Goals for Regional Sediment Management

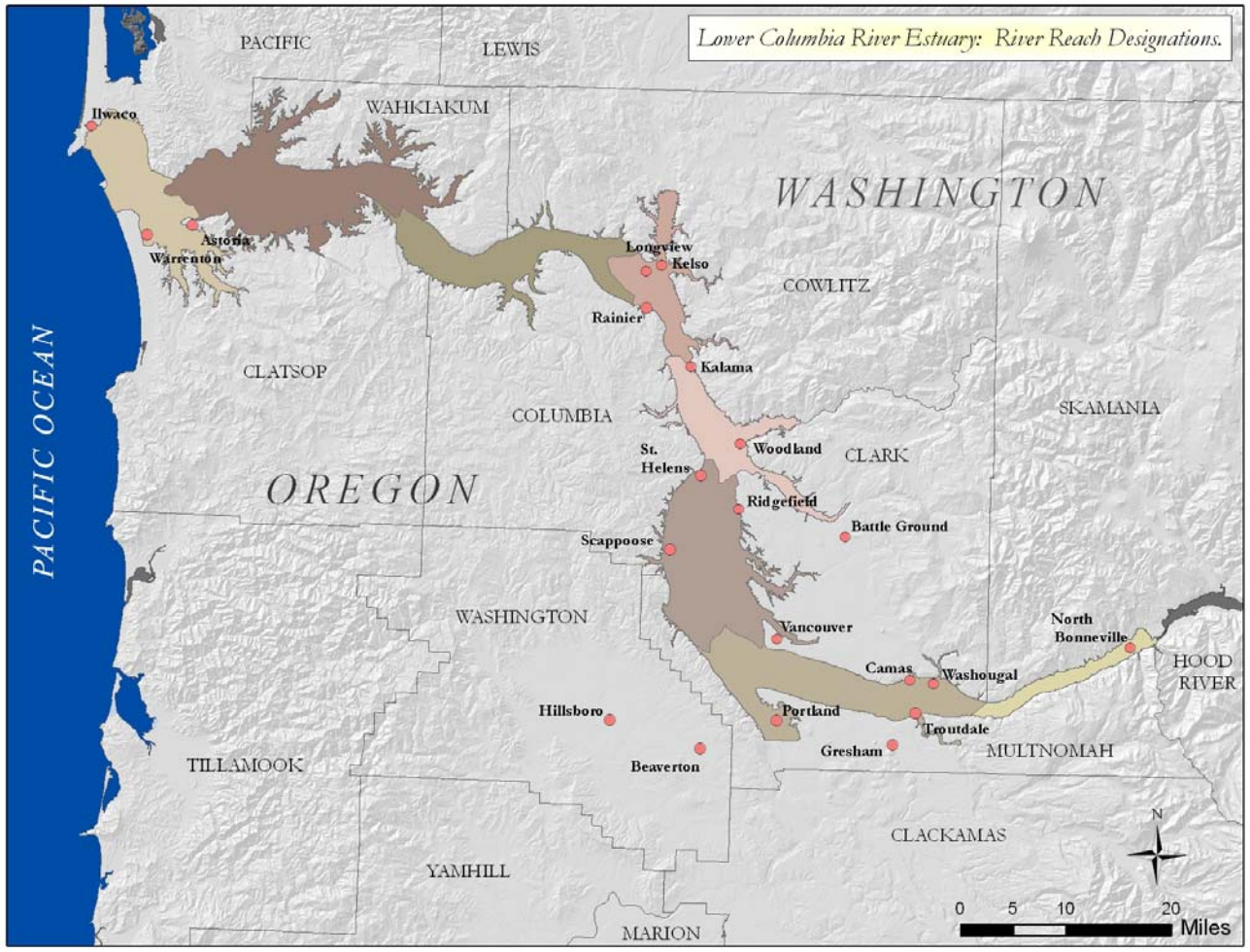
- Provide science-based rationale for placement of dredged sediment to maximize beneficial use of sediments
- Understand sediment processes as basis for dredge planning and restoration
- Understand movement of contaminated sediments
- Provide a plan that is adaptable to changing conditions and knowledge
- Develop the support needed to implement the plan – regulatory, scientific, community, legal, etc.

Phase 1 of Sediment Planning builds a foundation

- Identify the policy and technical issues regarding development of a sediment budget
- Assemble available literature on physical, biological and chemical processes with sediment
- Produce a physical conditions and processes chapter for the plan
- Analyze historical dredge material disposal records
- Produce interim analysis of regulatory framework for sediment management
- At one site, develop and test criteria for placing non-contaminated dredge materials for maximum beneficial use

Phase 1 Sediment Management Plan Development

- First phase in continuing process
  - Estuary Partnership request to Congress to support continuation
- First phase concentrating on Bonneville Dam to mouth
  - 8 River Reaches



Lower Columbia River Estuary Partnership

Phase 1 Sediment Management Plan Development

1. A) Identify policy/technical questions to support planning goals

   B) define parameters & steps needed to develop sediment budget

2. A) Identify and assemble pertinent literature and other data needed for plan development

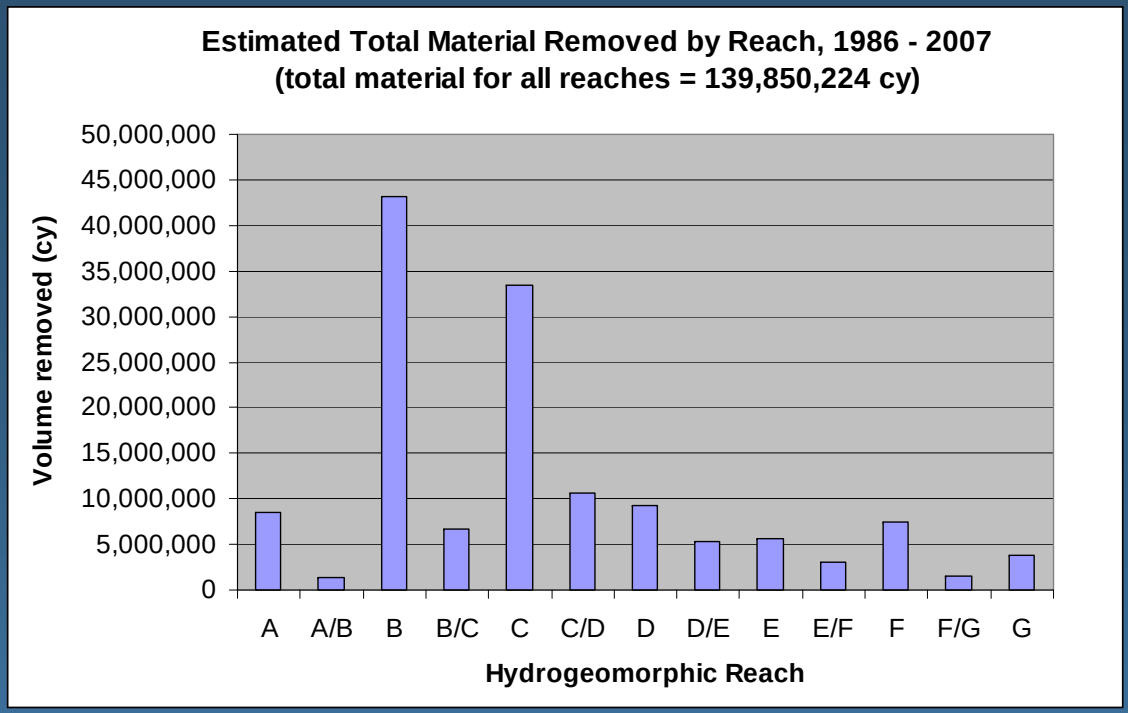
   B) identify data gaps and determine options for addressing gaps

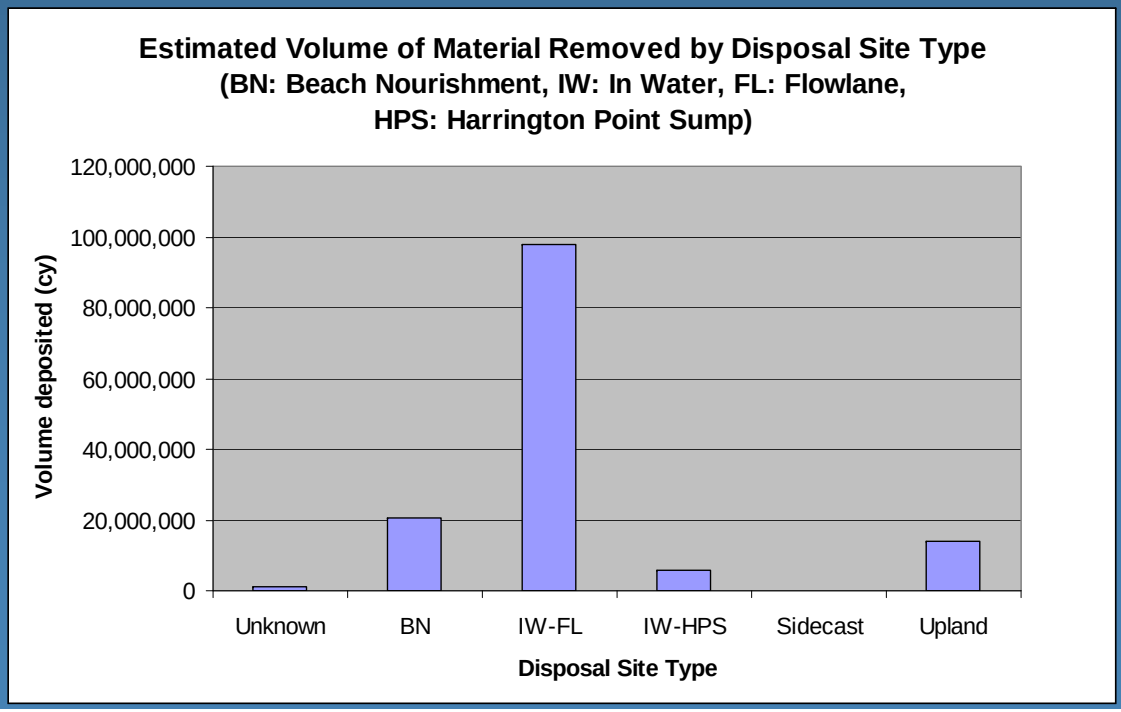
3. Produce an initial sediment-related physical conditions and processes chapter for plan

4. Produce an interim dredged material regulations and project “critical path” chapter for plan

Lower Columbia River Estuary Partnership

Phase 1 Sediment Management Plan Development

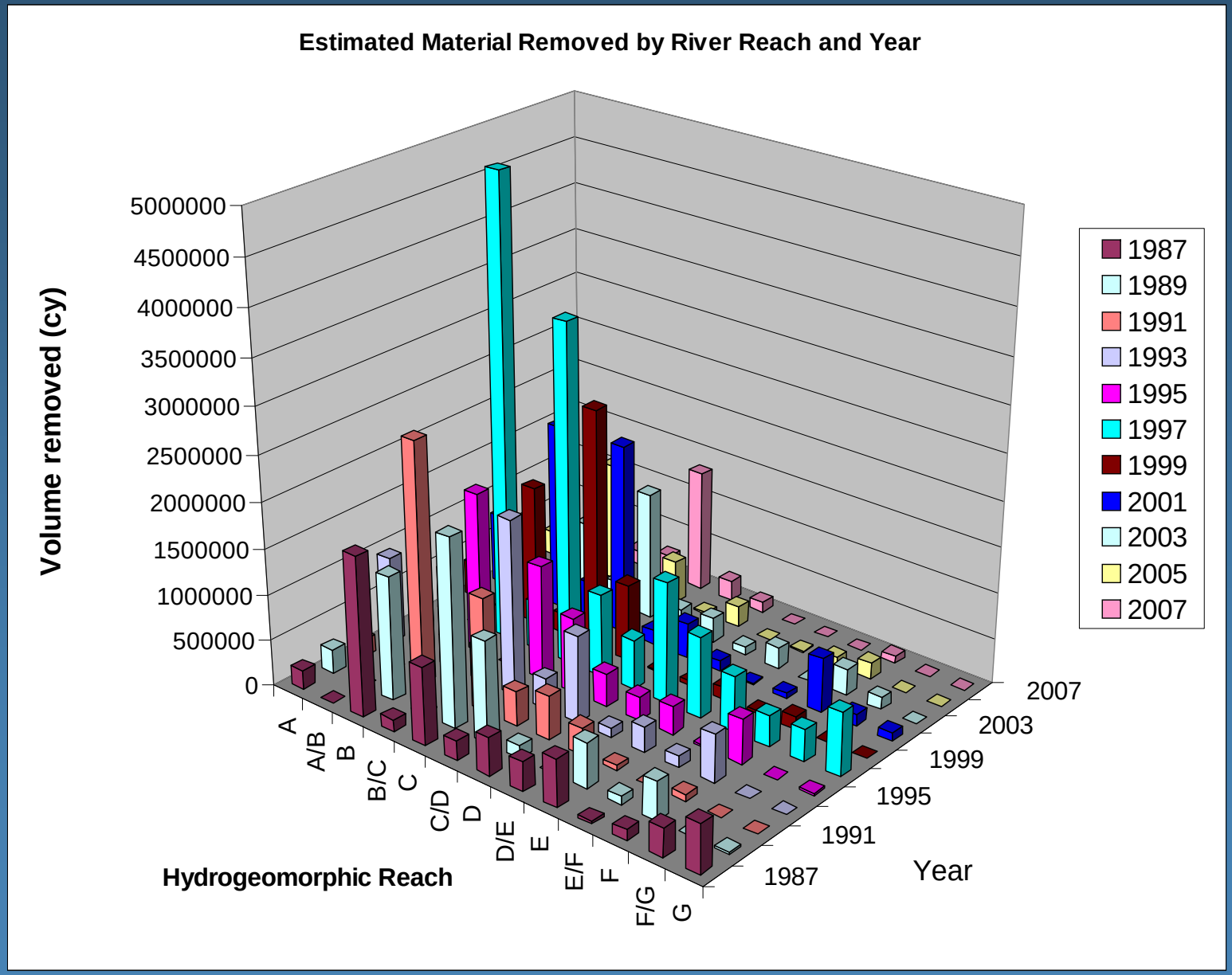




5. Compile historical dredged material disposal volumes and locations; characterize in terms of use categories (e.g., beach nourishment, upland, in-water)

Disposal data provided by USACE

Phase 1 Sediment Management Plan Development



Disposal data provided by USACE

Phase 1 Sediment Management Plan Development

6. **Develop and apply criteria for locating dredged material placement sites (non-contaminated materials)**
   - **Develop criteria for locating dredged material disposal sites**
   - **Test draft criteria by examining a reach of the lower river for potential sites**
   - **Criteria will incorporate ecosystem and economic considerations**
   - **Refine criteria and ultimately use in other 7 reaches of LCRE in 2-3 year planning horizon**

Lower Columbia River Estuary Partnership

Dataset 1: Digital Shoreline Mapping and Inventory

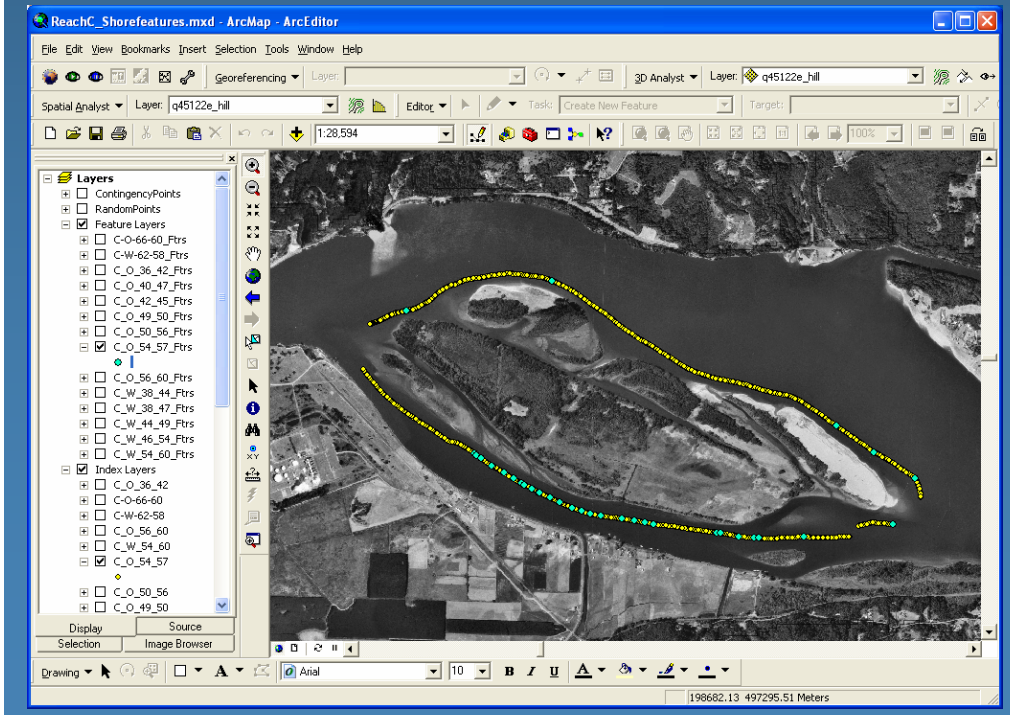
Location and categorization of the following shoreline features:

- General shoreline condition
  (modified vs. natural)
- Modified shoreline condition
  (armor, residential, commercial)
- Natural shoreline condition
  (riparian, tidal marsh, tidal swamp)
- In-Water structures
  (Pile dikes, jetties, boat ramps, debris)
- Over-Water structures
  (docks, log rafts/booms)
- Discharge locations
  (tidegates, point source outfalls)

Lower Columbia River Estuary Partnership

Digital Shoreline Mapping and Inventory: Methods

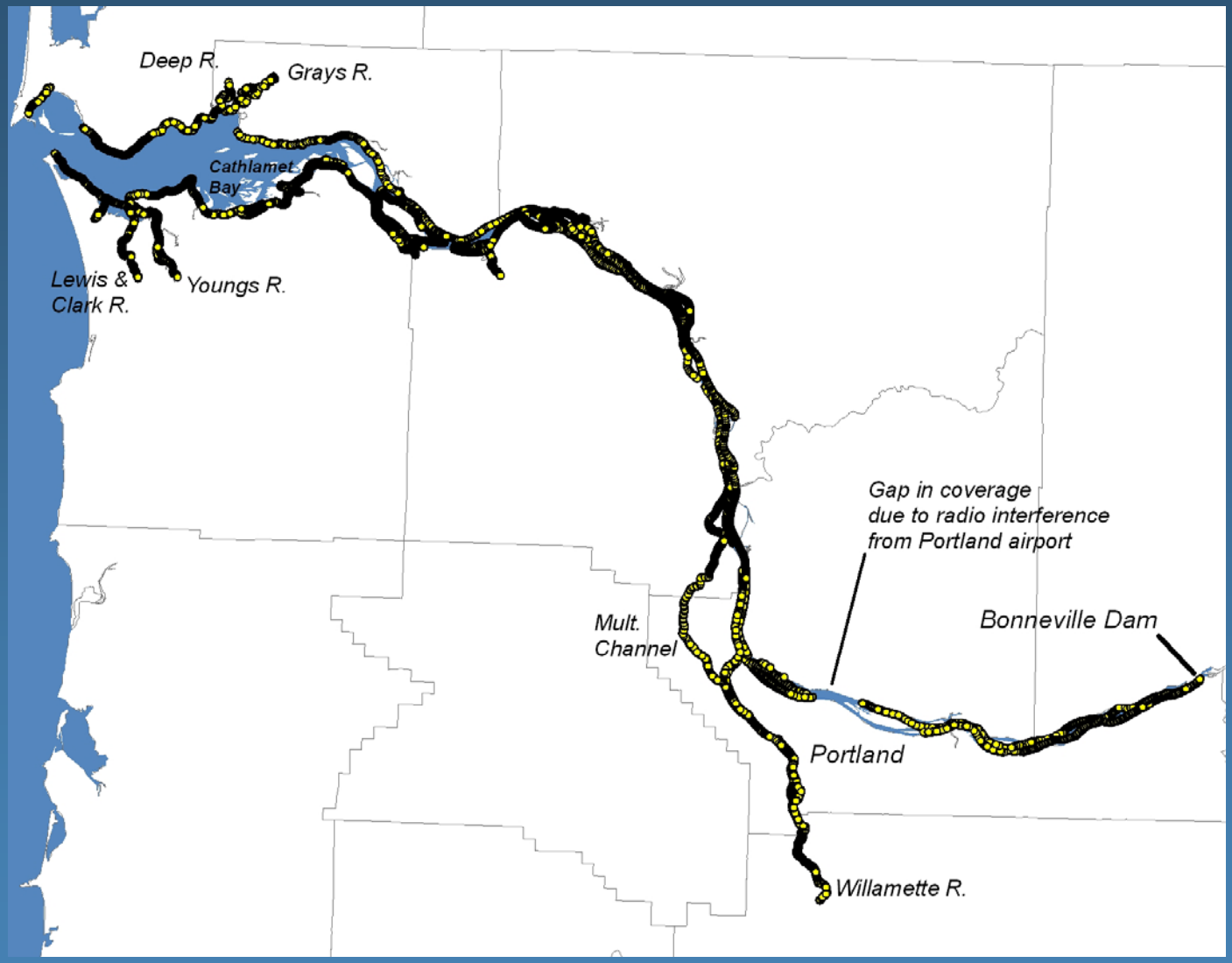
- **Step 1: Shoreline Field Recording using video camera with GPS**
- **Step 2: Import data to ArcGIS**
- **Step 3: Geodatabase Creation**



Lower Columbia River Estuary Partnership

Digital Shoreline Mapping and Inventory: Results

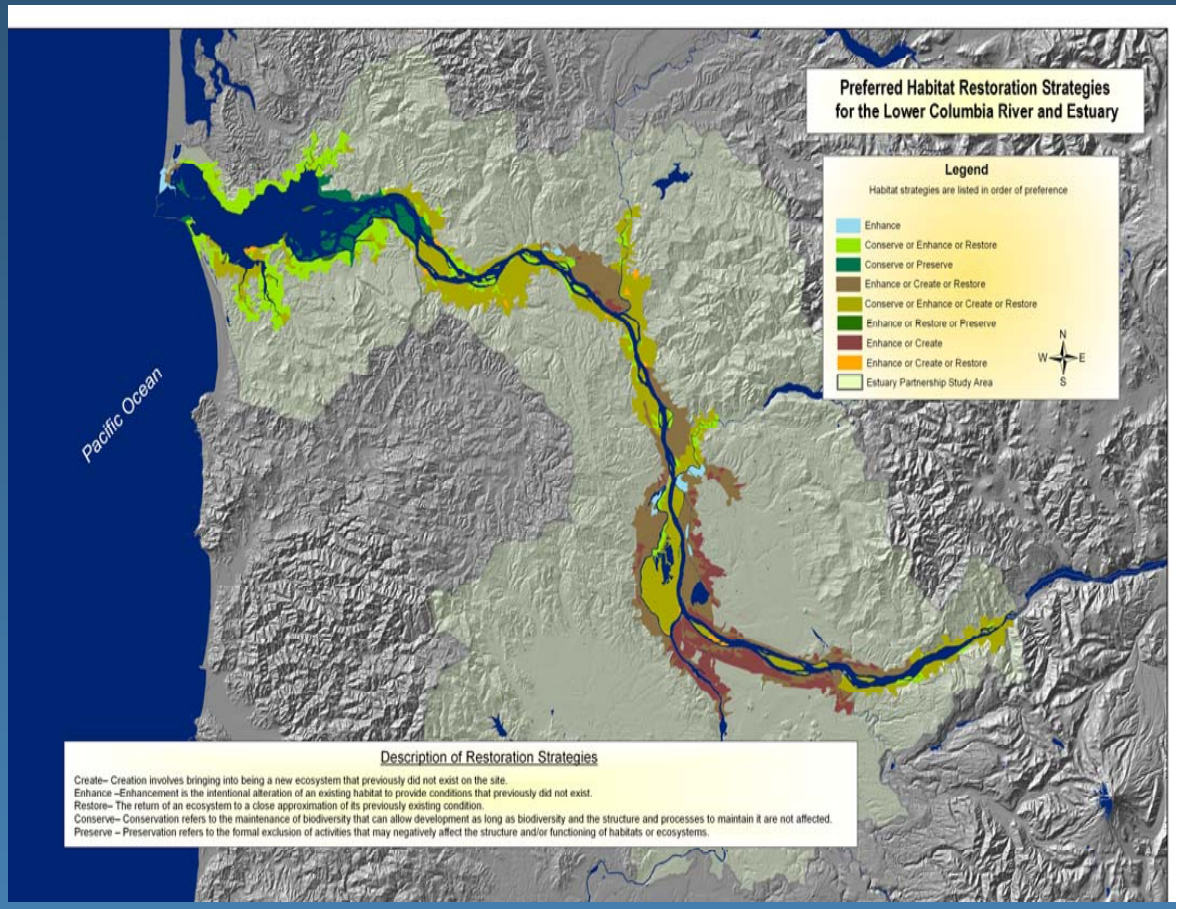
- 605 miles shoreline surveyed:
- Jul 2005 – Oct 2006
- Modified Shoreline: 277 miles
- Natural Shoreline: 250 miles



Lower Columbia River Estuary Partnership

Dataset 2: Habitat Restoration Prioritization Strategy

- Two-tiered approach - Scales from system-wide to project specific
- Tier 1 uses model
  - provides defensible method for comparing site function and structure at larger scales
  - Focuses on existing data
  - can refine by updating/adding new data



- Tier 2 provides scientific method of comparing specific projects using change in function and likelihood of success

Habitat Restoration Prioritization Strategy

Evaluation of 9 controlling factor metrics:

- Hydrology @ 3 scales:
  - River, Management Area & Site
- Sediment Quality
- Water Quality
- Light
- Sediment Dynamics
- Depth/Slope
- Physical Disturbance

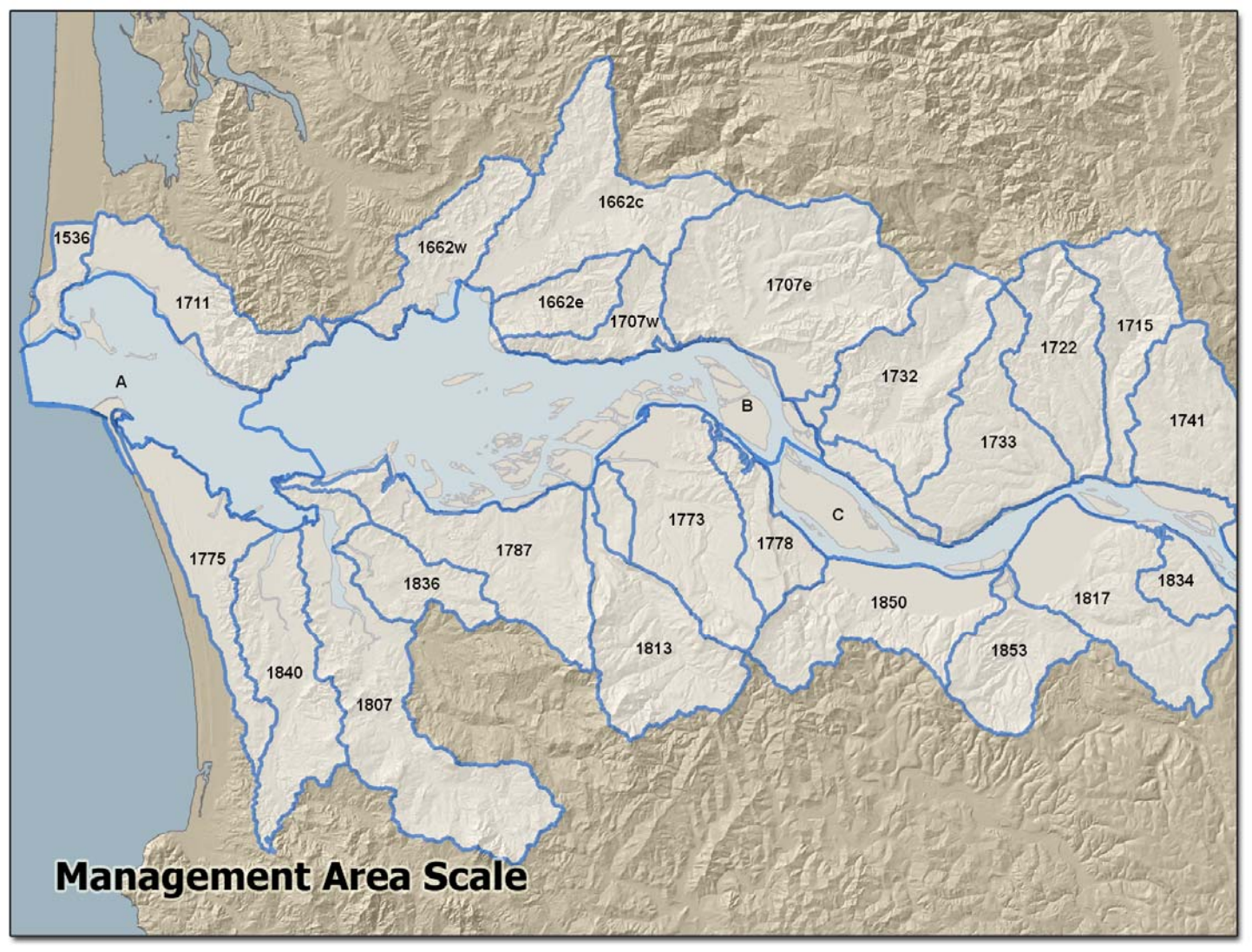
Primary Data Sources for Evaluation:

- Diked areas
- Tide gates and other flow-restricting structures
- Land cover derived from Landsat imagery
- Shoreline modifications (e.g., marinas, overwater structures, pile dikes)
- Toxic contaminants
- Proximity to Bonneville Dam

Habitat Restoration Prioritization Strategy

- Scale—Management Areas

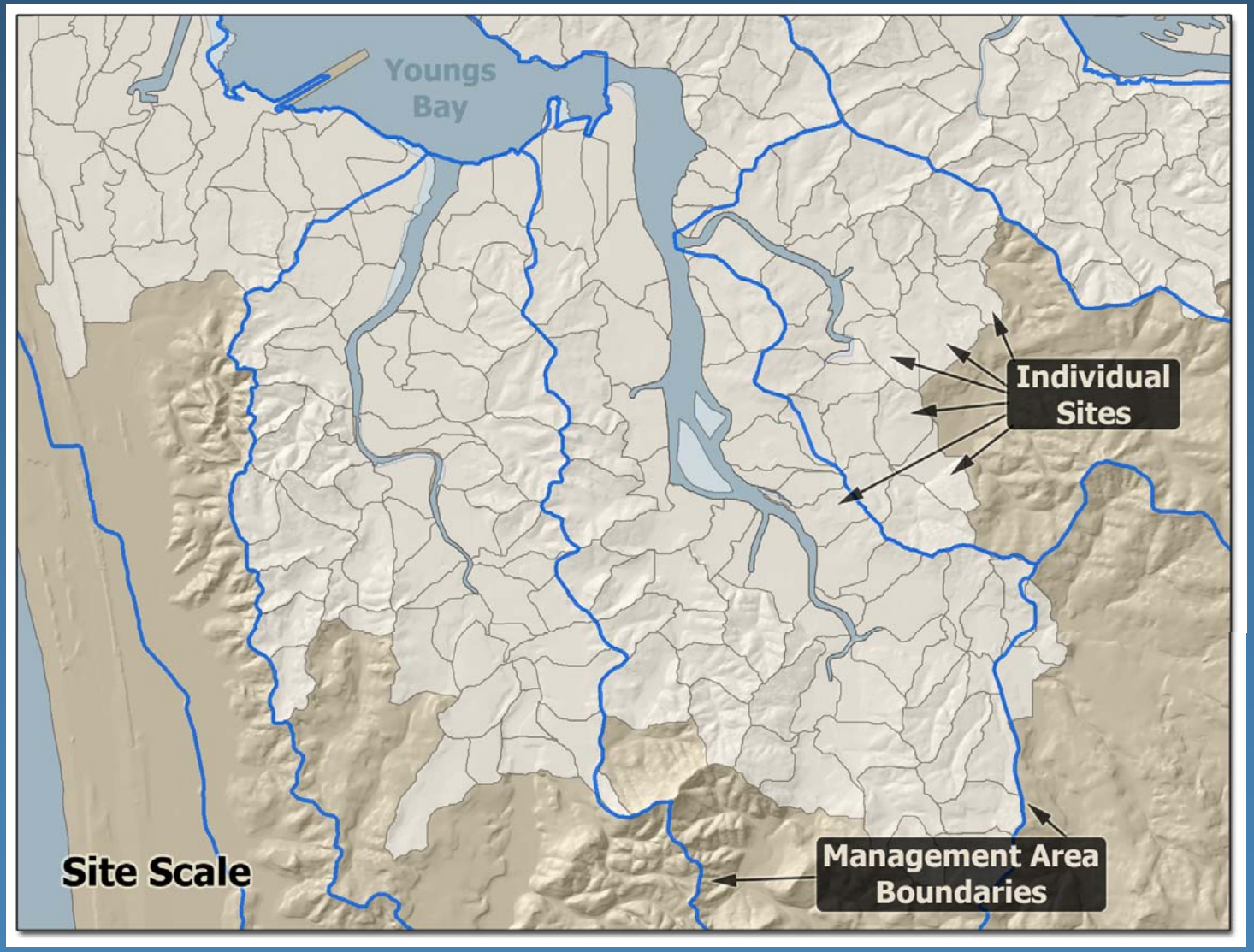
Defined by USGS level 6 HUC



Habitat Restoration Prioritization Strategy

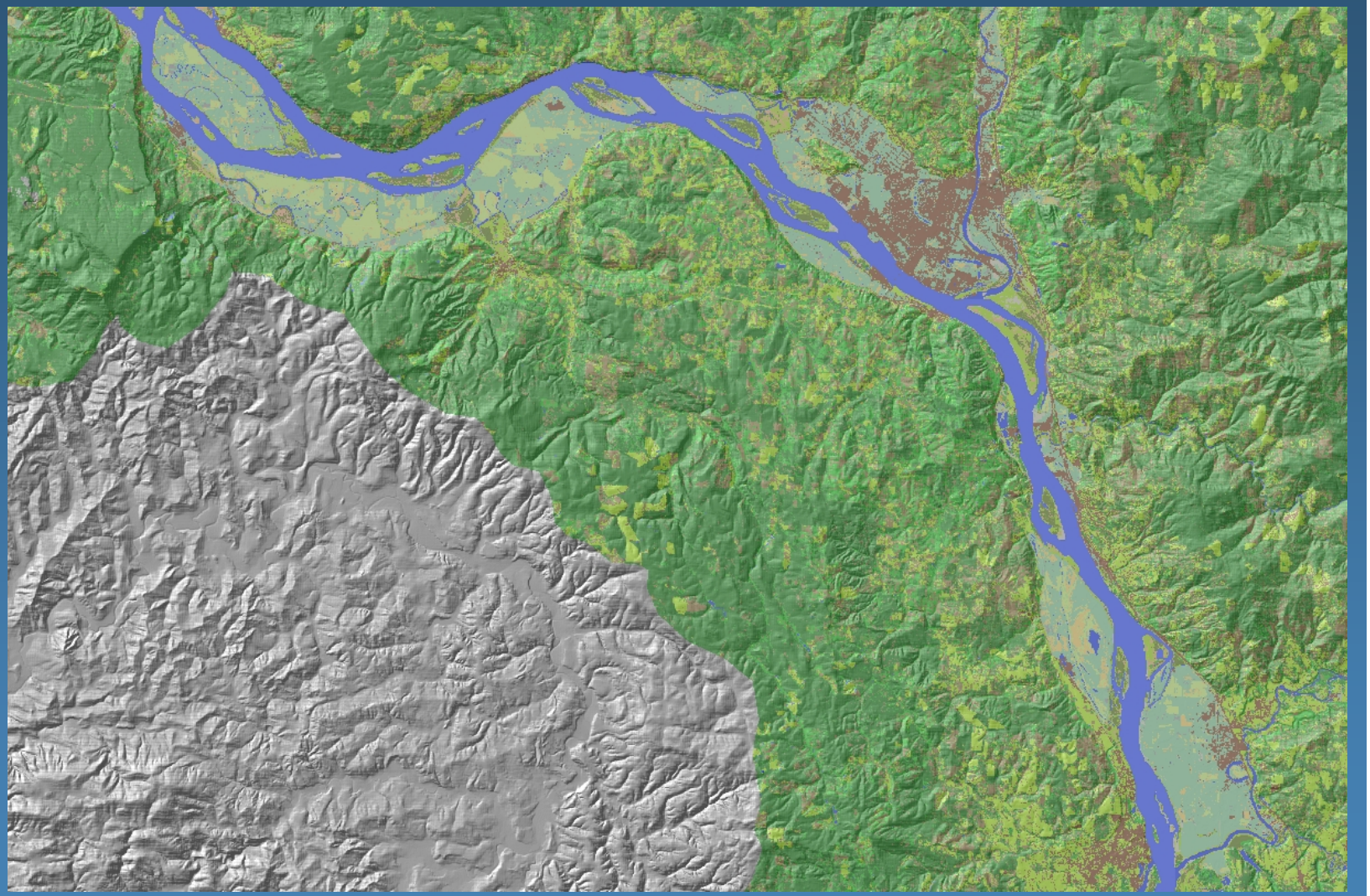
- Scale — Sites

Limited to floodplain



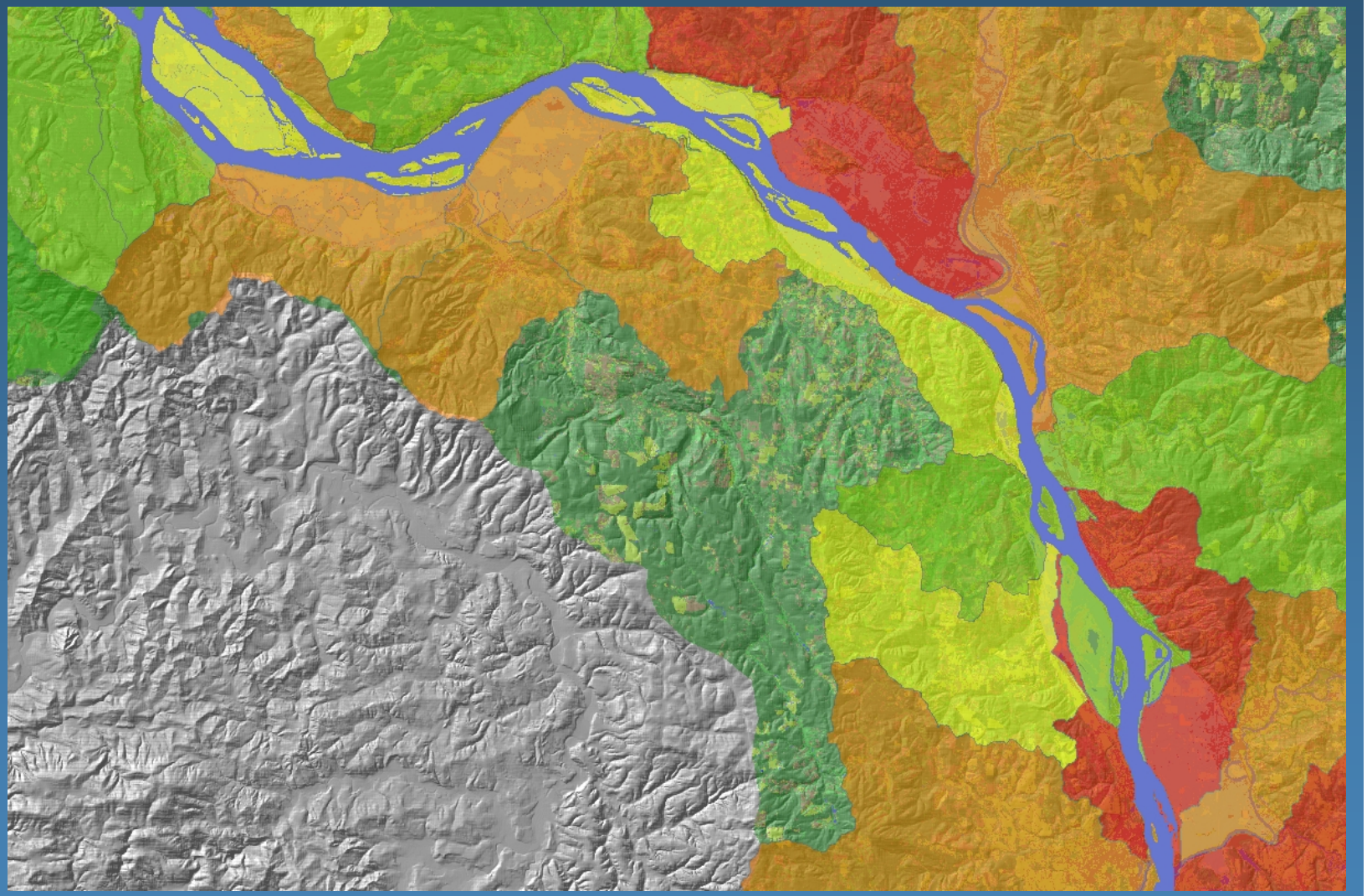
Habitat Restoration Prioritization Strategy

Results:



Habitat Restoration Prioritization Strategy

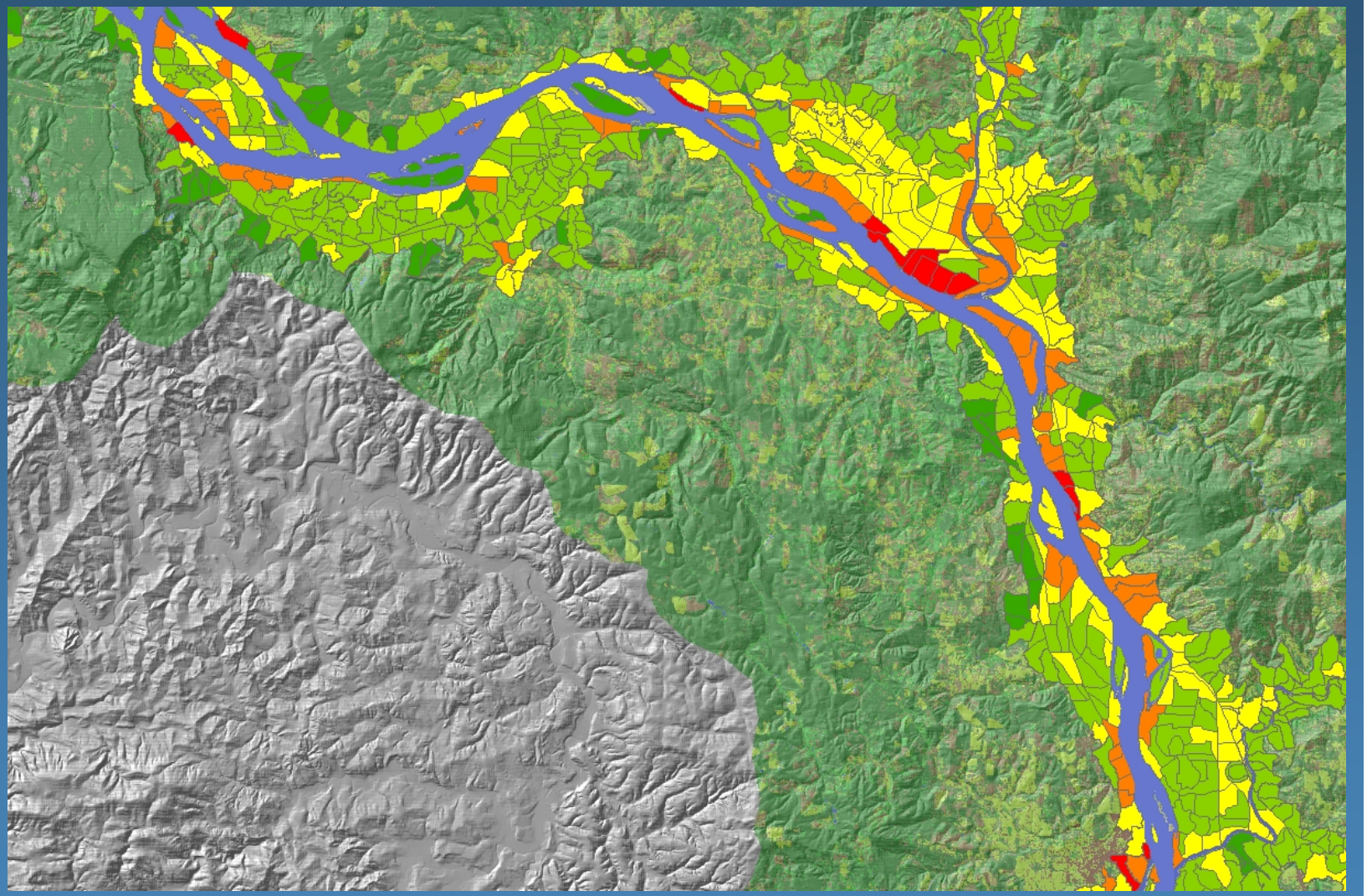
Results:



Management Area Scale

Habitat Restoration Prioritization Strategy

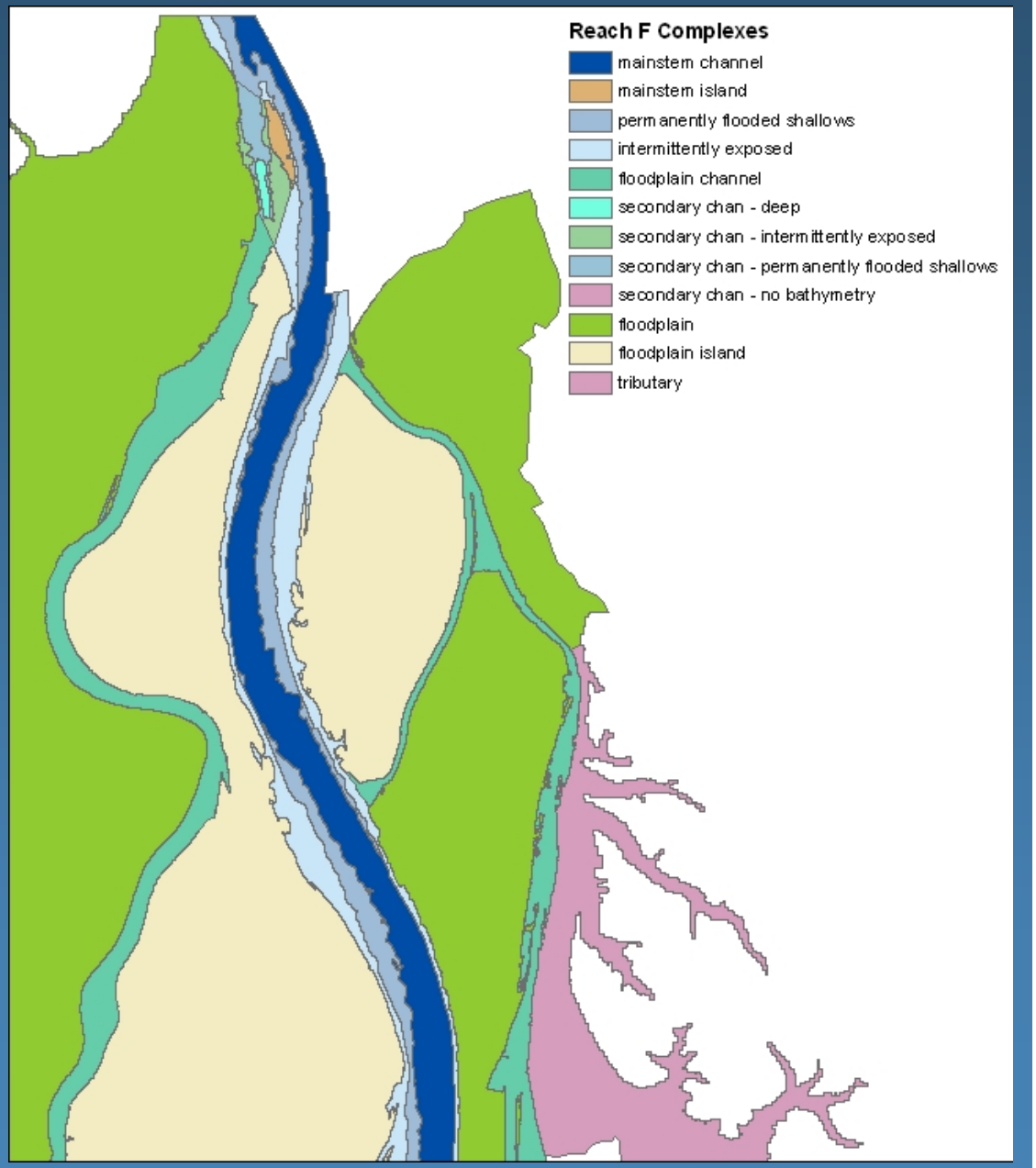
Results:



Site Scale

Dataset 3: Columbia Estuarine Ecosystem Classification

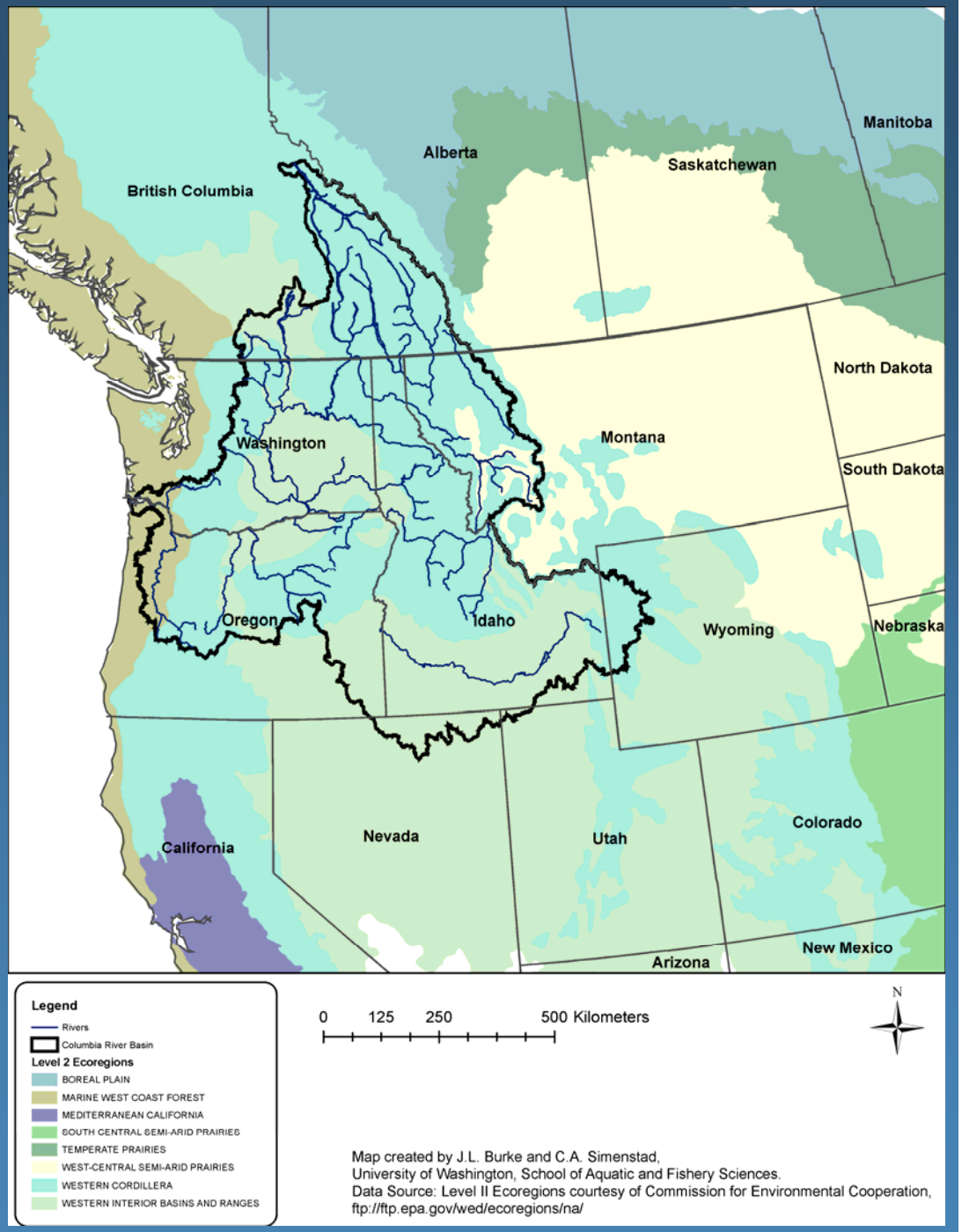
- University of Washington with USGS
- Provides hierarchical classification of habitats across different scales
  - 6 Hierarchies
  - Large-scale to finer scales
- Useful in selecting monitoring sites and in habitat restoration prioritization
- Uses hydro-geomorphology as foundation to characterize variation in ecosystem processes



Columbia River Estuarine Ecosystem Classification Level 1

ECOSYSTEM PROVINCE

[Based on US EPA Level II: Ecoregions]

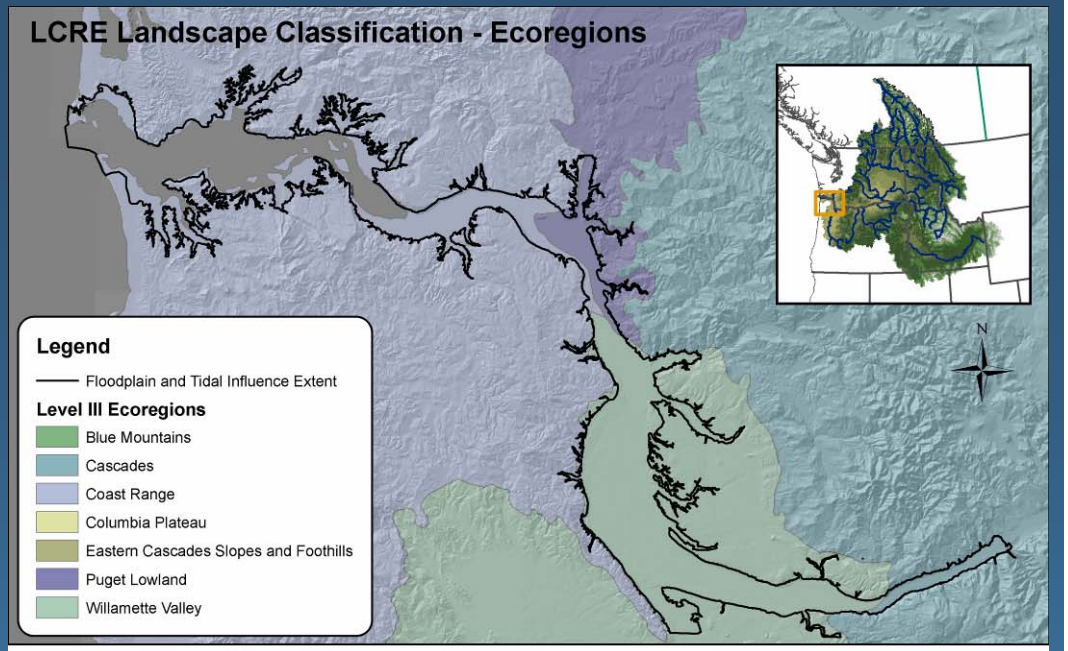


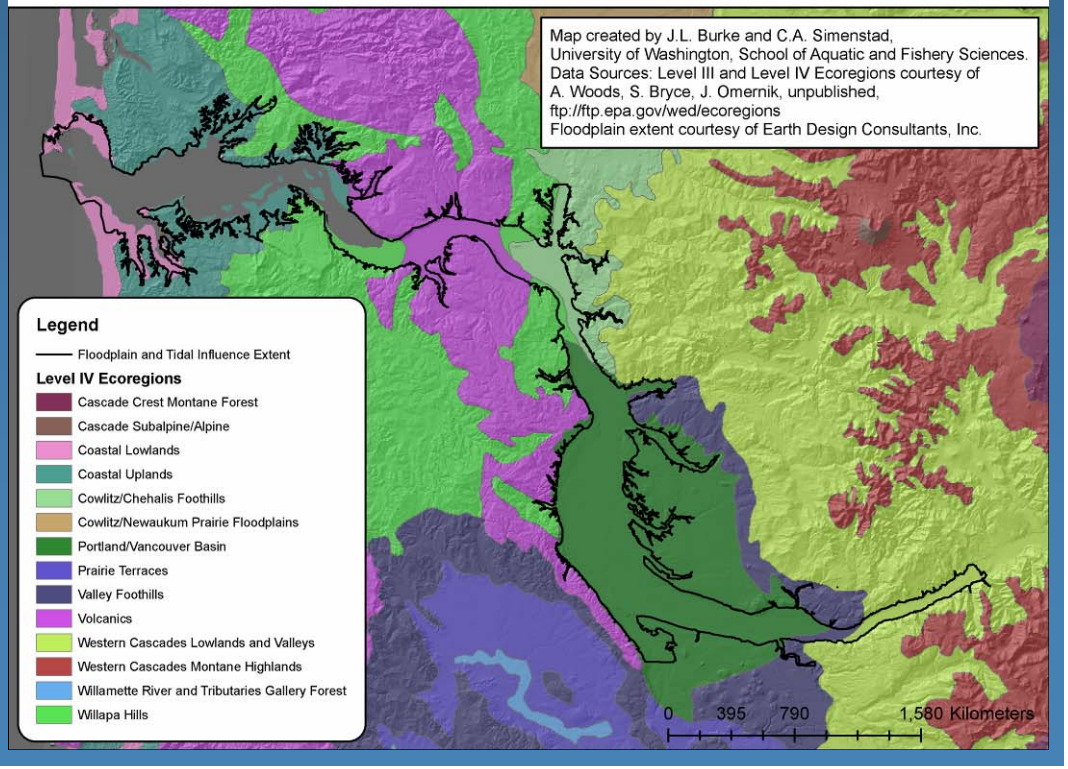
Columbia River Estuarine Ecosystem Classification Levels 2 and 3

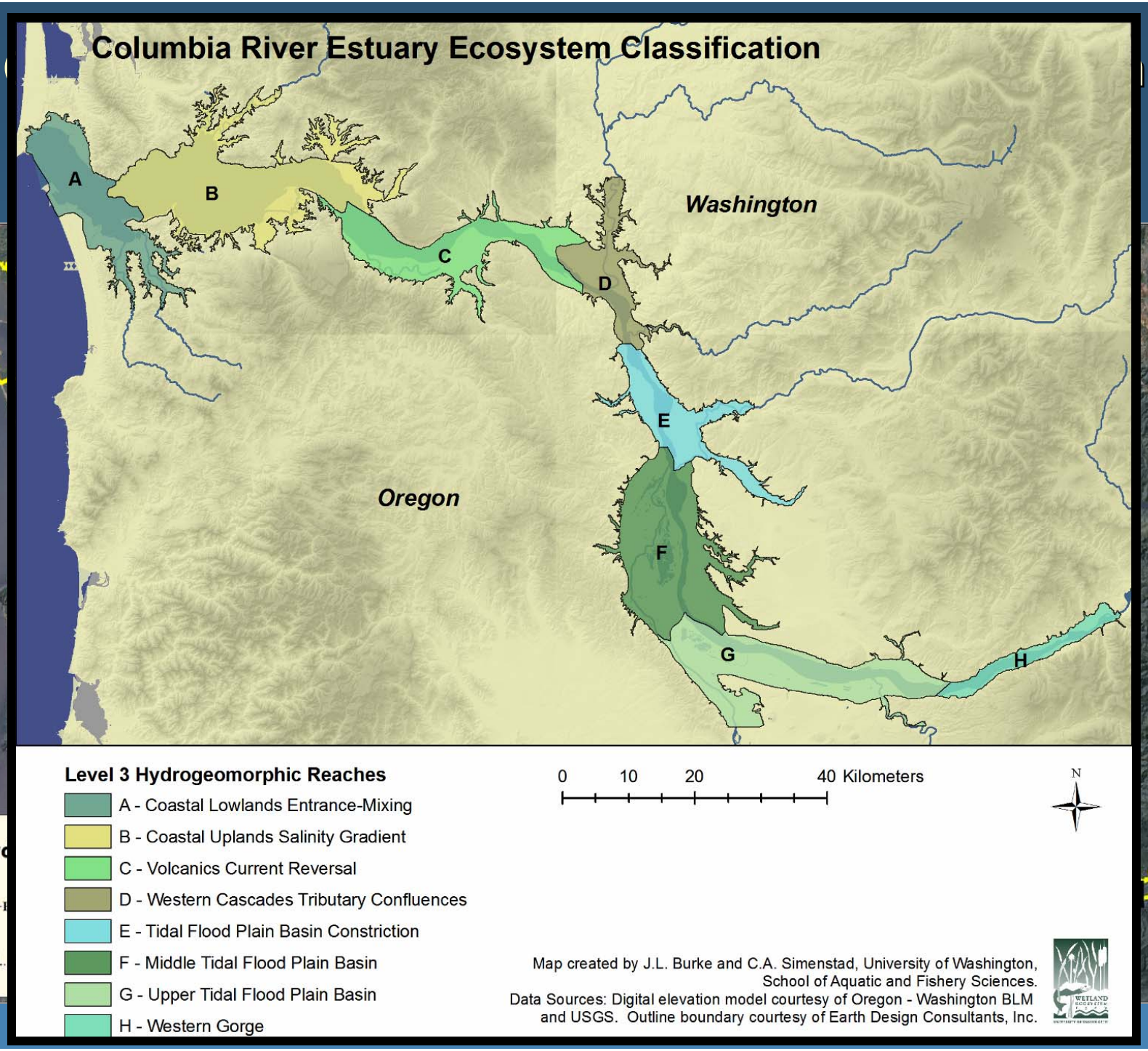
ECOREGION
(top)

HYDROGEOMORPHIC REACH
(bottom)

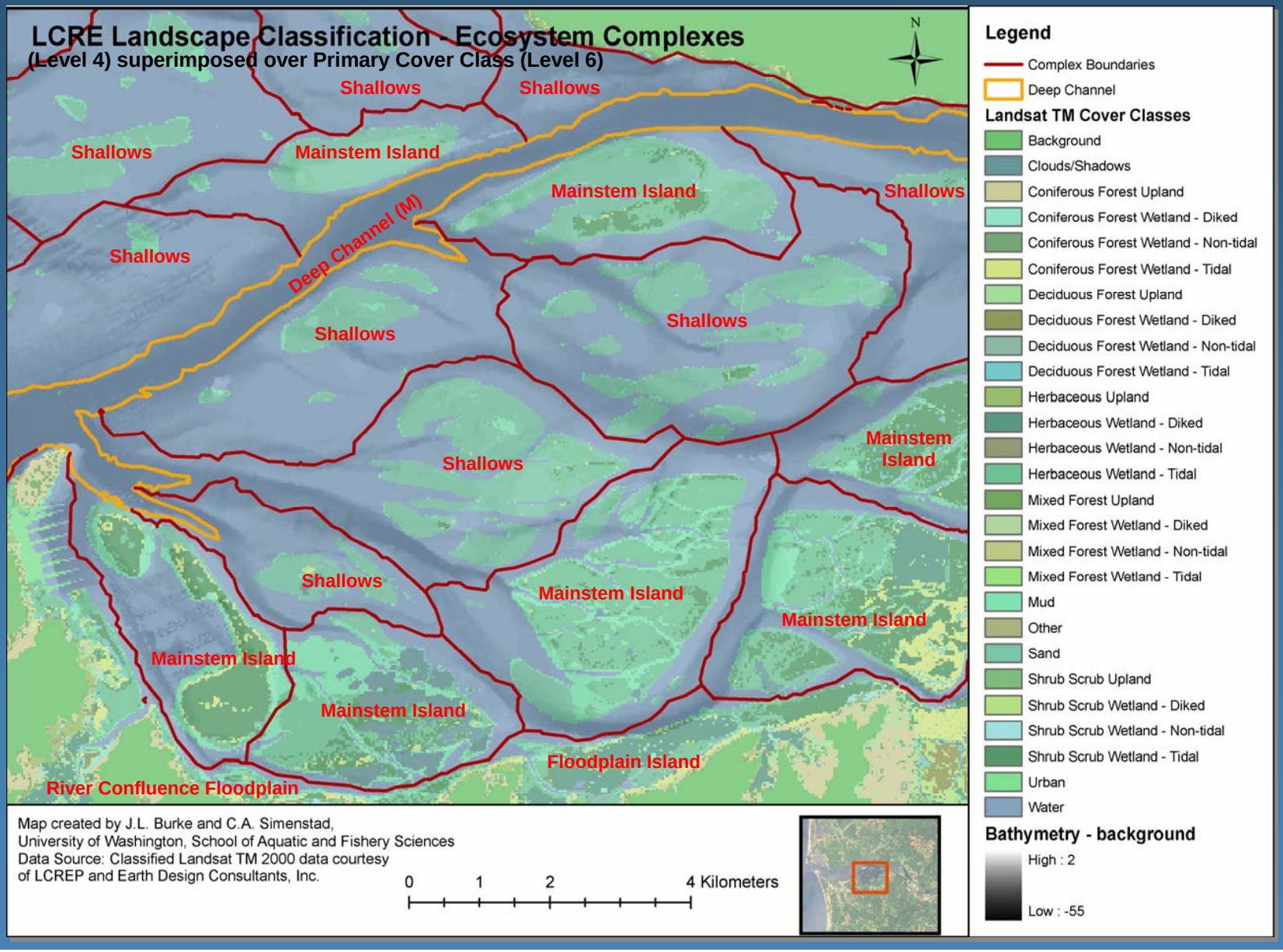
[Modified from US EPA Levels III and IV Ecoregions]






Columbia River Estuary Ecosystem Classification
A
B
C
D
E
F
G
H
Washington
Oregon
Level 3 Hydrogeomorphic Reaches
A - Coastal Lowlands Entrance-Mixing
B - Coastal Uplands Salinity Gradient
C - Volcanics Current Reversal
D - Western Cascades Tributary Confluences
E - Tidal Flood Plain Basin Constriction
F - Middle Tidal Flood Plain Basin
G - Upper Tidal Flood Plain Basin
H - Western Gorge
0 10 20 40 Kilometers
N
Map created by J.L. Burke and C.A. Simenstad, University of Washington, School of Aquatic and Fishery Sciences.
Data Sources: Digital elevation model courtesy of Oregon - Washington BLM and USGS. Outline boundary courtesy of Earth Design Consultants, Inc.

Columbia River Estuarine Ecosystem Classification
Level 4: Ecosystem Complex



Columbia River Estuarine Ecosystem Classification
Level 5: Geomorphic Catena

Distributary channels

Dendritic channels

High order

Low order

Emergent Marshes

Immature marshes

Established marshes

Developed marshes

Mature marsh

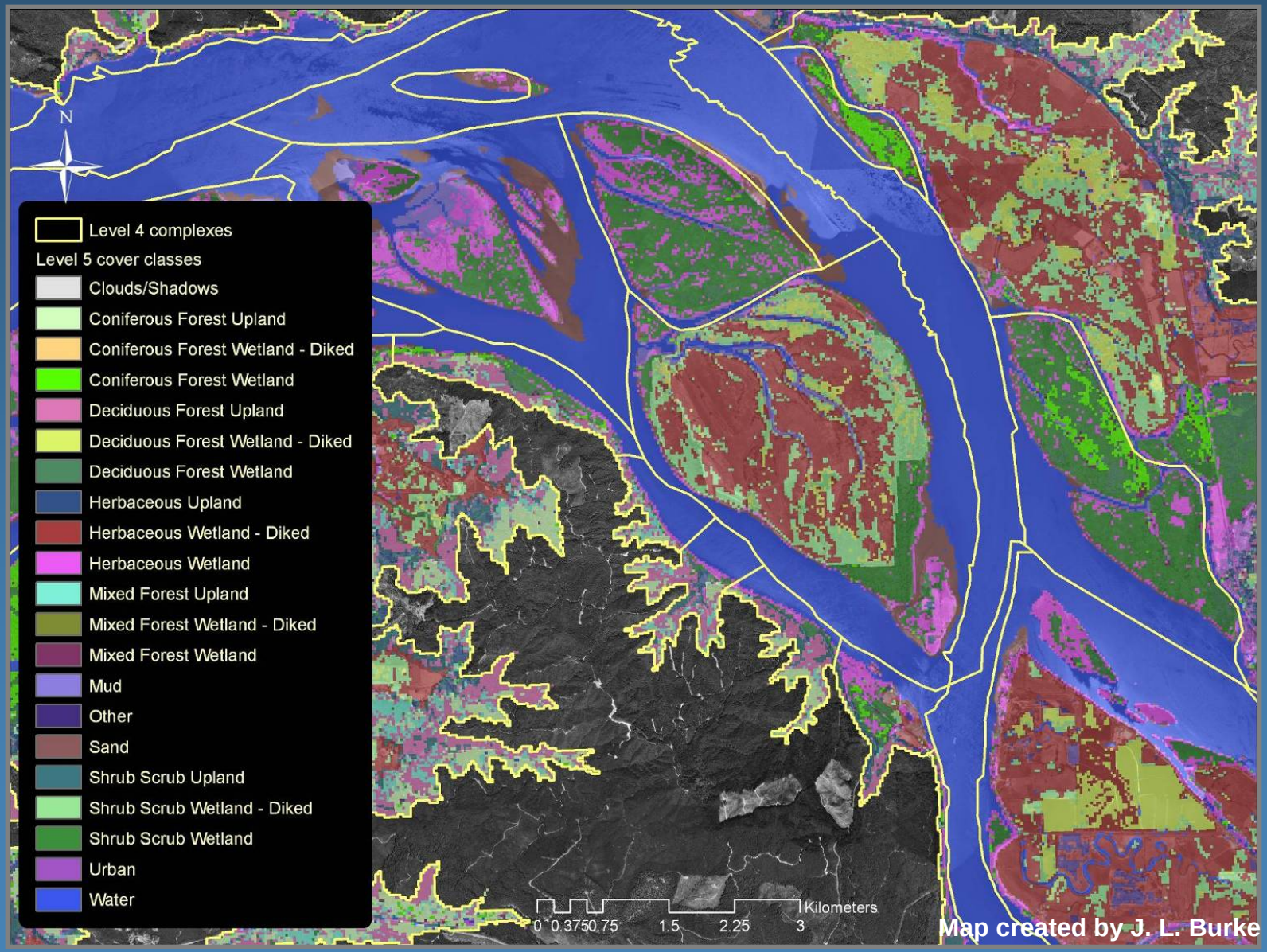
Columbia River estuary

N W E S

0 0.045 0.09 0.18 Kilometers

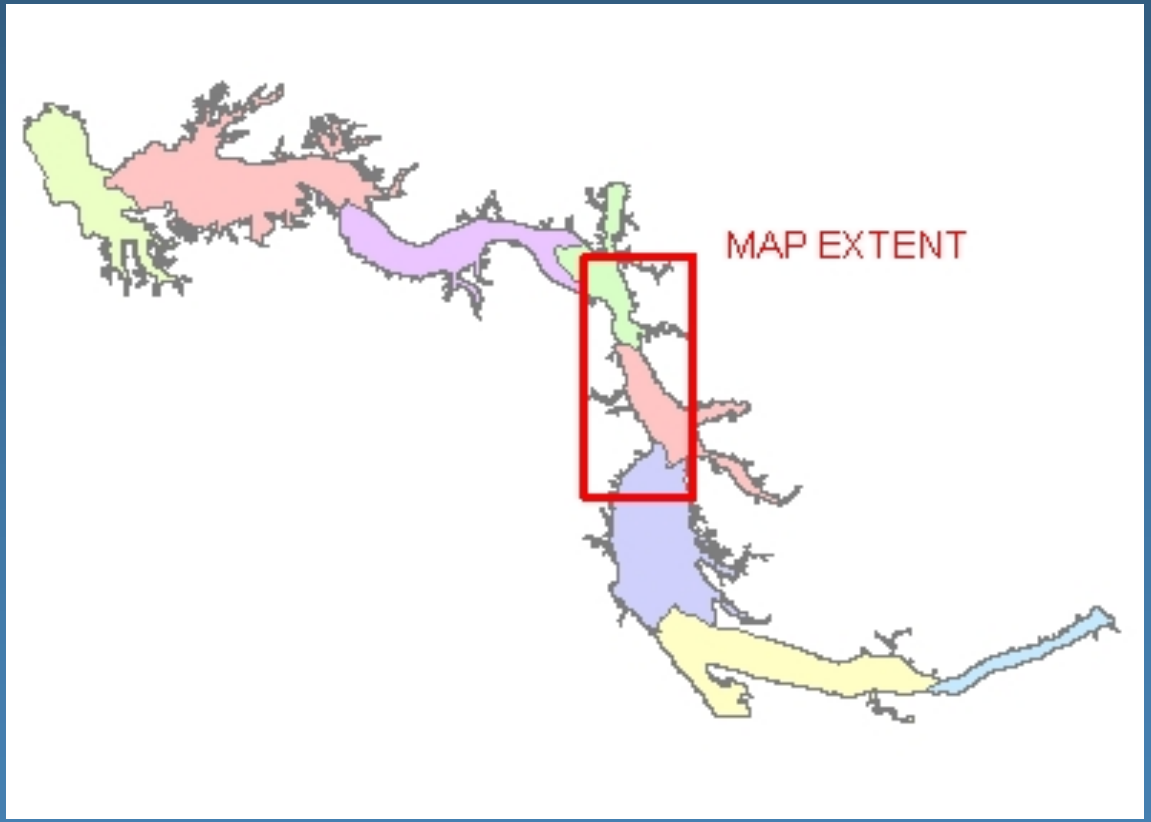
Map created by J. L. Burke

Columbia River Estuarine Ecosystem Classification
Level 6: Primary Cover Class



Phase 1 Sediment Management Plan Development

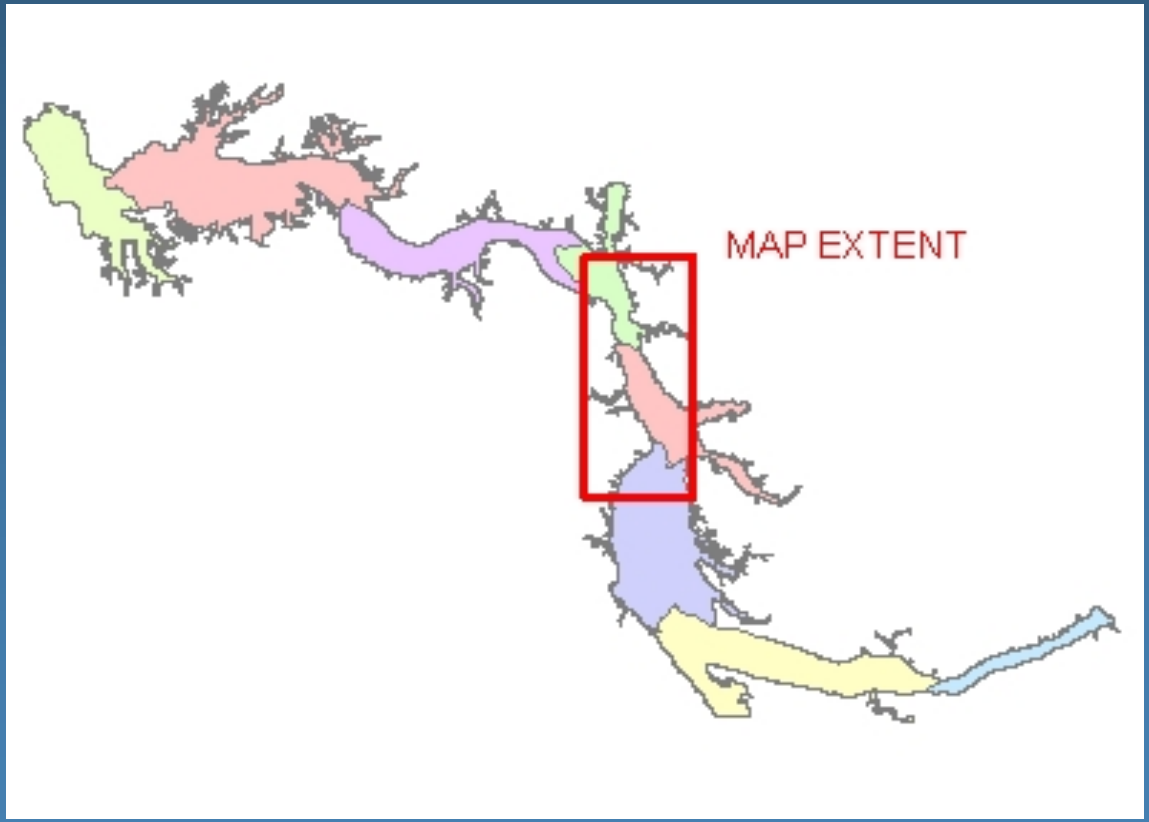
- **Task 6 - Develop and apply criteria for locating dredged material placement sites**
  - **Develop criteria for locating dredged material disposal sites**
  - **Test draft criteria by examining a reach of the lower river for potential sites**



Proposed Pilot Reaches

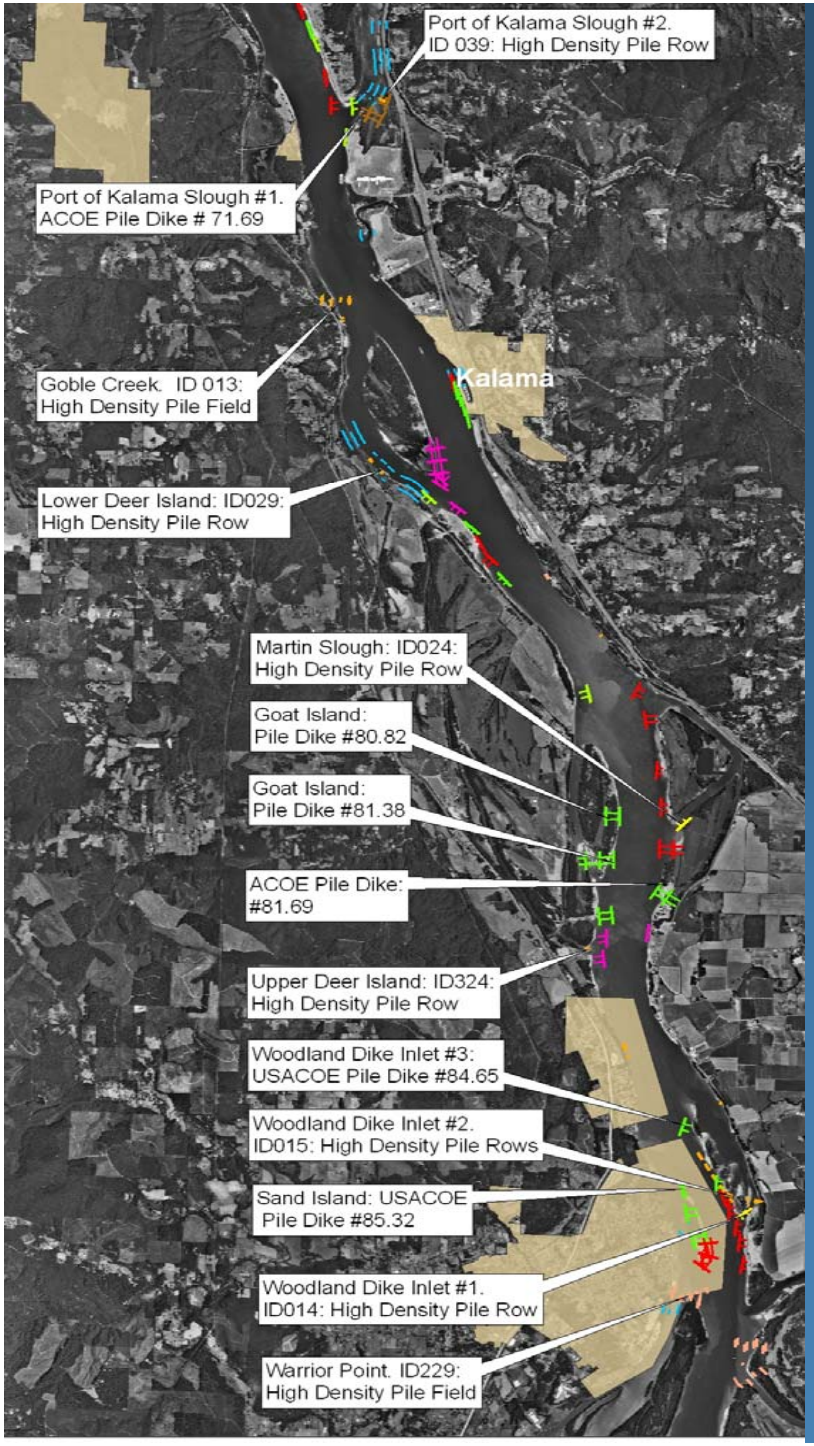
Proposed Pilot Reaches

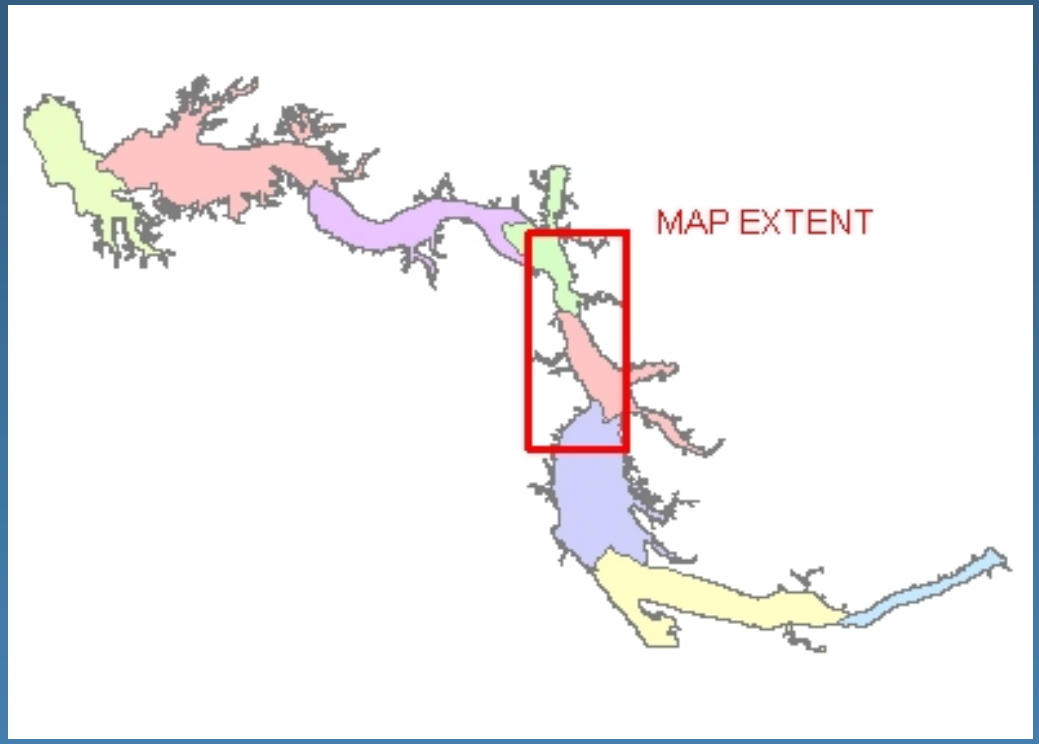
- **Pile Structure Program**
- **Working with US ACE, BPA and others**
- **Have compiled extensive related dataset for these reaches**



Proposed Pilot Reaches

Proposed Pilot Reaches





Proposed Pilot Reaches

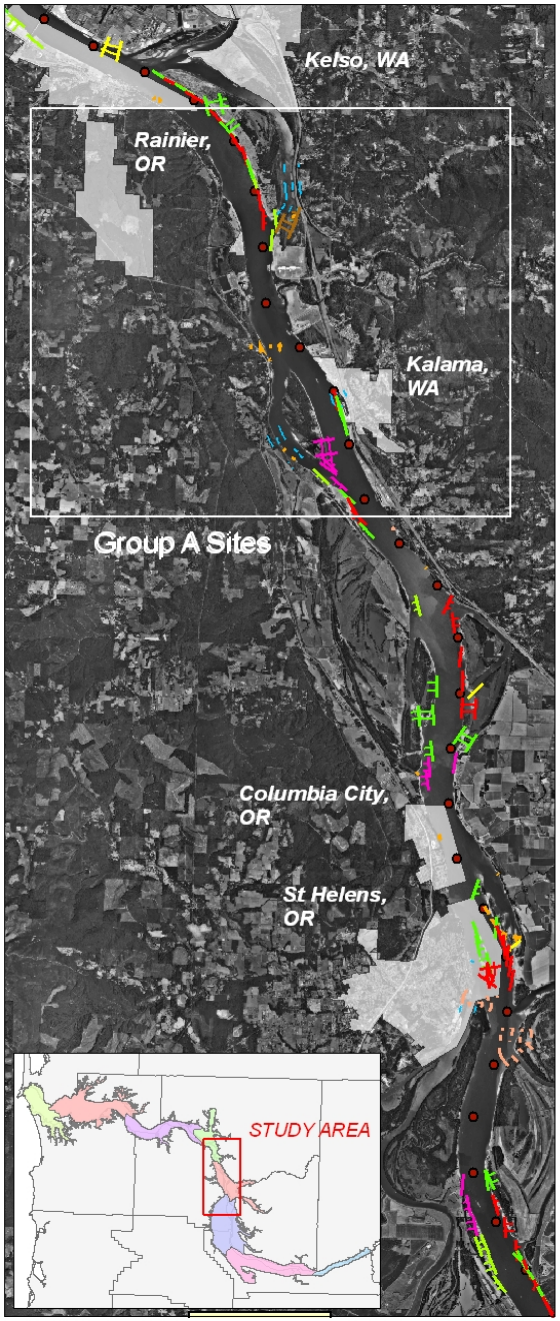
- **Pile Structure Program**
- **Site visits**
- **Field data**
- **Aerial images**
- **Historical photos in comparison to current**
- **Landowner information (for subset of pilings)**

Estuary Partnership Pile Evaluation & Removal Program:

Site Map for Structures Adjacent to Port of Kalama, WA

Lower Columbia River Estuary Partnership

Study Area View



Legend:

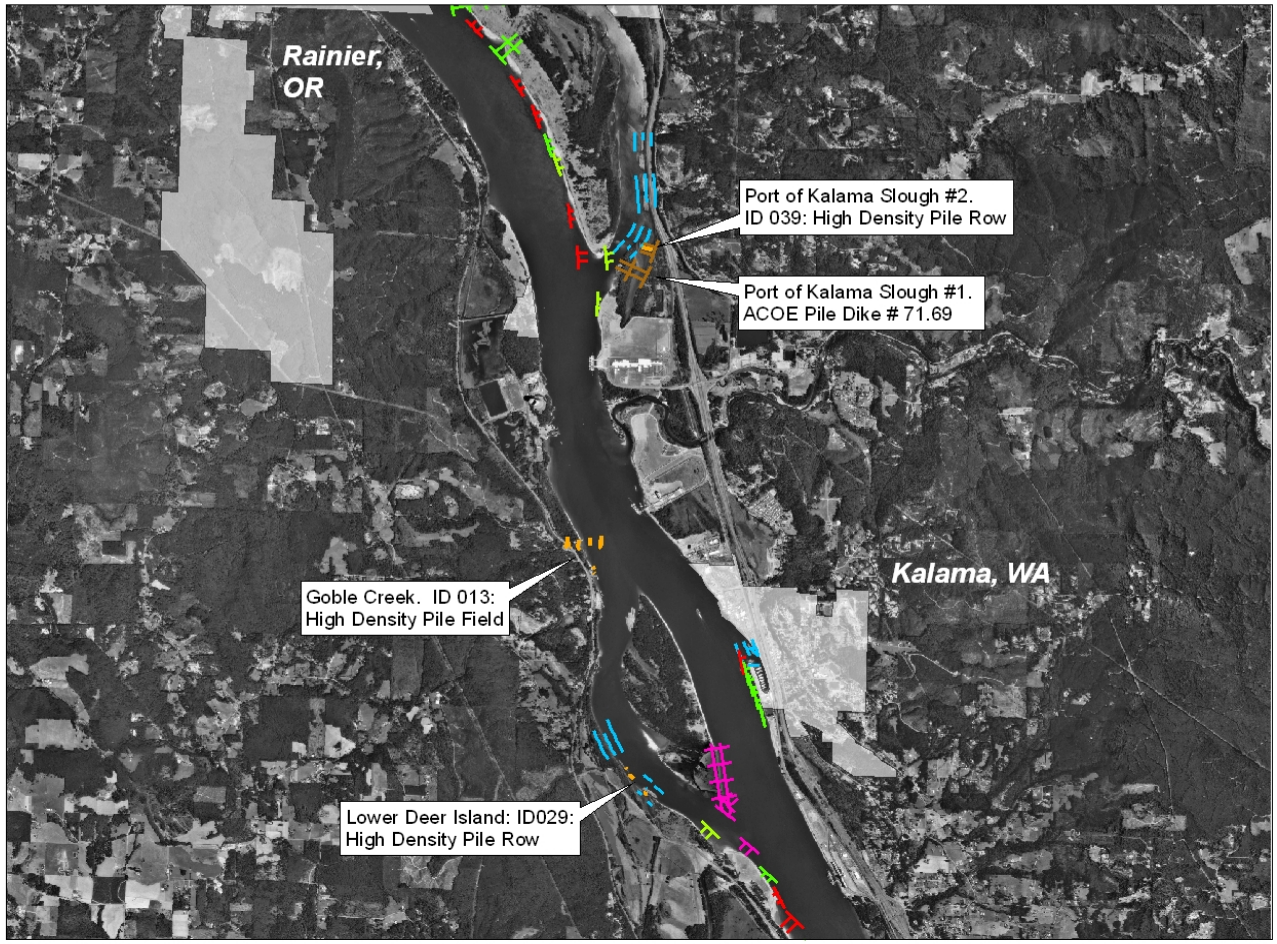
EP Pile Inventory

- High Density Piling Field
- High Density Piling Row
- Medium Density Piling Field
- Medium Density Piling Row
- Other Pile Structure
- Pile Dike, Not in VE Report
- Log Rafting

ACOE Pile Dike, VE Recommended Action

- None Listed
- Abandon-develop method
- Abandon-silted in or off repair list
- Maintain
- No action
- Study
- City Limits

Group A Sites View, River Mile 69 - 77

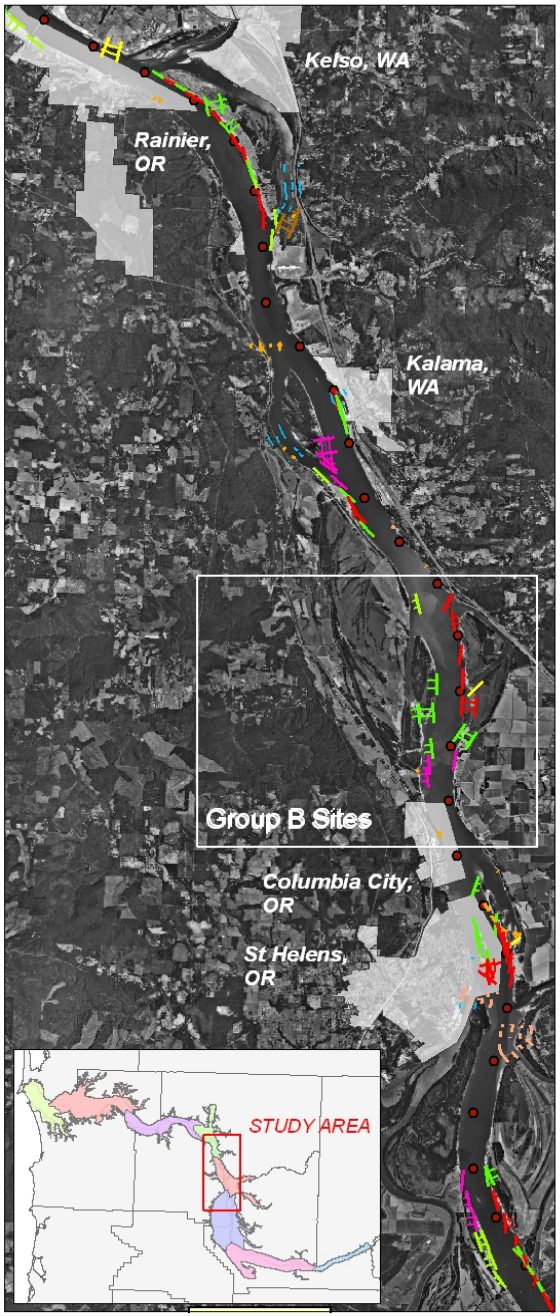


Estuary Partnership Pile Evaluation & Removal Program:

Site Map for Structures Adjacent to Goat and Deer Islands

Lower Columbia River Estuary Partnership

Study Area View



Legend:

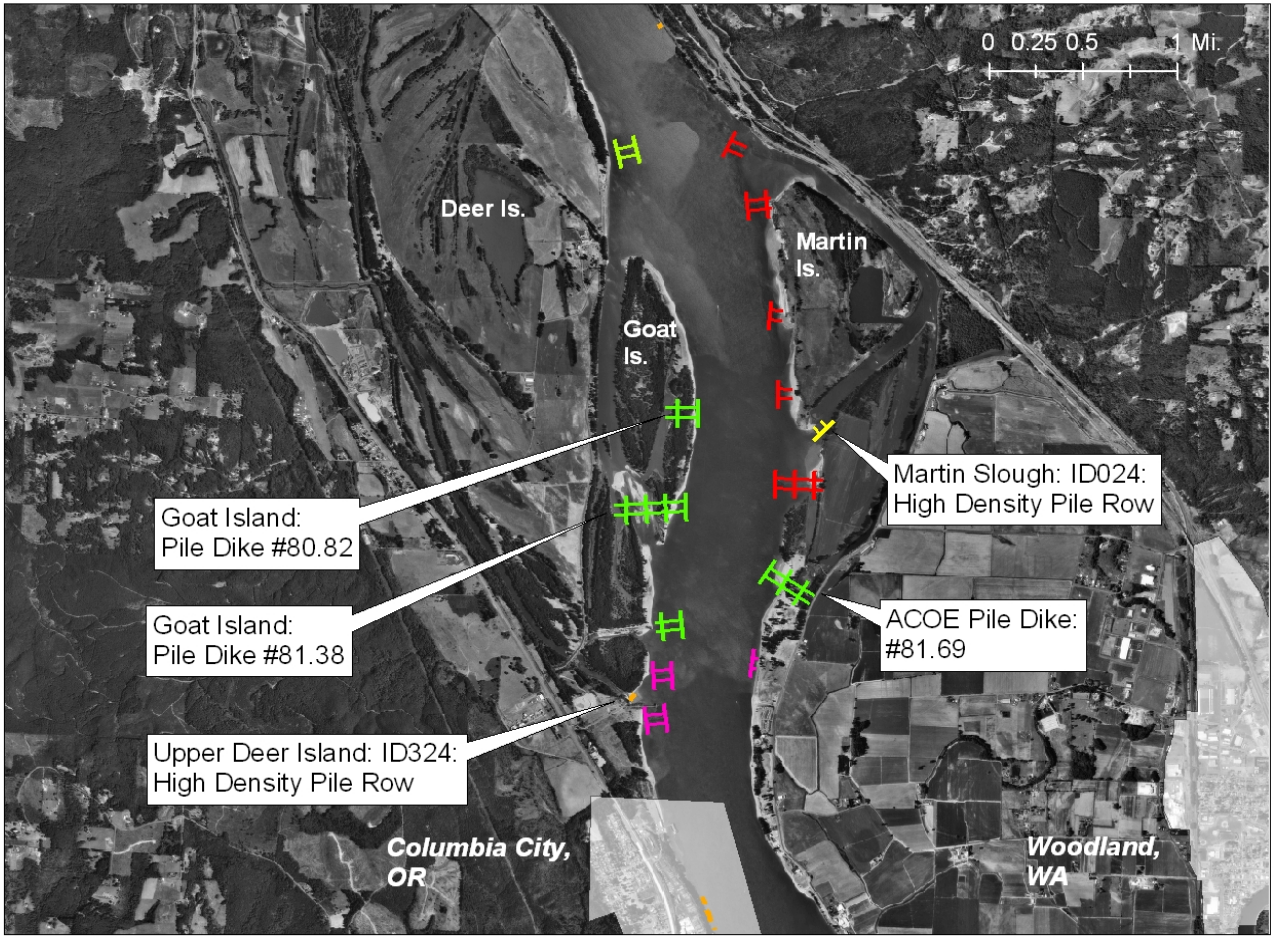
EP Pile Inventory

- High Density Piling Field
- High Density Piling Row
- Medium Density Piling Field
- Medium Density Piling Row
- Other Pile Structure
- Pile Dike, Not in VE Report
- Log Rafting

ACOE Pile Dike, VE Recommended Action

- None Listed
- Abandon-develop method
- Abandon-silted in or off repair list
- Maintain
- No action
- Study
- City Limits

Group B Sites View, River Mile 99 - 84

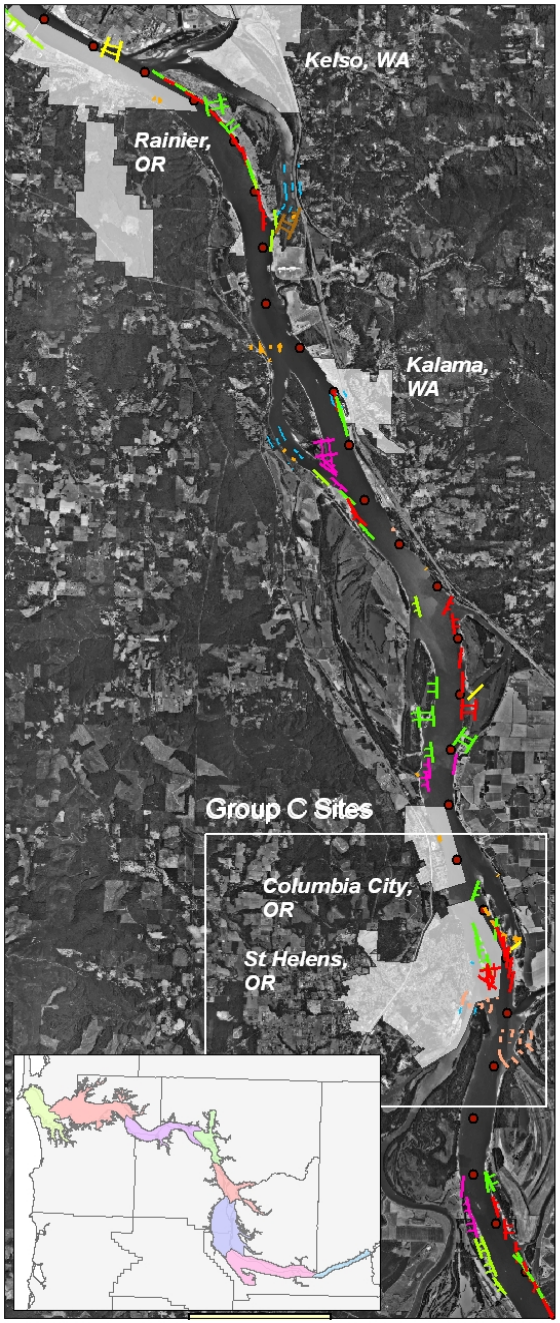


Estuary Partnership Pile Evaluation & Removal Program:

Site Map for Structures Adjacent to St. Helens, OR

Lower Columbia River Estuary Partnership

Study Area View



Legend:

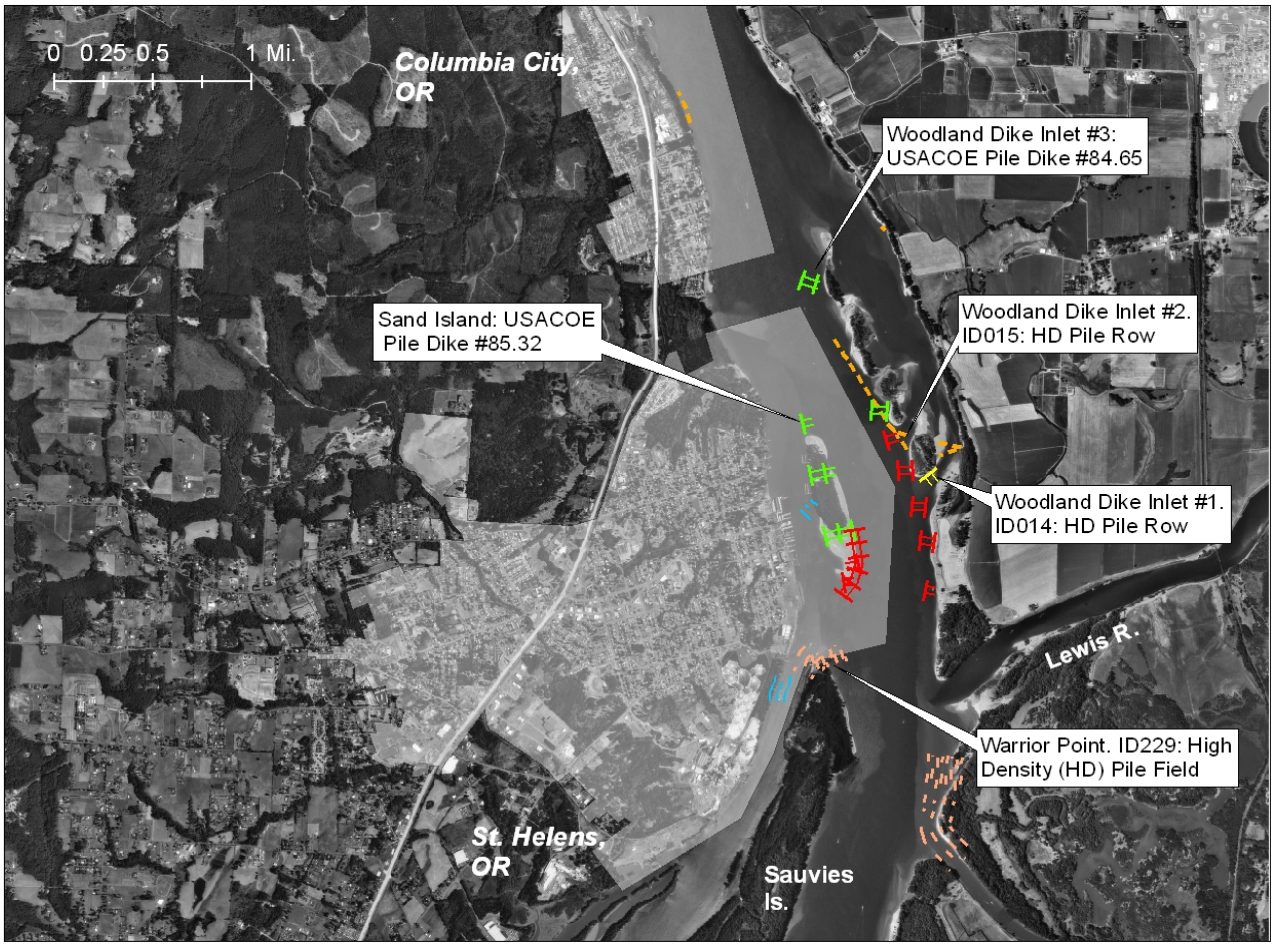
EP Pile Inventory

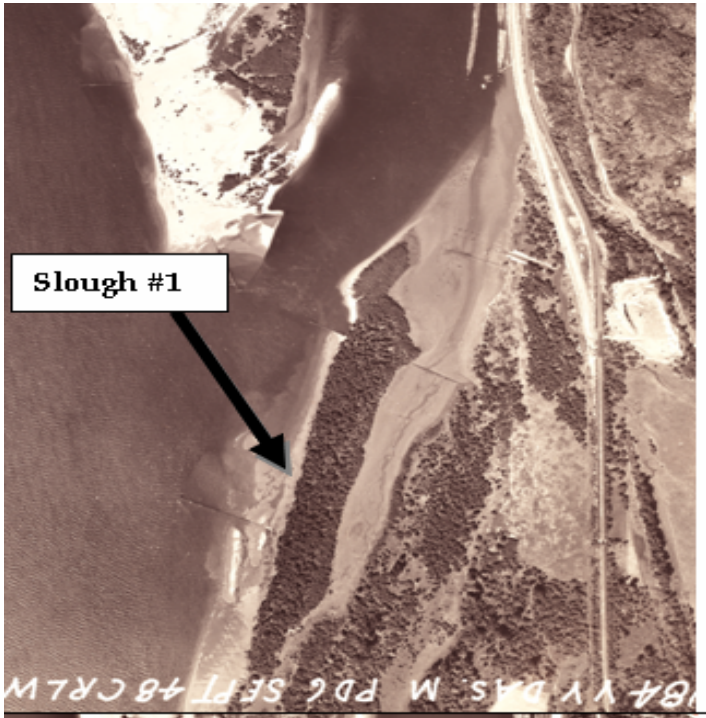
- High Density Piling Field
- High Density Piling Row
- Medium Density Piling Field
- Medium Density Piling Row
- Other Pile Structure
- Pile Dike, Not in VE Report
- Log Rafting

ACOE Pile Dike, VE Recommended Action

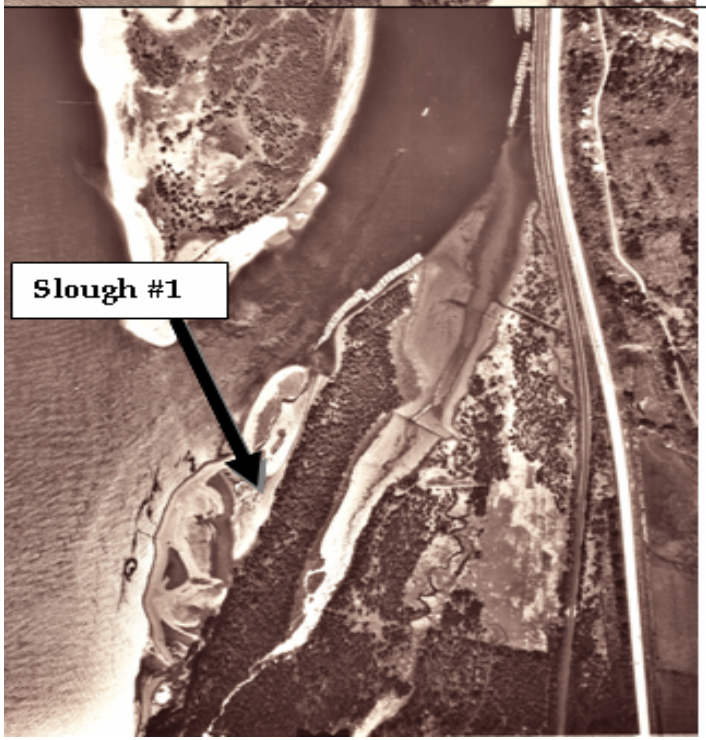
- None Listed
- Abandon-develop method
- Abandon-silted in or off repair list
- Maintain
- No action
- Study
- City Limits

Group C Sites View, River Mile 84 - 89





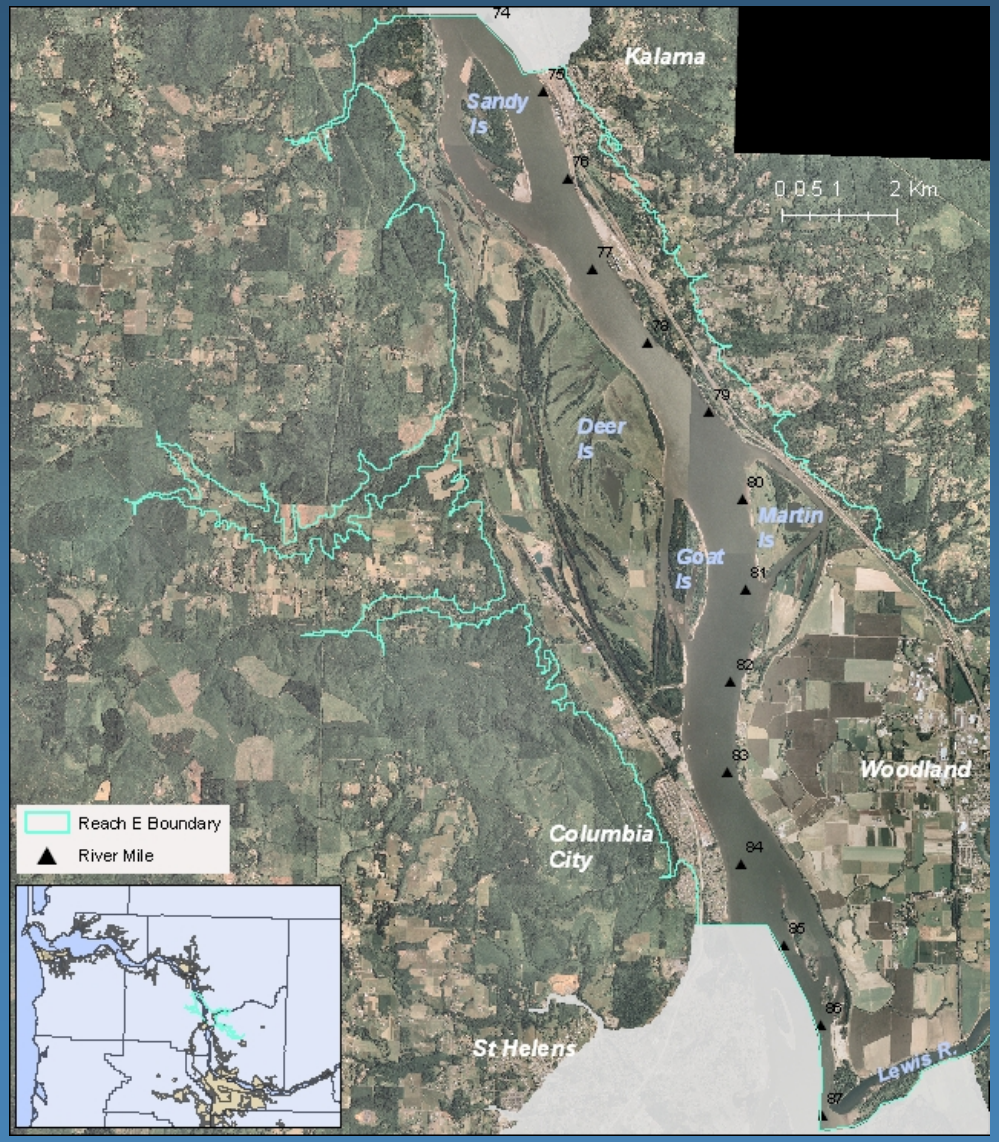
Cottonwood Island -1948



Cottonwood Island -1968

Historical Photos

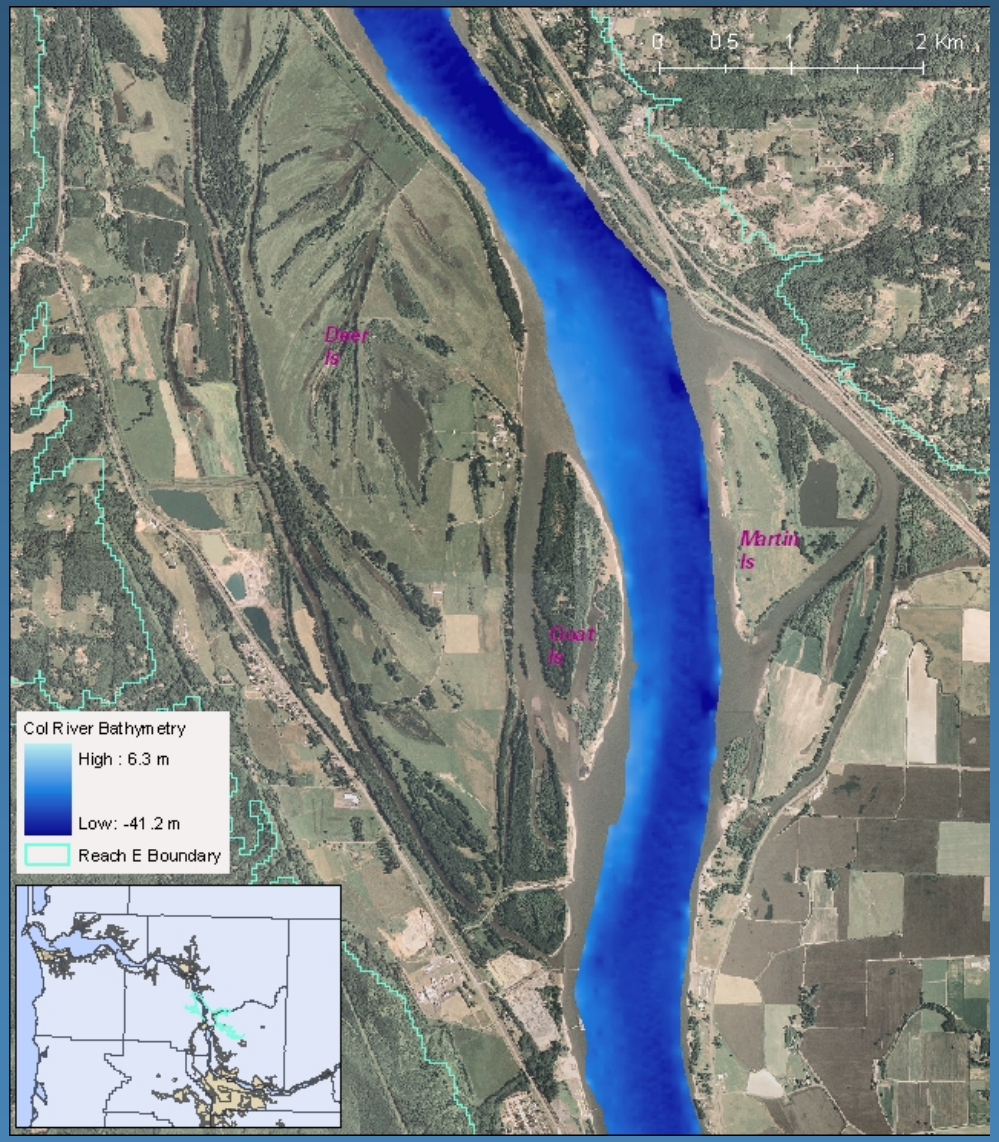
Phase 1 Sediment Management Plan Development



- River Reach E

Lower Columbia River Estuary Partnership

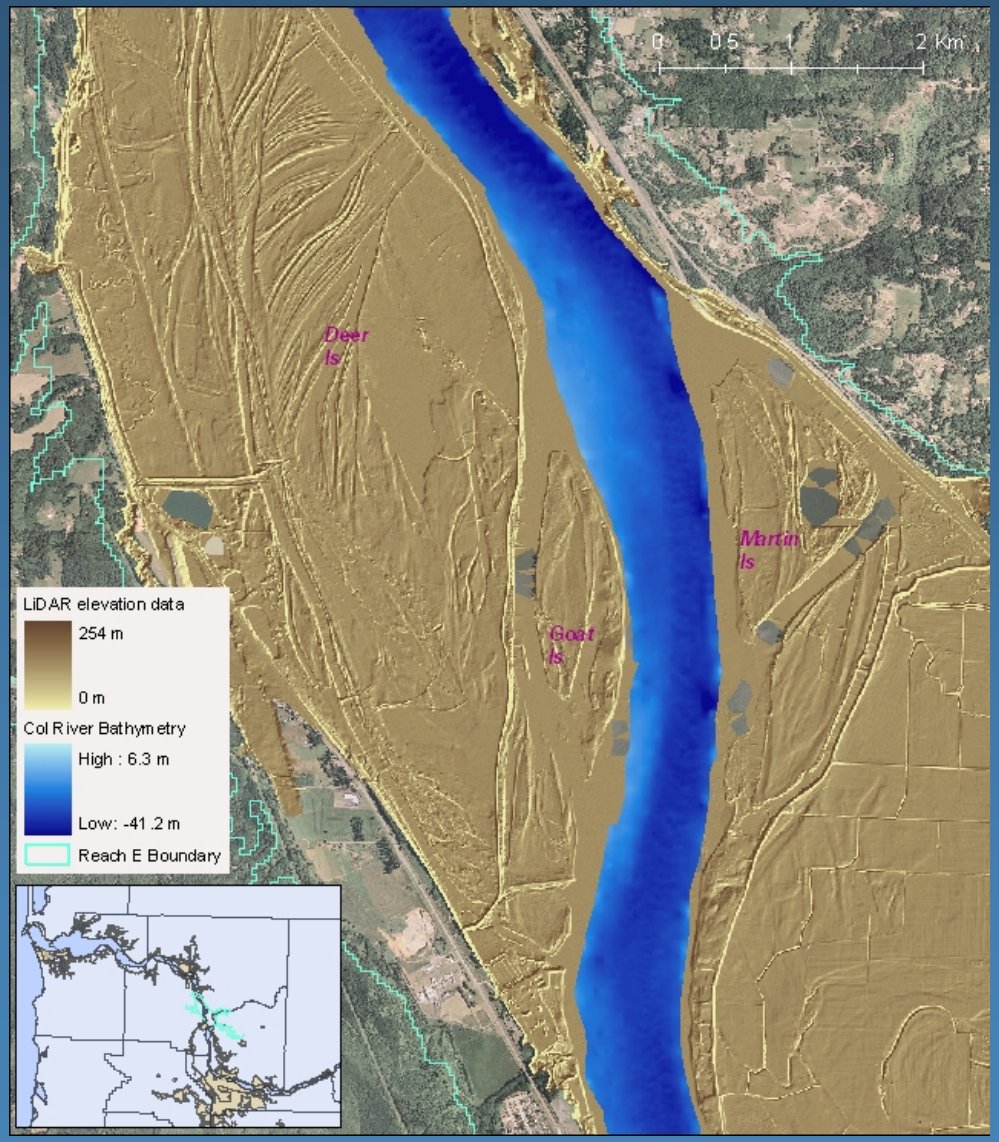
Phase 1 Sediment Management Plan Development



- Smaller Area within Reach E
  - (Deer, Goat, Martin Islands area)
- + Bathymetry Criteria

Lower Columbia River Estuary Partnership

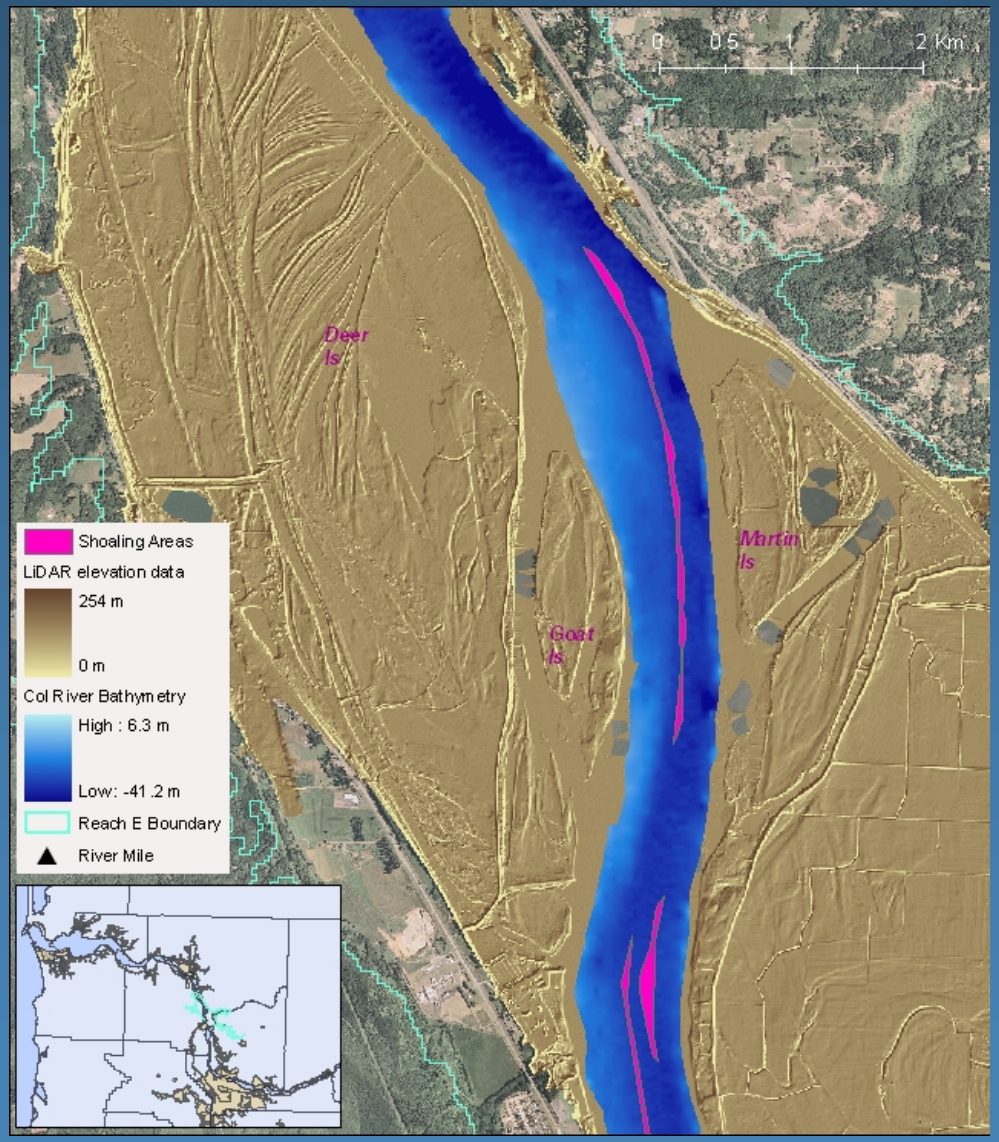
Phase 1 Sediment Management Plan Development



- Smaller Area within Reach E
  - (Deer, Goat, Martin Islands area)
- Bathymetry Criteria
- + LiDar Elevation Criteria

Lower Columbia River Estuary Partnership

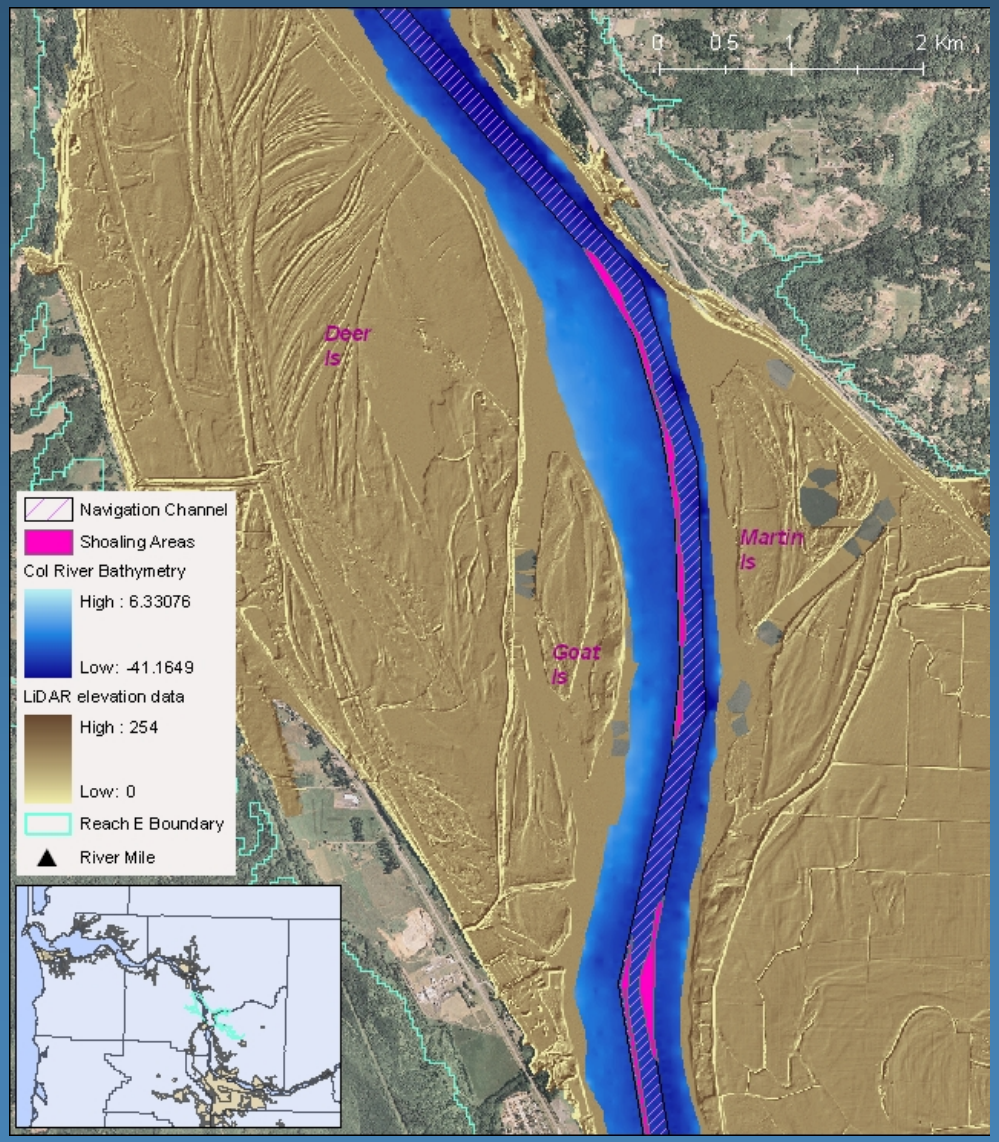
Phase 1 Sediment Management Plan Development



- Smaller Area within Reach E
- Bathymetry Criteria
- LiDar Elevation Criteria
- + Shoaling Criteria

Lower Columbia River Estuary Partnership

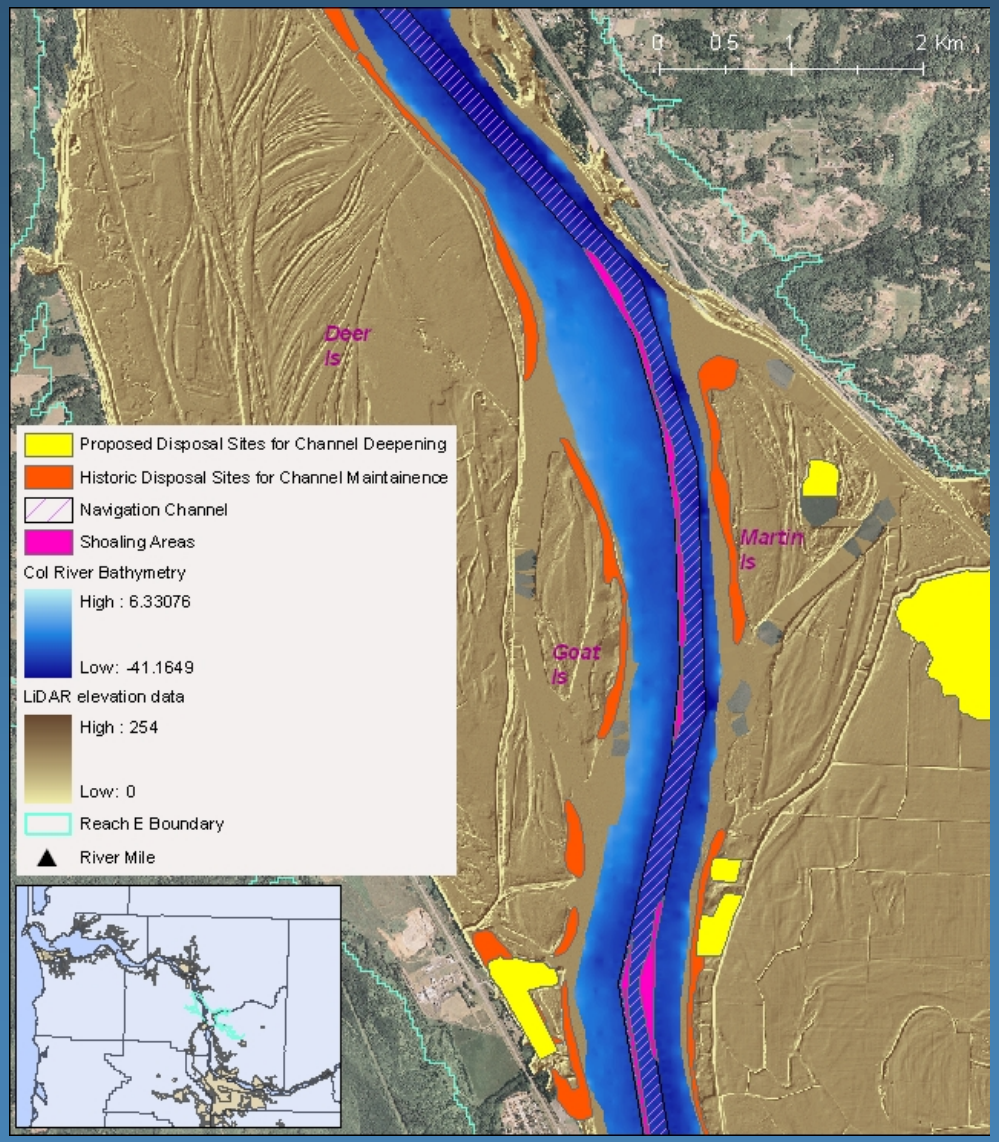
Phase 1 Sediment Management Plan Development



- Smaller Area within Reach E
- Bathymetry Criteria
- LiDar Elevation Criteria
- Shoaling Criteria
- + Navigation Channel

Lower Columbia River Estuary Partnership

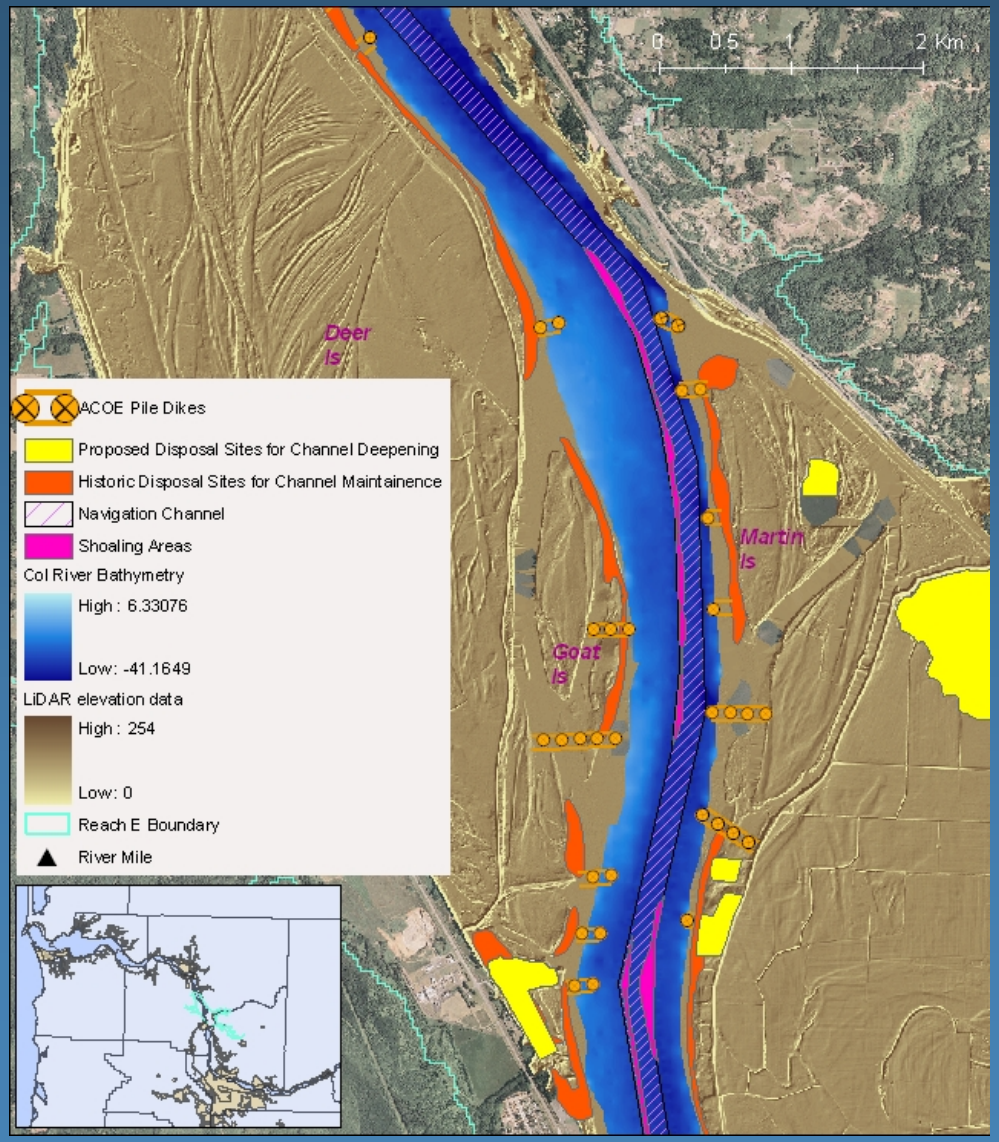
Phase 1 Sediment Management Plan Development



- Smaller Area within Reach E
- Bathymetry Criteria
- LiDar Elevation Criteria
- Shoaling Criteria
- Navigation Channel
- + Dredge Material Placement Site Criteria

Lower Columbia River Estuary Partnership

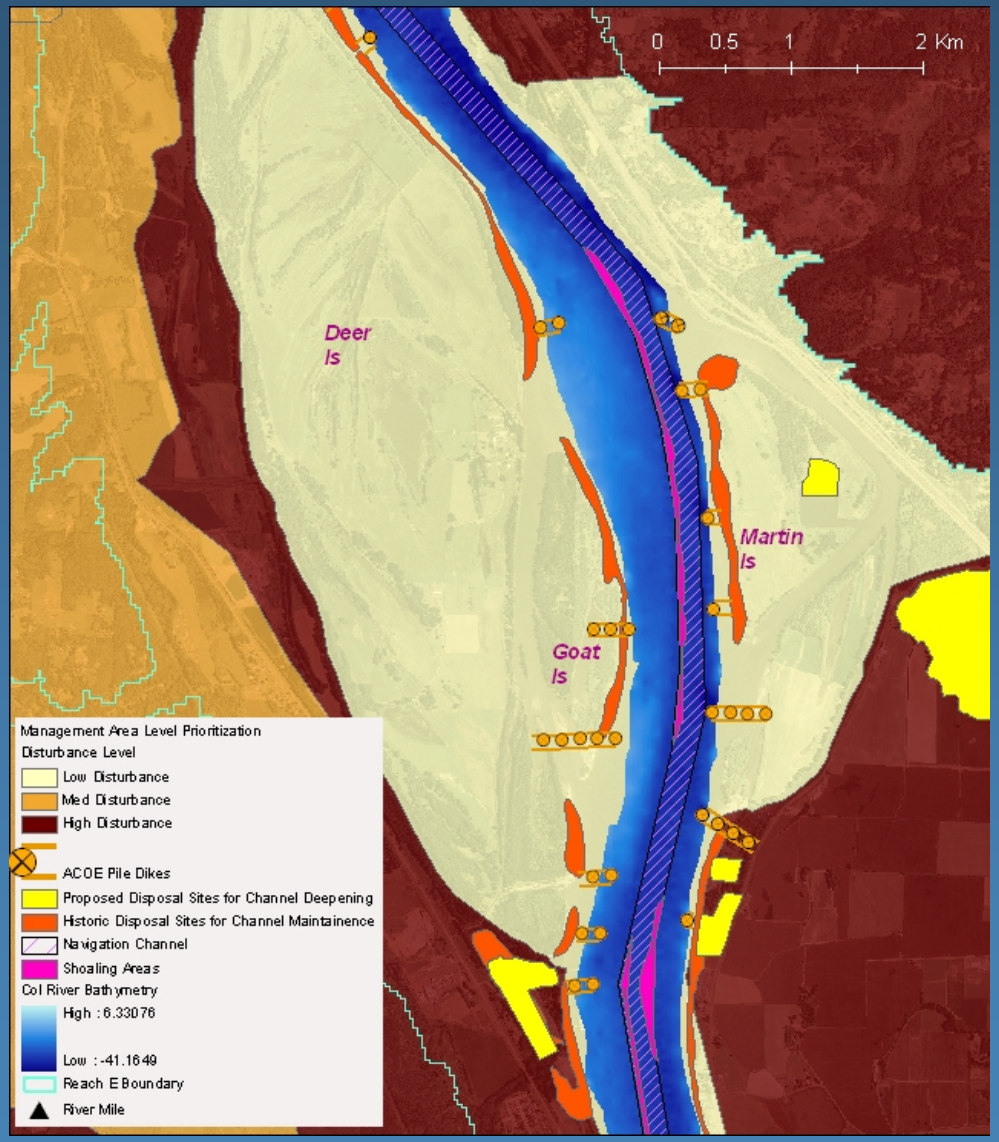
Phase 1 Sediment Management Plan Development



- Smaller Area within Reach E
- Bathymetry Criteria
- LiDar Elevation Criteria
- Shoaling Criteria
- Navigation Channel
- Dredge Material Placement Site Criteria
- + Pile Dike Criteria

Lower Columbia River Estuary Partnership

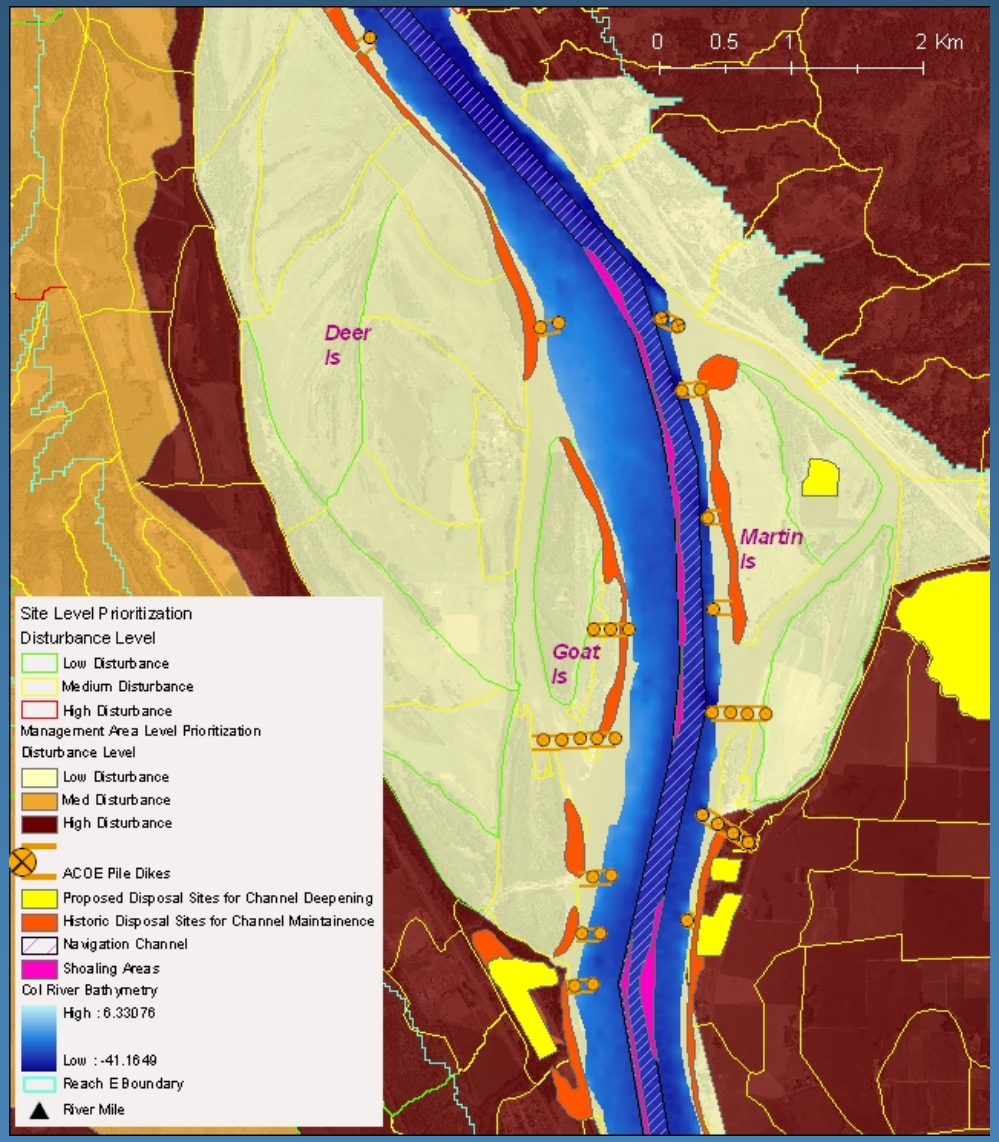
Phase 1 Sediment Management Plan Development



- Bathymetry Criteria
- LiDar Elevation Criteria
- Shoaling Criteria
- Navigation Channel
- Dredge Material Placement Site Criteria
- Pile Dike Criteria
- +Restoration Prioritization Strategy Management Area Level Criteria

Lower Columbia River Estuary Partnership

Phase 1 Sediment Management Plan Development



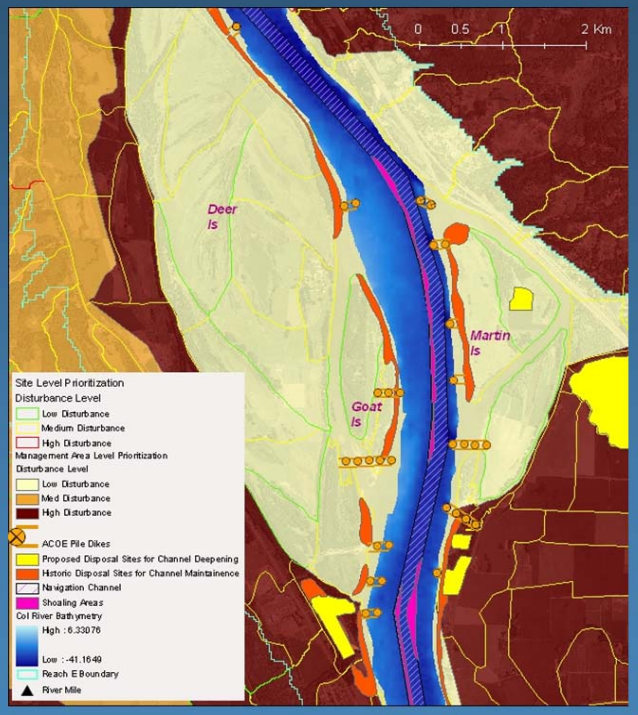
- Bathymetry Criteria
- LiDar Elevation Criteria
- Shoaling Criteria
- Navigation Channel
- Dredge Material Placement Site Criteria
- Pile Dike Criteria
- Restoration Strategy Management Area Level Criteria
- + Restoration Prioritization Strategy Site Level Criteria

Lower Columbia River Estuary Partnership

Phase 1 Sediment Management Plan Development

- Model allows river-wide and site-level evaluation for dredge material placement
- Can be used by US ACE, Ports, regulatory community
- Can be combined with other screening factors

Phase 1 Sediment Management Plan Development



- Bathymetry Criteria
- LiDar Elevation Criteria
- Shoaling Criteria
- Navigation Channel
- Dredge Material Placement Site Criteria
- Pile Dike Criteria
- Restoration Strategy Management Area Level Criteria
- + Site Level Prioritization Disturbance Level Criteria

Lower Columbia River Estuary Partnership