Analysis of Barge/Ferry Service for Trucks from Hunts Point Market to Midtown-Manhattan

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Abstract

In May 2007, the New York Metropolitan Transportation Council (NYMTC) undertook an analysis of providing some means of barge or ferry service to Manhattan for the trucks and vans serving the new Fulton Fish Market and other markets in Hunts Point. This report examines the issue through several categories of related topics: tides and waterways, landing sites, vessel types, operational types and possible operating plans, issues and costs.

Disclaimer

Credits

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Overview

In April of 2003, the Hunts Point Task Force, a diverse group of stakeholders including public agencies, non-profit organizations, civic organizations, residents, local businesses and elected officials was convened to develop a strategic plan for the Hunts Point Peninsula. The resulting document, the *Hunts Point Vision Plan*, focused on improvements in four areas – land use, waterfront, workforce development and traffic and transportation. One outcome of the plan was a waterborne freight study, the *Hunts Point Waterborne Freight Assessment*. The Assessment was undertaken by the New York Metropolitan Transportation Council (NYMTC) and explored opportunities to use waterborne modes to transport goods to and from Hunts Point.

In May 2007, the office of Congressman José Serrano requested that NYMTC evaluate waterborne service for the trucks and vans serving the new Fulton Fish Market now located at the Hunts Point Distribution Center to and from Manhattan. This study examines the issue through several categories of related topics: tides and waterways, landing sites, vessel types, operational types and possible operating plans, issues and costs.

The current study expands on the Assessment by focusing on a detailed local waterborne distribution service from the Fulton Fish Market to midtown Manhattan. Each aspect of the service concept is evaluated.

This analysis can now be used by local officials to decide if further exploration of a waterborne distribution service is deemed appropriate.

Examples of Waterborne Truck Services

Three types of vessels which are considered as candidates appropriate for this service, are discussed below. Others, such as container barge, high speed truck ferry, water taxi, super-fast passenger and vehicle ferry, large conventional ferry and hovercraft, are not considered for various reasons.

Truck Barge

A truck barge is simply a barge that is moved by being lashed to a tug and then brought to its destination. The trucks are secured to the deck of the barge.

Detroit-Windsor Truck Barge

This service was primarily proposed for moving hazardous materials. But after it started operation in 1990, the operator was successful in attracting new markets such as over-dimensional shipments by truck and some expedited, time-sensitive services (e.g., FedEx). The service runs between Detroit, Michigan (U.S.) and Windsor, Ontario (Canada) on the Detroit River. It is run by a private company and has been proven to be profitable. In 2004, the truck ferry handled over 109,300 metric tons of freight, up from 91,900 metric tons in 2003.

The transit time is 20 minutes in which truckers are not allowed out of their vehicles. The barge can handle eight trailers and tractors. Each terminal occupies a two-acre site located in industrial areas. The vessel is an existing barge and is used as a ramp at both terminals allowing trucks to be driven on and off the barge.

Figure 1. Windsor-Detroit Freight Ferry[1]

[1] http://www.truckferry.com/index.html

The truck barge operates as a scheduled service with reservations generally required. About 80 percent of the vehicles use the reservation system. Beyond the reservation process, the ferry company has negotiated several specific contracts with steel companies. The contracts provide a subscription type of service with regular trips booked in advance for a specified price. The ferry makes five round trips daily on weekdays. Service begins at 7 am with the final run from Windsor to Detroit leaving at 4 pm The current fee structure for the ferry is shown in Table 1.

Table 1. Current Fee Structure on the Detroit-Windsor Truck Barge [2]

Commercial Vehicles: (including driver and passengers)	Current Rates
Escort	$ 5.00
Tractor Only	$ 30.00
Van or Pick-up	$ 60.00
Straight Truck	$ 85.00
Tractor-Trailer - less than 80,000 GVW and less than 80' length	$ 115.00
• Over width only - less than 10' wide and less than 80,000 GVW* and less than 80' length	$ 115.00
• Over width only - between 10'-14' wide and less than 80,000 GVW* and less than 80' length	$ 200.00
• Over width only - between 14' - 16' wide and less than 80,000 GVW* and less than 80' length	$ 250.00
• Over height only- less than 80,000 GVW* and less than 80' length	$ 250.00
• Over height and over width - less than 100,000 GVW* and less than 80' length	$ 500.00
Heavy lift - greater than 80,000 GVW* and less than 150' length	$1,100.00
Superload - greater than 80,000 GVW* and greater than 150' length	$1,650.00

Source: Detroit-Windsor Truck Ferry, http://www.truckferry.com

Quincy-Deer Island Barge:

The Deer Island Barge service was in place for a decade in the Boston Harbor, from 1990 to 2000, and served as a means for moving construction materials from the mainland to Deer Island for development of a wastewater treatment plant. It is special in that the niche market it served is limited to construction equipment. The truck barge only operated during a major multi-year

[2] (A.L.C. de Cerreno et al, Bi-State Domestic Freight Ferries Study, 2006)

project. The Deer Island Barge was designed to meet the need to convey a significant amount of construction material to a site for a prolonged period of time in a manner that reduced the negative impacts on the neighboring community. Of note, the "market" was created through a public policy decision to barge material and personnel.

The Massachusetts Water Resources Authority (MWRA) sponsored this service for 10 years during the construction of the $3.8 billion wastewater treatment plant on Deer Island in Boston Harbor. Over the 10-year period, the ferry service handled 464,000 trucks and approximately $2.2 billion worth of cargo. No trips were ever cancelled nor were any claims filed for damage to cargo. Approximately 10 acres of a former shipyard dock in Quincy, Massachusetts were used for the ferry operation and as a staging area.

The physical operation of the freight barge consisted of trucks and construction equipment (e.g., bulldozers, cranes) loaded onto a specially designed barge. Drivers were not permitted to move their vehicles onto the barge; the operator, Boston Towing, retained a trucking service – Pennsylvania Truck Lines – for this purpose. Drivers were also not permitted to travel with their vehicles on the barge; rather, they were required to ride a separate 40-passenger "runabout" vessel for the one-hour trip. The runabout also served as an auxiliary tugboat for maneuvering the barge into the transfer bridges. If the drivers had remained with their vehicles, the operation would have been subjected to additional expenses associated with U.S. Coast Guard requirements, including life saving equipment and barge inspection. The Coast Guard, according to the interviewees, does not typically inspect deck barges.

The two barges were designed for the project by Seaworthy Systems and constructed by NABRICO of Nashville, Tennessee. Each barge was designed with 15,800 square feet of deck space with the capacity for twenty-five 55-foot tractor-trailers and a maximum allowable wheel load on deck of 15 tons per trailer axle. The barges were designed to be maneuvered by existing tugboats operated by Boston Towing.

The freight barge operated as a scheduled service with reservations required. Construction management staff determined the delivery priority of the shipments and provided information to the operator 24 hours before each trip. The information included data on cargo types, value and vehicle dimensions and weight. Vehicles were required to arrive at least one hour prior to departure for a pre-boarding inspection as mandated by the Federal Highway Administration and the Federal Railroad Administration intermodal regulations. The speed of the barge/tug is more than nine knots.

Frequency of service varied over the course of the construction project. One barge operated twice a day, five days a week, in both directions for about two years. Service then expanded to two

barges, each operating twice daily (morning and afternoon) for about five years. Service was again reduced to a single barge during the remainder of the project.

The barge service was not a for-fee service; the drivers did not pay a fee to use it. Instead, the MWRA decided to consolidate and coordinate all transportation related activities for the treatment plant construction at the inception of the project. The authority paid for equipment, consisting of two custom built barges, four transfer bridges and a site in Quincy, Massachusetts (formerly the General Dynamics Shipyard), along with the barge operations. The four transfer bridges, two at Quincy and two at Deer Island, cost approximately $2.5 million each.

The entire water transportation cost (construction and operation), including both the freight ferry and the construction worker ferries (a separate contract from the freight operation), totaled $81 million over the 10 years of the project. The estimated cost of the freight operation alone was between $35 and $40 million.

Applicability to Hunts Point

An operation similar to the Detroit-Windsor Truck Barge– trucks on barges moved by tugs – could provide a simple, low-speed, low-cost waterborne truck connection for Hunts Point. Terminal costs would be fairly modest and vessel capital and infrastructure costs are low. For purposes of this study, we are assuming the use of a 4,000-hp tug joined to a 400' by 80' (approximate dimensions) barge with a draft of **15 to 24 feet**. The 4,000-hp tug would be capable of moving the barge through all local waters, including Hell Gate against the tide with an average service speed of **nine knots**. The barge, which would be fitted with onboard loading ramps at each end, could accommodate a minimum of **30** tractor-trailers or a larger number of smaller trucks. There is no passenger handling capability. Vessel capital cost is estimated at $4 million for the barge; the tug would be leased at a cost of $4,800 per day (for more than 12 hours) with an additional fuel consumption cost of $350 per hour. In addition, the tug could be leased at $400 per hour for a minimum period of four hours.

Medium-Speed Truck Ferry

A medium-speed truck ferry is a self propelled vessel that can carry motor vehicles and, in some cases, passengers at an average speed of 15 knots

<u>City of Stavanger, Norway</u>

Fjellstrand, a Norwegian manufacturer (http://fsweb.brandmaker.no/), introduced the FerryCat 120 in 2003. The Norwegian operator, Stavangerske, operates a vessel between the City of Stavanger and its suburbs. The concept is a double ended, medium speed car and passenger ferry

based on a catamaran hull. The speed is **22 knots** (41 km/h). The car deck has space for 120 cars or a mix of cars and trucks, with passenger capacity of 400 passengers. In most cases, one FerryCat can replace two traditional ferries. Four rotatable thrusters, one at both end of each hull as well as a 180 degree rotatable wheelhouse, ensures maneuverability, safety and redundancy for this type of ferry service. The Ferry Cat provides a unique alternative to the traditional type of car ferries for short routes, with improved service to the travelers and cost saving for the operator as a result.

360 Degree Rotatable Thrusters and Car Deck High Enough for Trucks

Figure 2. Ferry Cat 120 Freight and Passenger Ferry

Figure 3. Ferry Cat 120 Freight and Passenger Ferry
Timesaving Handling: Trucks Departing from the Deck

Applicability to Hunts Point

For this study, we are assuming the use of a 5,100-hp vessel of approximately 350-feet by 70-feet, capable of loading and unloading at both ends, with a draft of **10 feet**. The vessel would be capable of moving through all local waters, including Hell Gate against the tide, with an average service speed of **15 knots**. The vessel could accommodate a minimum of **30** tractor-trailers or a larger number of smaller trucks. It also can accommodate passengers if desired. Vessel capital cost is estimated at $18 million with an average operating cost of around $11,000 per day including fuel. This represents non-fuel operating cost of around $7,000 per day (for more than 14 hours) with an additional fuel consumption cost of $300 per hour. The fuel cost assumes a more efficient engine design than a tug.

Small Conventional Ferry

Small conventional ferries offer the advantage of quick initiation of service at relatively low cost but with the disbenefit of a great deal of capacity.

Shelter Island Ferry, Long Island, New York

Two small conventional ferry services running between Shelter Island and the town of Greenport to the north and village of North Haven to the south. This is an inexpensive, proven design. However, with capacity of 12 to 15 cars, it is capable of handling a limited number of trucks per trip. Fitted as a double-ended dedicated truck ferry, it would probably carry only six trucks. To move 30 trucks at nine knots, you would need five of these vessels at a capital cost of $12.5 million and an operating cost of $12,000 per day. This is based on the service frequency of a boat every 15 minutes from 5:45 am to 1:45 am (11:45 pm Labor Day thru May 30 on Sunday to Thursday). The ferry route is less than one mile long.

The current fee structure for the ferry is shown in Table 2. The rates for standard trucks are relatively cheaper.

Table 2. Current Fee Structure on the Shelter Island Ferry[3]

	TRACTOR-TRAILERS & FLATBEDS IN TOW UNDER 40 FEET	**TRACTOR-TRAILERS & FLATBEDS IN TOW** OVER 40 FEET
	STANDARD TRUCK RATES	
	(18’ To Under 20’)	LIGHT:
One Way	$10	$35
Round Trip	$15	$50
	(20’ To Under 40’)	HEAVY:
One Way	$10 + $0.5/Foot over 20’	$55
Round Trip	Double One Way Fare	$85

Applicability to Hunts Point

Fitted as a double-ended dedicated truck ferry, it would probably carry only **six** trucks. The vessel costs $2.5 million, with an operating cost of $2,400 per day (20 hour operation per day and a frequency of four boats per hour). To move 30 trucks at **nine knots** at the same time, you would need five of these vessels at a capital cost of $12.5 million.

Because of its low load capacity, an estimate of **10 feet** draft may work, because this requires less dredging around piers.

[3] (http://www.southferry.com/rates.html)

Figure 4. Shelter Island Ferry

Physical Considerations

Tides and Water Levels

Water levels and current speeds are important characteristics to consider because they can determine the extent and expense of building facilities to provide the service as well as the type of vessel that is appropriate to the service. For example, water current speed could determine the amount of power needed to overcome its drag. The depth of the water could determine the draft of the vessel e.g. a lower depth requires a shallower draft vessel.

In general water levels are not adequate at most of the docking locations. Dredging would have to be done to provide adequate depths for any of the vessel types described in a previous section of this report.

Water current speeds in the East River or Hudson River could be overcome by using vessels with more powerful engines although this use more fuel.

Descriptions of water levels at each of the possible locations are located in Appendix 1.

Current Speeds

Current speed varies along the ferry routes. The highest current speed can be found at Hell Gate and 75th Street where the maximum current speeds may reach five knots. But the average current speed along East River is two to three knots, and one to two knots in Hudson River.

Because the time of the high tide shifts every day, it may be very hard for ferry operators to avoid or take advantage of tides. We assume that the tugs and ferries are powerful enough to compensate the reverse tide, given that more fuel would be consumed.

Potential Landing Sites

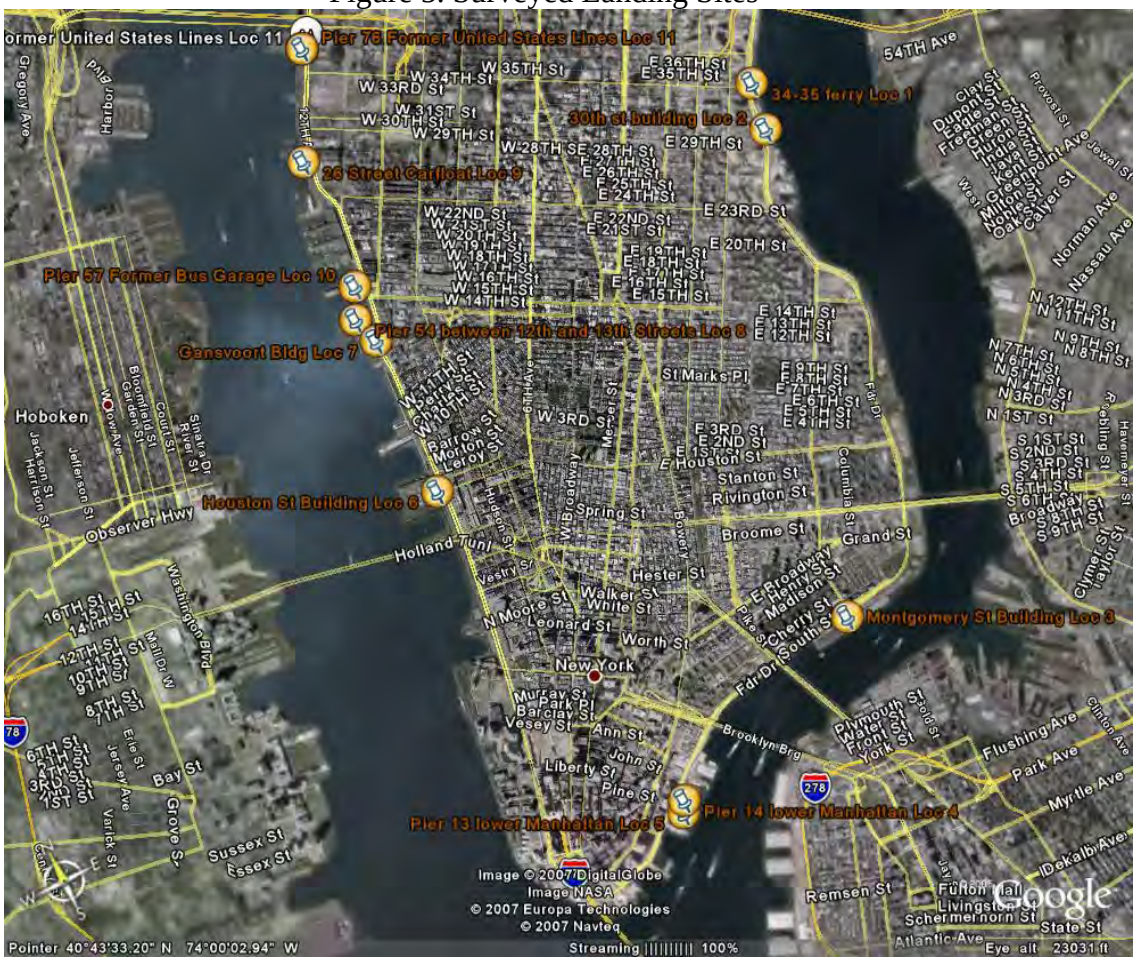
As part of this study, a reconnaissance was performed for all locations that could function as a mooring site for either a barge/tug operation or a ferry operation. Each site was examined for various characteristics. The table below is an inventory of the locations.

In general, the Manhattan waterfront has limited opportunities to allow for docking or mooring of freight vessels. There are few piers on either the West or East side and the piers that are extant are serving non-freight and, in some cases, non-commercial use. Much of the waterfront on the East side of Manhattan is occupied by non-commercially active land uses such as greenways, esplanades, vehicle storage. Two piers that now exist (Piers 13 and 14) are slated for demolition. On the West side, old liner piers have been converted to uses such as recreation or municipal use for police. Table 3 summarizes the data for each location.

Table 3. Evaluation of Surveyed Landing Sites

	Location Characteristics						Color indicates site as poss. landing
Location #	Location Name	Owner	Land Use	Road Access	Traffic Cond.	Neighboring Property	Other Consid.
Number 1	37th Street	NYC	None	To FDR Drive	Heavy on FDR	Moored barge restaurant to south	Poss. Site to north of ferry pier. Unused pier juts out Has mooring posts.About 100 yards in length. Under a long-term lease with Con Ed. Probably be eventually transferred to Parks Dept as part of a new waterfront esplanade.
2	30th st building	?	restaurant, semi-perm moored	frontage road	light on frontage road	esplanade and apartments to south, heliport	No place to dock
3	Montgomery St Building Pier 43	NYC	sanitation, EMS, fruit pier aband.	From South St.	light	EMS, NYFD	north corner of P43-poss.ro-ro
4	Pier 14 lower Manhattan	NYC	None	Frm South Street	High ped traffic	None	To be demolished
5	Pier 13 lower Manhattan	NYC	None	Frm South Street	High ped traffic	None	To be demolished
6	Pier 40 Houston St Building	NYC	park, ball fields, parking garage	Frm West Street	Heavy on West St.	None, Hudson R. Pk continues	
7	Gansevoort Bldg	NYC	NYCDOS, NYFD on north	Frm West street	Heavy on 11th Ave	Meat Mkt on east side, Hud. R. pk continues	Future transfer station
8	Pier 54 between 12th and 13th Streets	NYC	Recreation	Frm West Street	Heavy on 11th Ave	None, Hudson R. Pk continues	
9	Pier 66A 26 Street Carfloat	?	Recreation, historical, park	Frm West Street	Heavy on 11th Ave	Concession to north, Chelsea Piers to so.	
10	Pier 57 Former Bus Garage	HRPT	Parking garage	Frm 12th Ave Street	Heavy on 12th Ave	Storage and studios on east side of 12th Ave	Future use is for a large banquet/events facility, museums ,an acre of rooftop public open space, a marina, and a variety of showrooms and retail stores
11	Pier 76 Former United States Lines	?	vehicle and horse storage for NYPD	Frm 12th Ave Street	Heavy on 12th Ave	Duck Tour to north	Old United States Lines pier

Figure 5. Surveyed Landing Sites



Docking Opportunities

Hunts Point Peninsula: This site does not include an operational pier. There are no docking facilities currently in place near the Fulton Fish Market. The water's edge in the vicinity of the Fish Market is either rip rap or a bulkhead. At one time the New York, New Haven and Hartford Railroad provided carfloat services from here. The absence of a facility here could raise the funding level for the project as well as environmental issues.

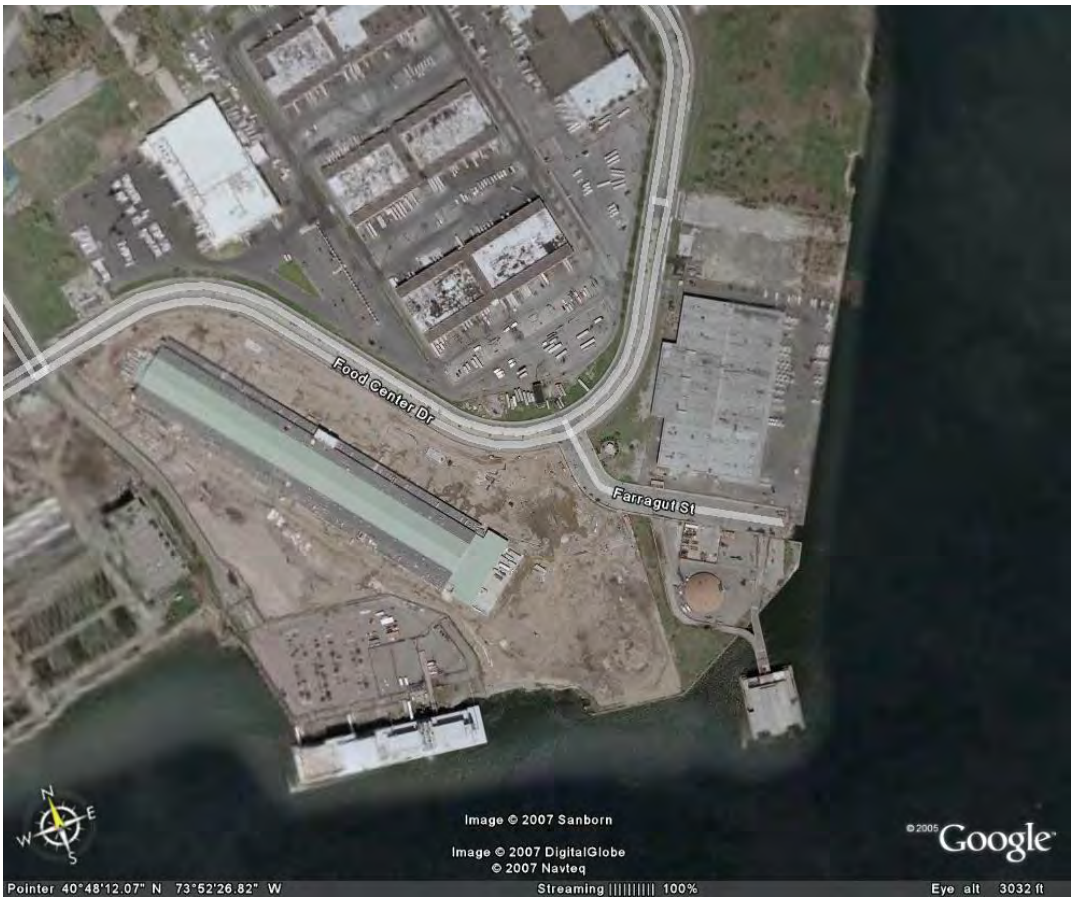


Figure 6. Hunts Point Peninsula

The locations discussed below are derived from a longer list of surveyed locations (see Table 3. The others are not included because there were circumstances which preclude them as workable landing sites.

Location 1

. This unused pier is located north of the East 34th Street heliport and ferry terminal at the end of the pedestrian promenade at 37th Street. This cordoned off facility has mooring posts and could accommodate a barge or ferry at the south niche end of the pier where it would be protected from fast currents. Road access would be problematic in that it would necessitate entering the FDR Drive which has high-speed traffic at this location.

Figure 7. Location 1 Unused Pier at 37th Street

Location 3

Pier 43 (Old Fruit Pier) at Montgomery Street Pier 43 is located along the East River at the north end of a large pier complex with Pier 42 at its southern end. Tropical fruit ships tied up at this location as recently as the 1980s. The shed at the location is now unused. There is a niche of protected water located at the northern end of the pier. A barge was tied up there during field work. As shown in the photo there is adequate maneuvering room for trucks entering or leaving the area. Road access would be to South Street or Montgomery Street.

Figure 8. Location 3 Pier 43 (Old Fruit Pier) at Montgomery Street

Location 7

Pier 52 (New York City Department of Sanitation (NYCDOS)) is located at Gansevoort Street at the Hudson River. Pier 52 is slated to be one of the Department of Sanitation's (DSNY) transfer facilities. As it is currently configured, there is an area on the north side with direct access to the water that appears to be unused. Road access is via a frontage road running parallel to 11th Avenue.

Figure 9. Location 7 Pier 52 (NYCDOS)

Characteristics of Fish Market Operators in the Hunts Point Market

Trip-Making

Operators at the Fulton Fish Market conduct operations in two ways. There are retailers who send vehicles to the market to select and pick up product and there are wholesalers who distribute product to customers. The following table illustrates vehicle origins and destinations.

Table 4. Origins and Destinations of Fish Market Suppliers and Retailers
(Surveyed Vehicles Only)

	Supplier Truck		Retail Vehicle	
Origin or Destination	Arrivals From	Departures To	Arrivals From	Departures To
Bronx	10% (all NYC)	28% (all NYC)	6%	10%
Queens			29%	21%
Brooklyn			4%	17%
Manhattan			6%	15%
Staten Island			4%	0%
Long Island	5%	6%	15%	10%
Other New York State	0%	6%	11%	10%
New Jersey	14%	22%	21%	15%
Pennsylvania		6%		
Delaware		6%		
Maryland	14%			
Florida	19%			
New England	38%	28%	2%	2%

Source: *Hunts Point Truck Study,* URS Corporation.

Vehicle Types

Retailer vehicle types are made up of five types of vehicles: single-unit trucks, light trucks, commercial 2 axle trucks, vans and cars.

Current Truck Travel Demand

The purpose of this exercise is to determine the number of truck trips that could use the truck service based on existing volumes and rationalized by time period as well as direction of travel.

Current Truck Travel

Based on information collected through the *Hunts Point Waterborne Freight Assessment*, retailers arrive after the suppliers (mostly between 2:00 am and 5:00 am). The peak hour of retailer vehicle arrival at Hunts Point is from 2:00 am to 5:00 am, well before traffic congestion is a factor. The peak hour of retailer/wholesaler vehicle departure is from 5:00 am to 9:00 am, during which congestion is a factor.

It is estimated that 1,050 inbound and 1,050 outbound trips occur each day. The traffic from Manhattan to Hunts Point is 63 or 6 percent of the arrival traffic (from Table 4); to Manhattan from Hunts Point is 157 or 15 percent of departure traffic (from Table 4). It is assumed that all trucks from Manhattan belong to retailers who shop in the Market and all trucks to Manhattan include all retailers' trucks and wholesalers' trucks or trucks hired by wholesalers.

The highest arrival traffic is 74 percent of total arrival traffic from Manhattan. The highest departure traffic is 73 percent of total departure traffic to Manhattan. It is estimated that the maximum demands for the ferry service would be:

47 **Manhattan to HP (Early Morning)**
113 **HP to Manhattan** and
66 **Manhattan to HP (Return Trip)**

Determining Peak Truck Travel Demand

A barge or ferry service for trucks between Hunts Point and Manhattan, which serves the peak hour truck flow (to maximize the utilization of the service), could include two sections: from Hunts Point to Manhattan which serves both retailer and wholesaler trucks and from Manhattan to Hunts Point in late morning which serves wholesaler trucks. Retailer trucks from Manhattan to Hunts Point in early morning may not need this service, because for them, congestion is not an issue due to their early schedule. The number of trucks that would use this service is estimated on the basis that the service will operate to meet peak demand. So in the best scenario, the demand is 179 trucks per day (113 plus 66). The forecasts are summarized in Table 5.

The peak period of retailer/wholesaler vehicle departure is from 5:00 am to 9:00 am. It is estimated that 88 of the 113 trucks depart after 6:00 am, when congestion

begins. The total number of trucks that would encounter congestion could be **154**, (affected HP to Manhattan trucks plus Manhattan to HP).

Table 5. Number of Trucks in Different Market Penetration Scenarios

Market Penetration		**Manhattan to HP (Early Morning-not considered further)**	**HP to Manhattan**	**HP-Manhattan-Congestion Affected Trucks**	**Manhattan to HP (Return Trip)**
I	**100 Percent**	47	113	88	66
II	**50 Percent**	24	57	44	33
III	**25 Percent**	12	29	22	17

Given that many trucks drive to more than one drop-off place, we assume that the average length of trips to Manhattan is 10 miles. The off-peak travel time is around 30 minutes. It is reported that a trip could take as long as two hours. The fleet that is mostly affected by peak-hour traffic is the return-trip trucks (66 trucks). Manhattan-bound trucks leaving later than 6 am may encounter congestion also.

Possible Operating Scenarios

Operational Assumptions - The basic operational assumptions are based on the Hunts Point Waterborne Freight Assessment. Vessel operating characteristics and costs are estimated below.

Vessel "turn time" for truck barges and truck ferry would be 30 minutes (15 minutes to offload and 15 minutes to load).

Truck operating costs per mile is $0.42 per mile in the Assessment. No truck will use toll facilities between Manhattan and Bronx.

We assume the trucker will stay with their vehicles on the ferry although current truck barge operations do not permit this. A $50 per hour ***trucker value of time*** is assumed.[4] For instance, the cost of time will be $100 if a trucker takes two hours to drive from Hunts Point to Manhattan. The ***total "dead time"*** for an average truck is assumed to be 30 minutes, including 15 minutes in queue, 7.5 minutes to load and 7.5 minutes to unload. A good trucker information and reservation system may help to reduce the dead time.

The total cost for a trucker includes a mileage cost of $4.20 ($0.42/mile for a 10-mile trip) and a time cost from $25 (for a half-hour) to $100 (for two hours).

Table 6. Travel Time between Terminals

From	To	Distance (Nautical Miles)	Small Conventional Ferry and Truck Barge at 9 knots		Medium-Speed Ferry at 15 knots	
			Vessel Travel Time	Total Time including vessel Travel Time	Vessel Travel Time	Total Time including vessel Travel Time
Hunts Point	37th Street East Bulkhead	6.33	0:42	1:12	0:25	0:55
Hunts Point	Montgomery Street Pier 42	8.85	0:59	1:29	0:35	1:05
Hunts Point	Gansevoort Street Pier 52	13.34	1:29	1:59	0:53	1:23

[4] Smalkoski, Brian and David Levinson Value of Time for Commercial Vehicle Operators in Minnesota. Transportation Research Board International Symposium on Road Pricing, Key Biscayne, Florida. November 20-22 2003. Journal of the Transportation Research Forum. 44:1 89-102.

The truck travel times (including the dead time) for truck barge and small ferry would be 1.2 (37^{th} St) hours, 1.48 hours (Pier 42) or 1.98 hours (Pier 52). For medium-speed ferry, the travel times are 0.92, 1.08 and 1.38 hours, respectively. Travel time for each vessel type is shown in Table 6.

The time savings and the values of savings in time and mileage are summarized in Table 7. Two important conclusions can be drawn from Table 7. A terminal on the East River is more favorable than any one on the Hudson River due to its closer proximity to Hunts Point. The closer proximity translates into a shorter travel time and and therefore time savings and ultimately cost savings. One assumption in the table is that the service fee to truckers should be equal to or lower than the estimated cost savings because these savings do not consider the travel costs from piers to and from the drop-off locations.

Table 7. Time Savings and Service Cost

From	To	Distance (Nautical Miles)	Small Conventional Ferry and Truck Barge			Medium-Speed Ferry		
			Travel Time (hrs) at 9 knots	Time Saving (2 hours travel time in congestion)-(Ferry travel time)-(0.5 hours dead time	Service Cost (Time Saving + $4.2 for 10 miles highway)	Travel Time (hrs) at 15 knots	Time Saving (2 hours travel time in congestion)-(Ferry travel time)-(0.5 hours dead time	Service Cost (Time Saving + $4.2 for 10 miles highway)
Hunts Point	37th Street East Pier	6.33	42 min (0.70)	48 min (0.80)	$44.2	25 min (0.42)	1 hr,5 min (1.08)	$58.4
Hunts Point	Montgomery Street -Pier 42	8.85	59 min (0.98)	31 min (0.52)	$30.0	35 min (0.58)	55 min (0.92)	$50.0
Hunts Point	Gansevoort Street - Pier 52	13.34	1 hr, 29 min (1.48)	1 m in (0.02)	$5.0	53 min (0.88)	37 min (0.62)	$35.0

Operational Plans - The design of the operational plans should be considered together with the characteristics of vessels in terms of capacity, speed, capital investment and operating costs. The characteristics of the three types of vessels are summarized in Table 8. It should be noted that the cost information we have is incomplete. Some assumptions in estimating operating costs must be made. The operating hours are assumed to be around six hours from 5:00 am to 11:00 am to meet the peak demand traffic.

Table 8. Characteristics of the Three Types of Vessels

	Truck Load Capacity	Draft (ft)	Speed (knots)	Vessel Unit Cost	Operating Costs		Operating Plans
					Vessel Operating Cost	Fuel Cost	
Truck Barge	30 Trailers or more	15-24	9	$4M	$4,800/day or $400/hour	$350/hour	Buy one barge, rent a tug for 6 hours per day
Medium-speed Truck Ferry	30 Trailers or more	10	15	$18M	$7,000 (more than 14 hours)	$300/hour	Buy one vessel
Small Conventional Ferry	6 Trucks	10	9	$2.5M	$2,400	n/a	Buy more than one vessel

The analysis below shows that all factors, such as terminal locations, capital investment (number of vessels), market penetration, service type/operating plans and vessel characteristics determine the feasibility of freight ferry service. Table 9 summarizes the analysis of all scenarios for all three types of vessels. A scenario is "not feasible" if no savings would accrue to the truck operators and/or if the revenue could not cover the total operating costs without being subsidized by a third party. The following sections will explain the results in Table 9.

Table 9. Feasibility Analysis of Scenarios
of Different Vessels, Terminal Locations and Market Penetrations

Vessel Type		37th Street Pier (East River)			Montgomery Street -Pier 42 (East River)			Gansevoort Street - Pier 52 (Hudson River)		
	Market Penetrations	25%	50%	100%	25%	50%	100%	25%	50%	100%
Truck Barge		×	×	×	×	×	×	×	×	×
Medium-Speed Ferry		×	√	√	×	×	×	×	×	×
Small Conventional Ferry		×	×	×	×	×	×	×	×	×

× - Not Feasible **√ - Feasible**

Truck Barge - We will assume the cost for a truck barge operation is $400 per hour (the $400 per hour tug rental cost) and a fuel cost of $350 per hour.

One large barge (30 trailers) with a tug would be needed based on demand in Table 5. The number of trucks being accommodated could be higher than 30 per vessel because many are smaller trucks or vans. It serves (III) (25 percent) in Table 5 with one round trip in 2.4 hours (37^{th} St), 3.96 hours (Pier 42) and 4.96 hours (Pier 52) for the 3 O-D pairs in Table 7. One vessel serves (II) (50 percent) in Table 5 with two round trips in 4.8 hours on ***HP-37th Street Pier*** route. The other two terminals are too far away to finish two roundtrips in six hours. For (I) (100 percent), two vessels are needed to transport all trucks in six hours.

The non-fuel operating cost is a fixed cost for a six-hour operation. The fuel cost is on the basis of the ferry travel time and one hour dead time per trip.

A ***$44*** fee is derived from Table 7 based on the highest cost savings and reflects the highest possible revenue. This fee is used in the calculations below.

For ***25 percent market penetration scenario (III),*** the cost for a six-hour, one-vessel operation is ***$2,400*** with no fuel cost. With a ferry fee of ***$44***, the revenue from 39

trucks will be ***$1,716***. It can not cover the operating cost, even when the fuel cost is not considered.

For ***50 percent market penetration scenario (II),*** the total cost for a six-hour, one-vessel operation is ***$4,680*** including the fuel and non-fuel operating costs. With a ferry fee of ***$44***, the revenue from 77 trucks will be ***$3,388***. It cannot cover the operating costs of $4,680. This service would not be competitive against truck-only service.

For ***100 percent market penetration scenario (I),*** with a ferry fee of ***$44***, the revenue from 154 trucks will be ***$6,776***. It cannot cover the operating costs of $9,360 (for two vessels). This service will not be competitive against truck-only service.

Medium-Speed Truck Ferry - Table 5 indicates only one large (30 trailer capacity) vessel is needed. It would serve market penetrations (III) (25 percent) in Table 5 with one round trip in 1.84 hours (37th St), 2.16 hours (Pier 42) and 2.76 hours (Pier 52), or (II) (50 percent) with two round trips in 3.68, 4.32 and 5.52 hours, respectively. For market penetration (I), three round trips are needed, which take 5.52, 6.48 and 8.28 hours. For the last two, the travel times are too long to meet the truckers' demand.

For the ***25 percent market penetration*** **scenario** ***(III)***, if the ferry fee is ***$58, $50 and $35*** for the three landing sites, the revenue from ***39 trucks*** will be ***$2,262*** (37th Pier) **,** ***$1,950*** (Pier 42) ***and $1,365*** (Pier 52). The total cost for a ***6-hour one-round-trip*** operation is ***$3,552, $3,648 and $3,828*** respectively, including the fuel and non-fuel operating costs. For all three landing sites, the revenue would be inadequate to cover the operating cost, thus the ferry service could not be competitive against truck-only service.

For the ***50 percent market penetration*** **scenario** ***(II)***, if the ferry fee is ***$58, $50 and $35*** for the three landing sites, the revenue from ***77 trucks*** will be ***$4,466*** (37th Pier) **,** ***$3,850*** (Pier 42) ***and $2,695*** (Pier 52). The total cost for a ***6-hour two-round-trip*** operation is ***$4,100, $4,300 and $4,660*** respectively, including the fuel and non-fuel operating costs. Only the ***HP-37th Street Pier route*** can cover the operating costs. This service could be competitive against truck-only service, while there is no saving of costs for truck drivers.

For the ***100 percent market penetration scenario (I)***, if the ferry fee is ***$58, $50 and $35*** for the three landing sites, the revenue from ***154 trucks*** will be ***$8,932*** (37th

Pier)***, $7,700*** (Pier 42) ***and $5,390*** (Pier 52). The total cost for a 6-hour three-round-trip operation is ***$4,800***, including the fuel and non-fuel operating costs. Only the ***HP-37th Street Pier route*** could finish the three roundtrips, cover the operating costs and thus be competitive against truck-only service. For the 37th Street Terminal, the truckers could only pay ***$32*** to cover the operating cost while enjoying the one-hour time saving.

Small Conventional Ferry - The low capacity of the small conventional ferry makes the service less efficient than the other type of vessels. Five vessels with one round-trip operation would be needed with a total capacity of 30 trucks. They would serve (III) (25 percent) in Table 5 with one round trip in 2.4 hours (37th St), 3.96 hours (Pier 42) and 4.96 hours (Pier 52). Three vessels would be needed to run two round trips in 4.8 hours on the HP-37th Street Pier route.

The total cost for a one round-trip operation is ***$6,000*** (half day) for five vessels. It would cost ***$3,600*** for three vessels and two round trips (half day), including the fuel and non-fuel operating costs. This is based on a flat operating cost of ***$2,400*** per vessel per day.

For ***market penetration scenario (III) (25 percent)***, with a ferry fee of ***$44*** (37th St)***, $30*** (Pier 42) ***and $5*** (Pier 52) for the three landing sites respectively, the revenue from 39 trucks would be ***$1,727, $1,177 and $196,*** respectively. None of these can cover the operating costs of any of the three operating scenarios above.

For ***market penetration scenario (II) (50 percent)***, five vessels are needed, which run two roundtrips to 37th Street Pier with a daily operating cost of $6,000. The revenue will be $3,454, $2,355 and $393, respectively. None of these can cover the operating costs of any of the three operating scenarios above.

For ***market penetration scenario (I) (100 percent)***, 10 vessels are needed for transporting 113 trucks to Manhattan (37th Street Pier) in six hours, which cost $12,000 daily. The revenue will be $6,908, $4,710 and $785, respectively. None of these can cover the operating costs of any of the three operating scenarios above.

Hybrid Ferry Service Using Medium-Speed Truck Ferry - Because of its high capital and operating costs, the freight ferry service alone is unlikely to be profitable or financially independent without long-term subsidies. A limited amount of demand on a fixed route has less potential of growth. To make an economy of scale, it is more feasible to build up a network or a combination with passenger ferry service.

Here is a possible example of this hybrid service. The medium-speed truck ferry considered in this study provides a potential of this type of operation, such as Ferry Cat 120 as an example. This vessel is capable of carrying 400 passengers and more than 30 trucks. In the Hunts Point Waterborne Freight Assessment study, it is estimated that 40 truck trips may happen between Hunts Point (HP) and Newark (EWR) Airport. If the suggested HP-Manhattan route is expanded to an HP-Manhattan-EWR network with both passenger and ferry services, one would need a totally different financing scenario.

Currently a passenger using NJ Transit to travel from EWR to New York Pennsylvania Station has to pay $14 for an hour-long trip, including a transfer from Air-Train. If we use ferry service, there is a short route connecting EWR and the potential landing sites as shown in Figure 16. The water route from the landing site to Manhattan (37^{th} Street Pier) is 12.5 nautical miles. An airport shuttle-ferry passenger service could finish the trip in 1.5 hours (including loading and unloading). The fee a passenger pays for this scenic ferry tour could be $10. The trip is cheaper and without transfer (e.g., shuttles on ferry).

Assuming 1,200 passengers taking the ferry per day (150 per one-way trip, 37.5 percent of capacity), there will be a $12,000 revenue together with the $10,482 revenue from trucks ($8,932 from HP-Manhattan trucks). The total revenue would be as much as $22,482, while the operating cost increasing from $5,200 to $6,888 (without considering costs of airport shuttle, security and others). In this scenario, the vessel is better utilized and the service is more likely to be profitable. Passenger and trucks using this service are less likely to be affected by traffic. It is also a service with growth potential because it could divert traffic from many freight routes, such as EWR-JFK (e.g., custom clearance, FedEx), HP-New Jersey (for less toll), EWR-Manhattan (e.g., FedEx and others) or other cross-harbor routes.

Figure 10. EWR-Manhattan-HP Passenger and Freight Ferry: EWR Landing Site

Appendix 1 – Water Depths

Water level at the Battery at the southern end of Manhattan changes from 0 to 5 feet above Mean Low Low Wave (MLLW) (NOAA) (Figure 5). This change would have impacts on the operation of vessels en route to piers for loading and unloading of trucks.

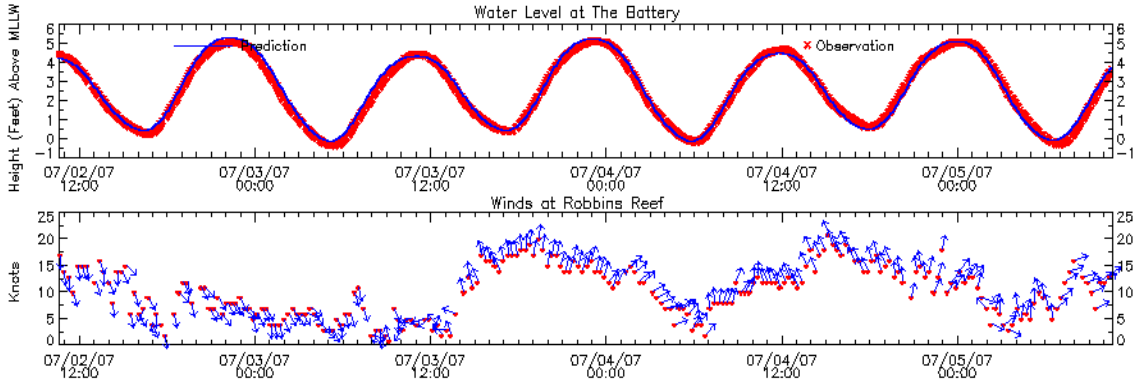


Figure A-1. The Battery Three-Day Water Levels[5]

The water levels at potential landing sites for the service concept are shown in Figures 6 through 9. The design of any pier facility and selection of vessels for the service concept must take the tide and water level into consideration.

[5] (http://tidesandcurrents.noaa.gov/ports_data.shtml?stn=8518750+The+Battery&data_type=3% 20Days% 20Water% 20Levels% 20and%20Meteorology&type=Physical% 20Oceanographic% 20Real-Time% 20System&port=ny)

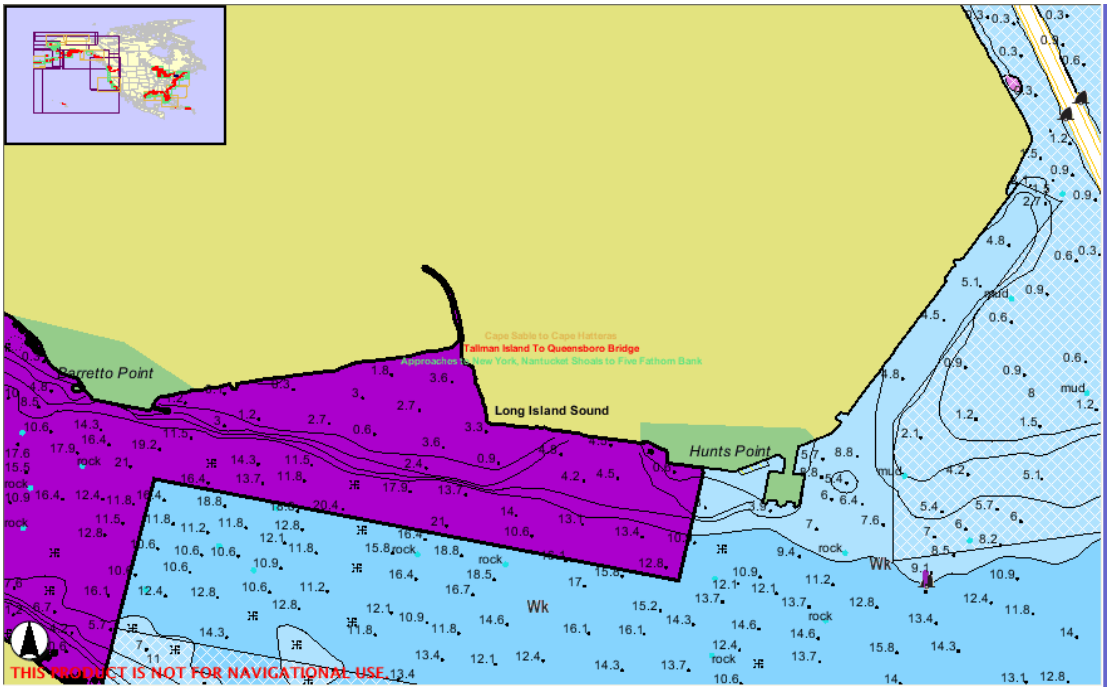


Figure A-2. Water Depth at Hunts Point

The water level at Hunts Point ranges from 5.7 to 8.8 feet. This is relatively lower than the minimum of any vessel draft. Some dredging work may be needed to make it more than 10 feet deep.

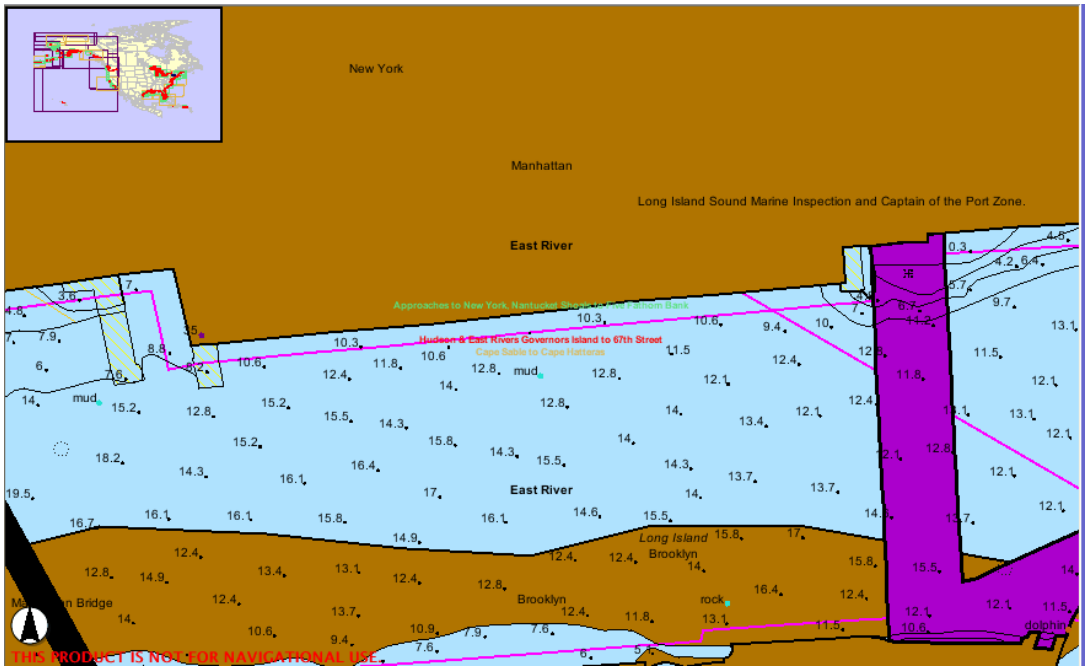


Figure A-3. Water Depth at Montgomery Street - Pier 42

The water level along the pier is adequate for a freight ferry operation.

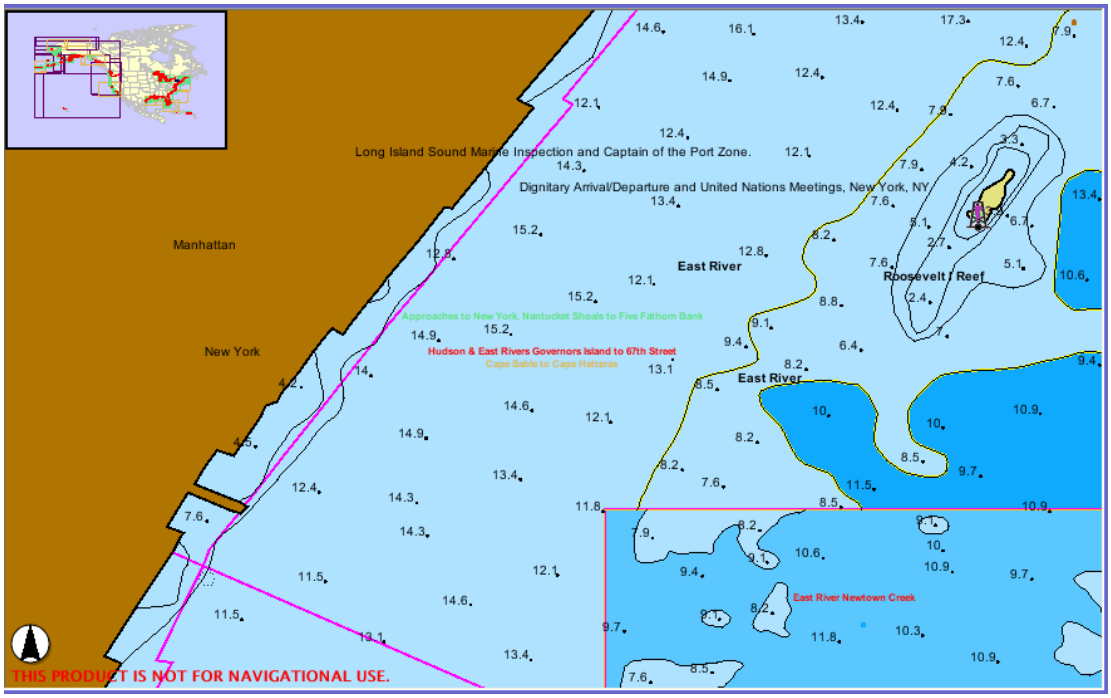


Figure A-4. Water Depth at 37th Street Pier

With an average of 12 feet, the water level at this site is good for ferry operation.

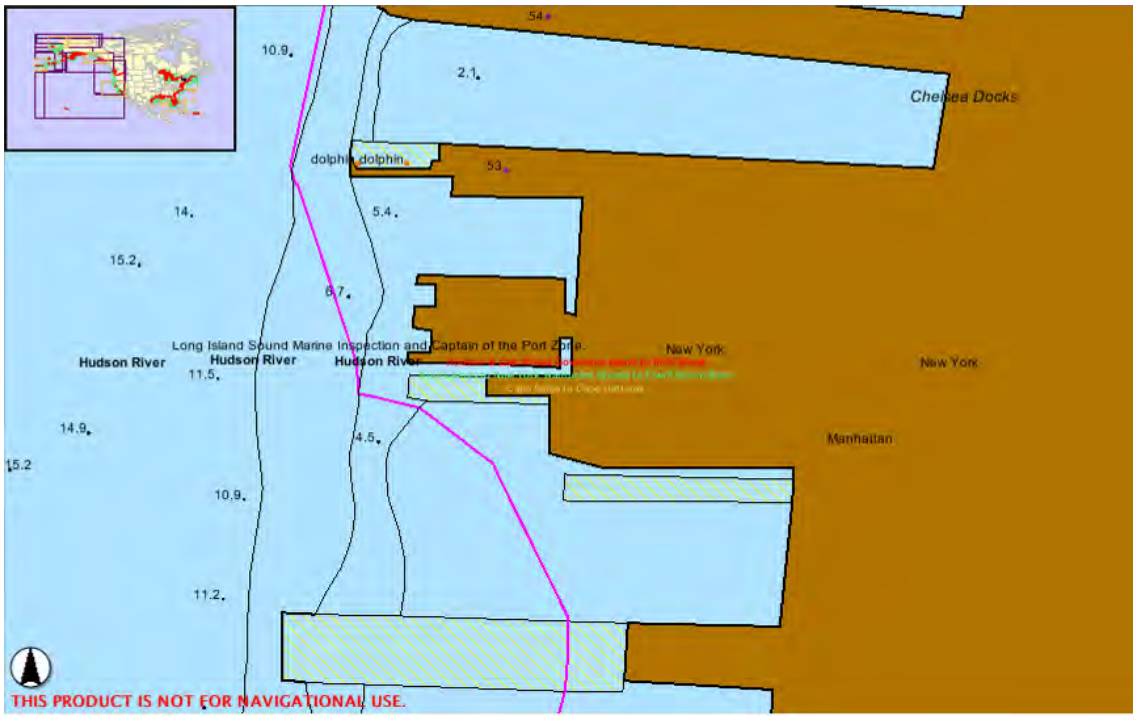


Figure A-5. Water Depth at Gansevoort Street – Pier 52

The water level is too low at this site. Some dredging work may be needed.