Del Mar Sediment Management and Habitat Evolution Studies

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Task 2 – Sediment Management Plan

- Purpose:
  - Understand sediment dynamics to inform dredging and nourishment

- Methods:
  - Collect data and develop long-term sediment budget
    - Develop existing conditions budget
    - Consider how each process will change with sea-level rise
  - Channel Dredging Plan
  - Beach Nourishment Plan

Sediment Budget "Boxes" to Understand Current Processes

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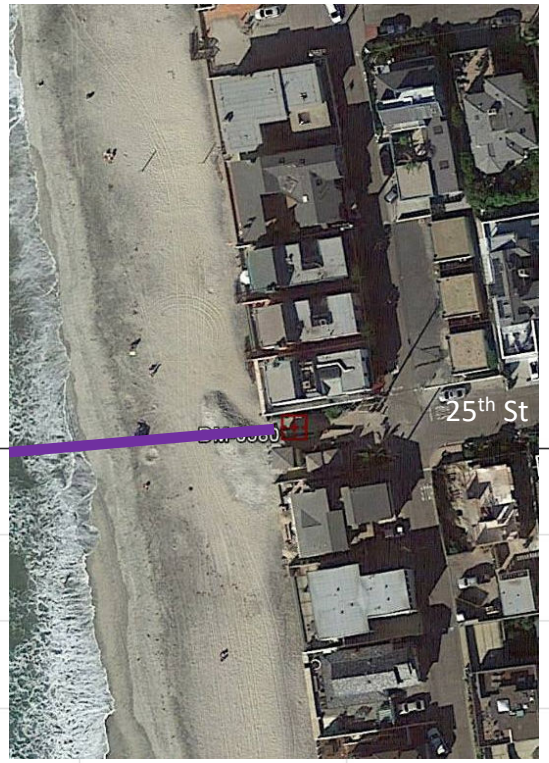
Beach Dynamics under Existing Conditions

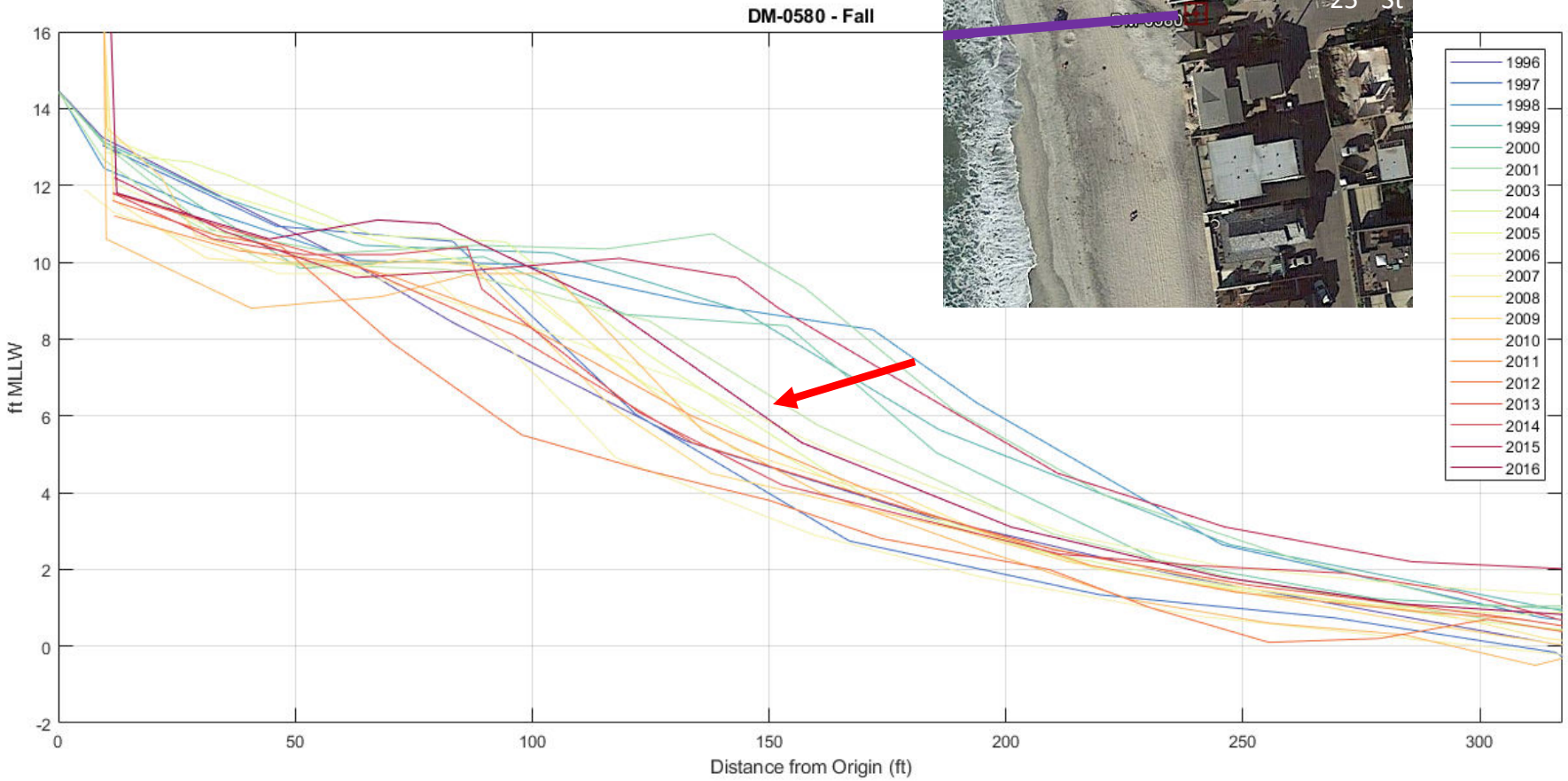
- Alongshore transport into box (from lit.)
- Dredging and bypassing (from SCE, others)
- Bluff/gully erosion (from lit.)
- Beach dynamics
  - Shoreline change
  - Beach transect volume change
- Influence of lagoon (lagoon box)

SANDAG Beach Transects

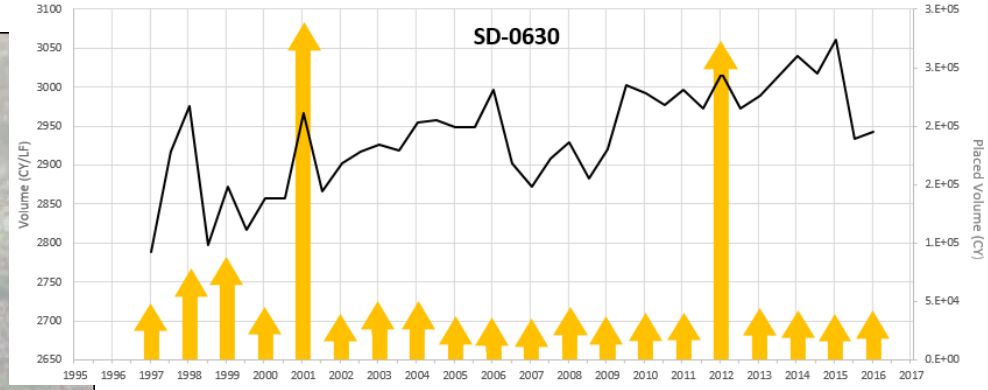
- Fall and spring surveys
- 1997 to present
- 7 transects between San Elijo & San Dieguito
- 4 transects between San Dieguito & Los Peñasquitos

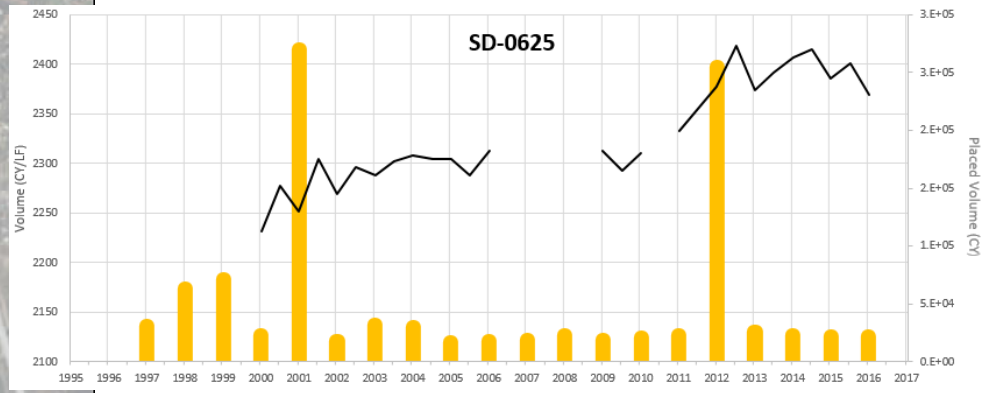
SANDAG Beach Transects

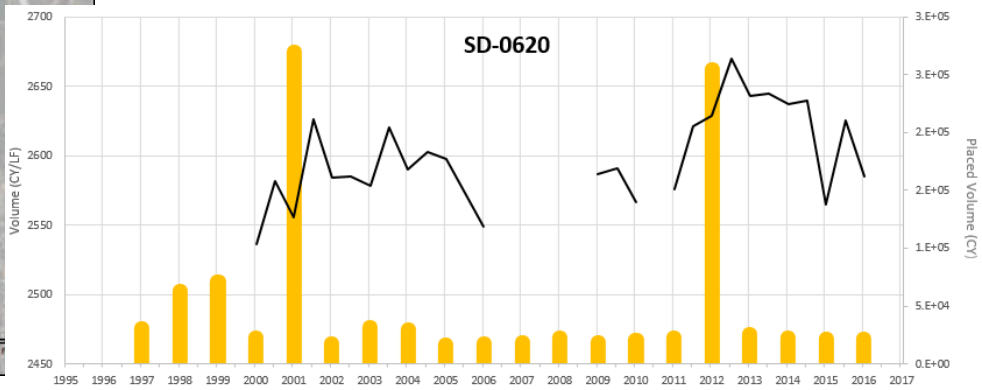




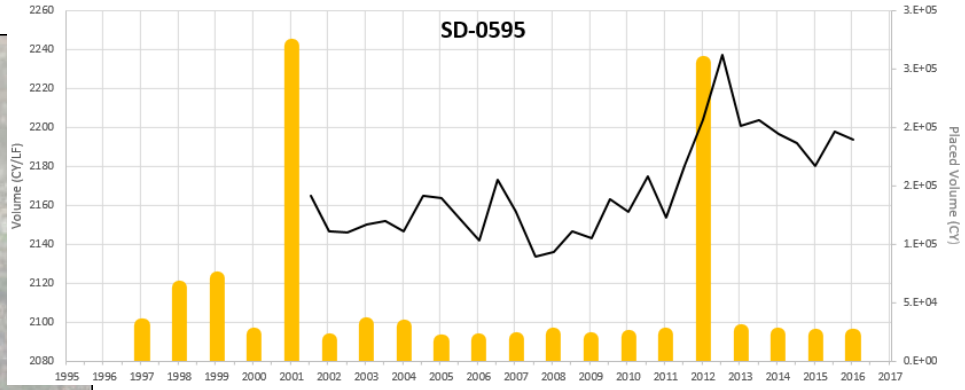
SANDAG Beach Volumes – Solana Beach

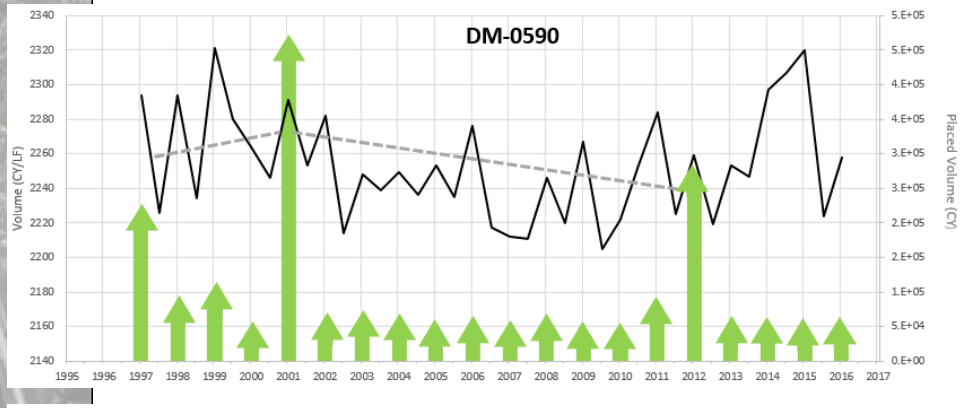


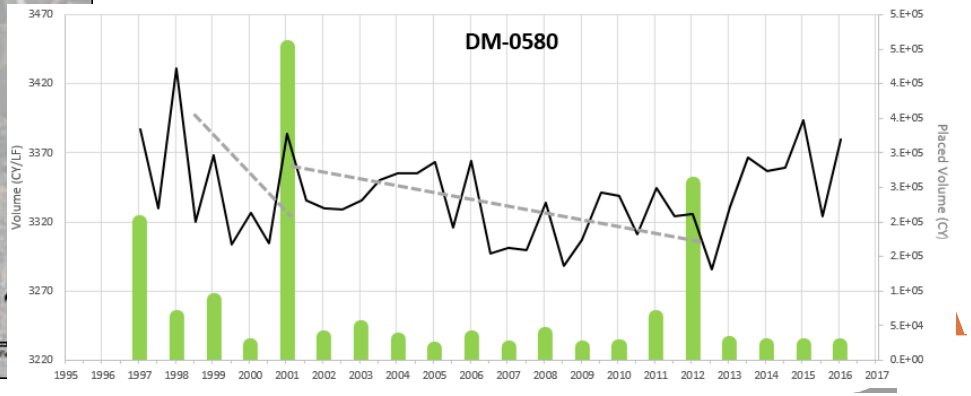




SANDAG Beach Volumes – Del Mar





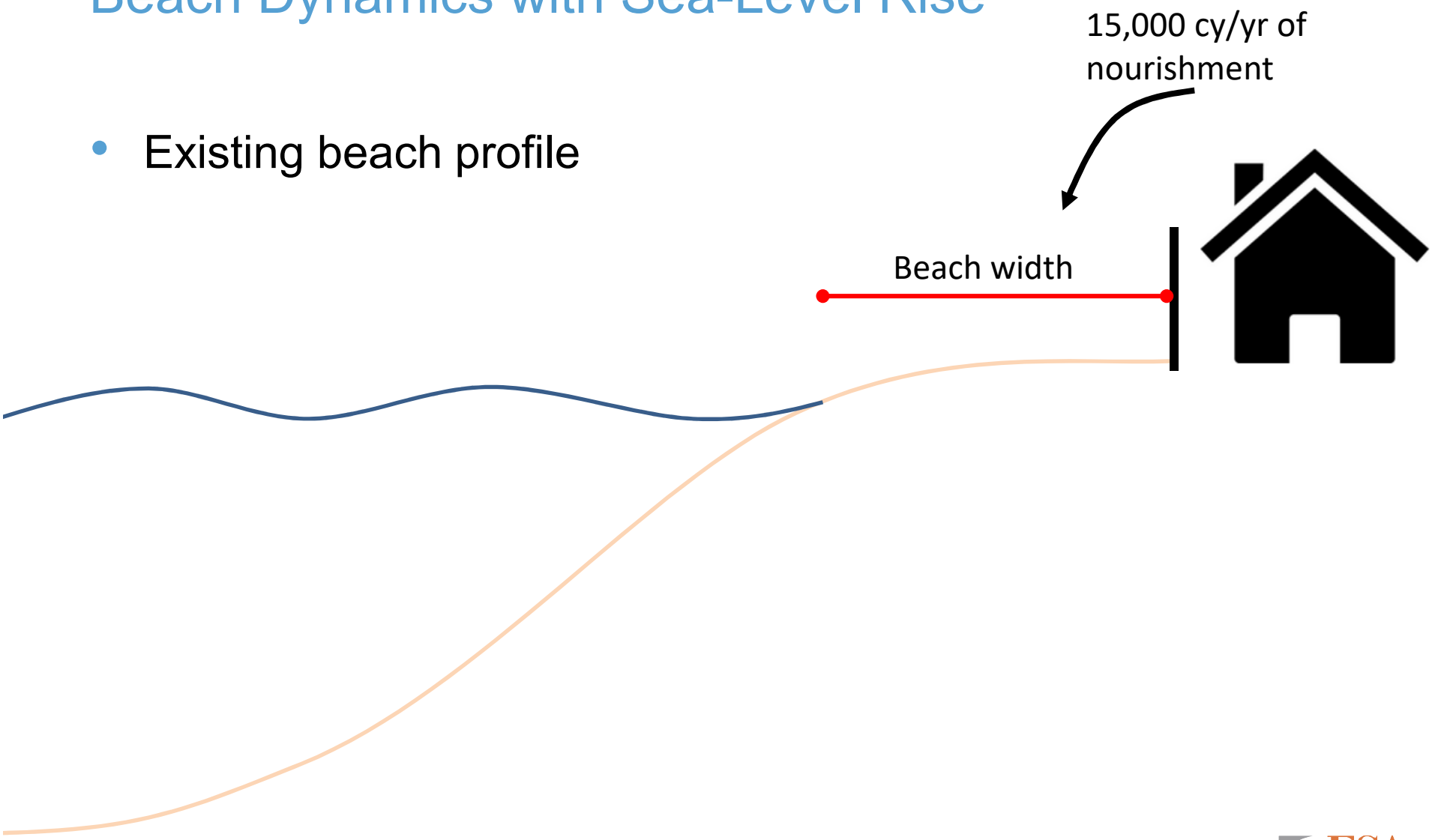


Existing Conditions Beach Dynamics – Initial Findings

- Solana Beach appears to be growing with bypassing from San Elijo lagoon and SANDAG nourishment
- Del Mar Beach appears to be eroding, even with bypassing from San Dieguito and upcoast SANDAG nourishment
  - Losing 7,900 cy/yr from beach
  - Already nourishing with 7,100 cy/yr from San Dieguito dredging/ bypassing
  - Beach needs 15,000 cy/yr to maintain width

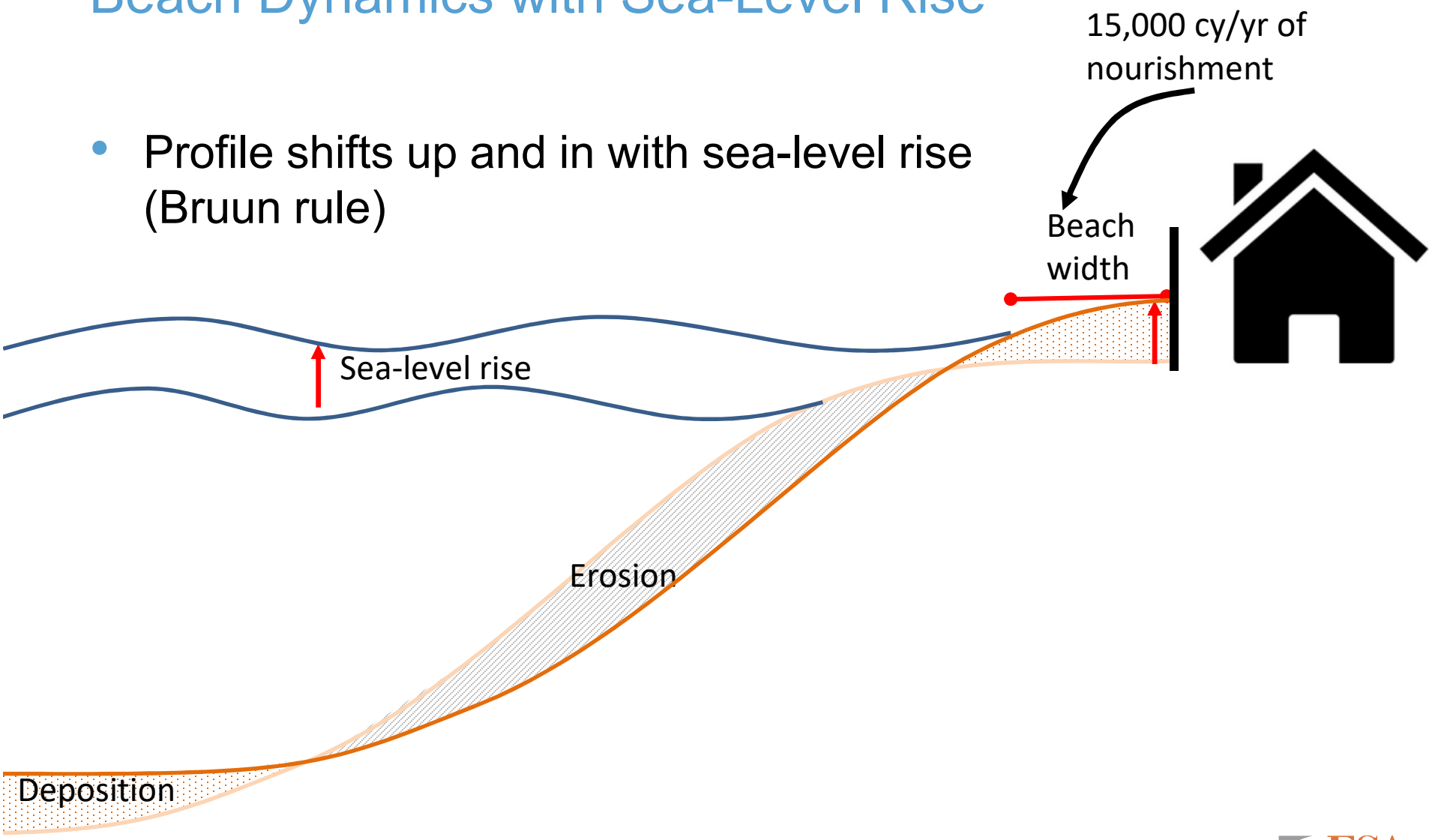
Beach Dynamics with Sea-Level Rise

- Existing beach profile



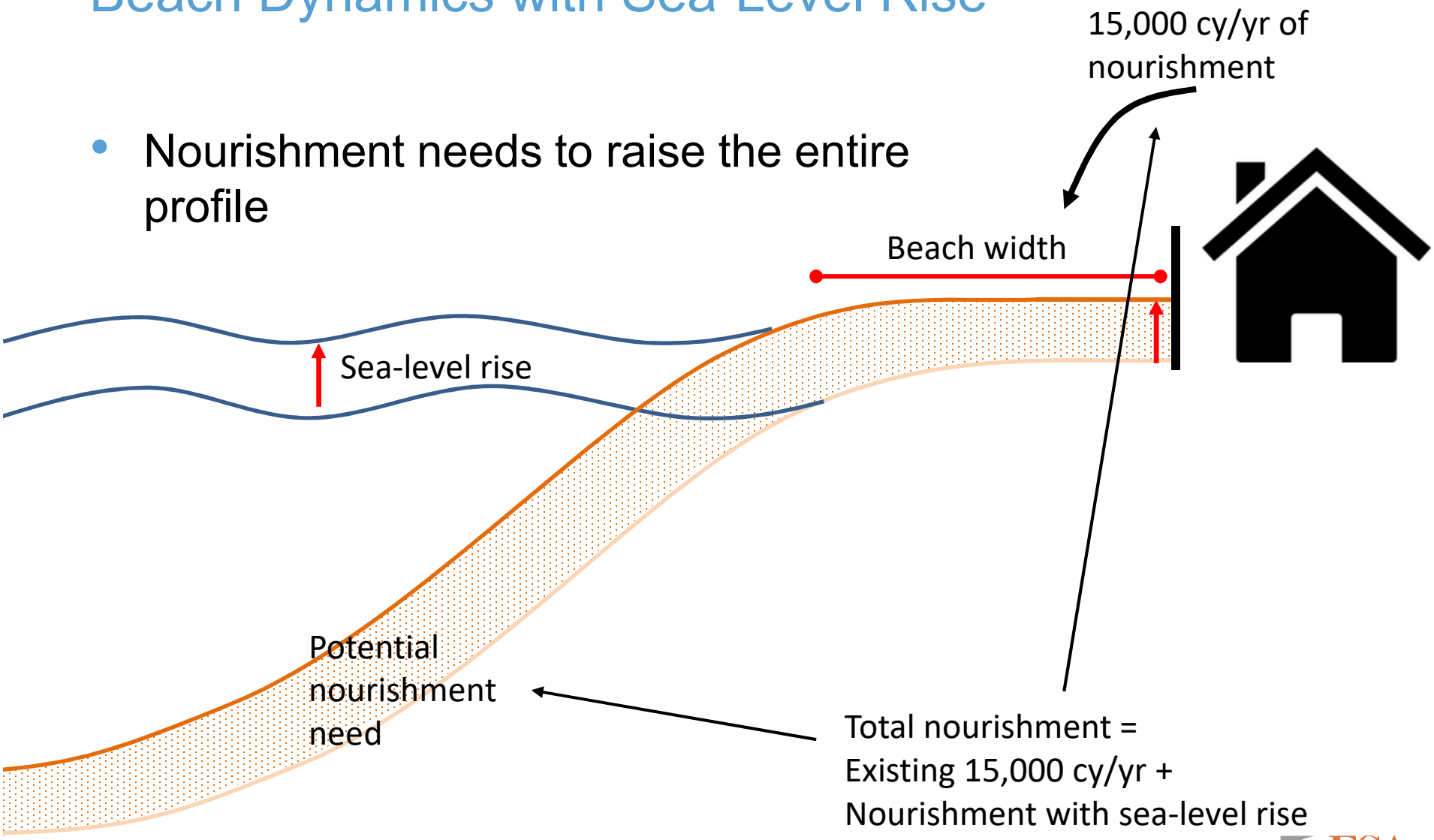
Beach Dynamics with Sea-Level Rise

- Profile shifts up and in with sea-level rise (Bruun rule)



Beach Dynamics with Sea-Level Rise

- Nourishment needs to raise the entire profile



Beach Nourishment - Initial Findings

- San Dieguito dredging nourishes roughly 7,100 cy/yr
- With nourishment, Del Mar beach still eroding 7,900 cy/yr
- Therefore, need 15,000 cy/yr to maintain beach width for entire Del Mar under current conditions
- With future sea-level rise, additional nourishment need:

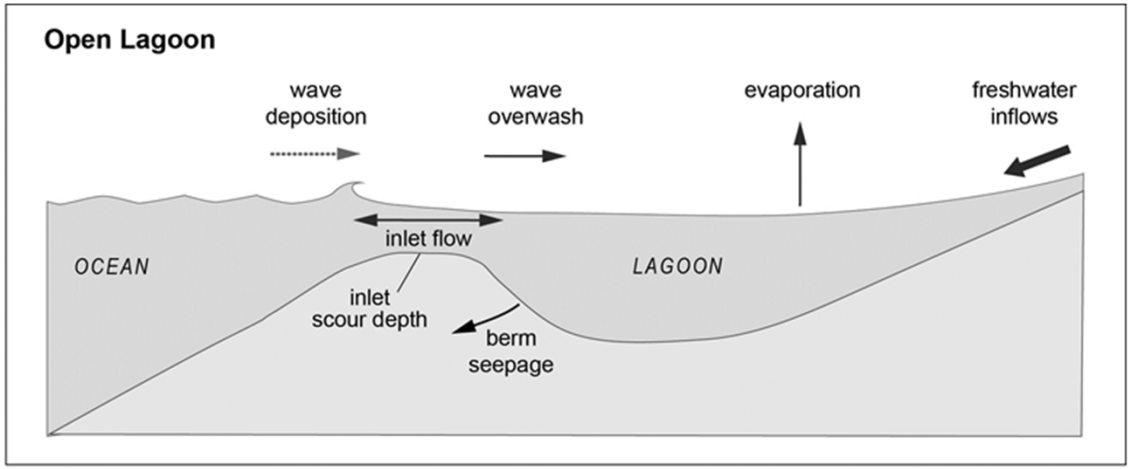
	1 ft of SLR	2 ft of SLR	5.5 ft of SLR
Current need	15,000 cy/yr	15,000 cy/yr	15,000 cy/yr
Additional need with SLR	14,000 – 20,000 cy/yr	38,000 – 44,000 cy/yr	58,000 – 66,000 cy/yr
Total nourishment	29,000 – 35,000 cy/yr	53,000 – 59,000 cy/yr	73,000 – 81,000 cy/yr

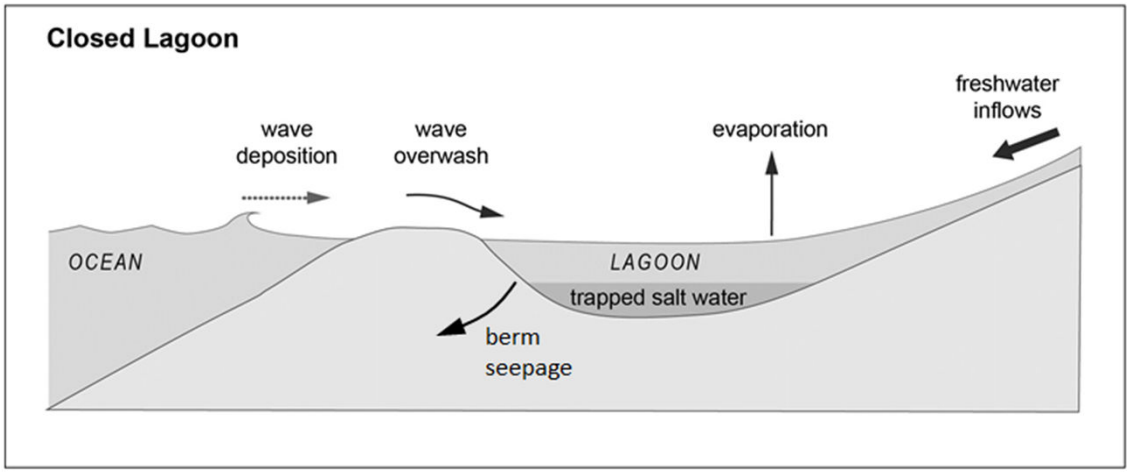
Lagoon Dynamics

- River/lagoon input (from lit.)
- Dredging and bypassing (from SCE, others)
- Lagoon mouth dynamics
  - Quantified Conceptual Model (QCM)

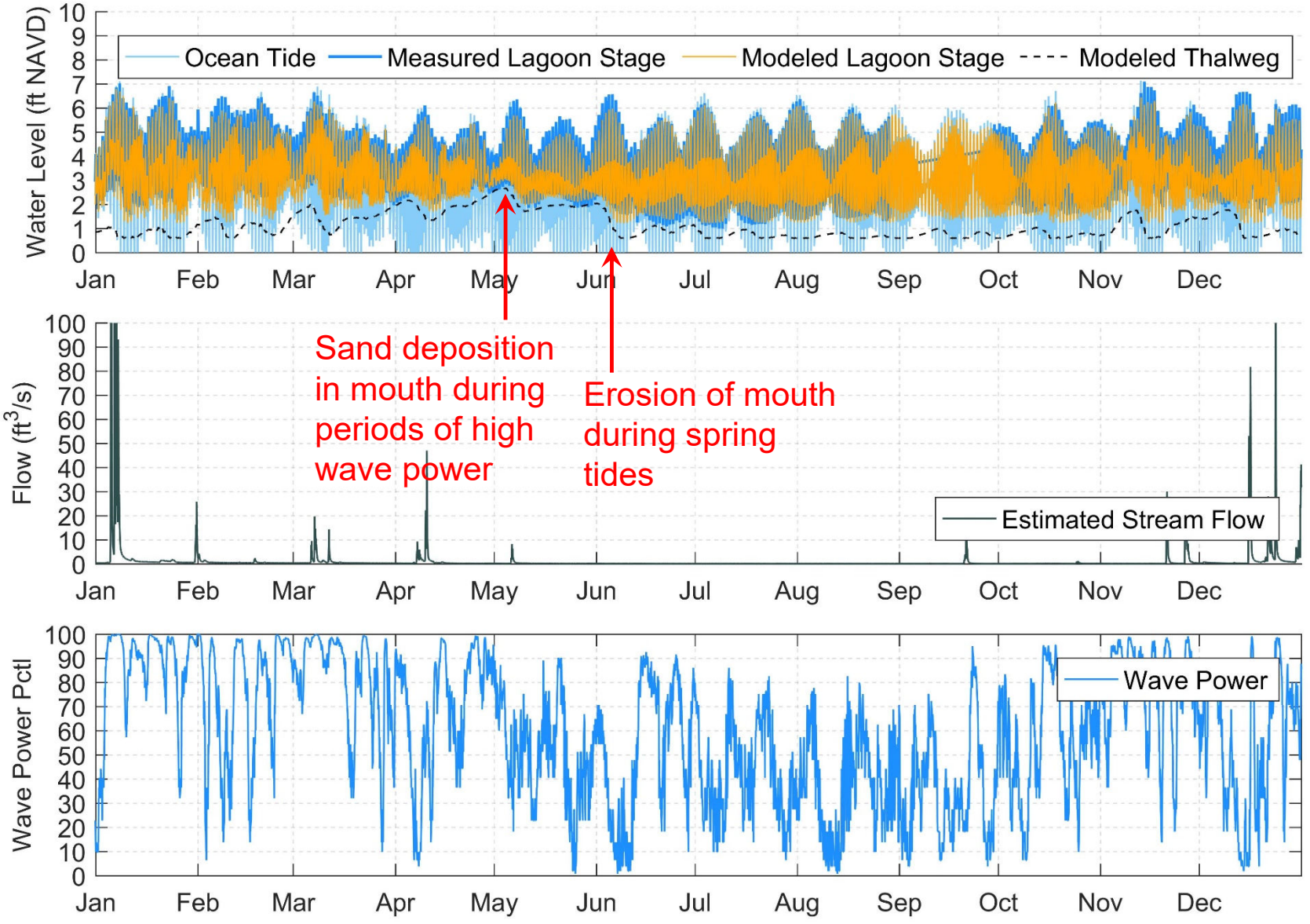
Quantified Conceptual Model (QCM)

Coastal Forcing **Inlet/Beach Morphology** **Lagoon Hydrology**



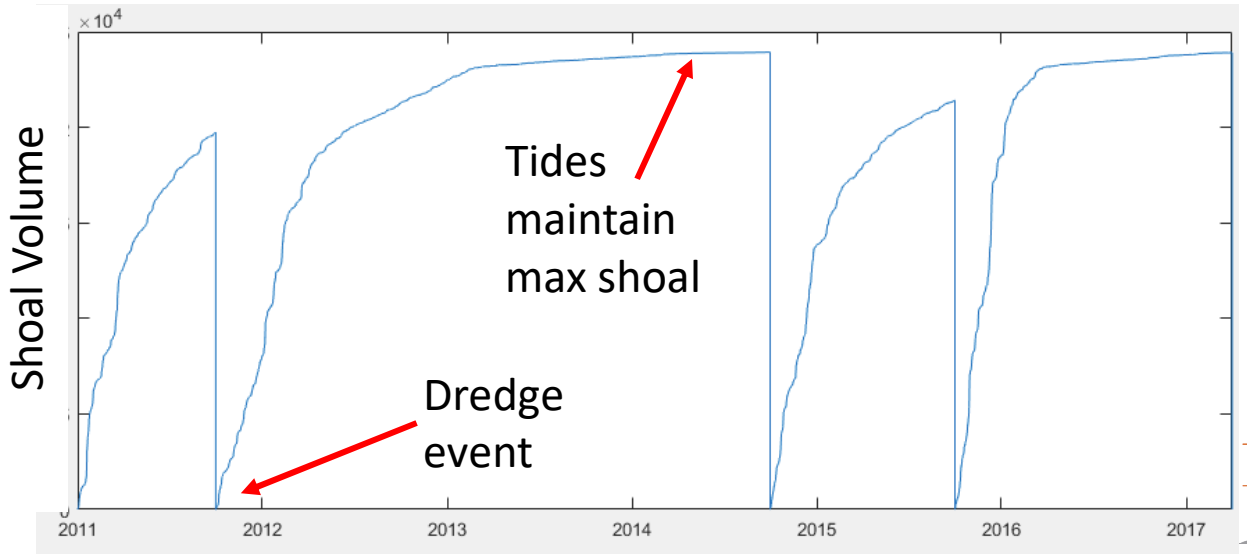


Existing Conditions (2016) Model Output- Initial Findings



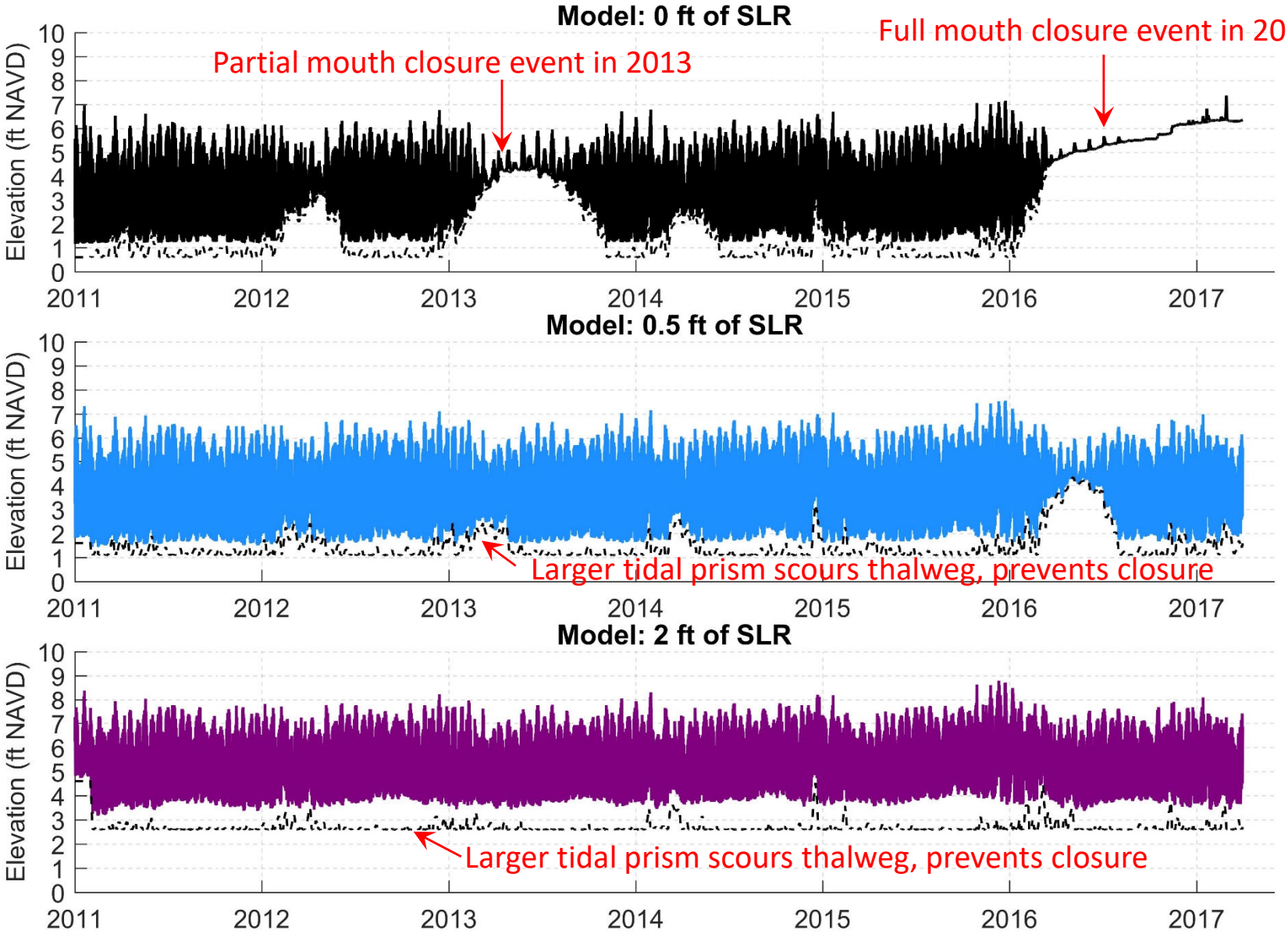
Existing Conditions Lagoon Dynamics- Initial Findings

- Waves bring sand into mouth
  - Builds flood shoal
  - Raises elevation of bottom of channel (or thalweg)
- Tides move sand out of mouth and limit shoal
  - More water moving causes scouring of mouth
- Dredging creates a hole, which fills rapidly at first, and then flattens out



ESA

Changes with Sea-Level Rise – Initial Findings



Lagoon Dynamics with Sea-Level Rise- Initial Findings

- Mouth may stay open without dredging
- Bed level predicted to increase with sea-level rise as assumed for Vulnerability Assessment
- Adaptation, for example mouth dredging, would be needed to reduce projected increase in flood risk as identified in Adaptation Plan
  - Mouth dredging volume would need to increase in order to maintain existing level of flood risk
  - Increased dredging volume is small compared to volume needed for beach nourishment

Feasibility Considerations – Next Steps

- Sources and availability of sand
- Frequency
- Cost

Other Considerations/ Initial Recommendations

- Sand retention structures to slow down sand transport and help maintain beach width with nourishment
- Coordinated regional sediment management with beach targets
  - Continuation of SANDAG with some optimization
- Approaches for strategically placing sand

Initial Findings Compared to SANDAG RSBP

	RSBP I	RSBP II	Average
	2001	2012	~Every 11 years
Del Mar	183,000	-	n/a
Solana Beach	146,000	142,000	144,000
Cardiff Beach	101,000	89,000	95,000
Oceanside Littoral Cell	1,833,000	1,082,000	1,457,500
Total for SANDAG RSBP	2,104,000	1,532,000	1,818,000

	Current	1 ft of SLR	2 ft of SLR	5.5 ft of SLR
Nourishment needed every 11 years	165,000 cy	319,000 – 385,000 cy	583,000 – 649,000 cy	803,000 – 891,000 cy

Next Steps

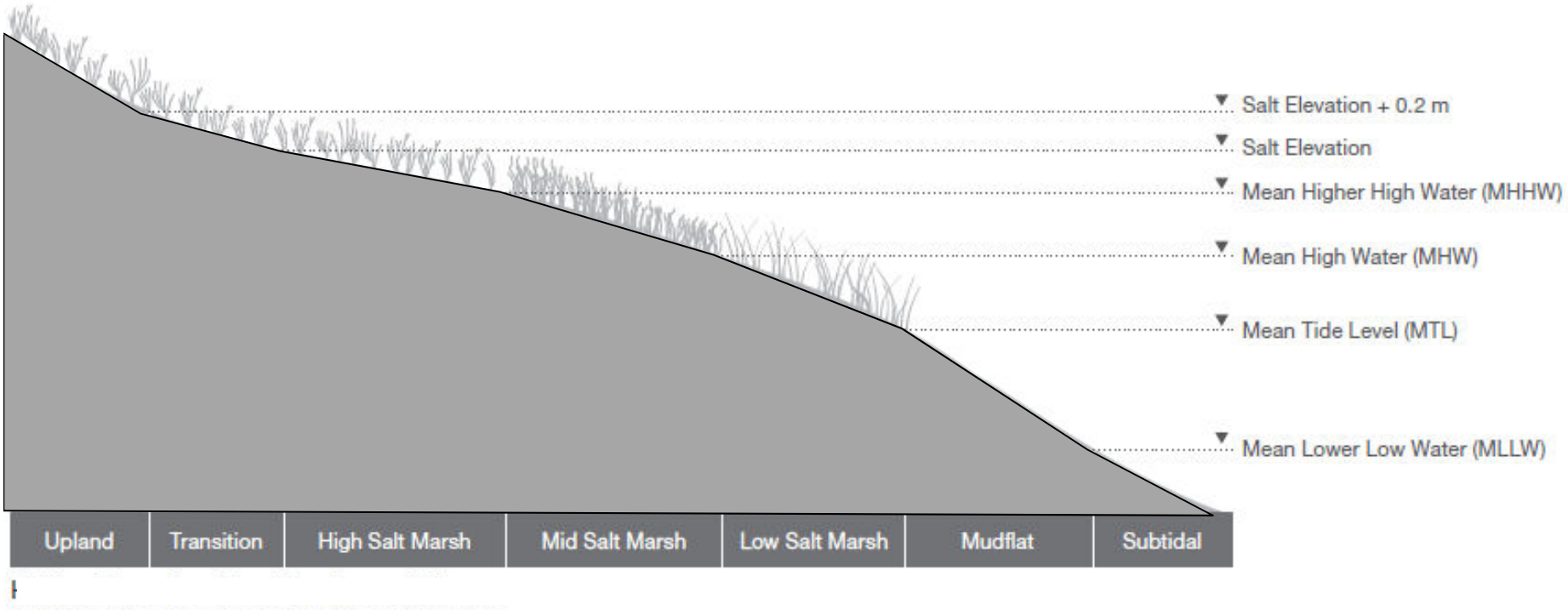
- Finalize analysis
- Provide Draft Sediment Management Plan

Task 3 – Lagoon Habitat Evolution Assessment

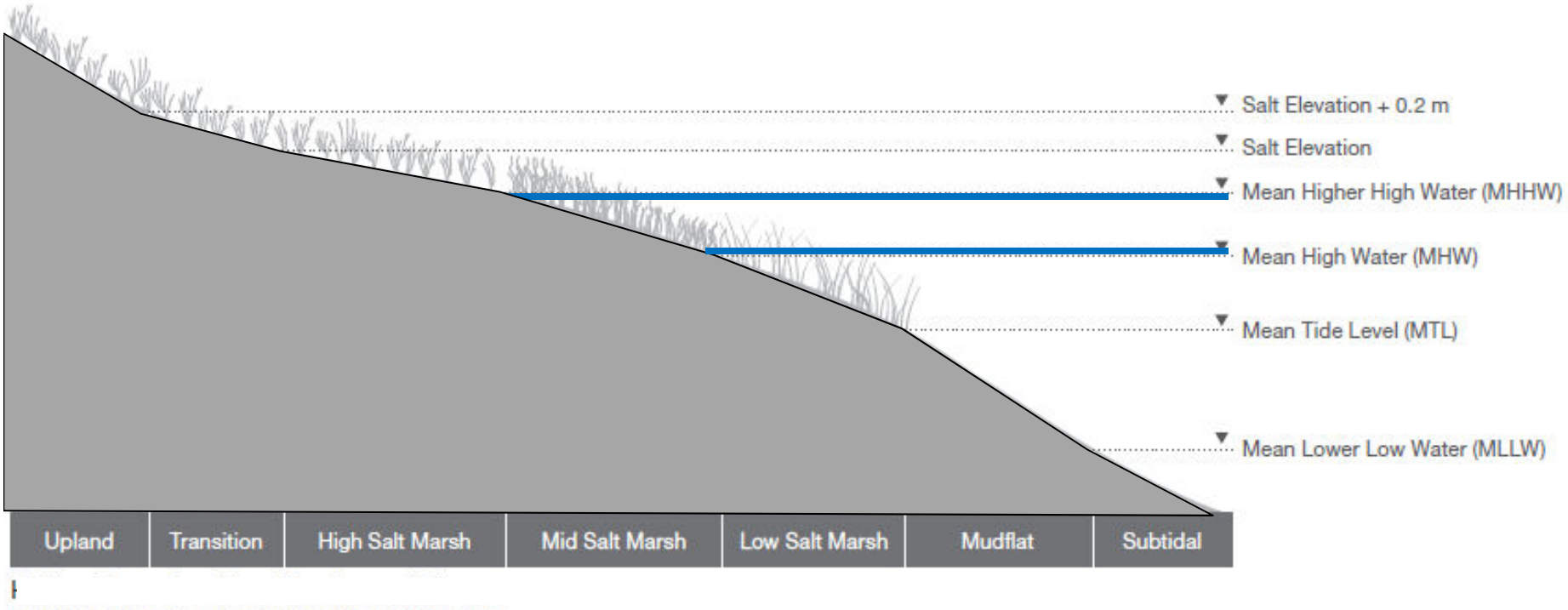
- Purpose:
  - Identify vulnerable habitats
  - Identify and evaluate adaptation options
    - Identify where wetland habitat could migrate with SLR
    - Evaluate potential for future habitat migration areas and corridors

- Method:
  - Sea Level Affecting Marshes Model (SLAMM)
  - GIS parcel analysis

Conceptual Habitat Model



Marsh Habitat Zones



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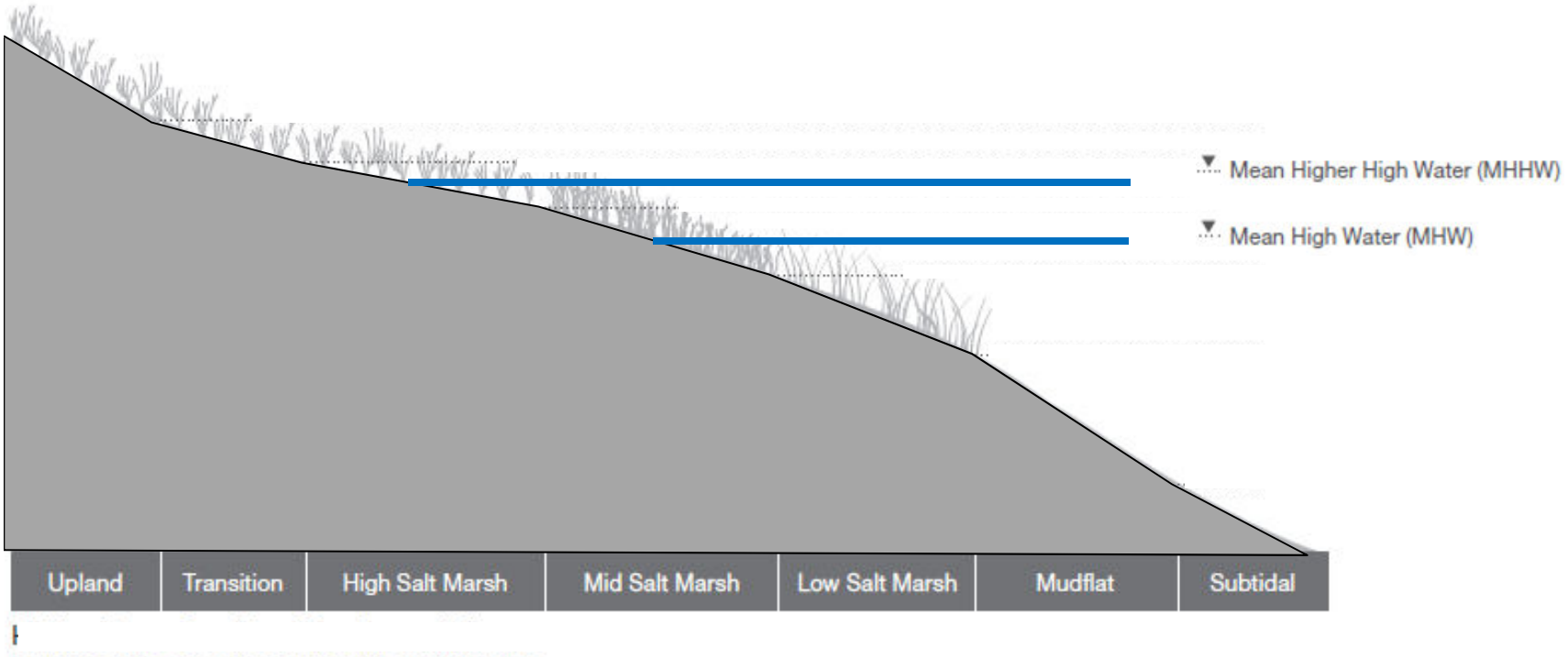

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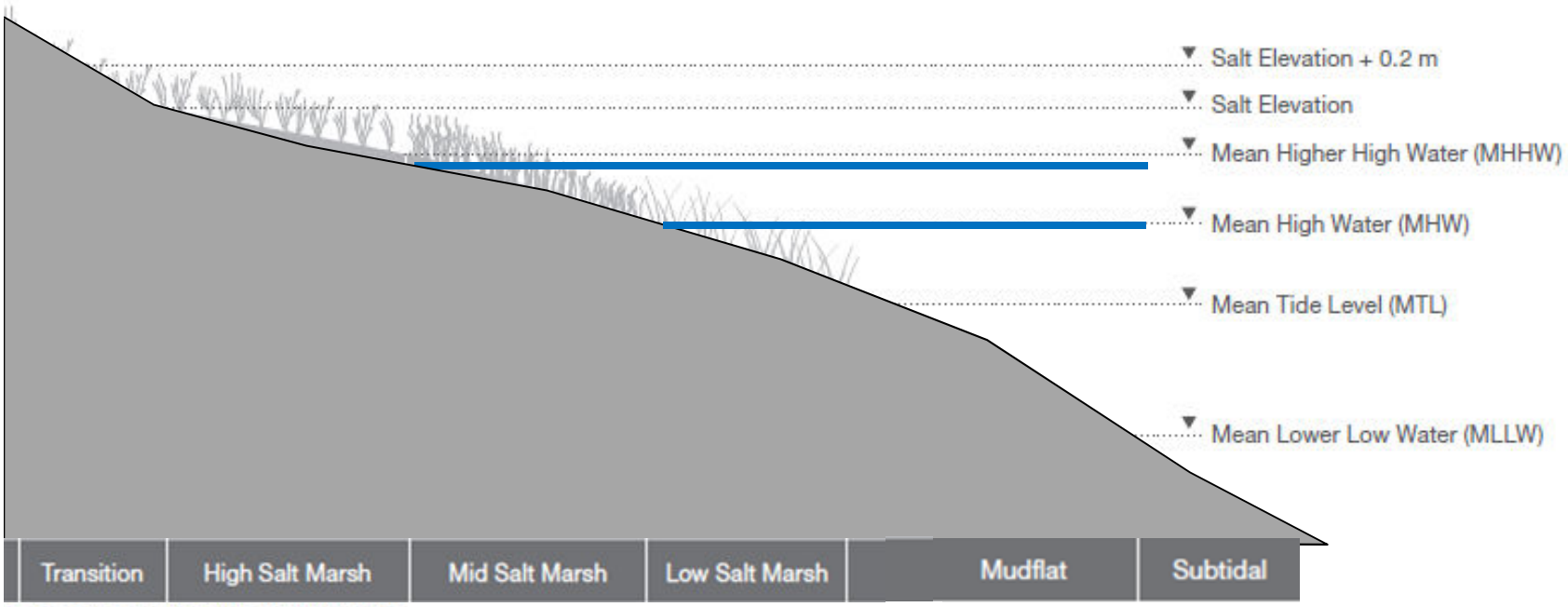
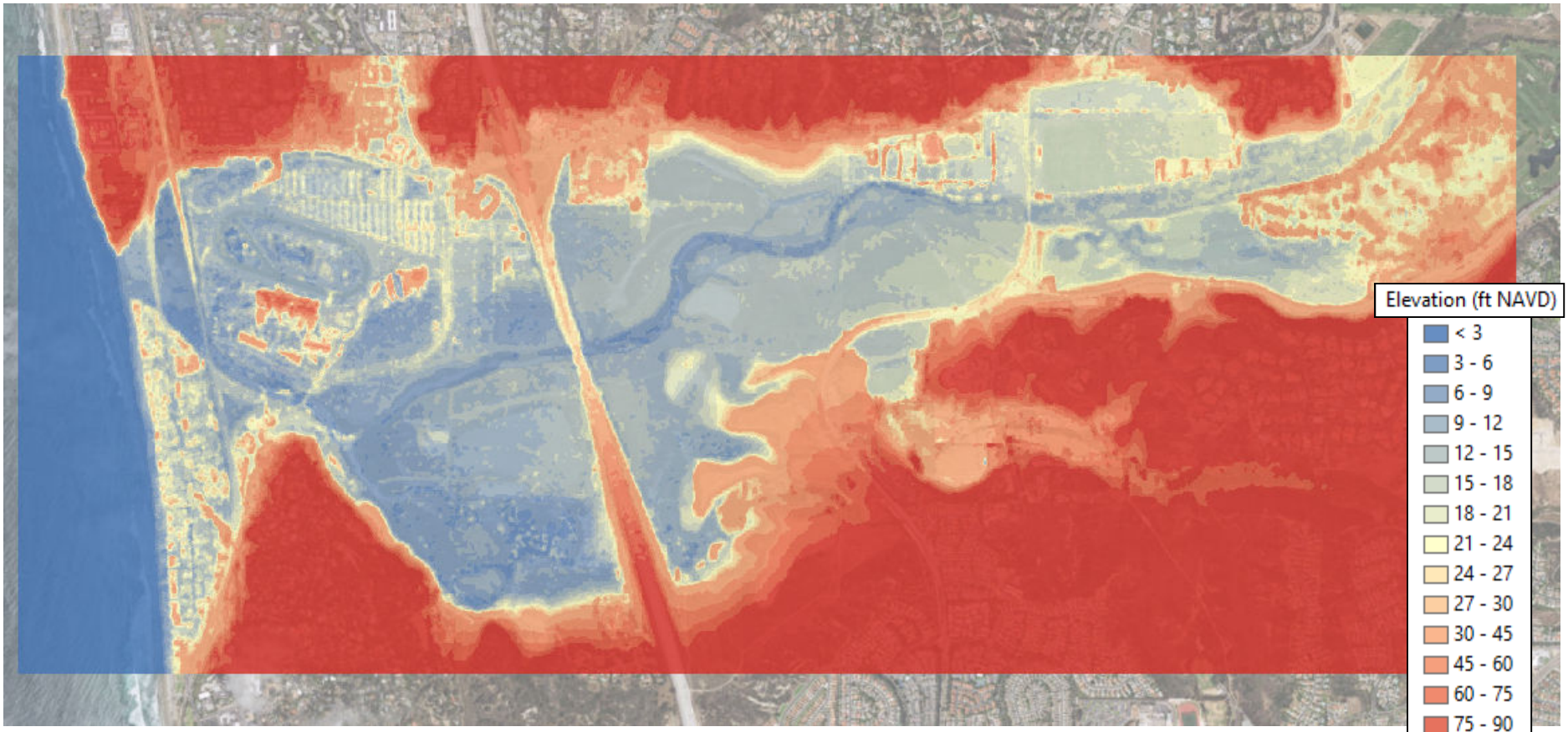
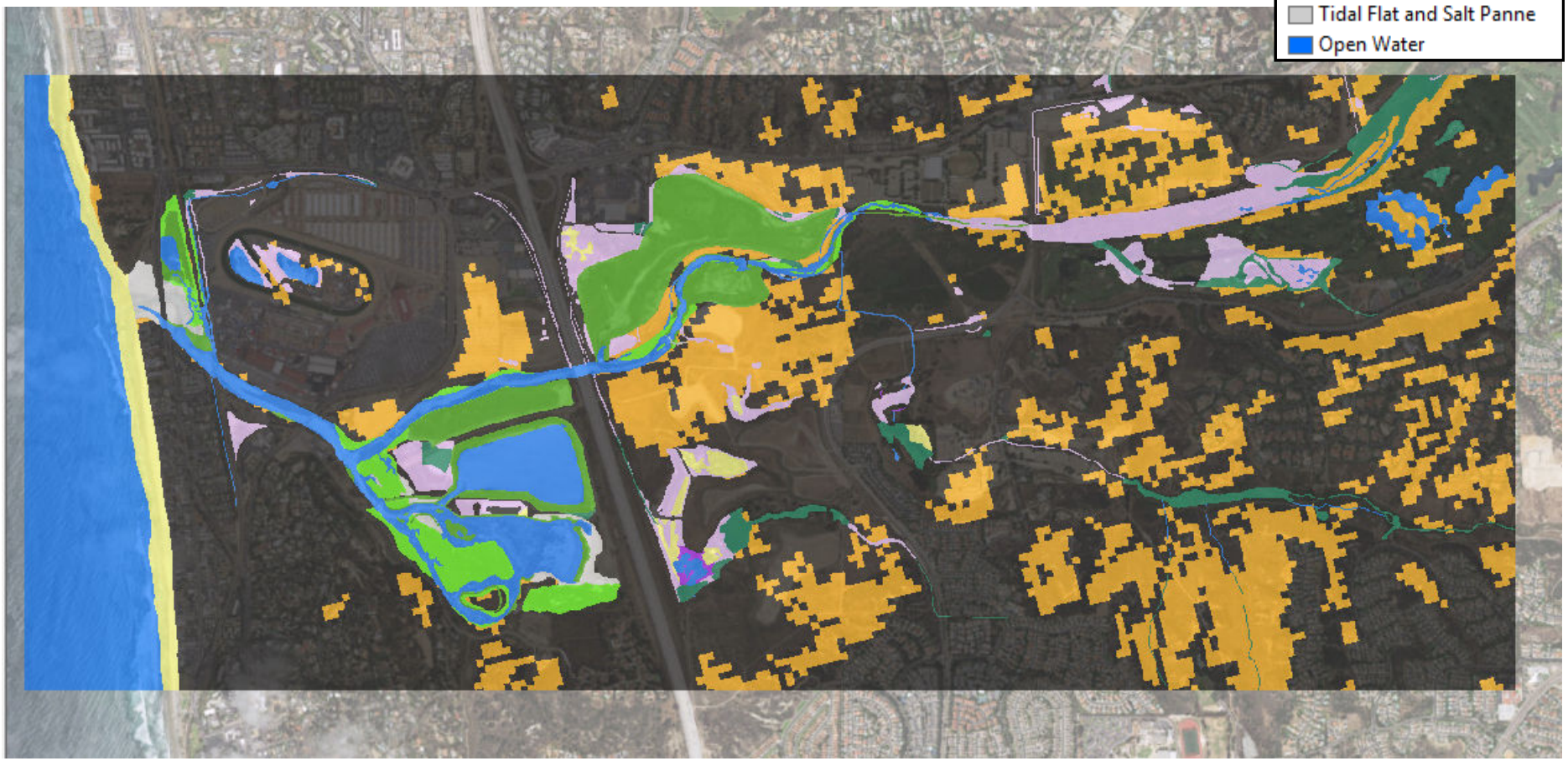


Existing Topographic Data



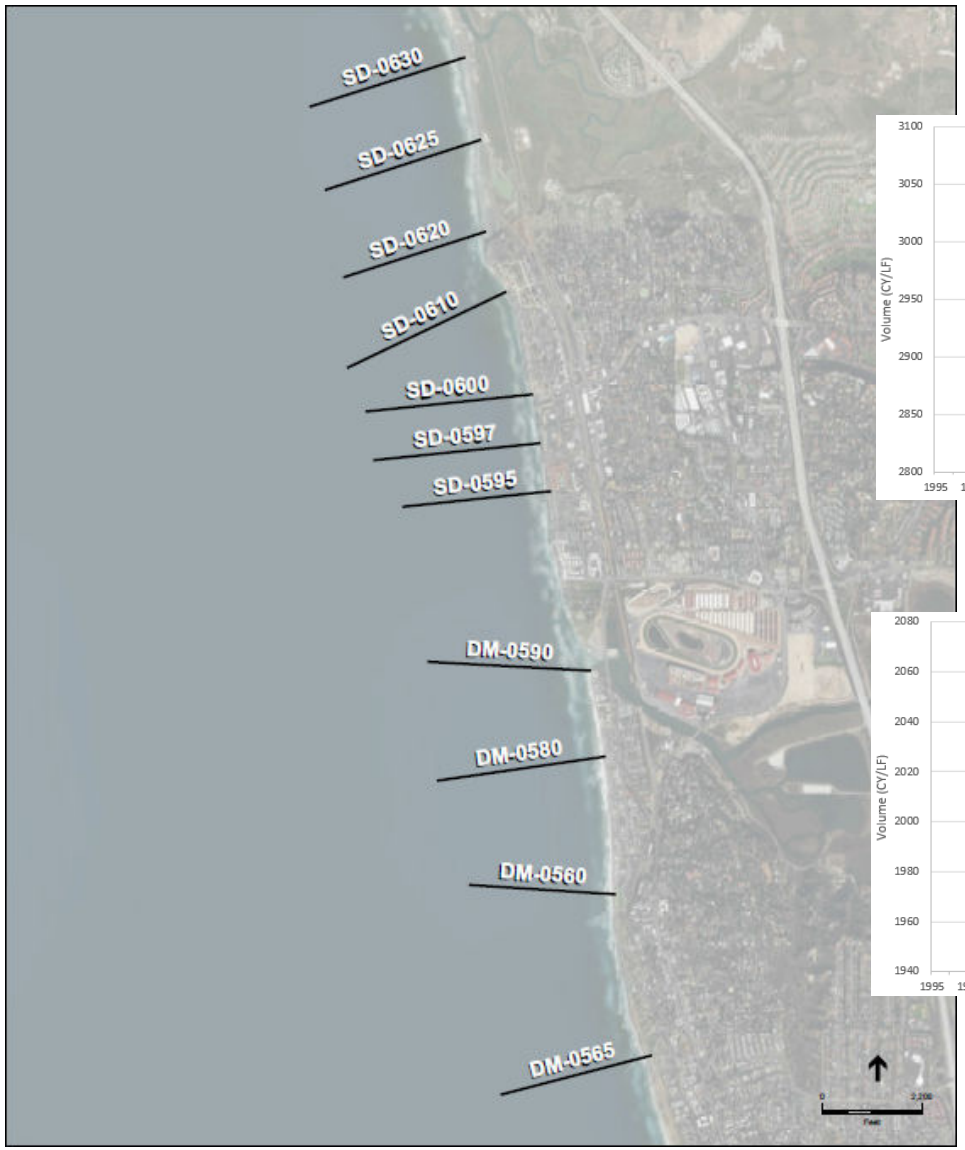
Existing Wetland Habitat Data

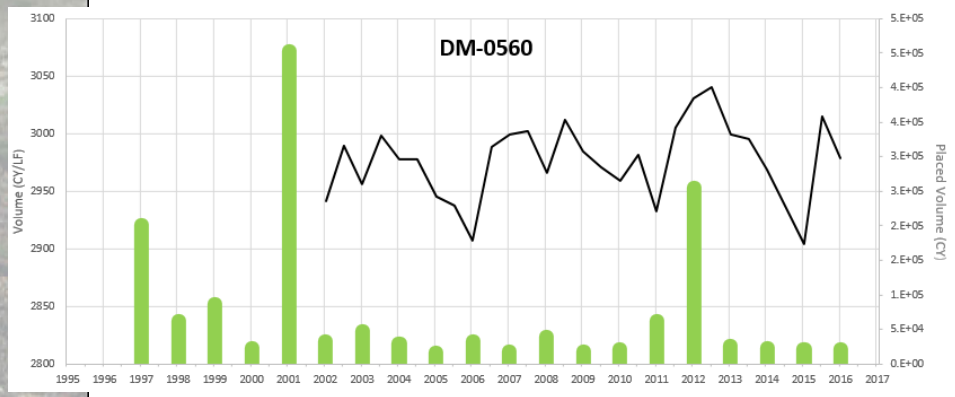


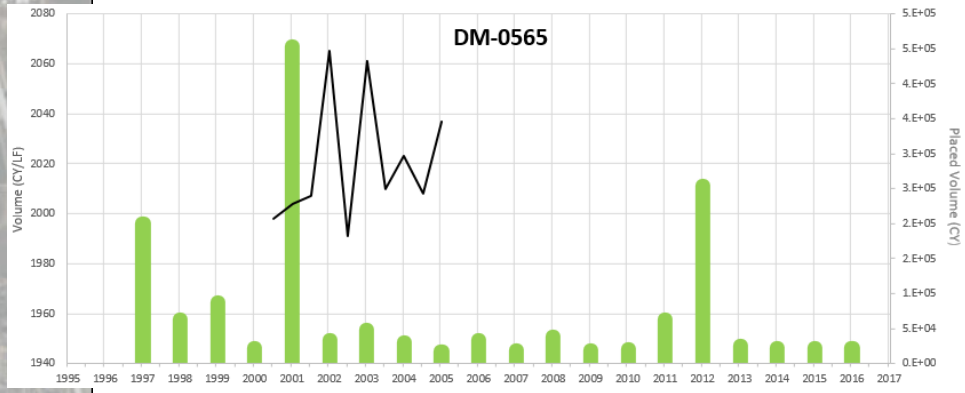
Questions?

Extra Slides

SANDAG Beach Volumes – Del Mar







ESA

Longshore Sediment Transport Rates and Sources

Source		Transport to South (cy/yr)	Transport to North (cy/yr)	Gross Transport (cy/yr)	Net Transport (cy/yr)	Method/Source
Marine Advisers	1960	760,000	545,000	1,305,000	216,000 To South	Wave energy flux method near Oceanside (in USACE 1991)
Hales	1978	643,000	540,000	1,183,000	102,000 To South	Wave energy flux method near Oceanside
Inman and Jenkins	1983	807,000	553,000	1,360,000	254,000 To South	Wave energy flux method near Oceanside (in USACE 1991)
Tekmarine, Inc.	1987	520,000	414,000	934,000	106,000 To South	South of Oceanside harbor (in USACE 1991)
Moffatt and Nichol	1990				1945-1977: 100,000 – 250,000 1978-1987: 0 – 40,000 To South	Along Del Mar coastline
USACE	1991	740,000	546,000	1,286,000	194,000 To South	Average of Marine Advisers 1960, Hales 1978, and Inman and Jenkins 1983
Inman and Masters	1991				1960-1978: 190,000 1983-1990: 50,000 To South	Between Carlsbad Submarine Canyon and Point La Jolla
Patsch and Griggs	2006				146,000 To South	Based on dredging at Oceanside harbor

San Dieguito River Yield

Source		Natural Sediment Yield (no dams) (cy/yr)	Total Sediment Yield (cy/yr)	Suspended Load (cy/yr)	Bedload (cy/yr)	Sand Yield (cy/yr)
Brownlie and Taylor	1981	64,200[1]	12,500[1]	9,000[1]	3,600[1]	12,500[1]
Stow and Chang	1987					15,041
USACE	1988					7,100[2]
Everest	2002	131,000[3]				
Slagel and Griggs	2006	58,900[4]	9,200[4]	6,500[4]	2,600[4]	3,900[4]
USGS	2007			2,500[5]		
Warrick and Farnsworth	2009			2,500[5]	380[6]	
USACE	2016		9,900[7]			