COLUMBIA RIVER CHANNEL IMPROVEMENT PROJECT

SEDIMENTATION ISSUES

- SAND TRANSPORT in the RIVER
- EROSION/ACCRETION in the ESTUARY
- SAND BUDGET at the MCR
- COASTAL EROSION/ACCRETION

SEDIMENT IMPACTS DEFINED in FEIS, BA & BiOp

- DEEPER RIVERBED
- LOCALIZED INCREASES in SUSPENDED SEDIMENT
- NO IMPACT ON SALMON HABITAT
- NO CHANGE TO SEDIMENT BUDGETS
  - River
  - MCR

COLUMBIA RIVER CHANNEL IMPROVEMENT PROJECT

RELATED ACTIVITIES

- Southwest Washington Coastal Erosion
- MCR Dredging
- Ocean Disposal
- Benson Beach Disposal
- Regional Sediment Management
- Reservoir Operations

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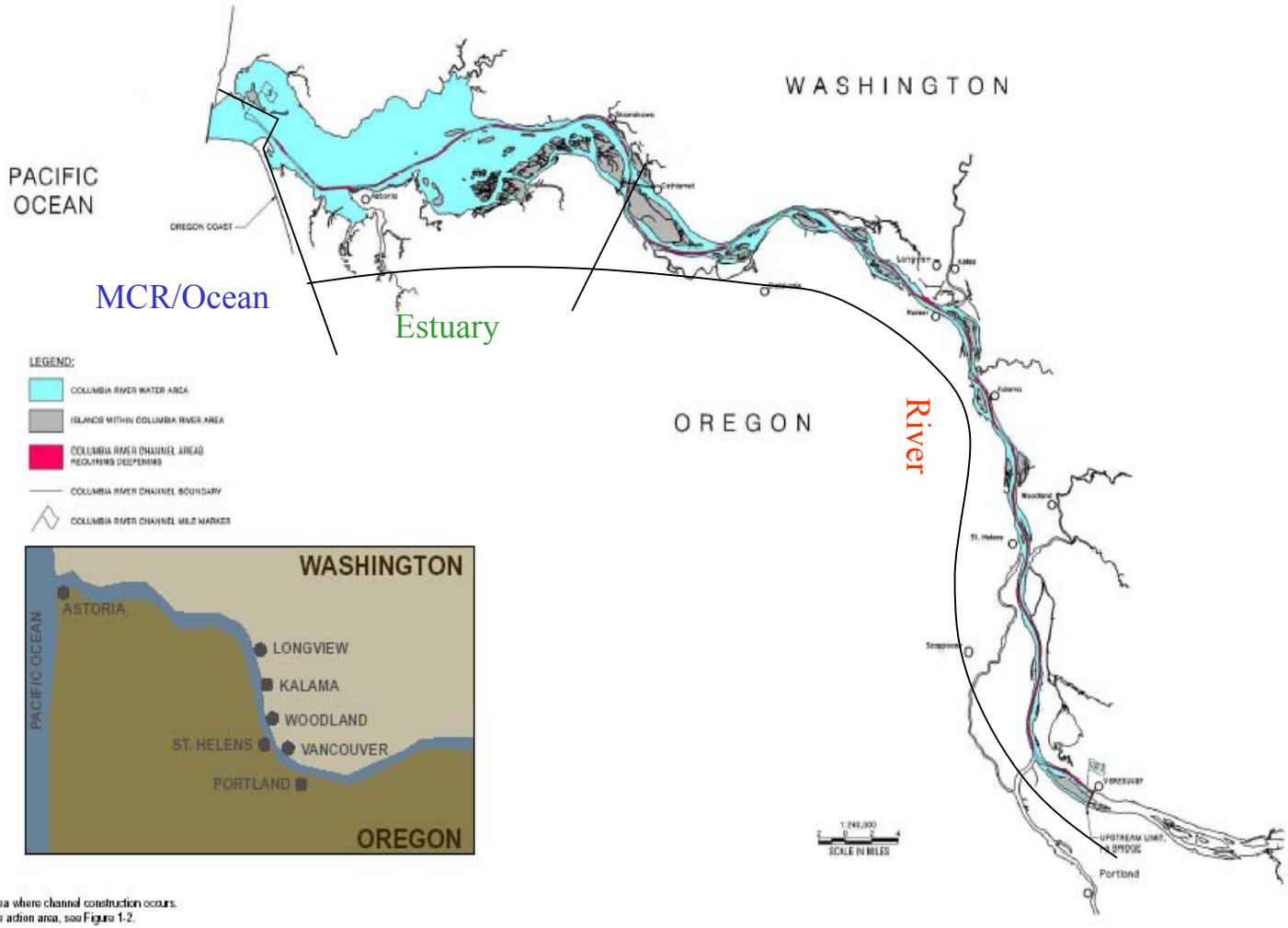
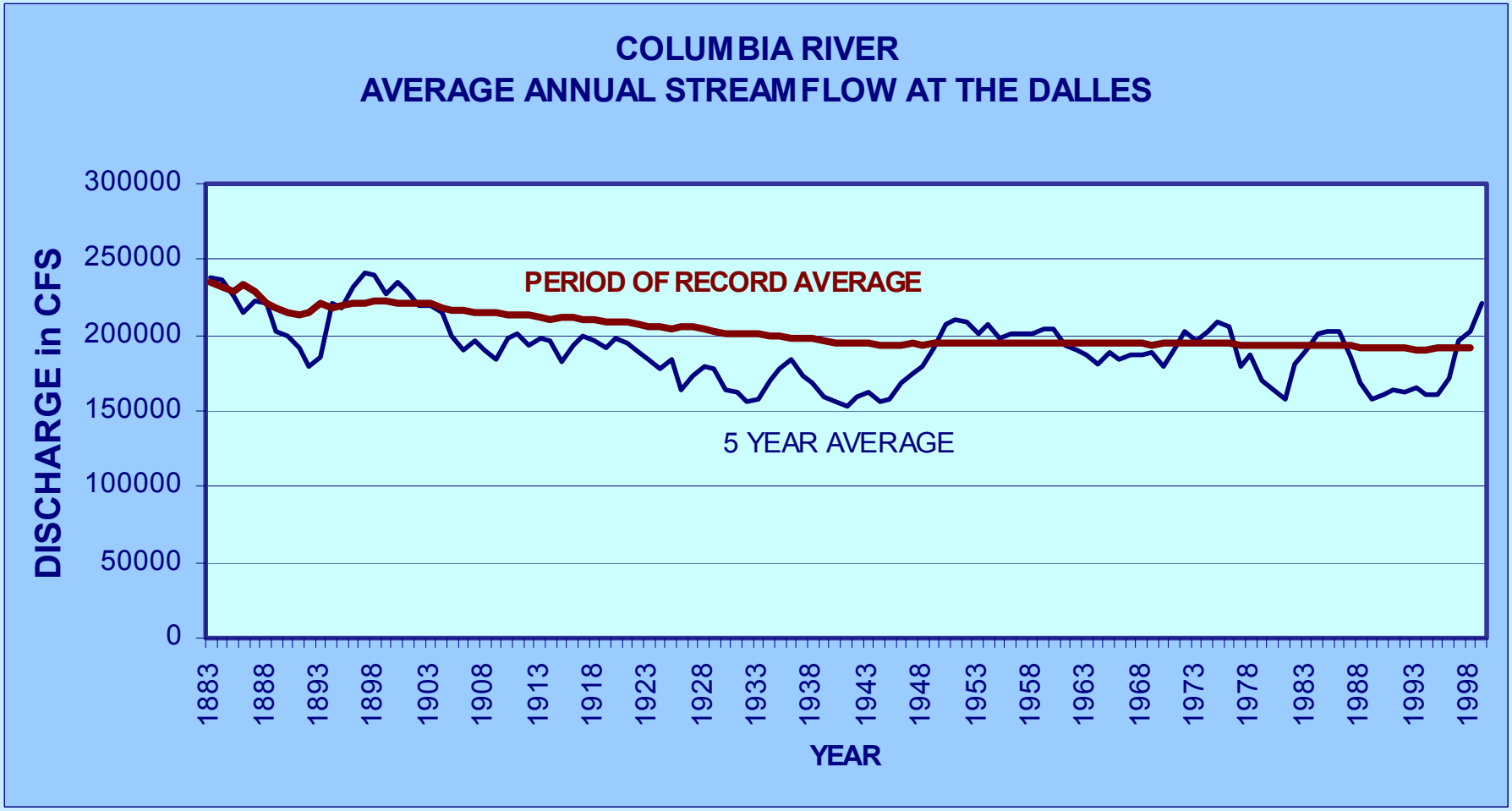


Note: Map includes area where channel construction occurs.
For map of entire action area, see Figure 1-2.

Figure 1-1
Navigation Channel
Improvements Project Area



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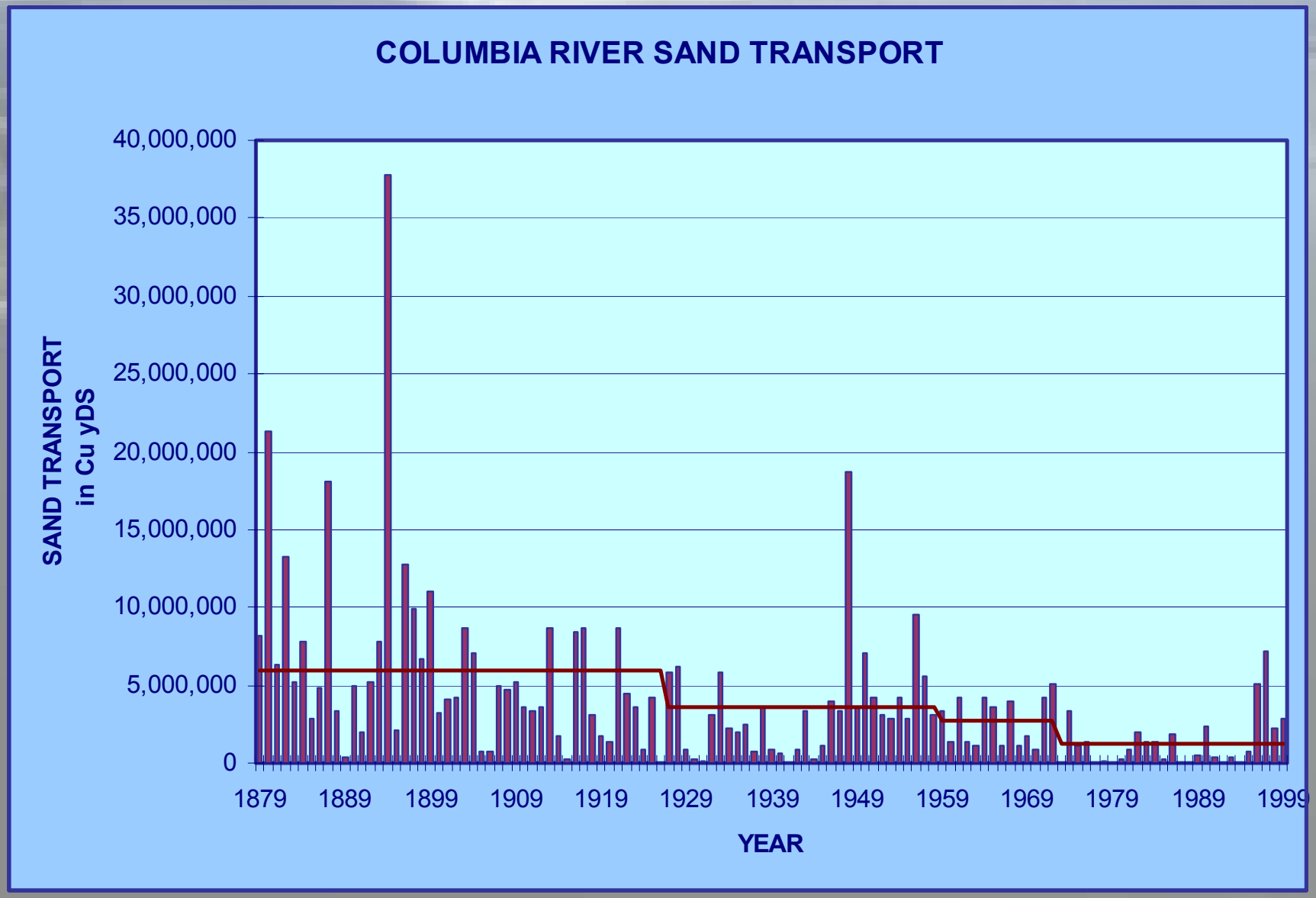

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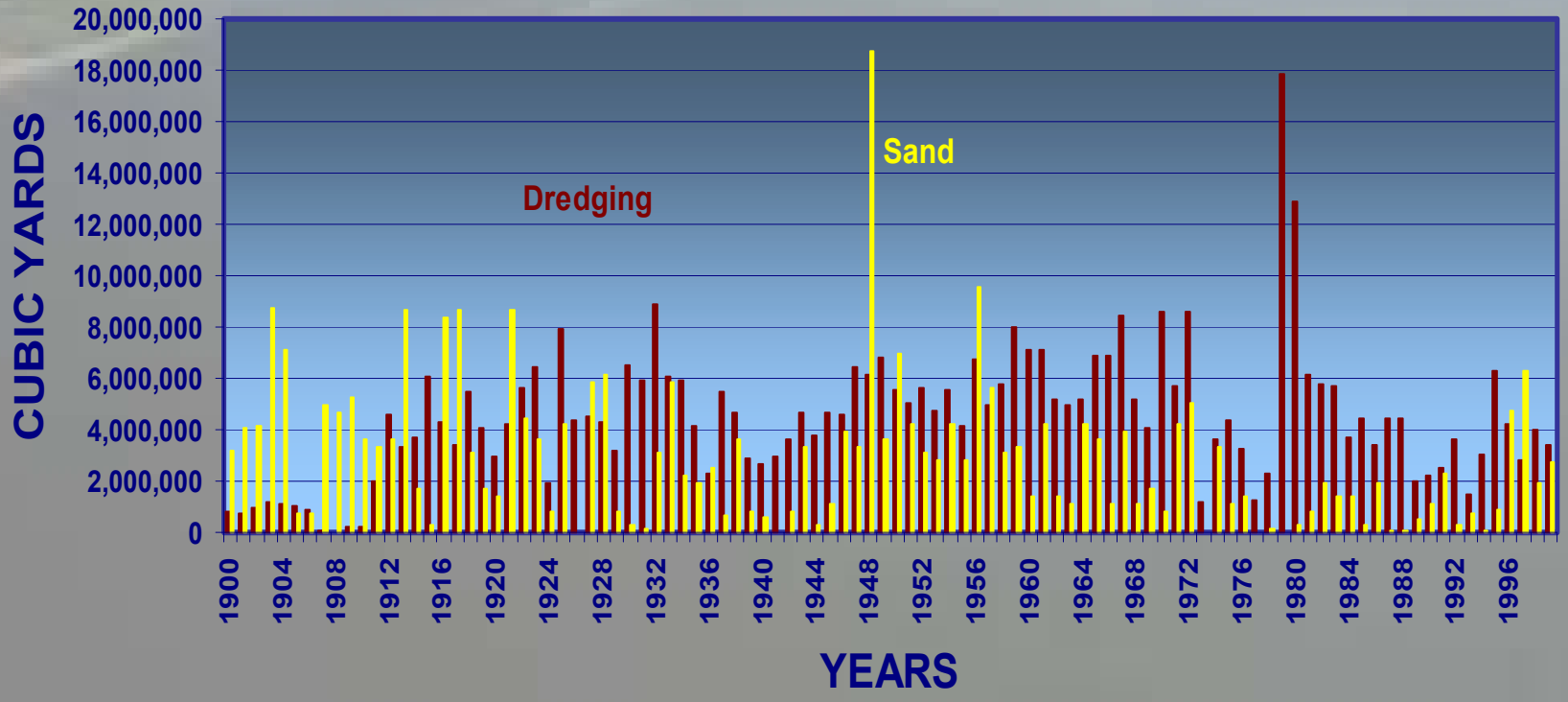
COLUMBIA RIVER RM 41-106
NAVIGATION DREDGING vs TOTAL SAND TRANSPORT



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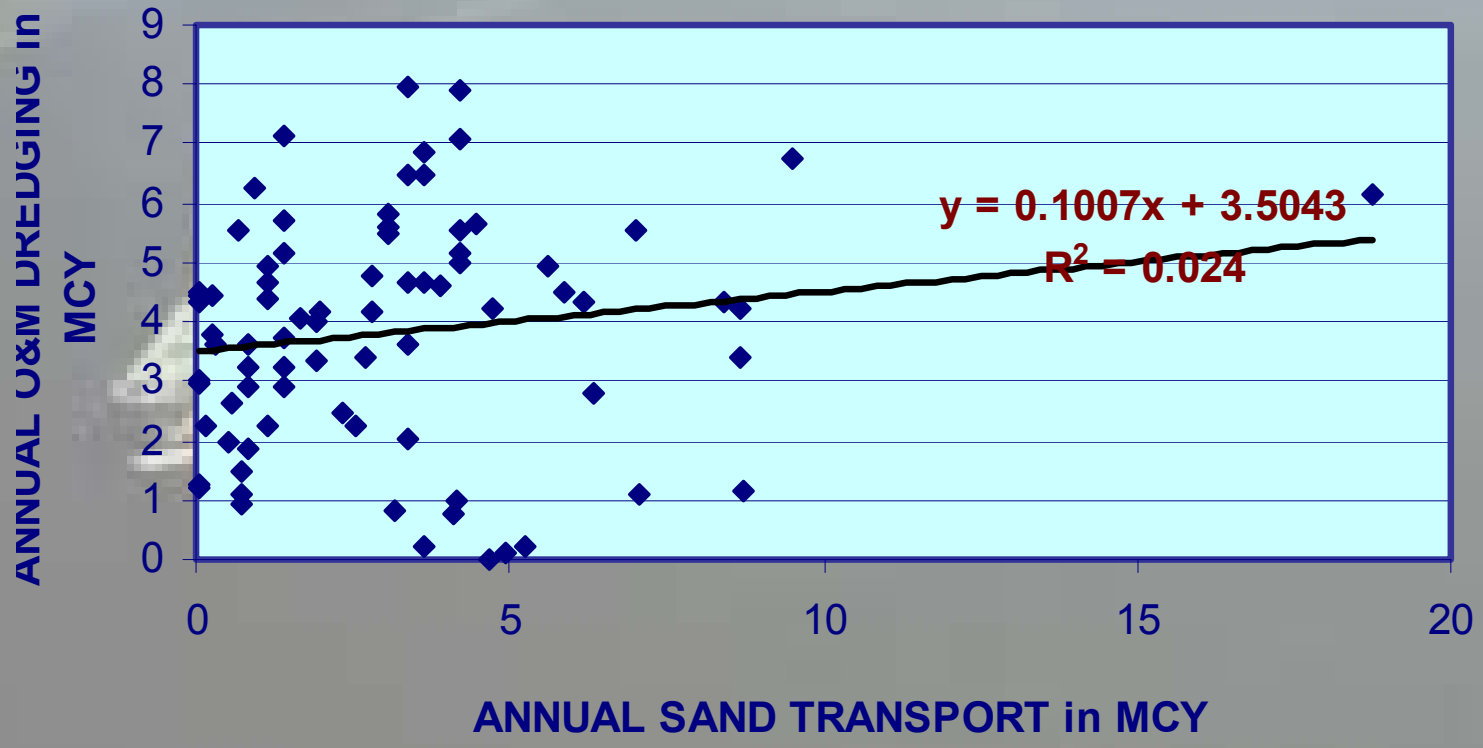
COLUMBIA RIVER RM 41-106
O&M DREDGING vs SAND TRANSPORT



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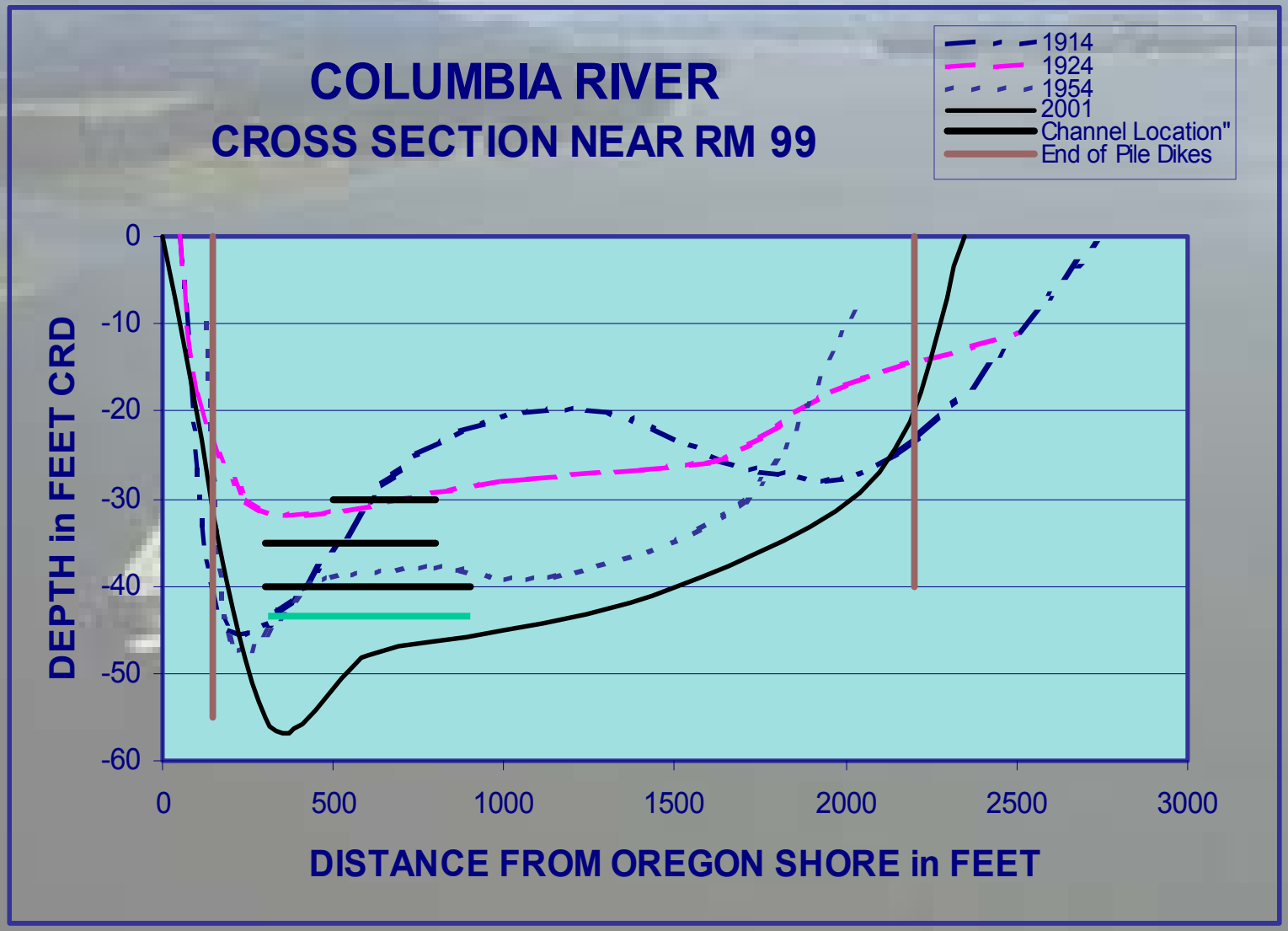

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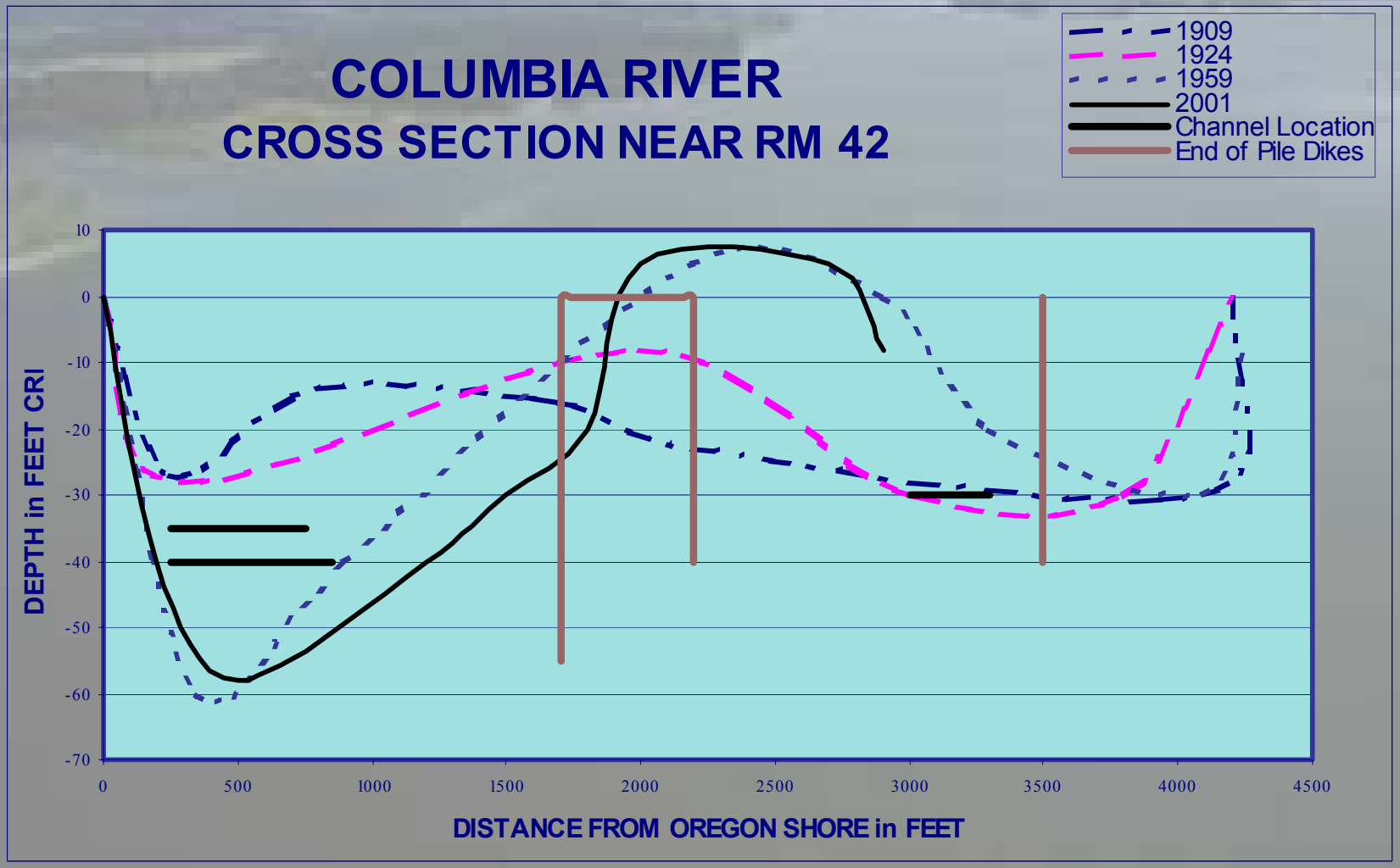
COLUMBIA RIVER
CROSS SECTION NEAR RM 42



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RIVERINE CONCLUSIONS

- Navigation Development has Altered the River's Cross-section (Deeper & Narrower)
- O&M Dredging is Related to Local Bedload, Not Total Sand Transport in the River
- Abundant Sand Supply From Riverbed and Cascade Tributaries
- Q_{SAND} vs Q_{WATER} Relationship is Unchanged Since 1878
- Q_{SAND} at Vancouver Equals Q_{SAND} Delivered to RM 48
- **3-ft Deepening Will Not Alter Any of the Above**

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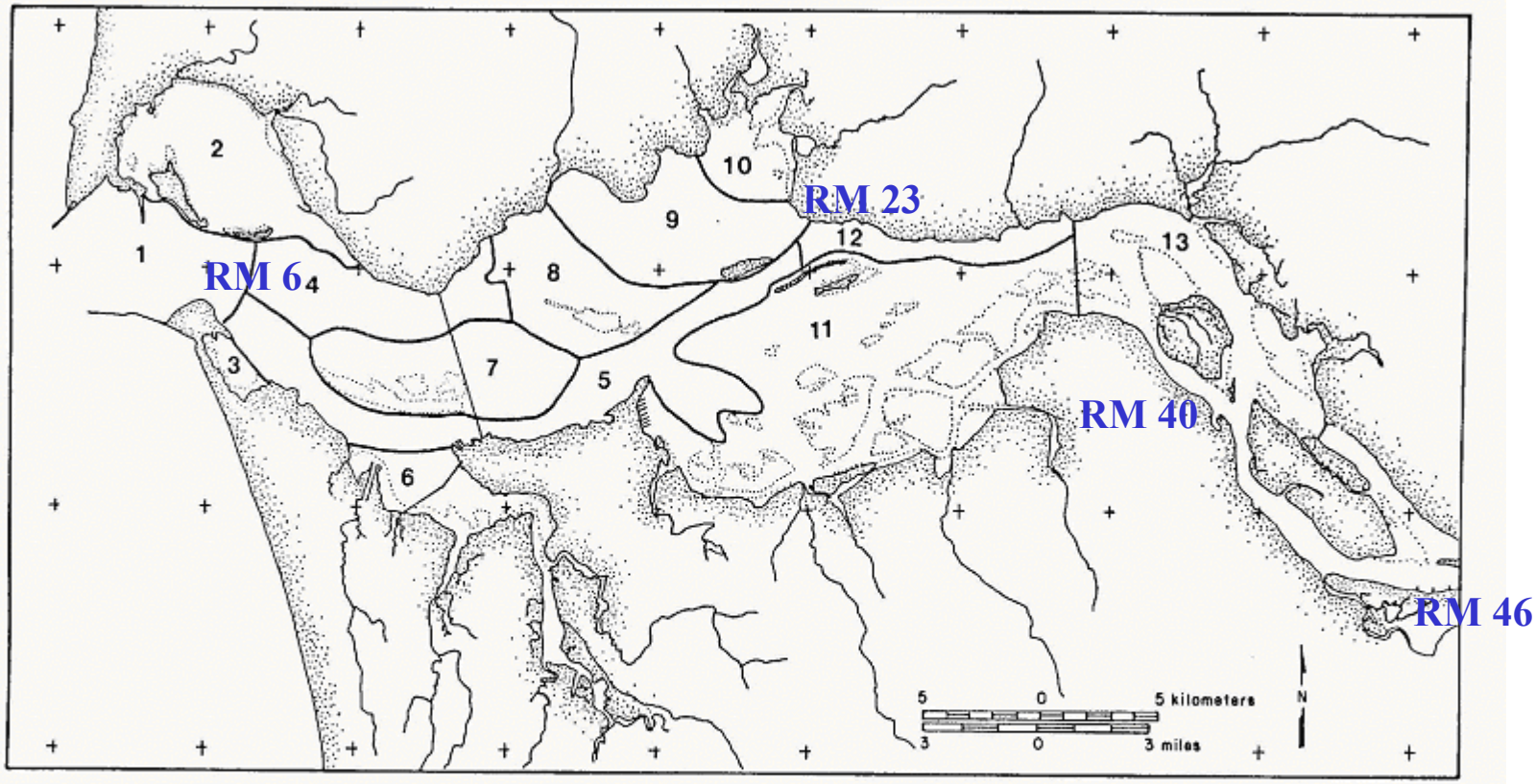
COLUMBIA RIVER CHANNEL IMPROVEMENT PROJECT

SEDIMENTATION ISSUES

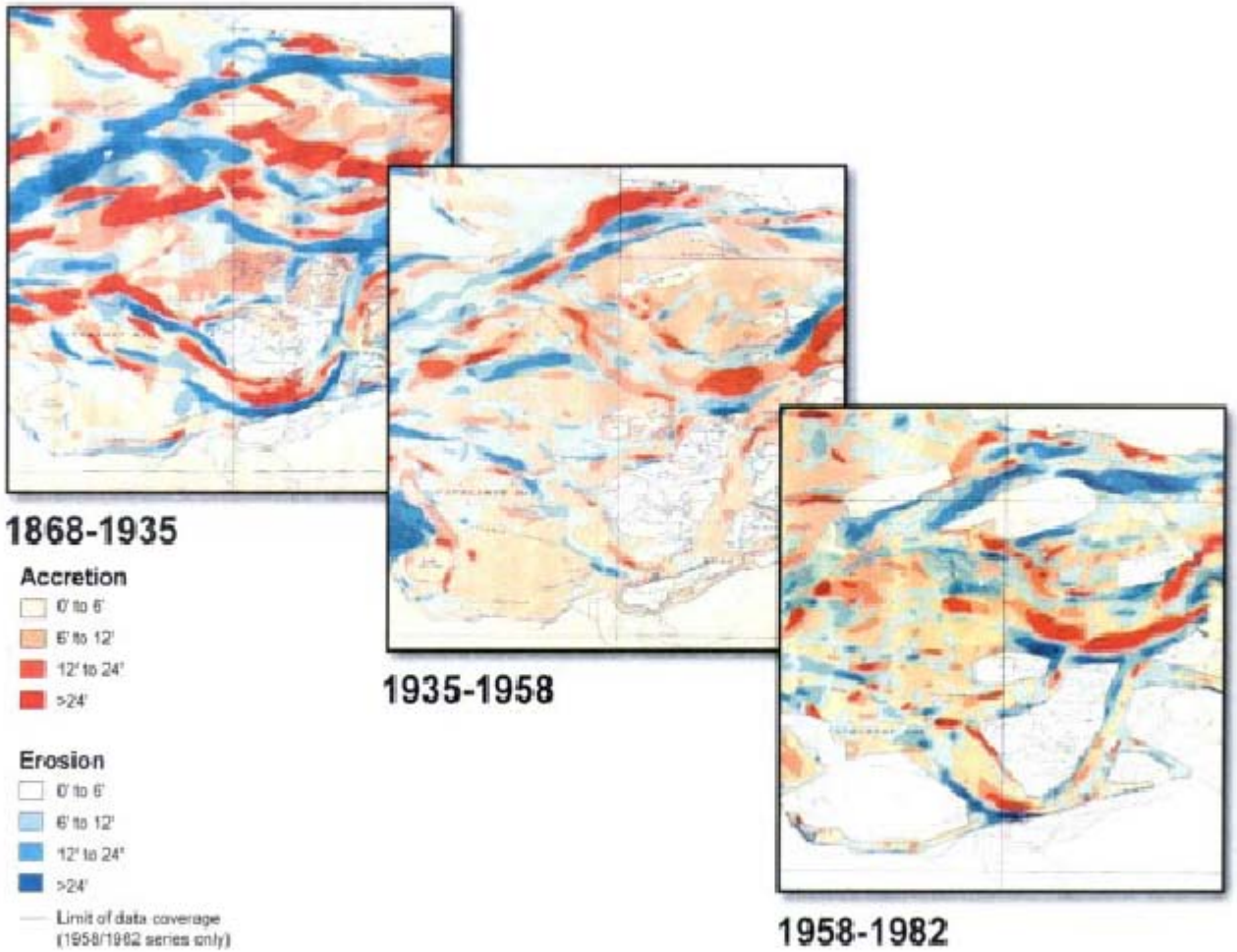
- SAND TRANSPORT in the RIVER
- EROSION/ACCRETION in the ESTUARY
- SAND BUDGET at the MCR
- COASTAL EROSION/ACCRETION

COLUMBIA RIVER ESTUARY



Map of the Columbia River Estuary showing 13 subareas used in volume and area calculations: 1) Entrance, 2) Baker Bay, 3) Trestle Bay, 4) North Channel, 5) South Channel, 6) Youngs Bay, 7) Desdemona Sands, 8) Mid-Estuary Shoals, 9) Grays Bay, 10) Brix Bay, 11) Cathlamet Bay, 12) Lower River Channel, 13) Upper River Channel.

Sherwood et al., 1984



Source: Simenstad, SEI Presentation, May 2001

CREDDP Atlas, 1983

Figure 2-3
Sediment Accretion and Erosion in Representative Portion of Columbia River Estuary, 1868-1982

Table 4. Columbia River Estuary and River Shoaling and Erosion Rates						
ESTUARY SUBAREA	1868-1926			1927-1958		
	Volume Change MCY	Fines in MCY	**Sand in MCY**	Volume Change in MCY	Fines in MCY	**Sand in MCY**
Baker Bay	122.2	61.1	**61.1**	-8.9	-4.4	**-4.4**
North Channel (RM 6-14)	-1.4	0.0	**-1.3**	-10.5	0.0	**-10.0**
Youngs Bay	39.2	5.1	**34.1**	7.2	0.9	**6.3**
Desdemona Sands	53.4	0.5	**52.8**	24.1	0.2	**23.8**
Mid-Estuary Shoals	1.8	0.0	**1.8**	-0.5	0.0	**-0.5**
Brix Bay	8.4	0.1	**8.4**	-1.1	0.0	**-1.1**
Grays Bay	32.6	0.3	**32.3**	-7.5	-0.1	**-7.4**
Cathlamet Bay	50.2	10.5	**39.7**	50.1	10.5	**39.6**
South Channel (RM 6-23)	-22.8	-0.2	**-22.5**	32.9	0.3	**32.6**
Lower River Channel (RM 23-31)	-9.8	-0.1	**-9.7**	1.6	0.0	**1.6**
Upper River Channel (RM 31-48)	20.9	0.2	**20.7**	15.4	0.2	**15.2**
ESTUARY TOTALS		**77.6**	**217.2**		**7.7**	**95.7**
Sediment Inflow in MCY		355	**355**		177	**113**
Deposition as a Percent of Sediment Inflow		22%	**61%**		4%	**85%**
Sediment discharge to the MCR in MCY		277	**138**		169	**17**

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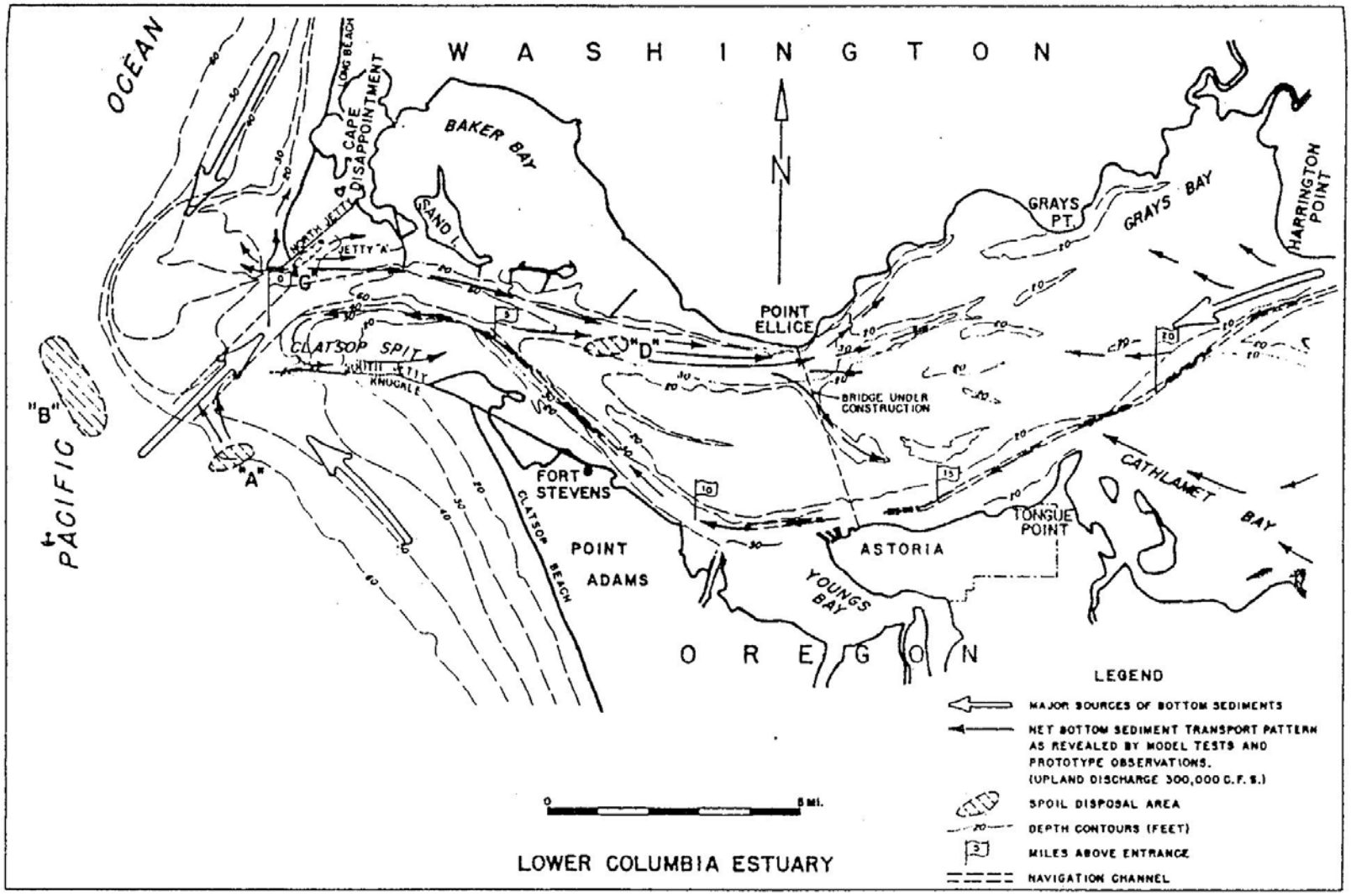
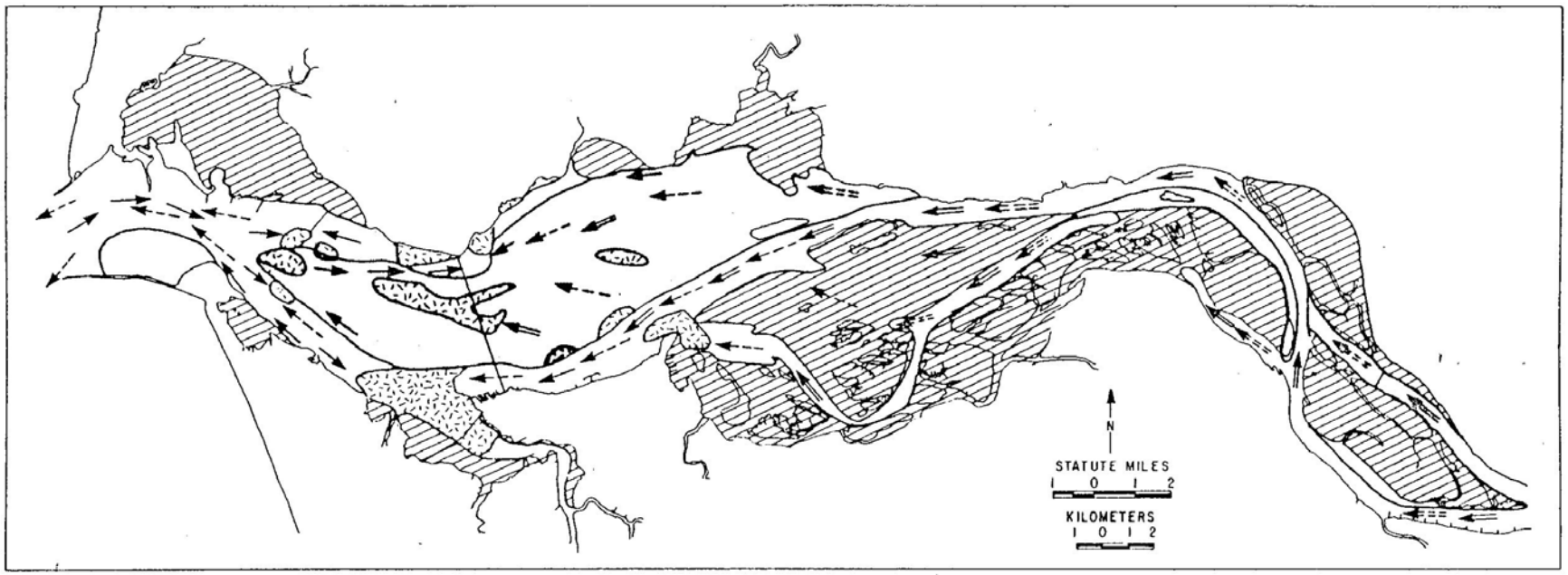


FIG. 1.—LOWER COLUMBIA ESTUARY

Lockett, 1967

SCHEMATIC SUMMARY OF SEDIMENT TRANSPORT AND DEPOSITION PATTERNS



Long-term deposition of coarser sediments in association with channel migration and/or split growth

Ephemeral deposition of fine sediments in association with turbidity maximum processes

Long-term deposition of fine sediments

Non-deposition or erosion

BEDLOAD TRANPORT

→ Net of reversing transport

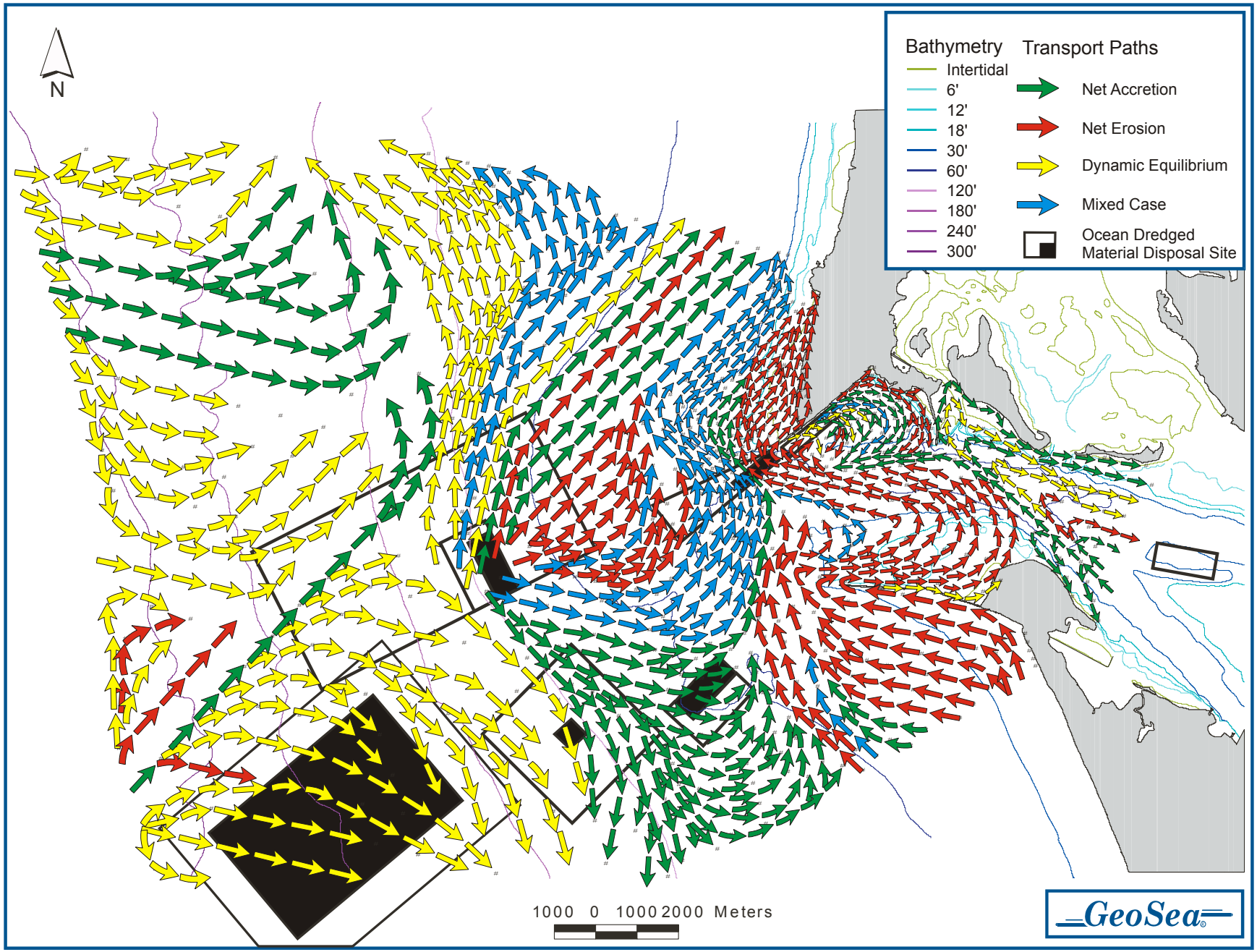
⟹ Unidirectional transport

SUSPENDED LOAD TRANSPORT

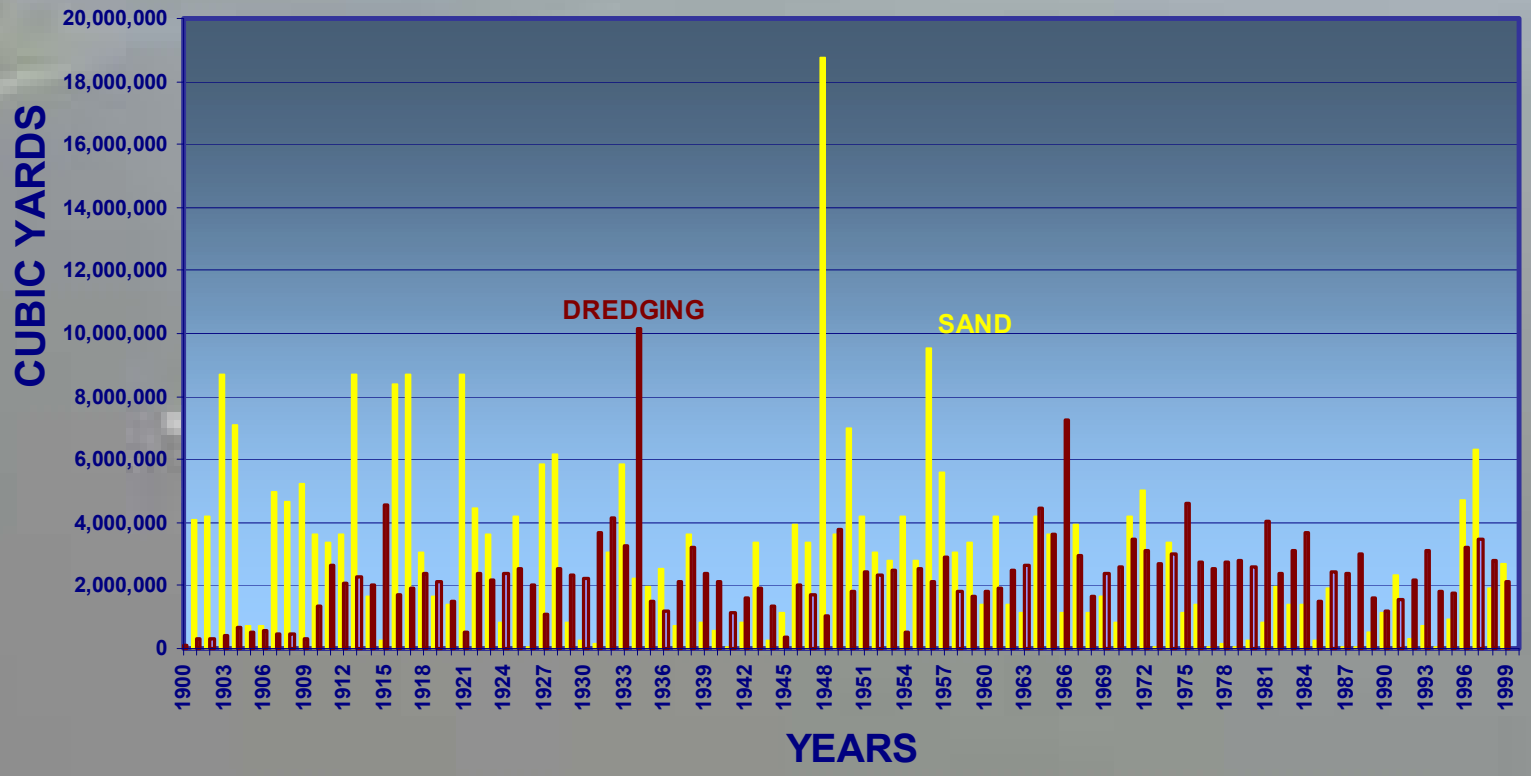
- - → Net of reversing transport

= = ⇒ Unidirectional transport

Sherwood et al., 1984


N
Bathymetry
Intertidal
6'
12'
18'
30'
60'
120'
180'
240'
300'
Transport Paths
Net Accretion
Net Erosion
Dynamic Equilibrium
Mixed Case
Ocean Dredged Material Disposal Site
1000 0 1000 2000 Meters
GeoSea

COLUMBIA RIVER ESTUARY D/S RM 41
DREDGING vs RIVER SAND INFLOW



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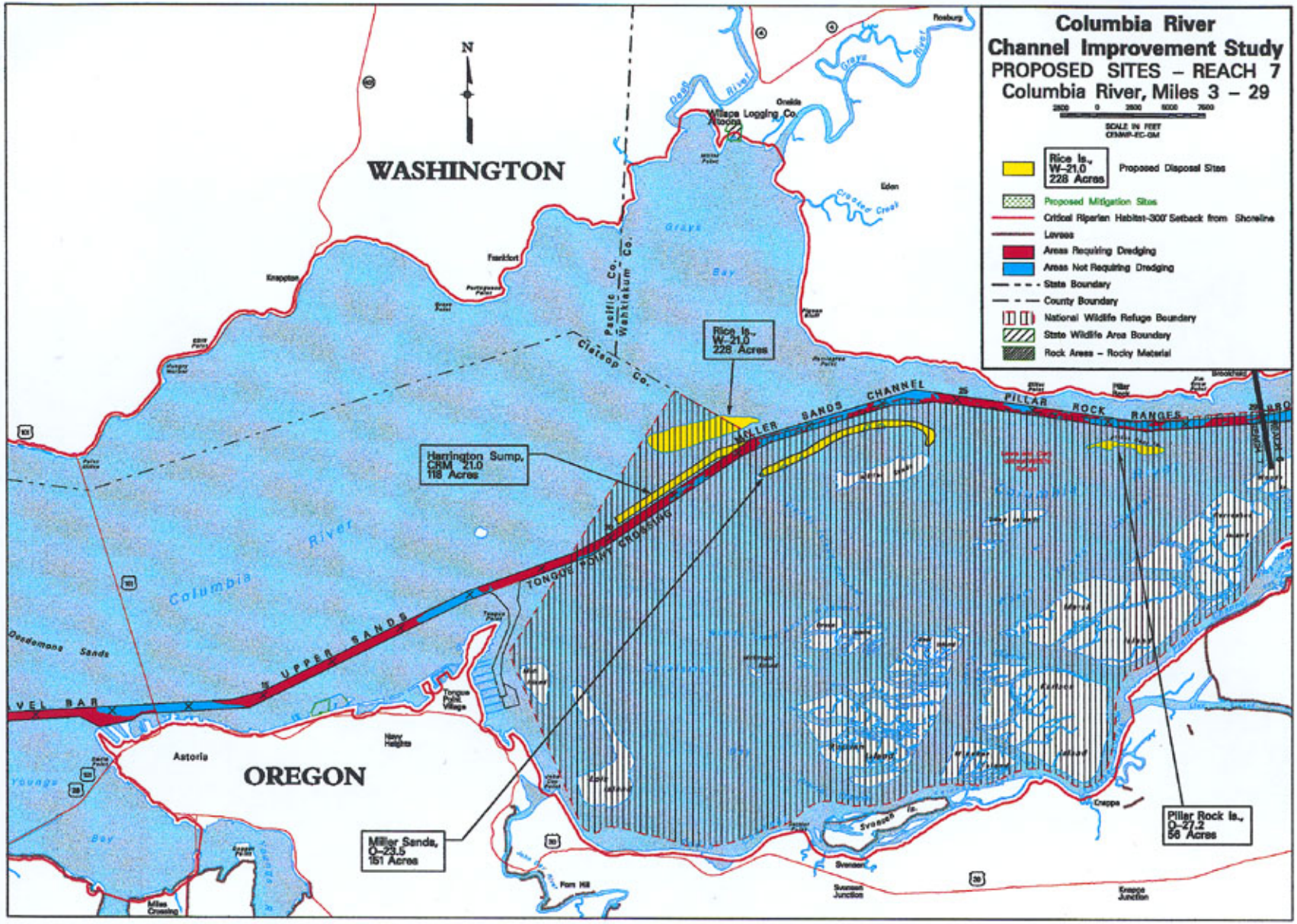
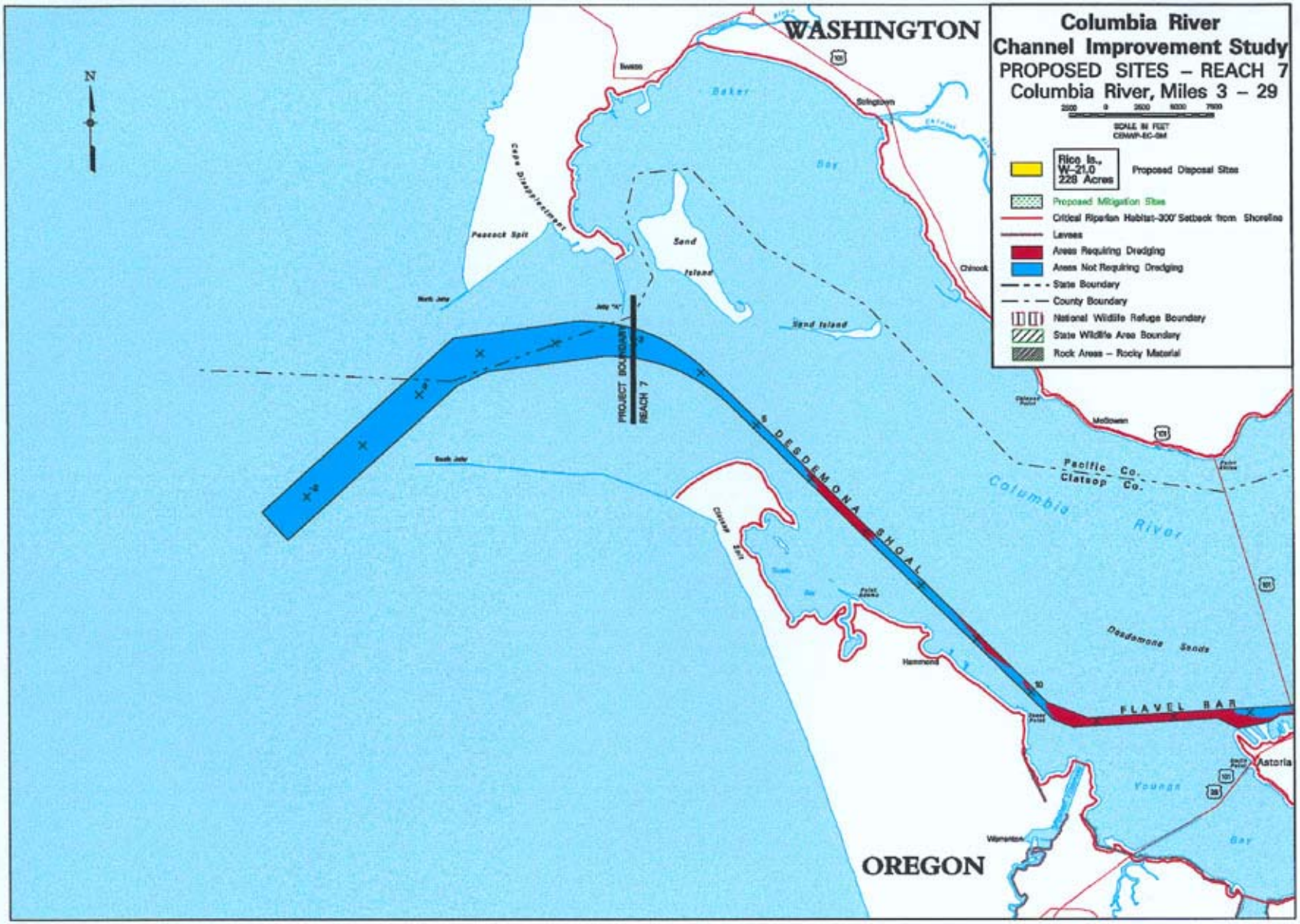


Columbia River
Channel Improvement Study
PROPOSED SITES – REACH 7
Columbia River, Miles 3 – 29
SCALE IN FEET
CENWP-EC-GM
Rice Is., W-21.0 228 Acres
Proposed Disposal Sites
Proposed Mitigation Sites
Critical Riparian Habitat-300' Setback from Shoreline
Levees
Areas Requiring Dredging
Areas Not Requiring Dredging
State Boundary
County Boundary
National Wildlife Refuge Boundary
State Wildlife Area Boundary
Rock Areas – Rocky Material
WASHINGTON
OREGON
N
Rice Is., W-21.0 228 Acres
Harrington Sump, CRM 21.0 118 Acres
Miller Sands, O-23.5 151 Acres
Pillar Rock Is., O-27.2 56 Acres
MILLER SANDS CHANNEL
PILLAR ROCK RANGES
TONGUE POINT CROSSING
UPPER SANDS
Columbia River
Grays Bay
Pacific Co.
Wahkiakum Co.
Clatsop Co.
Willapa Logging Co.
Astoria
Tongue Point Village
Navy Heights
Fort Hill
Svensen
Svensen Junction
Knappa Junction
Crappe
Miles Crossing
Knappton
Frankfort
Oneida
Eden
Roseburg
Desdemona Sands
Youngs Bay



Columbia River
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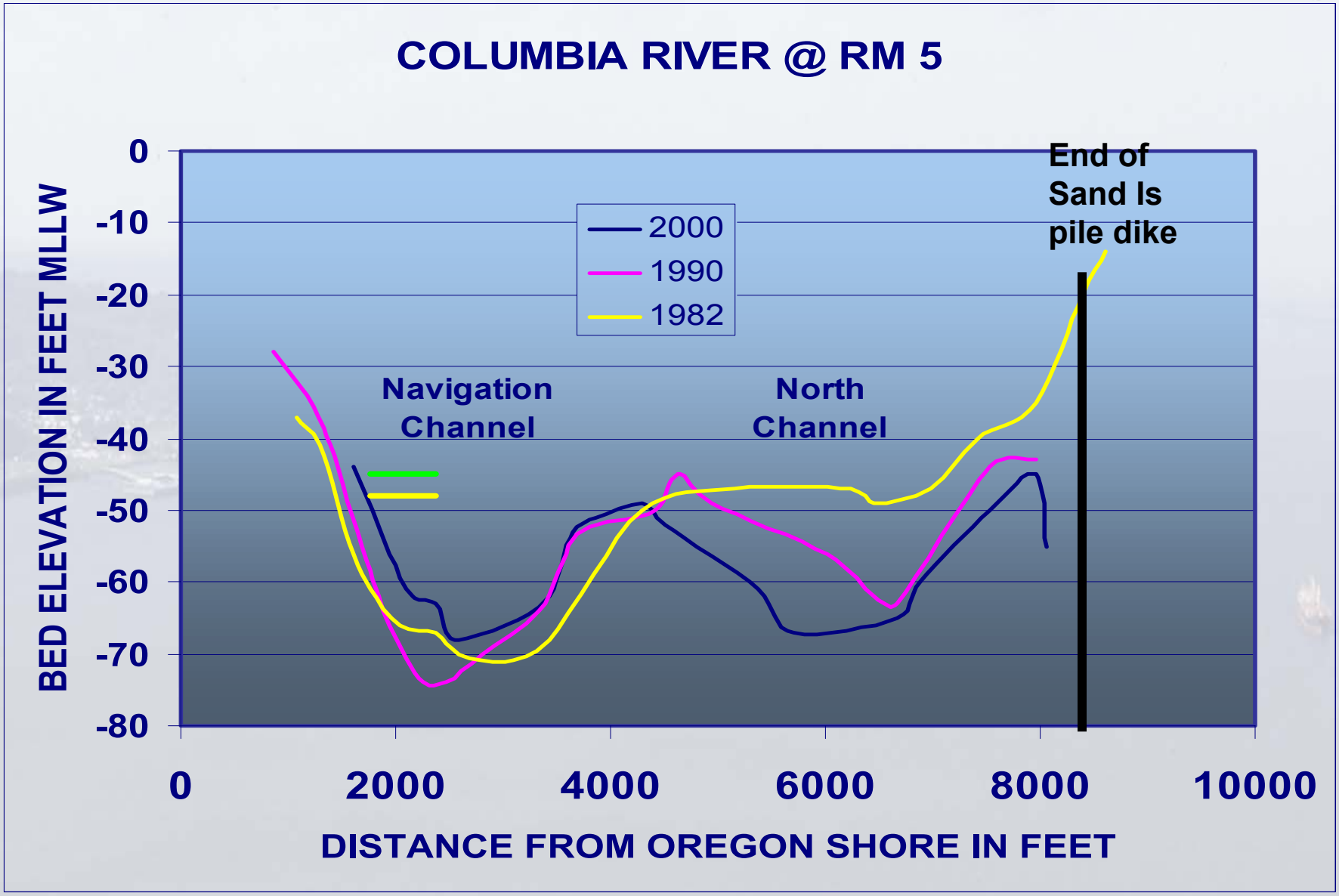
Areas Requiring Dredging
Areas Not Requiring Dredging
State Boundary
County Boundary
National Wildlife Refuge Boundary
State Wildlife Area Boundary
Rock Areas – Rocky Material
WASHINGTON
OREGON
N
Baker Bay
Cape Disappointment
Peacock Spit
Sand Island
Sand Island
Chinook
Stringtown
Ilwaco
North Jetty
South Jetty
Jetty "A"
PROJECT BOUNDARY
REACH 7
DESDEMONA SHOAL
FLAVEL BAR
Desdemona Sands
Pacific Co.
Clatsop Co.
Columbia River
McGowan
Hammond
Astoria
Youngs Bay
Warrenton



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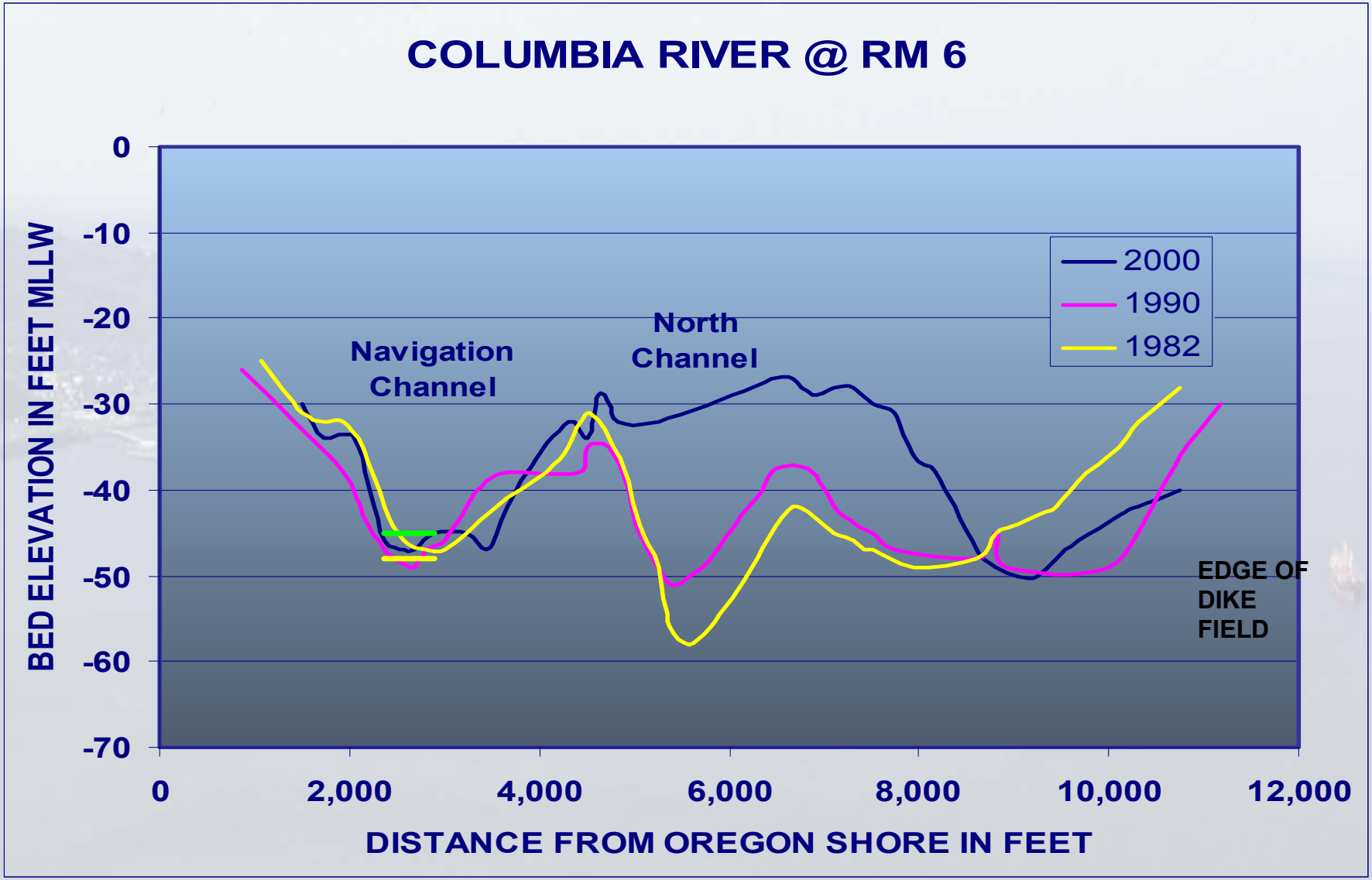

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ESTUARY CONCLUSIONS

- River Sand Accretes in Bays and Shallows U/S of RM 15 and in South Channel D/S RM 23
- Desdemona Sands Accretes Sand From Estuarine and MCR Sources
- 800 to 7,000+ Years of Accommodation Space
- Net D/S Sand Transport in South Channel to MCR
- Net U/S Sand Transport in North Channel to RM 13+/-
- Minor Changes in Transport Paths Since 1930's
- Large Freshets Discharge Most Sand to the MCR
- In-Water Disposal Has Keep Sand in the System
- **3-FT Deepening Will Not Alter Any the Above**

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COLUMBIA RIVER CHANNEL IMPROVEMENT PROJECT

SEDIMENTATION ISSUES

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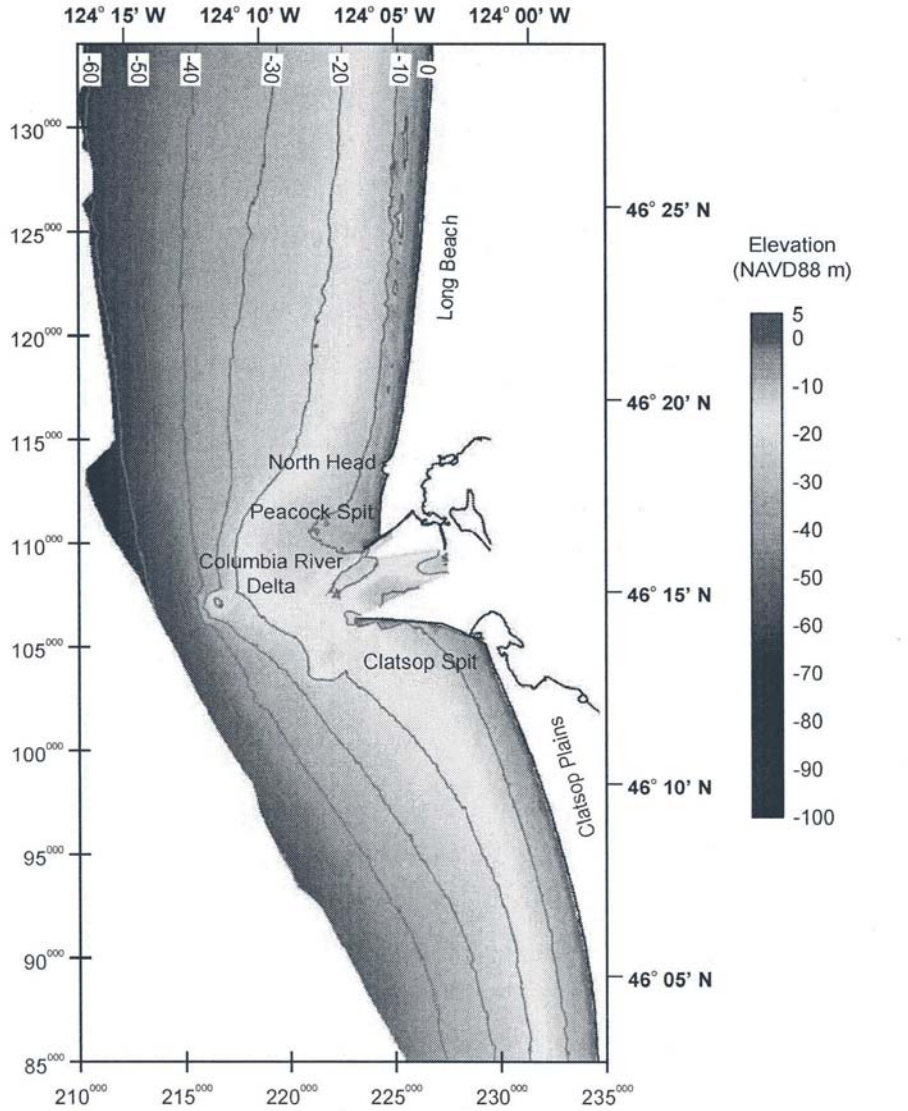


Contour Interval is 10 m NAVD88.

90000 WA State Plane South Zone 4602 (m)

46° 05' N Latitude/Longitude

N

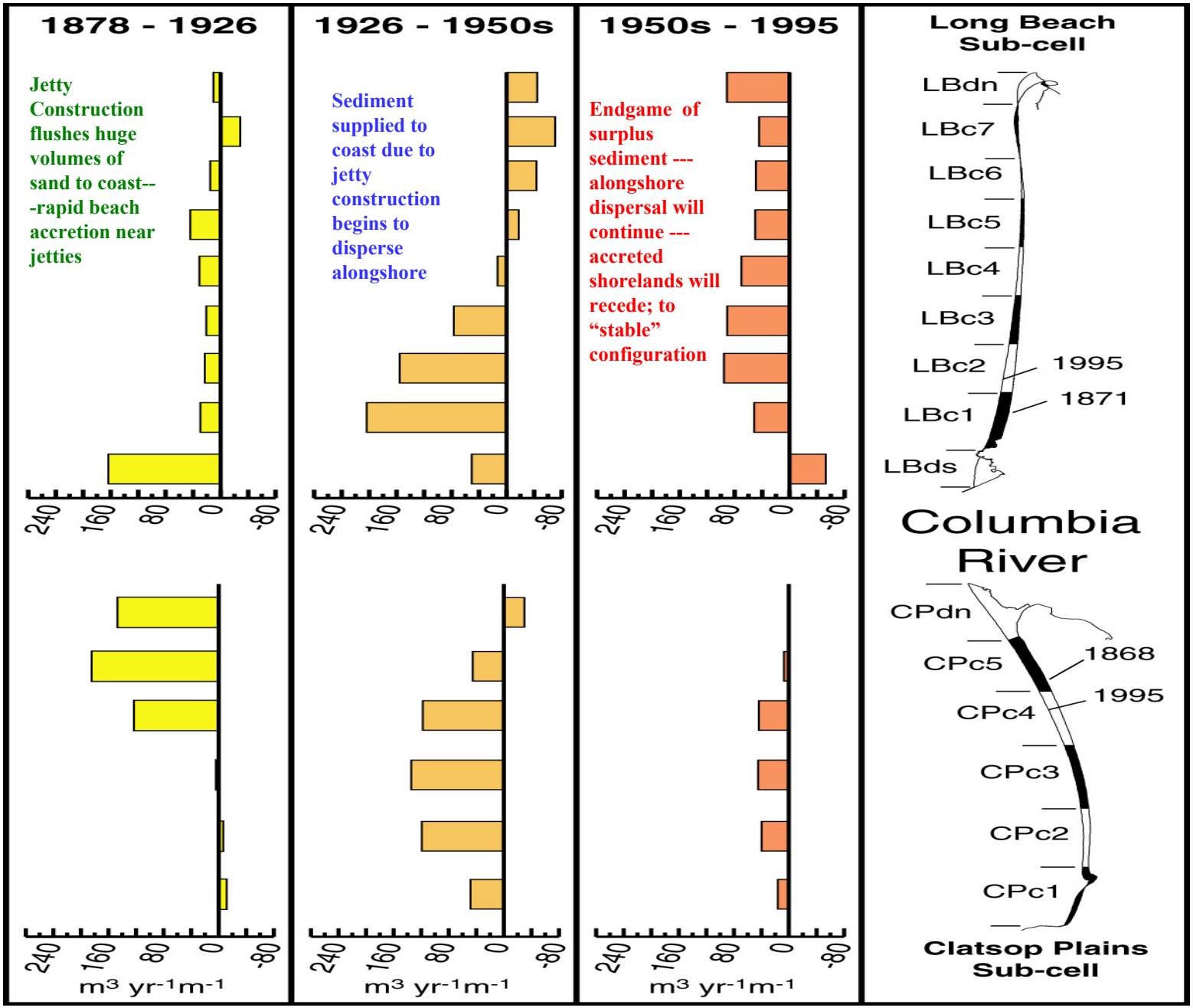
1 0 1 2 3 4 5 6 7 8 9 10 Km

1 0 1 2 3 4 5 6 Mi

	1868-1926	1926-1958	1958-1999
Long Beach and Peacock Spit	66	71	130
Long Beach inner shelf/offshore		48	-1.3
Inlet	-202	-113	-75
Outer Delta	231	140	122
South Flank	-275	-45	-56
Clatsop Plains	102	83	56
Clatsop Plains inner shelf	-31	-34	
Clatsop Plains offshore		-128	-83
Net Volume Change	**-109**	**22**	**93**
Sand Yield from CR	138	17	N/A

RM 16

Gelfenbaum et al., 2001


1878 - 1926
1926 - 1950s
1950s - 1995
Long Beach Sub-cell
Jetty Construction flushes huge volumes of sand to coast--rapid beach accretion near jetties
Sediment supplied to coast due to jetty construction begins to disperse alongshore
Endgame of surplus sediment --- alongshore dispersal will continue --- accreted shorelands will recede; to "stable" configuration
LBdn
LBc7
LBc6
LBc5
LBc4
LBc3
LBc2
LBc1
LBds
1995
1871
Columbia River
CPdn
CPc5
CPc4
CPc3
CPc2
CPc1
1868
1995
Clatsop Plains Sub-cell
240
160
80
0
-80
m³ yr⁻¹m⁻¹

SWCES

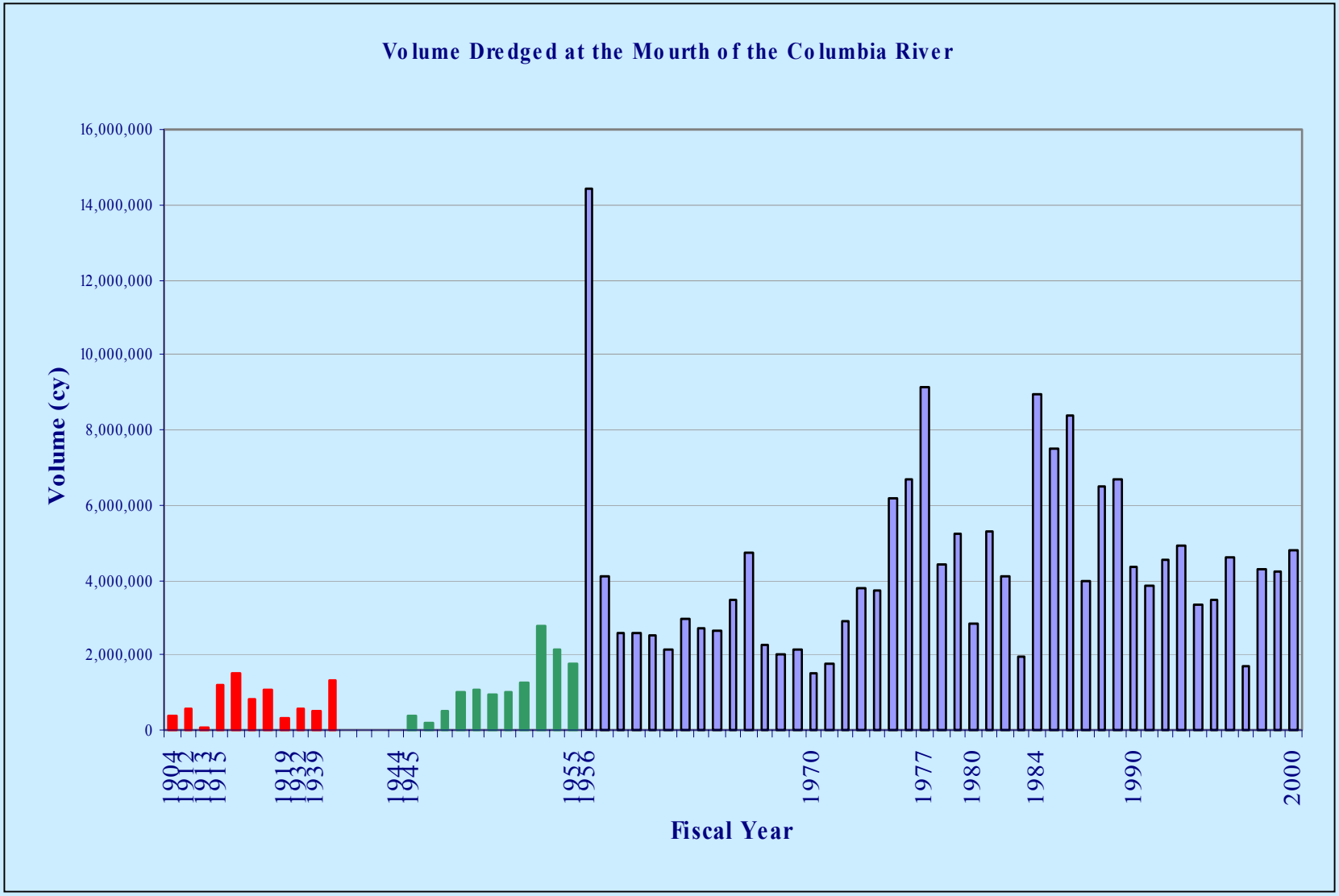


Figure 9 Volume Dredged at MCR

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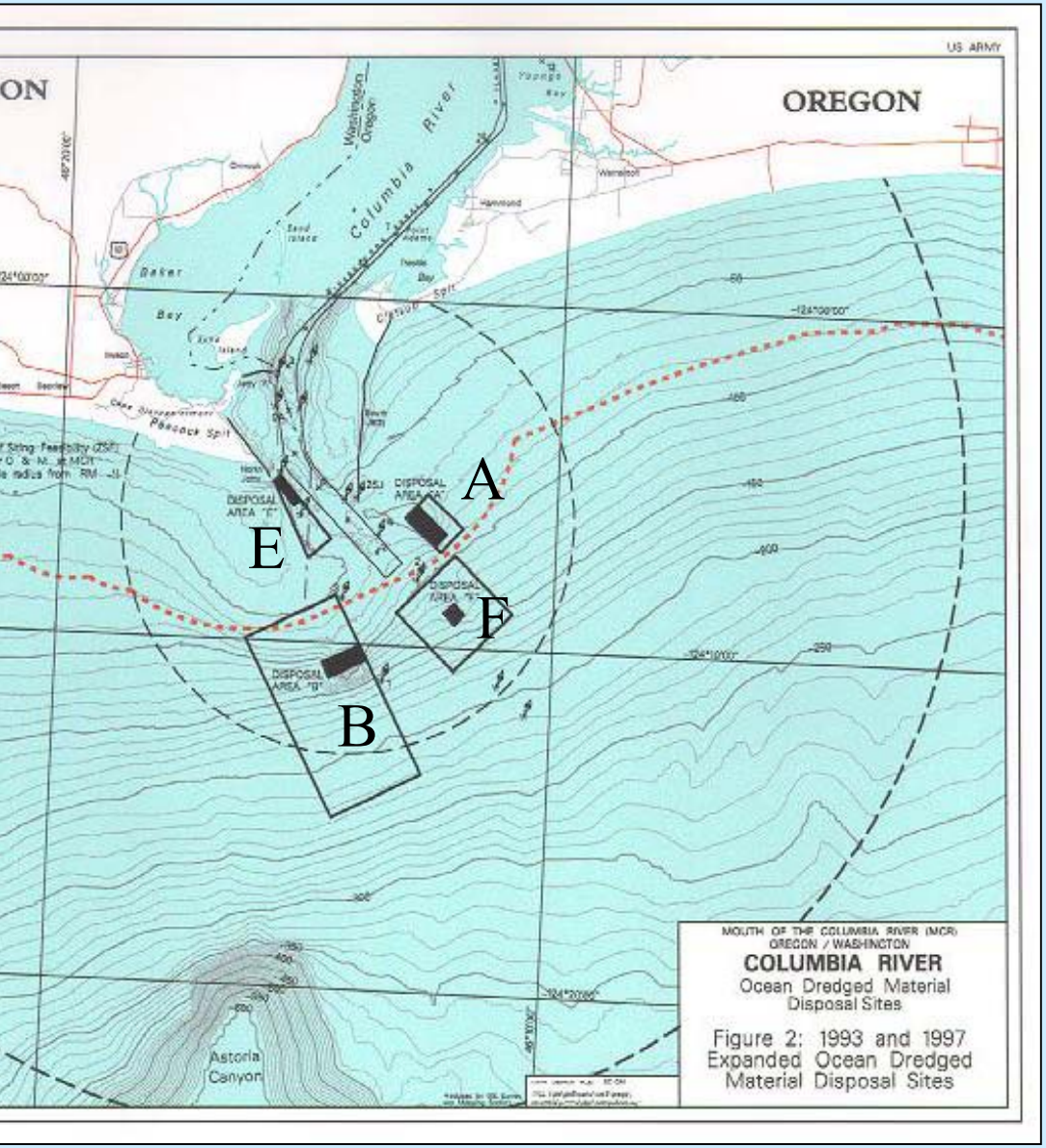

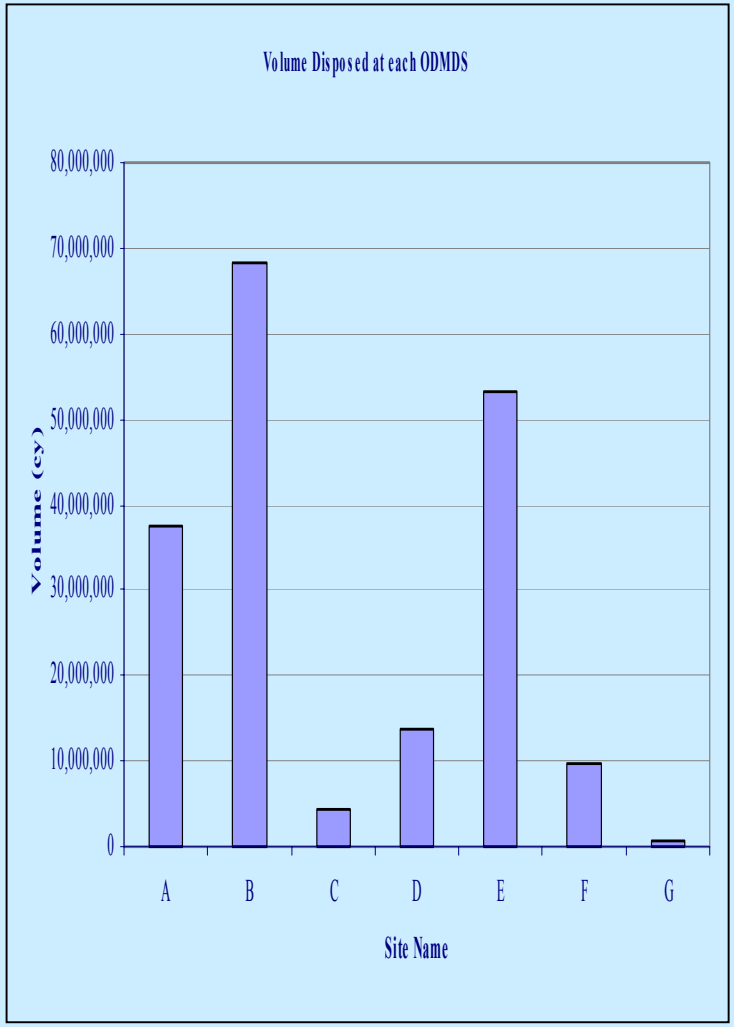

Figure 11 Volume Disposed

MCR & COAST CONCLUSIONS

- Sand is Transported Seaward & Landward at Estuary/MCR Interface
- Over 700 MCY has been Displaced from the Vicinity of MCR & South Flank Since 1868
- Sand Accreted along Long Beach (260 mcy) & Clatsop Plain (240 mcy) from 1868 to 1999
- **3-Ft Deepening will not Alter MCR or Coastal Sand Budget**

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43-FT MONITORING ACTIONS

- 3 Hydraulic monitoring stations in the Estuary for 7 years
- Report dredged volumes
- Main channel bathymetric surveys for LOP
- Bank-to-bank hydrographic survey of Estuary prior to construction
- Habitat surveys for 3 years after construction