Port of LA photo – pier 400

Measuring Resilience in California Freight

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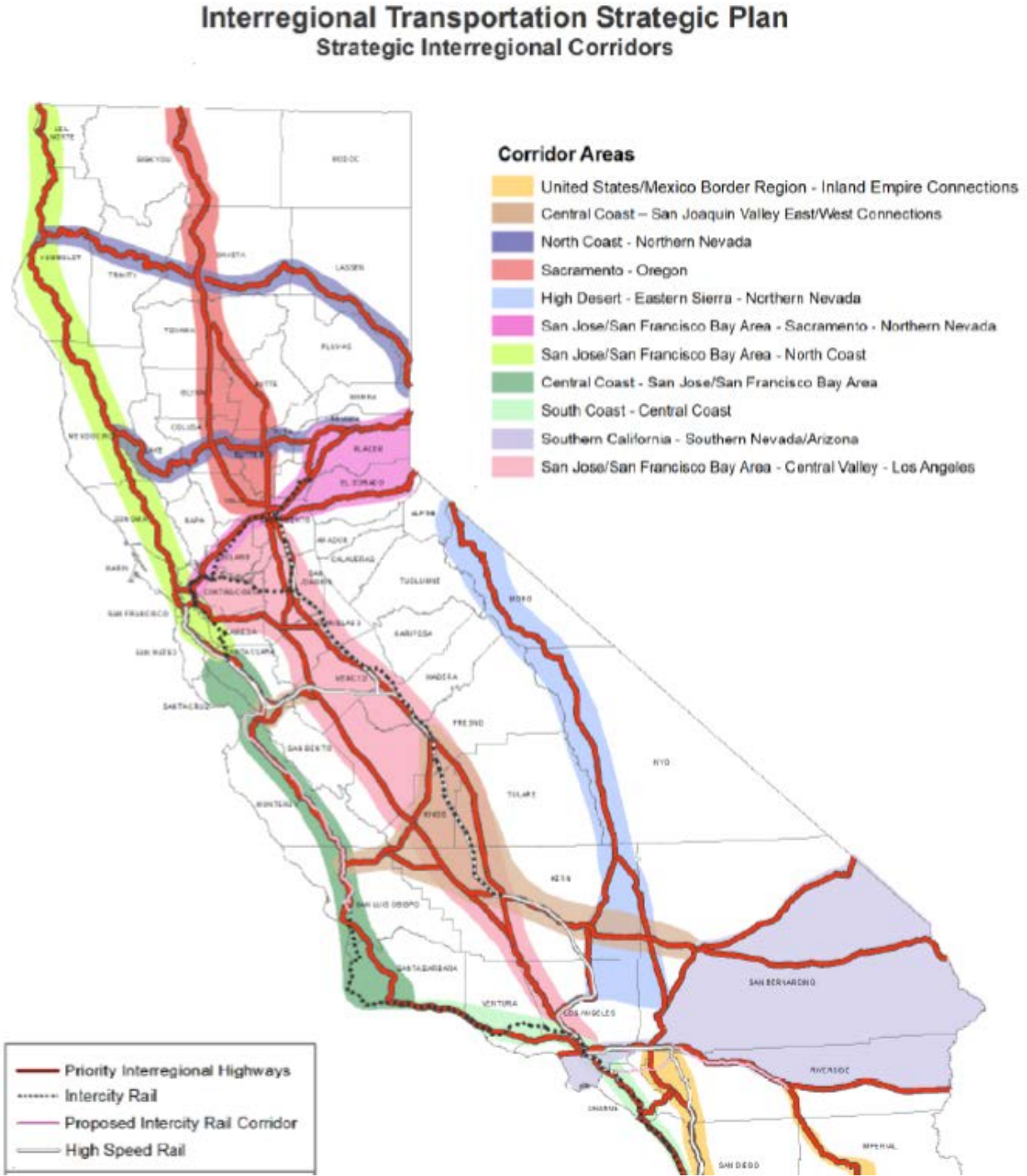
Overview

1. California Goods Movement
2. Prioritizing Adaptations
3. US Army Corps of Engineers Resilience Work
4. Trade Corridor Enhancement Program
5. Del Mar Bluffs Example



- About 40 percent of U.S. imports and 25 percent of U.S. exports transit through the San Pedro Bay ports.
- Imports 120 % estimated increase by 2045
- Exports >300% estimated increase by 2045

California's goods movement system is vulnerable to natural hazards

- Wildfires
- Floods
- Sea Level Rise
- Storm Surge

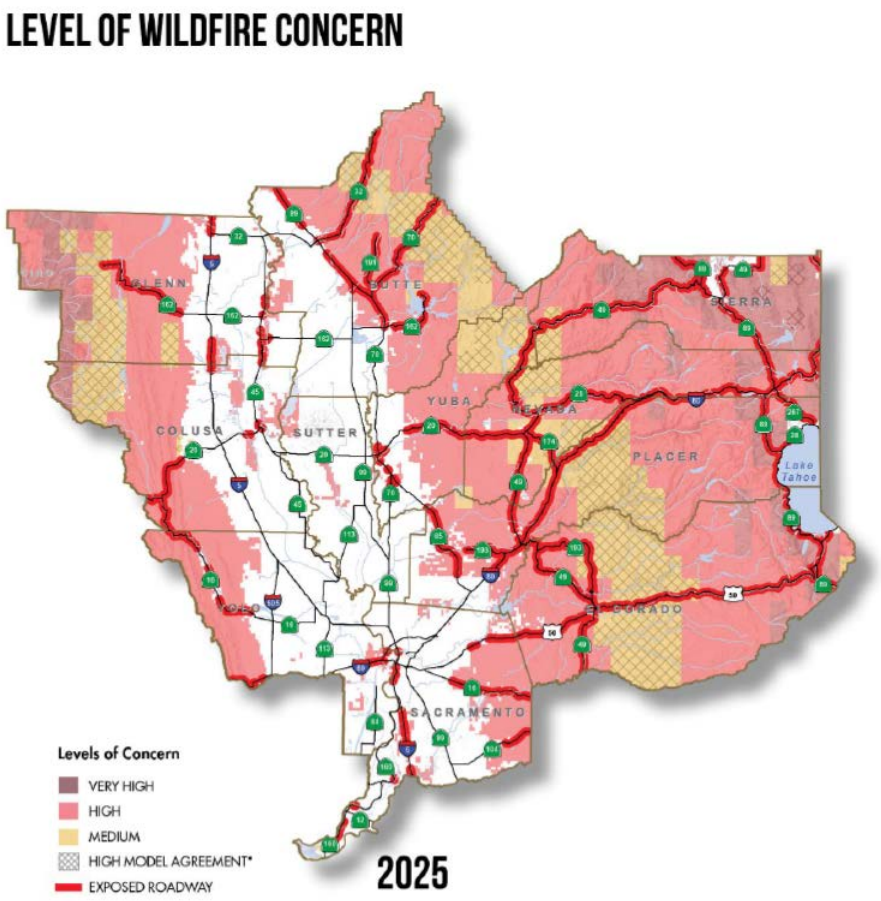
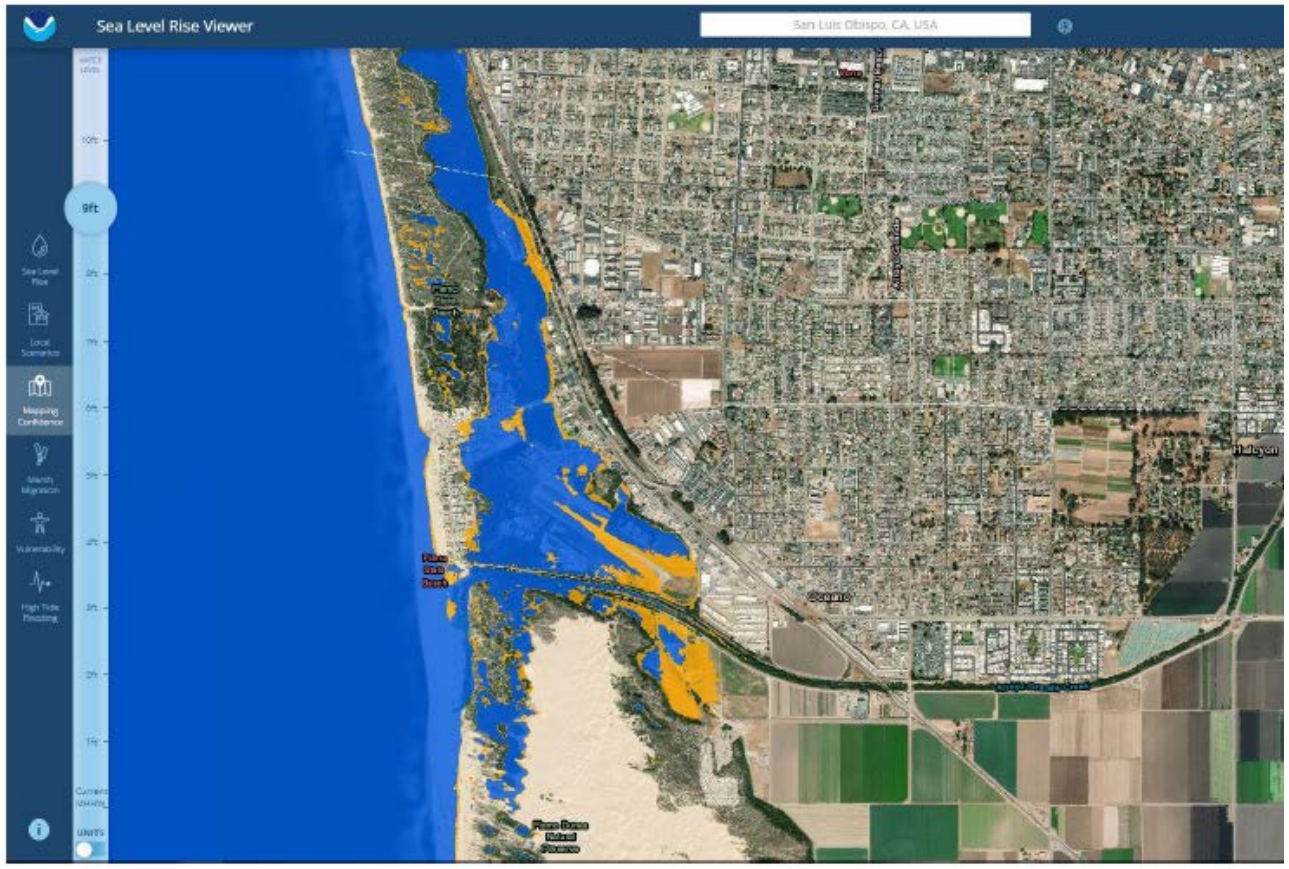


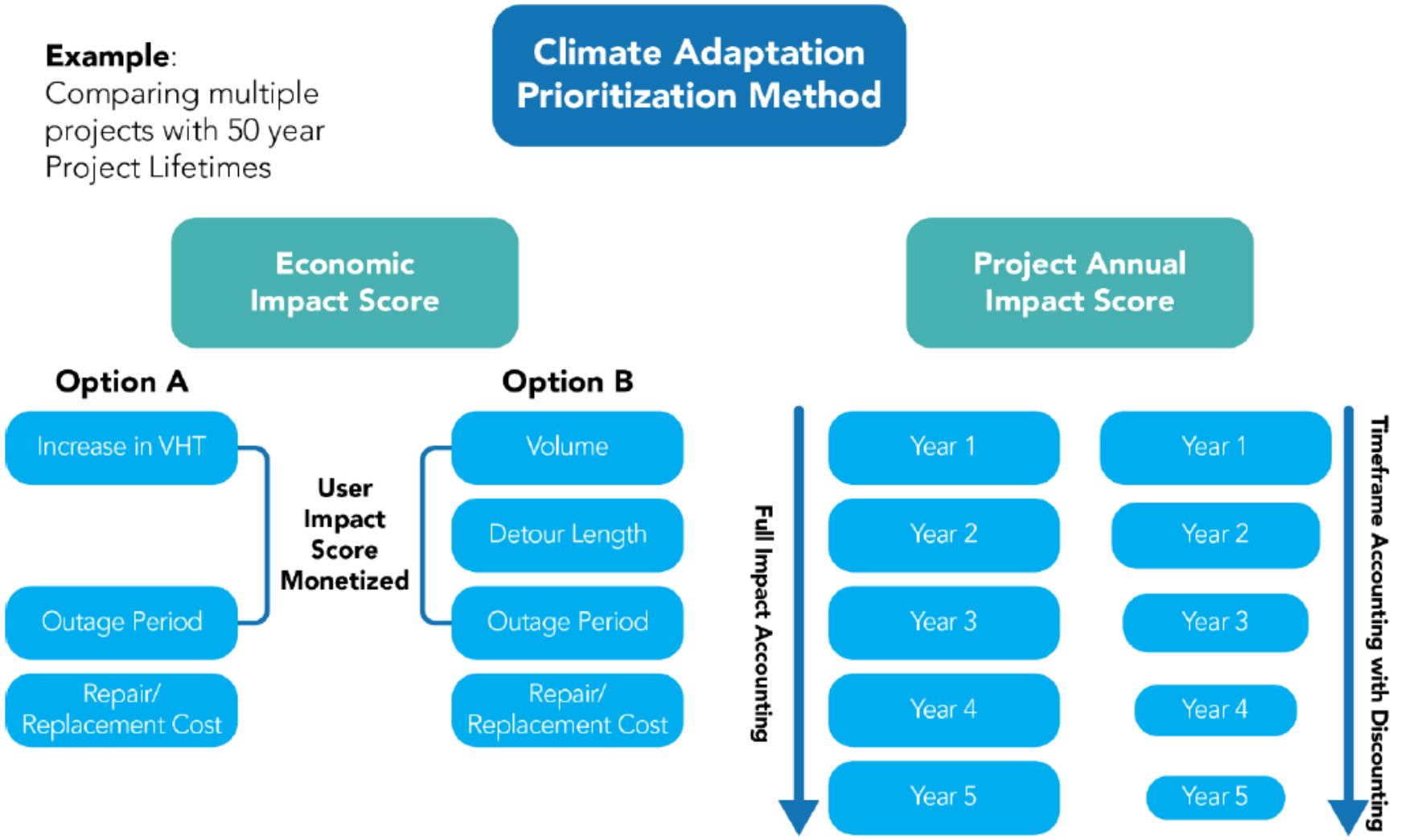
FIGURE 18: NOAA SEA LEVEL RISE VIEWER



Prioritizing Adaptations

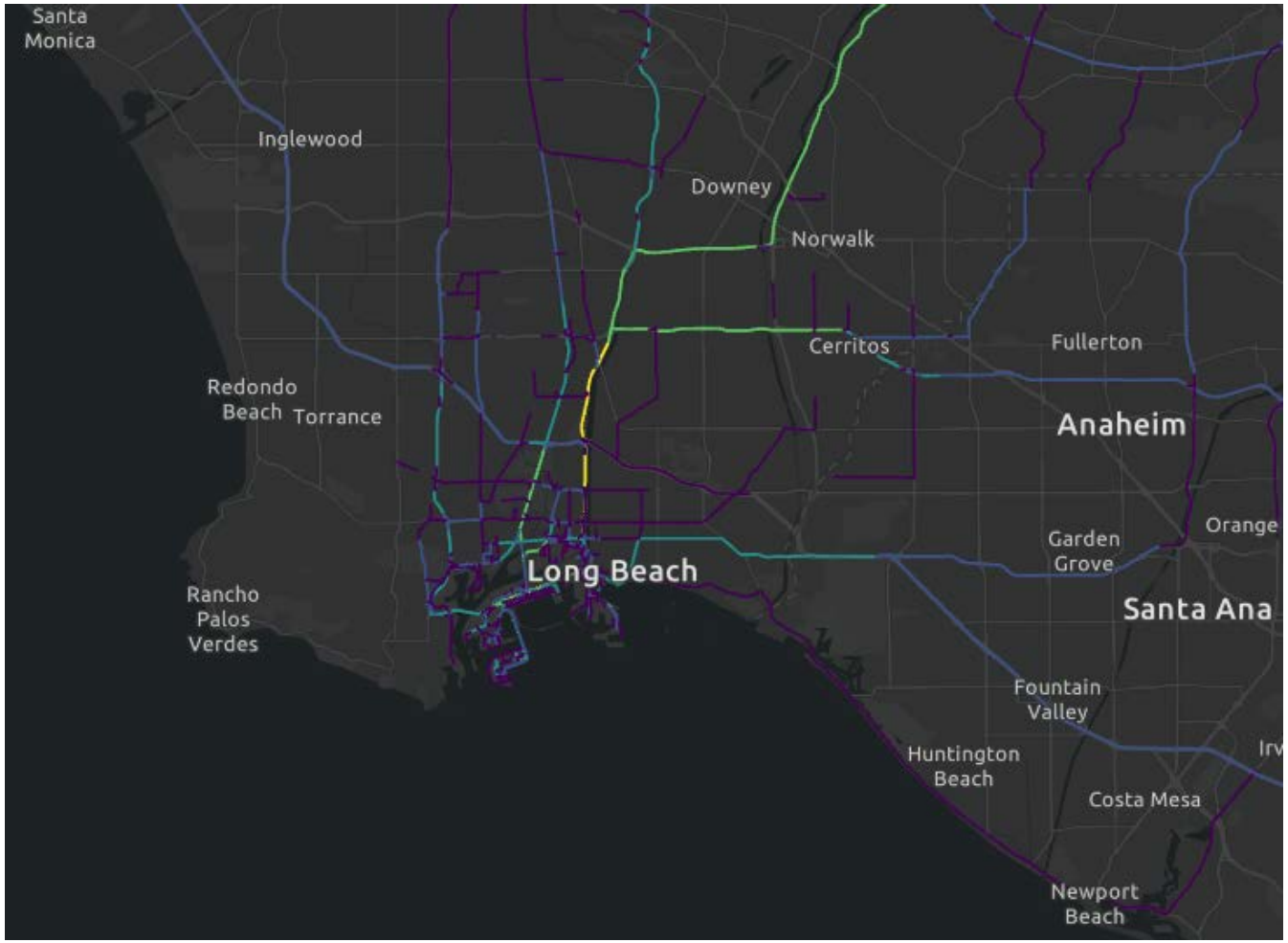
FIGURE 31: APPROACH FOR PRIORITIZATION METHOD

Example:
Comparing multiple projects with 50 year Project Lifetimes



The Commission is working with the U.S. Army Corps on a policy decision tool

- Goal is to create a tool to help us identify optimal resiliency projects
- Example: identify back-up ports in case of a closure.
- Identify where re-routing, additional capacity, or truck only lanes are needed.



ERDC
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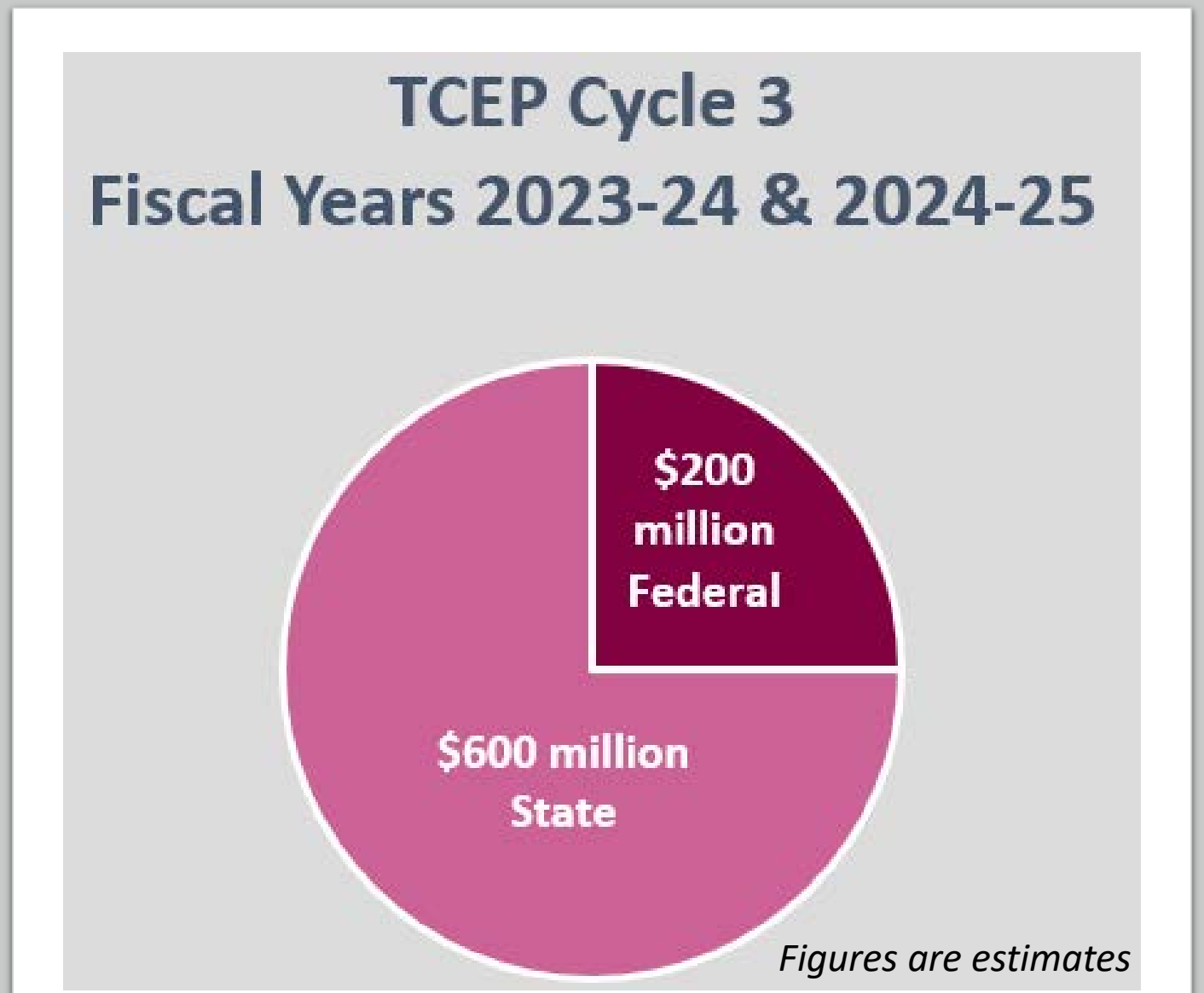
Trade Corridor Enhancement Program

- Funds freight infrastructure projects
- About $400 million a year



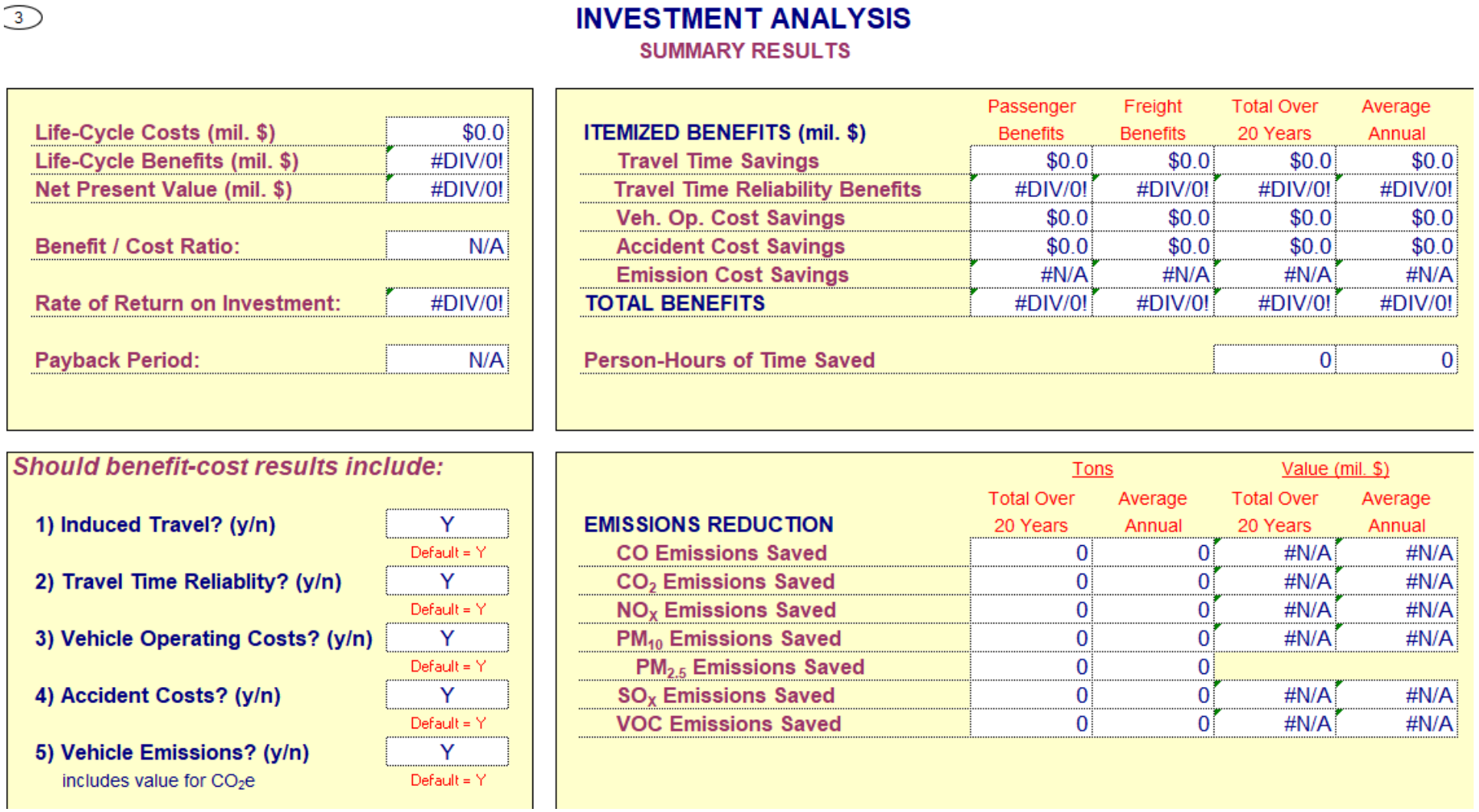
Del Mar Bluffs

- $1.2 billion in two-way trade of goods crosses Mexico/California border each day.
- Only viable freight rail corridor linking San Diego with destination points north and east.
- Cliff retreat: Approximately 72% of the California coast has eroding coastal cliffs due to the various forces at play in these areas, including the effects of ocean wave energy on beaches and cliffs

https://www.delmartimes.net/news/story/2021-03-02/railroad-bluff-collapse-will-require-repairs
https://www.sandiegouniontribune.com/communities/north-county/story/2021-07-22/fence-plan-revised-for-del-mar-train-tracks

Cal B/C Model

- Main tool used to quantify project benefits
- The model estimates savings achieved by project to capture benefits.



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INVESTMENT ANALYSIS

SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$0.0
Life-Cycle Benefits (mil. $)	#DIV/0!
Net Present Value (mil. $)	#DIV/0!
Benefit / Cost Ratio:	N/A
Rate of Return on Investment:	#DIV/0!
Payback Period:	N/A

ITEMIZED BENEFITS (mil. $)	Passenger Benefits	Freight Benefits	Total Over 20 Years	Average Annual
Travel Time Savings	$0.0	$0.0	$0.0	$0.0
Travel Time Reliability Benefits	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Veh. Op. Cost Savings	$0.0	$0.0	$0.0	$0.0
Accident Cost Savings	$0.0	$0.0	$0.0	$0.0
Emission Cost Savings	#N/A	#N/A	#N/A	#N/A
TOTAL BENEFITS	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Person-Hours of Time Saved			0	0

Should benefit-cost results include:

1) Induced Travel? (y/n)	Y (Default = Y)
2) Travel Time Reliablity? (y/n)	Y (Default = Y)
3) Vehicle Operating Costs? (y/n)	Y (Default = Y)
4) Accident Costs? (y/n)	Y (Default = Y)
5) Vehicle Emissions? (y/n) includes value for CO_2e	Y (Default = Y)

	Tons		Value (mil. $)	
EMISSIONS REDUCTION	Total Over 20 Years	Average Annual	Total Over 20 Years	Average Annual
CO Emissions Saved	0	0	#N/A	#N/A
CO_2 Emissions Saved	0	0	#N/A	#N/A
NO_X Emissions Saved	0	0	#N/A	#N/A
PM_{10} Emissions Saved	0	0	#N/A	#N/A
$PM_{2.5}$ Emissions Saved	0	0		
SO_X Emissions Saved	0	0	#N/A	#N/A
VOC Emissions Saved	0	0	#N/A	#N/A

Example: Del Mar Bluffs Benefit Calculations for BCR

Results Summary of the Benefit-Cost Analysis

Summary of Results Over the Study Period. All Values in Millions of 2018$

Impact Categories	NPV Over 20 Years of Operations	
	Undiscounted	Discounted at 4%
Benefits		
Benefits from Double Tracking		
Shipper Cost Savings	$232.3 M	$117.2 M
Avoided Freight Transportation Accidents	$35.3 M	$17.8 M
Avoided Pavement Maintenance Costs	$39.2 M	$19.8 M
Avoided Freight Transportation Emissions	$7.0 M	$4.9 M
Avoided Passenger Vehicle Operating Costs	$27.3 M	$15.2 M
Reduced Passenger Travel Time	$5.9 M	$3.3 M
Avoided Passenger Transportation Accidents	$5.8 M	$3.2 M
Avoided Passenger Transportation Emissions	($9.4 M)	($6.0 M)
Benefits from the New Convention Center Station		
Reduced Passenger Travel Time	$9.9 M	$5.5 M
Benefits from Avoided Bluff Failure		
Avoided Emergency Bluffs Stabilization Costs	$39.8 M	$30.3 M
Avoided Regular Bluffs Maintenance Costs	$4.1 M	$2.3 M
Shipper Cost Savings	$9.0 M	$6.8 M
Reduced Passenger Travel Time	$10.4 M	$7.9 M
Avoided Passenger Vehicle Operating Costs	$5.9 M	$4.5 M
Avoided Passenger Transportation Accidents	$0.5 M	$0.4 M
Avoided Passenger Transportation Emissions	($1.0 M)	($0.7 M)
Avoided Freight Transportation Accidents	$2.8 M	$2.1 M
Avoided Freight Transportation Emissions	$1.5 M	$1.1 M
Avoided Pavement Maintenance Costs	$1.1 M	$0.8 M
Benefits from the Overall Project		
Residual Value of Capital Assets	$92.5 M	$34.7 M
PV Benefits	**$519.9 M**	**$271.0 M**

Avoided Emergency Bluffs Stabilization Costs

			2027
Bluffs Failure Flag			1
Variable	**Unit**	**Constant**	
General Calculations			
Bluff/Track Repair Costs	**$39,751,900**		
Telecommunications Repair Costs	**$86,000**		
No-Build Scenario			
Bluff/Track Repair Costs	$/year		$39,751,900
Telecommunications Repair Costs	$/year		$86,000
Emergency Bluffs Stabilization Costs	**$/year**		**$39,837,900**
Build Scenario			
Project Completion	indicator		1
Bluff/Track Repair Costs	$/year		$-
Telecommunications Repair Costs	$/year		$-
Emergency Bluffs Stabilization Costs	**$/year**		**$-**
Project Impact			

Avoided Emergency Bluffs Stabilization Costs

			2026	2027
Bluffs Failure Flag			0	1
Variable	**Unit**	**Constant**		
General Calculations				
Annual Bluffs Drainage Costs	**$203,650**			
No-Build Scenario				
Bluffs Drainage Costs	$/year		$203,650	$203,650
Emergency Bluffs Stabilization Costs	**$/year**		**$203,650**	**$203,650**
Build Scenario				
Project Completion	indicator		1	1
Bluffs Drainage Costs	$/year		$-	$-
Emergency Bluffs Stabilization Costs	**$/year**		**$-**	**$-**
Project Impact				
Avoided Bluffs Maintenance Costs	**$/year**		**$203,650**	**$203,650**

Avoided Regular Bluffs Maintenance Costs (2026-2045)

Variable	Unit	Constant	2027
No-Build Scenario			
Loaded Trucks - General Freight	trucks/year		37,440
Loaded Trucks - Auto	trucks/year		13,926
Total Shipper Costs		**$216**	**$11,095,142**
Build Scenario			
Rail Carloads - General Freight	carloads/year		14,400
Rail Carloads - Autos	carloads/year		7,834
Shipper Costs - Rail		**$95**	**$2,109,969**
Project Impact			
Shipper Cost Savings from Capacity Improvements	**$/year**		**$8,985,174**

Shipper Cost Savings

No-Build Scenario			
Annual Truck Distance Traveled	miles/year		10,114,214
Hundred Million Truck Miles Traveled	million miles/year		0.1
Expected Fatal Accidents from Truck Transportation	accidents/year	**1.47**	0.1
Expected Injury Accidents from Truck Transportation	accidents/year	**37.30**	3.8
Expected PDO Accidents from Truck Transportation	accidents/year	**160.00**	16.2
Total Expected Costs of Highway Fatal Accidents	$/year	**$10,200,000**	$1,515,497
Total Expected Costs of Highway Injury Accidents	$/year	**$188,100**	$709,683
Total Expected Costs of Highway PDO Accidents	$/year	**$147,600**	$2,388,573
Total Expected Accident Costs	**$/year**		**$4,613,753**
Build Scenario			
Annual Rail Distance Travelled	miles/year		132,840
Million Miles Railed - Freight	million miles/year		0.1
Expected Fatal Events from Rail Transportation	Events/year	**1.0**	0.1
Expected Injury Events from Rail Transportation	Events/year	**7.4**	1.0
Expected PDO Events from Rail Transportation	Events/year	**13.2**	1.7
Total Expected Costs of Fatal Events	$/year	**$10,200,000**	$1,364,387
Total Expected Costs of Injury Events	$/year	**$188,100**	$183,754
Total Expected Costs of PDO Events	$/year	**$147,600**	$258,230
Total Expected Accident Costs	**$/year**		**$1,806,370**
Project Impact			
Reduced Transportation Accident Costs due to Bluffs Failure	**$/year**		**$2,807,382**

Avoided Freight Transportation Accidents

Avoided Pavement Maintenance Costs

			2027
Bluffs Failure Flag			1
Variable	**Unit**	**Constant**	
No-Build Scenario			
Truck Miles	miles/year		7,106,112
Pavement Damage Costs	**$/year**	**$0.15**	**$1,054,851**
Build Scenario			
Truck Miles	miles/year		-
Pavement Damage Costs	**$/year**	**$0.15**	**$-**
Project Impact			
Avoided Pavement Damage Costs	**$/year**		**$1,054,851**

Avoided Pavement Maintenance Costs

Performance Metric Example - Reliability

Metric (Reliability)
Annual Freight Rail Volumes Impacted During a Bluff Event

Build	No Build	Change
0	1,080	-1,080

Freight			
General Freight			
Volume Continued on Rail	trains/year		720
Volume Continued on Rail - Loaded	trains/year	**100.0%**	360
Volume Continued on Rail - Loaded Railcars	railcars/year	**40**	14,400
Tons Continued on Rail	tons/year	**65**	936,000
Total Miles Railed	miles/year	**123**	88,560
Ton-Miles Railed	ton-miles/year	**123**	115,128,000
Autos			
Volume Continued on Rail	trains/year		360
Volume Continued on Rail - Loaded	trains/year	**47.1%**	245
Volume Continued on Rail - Loaded Railcars	railcars/year	**32**	7,834
Vehicles Transported	vehicles/year	**16**	125,338
Tons Continued on Rail	tons/year	**1.5**	188,006
Total Miles Railed	miles/year	**146**	44,280
Ton-Miles Railed	ton-miles/year	**146**	27,448,934

Example Emissions Savings

- Estimate emissions savings based on vehicle miles travelled, emission factors, and associated health costs.

HIGHWAY EMISSIONS FACTORS (g/mi)

Model Year 2044

Mode	Speed	CO	CO2	NOX	PM10	SOX
Auto	0	1.7535	60.2289	0.1686	0.0008	0.0006
	5	0.5559	330.9034	0.0223	0.0019	0.0033
	6	0.5576	324.7042	0.0221	0.0018	0.0032

HEALTH COST OF TRANSPORTATION EMISSIC

($/ton)

Area	Proj Loc	CO	CO_2e	NO_X	PM_{10}
LA/South Coast	1	$170	$48	$69,200	$566,800
CA Urban Area	2	$90	$48	$20,300	$163,700
CA Rural Area	3	$80	$48	$15,100	$116,700

Impact Title	Location in Cal B/C Model	Base Number, Percent, or Cost	Average Probability	Percent Cost Impact	Impact (No Build)	Project Mitigation/Adaptation Strategy	Impact (Build)
Speed	Project Information tab cell G30&H30				0		
Average Daily Traffic Year 1	Project Information tab cell G38&H38				0		
Truck speed	Project Information tab cell G44				0		
	Project Information tab						

Potential
Climate Impacts
Cost/Cost
Savings
Calculation Tool

- Active flood
- Flooded facilities
- Burned structures/facilities
- Structural damage
- Damaged structural support/loss of stability
- Scour effects on bridge structure elements
- Expansion/contraction of bridge joints
- Deterioration of the materials used in the pavement.
- Broken pavement
- Damaged bridge approaches
- Damaged bridge pieces
- Delayed emergency response

Qualitative Measures

Climate Resilience & Adaptation

Realigning or relocating infrastructure

Providing evacuation planning

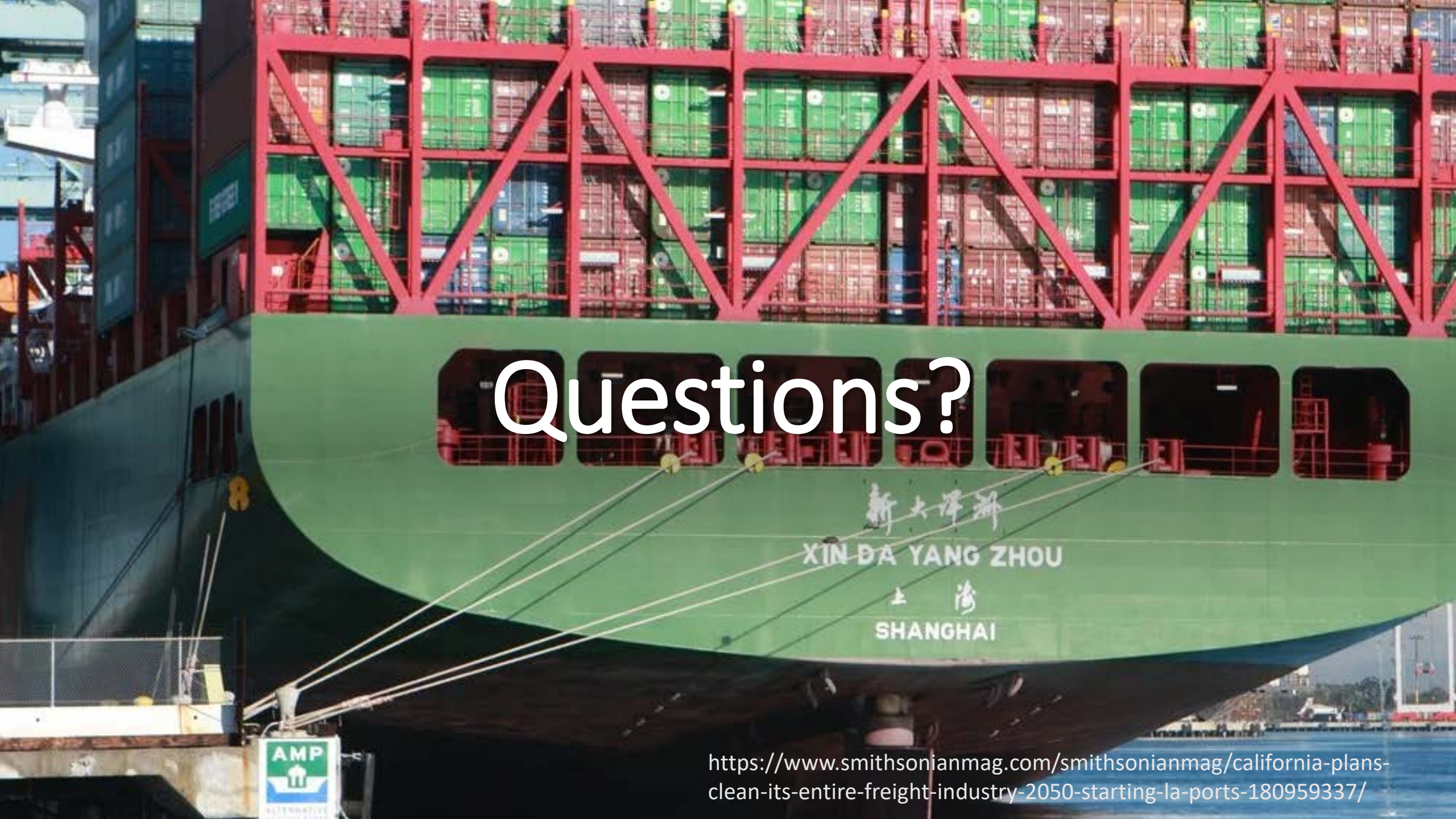
Including energy storage solutions

Protection of Natural and Working Lands

Employs land conservation measures and integrates natural or green infrastructure

https://www.sfchronicle.com/california-wildfires/article/Feeling-panic-Paradise-residents-15555293.php

Questions?



https://www.smithsonianmag.com/smithsonianmag/california-plans-clean-its-entire-freight-industry-2050-starting-la-ports-180959337/