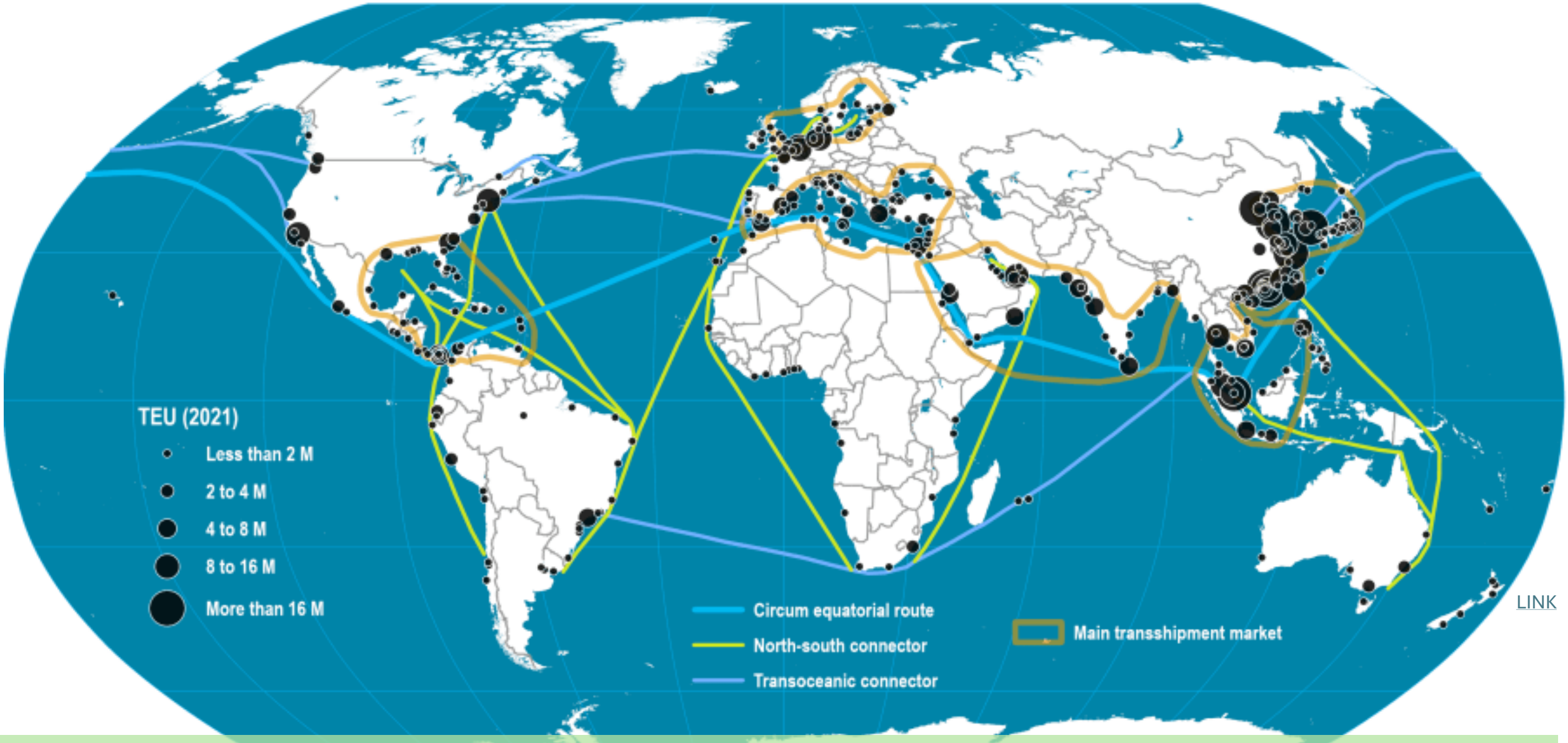
Environmental Quality and Port Cities

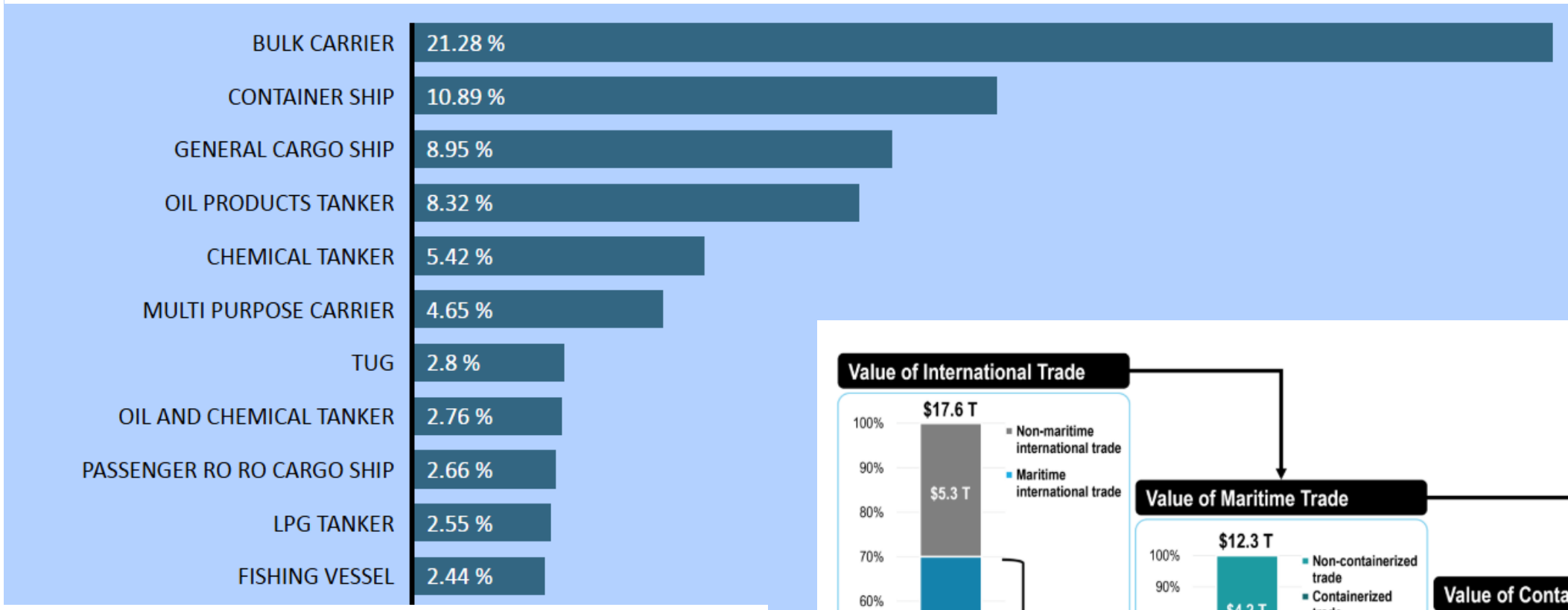


LINK

“Ports play a greater role than simply handling cargo at the quayside; the port’s role in the transport chain has the potential to shape the social and environmental performance of transport systems around the world”

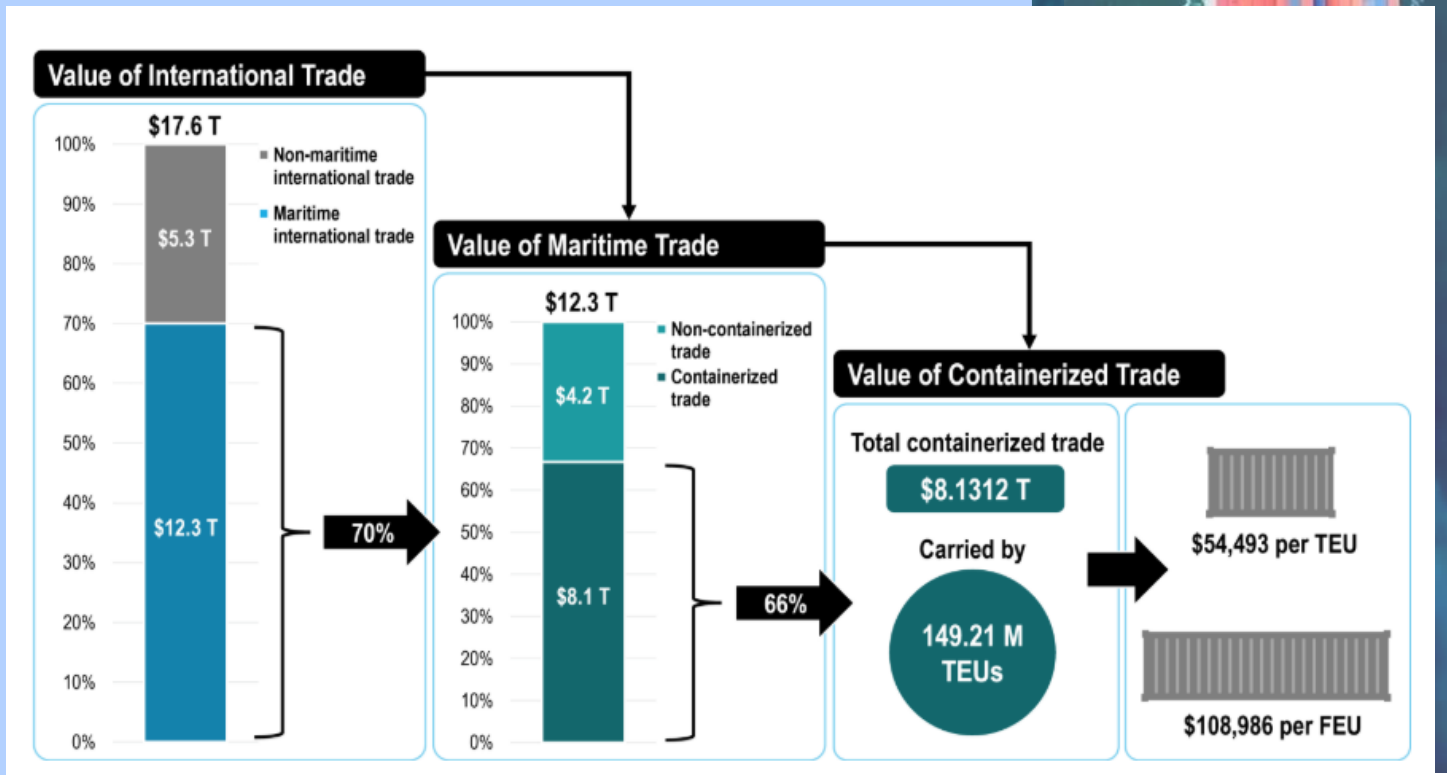
- Green Ports in Theory and Practice (2019)

Distribution of World Merchant Fleet by Ship Type



Maritime trade accounts for about 80% of global trade by *volume*

Maritime trade accounts for about 70% of global trade by *value*



Tonnage by U.S. Port

Port Name	Export Tonnage	Import Tonnage	Total Tonnage
Anchorage, Alaska	49,266	5,963	55,229
Baltimore, Maryland	753,374	1,401,876	2,155,250
Boston, Massachusetts	174,809	275,490	450,299
Charleston, South Carolina	3,021,761	3,699,056	6,720,817
Chester, Pennsylvania	124,274	312,744	437,018
Dutch Harbor, Alaska	46,320	8,202	54,522
Everett, Washington	9,515	48,543	58,058
Fort Myers, Florida	18,346	26,003	44,349
Freeport, Texas	56,381	52,733	109,114
Galveston, Texas	45,831	199,295	245,126
Gulfport, Mississippi	196,491	118,441	314,932
Honolulu, Hawaii	258,467	205,607	464,074
Houston, Texas	5,812,134	6,121,421	11,933,555
Jacksonville, Florida	348,184	671,866	1,020,050
Kodiak, Alaska	3,446	927	4,373
Long Beach, California	3,787,540	8,439,514	12,227,054
Los Angeles, California	4,408,458	7,889,439	12,297,897
Miami, Florida	1,853,971	2,315,609	4,169,580
Mobile, Alabama	534,671	659,498	1,194,169
New Orleans, Louisiana	3,301,925	7,002,352	10,304,277
New York/New Jersey	5,490,185	12,490,613	17,980,798
Norfolk, Virginia	5,411,128	5,256,167	10,667,295
Northwest Seaport Alliance	2,010,916	2,360,174	4,371,090
Oakland, California	2,042,205	2,061,984	4,104,189
Panama City, Florida	19,531	46,423	65,954
Philadelphia, Pennsylvania	518,208	1,741,261	2,259,469
Port Everglades, Florida	1,030,570	1,160,063	2,190,633
Port Hueneme, California	161,890	501,905	663,795
Port Manatee, Florida	122,216	345,922	468,138
Portland, Maine	22,343	46,899	69,242
Portland, Oregon	155,301	119,064	274,365
San Diego, California	8,768	25,889	34,657
San Juan, Puerto Rico	60,418	172,628	233,046
Savannah, Georgia	5,850,516	7,515,563	13,366,079
Tampa, Florida	86,166	234,477	320,643
Virgin Islands	17,177	27,796	44,973
West Palm Beach, Florida	322,262	119,019	441,281
Wilmington, Delaware	127,657	318,610	446,267
Wilmington, North Carolina	2,290,469	2,049,870	4,340,339
Total	**50,553,090**	**76,048,906**	**126,601,996**

Also…the ports of Long Beach and LA handle **~40%** of total U.S. containerized imports

Ports and Port Cities – Environmental Concerns

- Air pollution
- Aquatic (water) pollution
- Traffic congestion
- Terrestrial and marine biodiversity loss
- Noise pollution
- Light pollution
- Waste management
- Soil contamination
- Viewshed/visual pollution

Water and Air Quality – Port of Los Angeles

Relevant Questions:

- What gets monitored?
- How often and where?
- What is the response to exceedance of thresholds or limits?
- Whose responsibility is this action loop?

Regional Setting – The Port of LA

- The Inner Harbor (channels, basins, and slips N of the Vincent Thomas Bridge);
- Main Channel (between the Vincent Thomas Bridge and Reservation Point;
- The Outer Harbor (S of Reservation Point to San Pedro and Middle breakwaters)

The Port has been physically modified through past dredge & fill projects, channelization and construction of breakwaters and piers.

The Port of LA is adjacent to the Port of Long Beach, and together they function as a single oceanographic unit.

Freshwater Inflow:

The **Dominguez Channel** discharges into LA Harbor via the Consolidated Slip;

The **LA River** discharges into San Pedro Bay at the east side of Long Beach Harbor.

Clean Water Act (CWA) Section 303(d) Listed Waters and Impairments in Los Angeles Harbor

Listed Waters/Reaches	*Impairments*
Los Angeles/Long Beach Outer Harbor, inside breakwater (4,042 acres)	Tissue: DDT, PCBs Sediment: Toxicity
Cabrillo Marina (77 acres)	Tissue: DDT, PCBs Sediment: Benzo(a)pyrene
Inner Cabrillo Beach (82 acres)	Water: Indicator bacteria Tissue: DDT, PCBs
Los Angeles/Long Beach Inner Harbor (3,003 acres)	Water: Beach closures (pathogens) Tissue: DDT, PCBs Sediments: Benthic community effects, toxicity, benzo(a)pyrene, chrysene, copper, zinc
Fish Harbor (91 acres)	Tissue: DDT, PCBs Sediment: Toxicity, chlordane, DDT, PCBs, PAHs, benzo[a]anthracene, benzo[a]pyrene, chrysene, dibenz[a,h]anthracene, phenanthrene, pyrene, copper, lead, mercury, zinc
Consolidated Slip (36 acres)	Tissue: Chlordane, dieldrin, DDT, PCBs, toxaphene Sediments: Benthic community effects, toxicity, chlordane, DDT, PCBs, benzo[a]anthracene, benzo[a]pyrene, chrysene, phenanthrene, pyrene, 2-methynaphthalene, cadmium, chromium, copper, lead, mercury, zinc
Dominguez Channel Estuary	Water: Ammonia, coliform bacteria Tissue: Chlordane, dieldrin, DDT, lead Sediment: Benthic community effects, benzo[a]pyrene, benzo[a]anthracene, chrysene, phenanthrene, pyrene, DDT, PCBs, zinc, sediment toxicity

Where (and when) do these problems come from? What does the contemporary shipping industry contribute?

Listed Waters/Reaches	*Impairments*
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Water quality protection in harbors is the most significant environmental management challenge for port management/port authorities

A significant majority (~ 80%) of oil spills happen within harbors

Improperly handled wastewater discharge can spread pathogens

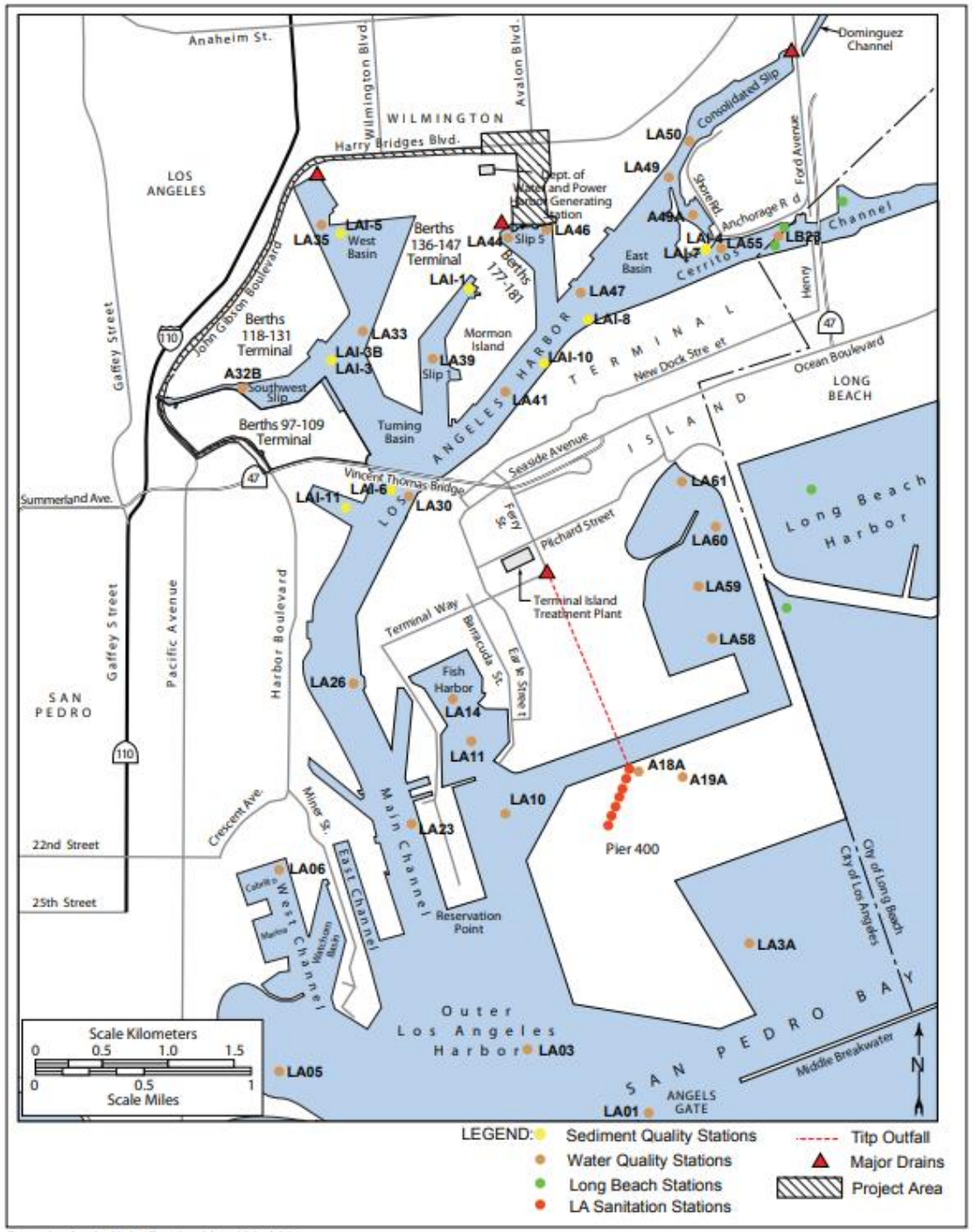
Improperly handled ballast water can introduce invasive species

Anti-fouling treatments introduce contaminants with potential for broad-based ecological toxicity

Larger vessels with deeper drafts increase sediment resuspension and contaminant redistribution

How does this all get managed?

- Clean Water Act - **Total Maximum Daily Load (TMDL)**
- A TMDL is an evaluation of water quality conditions, sources, and control actions needed to restore and/or protect water bodies.
- A TMDL accounts for ALL sources of pollutants that caused the water to be impaired
- **Section 303(d)** of the CWA requires that states identify water bodies not attaining standards and develop TMDLs for those water bodies
- Federal law requires that TMDLs be incorporated into state water quality control plans; states have requirements for compliance; the USEPA has oversight and enforcement for protecting water quality.



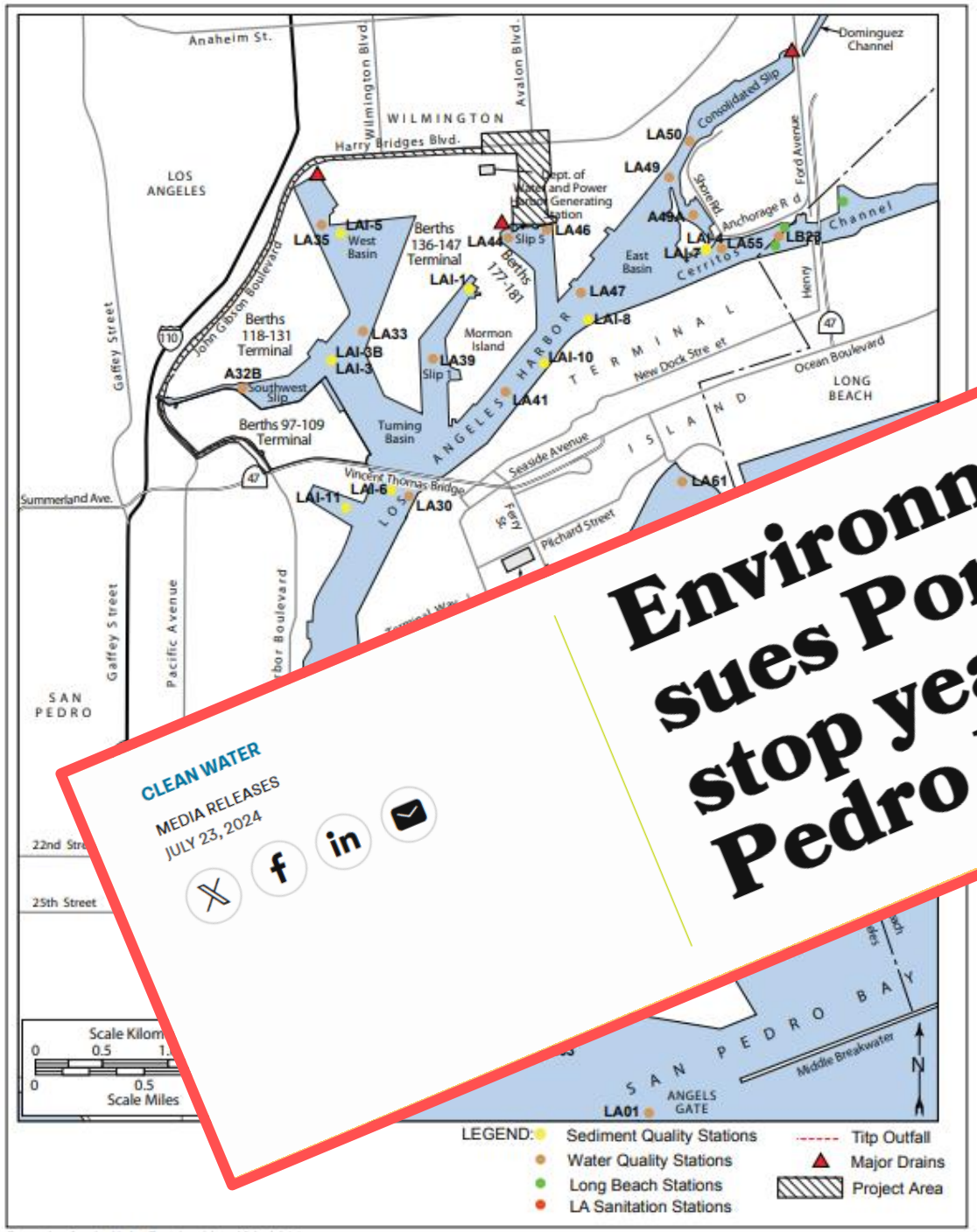
What do the Port of LA discharge Permits require for sampling?

- One sample per week at the WWTP outfall during periods of frequent or extended discharge;
- Grab samples twice per year at water quality stations in the Harbor.

Is this enough monitoring? No.
Is it typical? Yes.

- The **Los Angeles/Long Beach Inner Harbor** are on the 303(d) List of impaired water bodies due to copper and/or bacterial contamination.
- The beaches in **San Pedro Bay** are closed to the public following most rain events due to elevated bacteria levels.

Can the program be gamed? Absolutely.



CLEAN WATER

MEDIA RELEASES

JULY 23, 2024

Environment California sues Port of Los Angeles to stop years of polluting San Pedro Bay

What do the Port of LA dis… …ermits require for…

- One sample n… …during period…
- …

…/Long Beach Inner Harbor are …(d) List of impaired water bodies due to …pper and/or bacterial contamination.

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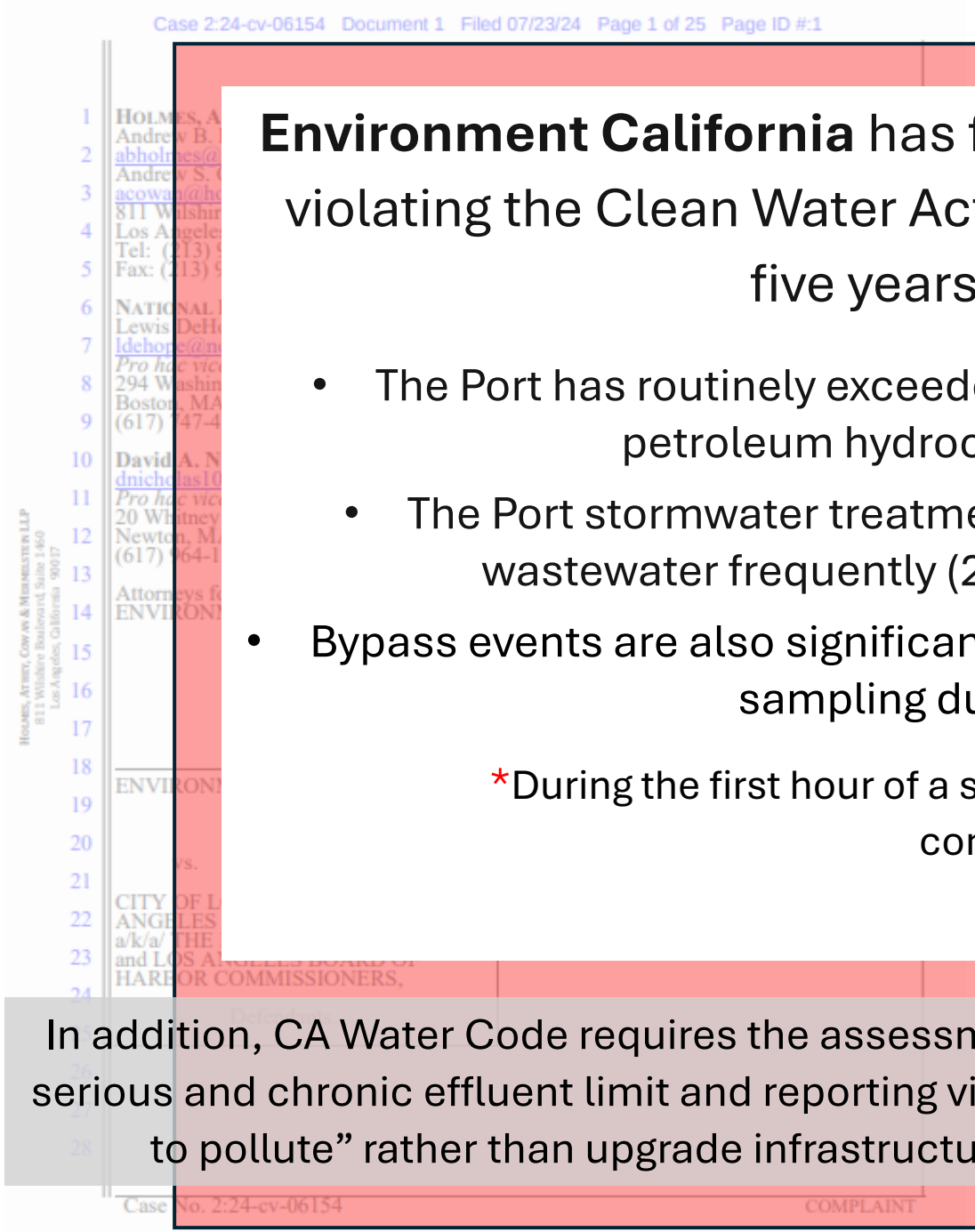


Environment California has filed a Federal lawsuit against the Port of LA for violating the Clean Water Act with **2,000+ illegal discharges** over the past five years. The lawsuit charges that:

- The Port has routinely exceeded legal limits on fecal coliform bacteria, copper, and petroleum hydrocarbons in discharges into San Pedro Bay.
- The Port stormwater treatment system is significantly undersized and untreated wastewater frequently (20+ times per year) bypasses the system entirely
- Bypass events are also significantly under-sampled. The Port appears to undertake storm sampling during the first hour of storm events*.

*During the first hour of a storm, treated wastewater comprises a larger portion of the combined bypass discharge.

In addition, CA Water Code requires the assessment of mandatory penalties of at least **$3,000** per violation for serious and chronic effluent limit and reporting violations. The lawsuit charges that the Port of LA routinely "pays to pollute" rather than upgrade infrastructure to eliminate discharges in excess of what is permitted.

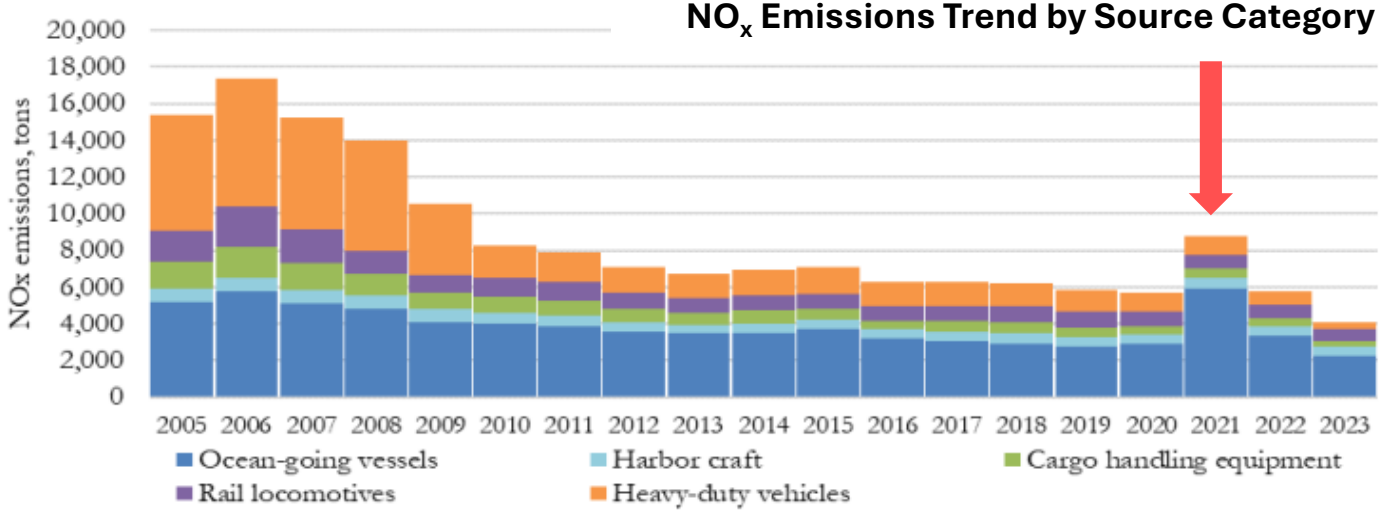
What about air quality?

Table ES.2 summarizes the Port's 2023 maritime industry-related mobile source emissions of air pollutants in the South Coast Air Basin (SoCAB) by the following categories: ocean-going vessels (OGVs), harbor craft, cargo handling equipment (CHE), locomotives, and heavy-duty vehicles (HDV). In 2023, approximately 46% of the Port's total $PM_{2.5}$, and 55% of the Port's total NO_x emissions are attributed to OGV.

Table ES.2: 2023 Maritime Industry-related Emissions by Category

Category	PM_{10} tons	$PM_{2.5}$ tons	DPM tons	NO_x tons	SO_x tons	CO tons	HC tons	CO_2e tonnes
Ocean-going vessels	41	38	27	2,258	76	213	106	164,054
Harbor craft	11	10	11	482	1	96	27	51,808
Cargo handling equipment	10	9	9	329	2	624	79	145,461
Locomotives	24	23	24	659	1	159	38	55,408
Heavy-duty vehicles	3	3	3	350	3	285	35	356,601
Total	**90**	**83**	**75**	**4,078**	**82**	**1,377**	**285**	**773,331**

NO_x Emissions Trend by Source Category



MDPI
sustainability

Article

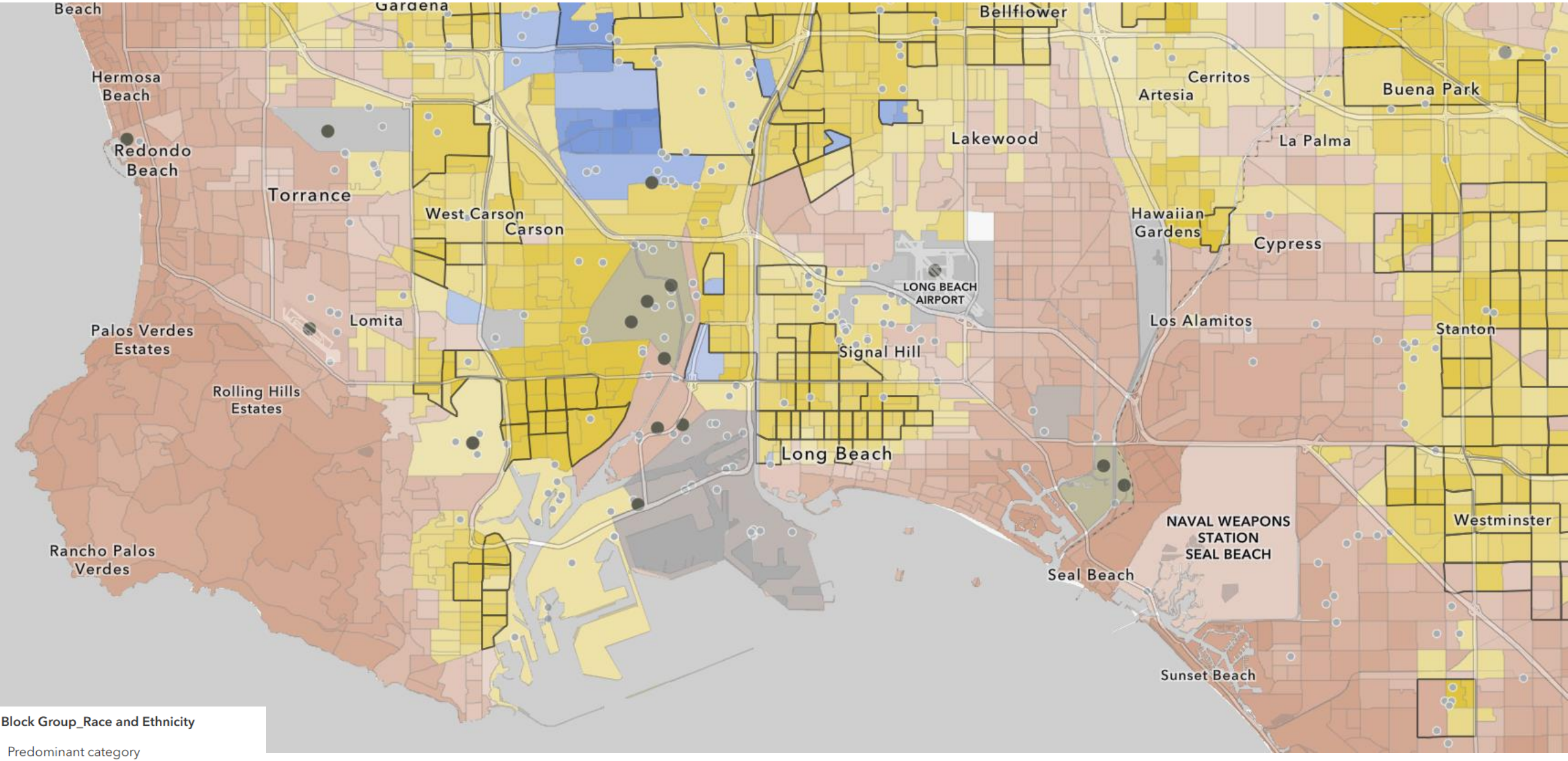
Ports in a Storm: Port-City Environmental Challenges and Solutions

Toby Roberts [1,*], Ian Williams [1], John Preston [2], Nick Clarke [3], Melinda Odum [3] and Stefanie O'Gorman [4]

Air pollution causes or worsens some of the most significant **public health concerns** in the vicinity of ports

Table 2. Frequency of complaints about pollution received by the port.

Type of Pollution	Frequency				
	Daily	Weekly	Monthly	Yearly	Never
Air	1 (3%)	5 (13%)	7 (18%)	16 (42%)	9 (24%)
Water	0	0	14 (36%)	15 (38%)	10 (26%)
Soil	0	0	4 (11%)	10 (27%)	23 (62%)
Noise	0	1 (3%)	15 (38%)	13 (33%)	10 (26%)
light	0	0	4 (11%)	6 (17%)	26 (72%)
Waste	0	2 (5%)	4 (11%)	15 (41%)	16 (43%)
Invasive species	0	0	3 (8%)	9 (25%)	24 (67%)



Block Group_Race and Ethnicity

Predominant category

- White alone, not Hispanic or Latino
- Hispanic or Latino Population
- Black or African American alone, not Hispanic or Latino

SVI_2022 US_Census Tract

Overall percentile ranking

- > 0.9 – 1

National Emissions Inventory (NEI) 2020 for Facility Point Sources, US EPA, OAR, OAQPS

Facility Emission Type

- CAPs Major
- CAPs Minor

Social Vulnerability in U.S. Port Cities

Monitoring Air Quality in L.A. Harbor

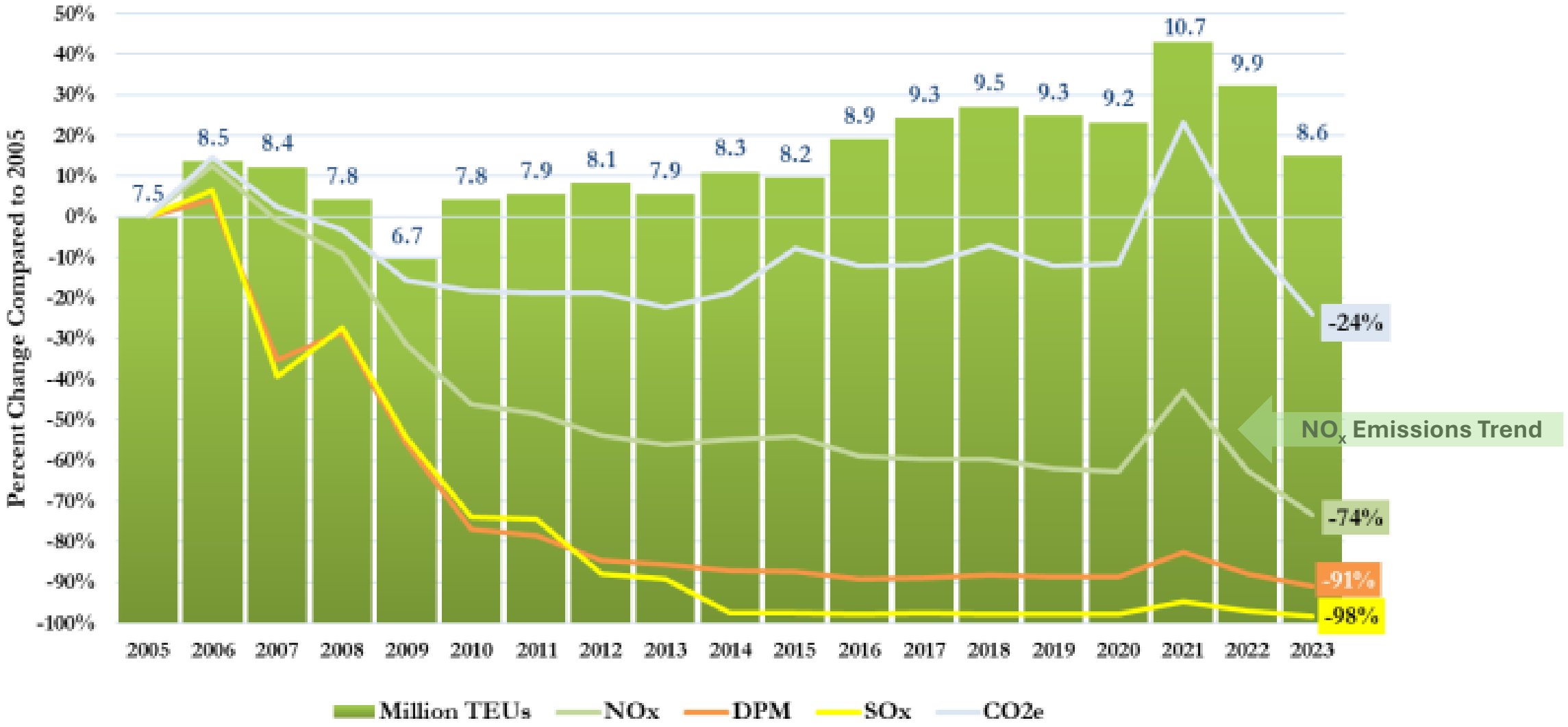
- The monitoring program includes a network of four air monitoring stations that measure ambient air pollution levels in the vicinity of the Port.

- Real-time monitoring includes:
  - Ozone (O_3),
  - Sulfur dioxide (SO_2),
  - Nitrogen dioxide (NO_2),
  - Carbon monoxide (CO),
  - Coarse particles (PM_{10}),
  - Fine particles ($PM_{2.5}$),
  - Ultrafine particles (($PM_{<2.5}$), and
  - Polycyclic aromatic hydrocarbons (PAHs)

Monitoring Air Quality in L.A. Harbor

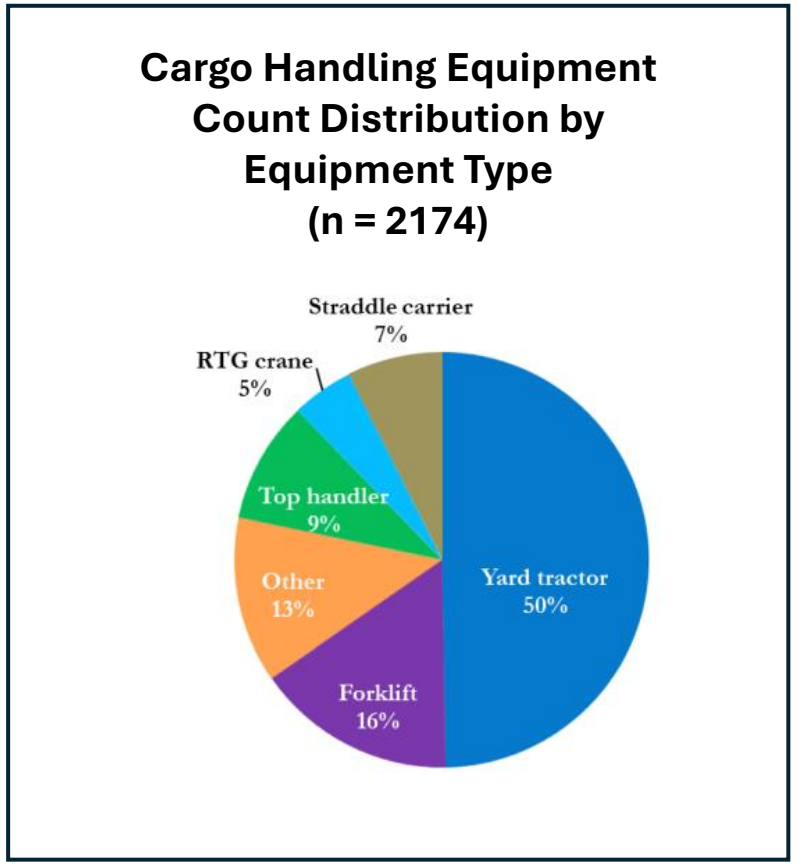
- The program also includes 24-hour integrated particulate sampling (collected on filters) every third day.
- In addition, meteorological monitoring stations operate adjacent to each air monitoring station to help interpret the air quality data.
- Meteorological monitoring includes wind speed, wind direction and temperature + solar radiation, relative humidity, and barometric pressure.

Overall Port of LA Emissions Trends for NO_x, DPM, SO_x, and CO_2



Strategies underway for continuing improvement of port air quality

- Advancing the **Clean Trucks Program*** to phase out older trucks and transition to near-zero emission and zero-emission trucks by 2035.
- Requiring operators to purchase **zero-emissions equipment**, if feasible, or cleanest technology available when procuring new equipment.
- Expanding the use of **on-dock rail** to shift more of the cargo leaving the port to rail.
- Transitioning the oldest, most polluting ships out of the San Pedro Bay fleet.
- Accelerating the deployment of **cleaner engines** and operational strategies to reduce emissions from **all harbor craft** (fishing; excursion; ship assist; ferries).

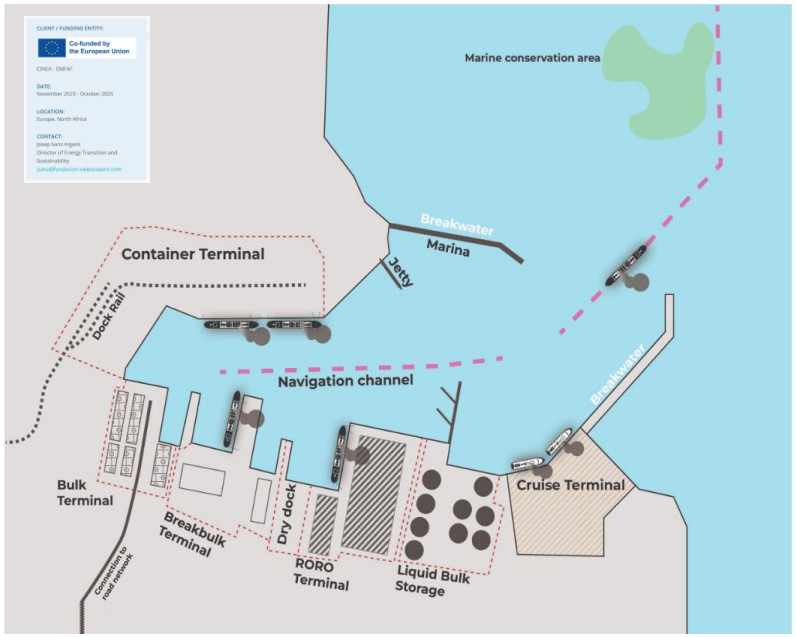


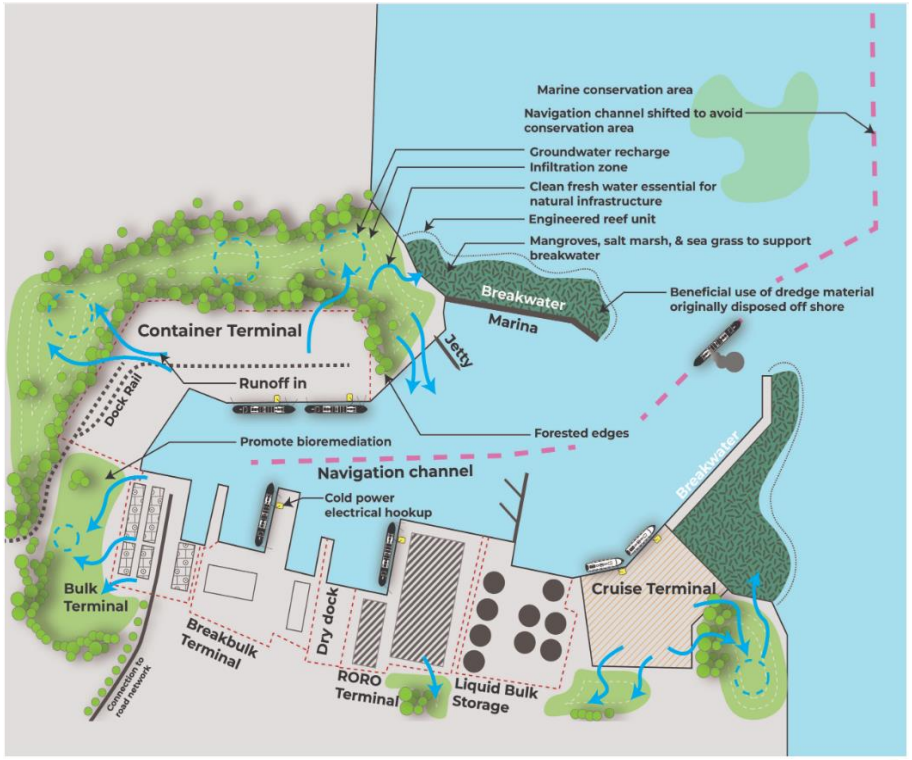
*The Boards of Harbor Commissioners of the City of LA and the City of Long Beach approved the collection of a Clean Truck Fund (CTF) @ a rate of $10 per loaded TEU moved by trucks in and out of port terminals. The CTF rates provide funds to incentivize the transition to low and zero-emission trucks through a Voucher Program. Zero-emission trucks are exempt from the rate.

Shipping industry accounts for about **3% of global CO_2 emissions**. This figure could rise to **17%** by 2050 if it remains unregulated.

The International Maritime Organization (IMO) is targeting a **50% reduction in CO_2 emissions by 2050**, but it applies only to international shipping – not ports and local shipping. Port cities have a critical role to play in filling that gap.

As ports are often at high risk from **storms, coastal flooding and sea-level rise**, projects that can incorporate **nature-based coastal protection** solutions generate significant benefits.





LINK

Carbon Capture Technologies/Strategies