

Alternative Designs for the Relocation of the San Elijo Lagoon Inlet



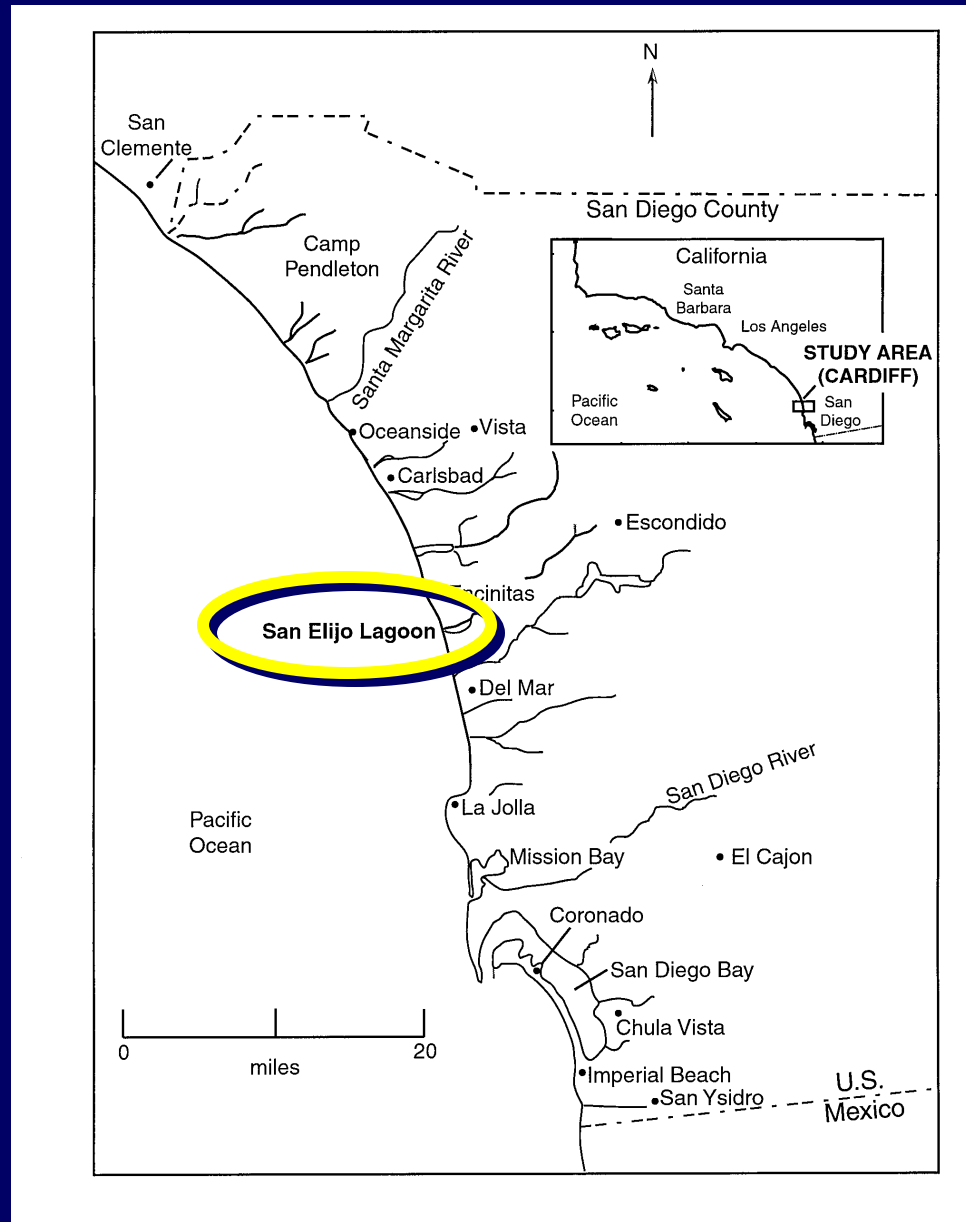
Hany Elwany, PhD
Scripps Institution of
Oceanography

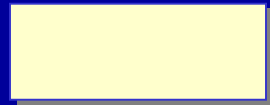
Fernando Marván, PhD
Coastal Environments

ICCE 2006
San Diego

5 September 2006

Project Location





Background



Lagoon Enhancement



Engineering



Project Evaluation



Conclusions

Project Area

Background

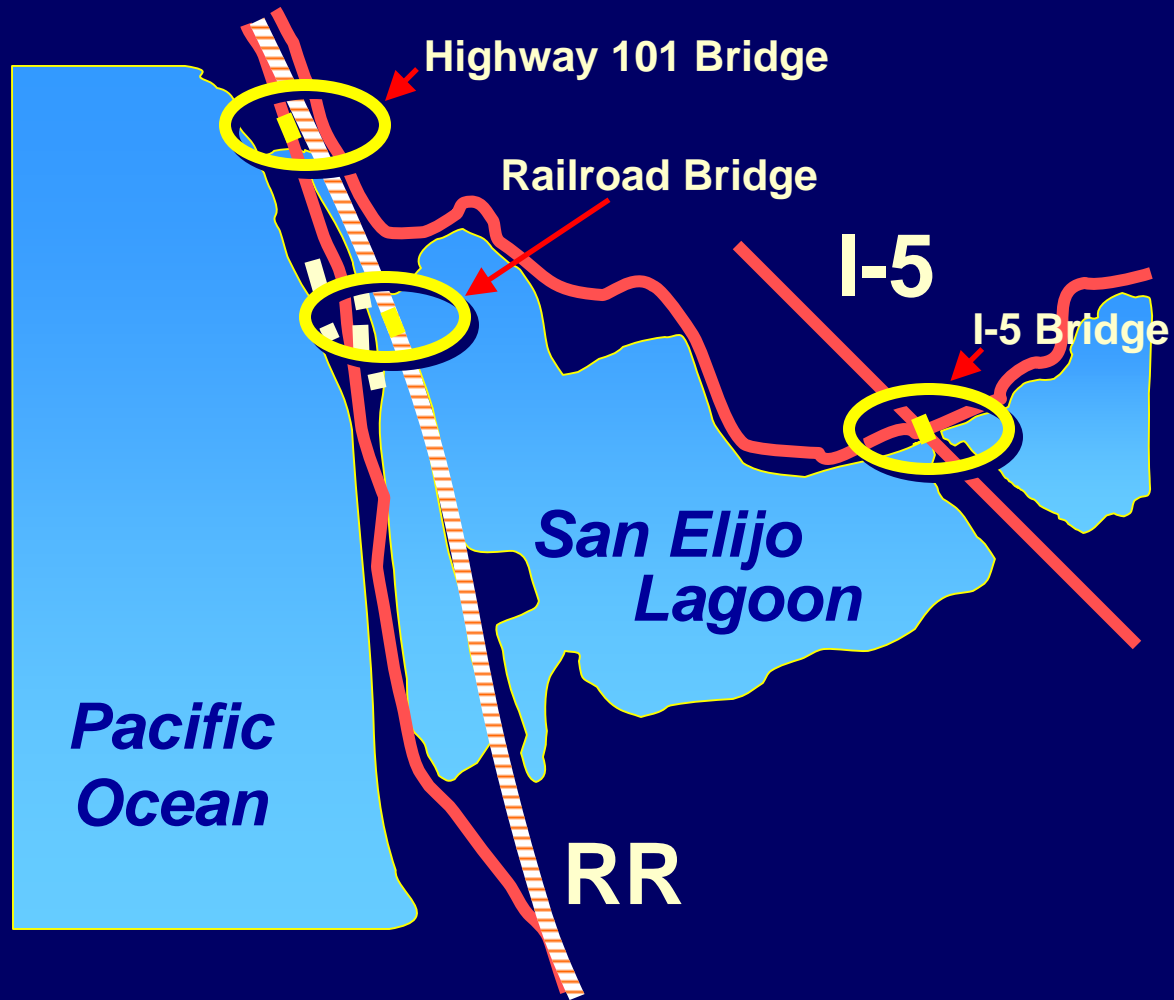
Project Needs

- Deterioration of Hwy 101 provided opportunities to relocate the lagoon inlet
- Lagoon inlet channel long and narrow
- Protection of Hwy 101 from wave storm flooding



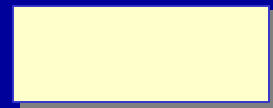
Existing Bridges

Background





Background



Lagoon Enhancement



Engineering



Project Evaluation



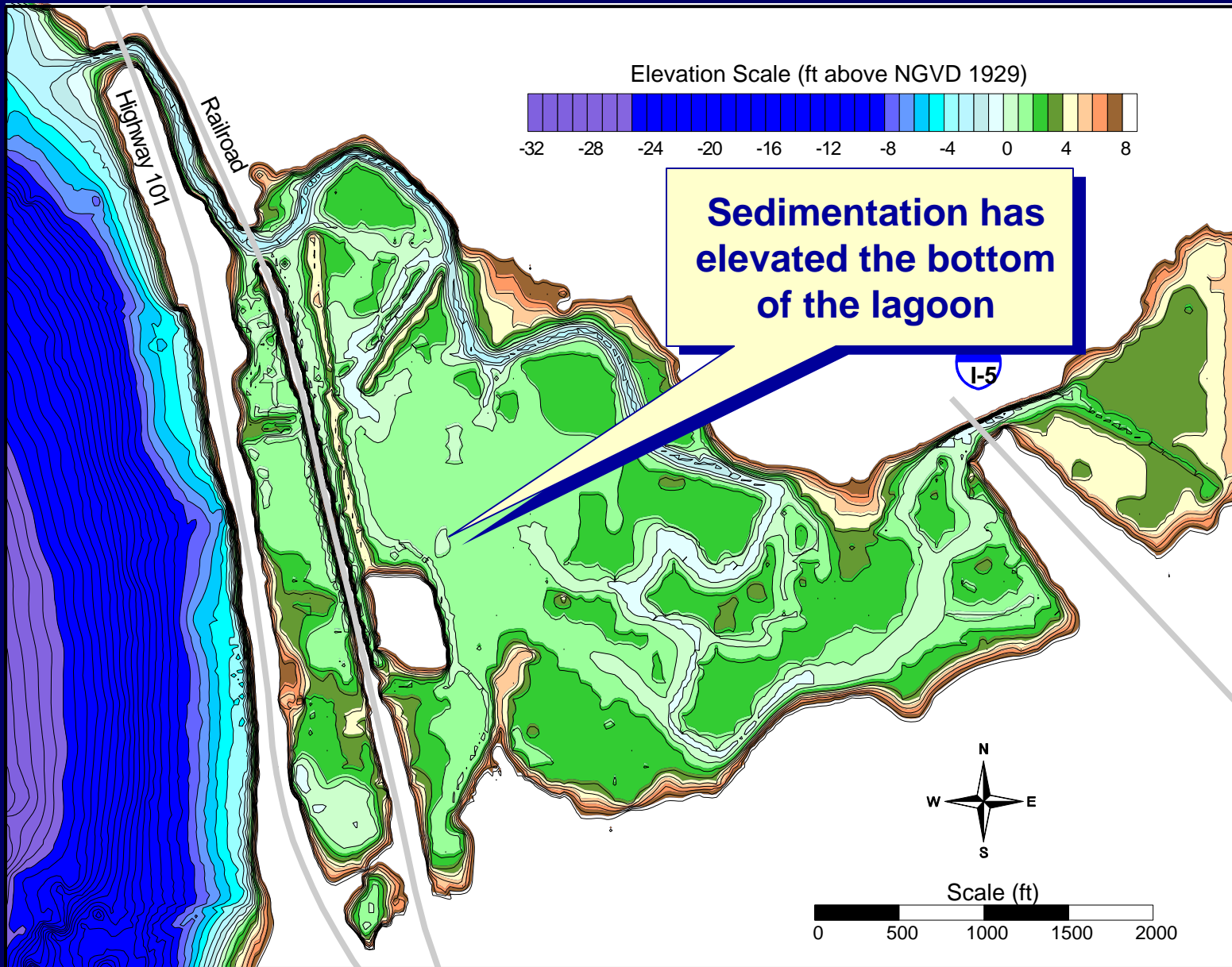
Conclusions

Present Conditions

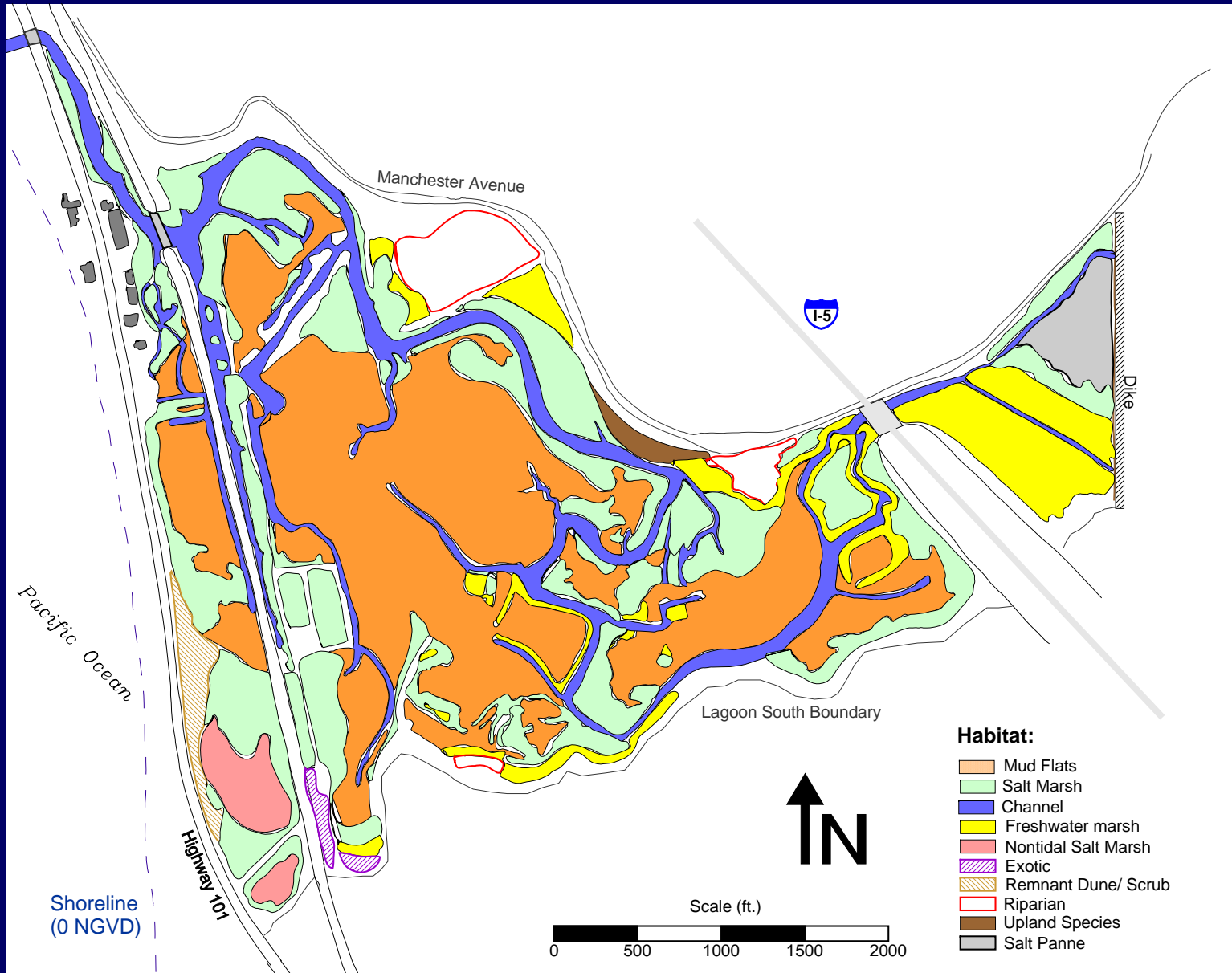
Enhancement

- Weak tidal circulation
- Poor water quality
- Poor biological diversity
- Flooding of Highway 101 and businesses

Baseline Bathymetry



Baseline Habitat



Benefits of the Project

Enhancement

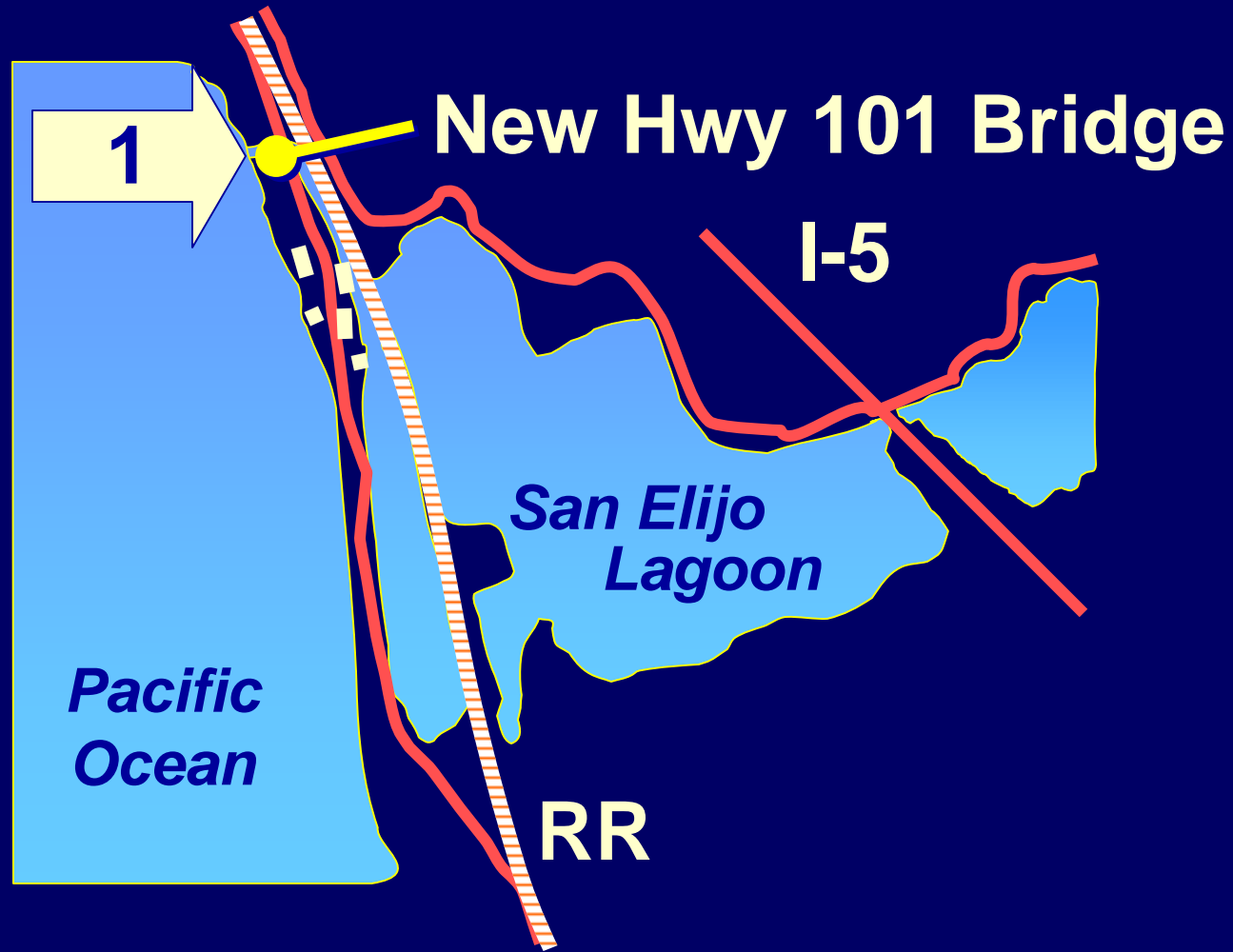
- Lagoon enhancement
 - ▶ Increased tidal circulation
 - ▶ High water quality
 - ▶ Biological diversity
- Replace deteriorating bridge
 - ▶ Minimize potential flood damage
- Public use/enjoyment

Project Elements

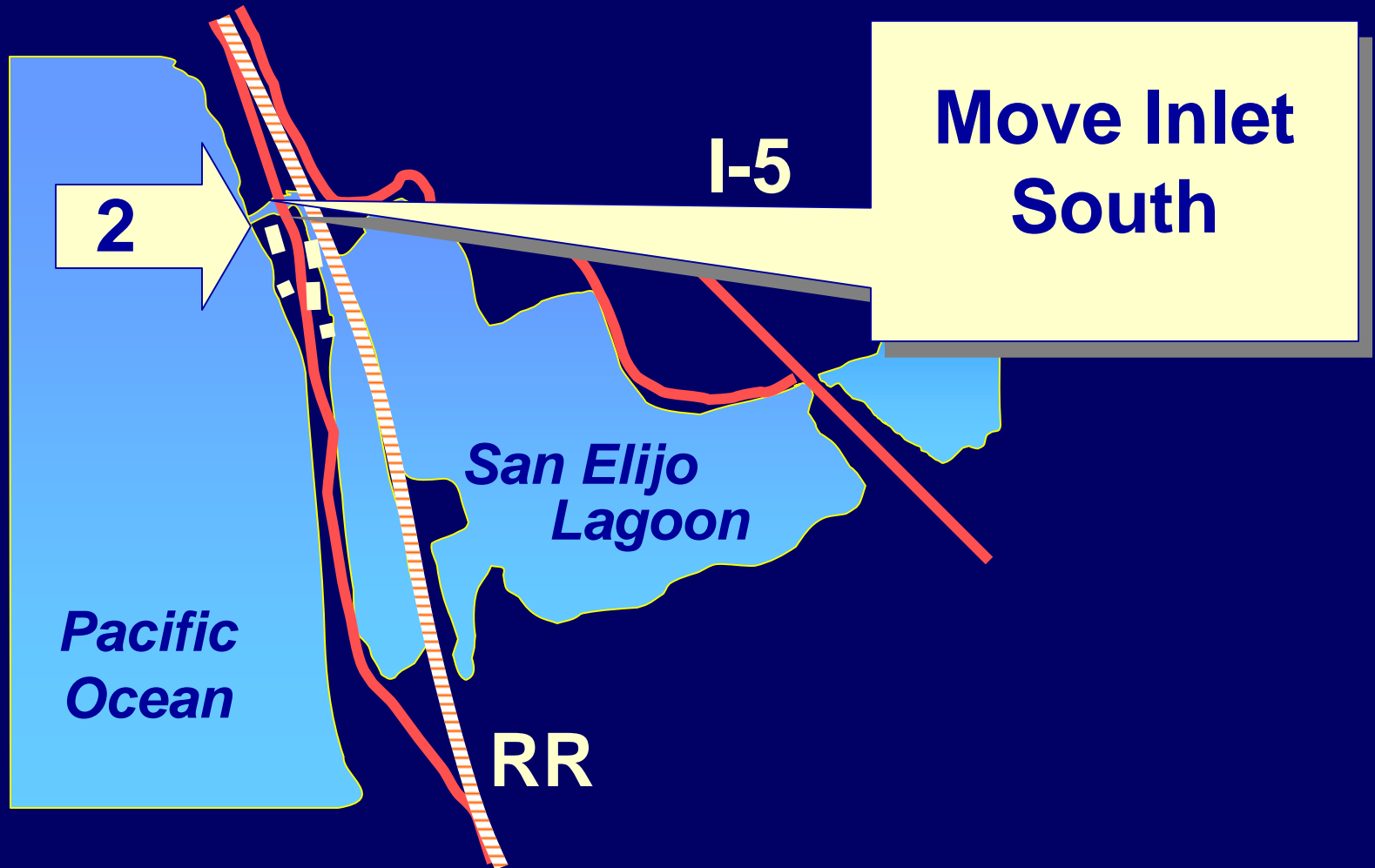
Enhancement

- Inlet relocation (three locations proposed)
- Dredge lagoon
- Hwy 101 bridge construction
 - Hwy 101 flood protection
- RR bridge construction

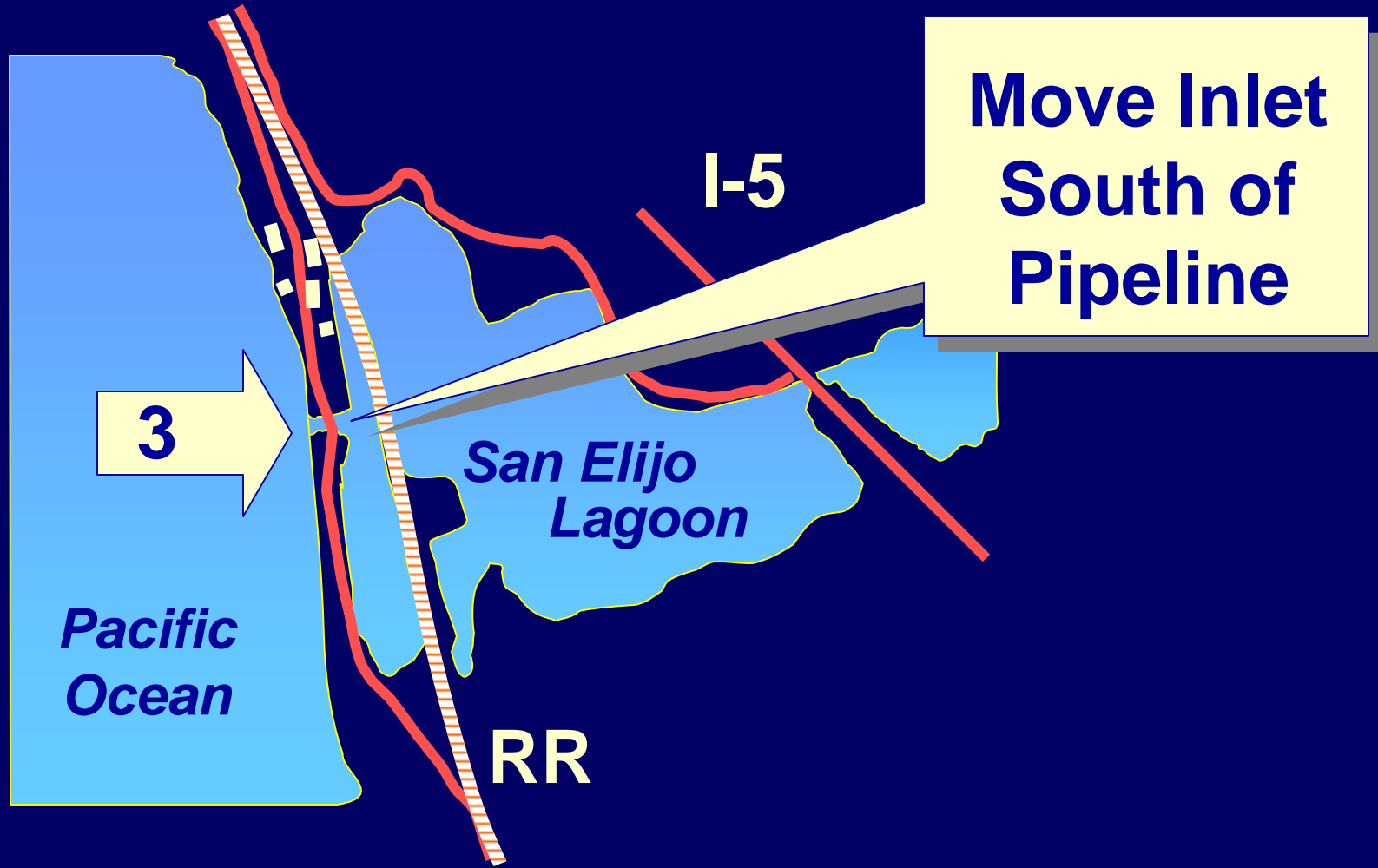
Inlet Alternative 1



Inlet Alternative 2



Inlet Alternative 3

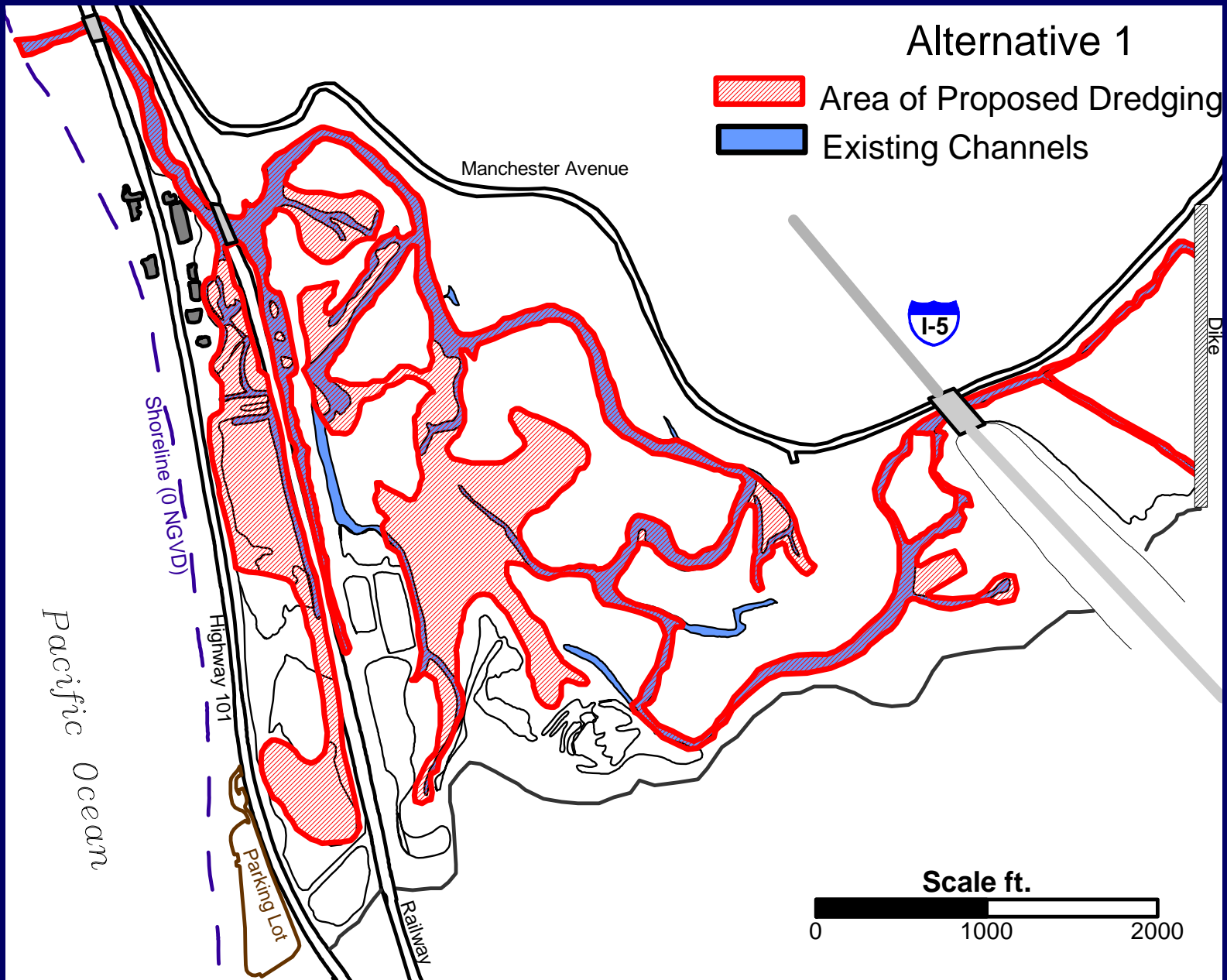


Lagoon Dredging

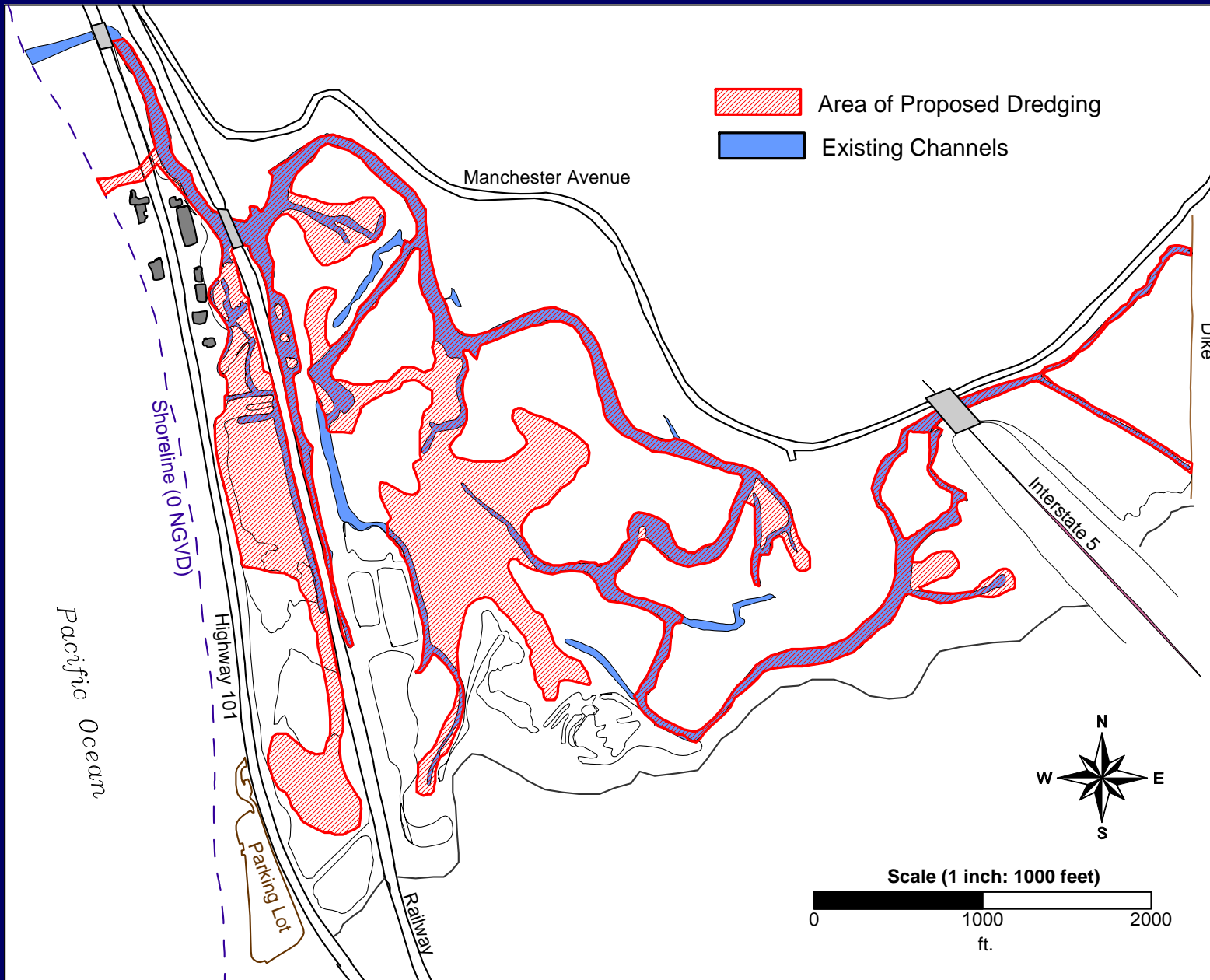
Enhancement

- Improve tidal circulation
- Improve water quality
- Keep lagoon inlet open
- Minimize invasive species
- Improve circulation between lagoon basins

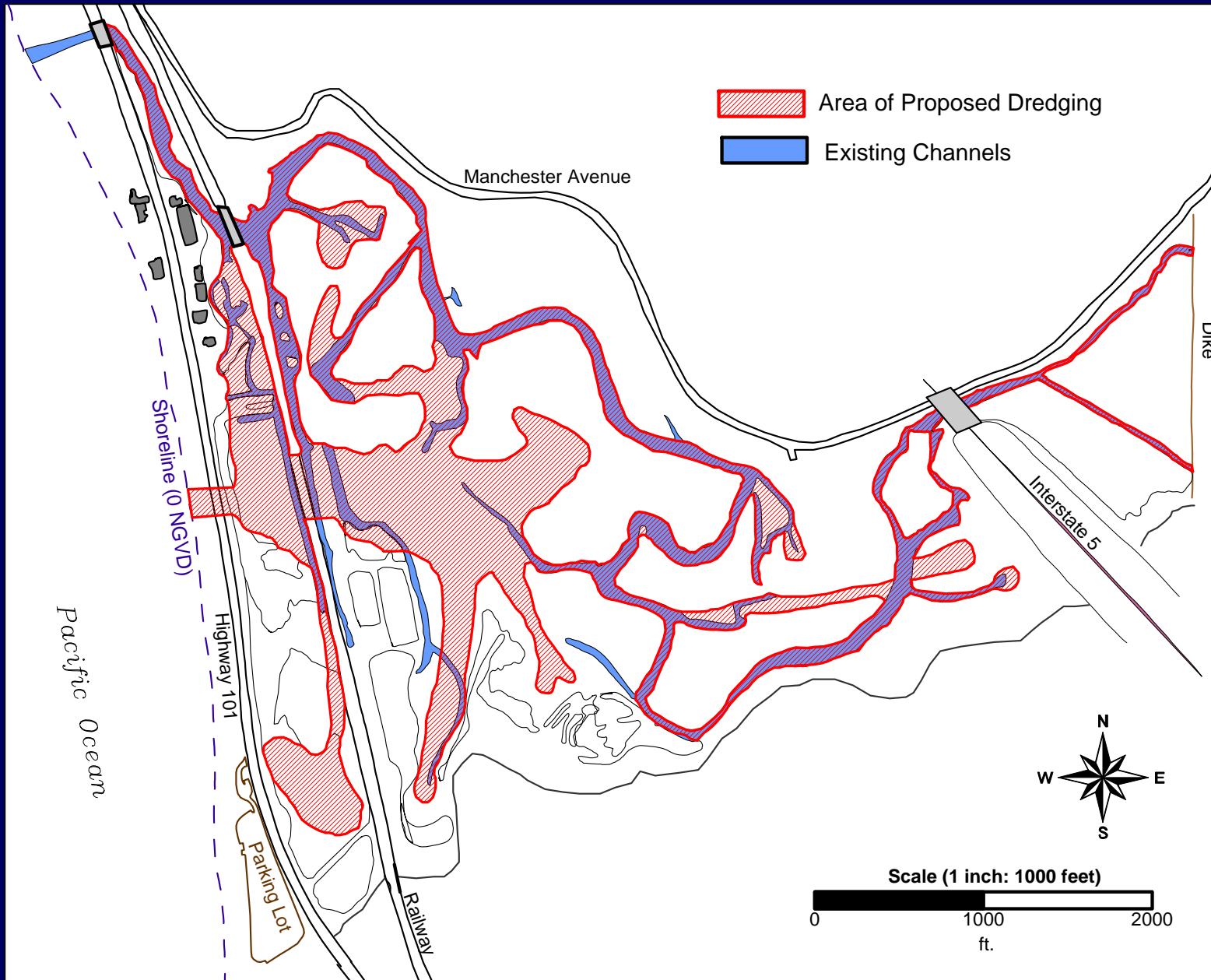
Alternative 1



Alternative 2



Alternative 3

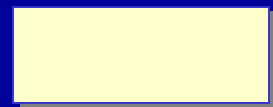




Background



Lagoon Enhancement



Engineering



Project Evaluation



Conclusions

Engineering Overview

Engineering

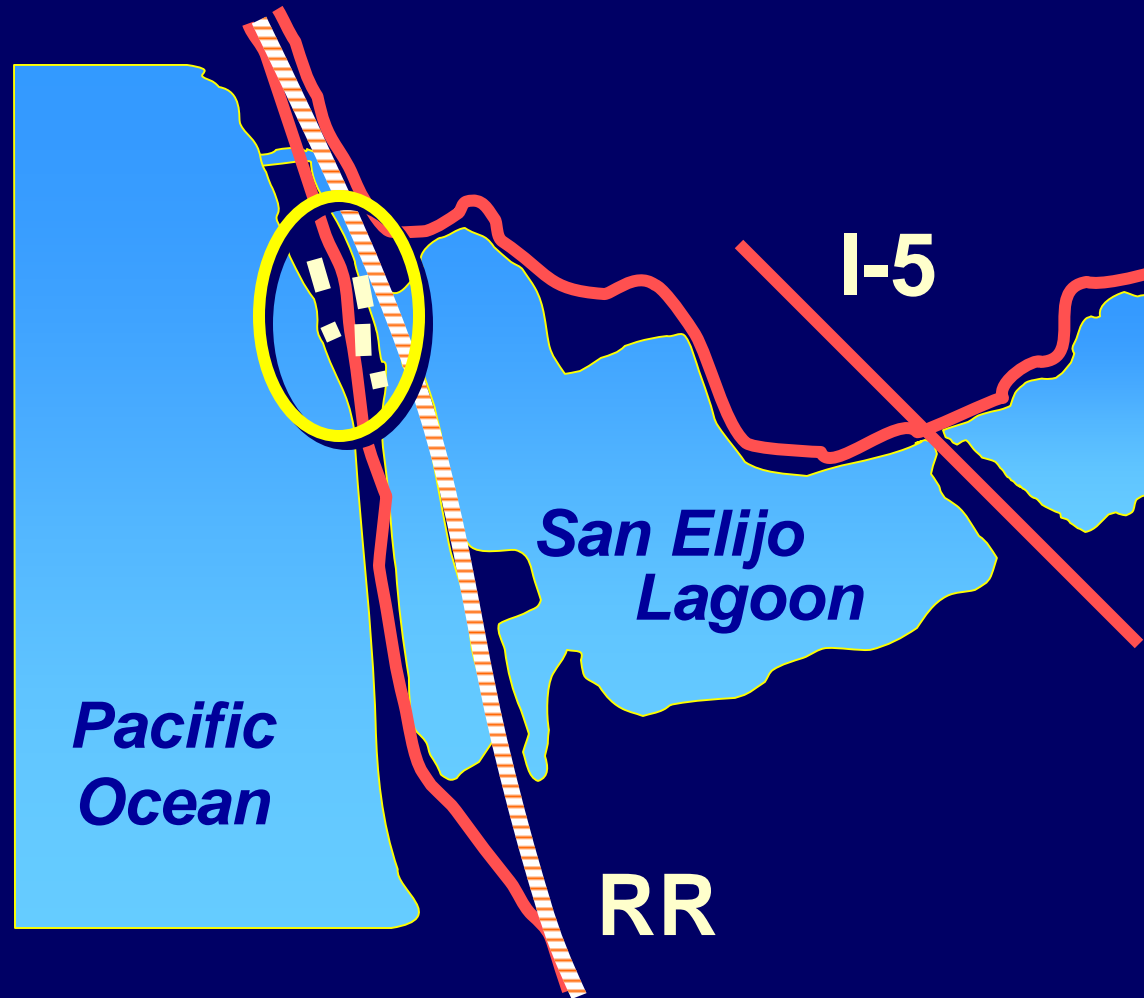
- Lagoon hydrodynamics
- Lagoon hydrology
- Engineering considerations
- Highway bridge design
- Railway bridge design
- Highway 101 flood protection

Engineering Considerations

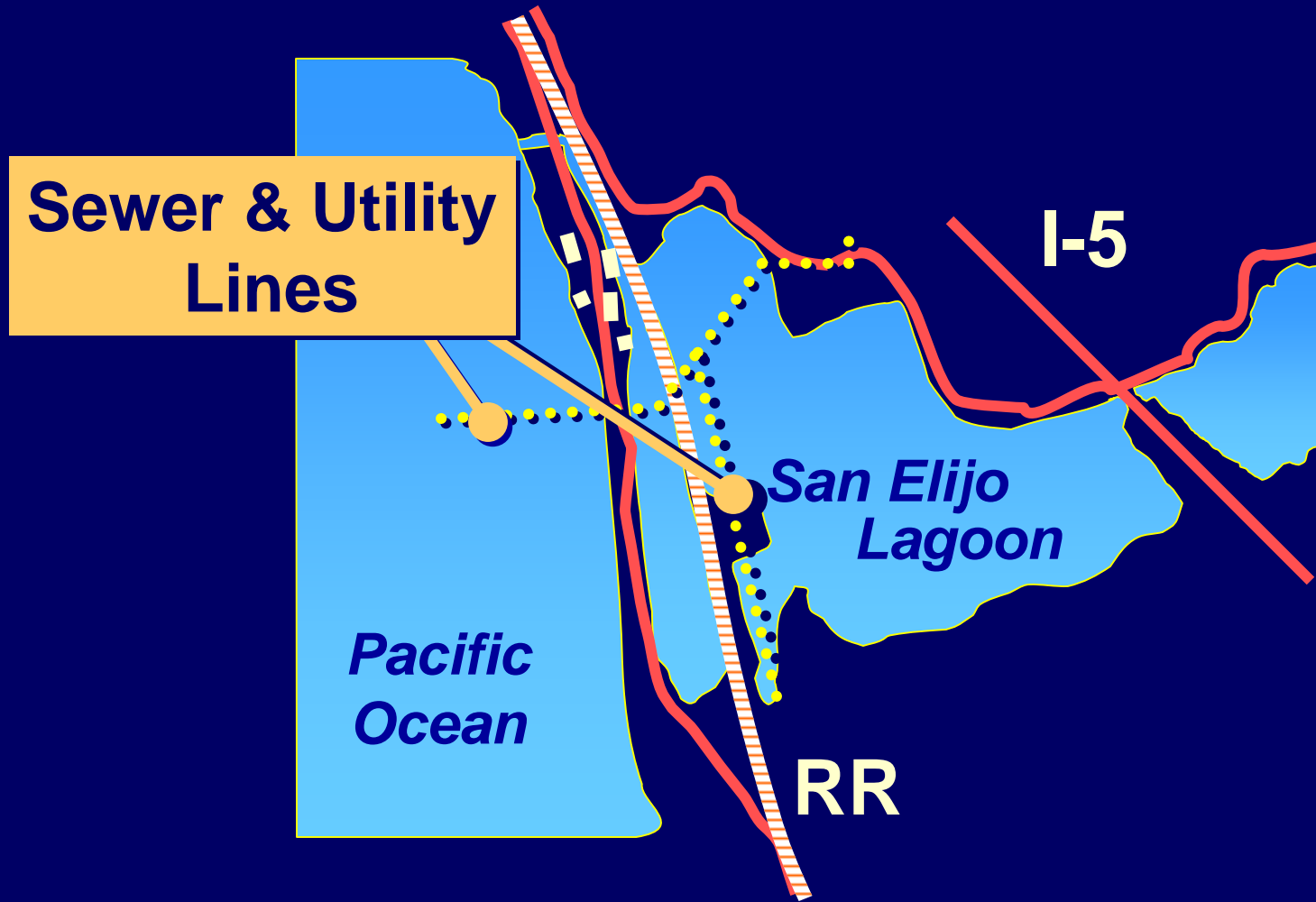
Engineering

- Businesses
- Public access
- Utility lines
- Sewage pipe
- Access roads
- Traffic flow

Local Businesses



Sewer and Utility Lines



Engineering Options

Engineering

- Highway 101 Bridge Design
- Railroad
- Shore Protection

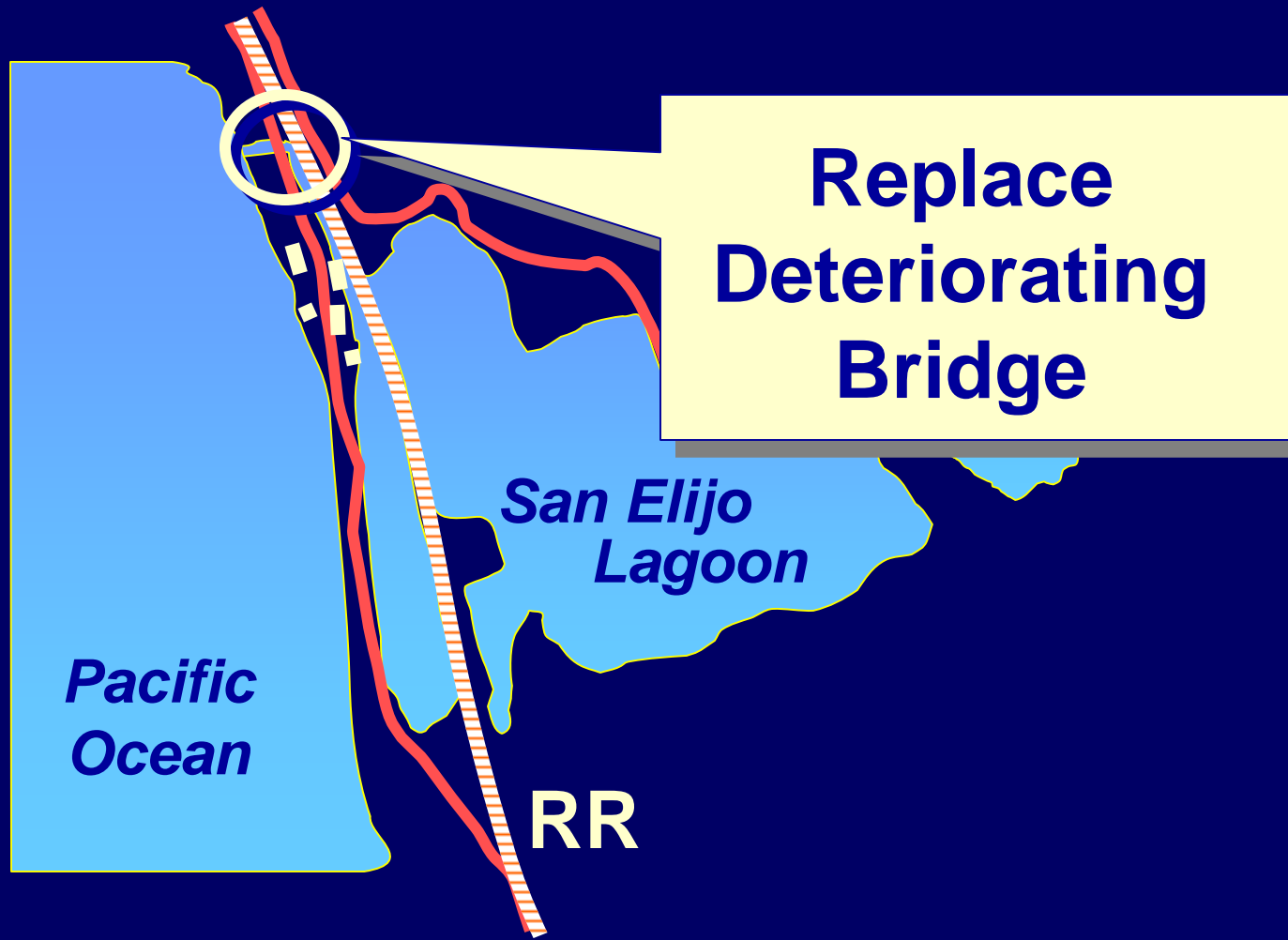
Highway 101 Bridge Design

Engineering

- New 300 foot highway bridge
- Move inlet to south and add 3,600-ft highway bridge

Hwy 101 Bridge Options

Engineering



Hwy 101 Bridge Options

Engineering



Railroad Options

Engineering

- Maintain existing railroad bridge
- New 3,600-ft railroad bridge on piles on new alignment
- New 500-ft railroad bridge and berm on new alignment

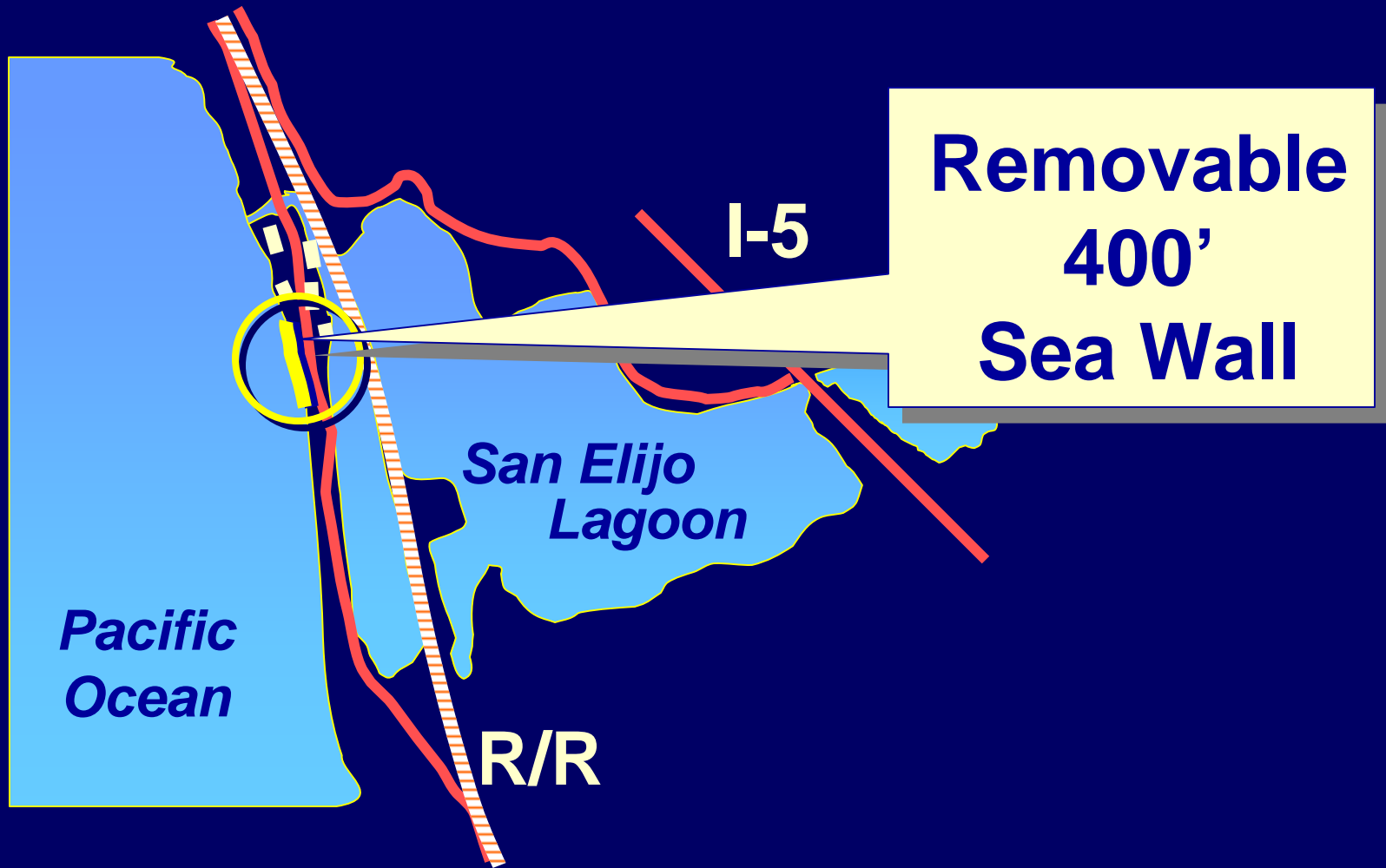
Highway 101 Flood Protection Options

Engineering

1. Add removable sea wall
 - ▶ Between November and March
 - ▶ Block construction
2. Increase height of Highway 101
 - ▶ Increase highway height by six feet
 - ▶ Add removable sea wall

Highway 101 Flood Protection Alternatives

Engineering



Highway 101 Flood Protection Alternatives

Engineering





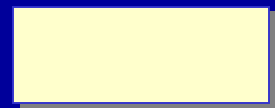
Background



Lagoon Enhancement



Engineering



Project Evaluation



Conclusions

Projects

Project Evaluation

Alternative	Project	Replace Hwy 101 Bridge (300')	New 3,600' Hwy 101 Bridge	Close Original Inlet	Add New Parking Lot	Add Removable Storm Protection	Elevate Hwy Berm 6' & Removable Storm Protection	New 500' R/R Bridge	New 3,600 R/R Trestle	Lagoon Dredging	Add Jetty (Optional)
1	A	•				•					
	B	•					•				
	C	•					•		•		
	D	•					•		•	•	
2	A	•		•	•	•					
	B	•		•	•		•				
	C	•		•	•		•		•		
	D	•		•	•		•		•	•	
3	A	•		•		•		•		•	•
	B	•		•			•		•	•	•
	C		•	•					•	•	•

-  Hwy 101 Bridge
-  Storm Protection
-  Railroad Bridge
-  Dredging
-  Jetty (Optional)

Screening Topics and Evaluation Criteria

Project Evaluation

- **Biology** (includes organisms, water quality/circulation, vegetation, birds, reefs, public health)
- **Engineering** (includes natural geomorphology, flooding, highway protection, utilities, erosion, drainage)
- **Recreation** (includes beach use, surfing, swimming, creating boat ramp, public parks)
- **Traffic** (includes traffic volume, construction impacts, public parking)
- **Economics** (includes long-term business impacts, business closure/flooding, construction impacts)
- **Aesthetics**

Evaluation of Alternatives

Alternative	1A	1B	1C	1D	2A	2B	2C	2D	3A	3B	3C
Biology	10	20	20	80	20	20	20	80	100	100	90
Engineering	70	79	79	89	70	79	79	89	94	100	89
Recreation	100	100	100	100	50	50	50	50	100	100	100
Traffic	100	100	100	100	67	67	67	67	67	67	34
Economics	100	100	100	100	67	67	67	67	67	67	34
Aesthetics	67	100	100	100	67	100	100	100	100	100	84

Weighting Factors

Screening Topics	Weighting Factors
Biology	0.43
Engineering	0.29
Recreation	0.12
Traffic	0.07
Economics	0.07
Aesthetics	0.02
Total	1.00

Final Ranking

Project Evaluation

Alternative	1A	1B	1C	1D	2A	2B	2C	2D	3A	3B	3C
Biology	4.3	8.6	8.6	34.4	8.6	8.6	8.6	34.4	43	43	38.7
Engineering	20.3	22.9	22.9	25.8	20.3	22.9	22.9	25.8	27.3	29	25.8
Recreation	12	12	12	12	6	6	6	6	12	12	12
Traffic	7	7	7	7	4.7	4.7	4.7	4.7	4.7	4.7	2.4
Economics	7	7	7	7	4.7	4.7	4.7	4.7	4.7	4.7	2.4
Aesthetics	1.3	2	2	2	1.3	2	2	2	2	2	1.7
Total	51.9	59.5	59.5	88.2 (3)	45.6	48.9	48.9	77.6	93.7 (2)	95.4 (1)	83.0

Cost (\$ mil)	5.5	6.8	29.8	52.8	7.7	9.9	32	56	46.2	58	96.5
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Background



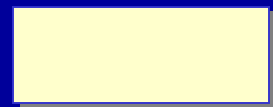
Lagoon Enhancement



Engineering



Project Evaluation



Conclusions

Conclusions

Conclusions

- San Elijo Lagoon has excellent potential for enhancement
- Inlet relocation is possible due to favorable coastal setting and processes
- Lagoon dredging will improve circulation, water quality and biological diversity
- Alternative 3B ranks the highest
- Recreation and businesses will benefit