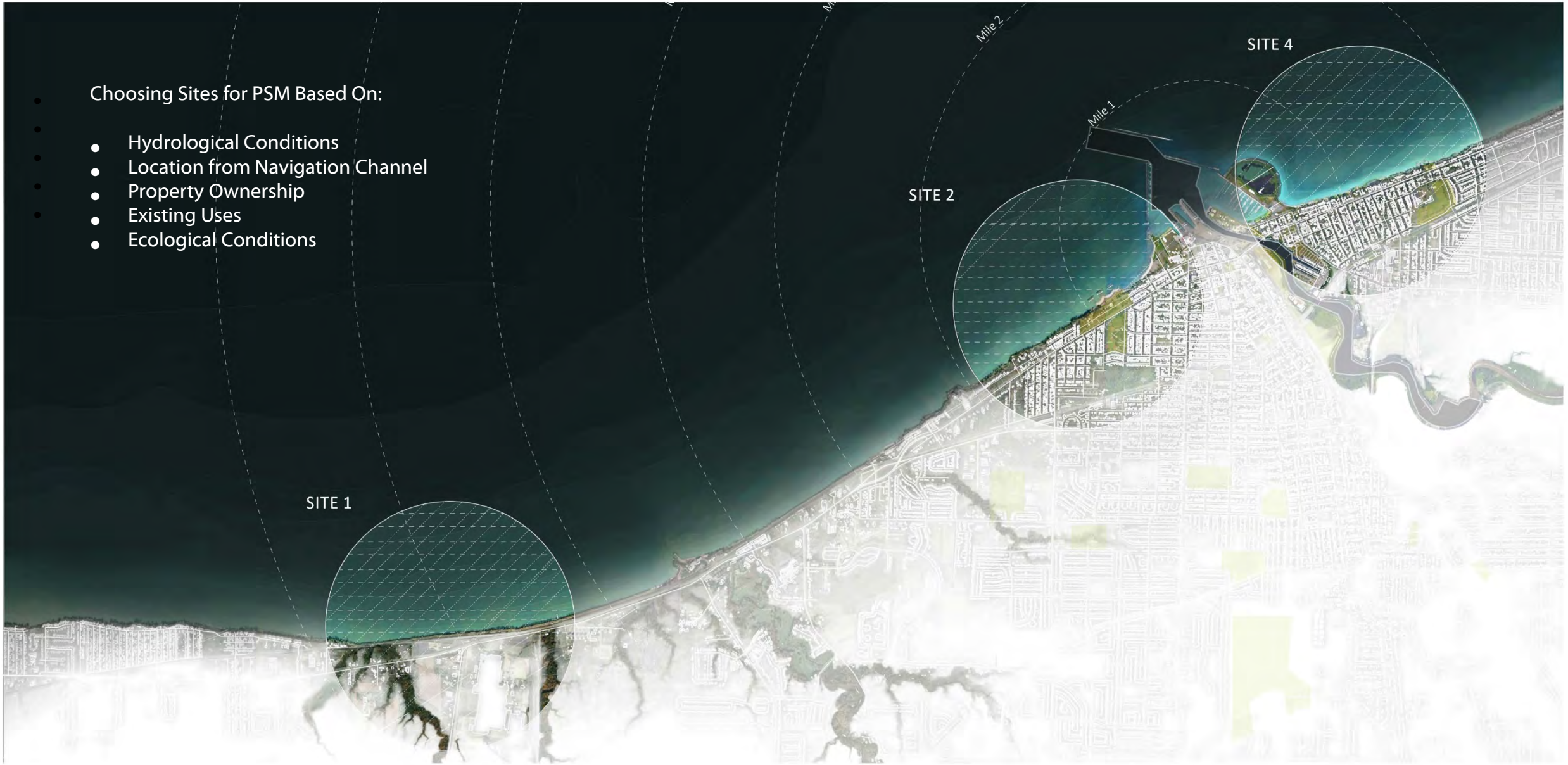




Shoreline armoring

Decrease in sediment input

LORAIN SITES



SITES DIFFERENCES | INFORM PASSIVE SEDIMENT MANAGEMENT INTENDED OUTCOMES AND DESIGN DECISIONS

SITE 1

DISTANCE TO CHANNEL	*8 MI*
WAVE EXPOSURE	*NONE*
LITTORAL DIRECTION	*E to W W to E*
OWNERSHIP	*Railroad*
PUBLIC ACCESS	*None*
OTHER	*Tributary*

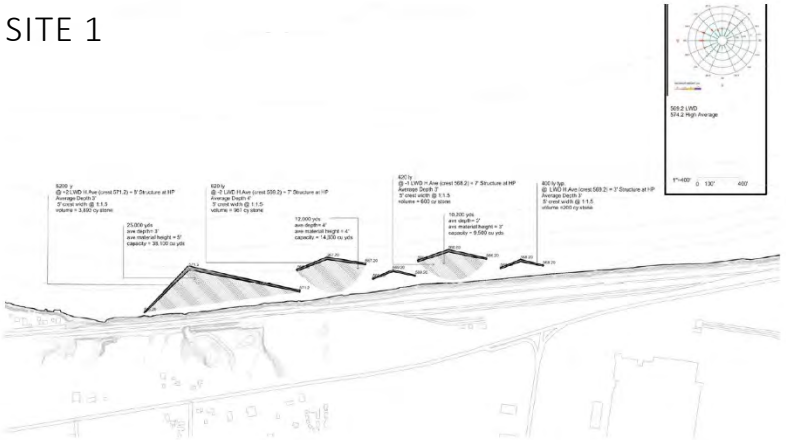
SITE 3

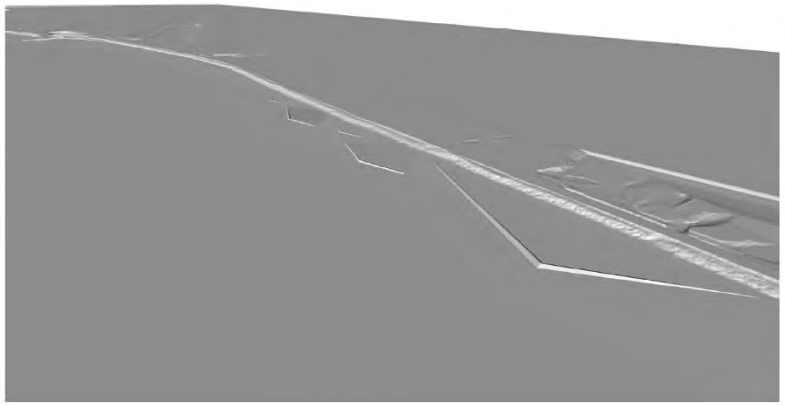
DISTANCE TO CHANNEL	*2 MI*
WAVE EXPOSURE	*W Shadow*
LITTORAL DIRECTION	*E to W*
OWNERSHIP	*Public/Private*
PUBLIC ACCESS	*Park*
OTHER	*Erosion*

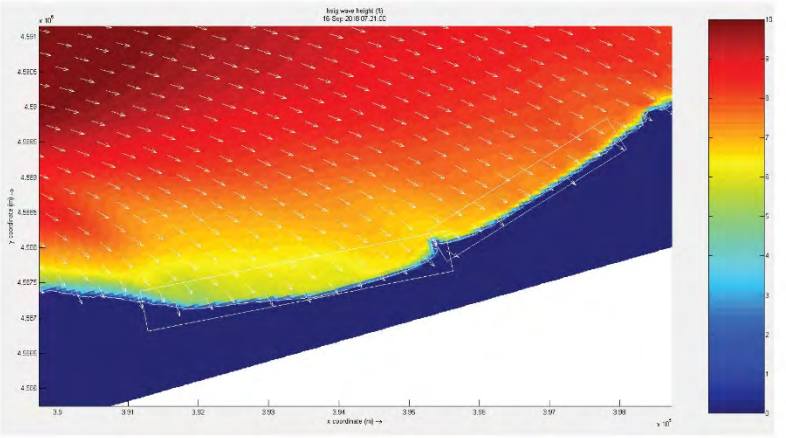
SITE 2

DISTANCE TO CHANNEL	*2 MI*
WAVE EXPOSURE	*NE Shadow*
LITTORAL DIRECTION	*W to E*
OWNERSHIP	*public*
PUBLIC ACCESS	*Park*
OTHER	*Erosion*

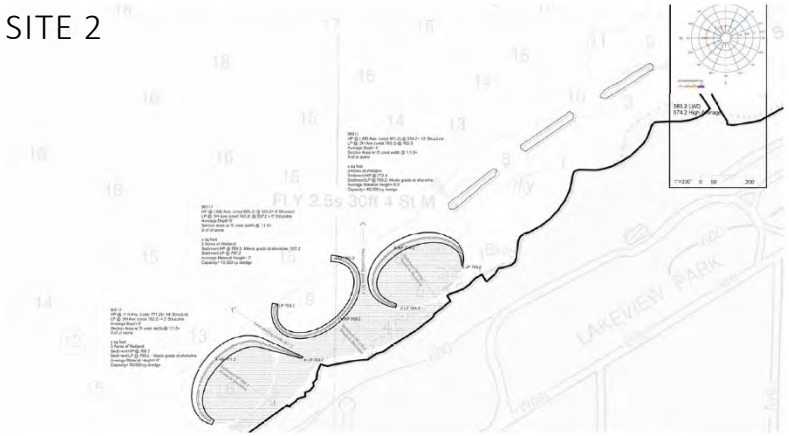
SITE 1

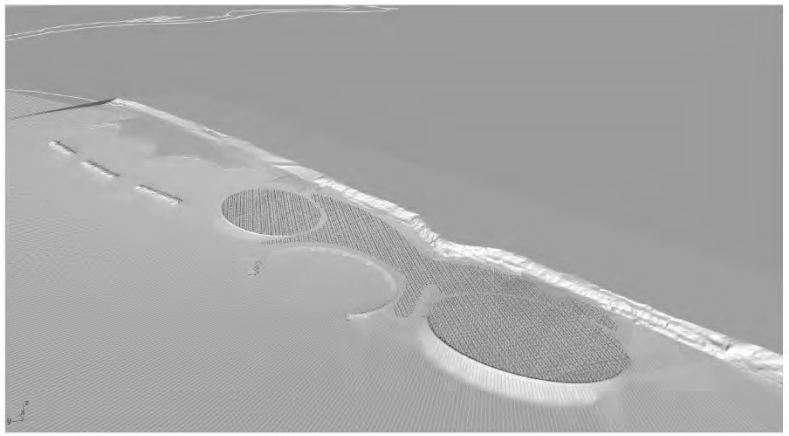


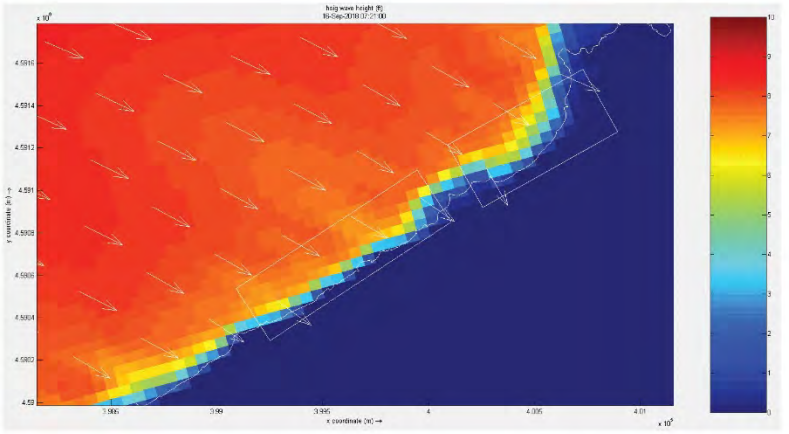




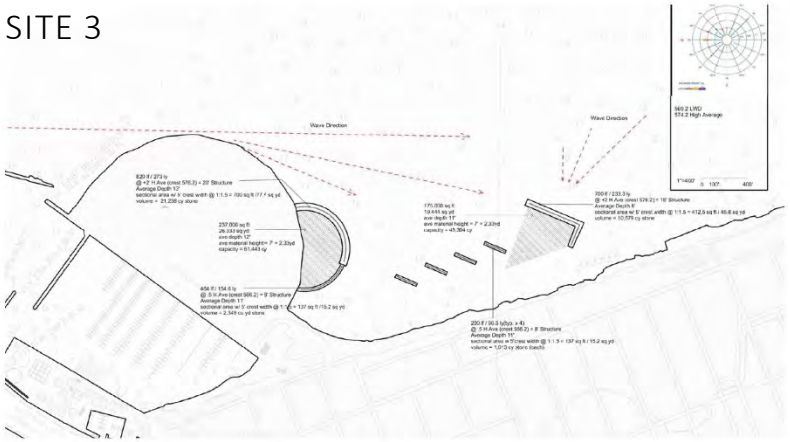
SITE 2

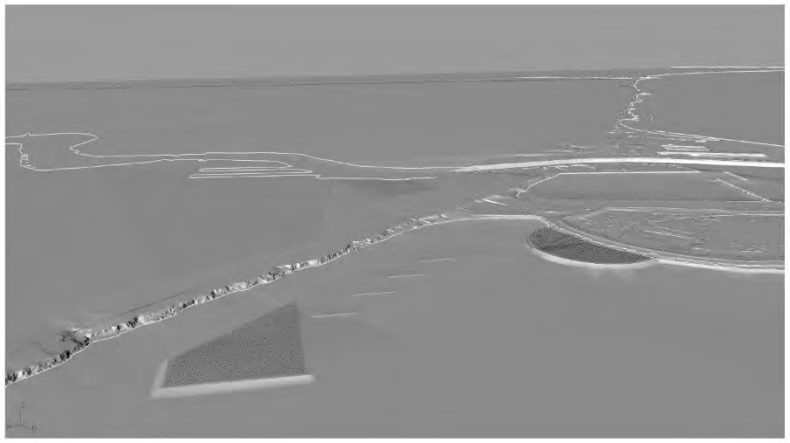


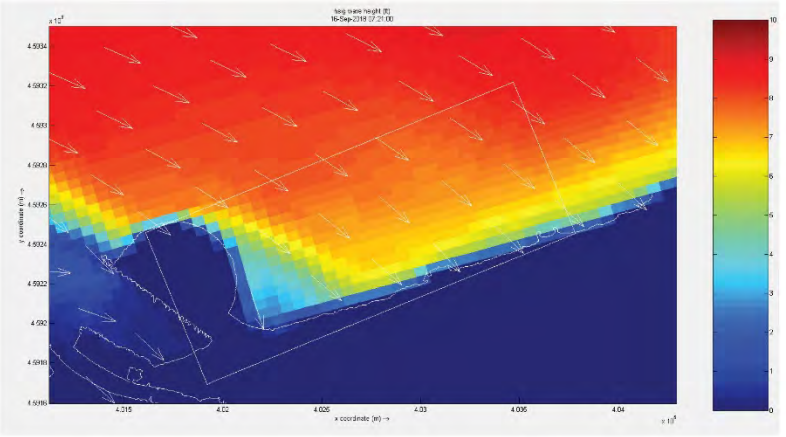




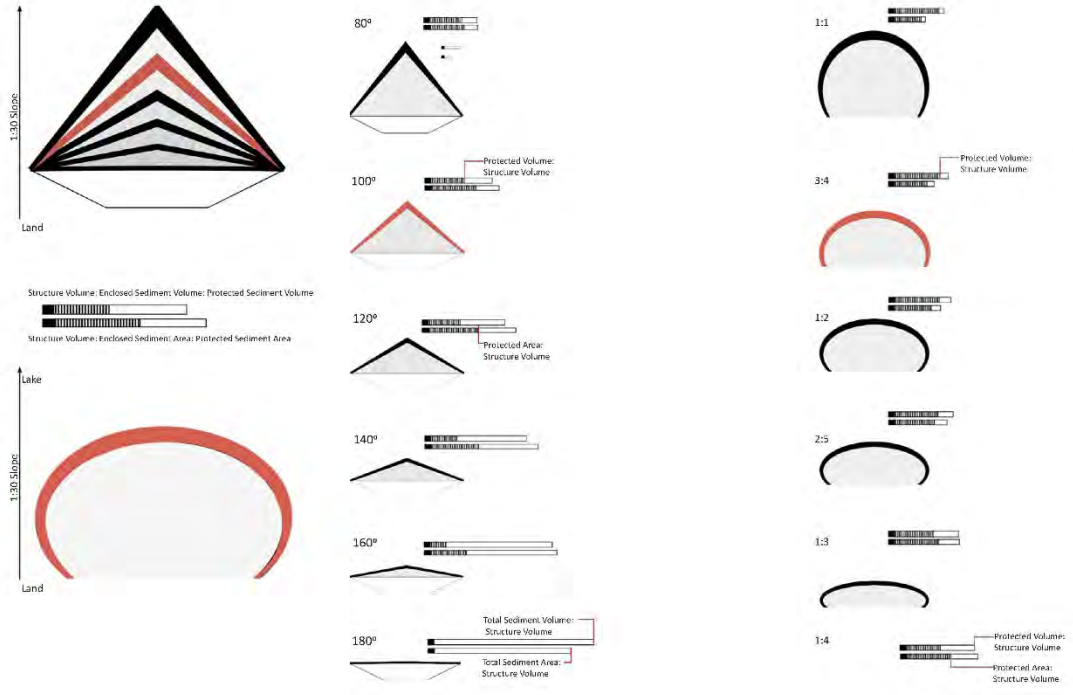
SITE 3



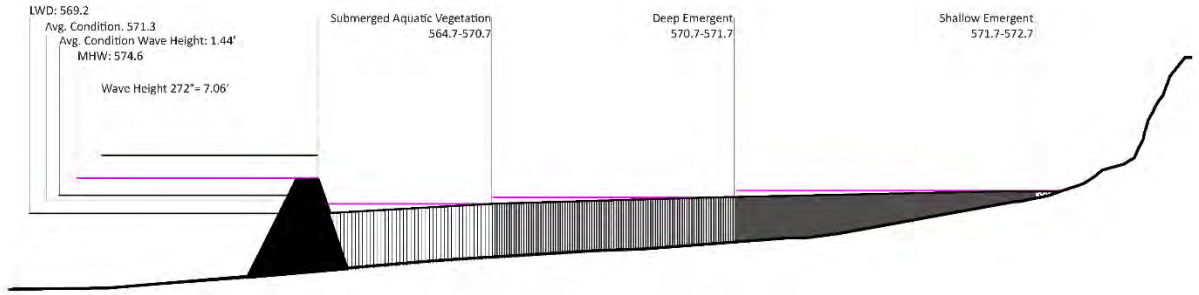




CALIBRATION | SHAPE AND SIZE

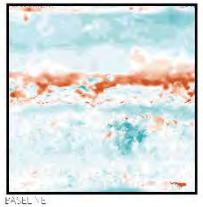


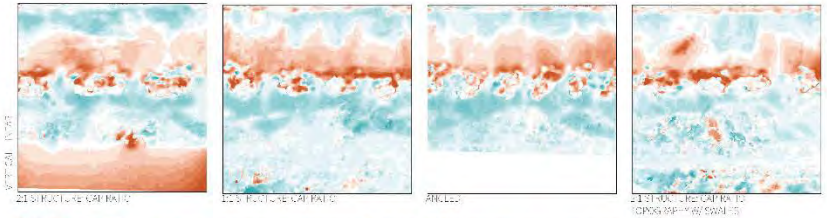
How does the SHAPE of containment structure change volume of structure to volume of dredged material?

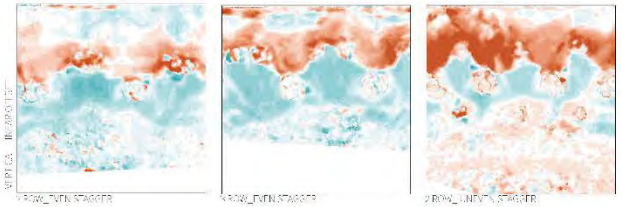


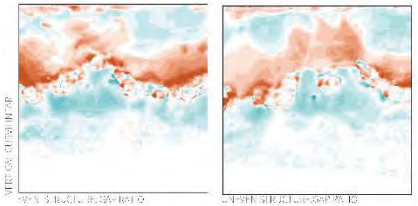
How does the PLACEMENT (bathmetric) of the structure change the volume of structure to volume of dredge material?

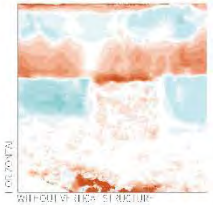
EROSION/ACCRETION



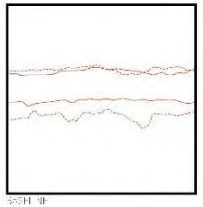


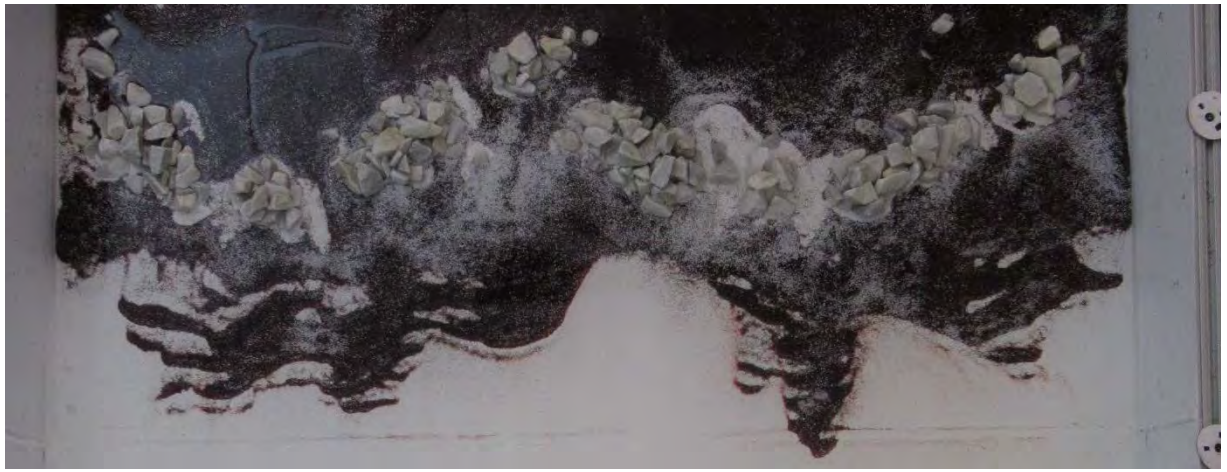


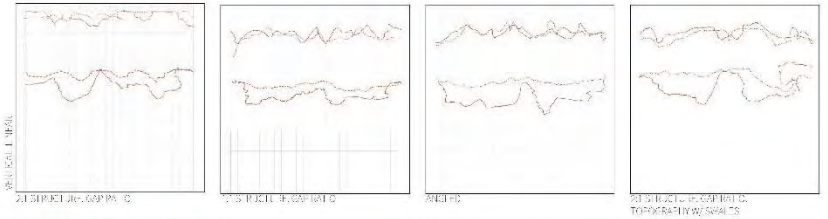


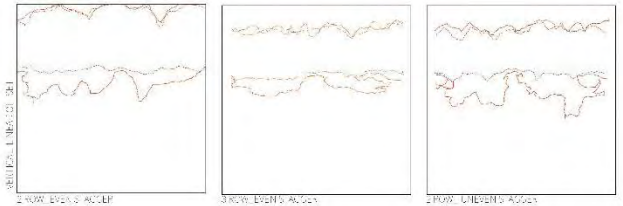


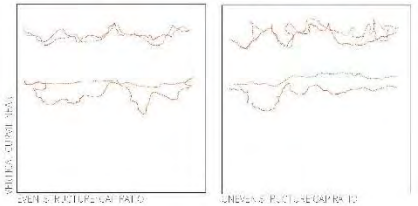
RESILIENCE

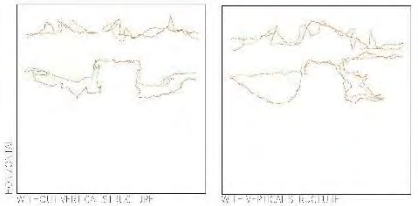




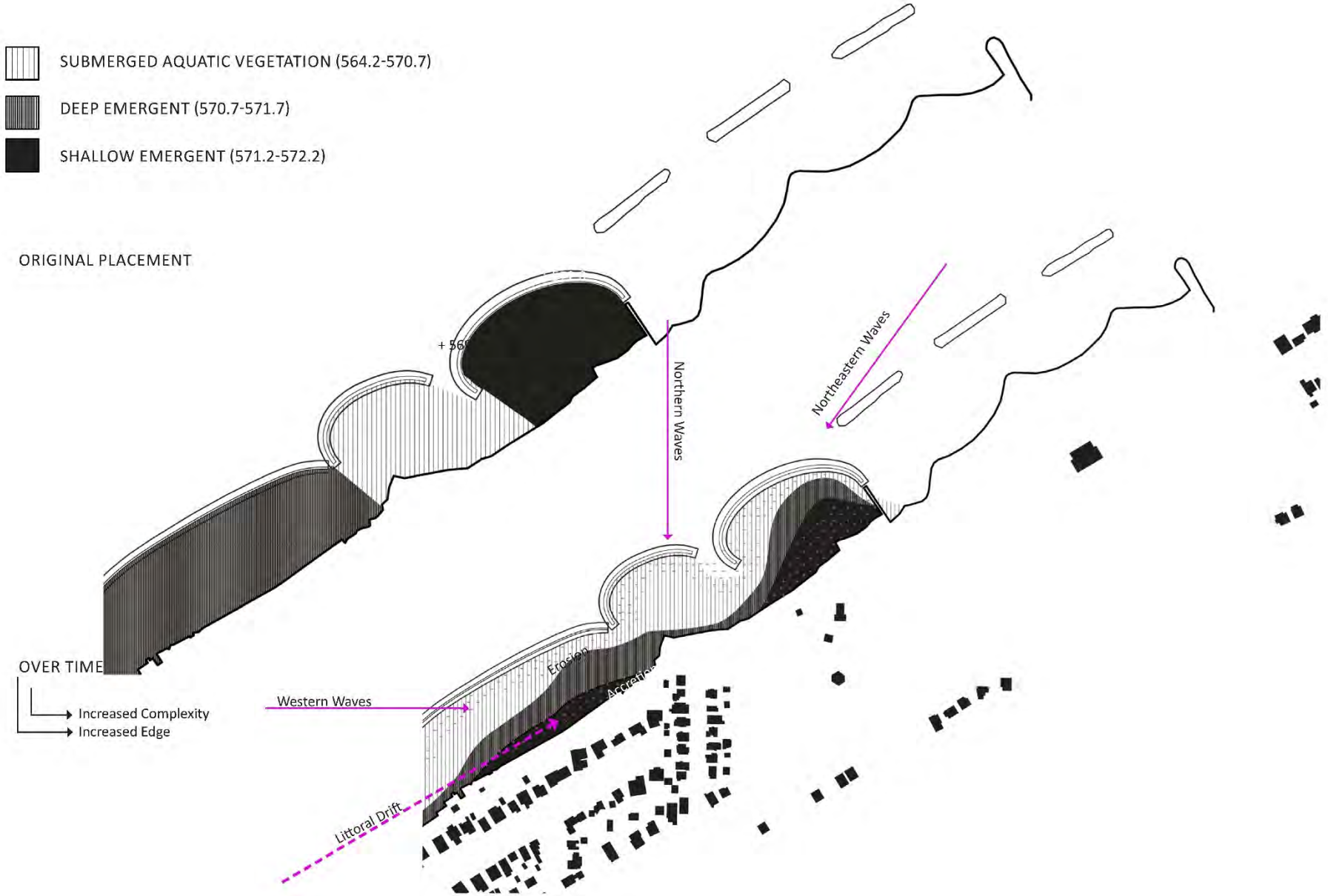






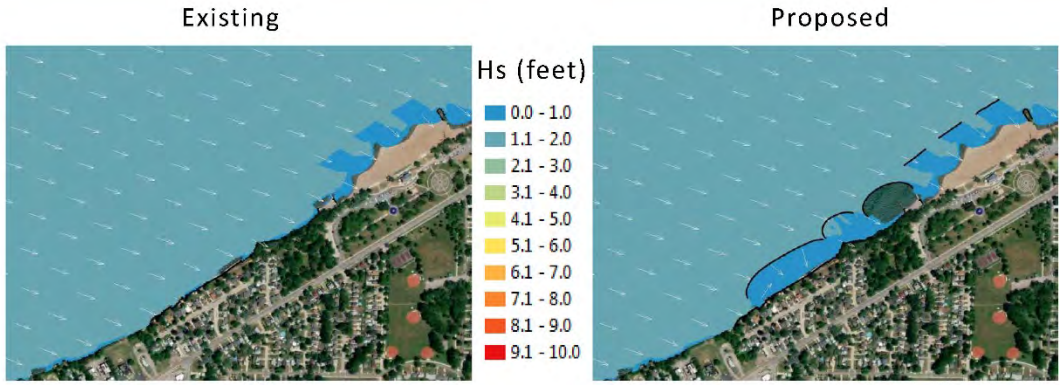


SITE 2| TESTING A HYPOTHESIS

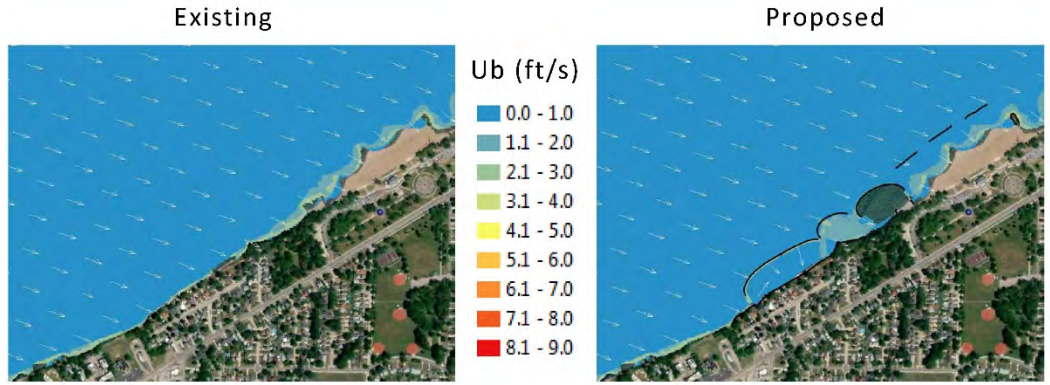


SITE 2| WAVE MODEL

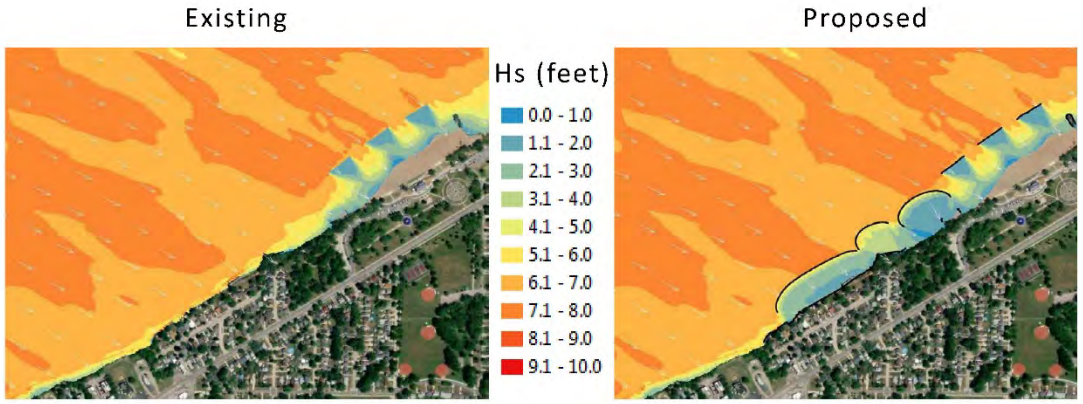
Wave Model Results – Typical Condition (West)
Significant Wave Height (Hs)



Wave Model Results – Typical Condition (West)
Orbital Velocity near Bottom (Ub)



Wave Model Results – Storm Condition (West)
Significant Wave Height (Hs)



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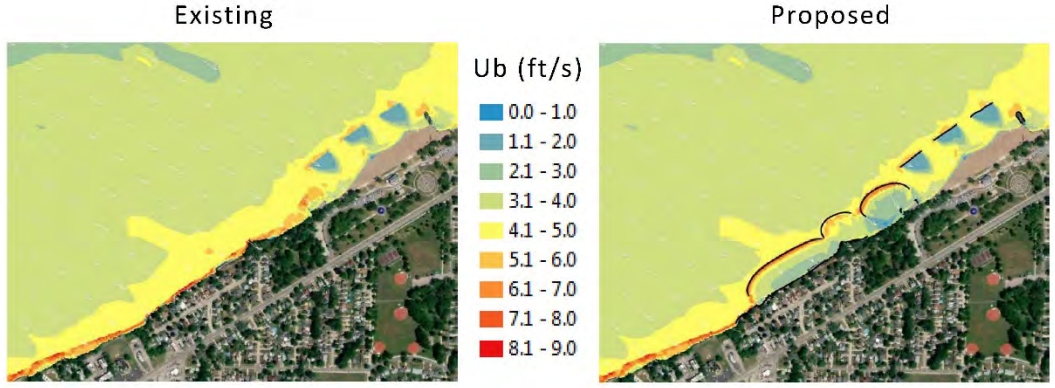

SITE 2| DESIGNING FOR CHANGE AND UNPREDICTABILITY

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Brian Davis – brd63@cornell.edu

PennDesign ANCHOR QEA Ohio Environmental Protection Agency ST. ANTHONY FALLS LABORATORY College of Science & Engineering University of Minnesota

Great Lakes Protection Fund