INTRODUCTION TO THE ADAPTING TO RISING TIDES EXISTING CONDITIONS AND STRESSORS REPORT

The Adapting to Rising Tides (ART) project evaluated the current condition of shoreline and community assets, and the stressors affecting them, because understanding existing conditions and stressors can inform an understanding of individual asset resilience (or lack thereof) to projected climate impacts, including sea level rise and storm events. Stressors can also provide information on current and future trends and how those trends may affect resilience. The existing conditions and stressors were analyzed and summarized for each asset category included in the ART project assessment. This analysis served as a foundation for the ART vulnerability and risk assessment, which examined asset exposure to five potential climate impacts, sensitivity of assets to these impacts, and the ability of assets to accommodate or adjust to these impacts with little financial or structural intervention.

The following Existing Conditions and Stressors report chapter includes:

- a definition of the asset category;
- a synthesis of information about current conditions and stressors; and
- discussion of these conditions through the lenses of sustainability organized by society and equity, environment, economy and governance.

The complete ART Existing Conditions and Stressors Report is available at the ART Portfolio website.

SEAPORT

Port of Oakland: Seaport

I. Definition

The Port of Oakland was created in 1927 as an autonomous department of the City of Oakland under the exclusive direction of the Board of Port Commissioners by an amendment to the City's Charter. As an independent department of the City, the Port manages property stretching along 20 miles of the eastern shore of San Francisco Bay. In addition to its airport and real estate assets, its marine seaport facilities—which include shipping berths, container storage areas, and intermodal rail facilities—constitute approximately 1,200 acres.

II. Location and Physical Features

The Seaport includes four major terminal areas, which total a combined 791 acres: the Outer Harbor Terminal Area, the 7th Street Terminal Area, the Middle Harbor Terminal Area, and the Inner Harbor Area. Figure 1 below shows the Port's location along the eastern shore of San Francisco Bay.



Figure 1. Layout and Location of the Port of Oakland. Source: Port of Oakland, 2011.

The Seaport has 18 deep water berths, 13 of which reach depths of 50 feet, and 36 container gantry cranes (30 of which are post-Panamax types), as well as two intermodal rail yards: the Oakland International Gateway, operated by Burlington Northern Santa Fe on Port-owned land; and Railport, owned and operated by Union Pacific Railroad on adjacent private property. Table 1 lists the operating characteristics of the berths at the Port.

Table 1. Berths at the Port of Oakland

Berths	Operator	Berth length (meters)	Water depth (ft, MLLW)	Terminal yard acreage (excluding berth area)	Container Cranes	Cranes
20/21, 22, 23, 24, 25/26	Ports America Outer Harbor LLC	1,677	20/21: 42 22-25/26: 50	210	10	
30, 32	TransPacific Container Service Corporation (TraPac)	610	50	65.7	4	
33, 34*	Port of Oakland's Chief Wharfingers	33: 258 34: 338	33: 50 34: 38	30		
35, 37	Evergreen Marine Corporation Ltd.	684	50	58.1	4	
55, 56	Total Terminals Inc., LLC	732	50	120	4	
57-59	SSA Terminals, LLC	1,091	50	151.2		6
60/61, 62/63	Eagle Marine Services	836	44	80		4
67-68	SSA Terminals, Inc.	614	42	50.3		4

* Berth function is vehicle roll-on / roll-off

III. Existing Plans and Future Capacity

The Port of Oakland's Vision 2000 Program more than doubled the port's size with the transfer of 530 acres of the former Navy Fleet Industrial Supply Center Oakland (FISCO) to new cargo transport land uses. Specifically, the program called for the deepening of the main marine navigation channel and terminals to 50 feet to accommodate 6,500-TEU¹ ships (completed in 2010 at \$432 million), a new 150-acre Joint Intermodal Rail Terminal with eight permanent tracks to provide direct access to the Union Pacific and Burlington Northern Santa Fe railroads, and the construction of two new marine terminals-Berths 55-56 and 57-59—which



Post-Panamax crane delivered to Port of Oakland. Source: Flickr user Niall Kennedy, 2005.

provide 6,000 linear feet of berthing area and 270 acres of new marine terminals and container

¹ "Twenty-foot equivalent units," a standardized size of the containers in which goods are shipped.

yards. The Port is also currently planning the development of a trade and logistics center on a portion of the former Oakland Army Base. This project would create an improved connection between marine terminals and intermodal railyards, as well as provide additional goods warehousing and truck parking.

Trade at the Port of Oakland is projected to increase from 2.33 million TEUs in 2010 to 3.1 million TEUs by 2018 (Table 2).

Container Forecast for Port of Oakland (1,000 TEUs)					
Fiscal Year	Actual	Forecast			
2010	2,330				
2011		2,387			
2012		2,491			
2013		2,617			
2014		2,696			
2015		2,804			
2016		2,889			
2017		2,976			
2018		3,078			

Table 2. Cargo Forecast at Port of Oakland

Source: BST Associates, 2011.

At its present size of about 779 acres of terminal space and with its existing rail infrastructure, the Port of Oakland is projected to have adequate capacity through 2021 (Tioga Group, 2009). Infrastructure improvements on rail and road connections would mean the Port would have sufficient capacity to meet forecast demand through 2030 or beyond. Thus, the Port of Oakland is not faced with immediate capacity constraints based on projected cargo demand.

IV. Existing Stressors

Earthquakes and liquefaction are a particular risk to Port facilities, with much of the complex situated on bay fill. Damage to facilities at the Port of Oakland in the 1989 Loma Prieta earthquake was due primarily to liquefaction of the hydraulic fill (ABAG, 2001). The most extensive damage was to the 7th Street Terminal (Berths 35-38), although all other terminals were also affected (see photo below). Yard areas settled up to 1 foot relative to the pile-supported crane rails. Ground accelerations at the Port caused widespread liquefaction in several terminals, resulting in settlement and distress to backland pavement, utilities, and small buildings. The damage to the perimeter dikes, yard pavements, and wharf structures of the 7th Street Terminal for several months and reduce operations for over a year until emergency repairs were completed.



Damaged pavement at Berths 36 and 37 after Loma Prieta earthquake, 1989. Source: U.S. Geological Survey, 1998.

Significant sand boils observed in the yard pavements indicated that much of the hydraulic sand fill behind the perimeter dike liquefied as a result of the earthquake. Horizontal ground movements were on the order of 4 to 6 inches near and along the Berth 37 perimeter dike. Ground settlements on the order of 5 to 7 inches (and as much as 10 inches) were recorded immediately behind the wharf deck. The landside crane rail behind the Berth 37 wharf was reported to have settled approximately 8 to 12 inches. The observed damage to the Berth 37 wharf structure included failure of most of the landside batter piles and about half of the waterside batter piles, as well as some damage to vertical piles at pile/deck connection.

The Port of Oakland conducted studies of its vulnerability after both the 1989 Loma Prieta earthquake and the 1995 Kobe earthquake in Japan. These studies show that the soils in Oakland are muddier and less sandy than in Kobe (ABAG, 2001). In addition, the Port of Oakland uses pilings ranging from 20 to 100 feet in depth, rather than caissons; the pilings are considered a sounder approach. The 30 deep water berths in Oakland are up to 50 feet deep; in Kobe, the equivalent berths are more than 100 feet deep. It is interesting to note, however, that despite the damage from the 1989 Loma Prieta earthquake, the Port of Oakland experienced very little disruption in cargo service. Through quick response and flexible operations, it was able to double up service at the remaining functional berths. Reportedly, only one ship turned away because of the earthquake damage (Port of Oakland, 1999).

In 2000, the Port authorized an extensive Wharf and Embankment Strengthening Program (WESP). The program was split into three phases and involved retrofitting or rebuilding over 12,000 linear feet of pile-supported wharf structures (see photo below). While many of the port facilities may still be vulnerable to liquefaction, the WESP projects have done much to reduce catastrophic damage to critical embankments and wharfs.



Pier 37 embankment strengthening. Source: Ben C. Gerwick, Inc., 2007.

V. Economics/Jobs

In total, nearly 444,000 jobs are related, in some way, to the movement of cargo at the Port of Oakland seaport (Martin Associates, 2011). In 2010, cargo handled at the Port supported about \$2.2 billion of total personal income, \$2.1 billion in revenue for businesses providing maritime services for cargo and vessels, and \$233 million in state and local tax revenue. In the Bay Area alone, cargo activity at the Port generated 28,833 direct, induced, and indirect jobs. Each year, depending upon the revenue surplus, the Port also makes financial contributions to the City of Oakland.

By number of annual TEUs, the Port of Oakland is the third busiest container port on the West Coast (after the Port of Los Angeles and the Port of Long Beach) and the fifth busiest in the United States (after the Port of New York/New Jersey and the Port of Savannah). In 2010, the Port of Oakland saw the arrival of 1,973 cargo vessels, transporting a total of over 2.33 million TEUs (see Table 3). Although total TEUs are up 13% from 2009 levels, shipping is still below the record peak of 2.39 million TEUs in 2006.

Year	TEUs	Percent Change from Previous Year
2005	2,273,990	+11.1%
2006	2,391,745	+5.2%
2007	2,387,911	-0.2%
2008	2,233,533	-6.5%
2009	2,045,211	-8.4%
2010	2,330,214	+13.9%

Table 3. Actual TEU Cargo Shipments at Port of Oakland

Source: Port of Oakland, 2011.

The Port serves as the principal ocean gateway for container cargo in northern California and provides an interface for waterborne international and domestic cargo moving between inland points in the United States and the Pacific Basin, as well as other points in the world (East Bay Economic Outlook, 2011). Ten percent of international cargo bound for the West Coast travels through the Port with machinery, electrical equipment, knit apparel, furniture, and beverages the leading types of goods. These imports arrive primarily from Asia, particularly China and Japan. In sum, over \$24.3 billion worth of imports flowed through the Port in 2010.

However, although international imports constitute a major economic role, the Port of Oakland plays a much greater role in the export of goods, specifically as a critical gateway for California's agricultural products (see Table 4). The Port is unique in that it exports more than it imports. More than 60% of all California exports of beverages, spirits, vinegar, coffee and tea, fruits, nuts, citrus, and melons leave the state via Oakland. In 2010, more than \$10.1 billion in California-made goods and commodities were shipped through the Port of Oakland, the highest level on record, representing over 29% of all exports produced in the state. More than 20% of all products shipped abroad through the Port were edible fruits, nuts, citrus, or melons from the Central Valley, totaling \$3.2 billion. An additional \$1.9 billion in meat and offal products were also exported via the Port. The value of all exports through the Port of Oakland in 2010 represented 9.3% of all California exports.

Port of Oakland Top 10 Imports and Exports by Value, 2010							
Rank	Import Commodity	Import \$ Millions	Import Percent	Export Commodity	Export \$ Millions	Export Percent	
1	Machinery	5,380	22.1%	Edible fruit and nuts	3,200	20.8%	
2	Electrical equipment	3,260	13.4%	Meat	1,900	12.3%	
3	Knit apparel	2,140	8.8%	Machinery	955	6.2%	
4	Furniture and bedding	1,430	5.9%	Inorganic chemicals/rare earth	901	5.9%	
5	Beverages	1,250	5.1%	Electrical machinery	684	4.4%	
6	Toys and sports equipment	860	3.5%	Beverages	682	4.4%	
7	Vehicles	761	3.1%	Vehicles	569	3.7%	
8	Plastic	757	3.1%	Cereals	420	2.7%	
9	Coffee	593	2.4%	Optical/medical instruments	411	2.7%	
10	Woven apparel	465	1.9%	Misc. chemical products	297	1.9%	
	Other	7,404	30.5%	Other	5,381	34.9%	
	Import Total	24,300	100.0%	Export Total	15,400	100.0%	

Table 4. Value of Import and Export Commodities Shipped Through the Port of Oakland

Source: Port of Oakland, July 2011.

VI. Equity and Environment

As a public agency, the Port of Oakland strives to solicit public input on its various plans and programs. The Port has many community-based programs that aim to reduce its impacts on adjacent neighborhoods.

The ships, trains, and approximately 2,000 trucks that operate out of the Port impact air quality by emitting diesel emissions that pollute surrounding neighborhoods such as West Oakland and East Oakland. As such, the Port of Oakland worked with a community task force from 2007 to 2009 to develop an air quality plan to reduce the environmental burden placed on the local community by diesel-fueled freight equipment serving the seaport. The Port's Board of Port Commissioners approved the Maritime Air Quality Improvement Plan (MAQIP) on April 7, 2009. MAQIP's primary goal is to reduce excess community cancer risk caused from Port-related diesel particulate matter by 85% from 2005 to 2020. The nearly 40-person task force that designed the MAQIP's goals and measures used seven guiding principles:

- 1. Seek economic growth.
- 2. Promote environmental stewardship.
- 3. Apply the concept of fair share.
- 4. Exercise the Port's authority.
- 5. Engage stakeholders.
- 6. Promote environmental justice.
- 7. Build knowledge.

The primary emissions control measures outlined in the MAQIP are:

- Early action retrofit and/or replacement of port drayage trucks.
- Compliance with the California Air Resources Board's shore power regulation.
- Design and operational efficiencies.
- Participation in pilot and verification projects for NO_x and diesel particulate matter reduction strategies.
- Early action construction emissions reductions.
- Support of enforcement of regulations by the California Air Resources Board and BAAQMD through coordination with Port tenants.
- Accountability, monitoring, and reporting

The complete plan is available at http://www.portofoakland.com/pdf/maqip090515.pdf.

Many of the Port's hiring policies promote local community benefits. The Maritime and Aviation Project Labor Agreement (MAPLA) was adopted by the Board of Port Commissioners in March 2000 (for more information on the MAPLA see page 32 of this report or go to *www.portofoakland.com/business/contract.asp*). In addition to MAPLA, the Port's Living Wage Program applies to all businesses with more than 20 employees.

Thus, the Port of Oakland strives to be an active community participant by developing innovative programs that ensure low-income and adjacent communities do not bear disproportionate impacts and are able to benefit from the economic benefits of global trade and commerce.

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