TECHNICAL MEMO

NYMTC Regional Freight Plan Update 2015-2040 Interim Plan

Task 2.1.3
Ports and Waterborne Network and Infrastructure

NYMTC
NEW YORK METROPOLITAN TRANSPORTATION COUNCIL

REVISED, JANUARY 2014

technical memorandum

Task 2.1.3 Technical Memorandum

Ports and Waterborne Network and Infrastructure

Revised, January 30, 2014

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1.0 Introduction

Since the time of European settlement in the 17th Century, New York Harbor has served as one of the primary marine gateways connecting North America to the world. Through transportation and logistics technological advancements over the centuries, such as the development of steam-powered vessels, construction of the Erie Canal, and adoption of intermodal containerized waterborne cargo carried by modern container ships, the Port of New York and New Jersey (PONYNJ) has achieved and maintained the status of the top port on the United States' East Coast.

Today, the PONYNJ district covers the area within a 25-mile radius of the Statue of Liberty. Within this area, the Port Authority of New York and New Jersey (PANYNJ) manages six marine terminals that receive imported containerized, bulk (oil, cement, etc.), and breakbulk (steel pipe, concrete blocks, etc.) cargoes, and send U.S. exports to markets around the world. In addition, domestic breakbulk and bulk cargoes are shipped inbound and outbound through nearly 200 public and private marine terminal facilities located throughout the NYMTC Region. The facilities that handle bulk and breakbulk cargoes are located within New York City, along the North Shore of Long Island, and along the Hudson River in Westchester and Rockland counties, as well as in New Jersey.

This memorandum describes an overview of the terminal and waterway networks that serve shippers and receivers in the NYMTC Region, including the types of commodities handled, the physical layout and operating characteristics, physical and operational constraints, and opportunities to expand physical or operational capacity of the terminals. Because most of the international containers that are imported or exported via New York Harbor cross the wharf at container terminals located in New Jersey, description of those facilities is provided, despite the fact that they are located outside of the NYMTC Region.

This analysis consists of three primary sections:

- Section 2 describes the Port Authority of New York and New Jersey (PANYNJ) container terminals at Red Hook, New York Container Terminal, Port Newark, Port Elizabeth, and Global Marine Terminal;
- Section 3 describes the bulk and breakbulk facilities at Port Authority marine terminals, and at privately-owned and operated facilities located in the NYMTC Region, primarily in New York City; and
- Section 4 describes challenges and opportunities facing waterborne freight transportation in the NYMTC Region.

Data in this document is taken from a combination of port and terminal web sites, the New York City Economic Development Corporation (NYCEDC), the American Association of Port Authorities (AAPA), and consultant team project experience.

2.0 Waterborne Network in the NYMTC Region

2.1 CONTAINERIZED CARGO

The Port of New York and New Jersey is the largest container port on the U.S. East Coast, and third-largest in the United States behind Los Angeles and Long Beach. In 2011, 3.2 million containers, or 5.5 million twenty-foot equivalent units (TEUs) passed through the six container terminals in the Port. In the 10 year period between 2002 and 2011, the volume of containerized TEUs increased by 47 percent, and 2011 volumes were 4 percent higher than 2010 volumes.[1]

About 62 percent of loaded TEUs are imports, while 38 percent contain goods that are being exported. The PONYNJ's top international trading partners are China, which accounted for 28 percent of the Port's trade in 2011, India (7.1 percent), Italy (5.2 percent), and Germany (5.0 percent). The top commodities traveling through the Port included furniture (263,000 TEUs), beverages (183,000 TEUs), apparel (170,000 TEUs), and menswear (133,000 TEUs).[2]

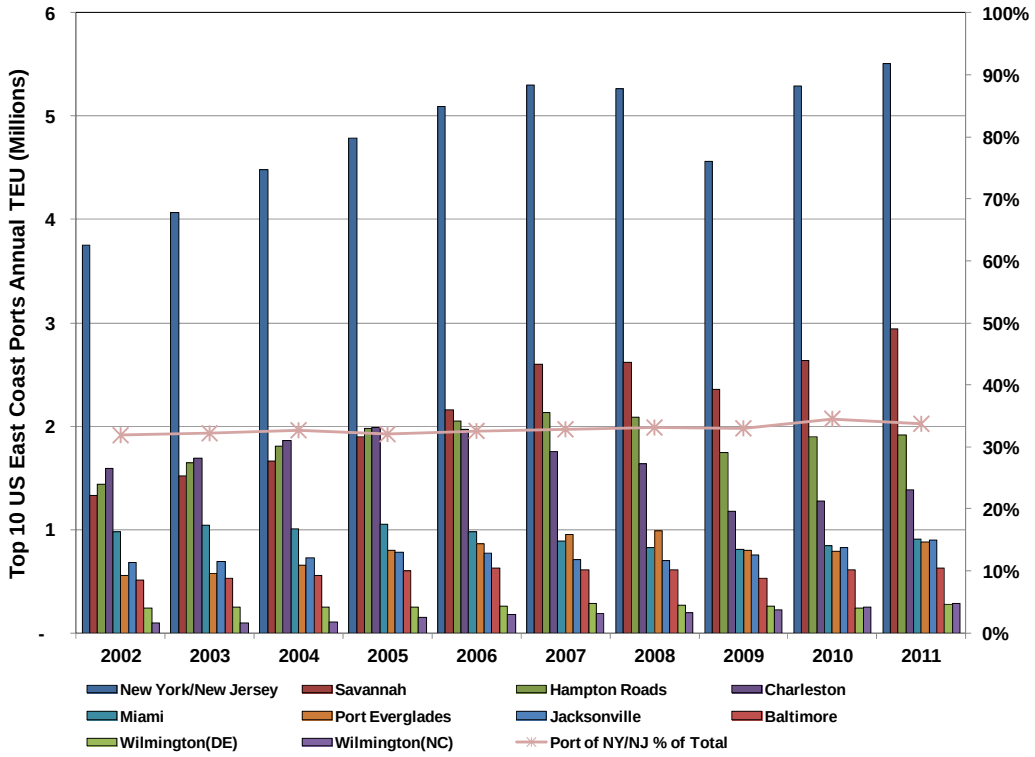
The PONYNJ serves as a major international gateway for imports and exports consumed and produced in the NYMTC Region. In addition, the Port serves a primary market area consisting of seventeen states in the Northeast, Mid-Atlantic, and Midwest. PONYNJ sends or receives 61 percent of the TEUs that pass through North Atlantic ports between Maine and Virginia.

Figure 2.1 shows a decade of throughput for the top 10 busiest U.S. East Coast ports, as well as PONYNJ''s relative share of the East Coast container market for each year.

[1] "2011 Trade Statistics," Port Authority of New York and New Jersey.

[2] Ibid.

Figure 2.1 2002-2011 Top 10 U.S. East Coast Port TEU Throughputs



Source: American Association of Port Authorities

Overall, the PONYNJ''s containerized cargo market share versus other U.S. East Coast ports has remained relatively steady over the past decade, at about a third of the overall East Coast volume.

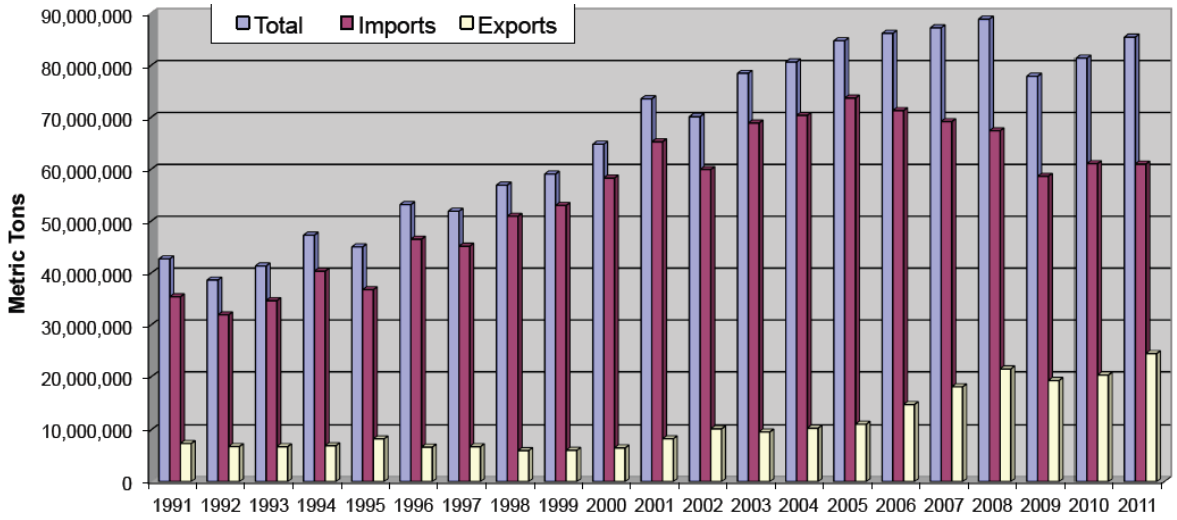
2.2 BULK AND BREAKBULK CARGO

Bulk and breakbulk cargoes are an important part of the business activity of Port Authority marine terminals. Although containers are the predominant method of handling for most cargo types, especially finished goods like clothes and electronics, many types of cargo are handled in bulk or noncontainerized breakbulk. This type of cargo is also known as "general cargo" and may include such things as:

- Construction materials, (cement, gypsum, paving stones, etc.);
- Salt;
- Food/juice/edible oils; and
- Petroleum products.

Figure 2.6, also taken from the PANYNJ web site, lists the annual volume of bulk and breakbulk cargo in metric tons over the past 10 years.

Figure 2.2 PANYNJ Bulk Plus Breakbulk Cargo Volume



Source: "2011 Trade Statistics," Port Authority of New York and New Jersey.

According to the TRANSEARCH database analyzed in the Commodity Flow Analysis Technical Memorandum, about 22 million tons of domestic bulk and breakbulk freight moved by water into, out of, and within the 10-county NYMTC Region in 2007. The top commodity groups carried by water included Petroleum or Coal Products (11 million tons), Nonmetallic Minerals (5.2 million tons), Waste or Scrap Materials (3.0 million tons), and Chemicals or Allied Products (1.6 million tons).

Most of this bulk and breakbulk waterborne freight is handled at nearly 200 public and privately owned and operated terminals throughout New York Harbor, Long Island, and the Hudson Valley. The major clusters of bulk and breakbulk marine terminals are identified and described in Section 3.2.

2.3 MARITIME SUPPORT SERVICES

Services that support the waterborne freight operations in the NYMTC region include:

- Support vessels, such as assist tugs, pilot boats, launch boats, derricks, and pollution response vessels;
- Anchorages and layberths;
- Vessel repair facilities; and
- Tie-ups for auxiliary activities such as crew changes, fueling, re-supply, and removal of bilge and gray water.

Facilities that provide these services are located throughout New York Harbor, Long Island Sound, and along the Hudson River.

In 2004, 1,190 barges and 231 towboats (including push boats and tugboats) were registered in New York and New Jersey, accounting for 26 percent of all barges and towboats on the East Coast. A study completed by the New York City Economic Development Corporation in 2007 found that those vessels required 221,283 linear feet of berth space, while 89,396 feet of berth space were available.[3]

The same study identified 25 mooring buoys located in and around New York Harbor, available for layberthing barges. The locations of the mooring buoys are identified in Table 2.1.

Table 2.1 Mooring Buoys in and Near the NYMTC Region, 2004

Location	Number of Mooring Buoys
Whitestone, NY	5
Westchester, NY	1
Eastchester, NY	2
Upper Bay, NY	5
Robbins Reef, NY	2
Hempstead, NY	2
Port Chester, NY	1
Port Jefferson, NY	1
Haverstraw, NY	2
South Amboy, NJ	2
Stamford, CT	1
New Haven, CT	1
Total	**25**

Source: New York City Economic Development Corporation, "Maritime Support Services Location Study," 2007.

In addition to on-site repair shops, mechanics, and metal shops present at most of the major container and bulk and breakbulk terminals in the region, a number of dry dock facilities are available to accommodate substantial repairs. In 2013, 15 dry docks are located in New York Harbor, listed in Table 2.2. Three fewer

[3] New York City Economic Development Corporation, "Maritime Support Services Location Study," 2007.

dry docks exist in the Harbor today, compared to, 2007, when 18 dry docks were open in the Harbor.[4] Dry docks in the Harbor consist of:

- Graving docks, which are basins that can be flooded to allow a vessel to enter, and then sealed off and pumped dry; and
- Floating dry docks, which use hydraulic pontoons to lower the floor of the dock deep enough below the water's surface to allow the vessel to enter, at which point the pontoons are raised, lifting the vessel above the water's surface.

Table 2.2 Dry Docks in New York Harbor, 2013

Facility	Graving Docks	Floating Dry Docks
Caddell, Staten Island	-	6
May Ship Repair, Staten Island	-	3
GMD Brooklyn Navy Yard	2	1
Union Drydock, Hoboken, NJ	-	2
GMD Bayonne, NJ	1	-
Total	**3**	**12**

Sources: Caddell Dry Dock and Repair Co., available from: http://www.caddelldrydock.com/; Mayship Repair, available from http://www.mayship.com/; GMD, available from: http://www.bayonnedrydock.com/gmd.html.

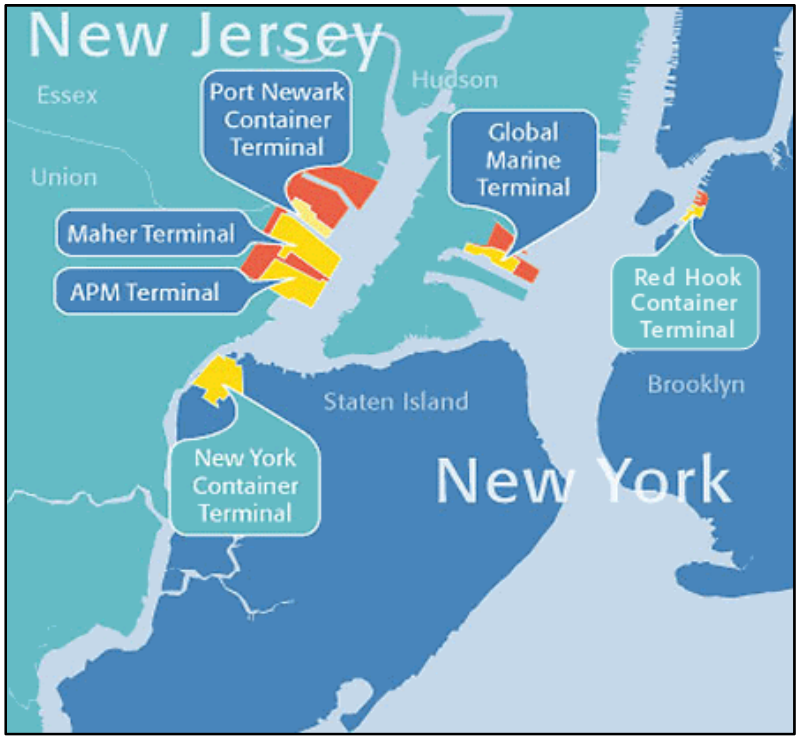
[4] *Maritime Support Services Location Study*, New York City Economic Development Corporation, 2007.

3.0 Profiles of Terminal Facilities and Clusters

3.1 PANYNJ TERMINALS

There are six terminals at the Port of New York and New Jersey which currently handle containerized cargo, including New York Container Terminal and Red Hook Container Terminal in New York, and Port Newark Container Terminal, Maher Terminal, APM Terminal, and Global Marine Terminal in New Jersey. Three of these terminals also handle other types of cargo. Global Marine Terminal handles roll-on/roll-off (RO-RO) and heavy lift cargo, while Red Hook Container Terminal handles breakbulk and general cargo. NYCT handles some general cargo and breakbulk, including cement, paper, glass, and metal products. Figure 3.1 below is a map of the locations of all six container-handling terminals. Table 3.1 summarizes the size, operational mode, equipment, capacity, and throughput at each of the six terminals.

Figure 3.1 Container Terminals at the Port of New York and New Jersey



Source: : http://www.panynj.gov/port/containerized-cargo.html.

Table 3.1 Key Operating Statistics at PANYNJ Container Terminals

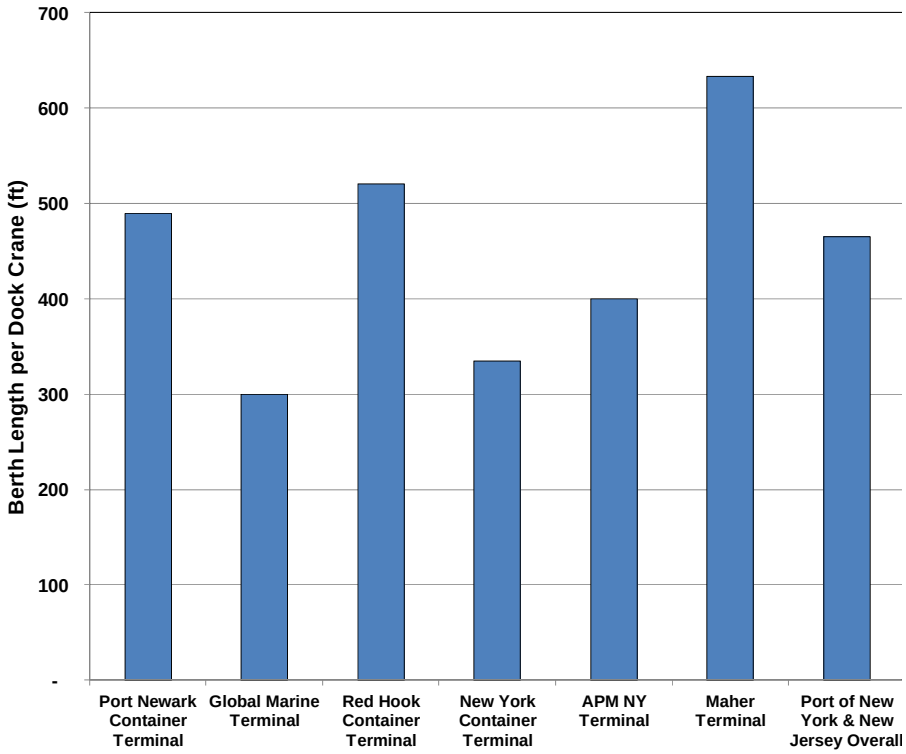
	Port Newark Container Terminal	Global Marine Terminal	Red Hook Container Terminal	New York Container Terminal	APM NY Terminal	Maher Terminal	All PANYNJ Container Terminals
Terminal Type	Container	Container, RO-RO, Heavy Lift	Container, RO-RO, Breakbulk	Container, General Cargo, Breakbulk	Container	Container	Container
Yard Crane Type	Strad	RTG	Pick	Pick	RTG	Strad	
Horizontal Transport Equipment	Strad	Tractor	Tractor	Tractor	Tractor	Strad	
Container Terminal Area (acres)	180	78	30	187	350	445	1,270
% of Port-Wide Container Area	14%	6%	2%	15%	28%	35%	100%
Est 2011 Vessel TEU Throughput	780,000	338,000	130,000	810,000	1,517,000	1,928,000	5,503,000
2011 Lifts at 1.72 TEU/Container	453,000	197,000	76,000	471,000	882,000	1,121,000	3,197,000
Est.Container Capacity (TEU)	1,543,000	669,000	257,000	1,603,000	3,000,000	3,814,000	10,886,000
Est. Container Capacity (Lifts)	897,000	389,000	149,000	932,000	1,744,000	2,217,000	6,329,000
% of Capacity	51%	51%	51%	51%	51%	51%	51%
Berth Length (ft)	4,400	1,800	2,080	3,012	6,001	10,128	27,421
Water Depth (ft)	50	43	42	45	50	50	50
Number of Dock Cranes	9	6	4	9	15	16	59
Berth Length (ft)/No. Dock Cranes	489	300	520	335	400	633	465
2011 Est TEU/Acre	4,330	4,330	4,330	4,330	4,330	4,330	4,330
2011 Est Lifts/Dock Crane	50,330	32,830	19,000	52,330	58,800	70,060	54,190
2011 Est Lifts/Berth-ft	103	109	37	156	147	111	117

Sources: "Port of New York and New Jersey," Port Authority of New York and New Jersey, available from: http://www.panynj.gov/port/; Global Terminal and Container Services, available from: http://www.global-terminal.com/t3/index.php?id=glbl_index.

Note that 2011 Estimated TEU/acre for each PANYNJ container terminal and the Port as a whole are identical at 4,330 TEU/acre; this is due to the terminal throughput estimation methodology used by the PANYNJ. The consultant team estimates that the PANYNJ overall should be able to accommodate at least 11M TEU per year on its existing terminals as they are remodeled over time to reflect industry best-practice in terms of high-density operations.

Figures 3.2-3.4 compare key operating statistics for the individual container handling terminals at the Port of New York and New Jersey to the Port as a whole. Figure 3.2 shows the average amount of berth space allocated to each dock crane. Less space per crane indicates a higher crane density and higher berth capacity.

Figure 3.2 Feet of Berth Length per Dock Crane

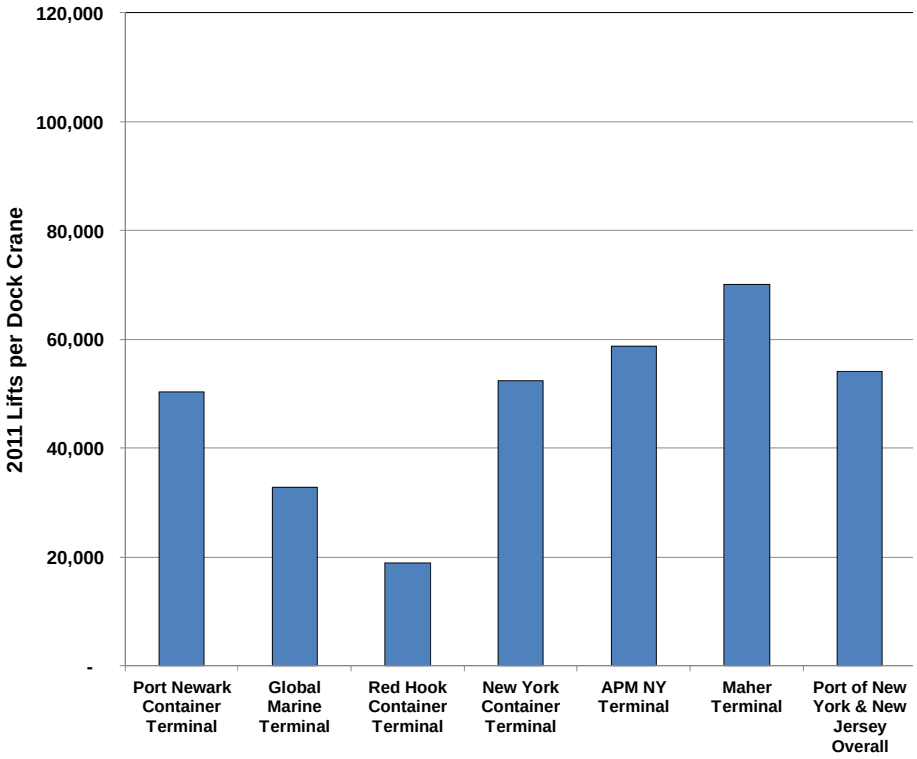


Sources: "Port of New York and New Jersey," Port Authority of New York and New Jersey, available from: http://www.panynj.gov/port/; Global Terminal and Container Services, available from: http://www.global-terminal.com/t3/index.php?id=glbl_index.

Maher, Port Newark, and APM container terminals all have wide dock crane spacing, and it's possible that new dock cranes could be added to these terminals to increase capacity if needed.

Figure 3.3 shows 2011 lifts per dock crane. While 2011 lifts had to be estimated based on terminal acreage for the individual PANYNJ terminals, the chart shows the approximate 2011 level of utilization of dock cranes.

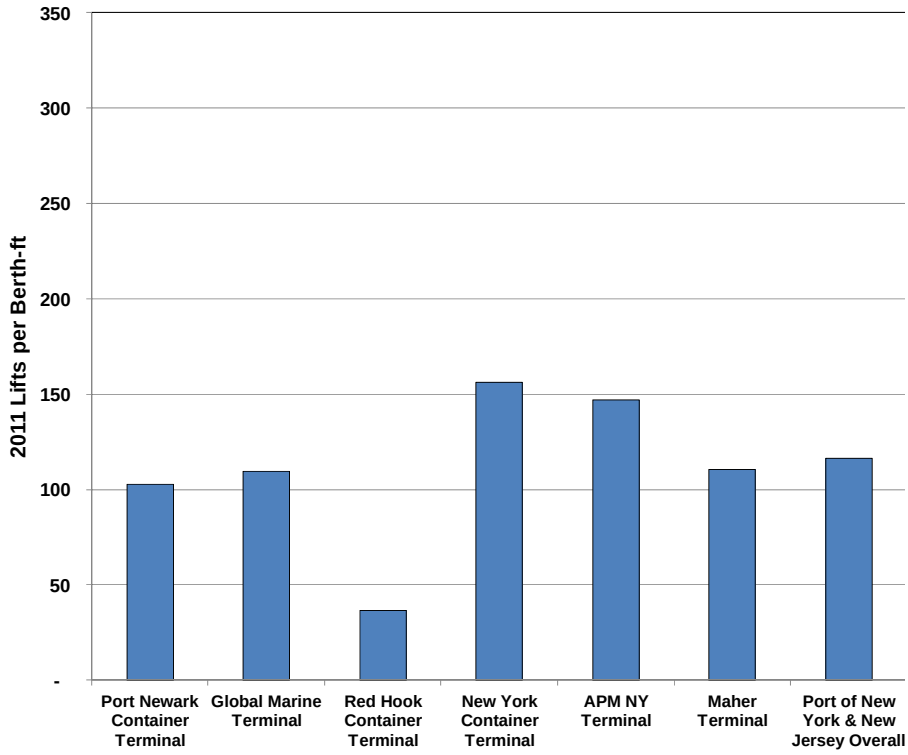
Figure 3.3 Estimated 2011 Lifts per Dock Crane



Sources: "Port of New York and New Jersey," Port Authority of New York and New Jersey, available from: http://www.panynj.gov/port/; Global Terminal and Container Services, available from: http://www.global-terminal.com/t3/index.php?id=glbl_index.

The dock cranes at the Port of New York and New Jersey as a whole performed about 54,000 lifts each on average in 2011. Figure 3.4 is a chart of 2011 lifts per berth-foot.

Figure 3.4 Estimated 2011 Lifts per Foot of Berth



Sources: "Port of New York and New Jersey," Port Authority of New York and New Jersey, available from: http://www.panynj.gov/port/; Global Terminal and Container Services, available from: http://www.global-terminal.com/t3/index.php?id=glbl_index.

Table 3.2 summarizes the number of local truck moves required at the Port to support every 1M annual TEUs, as well as the number of gate moves and related one-way truck trips required to support 2011 throughput. Local truck moves refer to gate transactions for containers being delivered to their final destination via truck, rather than for short-haul drayage moves to rail yards. Eighty-seven percent "Local via truck" in Line 'd' is based on the PANYNJ-reported 424,000 containers via rail in 2011, out of a throughput of 3.2M containers.

On-dock rail is offered, as a service branded as ExpressRail, at APM and Maher terminals in Elizabeth, Port Newark Container Terminal in Newark, and New York Container Terminal in Staten Island. The ExpressRail facilities are supported by the Corbin Street Intermodal Support Yard, located to the west of the Port Newark/Port Elizabeth marine terminals. Between 1991 and 2012, ExpressRail volumes have increased 15-fold, from 27,700 containers to more than 424,000 containers. Since 2007, when the Staten Island facility opened, ExpressRail volumes have increased 18 percent. In 2011, ExpressRail handled about 13 percent of all containers traveling through the Port.

Table 3.2 Truck Trips at PANYNJ Container Terminals

	Nominal 1M TEU	Actual 2011 TEU	
a	1,000,000	5,503,485	Annual TEU
b	1.72	1.72	TEU per container
c=a/b	581,395	3,199,701	Moves per year
d	87%	87%	% Local via truck (not to rail)
e = c*d	504,262	2,775,200	Gate moves per year
f = e/52	9,697	53,369	Gate moves per mean week
g	120%	120%	Peak/mean week
h = f*g	11,637	64,043	Gate moves per peak week
i	90%	90%	Weekdays
j = h*i	10,473	57,639	Gate moves per M-F peak week
k = j/5	2,095	11,528	Gate moves per mean day peak week
l	110%	110%	Peak/mean day
m = k*l	2,304	12,681	Gate moves on a peak day
n	80%	80%	Fraction of peak day moves in 8hr shift
o = m*n	1,843	10,144	Gate moves in 8hr
p	1.33	1.33	Gate moves per truck visit
q=o/p	1,386	7,627	Truck visits during peak shift
r	2	2	One-way truck trips per truck visit
s=q*r	**2,772**	**15,255**	**One-way truck trips per peak shift**
t=s/8	**346**	**1,907**	**Mean hourly one-way truck trips during peak shift**

Sources: "2011 Trade Statistics," Port Authority of New York and New Jersey; AECOM

Terminal Operating Modes

The PANYNJ container terminals use several different operating modes, referring to the types of equipment used, for transporting containers from the wharf, into stacks in the container yard, and from the container yard to the truck and rail operation areas of the terminals. The operating mode used to move containers around the terminal impacts the density with which the container yard can be filled with containers, and the efficiency with which containers can be relocated and processed through the facility. Operating mode is one of several factors (in addition to water depth, crane size and capacity, landside access, labor, and regulations) that determine the capacity of a marine terminal. Current yard equipment using non-overhead stacking cranes may be less optimal than some of the more efficient equipment available, but are justified in terms of immediate costs and benefits. Terminal operators in the Port are aware of the trade-offs and the challenges they may face increases with growing ship sizes and overall demand.

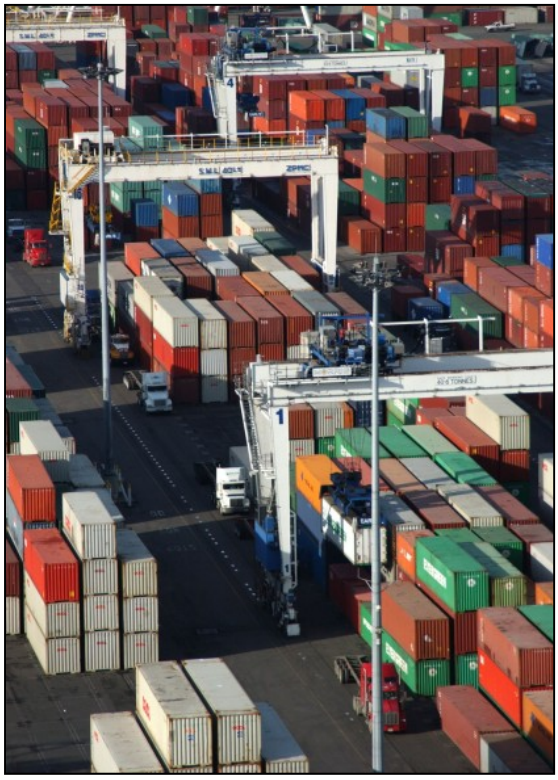
Red Hook and New York Container Terminals both primarily use top-picks or side-picks, traditional manual vehicles pictured in Figure 3.5.

Figure 3.5 Examples of Picks

Picks are common in older or mixed-use terminals. They have a disadvantage of requiring wide aisles to allow both picks and terminal yard tractors to circulate, reducing the density of the container yard compared to an overhead crane such as a rubber-tired gantry (RTG) crane. Picks also yield lower productivity than RTG-based terminals, especially for gate service where the ability to select specific containers is important.

Figure 3.6 shows a photo of RTG stacks. Note that the containers in Figure 2.4 are able to be stacked closely together without large circulation aisles between RTG runs, which increase container yard stacking density compared to pick-based operations. Both Global Marine and A.P. Moller (APM) Terminals at the Port have RTG-based container yards.

Figure 3.6 RTG Cranes



The third type of terminal at the Port is straddle-based; both Maher and PNCT have straddle carrier (strad)-based container yards. Figure 3.7 is an example photo of a strad.

Figure 3.7 Example of a Strad

Note that the container stacks in Figure 3.7 are limited to three-high stacks, as are PNCT and Maher Terminals within the PANYNJ. Overhead-crane-based terminals (such as RTGs) allow higher container stacking (one-over-five is the current standard RTG dimension). In addition, wide spacing between each row of containers is required to ensure adequate maneuvering space for the strads. These factors result in a much lower container-stacking density per acre in strad-based terminals than in RTG terminals.

Figure 3.8 Maher Terminal Strad-Based Container Yard

Below is a summary of the key operating statistics for each of the six container terminals at the Port, and for all container facilities at the Port as a whole. Note that individual container-terminal throughputs are propriety information; where necessary, individual terminal throughputs have been estimated using the formula (container terminal area/port wide container terminal area).[5] For Global Marine and Red Hook Terminals, the area listed is for dedicated container operations only, rather than the entire terminal.

New York Container Terminal

Location: 300 Western Avenue, Staten Island, NY

Size: 187 acres

Berth Length: 3,012 feet

Berth Depth (mean low water): 45 feet for 1,250 feet; 42 feet for 1,050 feet; 37 feet for 700 feet.

[5] 2011 Total Port TEU.

Container cranes: 9, including:

- 2 81-foot high, 115-foot reach, 40 long tons (LT) IHI cranes;
- 1 75-foot high, 115-foot reach, 40 LT IHI crane;
- 2 100-foot high, 135-foot reach, 40 LT Paceo cranes; and
- 4 120-foot high, 164-foot reach, 65 LT twin pick/50 LT single pick/75 LT underhook cranes.

Terminal Operating Mode: Top-pick and side-pick

On-dock rail: ExpressRail Staten Island facility

Red Hook Container Terminal

Location: 70 Hamilton Avenue, Brooklyn, NY

Size: 80 acres

Berth length: 2,080 feet for containers, 3,410 feet for breakbulk

Berth depth (mean low water): 42 feet

Container cranes: 4, including:

- 1 80-foot high, 120-foot reach, 40 LT Paceo crane;
- 1 82-foot high, 122-foot reach, 40 LT Star crane;
- 1 89-foot high, 133-foot reach, 50 LT Kone crane; and
- 1 100-foot high, 150-foot reach, 60 LT Liebherr crane.

Terminal Operating Mode: Top-pick and side-pick carriers

On-dock rail: None

Port Newark Container Terminal

Location: 241 Calcutta Street, Newark, NJ

Size: 180 acres

Berth length: 4,400 linear feet

Berth depth (mean low water): 40-50 feet

Container cranes: 9, including:

- 3 169-foot high, 118-foot reach, 46 LT Paceo cranes;
- 2 219-foot high, 167-foot reach, 50-60 LT ZPMC Post Panamax cranes; and
- 4 219-foot high, 167-foot reach, 50-60LT Fantuzzi cranes.

Terminal Operating Mode: Straddle carrier

On-dock rail: ExpressRail Newark facility

Maher Terminal

Location: 1210 Corbin Street, Elizabeth, NJ

Size: 445 acres

Berth length: 10,128 linear feet

Berth depth (mean low water): 45-50 feet

Container cranes: 16, including:

- 9 120-foot high, 200-foot reach, 65 LT cranes;
- 6 100-foot high, 135-foot reach, 50 LT cranes; and
- 1 100-foot high, 115-foot reach, 40 LT crane.

Terminal Operating Mode: Straddle carrier

On-dock rail: ExpressRail Elizabeth facility

A.P. Moller (APM) Terminal

Location: 5080 McLester Street, Elizabeth, NJ

Size: 350 acres

Berth length: 6,001 linear feet

Berth depth (mean low water): 40-50 feet

Container cranes: 15, including:

- 4 131-foot high, 206-foot reach, 50 LK ZPMC Super Post Panamax cranes;
- 6 120-foot high, 140-foot reach, 50 LT ZPMC Post Panamax cranes;
- 2 120-foot high, 140-foot reach, 50 LT Paceo-Mitsui Post Panamax cranes; and
- 3 85-foot high, 110-foot reach, 50 LT Paceo cranes.

Terminal Operating Mode: Rubber Tire Gantry (RTG) cranes

On-dock rail: ExpressRail Elizabeth facility

Global Marine Terminal

Location: 302 Port Jersey Boulevard, Jersey City, NJ

Size: 98 acres

Berth length: 1,800 linear feet

Berth depth (mean low water): 43 feet

Container cranes: 6, including:

- 6 110-foot high, 180-foot reach, 50 LT ZPMC Post Panamax cranes

Terminal Operating Mode: Rubber Tire Gantry (RTG) cranes

On-dock rail: None

3.2 NON-PANYNJ BULK AND BREAKBULK FACILITIES

In addition to PANYNJ bulk and breakbulk terminals, there are numerous private terminals along various New York waterways handling a variety of cargo such as sand and gravel, petroleum products, paper products, etc. Table 3.3 below summarizes all port facilities listed in the U.S. Army Corps of Engineers ports database, which are located in the NYMTC Region. The data is separated into several geographic areas defined and described below. Facilities without any common location are included under 'Other', which includes several different waterways: Coney Island Creek, East River, Glen Cove Creek, Gravesend Bay, Jamaica Bay, Hempstead Bay, Manhasset Bay, Oyster Bay, Port Jefferson, Greenport, and Port Chester Harbor. Table 3.3 lists the number of facilities which are categorized as able to handle each commodity type; as a result, facilities capable of handling multiple commodity types will be counted more than once. These facilities are mapped in Figure 3.5.

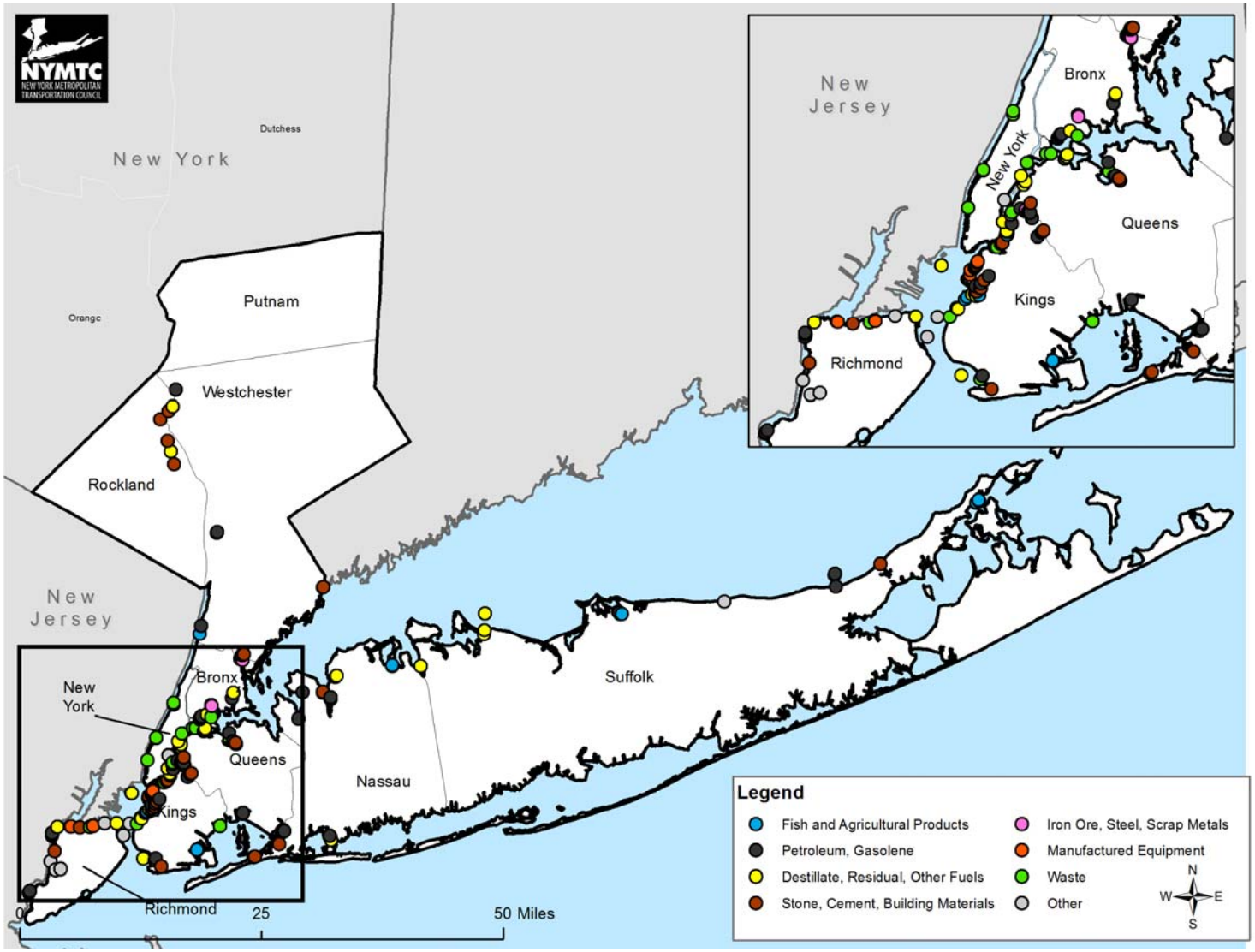
Table 3.3 New York Bulk and Breakbulk Cargo Facilities

	Brooklyn Navy Yard	Newtown Creek	Red Hook	South Bronx	Staten Island (Kill van Krull)	Upper Bay (Sunset Park / Erie Basin)	Flushing Bay	East Chester Creek	Hudson River	Other	Total
Agricultural Products & Food	1	-	2	-	-	1	-	-	1	-	5
All Manufactured Equipment & Machinery	-	-	7	-	4	-	-	-	-	2	13
Building Cement & Concrete	3	-	-	-	-	2	1	-	-	-	6
Coal,Lignite & Coal Coke	-	-	-	-	-	-	-	-	-	2	2
Crude Materials, Inedible Except Fuels	-	-	-	-	3	-	-	-	-	-	3
Distillate,Residual & Other Fuel Oils	3	-	2	4	1	2	-	-	3	14	29
Fish	-	-	-	-	-	-	-	-	-	3	3
Forest Products, Lumber, Logs, Woodchips	1	-	-	-	-	-	-	-	-	-	1
Gasoline, Jet Fuel, Kerosene	-	4	-	-	-	-	-	1	2	1	8
Iron Ore and Iron & Steel Waste & Scrap	-	2	-	1	-	-	-	1	-	-	4
Paper & Allied Products	-	-	-	-	2	-	-	-	-	2	4
Petroleum and Petroleum Products	3	4	-	9	7	3	2	3	7	10	48
Sand, Gravel, Stone, Soil, Dredged Material, etc	5	2	-	1	3	4	4	7	5	7	38
Sulphur (Dry), Clay & Salt	-	-	-	-	1	-	-	-	-	-	1
Waste Material, Landfill, Sludge, Waste Water	5	1	1	1	1	1	1	-	4	7	22
Total	21	13	12	16	22	13	8	12	22	48	187

Source: U.S. Army Corps of Engineers, 2012.

It is important to note that some of the facilities listed in Table 3.23currently may not be operational. Both privately operated facilities and PANYNJ terminals are included as well. Many facilities also are receiving cargo for use directly on the wharf. For example, some petroleum receipt facilities are for supplying power to plants located near the water. As a result, not all of the facilities listed will generate significant road or rail activity when in use.

Figure 3.9 Waterborne Freight Terminals and Commodities Handled, NYMTC Region



Source: U.S. Army Corps of Engineers, 2012

Each of the major water facilities regions are described below.

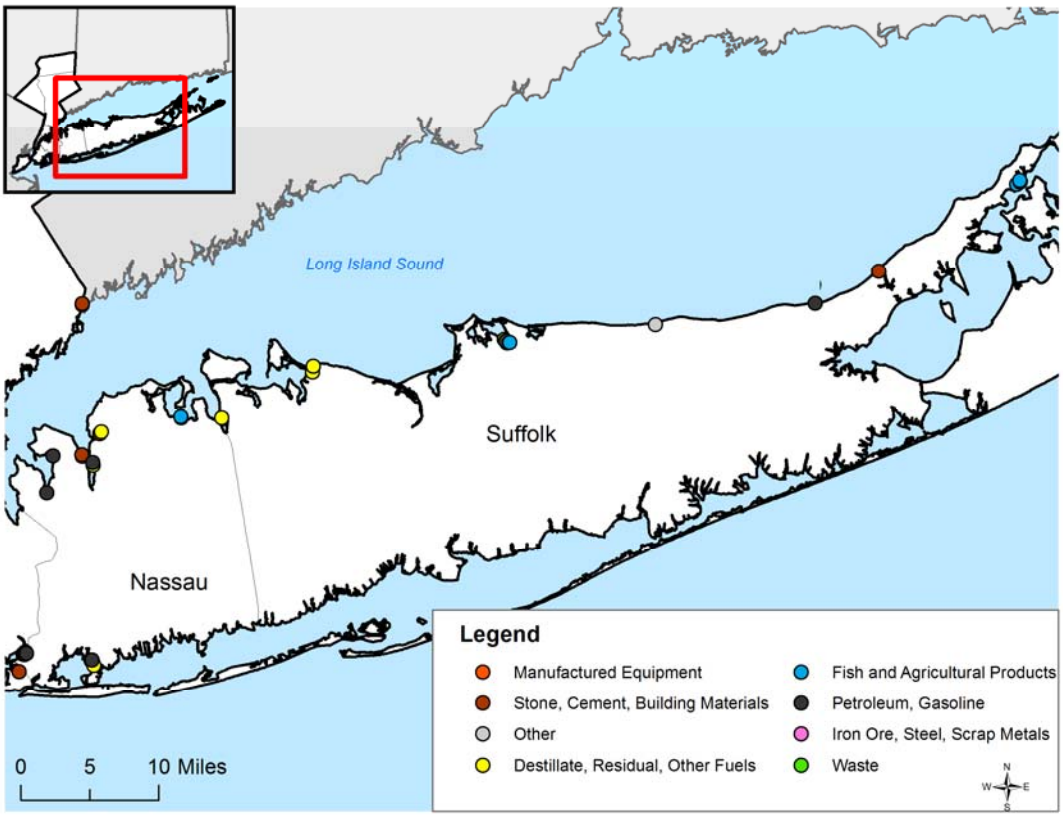
Long Island North Shore

Waterborne cargo handling facilities in Nassau and Suffolk counties are located primarily on the North Shore of the Island, along the inlets and coves that empty into Long Island Sound. Between Great Neck and Greenport, 26 facilities send or receive waterborne cargo. These facilities include:

- 7 petroleum and petroleum products facilities;
- 6 distillate, residual, and other fuel oils facilities;
- 6 of the NYMTC Region's 8 fish facilities;
- 6 sand, gravel, stone, rock, or dredged material facilities; and
- 1 pulp and waste paper facilities.

As shown in Figure 3.10, clusters of three or more facilities can be found along Hempstead Harbor in Hempstead and Glen Cove, Oyster Bay, Port Jefferson, and Greenport

Figure 3.10 Long Island North Shore Bulk and Breakbulk Terminals



Source: U.S. Army Corps of Engineers, 2012.

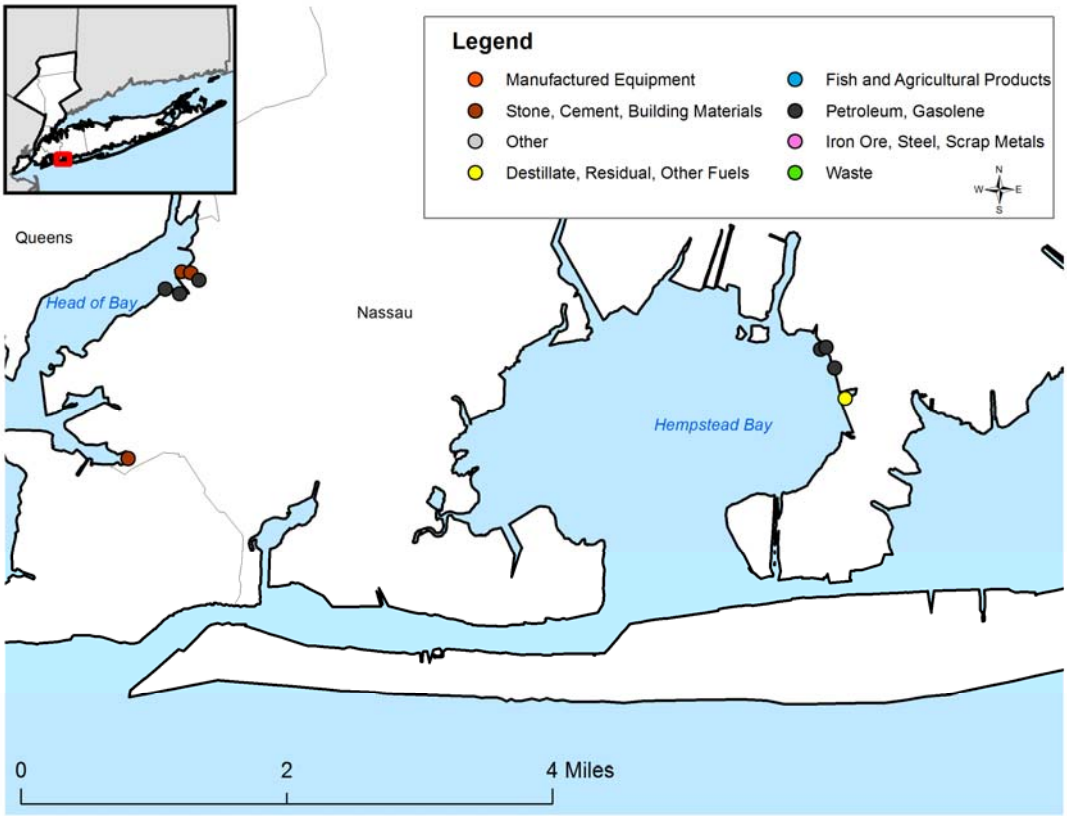
Long Island South Shore

Ten facilities are clustered on the South Shore of Long Island, all in the southwestern portion of Nassau County. These facilities include:

- 6 petroleum and petroleum products facilities;
- 3 sand, gravel, stone, rock, or dredged material facilities; and
- 1 distillate, residual, and other fuel oils facilities.

As shown in Figure 3.11, three of the petroleum facilities and the distillate and residual oils facility are located in Oceanside, along Hog Island Channel in Hempstead Bay. The remaining 6 facilities are located on Head of Bay and Mott Basin on the east side of Jamaica Bay in the villages of Lawrence and Inwood.

Figure 3.11 Long Island South Shore Bulk and Breakbulk Terminals



Source: U.S. Army Corps of Engineers, 2012.

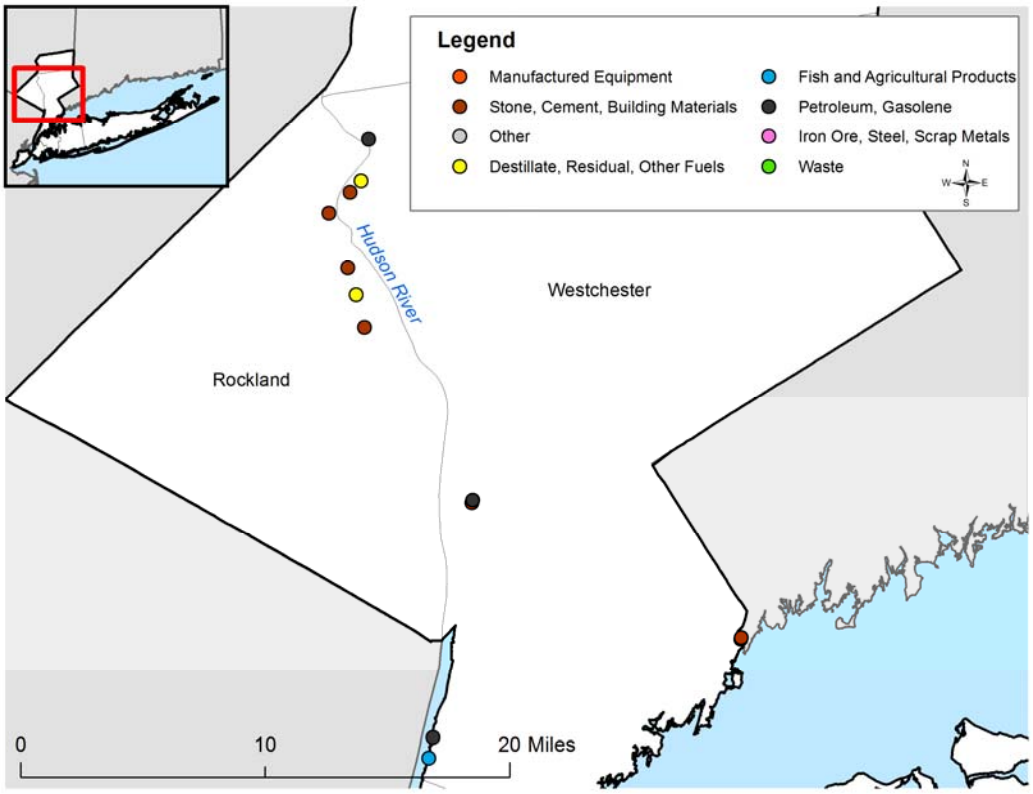
Mid Hudson South Area

In the Mid Hudson South area as shown in Figure 3.12, bulk and breakbulk marine terminals are located along both banks of the Hudson River in Westchester and Rockland counties. Seven terminals are located on the eastern bank of the Hudson River, in the municipalities of Yonkers, Tarrytown,

Buchanan, and Peekskill. Four terminals are located on the western bank in the towns of Haverstraw and Stony Point in Rockland County. The 11 terminals together include:

- 5 sand, gravel, stone, rock, or dredged material facilities;
- 3 petroleum and petroleum products facilities;
- 2 distillate, residual, or other fuels facilities; and
- 1 food or agricultural products facility.

Figure 3.12 Mid Hudson South Bulk and Breakbulk Marine Terminals

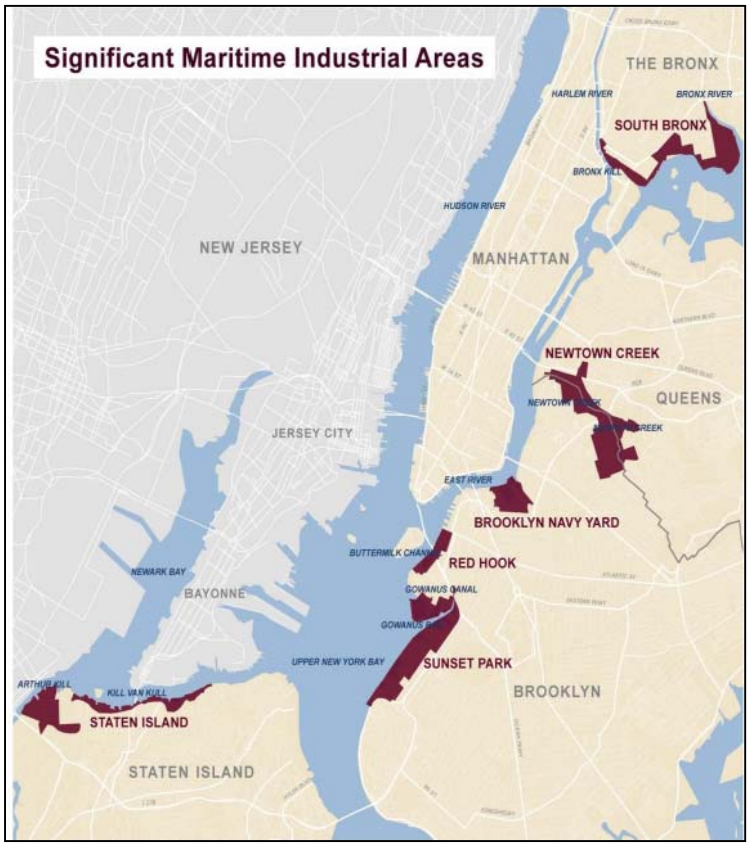


Source: U.S. Army Corps of Engineers, 2012.

New York City

Within New York City, bulk and breakbulk marine terminals and maritime support services are located in six primary clusters—the North Shore of Staten Island, Sunset Park in Brooklyn, Red Hook in Brooklyn, Brooklyn Navy Yard, Newtown Creek in Brooklyn and Queens, and the South Bronx waterfront. The major facilities and commodities handled in each of these clusters are summarized below and shown in Figure 3.13.

Figure 3.13 Significant Maritime Industrial Areas in New York City



Source: Maritime Support Services Location Study Phase Phase I and II, NYCEDC, Presented to Transportation Research Forum on May 13, 2010.

North Shore of Staten Island

Along the north shore of Staten Island, and along the shores of the Kill van Kull and Arthur Kill, several types of bulk and breakbulk terminals handle commodities such as petroleum products, sand, paper products, and machinery. This includes both private terminals and PANYNJ facilities. A variety of petroleum and gas products are handled on Staten Island. Mobil oil has multiple berths for receipt and shipment of petroleum products by tanker or bunkering barges, as does GATX Terminals Corp.

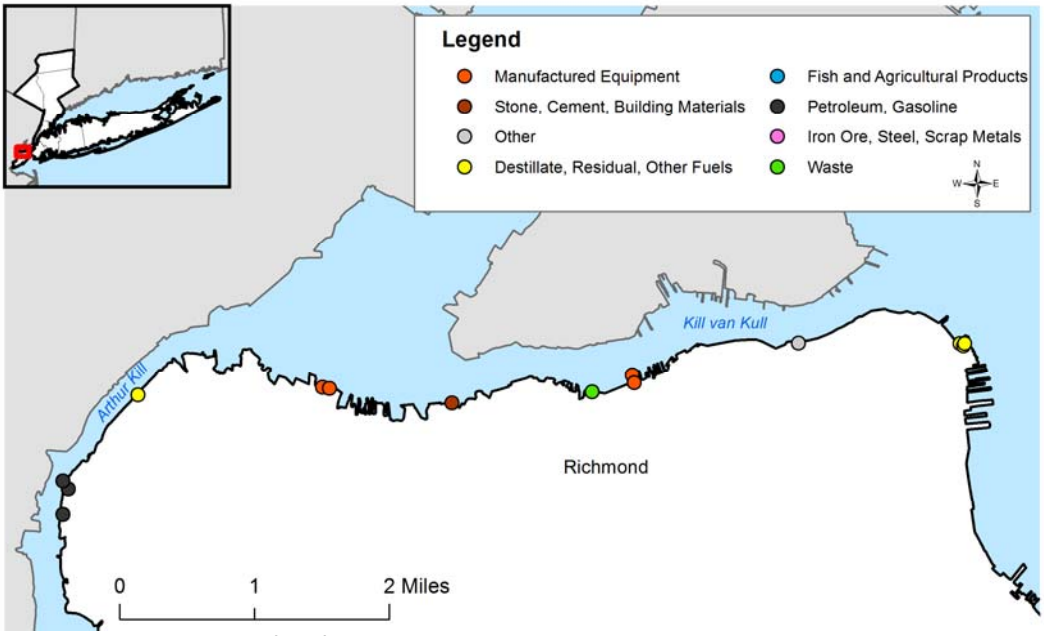
The Army Corps of Engineers ports database includes 14 bulk and breakbulk marine terminals located on the North Shore of Staten Island. These facilities include:

- 4 manufactured equipment and machinery facilities;
- 4 distillate, residual and other fuels facilities;
- 3 petroleum and petroleum products facilities;
- 1 sand, gravel, stone, rock, or dredged material facility;

- 1 waste facility (City of New York Wastewater Control Plant pier); and
- 1 sulfur, clay, or salt facility.

As described in Section 3.1, New York Container Terminal, located on Staten Island, handles some bulk/breakbulk cargo, such as cement, paper, glass, and metal products. Other types of materials handled in Staten Island (see Figure 3.14) include machinery and manufactured equipment at Caddell Dry Dock & Repair Co. and Southern Duo facilities; sand and gravel at Scaramix wharf; sulfur and salt at Atlantic Salt Co.; paper products at Visy Paper; and a municipal solid waste (MSW) marine transfer station (MTS) operated by the City of New York.

Figure 3.14 North Shore Staten Island Bulk and Breakbulk Terminals



Source: U.S. Army Corps of Engineers, 2012

Sunset Park and Red Hook

There are active industrial waterfront stretches along Upper New York Bay, Gowanus Bay and Gowanus Canal, and Buttermilk Channel in Brooklyn's Sunset Park, Gowanus, and Red Hook neighborhoods. The area contains Red Hook Container Terminal, which also handles breakbulk and Ro-Ro cargo.

There are 24 bulk and breakbulk facilities operating in this area, including:

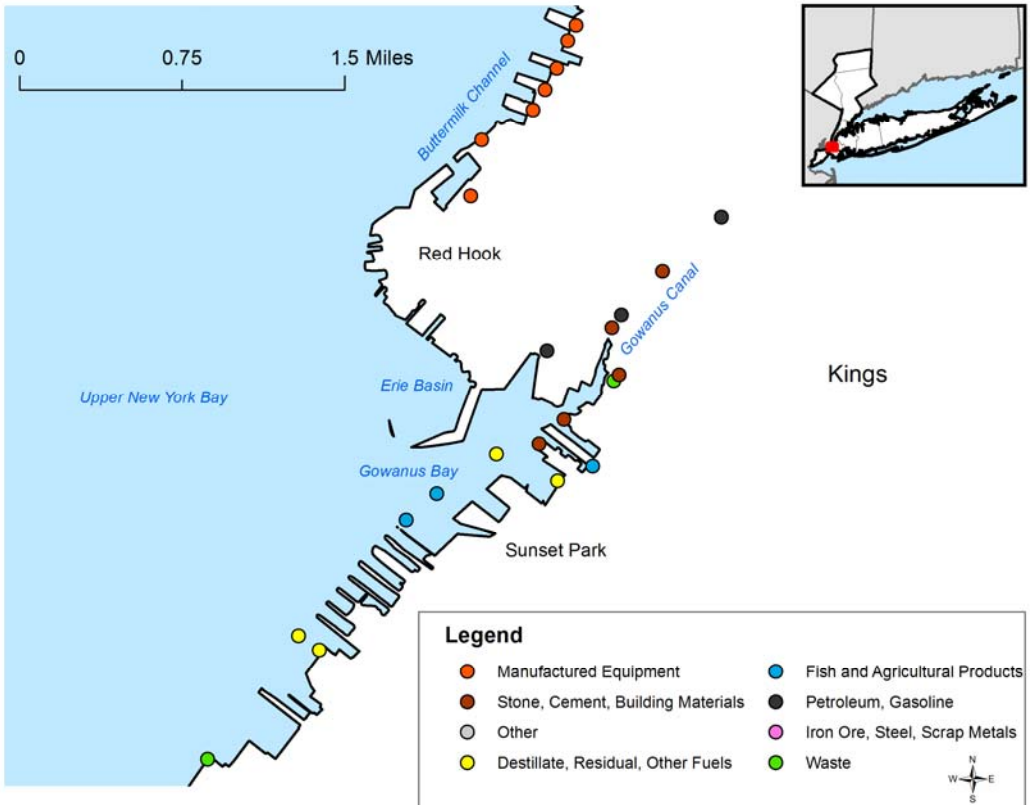
- Distillate and residual fuel oils and other petroleum products at three facilities: Consolidated Edison Co., Bayside Fuel Oil Depot, and Amerada Hess Corp Terminal;
- Sand, gravel, and stone at five facilities: Greco Brothers Ready Mix Concrete Co., Brooklyn Asphalt Plant, Ferrara Brothers Building Materials, New York

Sand & Stone Co.,; and Sunset Industrial Park, operated by New York Cement Co.;

- South Brooklyn Marine Terminal, which is used for receipt of agricultural and food products.
- The Owl's Head Pollution Control Plant, used for the shipment of sludge by the City of New York Department of Environmental Protection; and
- New York City marine transfer station at Hamilton Avenue.

The New York City Economic Development Corporation recently led a $115 million project to reactivate a portion of the South Brooklyn Marine Terminal to accommodate automobiles and other roll-on/roll-off cargo and a new municipal recycling facility. The project also extended the First Avenue rail line northward to serve the terminals, connecting them to the Bay Ridge Branch and the NYNJ Rail carfloat service (see the Rail and Intermodal memos for more detail). These facilities are shown in Figure 3.15.

Figure 3.15 Sunset Park and Red Hook Bulk and Breakbulk Terminals



Source: U.S. Army Corps of Engineers, 2012.

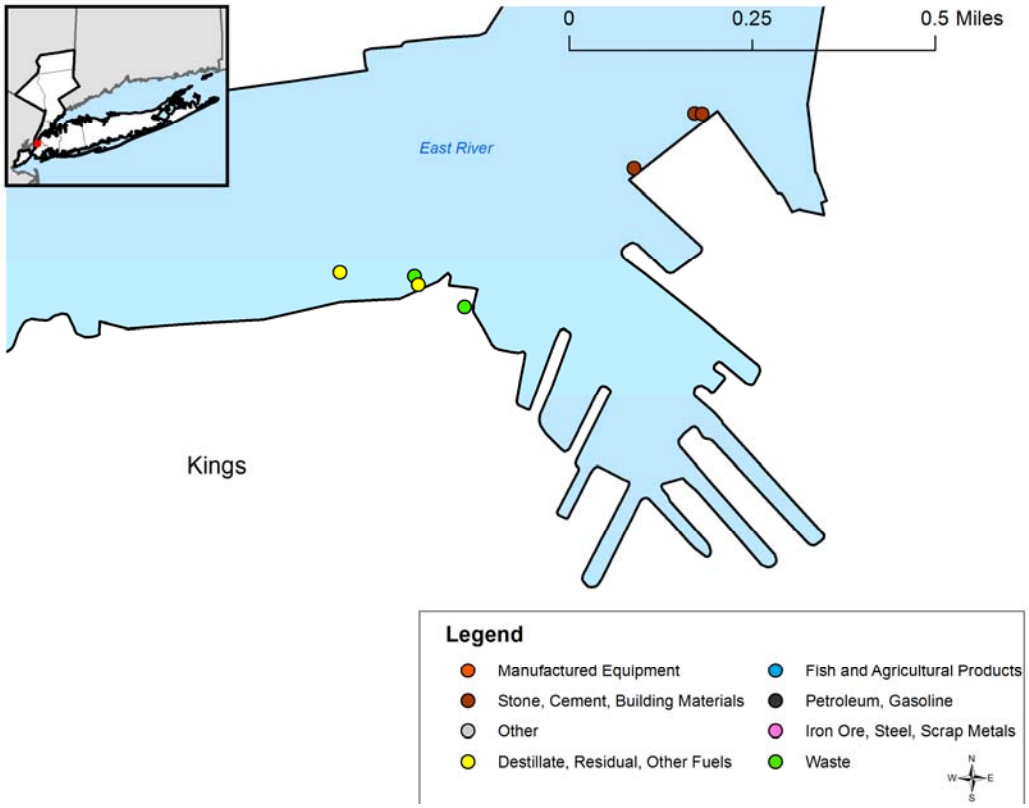
Brooklyn Navy Yard

The Brooklyn Navy yard is located along the East River and was historically used for shipbuilding and repairs, a function that continues today. Several types

of bulk and breakbulk cargoes also are shipped or received here (as shown in Figure 3.16), including:

- Various construction materials, including cement, concrete, gravel, stone, etc.; are handled at Norval Inc's Pier K, and New York Sand & Stone Co.'s Pier J.
- Distillate, residual, and other fuel oils at multiple Consolidated Edison Co. piers for consumption by plants.
- Shipment of waste water and sludge by various facilities:
  - Consolidated Edison Co Hudson Avenue Generating Station;
  - Red Hook Water Pollution Control Plant; and
- Forest products at the Lumber Exchange Terminal.
- Sugar at the Amstar Corp Raw Sugar Wharf.

Figure 3.16 Brooklyn Navy Yard Bulk and Breakbulk Terminals



Source: U.S. Army Corps of Engineers, 2012

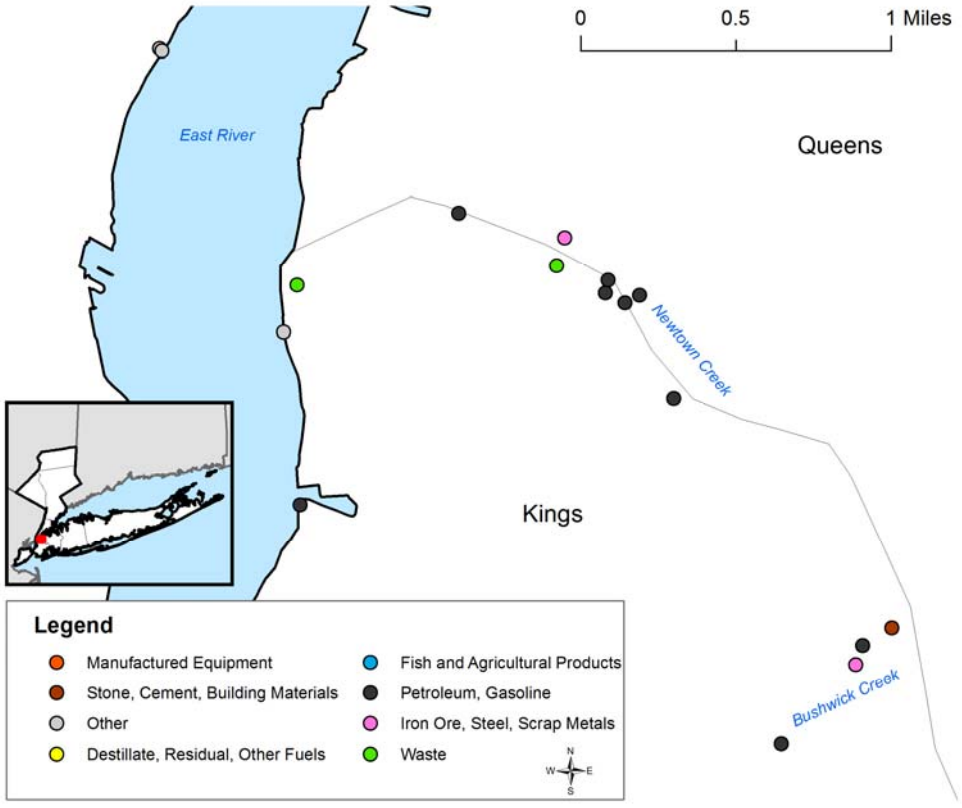
Newtown Creek

Newtown Creek is a tributary of the East River, and forms a portion of the border between Kings and Queens Counties. Fifteen bulk and breakbulk marine terminals are located in the vicinity of Newtown Creek, 9 of which accommodate

petroleum or gasoline at a variety of petroleum and aggregate materials terminals as shown in Figure 3.17, including:

- Gasoline, heating oils, and residual oils at piers operated by companies which include:
  - Shell Oil;
  - Metro Terminals Corp.;
  - Bayside Fuel Oil;
  - Ditmus Oil Associates;
  - Getty Petroleum; and
  - Amoco Oil.
- Scrap metals at Charles J King and Hugo Neu Schnitzer East Co. docks.
- Sand, gravel, and crushed stone at Empire Transit Mix and Principe-Danna docks.
- Refuse at the City of New York Department of Sanitation MSW Greenpoint MTS facility.

Figure 3.17 Newtown Creek Bulk and Breakbulk Terminals



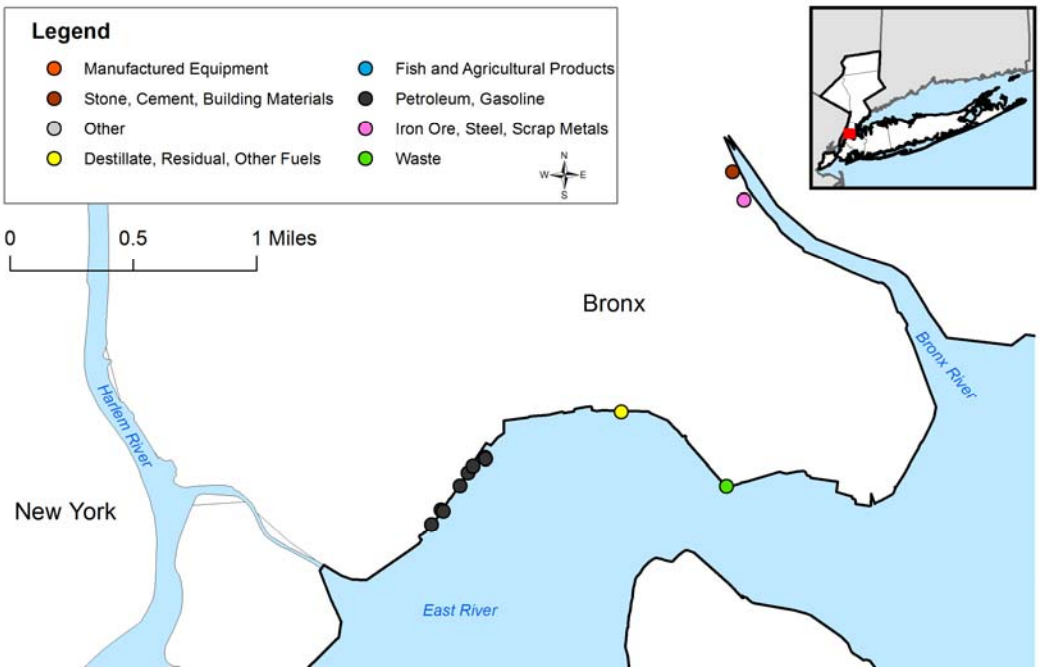
Source: U.S. Army Corps of Engineers, 2012

South Bronx Waterfront

Twelve bulk and breakbulk marine terminals are located in the South Bronx, along the East River and Bronx River as shown in Figure 3.18. The two largest facilities are the Castle Oil Corp. Bronx Terminals, and Stuyvesant Fuel Terminal Corp. East River Docks. Both receive petroleum products via barge. There also is a facility owned by Schildwachter & Sons used for receipt of heating oils by barge and small tankers.

Bronx Metals Recycling (a division of Hugo Neu Schnitzer East Co.) also operated a scrap metal shipment pier in the South Bronx. Another significant facility in the Bronx region is the Wards Island Water Pollution Control Plant, which has a wharf for the purpose of receiving sludge for processing. The Casa Redimix Concrete Corp. also operates in the South Bronx and receives crushed stone via barge.

Figure 3.18 South Bronx Bulk and Breakbulk Terminals



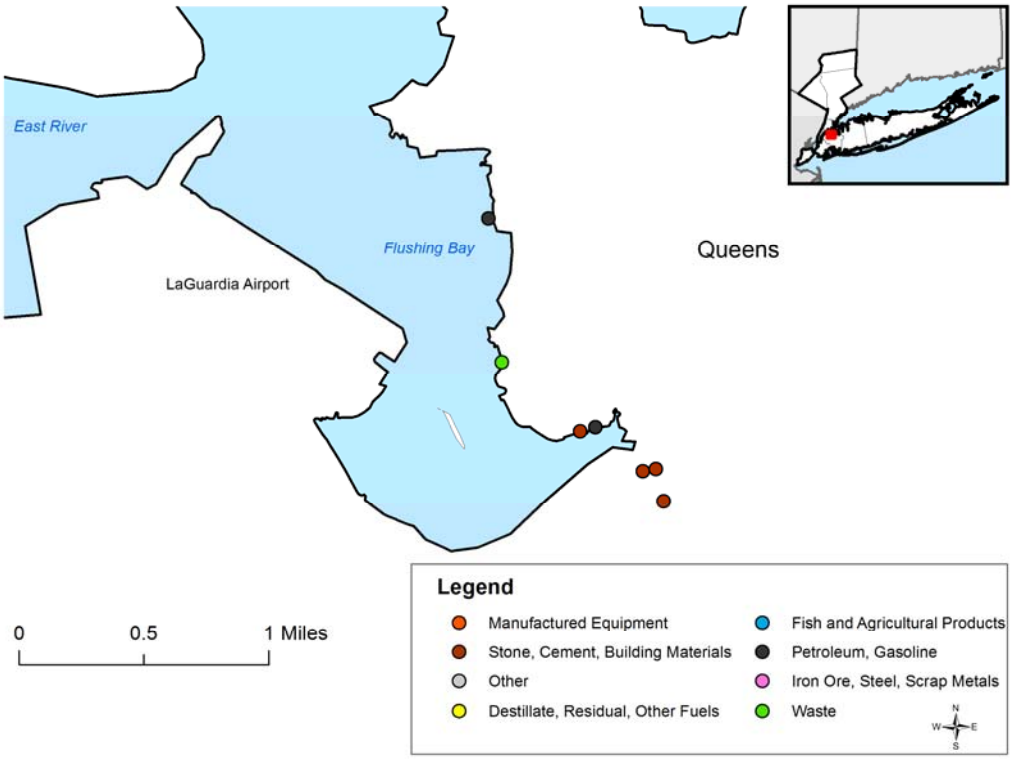
Source: U.S. Army Corps of Engineers, 2012

Other Areas

In addition to the six areas where most marine facilities are clustered, there are several locations with smaller clusters of cargo handling facilities, detailed below.

Flushing Bay– Located in Queens County, Flushing Bay includes two oil receipt terminals, four aggregate terminals, one cement terminal, and a refuse barge shipment terminal (see Figure 3.19).

Figure 3.19 Flushing Bay Bulk and Breakbulk Terminals



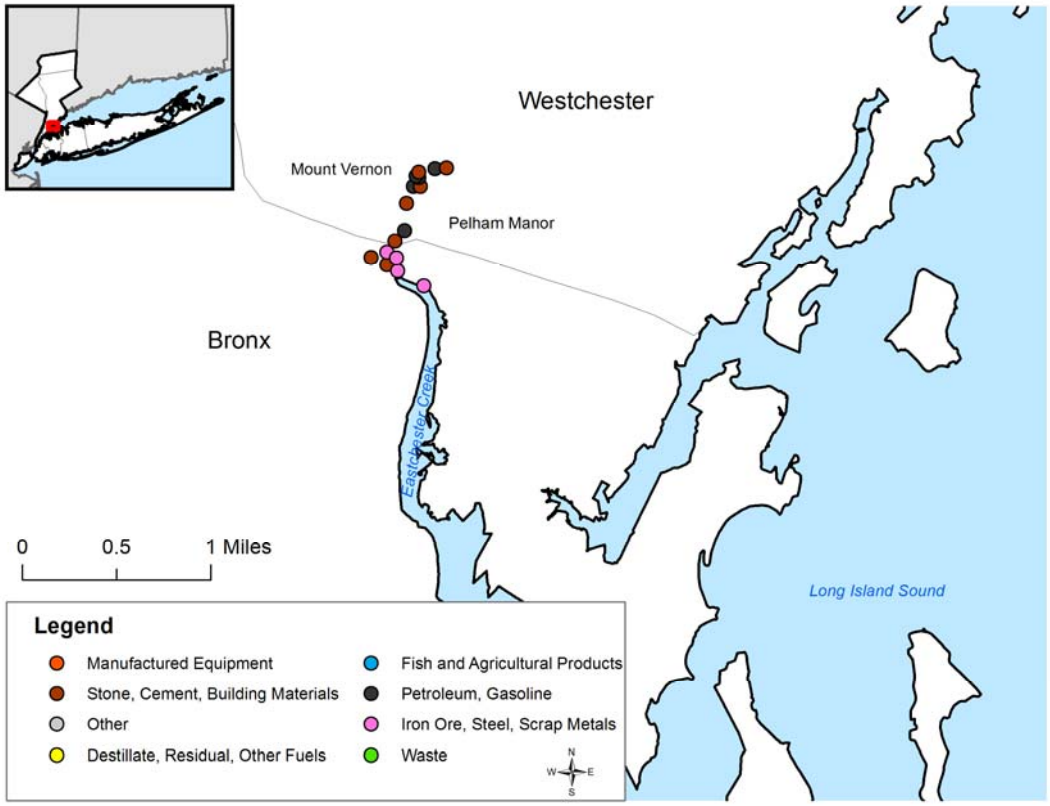
Source: U.S. Army Corps of Engineers, 2012

Eastchester Creek– Eastchester Creek (as shown in Figure 3.20) is a tributary of the Hutchinson River. Several marine-served industrial facilities are located along the creek in Bronx County and the Westchester County communities of Mount Vernon and Pelham Manor. Although the U.S. Army Corps of Engineers database indicates 16 active facilities located in Eastchester Creek (the Hutchinson River), only 7 facilities were active there as of 2011.[6] Pasco Scrap Metal Corp. has three berths for shipment of scrap metal by barge. Sprague Oil is the only remaining liquid bulk terminal located in the area. Four facilities are open for receipt of aggregate products such as stone and gravel. The decline in waterborne transport in Eastchester Creek is attributed to lapsed maintenance in dredging the channels and berths.[7]

[6] Empire State Development Corporation, "Small Business Dredge Needs Port of New York Study," 2012.

[7] Ibid.

Figure 3.20 Eastchester Creek Bulk and Breakbulk Terminals



Source: U.S. Army Corps of Engineers, 2012

4.0 Waterborne Cargo Challenges and Opportunities

4.1 Terminal Capacity Constraints and Expansion Plans

Port Newark Container Terminal

The primary long-term capacity constraint at Port Newark Container Terminal (PNCT) is its container yard throughput capacity. A strad-based container yard has a lower stacking-density and throughput-capacity per acre than other styles of operation. Three of PNCT''s nine dock cranes also are smaller and older, with limited ability to handle modern sized cargo ships, and which may need to be replaced to meet future capacities with an increased backland capacity. With its current style of container yard operation (strads), the terminal is operating near its container yard capacity, while the berth has spare capacity.

PNCT is estimated to have a capacity of 750,000 annual containers, or about 1.3 million annual TEU after $250 million in investments in the past decade.[8] About $500 million in further improvements are planned by PNCT by 2030, with up to another $150 million from the PANYNJ. These improvements include developing an additional 80 acres of container stacking area, upgrading equipment, purchasing additional strads, and purchasing three new Super Post-Panamax dock cranes, which will allow the terminal to accommodate the larger ships that are expected to arrive in the Port once the Panama Canal widening is completed in 2015. PNCT also plans to dredge its berths so two berths will have 50 feet of water depth. It is expected these improvements may raise capacity to 1.2 million annual containers (2.0 million annual TEU).

Global Marine Terminal

Global Marine Terminal already has a fairly densely spaced berth, with one dock crane for every 300 feet. Berth capacity is limited due to the length of the berth (1,800 feet), which can accommodate only a single large modern container ship at a time. However, major improvements are in tsore for the facility that will allow for efficient service for large post-Panamax vessels. Terminal expansion plans include incorporating an additional 70 acres of land for stacking areas and the berth will be extended 880 feet—yielding two full berths. The new design of the facility includes 20 automated stacking cranes (ASC) which allow denser

[8] http://www.panynj.gov/port/terminal-improvements.html

container stacking per acre. These changes will be supported by the addition of on dock rail to the facility, capable of 250,000 lifts per annum. The water depth (43 feet) also is insufficient to accommodate the largest containerships in operation.

Terminal expansion plans include incorporating an additional 70 acres of land for container stacking areas. The berth at Global also will be extended 880 feet, yielding two full berths. In addition, as part of an overall redesign of the facility, Global plans to implement 20 Automated Stacking Cranes (ASC) in 2013, a style of overhead crane which allows denser container stacking per acre than RTG styles of operation.

New York Container Terminal

NYCT''s primary capacity constraint is its current low-productivity, pick-style of operation. While this style of operation is suitable in a low-throughput environment, over time more efficient modes of operation will need to be implemented to ensure adequate container yard capacity.

NYCT has numerous expansion projects under consideration. A new berth with 50 feet of water depth is being planned; currently NYCT''s deepest berth of 45 feet is insufficient to handle large containerships. Almost 40 acres of backland also will be added to the terminal. As part of this expansion, NYCT will purchase 16 rail-mounted gantry cranes (RMG) and four new dock cranes.

APM Terminal

APM terminal already is a fairly densely configured RTG-based terminal. As the terminal's dock cranes already are fairly closely spaced, assuming no new cranes are added and each crane can perform about 100,000 annual lifts at capacity, APM terminal has a berth capacity of around 2.6M annual TEU. Overall, berth and backland capacity are fairly well balanced. Recent terminal upgrades include the purchase of four dock cranes capable of accommodating containerships loaded with 22 containers across at the widest point and increasing backland area from 266 to 350 acres.

Maher Terminal

Maher terminal has a berth up to modern standards, with 50 ft. of water depth and 9 dock cranes able to accommodate large containerships. The backland configuration is likely the constraining factor to the facility's overall capacity due to the low density of strad-based container-yard operations per-acre.

Maher also has implemented upgrades recently, primarily in new technologies, such as implementing the latest NAVIS terminal operating system. On-dock rail also was expanded to 45,000 total feet of track.

Additional Port Wide Improvement Plans

Rail facilities also will be expanded at key facilities, including additional tracks at Maher and APM terminals, as well as the ExpressRail facility serving PNCT. A new intermodal yard is planned, the Corbin Street Intermodal Support Yard. The facility will include 5 tracks up to 10,000 feet long each to increase rail capacity and flexibility.

4.2 WATERSIDE ACCESS CONSTRAINTS

Channel and berth depths pose existing or potential constraints on the waterborne transportation system. The harbor was deepened to 45 feet in 2005 to accommodate larger container vessels. Currently, the Port Authority and U.S. Army Corps of Engineers are working together to deepen the channels on the approaches to Port Newark, Port Elizabeth, Global Marine Terminal, and New York Container Terminal to 50 feet. This depth is necessary to accommodate Post-Panamax vessels that are expected to call on the Port after the Panama Canal is widened in 2015. Currently, Norfolk and Baltimore are the only other East Coast container ports that have 50-foot channels. The harbor deepening project is scheduled to be completed in 2014.

For independent bulk and breakbulk facilities, channel and berth depths are also a constraint notably in Eastchester Creek, and in the Mariners Harbor section of the North Shore of Staten Island. Many berths and piers are out-of-use due to insufficient water depths resulting from insufficient maintenance dredging.

Air draft clearance also poses a constraint in the Port. The Bayonne Bridge, which crosses Kill Van Kull 151 feet above the water's surface, is too low to allow passage of the largest container ships currently in service in other parts of the world. The Port Authority recently secured federal approval for a project to raise the roadbed of the Bayonne Bridge to 215 feet above the channel.

4.3 LANDSIDE ACCESS CONSTRAINTS

Landside access to marine terminals throughout the region is challenging due to congested highways and lack of rail access to most independent terminals. With the exceptions of Global Marine Terminal and Red Hook Container Terminal, all of the container terminals have on-dock rail. The Port Authority could potentially develop on-dock rail capability at Global Marine Terminal, due to the close proximity of Greenville Yard (see Rail memo for more detail). At Red Hook Container Terminal, there is no potential for a rail connection, and highway connections via the Gowanus Expressway and Brooklyn-Queens Expressway are chronically congested. Many of the bulk and breakbulk terminals, especially those located in the Sunset Park and Gowanus areas of Brooklyn, South Bronx, Newtown Creek, and the North Shore of Staten Island have similar highway congestion issues.

Preservation of waterfront industrial land for marine industrial use is another challenge in the Region. As waterfront residential and mixed-use development remains popular and desirable in many communities, the potential exists for encroachment upon and/or elimination of maritime industrial facilities.

The effects of climate change, such as sea level rise, and susceptibility to storm surge associated with hurricanes and nor'easters, present additional threats to landside marine facilities. Superstorm Sandy interrupted waterborne trade in the region, as cleanup and emergency repairs were required to restore many terminals to operating order. Although long-term preparedness, "smart" land use, and construction strategies are currently debated, Sandy demonstrated the Region's vulnerability to natural disasters, and set new benchmarks for the potential impacts of future storms.

Figure 4.1 Photographs of Superstorm Sandy Impacts at PANYNJ Container Terminals in New Jersey

Source: Anne Strauss-Wieder, Inc., 2013

4.4 MARITIME SUPPORT SERVICES

The 2007 Maritime Support Service Location Study identified a significant shortage of support services infrastructure in New York Harbor as an existing condition, which is expected to worsen in the future. Insufficient dry dock capacity in the Harbor, and a shortage of skilled labor, results in long repair queues and vessels being transported to other states for emergency repair. Similarly, long queues to undertake auxiliary operations such as fueling, water removal, bilge disposal, and crew changes impact the capability of the maritime industry to conduct business safely and efficiently.[9]

[9] New York City Economic Development Corporation, Maritime Support Services Location Study, 2007.

4.5 NEW MARKETS AND TRADE LANES

Panama Canal

The expansion of the Panama Canal, expected to be completed in 2015, will improve all-water access between the East Coast of the United States and East Asia, and could result in re-routing of some East Coast and Midwest cargo from West Coast ports to East Coast ports. This change in travel pattern could result in increased volume of containers traveling through PONYNJ, and a change in the direction of container travel on the region's highway and rail networks, as some West Coast-based land-bridge traffic could shift to an East Coast-based distribution pattern to other parts of the country. It is critical that the PANYNJ container facilities meet post-Panamax standards to ensure the continued leadership role of the Region's port facilities. Diversion of port traffic to other east coast ports would result in increases in the time and cost of shipping goods into and out of the region by rail or truck (with the latter impacting already severe roadway congestion), not to mention the direct loss of port-related employment and ancillary labor activities.

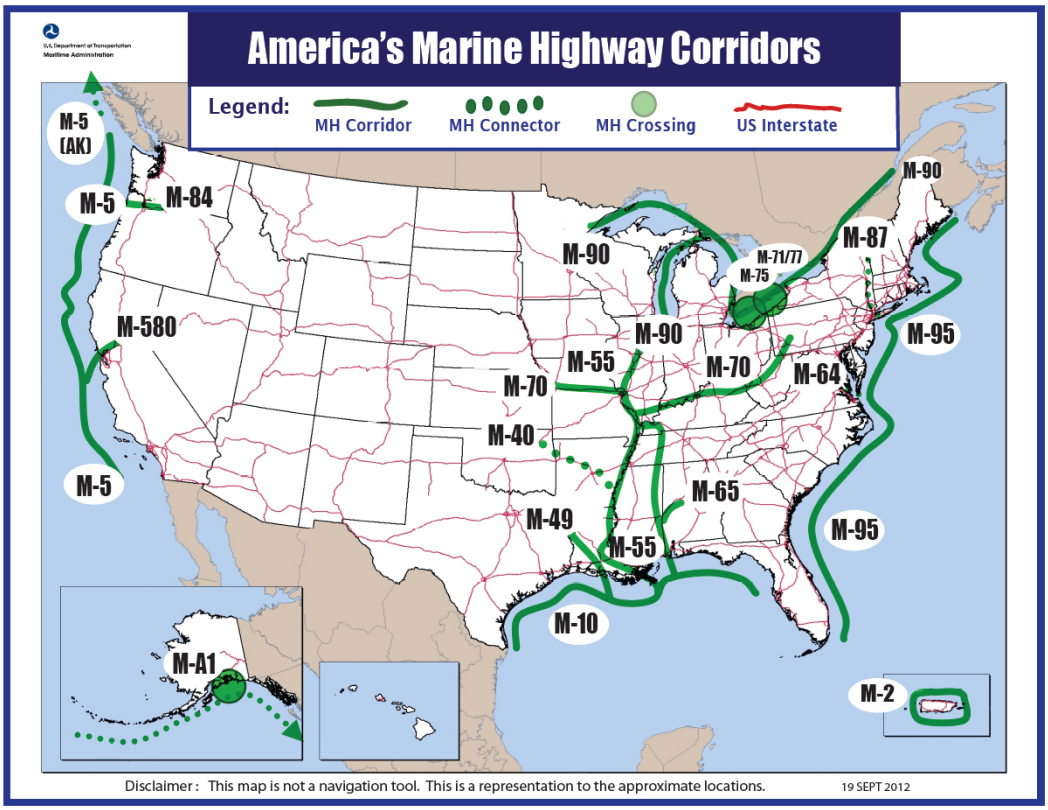
Marine Highways

The U.S. Maritime Administration (MARAD), in partnership with transportation agencies throughout the country, has designated 11 "marine highway" corridors throughout the country, including two that traverse the NYMTC Region, M-87 and M-95, shown in Figure 4.1. Marine highways are navigable waterways that support or relieve congested landside transportation systems. Currently 8 projects and 6 initiatives are underway along designated marine highway corridors, aimed at studying the feasibility of potential services, starting new services, or expanding existing services. Projects and initiatives impacting the NYMTC Region include:

- Cross Sound Enhancement Project, which aims to improve existing ferry services across Long Island Sound, increasing capacity to accommodate an additional 3,000 trucks per year between Connecticut and Long Island;
- Trans-Hudson Freight Connector Project, which aims to expand the quality and capacity of the Cross-Harbor rail float service between New Jersey and Brooklyn; and
- Hudson River Food Corridor Initiative, which aims to study the feasibility of transporting fresh produce from agricultural regions in North-Central New York near the Hudson River and Long Island to the New York-Newark Metropolitan Area.

These projects offer the potential to support the Region's maritime economy, complement landside transportation services, and relieve landside congestion.

Figure 4.2 Marine Highway Corridors



Source: U.S. Department of Transportation