New York Harbor

Kayakers Guide 2024

Introduction

This document provides a brief introduction to all of the physical attributes of New York Harbor that are relevant to a kayaker. Note that it does not address how to kayak, where to go, what to bring, or the rules and regulations that pertain to boating. Instead it simply introduces the various physical components of New York Harbor that a kayaker might find relevant.

Disclaimer

This document is a work in progress:

- Do not use for navigation purposes.
- Do not assume that all of the data provided is correct or complete.

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Selected Contents

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Number of Paddlers

More than 100,000 people went boating in human-powered boats (mostly in kayaks) on New York Harbor in 2018.

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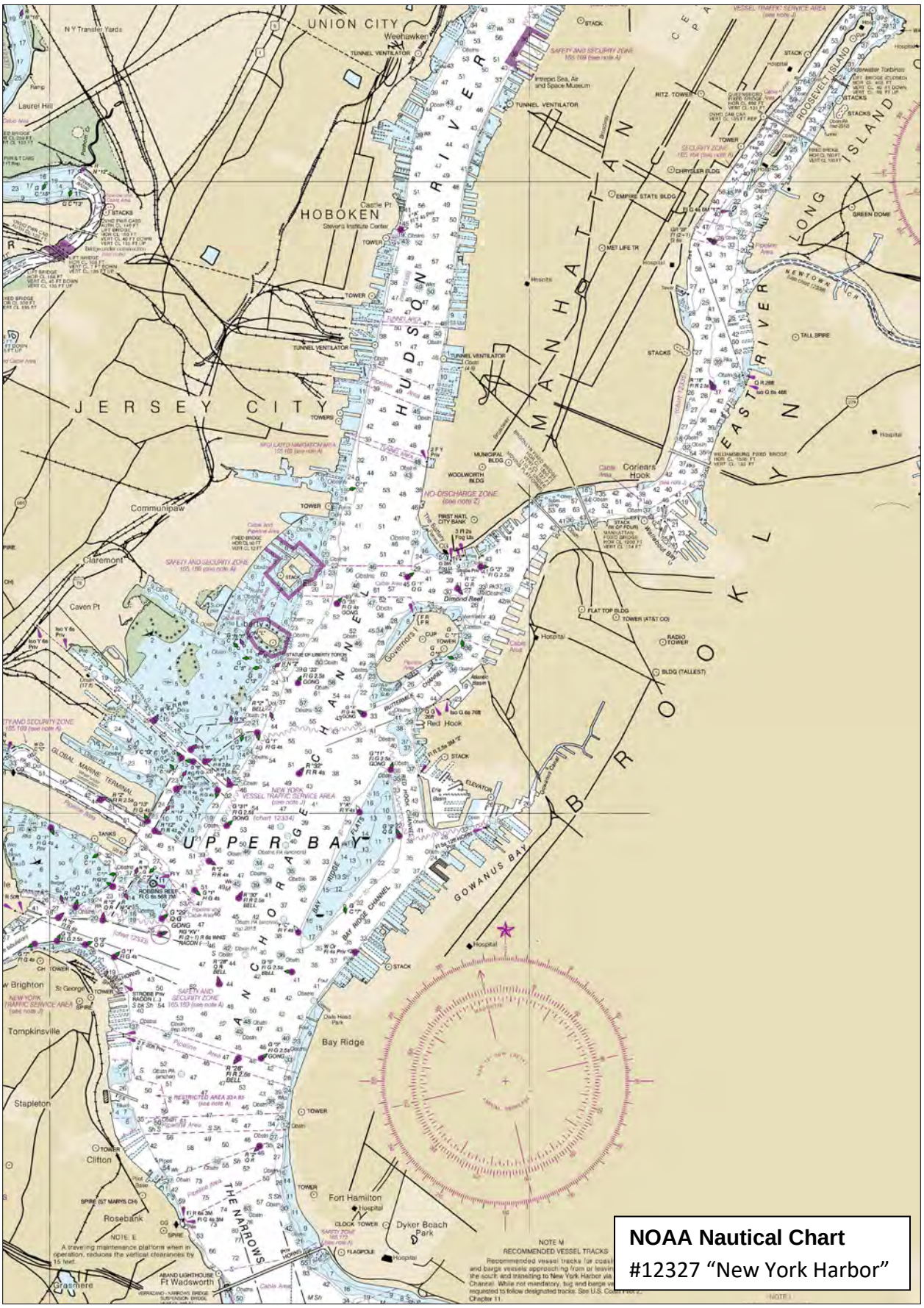
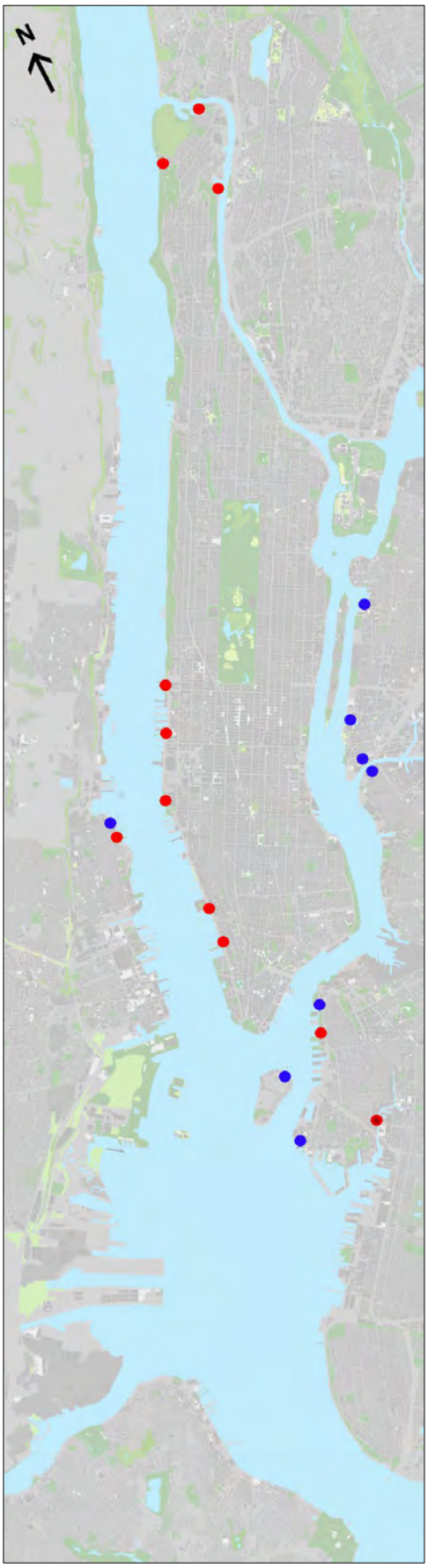
Map, New York Harbor



Human-Powered Boating Organizations



New York Harbor

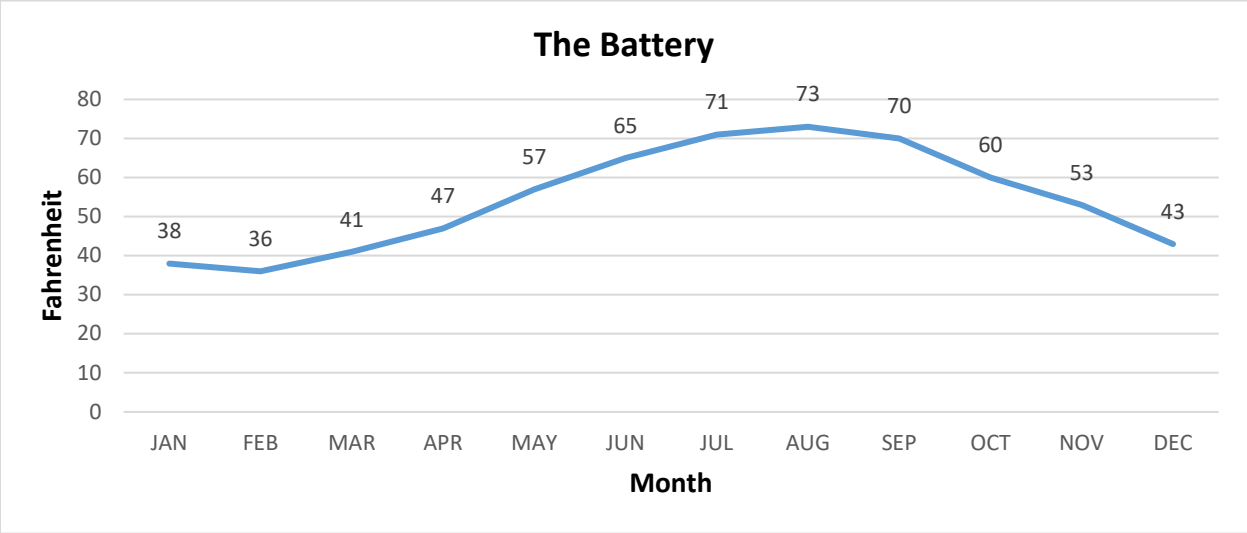
- Atlantic Kayak Tours
- Bronx River Alliance
- Brooklyn Bridge Park Boathouse
- Brooklyn Kayak Guides
- Columbia University Rowing
- Downtown Boathouse
- East River Crew
- Gateway Bike and Boathouse
- Gowanus Dredgers Canoe Club
- HarborLAB
- Harlem River Community Rowing
- Hoboken Cove Community Boathouse
- Hoboken Kayak & Paddleboarding
- Inwood Canoe Club
- Kayak Staten Island
- Ke Aloha Outrigger at Hoboken Cove
- Long Island City Community Boathouse
- Manhattan Community Boathouse
- Manhattan Kayak Company
- Marine Park, Jamaica Bay
- National Park Service, Jamaica Bay
- New York Kayak Polo
- New York Outrigger
- North Brooklyn Boat Club
- Red Hook Boaters
- Rocking the Boat
- Row New York
- Sebago Canoe Club, Jamaica Bay
- Touring Kayak Club, City Island
- Village Community Boathouse
- Yonkers Paddling and Rowing Club

Points on Map

- Red: Boathouse
- Blue: Boating program

Water Temperature

By Month



Hypothermia and Cold Water

Water Temperature (Fahrenheit)	Exhaustion or Unconsciousness	Expected Time of Survival
32.5 degrees	Under 15 minutes	Under 15 to 45 minutes
32.5 to 40 degrees	15 to 30 minutes	30 to 90 minutes
40 to 50 degrees	30 to 60 minutes	1 to 3 hours
50 to 60 degrees	1 to 2 hours	1 to 6 hours
60 to 70 degrees	2 to 7 hours	2 to 4 hours
70 to 80 degrees	2 to 12 hours	3 hours to indefinite
Over 80 degrees	Indefinite	Indefinite

Water Temperature

Ice

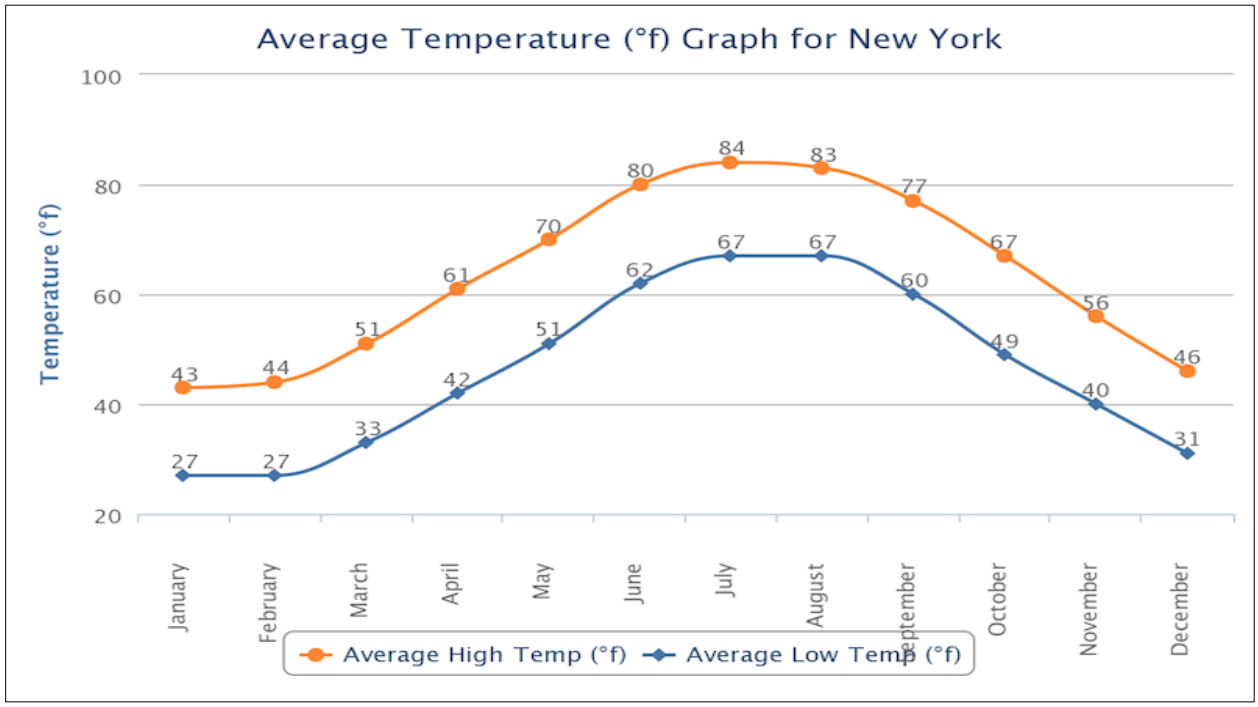
Lower Manhattan from Jersey City

Note

- New York Harbor water is usually too saline to freeze
- The ice is mostly frozen fresh water coming down from up river
- The ice tends to pile up on Manhattan shore – due to wind
- Location of ice changes rapidly with each tide

Air Temperature

By Month



Wind Chill

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperatur · (°F) V= Wind Speed (mph)

Effective 11/01/01

Air Temperature

Heat Index

The heat index (see chart below) is the "feels like", or apparent, temperature. As relative humidity increases, the air seems warmer than it actually is because the body is less able to cool itself via evaporation of perspiration.

As the heat index rises, so do health risks. When the heat index is 90°-105°F, heat exhaustion is possible. When it is above 105°F, it is probable. Heatstroke is possible when the heat index is above 105°F, and very likely when it is 130°F and above. Physical activity and prolonged exposure to the heat increase the risks.

Heat Exhaustion occurs when the body is dehydrated.

- **Symptoms:** Headache, nausea, dizziness, cool and clammy skin, pale face, cramps, weakness, profuse perspiration
- **First aid:** Move to a cooler spot, drink water with a small amount of salt added (one teaspoon per quart)
- It can lead to collapse and heatstroke.

Heatstroke occurs when perspiration cannot occur and the body overheats.

- **Symptoms:** Headache, nausea, face flushed, hot and dry skin, no perspiration, body temperature over 101°F, chills, rapid pulse
- **First aid:** Cool person immediately, move to shade or indoors, wrap in a cool, wet sheet, get medical assistance
- It can lead to confusion, coma, and death.

Temperature vs. Humidity

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

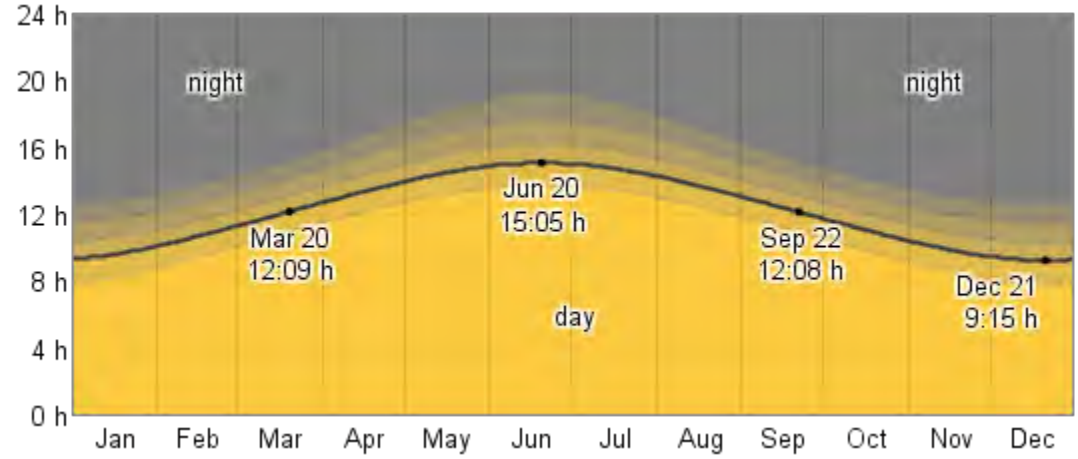
Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Daylight Hours

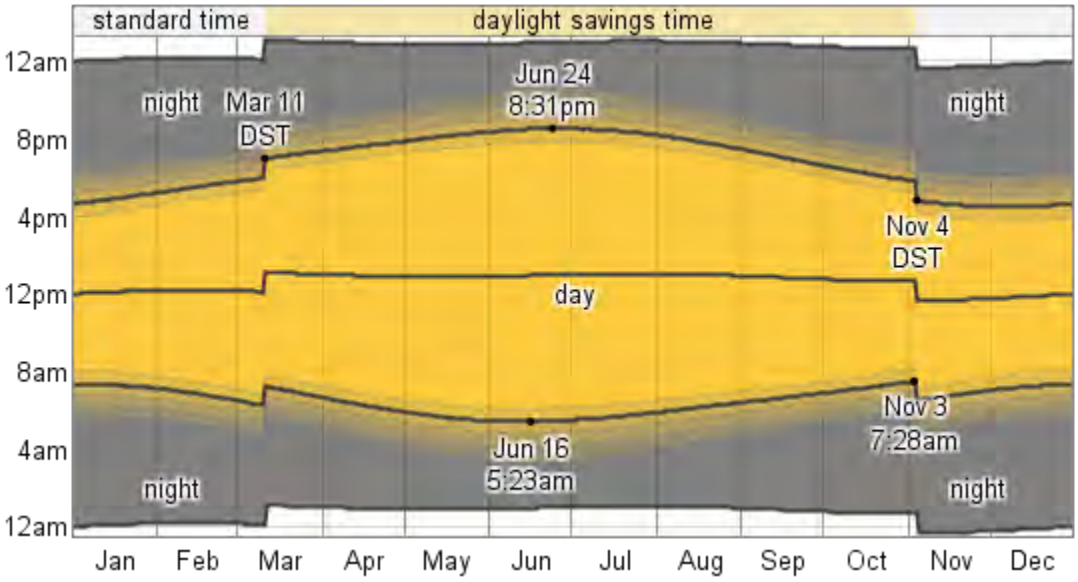
The shortest day is December 21 with 9:16 hours of daylight; the longest day is June 20 with 15:06 hours of daylight.

Daily Hours of Daylight and Twilight



The number of hours during which the Sun is visible (black line), with various degrees of daylight, twilight, and night, indicated by the color bands. From bottom (most yellow) to top (most gray): full daylight, solar twilight (Sun is visible but less than 6Â° from the horizon), civil twilight (Sun is not visible but is less than 6Â° below the horizon), nautical twilight (Sun is between 6Â° and 12Â° below the horizon), astronomical twilight (Sun is between 12Â° and 18Â° below the horizon), and full night.

Daily Sunrise & Sunset with Twilight and Daylight Savings Time



The solar day over the course of the year 2012. From bottom to top, the black lines are the previous solar midnight, sunrise, solar noon, sunset, and the next solar midnight. The day, twilights (solar, civil, nautical, and astronomical), and night are indicated by the color bands from yellow to gray. The transitions to and from daylight savings time are indicated by the "DST" labels.

Wind Speed & Direction

Wind Speed vs. Energy vs. Power

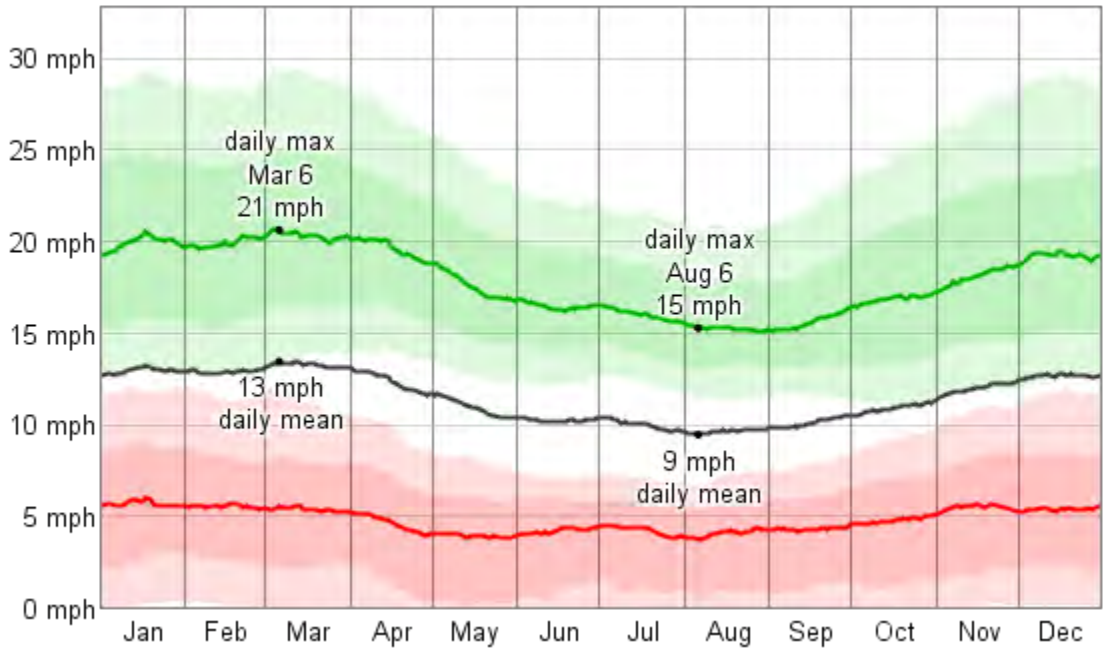
When the wind speed doubles:

- The wind energy increases four times.
- The wind power increases eight times.

High winds have vastly more power than a gentle breeze.

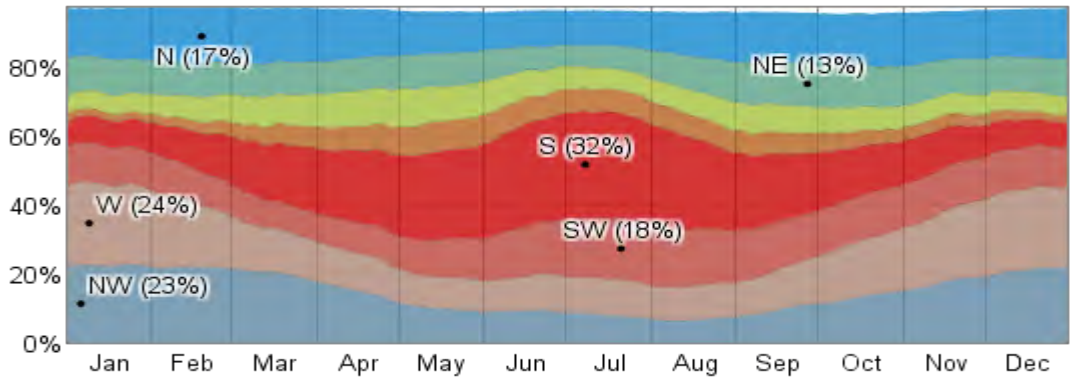
Wind Speed by Month

The table below shows the average daily minimum (red), maximum (green), and average (black) wind speed in New York City with percentile bands (inner band from 25th to 75th percentile, outer band from 10th to 90th percentile).



Fraction of Time Spent with Various Wind Directions

The fraction of time spent with the wind blowing from the various directions on a daily basis.



Fog

After Storm

Lower Manhattan from Jersey City

Early Morning

Lower Manhattan from Jersey City

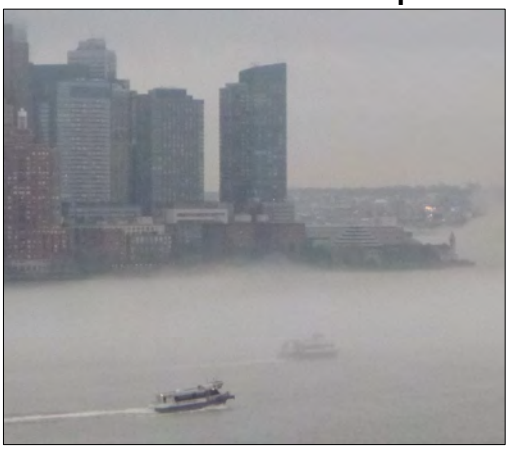
NY Harbor

In winter advection fog is common in the harbor on clear, calm mornings. During the spring and early summer the harbor as well as its approaches are susceptible to advection fog, riding in on east through south winds. A morning peak exists in the harbor, while the approaches exhibit an afternoon maximum. Steam fog is encountered on the harbor in the fall.

Fog Types

- **Advection Fog** occurs when moist air passes over a cool surface by advection (wind) and is cooled.
- **Evaporation Fog** forms over bodies of water overlain by much colder air. It can be quite denser, deep, and looks fluffy from above.
- **Steam Fog** form during the fall when cold air moves over a warm body of water.
- **Precipitation Fog** forms as precipitation falls into drier air below the cloud, the liquid droplets evaporate into water vapor. The water vapor cools and at the dewpoint it condenses and fog forms.

There are two ferries in this picture

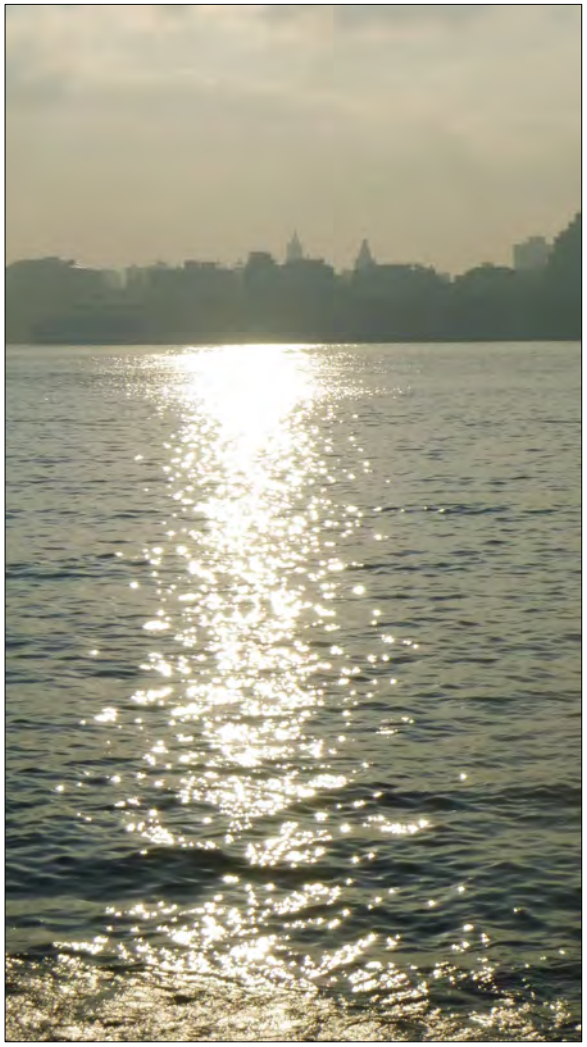


Low Light Conditions

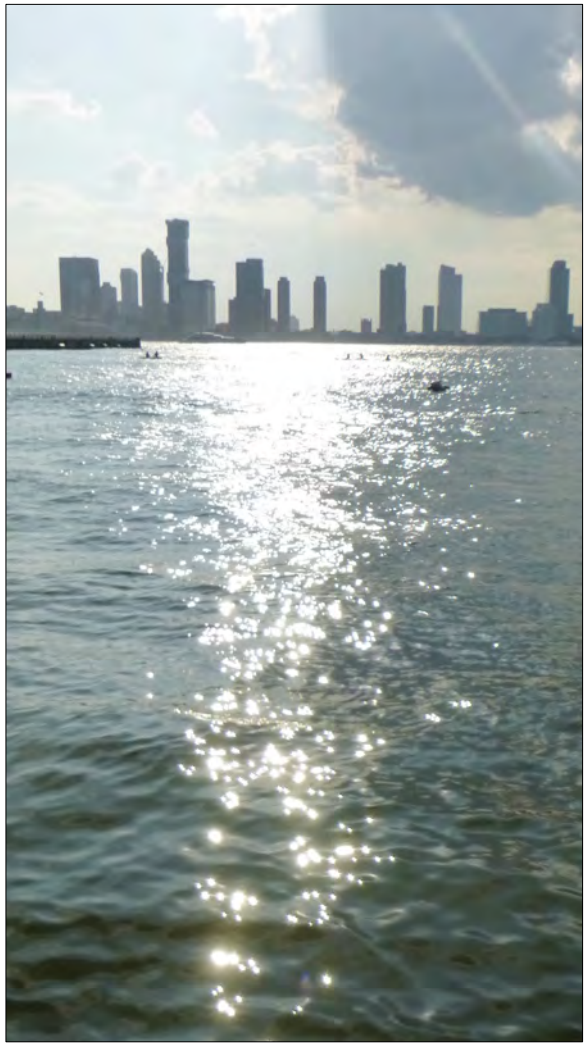
When the sun is low to the horizon, it creates a zone of glare on the water that makes a kayak largely invisible to a boat travelling into the sun. Note that the sun does not create a bright spot on the water. Instead, because every individual wave acts a separate reflector, it create a large zone of bright water that extends all of the way across the harbor.

The shape and size of this zone of brightness depends on the wave conditions and the height of the sun in the sky. As a general rule, if the surface of the water is wavy, the bright light zone will widen in the far distance.

Examples



View from Jersey City, early morning



View from Lower Manhattan, early evening

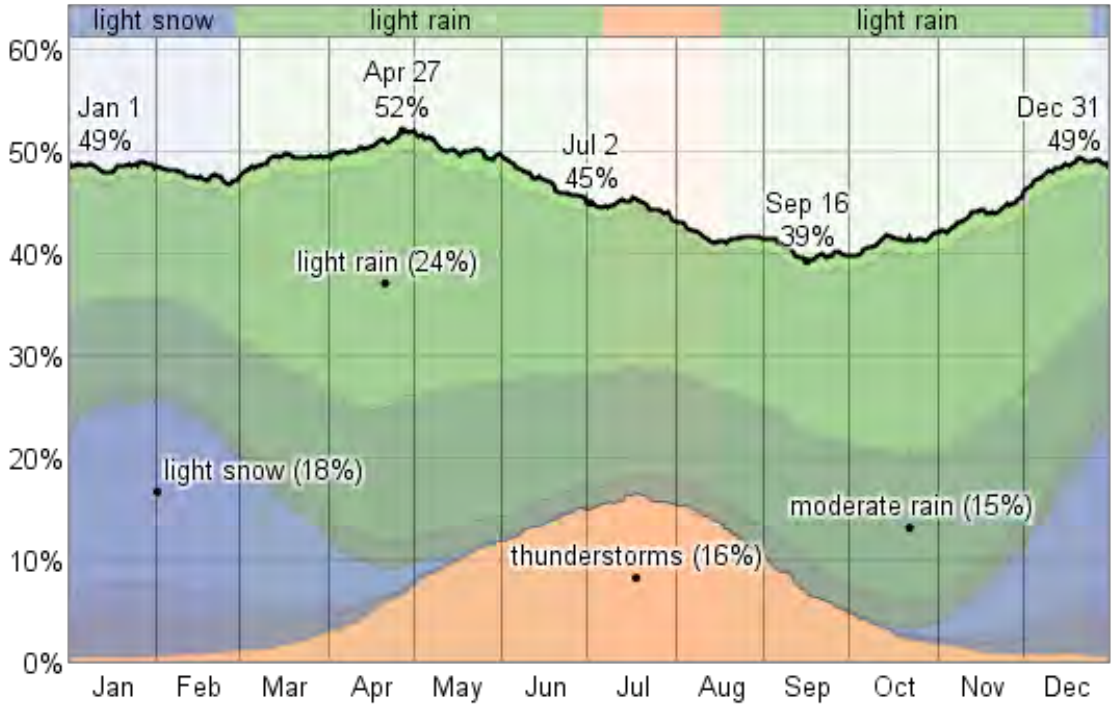
Warning

The radar on commercial vessels cannot detect kayakers.

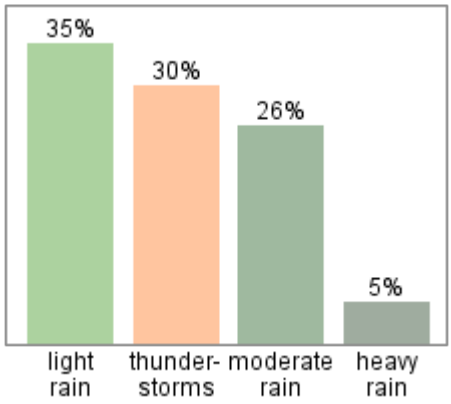
Precipitation

Probability of Precipitation at Some Point in the Day

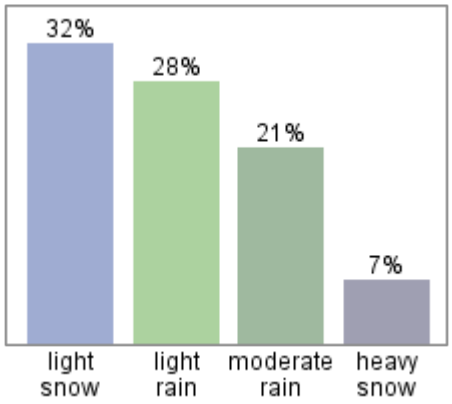
The fraction of days in which various types of precipitation are observed in New York City. If more than one type of precipitation is reported in a given day, the more severe precipitation is counted. For example, if light rain is observed in the same day as a thunderstorm, that day counts towards the thunderstorm totals. The order of severity is from the top down in this graph, with the most severe at the bottom.



Warm Season Precipitation



Cold Season Precipitation



Rain and Water Pollution

Heavy rain can result in the sewers opening up – see page 34.

Magnetic Field

Terminology

- **Magnetic Declination** is the angle on the horizontal plane between magnetic north (i.e. the direction that the north end of a compass needle points) and true north (i.e. the point about which the Earth rotates).
- **Magnetic Inclination** is the vertical angle that the Earth's magnetic field lines make (either into or out of the Earth) relative to the local horizontal plane.
- **Magnetic Deviation** refers to the error in a compass reading induced by nearby metallic objects. It is very common in urban environments where many structures (e.g. bridges and piers) have a high iron content.

Note

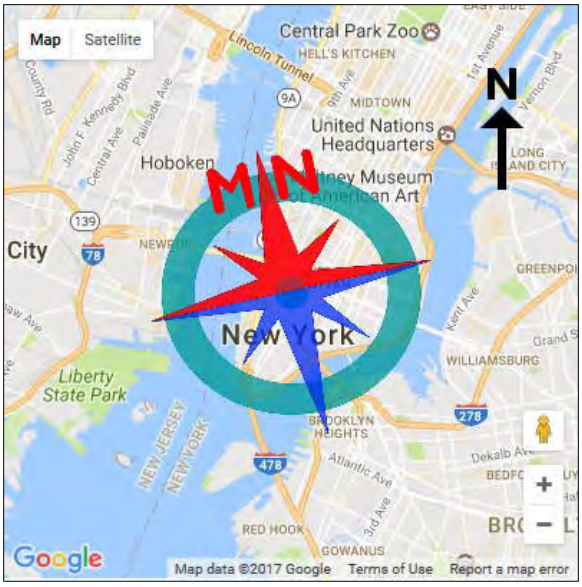
- Both the magnetic declination and the inclination vary depending on one's position on the Earth's surface, and over time.
- By convention, the declination is positive when magnetic north is east of true north, and negative when it is to the west, as it is in New York City.

New York Harbor

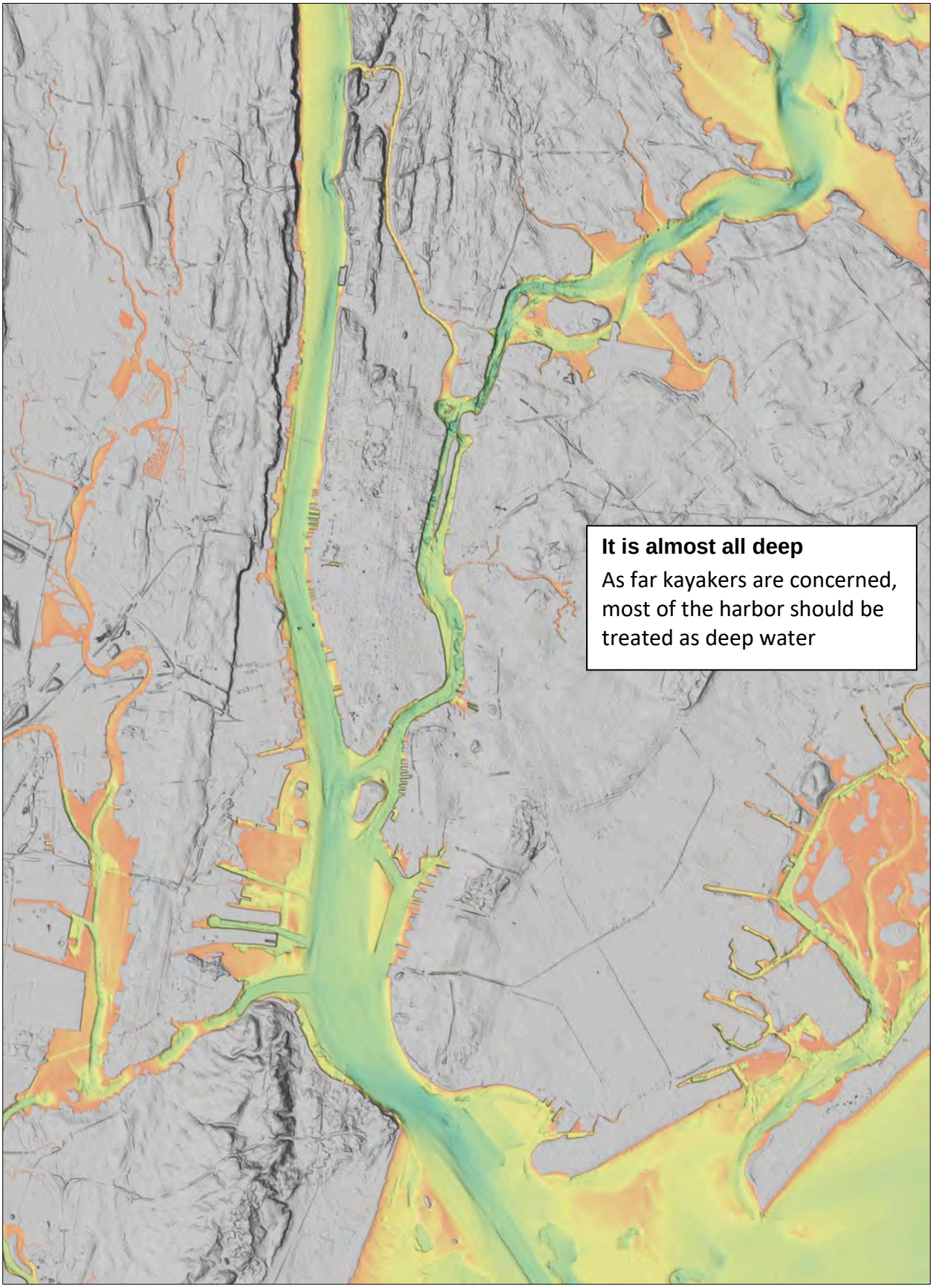
	Magnetic Declination	Magnetic Inclination
Current Value	-12° 55' 26"	66° 33' 11"
Change per Year	0° 1' 36"	-0° 5' 47"

Local Magnetic Disturbance

Differences of as much as 5° from the normal variation have been reported in Lower Bay in the vicinity of 40°29.6'N., 74°04.2'W.



Water Depth


It is almost all deep
As far kayakers are concerned, most of the harbor should be treated as deep water

Waves

New York Harbor

- Often get higher waves in afternoon
- Often get higher waves on eastern shores
- Longer stretches of open water create higher waves
- Typical wave/wake takes approximately two minutes to cross Hudson
- Harbor waves can get to be very high in certain conditions & locations. Check marine weather forecast for “small craft advisory”

Standing Wave near 59th Street Bridge

- Forms at certain times of the tide
- To avoid, take channel on the East side of Roosevelt Island

East River and 59th Street Bridge, West Channel

Speed of Waves

- Bigger waves travel faster
- Waves travel faster in deeper water
- Typical 8 second trade wind wave moves at 12.4 m/sec = 28 mph

Breaking Waves

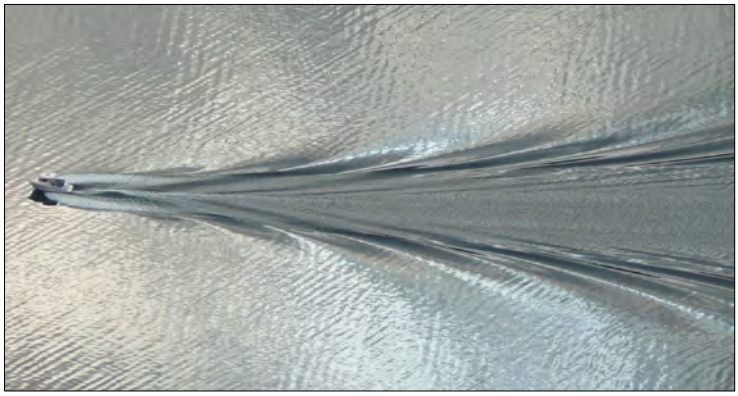
The type of wave break depends on the shape of the bottom:

- Steeply sloping bottoms cause plunging waves
- Gentle slopes cause spilling waves
- Abrupt slope change cause water to surges on to beach

Standing Wave

In physics, a standing wave, also known as a stationary wave, is a wave which oscillates in time but whose peak amplitude profile does not move in space. They occur on the harbor when moving water flows over an obstruction on the seafloor.

Wakes



Wakes are waves caused by passing motorboats.

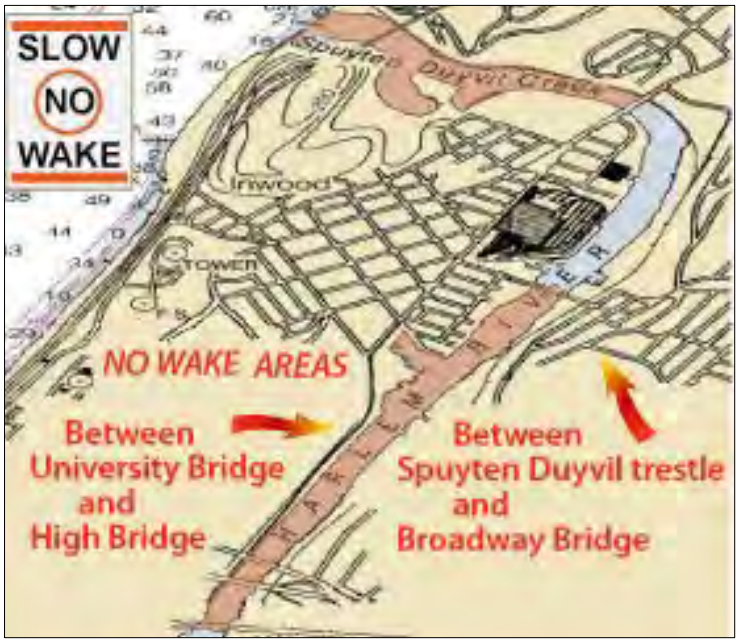
Reflecting Waves

Wakes are especially problematic in those parts of New York Harbor that have frequent motorboat traffic and where the bulkhead is nearby (i.e. no piers) and is a solid vertical wall (as opposed to loose rock which absorbs waves) as the wall causes the wakes to reflect back.

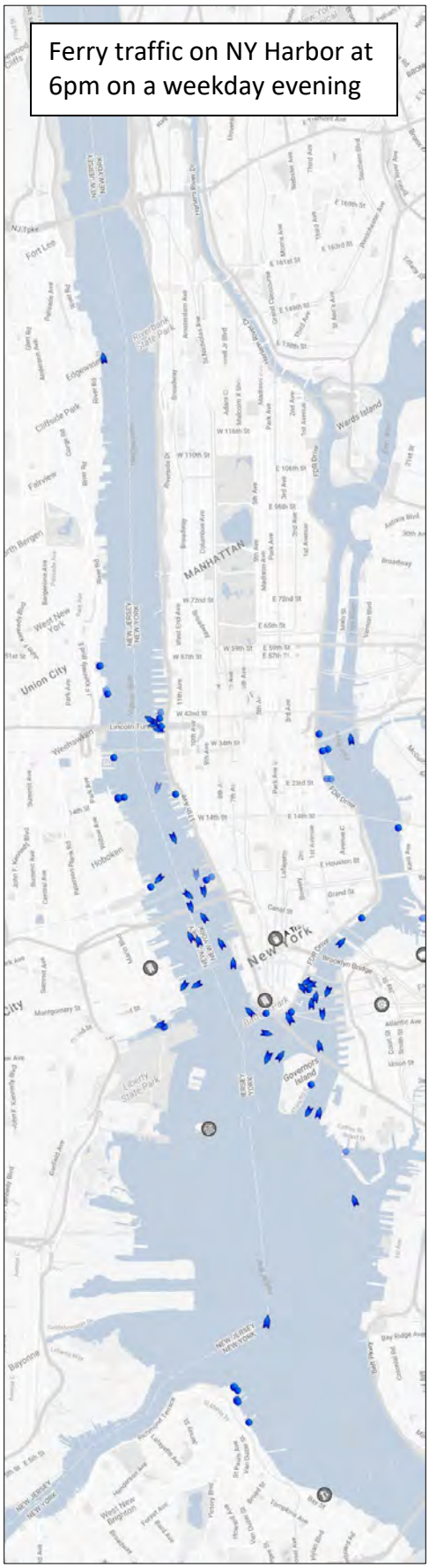
No Wake Zones

There are No Wake Zones defined on the Harlem River (does not apply to commercial vessels) and 200' off New Jersey pier heads and 100' off New York pier heads.

Never assume that there will be no wakes in a no-wake zone!



Wakes



Ferry traffic on NY Harbor at 6pm on a weekday evening

Ferries and Wakes

There are more than 2,000 wake-producing boat trips on NY Harbor every business day, the majority of which are by ferries.

In general, older ferries create larger wakes than newer ones. Mono-hull ferries produce large wakes, especially when transitioning from low speed (i.e. displacement mode) to high speed (i.e. planning mode). The newest catamaran ferries produce smaller wake at all speeds.

Mono-hull – Larger Wake

View From south end of Roosevelt Island

Catamaran – Smaller Wake

View from Red Hook, Brooklyn

Points on Map

- Blue dots show ferry in terminal
- Blue arrows show direction of moving ferry

Maritime Security Zones

25 Yard Rule

All waters within 25 yards of a dock or pier where a barge, ferry or other commercial vessel is operating are considered to be a security zone. Keep away.

Special Events

Additional security zones are defined on the East River, including full river closure, for special events (e.g. when the United Nations is in session).

Maritime Security Zones

Ellis Island Bridge

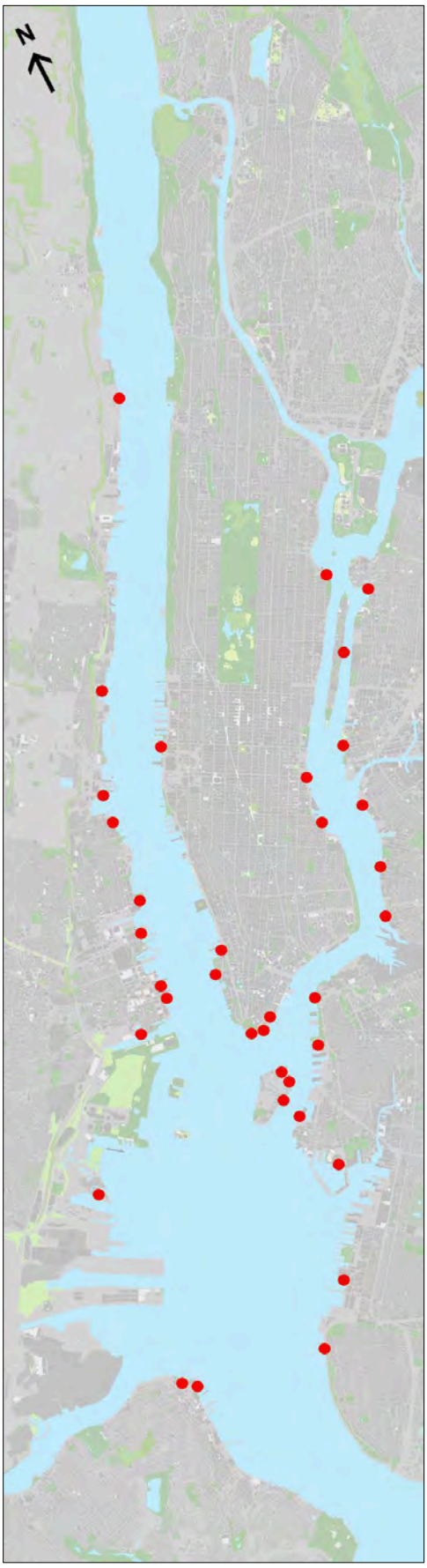
Ellis Island Bridge, from Liberty State Park

Ellis Island Bridge

All waters within 150 yards of Liberty and Ellis Island are a security zone and so should not be entered. So is the Ellis Island Bridge, but human-powered vessels may transit underneath the bridge subject to the following conditions:

- **Dates/Times:** On weekends only, to include Federally Observed Holidays on a Friday or Monday, from Memorial Day Weekend through October 1 each year, between one hour after sunrise and one hour before sunset.
- **Vessel types:** Human powered vessels equal to or less than twenty five feet. Human powered vessels must be able to safely navigate under the bridge.
- **Notification:** Human powered vessels desiring to transit shall contact the United States Park Police Command Center at 212-363-3260 or VHF CH 13 regarding intentions of passage prior to entering the safety and security zone and transiting under the Ellis Island Bridge.
- **Route:** Transits through the safety and security zone and under the bridge shall occur only at the designated route marked with lights and signage.
- **Passage:** Vessels transiting under the Ellis Island Bridge shall make expeditious passage and not stop or loiter within the safety and security zone.

Ferry Terminals



Ferry Terminal Activity

Location	Arrivals & Departures per Hour			
	Weekday 8am	Weekday noon	Weekday 5pm	Weekend noon
W 39th St.	34	18	36	18
WFC	38	20	38	8
Wall St.	36	10	42	2
Whitehall	8	4	8	4

Warning

- Above activity rates are approximate
- Activity may be much higher for short periods.
- Some terminals are most active on weekends and on holidays (e.g. on Governors Island).

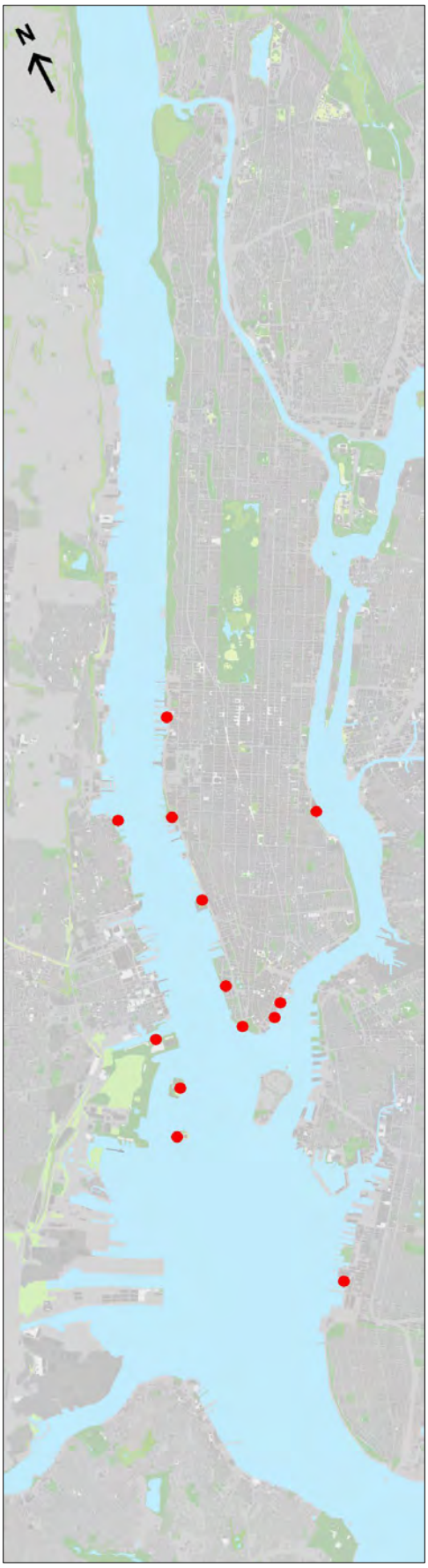
Terminals

WFC (World Financial Center) Terminal, Lower Manhattan

Whitehall (Staten Island Ferry Terminal), Lower Manhattan

Hoboken

Tourist & Party Boat Terminals



Hudson River, Manhattan

- Pier 82, 42nd Street
- Pier 64, Chelsea Piers
- Pier 40, Houston Street
- World Trade Center
- Battery Park

Hudson River, New Jersey

- Weehawken
- North Hoboken
- Morris Canal Basin, Jersey City

East River, Manhattan

- Wall Street
- South Street Seaport
- East 23rd Street

Other

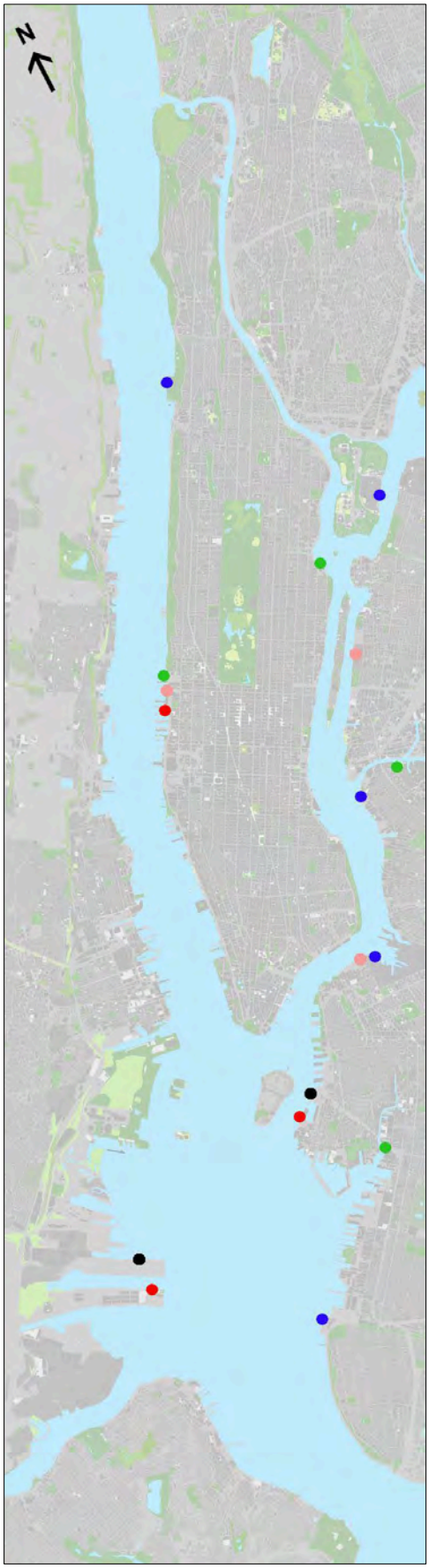
- Ellis Island
- Liberty Island

Tourist Boats

Near Governors Island

Near Hoboken

Large Ship Terminals



Colors

- Black: Container ship terminal
- Blue: Sewer sludge ship terminal
- Green: Waste transfer terminal
- Pink: Power station
- Red: Cruise boat terminal

Cruise Ship Departure Times

The Queen Mary II has to leave the pier where it docks (in Red Hook) precisely at high tide in order to have deep water in the Buttermilk Channel. It cannot wait.

The large cruise ships that use the Overseas Terminal in Midtown Manhattan almost invariably depart between 3:30pm and 4:30pm on weekends.

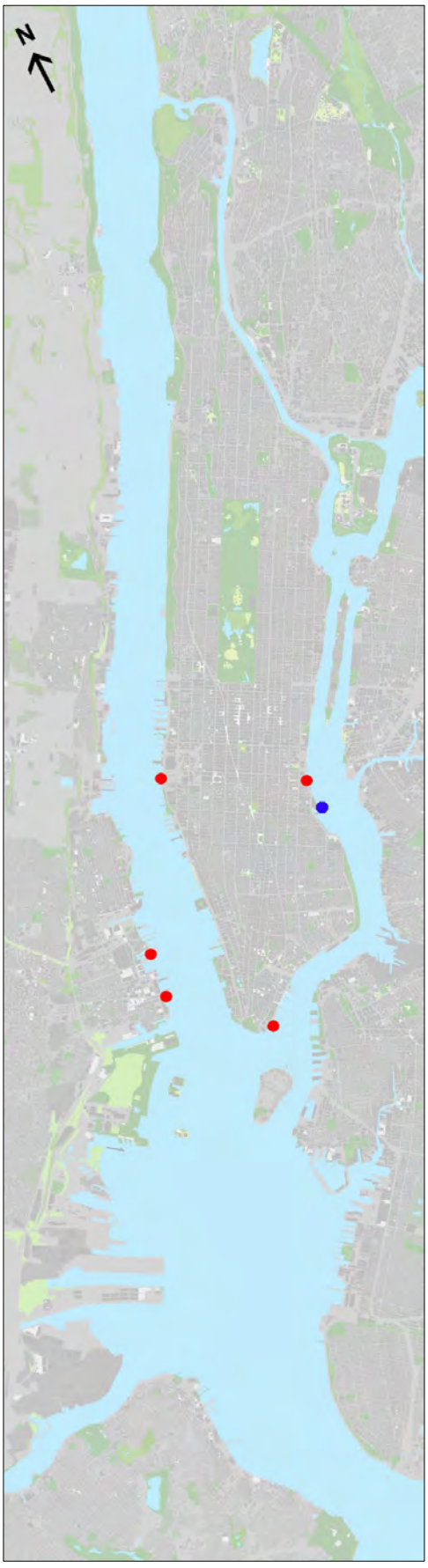
Warning

- Large vessels cannot easily stop, slow down, or turn. Stay out of their way.
- If a large ship is delayed for some reason, it may impact multiple other large ships in the channel behind it, all of which have to maintain a certain spacing between each other for safety.
- Cruise ships have bow thrusters (i.e. side facing propellers at the front of the boat) that are as powerful as the main propellers on many smaller ships. Keep well away.

Cruise Ship

Cruise ship passing Lower Manhattan

Helicopter & Seaplane Terminals



Colors

- Red: Helicopter terminal
- Blue: Seaplane terminal

Seaplanes

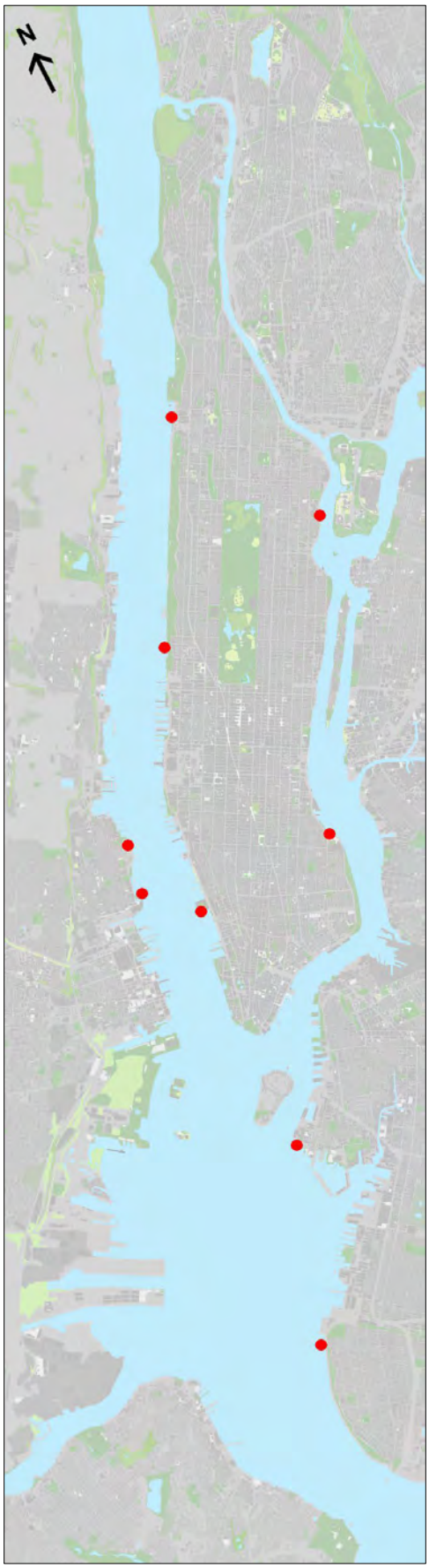
East River, 23rd Street

East River Seaplane Anchorage and Runway

Helicopters

Hudson River, 28th Street

Fishing Piers



Notes

The most popular fishing locations in NY Harbor tend to be where the current flows strongly through the pier or along the waterfront.

Hudson River

- Harlem Piers, 125th St.
- Pier I, Riverside Park, 70th St.
- South side of Pier 40, Houston St.
- Hoboken, Pier A, near train station.
- Hoboken, Castle Point.

East River

- FDR Drive, East 18th St.
- FDR Drive, East 107th St.

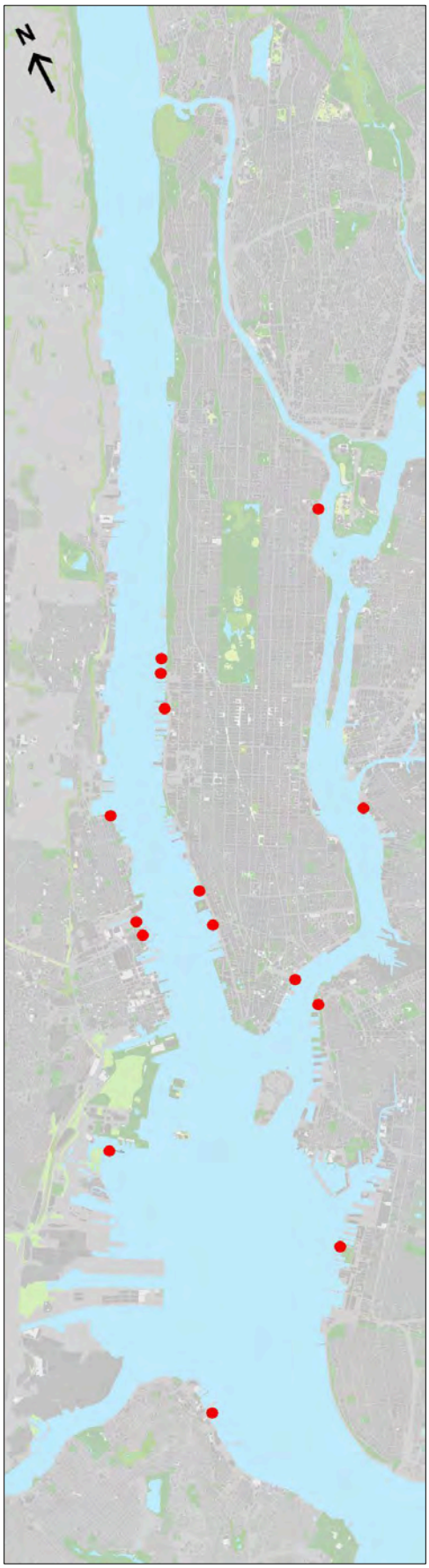
Buttermilk Channel

- Louis Valentino, Jr. Pier, Red Hook, Brooklyn

Warning

- Keep >100 feet away from fishing piers.
- Keep further away on downstream side.
- Fishing lines are often impossible to see.

Pile Fields



Hazards

- Numerous sharp objects (e.g. shellfish)
- Underwater hazards that can tip boat
- Acts as a strainer on an outgoing tide
- Problematic in wave conditions
- Often results in kayak tipping

Instructions

- Look for current heading through piles
- Keep well away from upstream side

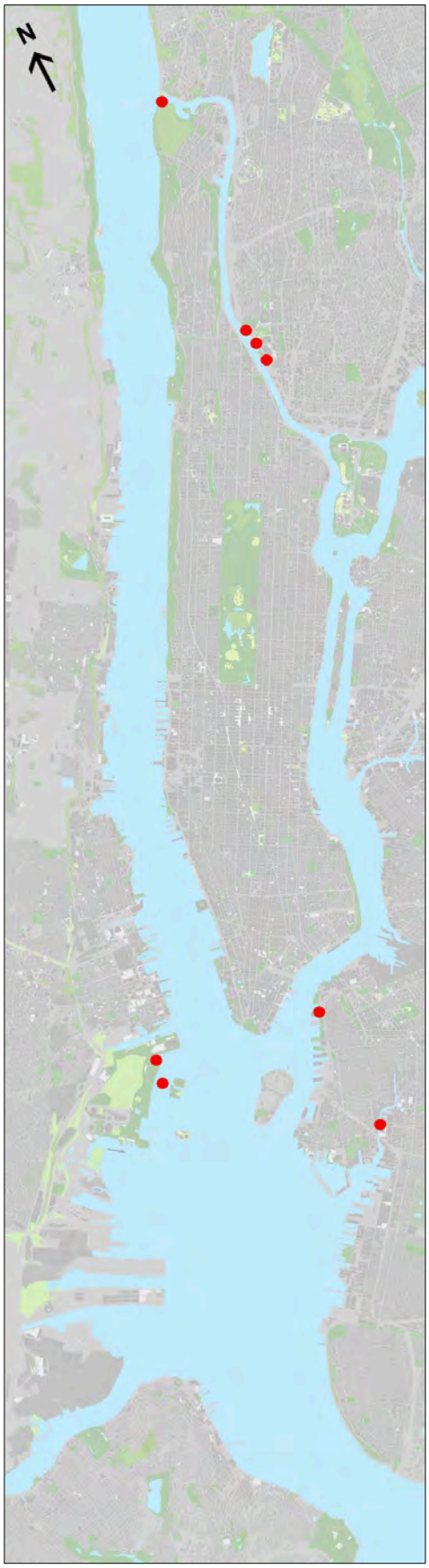
New Piers and Piles

Many new piers are built on top of existing pile fields. There are often a lot more piles under the pier than what is obvious from the outside.

Harlem River, 110th Street

Hoboken, South End

Low Bridges



Spuyten Duyvil Rail Bridge

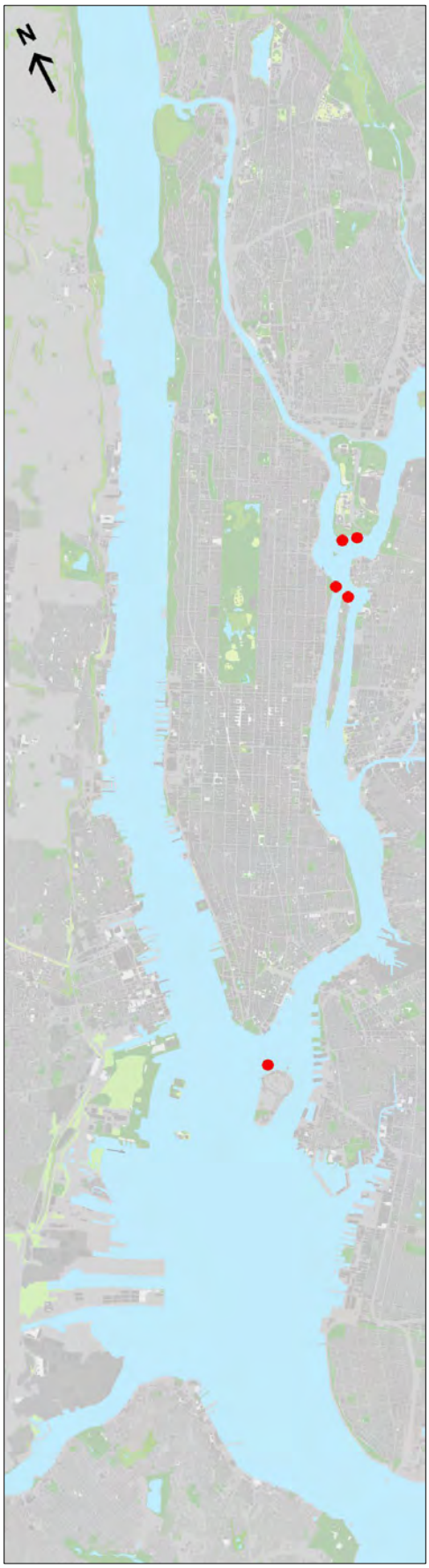
- Bridge too low at high tide for kayakers to go under.
- Swings open for boats except when train passing.
- Approximately 30 trains per day during summer.
- Schedule is not posted on web.

Other

Brooklyn Bridge Park

Carroll Street Bridge, Gowanus Canal

Tidal Eddies



Notes

An eddy is the swirling of a fluid and the reverse current that is created when the fluid flows past an obstacle. In extreme cases there can be a whirlpool in the center of, or underneath, the eddy.

Hell Gate

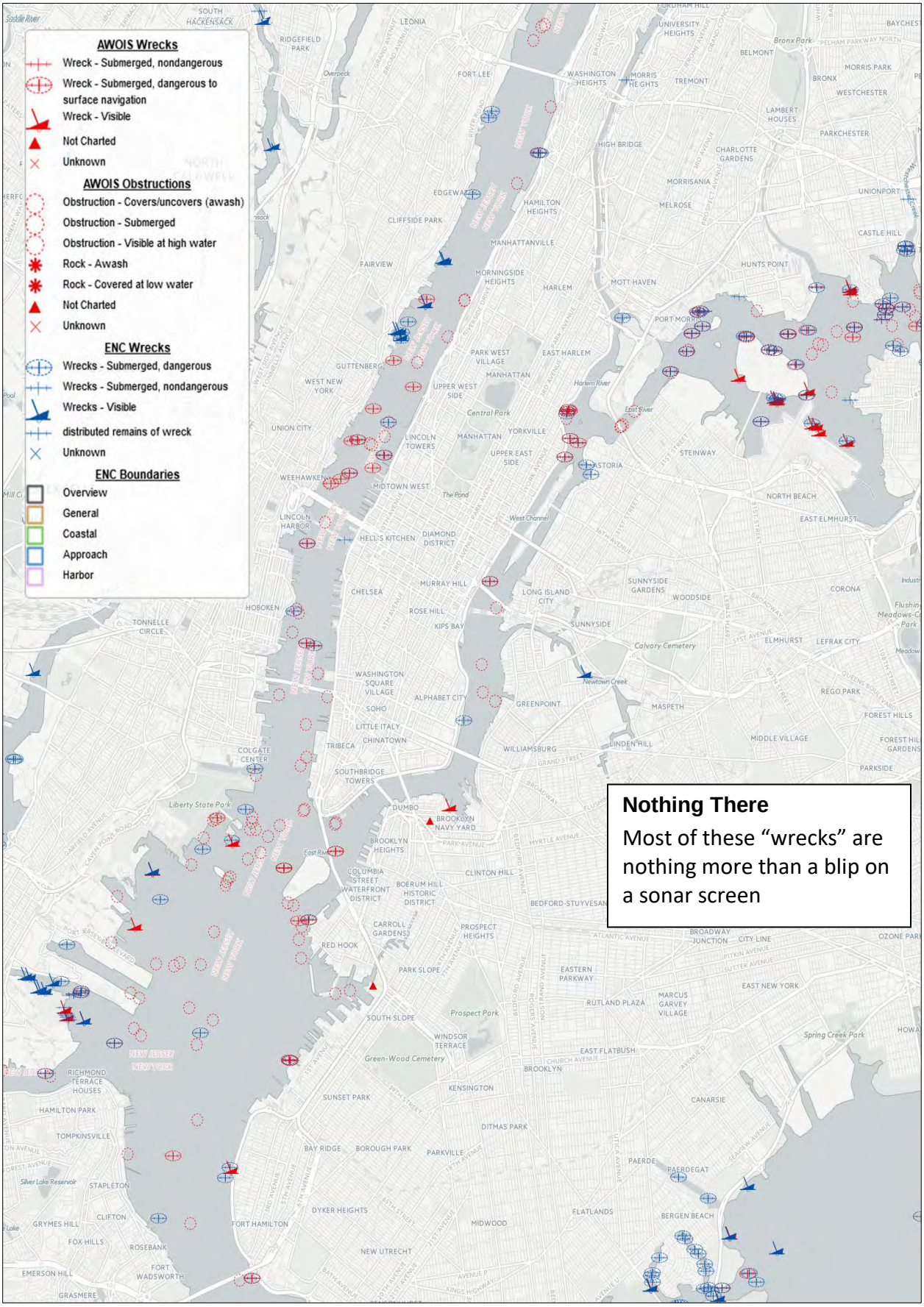
They are especially common in the Hell Gate area, but their location and strength depends on the time of the tide:

- South of Randal's Island, near Hog Back (during northbound tide)
- Near Gracie Mansion
- North tip of Roosevelt Island

The Battery

The phenomena known as the "Spider" is a swirl off the Battery that results from the confluence of the Hudson's volume and the East River's flow within 1.5 to 2 hours before and after the change of current.

Shipwrecks


AWOIS Wrecks
Wreck - Submerged, nondangerous
Wreck - Submerged, dangerous to surface navigation
Wreck - Visible
Not Charted
Unknown
AWOIS Obstructions
Obstruction - Covers/uncovers (awash)
Obstruction - Submerged
Obstruction - Visible at high water
Rock - Awash
Rock - Covered at low water
Not Charted
Unknown
ENC Wrecks
Wrecks - Submerged, dangerous
Wrecks - Submerged, nondangerous
Wrecks - Visible
distributed remains of wreck
Unknown
ENC Boundaries
Overview
General
Coastal
Approach
Harbor
Nothing There
Most of these “wrecks” are nothing more than a blip on a sonar screen

Whales

They're Back

East River, near Gracie Mansion, Dec/31 2016

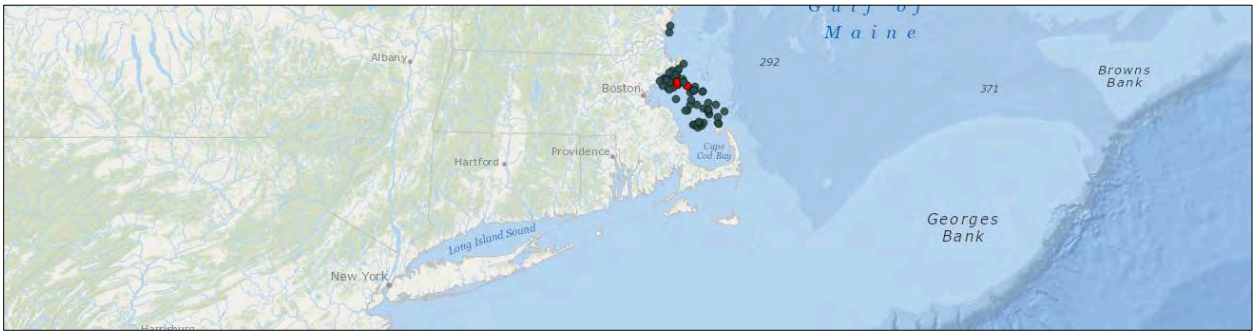
Frequency

There were 20 individual whales documented in New York Harbor in 2016.

Right Whale Migration Season

Mandatory speed restrictions of 10 knots or less are required in Seasonal Management Areas along the U.S. East Coast (note: but not inside New York Harbor) during those times of the year when right whales are migrating. For the entrance to New York Harbor, speed restrictions apply between Nov/1 through Apr/30.

Right Whale Location Map



For May/2022. Red dot = acoustic sighting. Black dot = visual sighting.

NOAA Whale Watching Guidelines

- Do not approach any whale within 100ft
- Do not approach any North Atlantic Right Whale within 1500ft
- Do not travel behind or in front of whales
- Get out of the way if one comes up behind you
- Do not interrupt any marine mammal's natural behavior
- Always approach from the side – moving parallel with the animal's direction of travel

Events

Tugboat Race, from Pier 96, Manhattan

Fireworks, Lower Manhattan, from Jersey City

NY Harbor Events

- Fireworks
- Fleet Week
- Kayaking – Manhattan Circumnavigation
- Paddleboard Race – around Manhattan
- Parade of Ships
- Powerboat Races
- Sailing Races
- Swim Races
- Tugboat Race

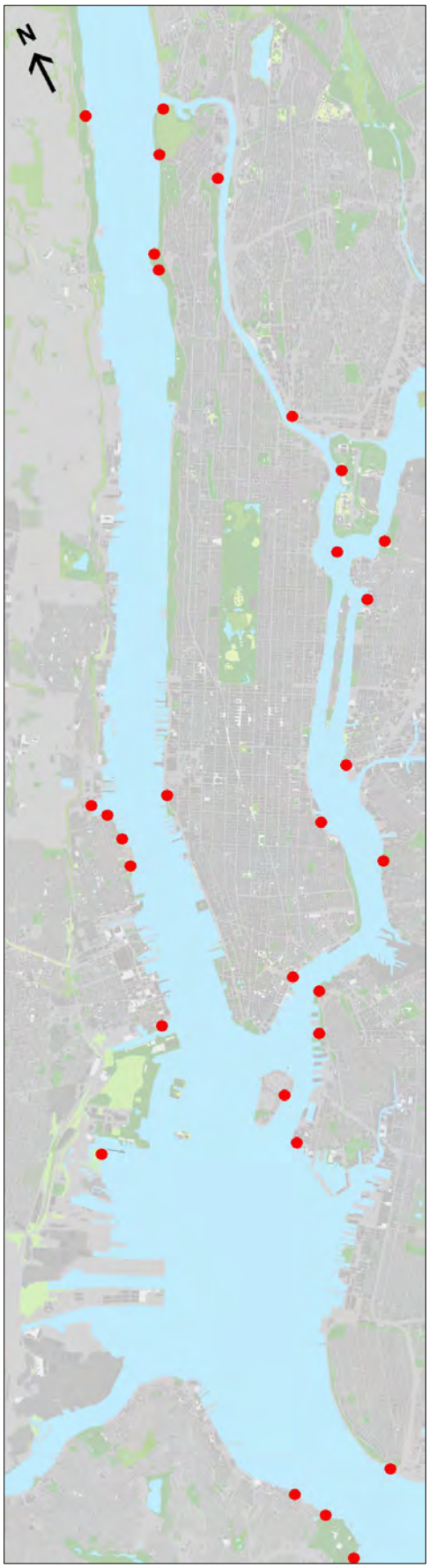
On Land Events

- Beach closures
- Dock repairs

Notice to Mariners

The US Coast Guard, First District, publishes a monthly and weekly "Notice to Mariners" (PDF) that lists all events on NY Harbor that will affect mariners.

Beaches



Public Access

Many beaches on New York Harbor are closed to the public. See page 33 for a list of legal launch sites.

Beaches

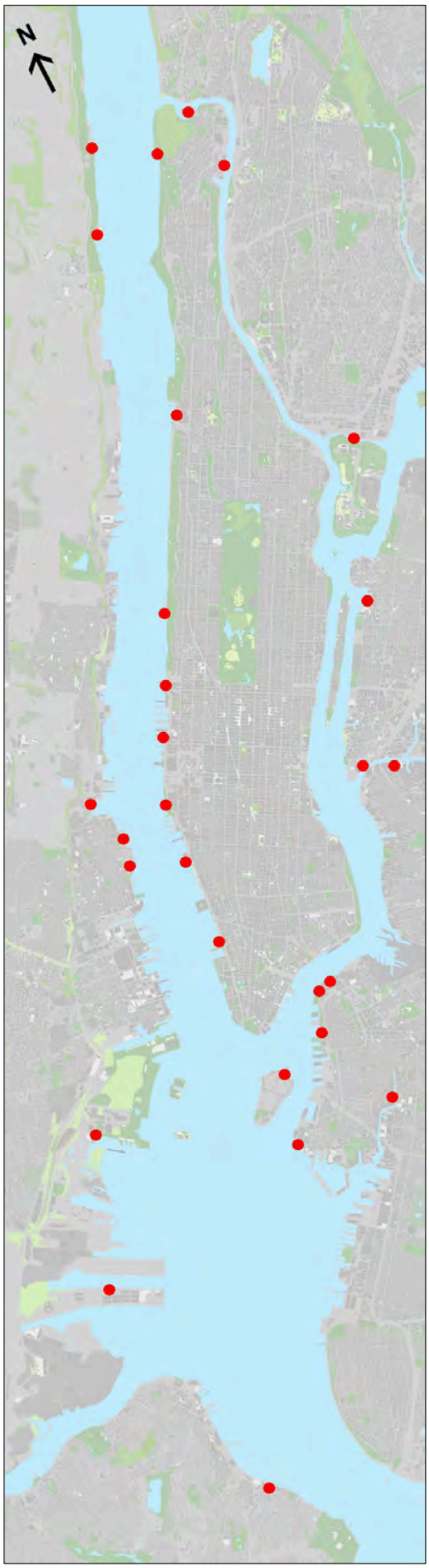
Brooklyn Bridge Park Cove

Maxwell House Cove, Hoboken

Halletts Cove, Astoria, Queens

Spuyten Duyvil, Manhattan

Kayak Launch Sites



Safe Capacity

The safe capacity of a highly developed body of water like New York Harbor for human-powered recreational boating is constrained by the number of people that can get off the water in five minutes at a given location, as might need to occur if the weather suddenly changes for the worse, or there is a police emergency.

Unfortunately, with the notable exception of the few public beaches, most launch sites on New York Harbor are not designed to handle large numbers of kayakers. Plan your trip accordingly.

Hudson River Park

The launch sites in Hudson River Park are open when the adjacent boathouse is also open

Governors Island

Kayakers visiting Governors Island must land at the Pier 101 kayak dock (in NE Corner of island). They can come from 7:00am and must depart by 6:00pm Mon thru Sun.

If the Pier 101 gate is locked, which it should be, call the Security Desk at 212-809-3299 to get the gate opened (there is sign on the Pier gate to call security). Kayaks should be left on the Pershing Hall hill adjacent from the pier. To depart the island, call Security to have the gate opened.

With Nearby Restrooms

Hudson River

- Dyckman St.
- Frank Sinatra Park, Hoboken
- Gansevoort Peninsula, Hudson River Park
- Liberty State Park, Jersey City
- Pier 26, Harrison St. Hudson River Park
- Riverside Park Boat Basin, 79th St.

East River

- Halletts Cove, Astoria, Queens
- Brooklyn Bridge Park, Dumbo, Brooklyn
- Governors Island

Free Kayaking

New York Harbor is unique worldwide in that the vast majority of the 50,000 people who go kayaking on the harbor do every year so for free – thanks to volunteer-run and community-supported free public kayaking programs. Below is just a sample.

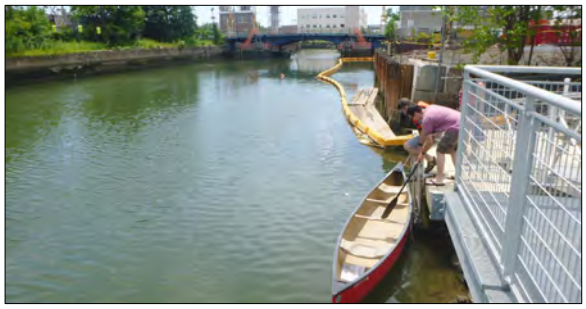
Brooklyn Bridge Park Boathouse

Brooklyn Bridge Park

Downtown Boathouse

Pier 26, Lower Manhattan

Gowanus Dredgers Canoe Club



Gowanus Canal, Brooklyn

Hoboken Cove Community Boathouse

Maxwell House Cove, North Hoboken

Kayak Staten Island

Conference House Park, Staten Island

Long Island City Community Boathouse

Halletts Cove, Astoria, Queens

Manhattan Community Boathouse

Pier 96, Midtown Manhattan

Red Hook Boaters

Valentino Park, Red Hook, Brooklyn

NYC Parks Boating Regulations

Kayaks and Canoes

- A permit allows a permittee and his or her guests to use the City's access facilities for a kayak or canoe. A permittee may have more than one boat listed on his or her permit, but each kayak or canoe on the water must carry a permittee.
- The permittee is responsible for the safety of all those in his or her craft. Operation of the kayak or canoe under a permit is solely at the operator's own risk.
- Permittees and guests should be strong, experienced swimmers. It is recommended that permittees be able to sustain themselves fully clothed for ten minutes in deep water; swim two body-lengths underwater at a depth of six feet; and tow a "victim" fifteen feet.
- Permittees must be familiar with and obey all federal, state and local boating rules and regulations.
- Permittees must be aware that environmental conditions such as rip tides and other strong currents can overwhelm even the most adept swimmers. They should know the water and weather conditions before going out.
- Because the waters can be polluted, boaters should avoid water contact to the greatest degree possible.
- Swimming, water skiing, windsurfing, scuba diving or practicing immersion escape techniques in the waters to which the launch site give access are prohibited.
- No wildlife or natural land features may be disturbed.
- Kayaks and/or canoes may be launched only at launch sites designated for this purpose. No person shall launch any boat or water vehicle that requires the use of a boat trailer or other such trailer for its land transportation. A person shall not launch a motor powered vessel, or use either an inboard or outboard motor on any vessel once underway. No person shall launch rafts or other inflatables, sailboats, rowboats, "wind surfers" or sailboats of any kind.
- All persons using a kayak or canoe must wear a Personal Flotation Device.
- No person launching a boat from a kayak and/or canoe launch may begin a boating trip before sunrise or complete a boating trip after sunset. The launch sites will be open from April 1 to December 1
- No person shall enter a launch site, or operate or ride as a passenger in a canoe or kayak, under the influence of drugs or alcohol.
- No person shall use any boat-launching site or any adjacent waters within 100 feet from the shore of a launch area, including offshore and inshore approaches, for any purpose other than launching boats or removing boats from the water, unless a written permit is obtained from the department.

Buy a Permit

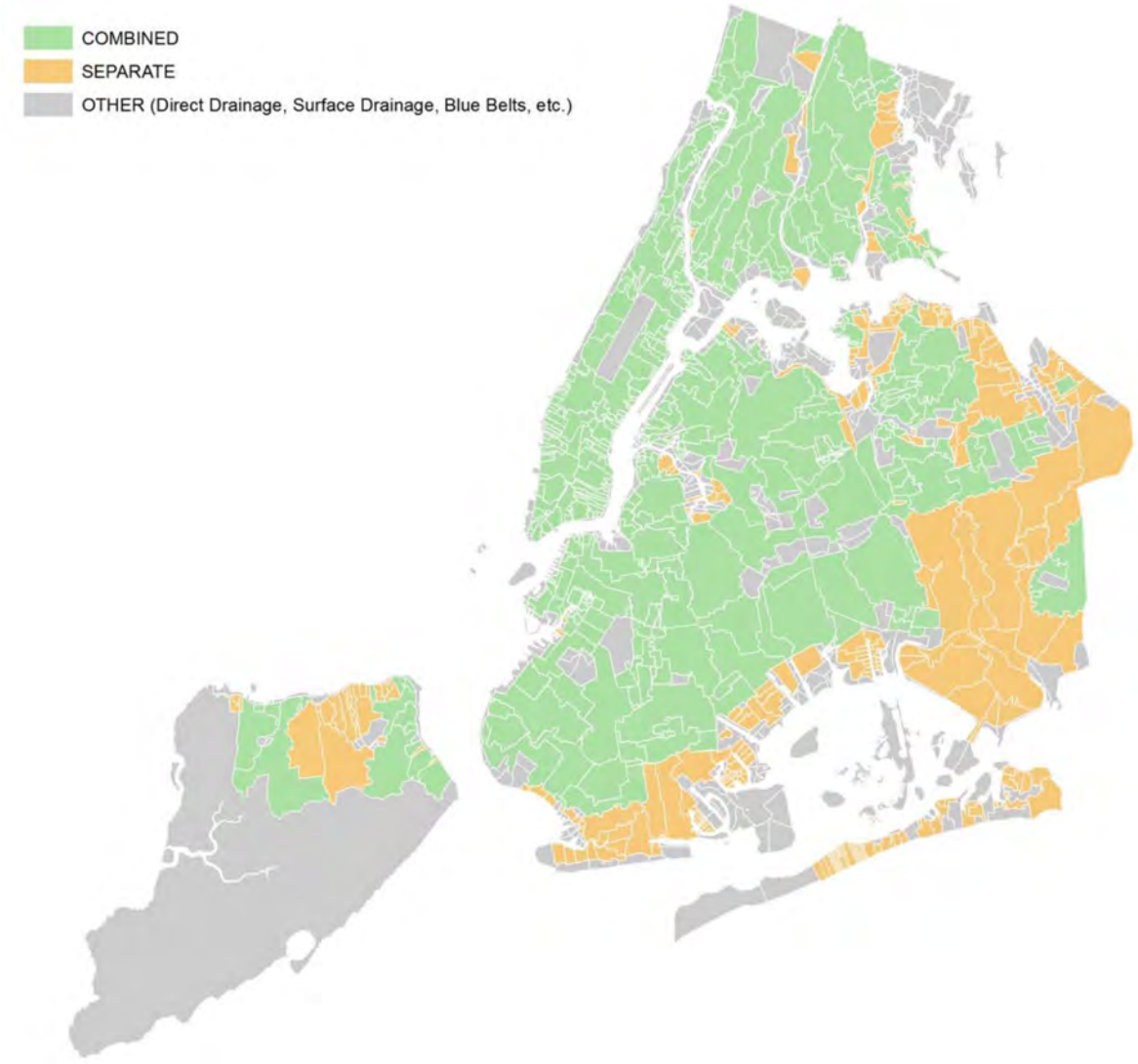
It is cheap – only $15 per year. It is easy to get (by mail). It is required by law if you launch in New York City. And it helps the city know how many people go kayaking.

NYC Stormwater Drainage and Sewers

In New York City, stormwater is conveyed through combined sewers or separate sewer systems. In unsewered areas, water flows directly over the ground into waterways.

- **Combined Sewer Areas:** In most areas of the City, sanitary and industrial wastewater, rainwater and street runoff are collected in the same sewers and then conveyed together to the City's treatment plants. This is known as a combined sewer system. Approximately 60 percent of the City sewers are combined.
- **Separate Sewer Areas:** In some New York City neighborhoods, sanitary waste and stormwater runoff are channeled in separate sewer systems: sanitary waste is carried to wastewater treatment plants while stormwater is channeled directly to local streams, rivers, and bays.

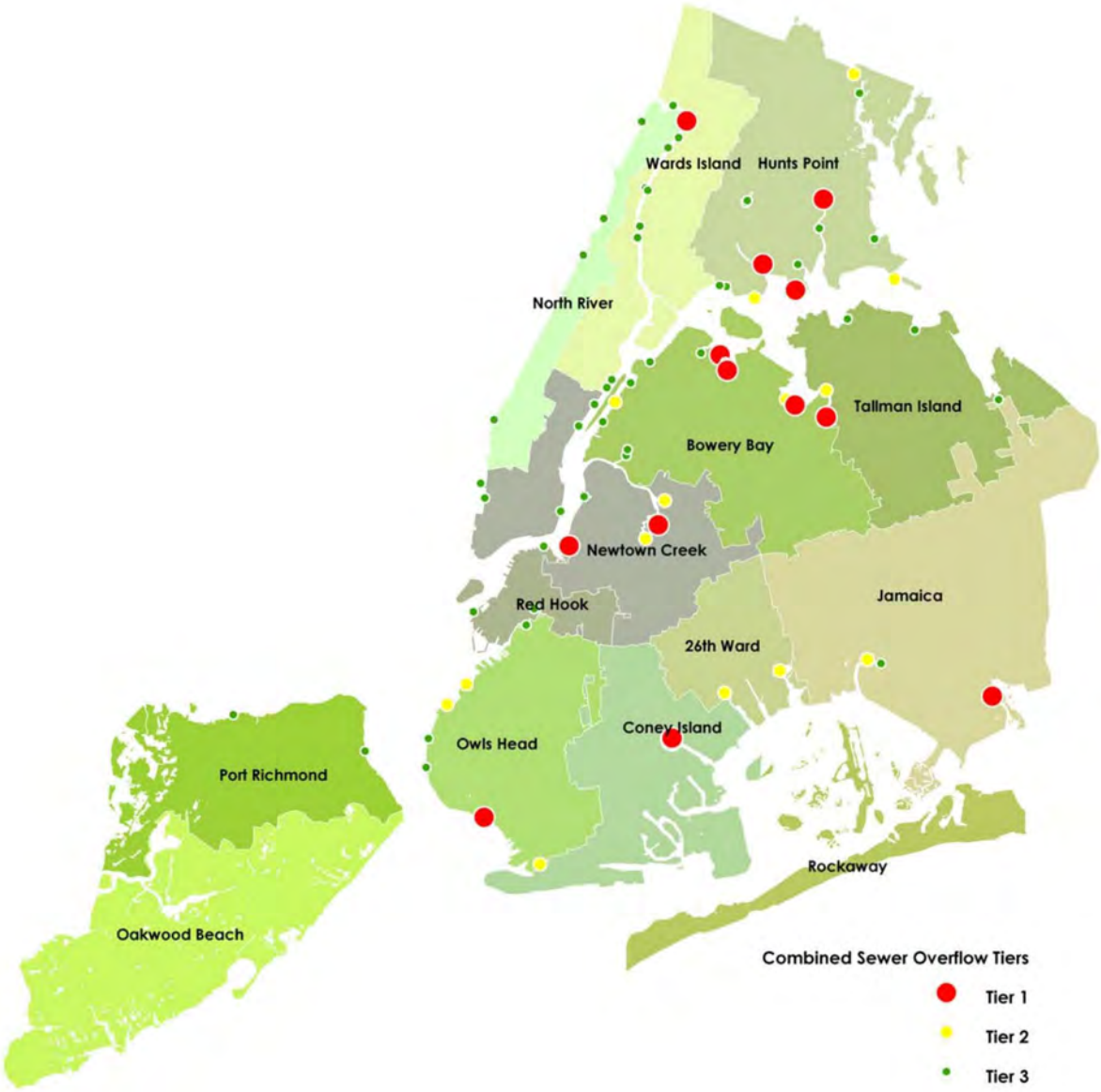
Map



NYC Combined Sewer Overflows (CSOs)

Sometimes, during heavy rain and snow storms, combined sewers receive higher than normal flows. Treatment plants are unable to handle flows that are more than twice design capacity and when this occurs, a mix of excess stormwater and untreated wastewater discharges directly into the City's waterways at certain outfalls. This is called a combined sewer overflow (CSO).

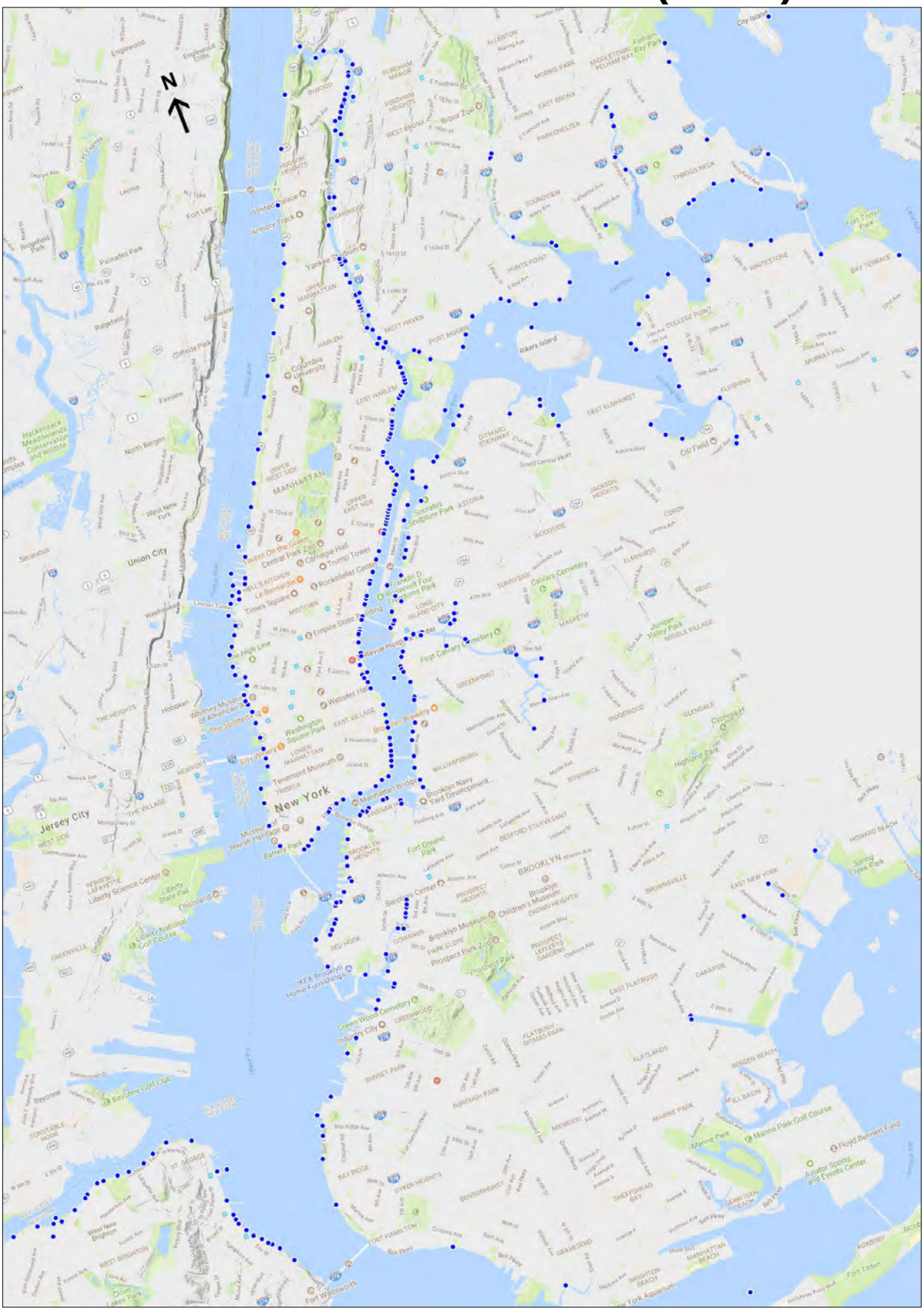
Map



Outfall Tiers

- Tier 1 outfalls discharge over 500 MGY (i.e. million gallons per year) and comprise roughly 50% of all CSO volume.
- Tier 2 outfalls discharge between 250 and 500 MGY, which is 20% of CSO volume.
- Tier 3 outfalls discharge between 50 and 250 MGY, which is 10% of CSO volume.

NYC Combined Sewer Overflows (CSOs)



Water Quality

Water Quality Standards

The New York State Department of Environmental Conservation uses two metrics as indicators of ecosystem health and degradation:

- Dissolved oxygen
- Fecal coliform bacteria

State standards reflect a range of acceptable water quality conditions corresponding to state designated "best usage" of the water body. In addition, the Environmental Protection Agency recommends a standard for enterococci in marine recreational waters. The standards for these three indicators are listed in the table below:

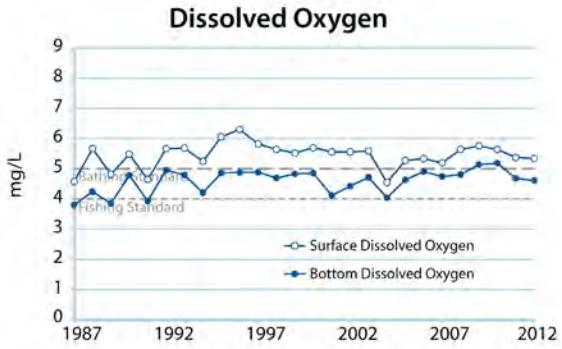
Best Usage	Dissolved Oxygen	Fecal Coliform (geometric mean)	Enterococci (geometric mean)
Bathing and other recreational uses	Never less than 5.0mg/L	Less than 200 cells/100 mL	Less than 35 cells/100 mL
Fishing or boating	Never less than 4.0 mg/L	Less than 2,000 cells/100 mL	No standard
Fish survival	Never less than 3.0 mg/L	No standard	No standard

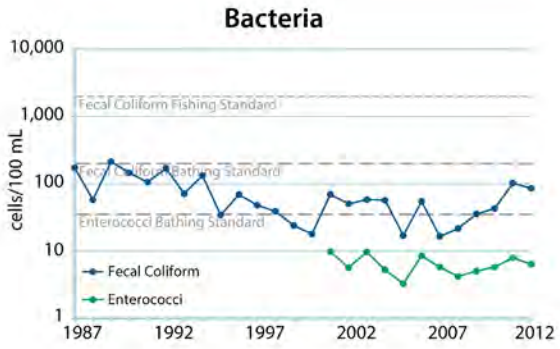
Other Metrics

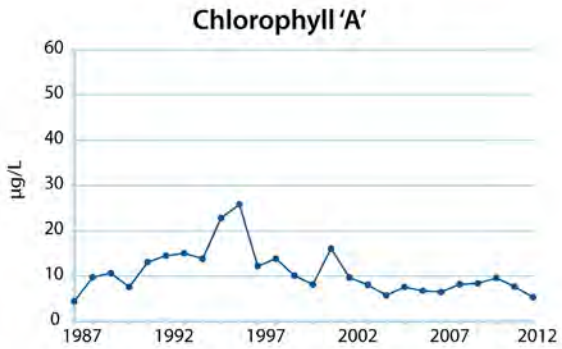
- **Secchi Transparency** is used to estimate the clarity of surface waters Secchi disks are lowered into the water. High Secchi transparency (greater than 5.0 feet) indicates clear water. Reduced transparency is often due to high suspended solids concentrations or plankton blooms.
- **Total Suspended Solids** (TSS) include all particles suspended in water that will not pass through a filter. As TSS levels increase, a water body may lose its ability to sustain a healthy ecosystem. Suspended solids absorb sunlight, increase water temperature and decrease dissolved oxygen.
- **Chlorophyll 'A'** is a green pigment found in most plants, algae, and phytoplankton. It is vital for photosynthesis and can be used as an indicator of the health of an aquatic ecosystem's primary producers, which are the base of the food chain. Overgrowth of primary producers can indicate eutrophication.
- **Total Nitrogen:** Nitrogen-based molecules are important nutrients for plant growth. But excess nitrogen can cause eutrophication. The city's wastewater treatment plants measure the total amount of nitrogen in plant effluent in order to monitor nutrient loading in receiving waters.
- **Removal Efficiency:** The primary indicator of wastewater treatment plant performance is the removal efficiency, the percent of certain pollutants that are removed during the treatment process. All 14 wastewater treatment plants measure the removal of TSS, and carbonaceous biochemical oxygen demand (CBOD), a measure of the organic content present in a sample. Measurements for raw wastewater are compared to the plant's effluent to determine the percent of the pollutant removed.
- **Plant Flow:** Each of the city's 14 wastewater treatment plants have both automatic and manual systems for measuring the amount of wastewater that flows through the plant.

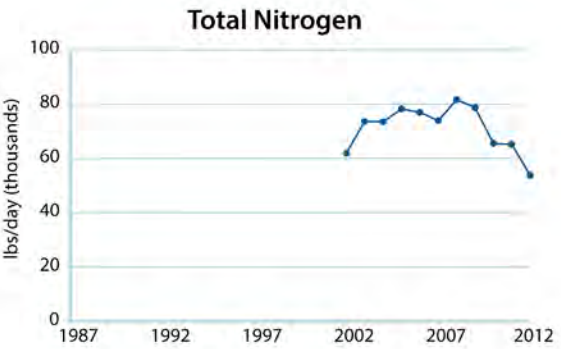
Water Quality

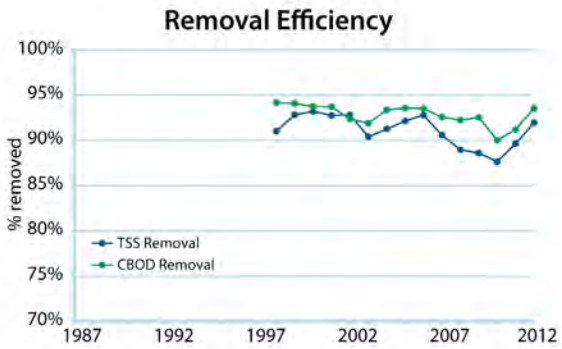
The State of the Harbor 2012 Report

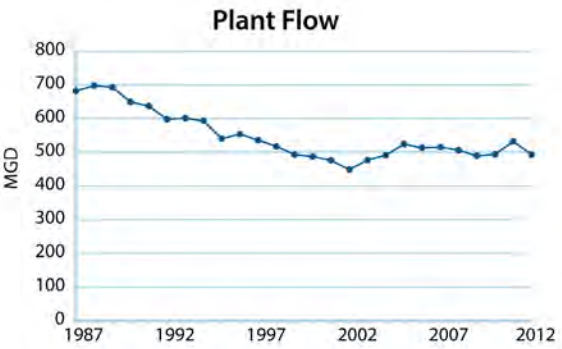












Water Pollution Events

When

- After a major rainstorm

Where

- All over the harbor after a major rainstorm
- In areas with limited tidal flow much more frequently

What

- Raw sewerage, if CSOs open up
- Road trash from storm drains

Locations

Waterbody	Rainfall* Triggers (inches) and Durations For Waterbody CSO Advisories			
	12 Hrs	24 Hrs	36 Hrs	48 Hrs
Bergen Basin	0.10	0.25	2.50	N/A
Bronx River	0.60	N/A	N/A	N/A
East River	N/A	N/A	N/A	N/A
Flushing Bay	0.80	1.30	N/A	N/A
Flushing Creek	0.40	1.00	1.25	1.50
Fresh Creek	0.75	1.25	2.50	N/A
Gowanus Canal	0.15	0.40	0.45	0.60
Harlem River	N/A	N/A	N/A	N/A
Head of Bay	1.00	1.40	2.50	N/A
Hendrix Creek	N/A	N/A	N/A	N/A
Hudson River	N/A	N/A	N/A	N/A
Hutchinson River	0.70	N/A	N/A	N/A
Jamaica Bay	N/A	N/A	N/A	N/A
Kills	N/A	N/A	N/A	N/A
Little Neck Bay	N/A	N/A	N/A	N/A
Lower Bay	N/A	N/A	N/A	N/A
Mill Basin	2.50	N/A	N/A	N/A
Newtown Creek	0.10	0.20	0.80	1.30
North Jamaica Bay	2.00	2.50	N/A	N/A
Paerdegat Basin	0.10	0.15	0.25	0.75
Sheepshead Bay	1.00	N/A	N/A	N/A
Shellbank Basin	1.40	2.50	N/A	N/A
Shellbank Creek	N/A	N/A	N/A	N/A
Spring Creek	1.40	2.50	N/A	N/A
Thurston Basin	0.10	0.30	1.00	N/A
Upper Bay	N/A	N/A	N/A	N/A
Westchester Creek	0.25	0.60	N/A	N/A
Western Long Island Sound	N/A	N/A	N/A	N/A

* Values shown correspond to storm sizes required to cause a Waterbody Advisory for secondary-contact recreation as a result of CSO discharges. Storms are defined as periods with fewer than 12 consecutive rainless hours. “N/A” means that no analyzed storm condition caused an advisory. Insufficient information is available for storms in excess of 3.5 inches.

Sulfuric Acid Discharges

The Problem

Effective Jan/1, 2020 the International Maritime Organization reduced the maximum sulfur content for marine fuels from 3.5% to 0.5%, except for ships that have an exhaust gas cleaning system, also known as a scrubber. Most large ships now use 0.5% sulfur fuel, but some ship owners have installed scrubbers rather than use the more expensive low-sulfur fuel.

A scrubber sprays the exhaust gas with sea water and then (in most cases) discharges the resultant diluted sulfuric acid directly into the ocean. Approximately 34% of all cruise ships use scrubbers

The Volume

In a typical year, more than four million tons of diluted sulfuric acid is discharged into NY Harbor. The largest single source seems to be cruise ships docking at the Overseas Terminal in Midtown Manhattan, which discharge more than one million tons per year.

Other Ports

More diluted sulfuric acid is discharged into New York Harbor in a normal year than into every harbor in China, or in Japan, or France, or Germany.

Shipboard scrubbers are banned in Hawaii, California, and Connecticut. Ships visiting these states have to burn low-sulfur fuel. No such restrictions apply in New York State. Nor is there any monitoring.

Tides and Currents

Two Hours after High Tide at the Battery

Observe Above

- Water level is dropping at the Battery.
- Current is still going in on the Hudson River.
- Current is going out on the East River and at the Verrazano Narrows.

Tides vs. Currents

- Tides refer to the rise and the fall of the water.
- Currents refer to the inflow and outflow of the water.
- The two features are <u>not</u> synchronized in NY Harbor.
- Different parts of the harbor change at different times.
- Tides and currents follow an approximately 12½ hour cycle.

Impact of Moon

- Tides are higher/lower during full or new moon (see page 55).
- Tides are higher/lower when moon is closer to earth (see page 55).

Impact of Wind

- An Easterly wind pattern will increase tidal ranges with Southeast winds being responsible for the highest tidal levels. It will also cause tidal changes to occur later than expected.
- Extended periods of west-north-westerly weather will hold levels below normal and cause tidal changes to occur earlier and with less velocity.

Tides and Kayak Trip Planning

Manhattan Circumnavigation – Counter Clockwise from Pier 26

- Takes 12 hours
- Steady pace, not fast
- Depart two hours after low tide
- Wait for tide changes in Astoria and Inwood

Other Start Points

Those start points that are where one channel meets another (e.g. Northern Manhattan) may enable one to circumnavigate the island with only one wait for a tide change.

Choke Points

Some places can only be passed on the tide:

- Southern Tip of Manhattan
- Most of East River
- Hell Gate

Things to Know

Besides knowing how to use a kayak and the rules of the road, when kayaking on New York Harbor one should also know about:

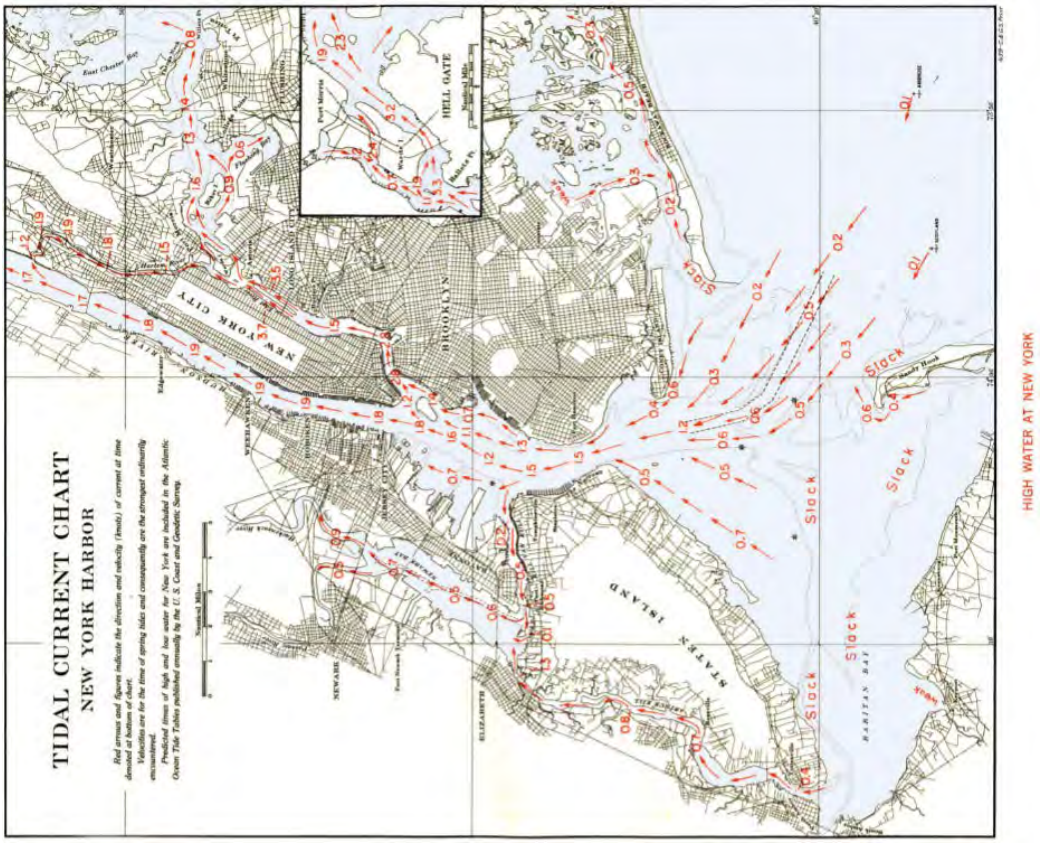
- Tide Tables (see page 51)
- Current patterns (see page 44)
- Security zones (see page 19)
- Ferry terminals (see page 19)
- Water pollution (see page 41)
- Launch sites (see page 33)

Hudson River, 46th Street

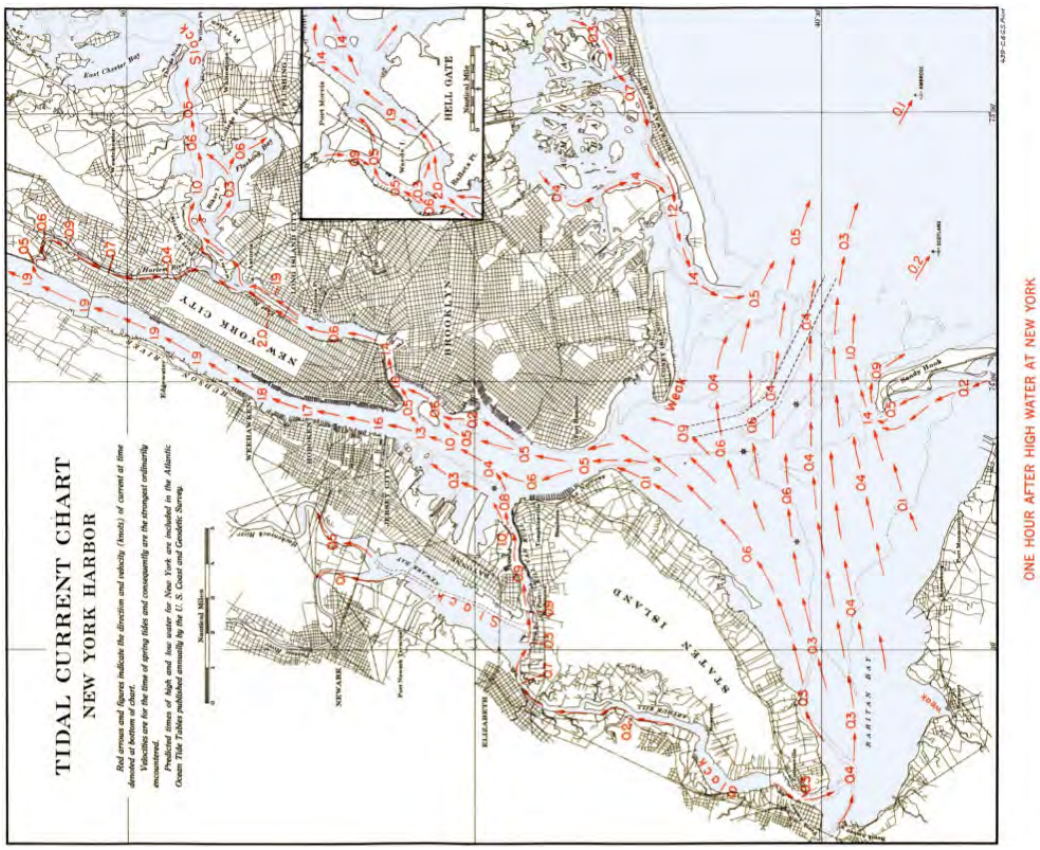
Hudson River, 28th Street

Tidal Current Charts

High Tide at the Battery

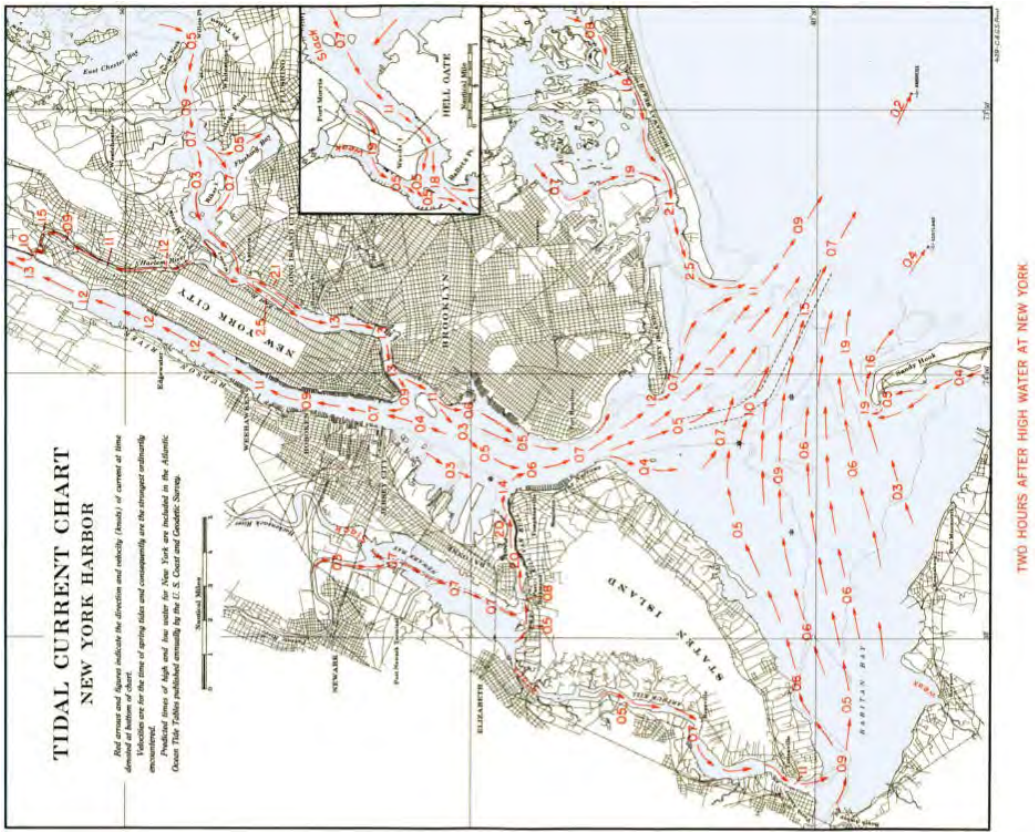


One Hour after High Tide

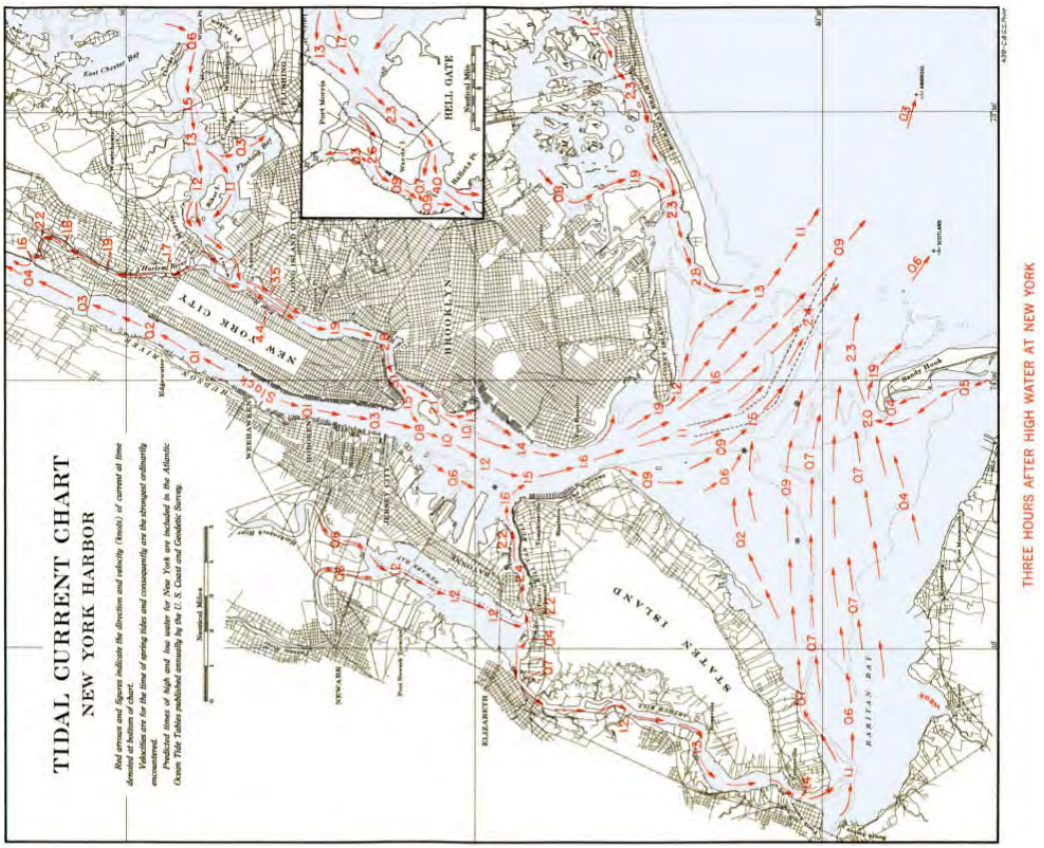


Tidal Current Charts

Two Hours after High Tide

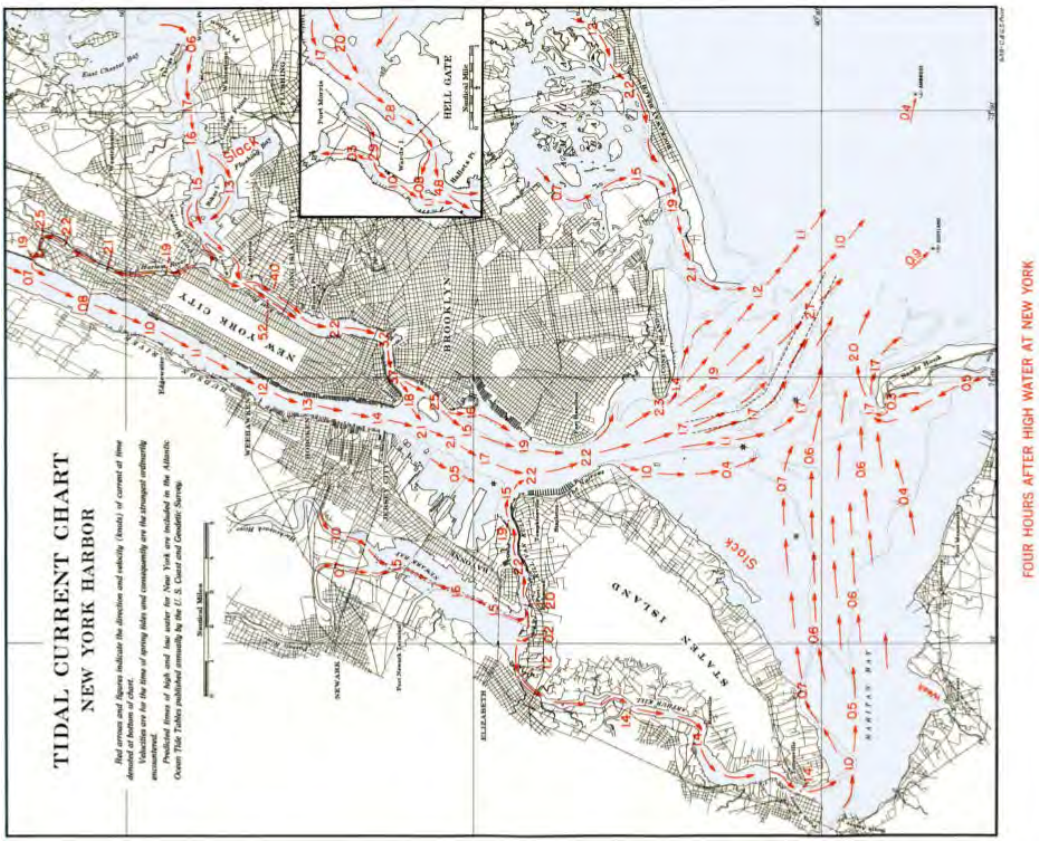


Three Hours after High Tide

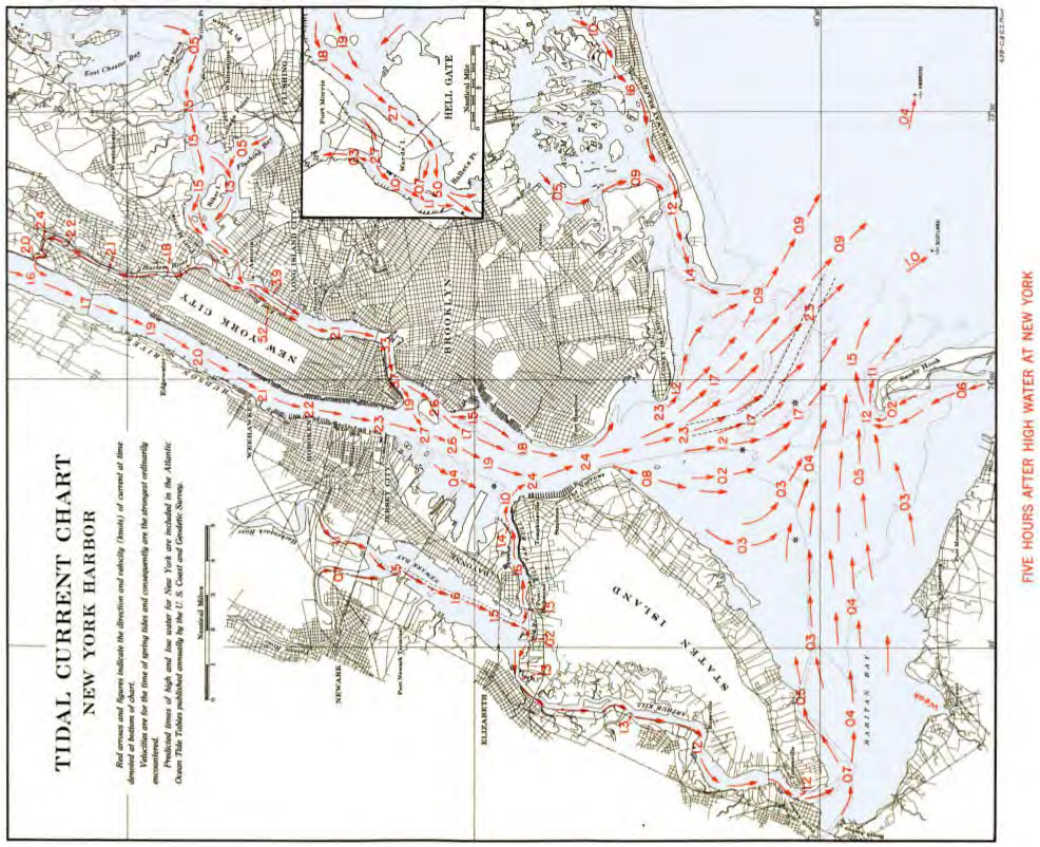


Tidal Current Charts

Four Hours after High Tide

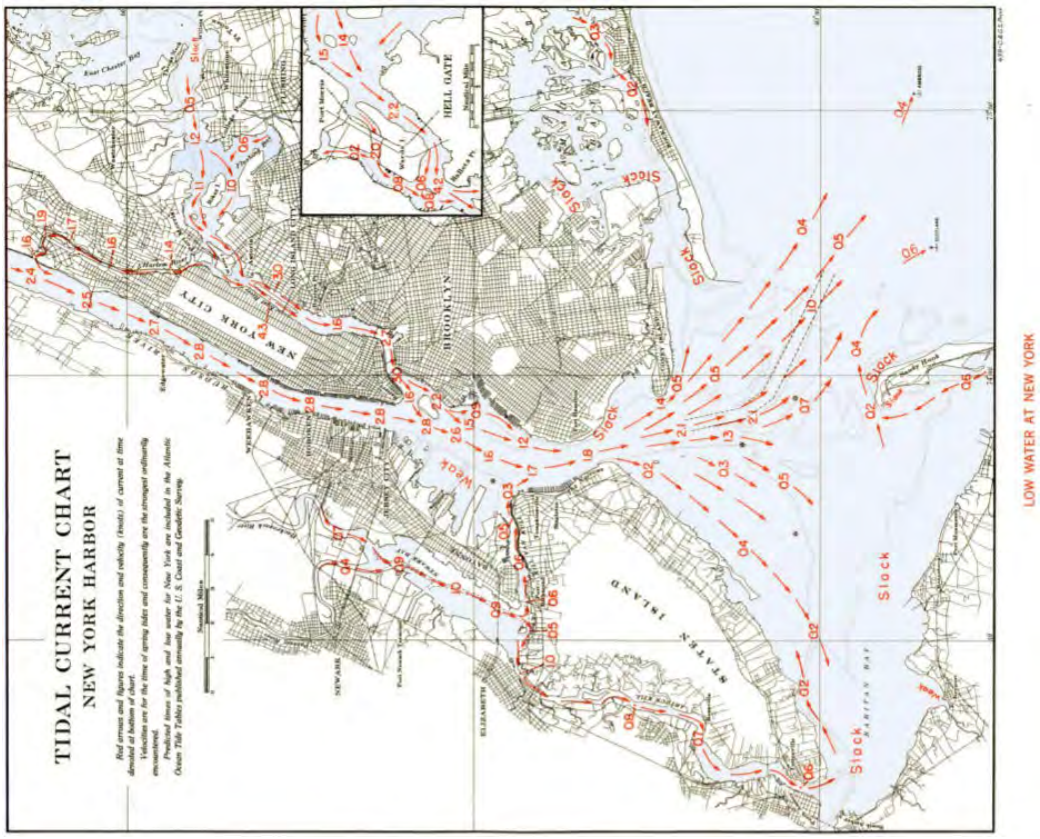


Five Hours after High Tide

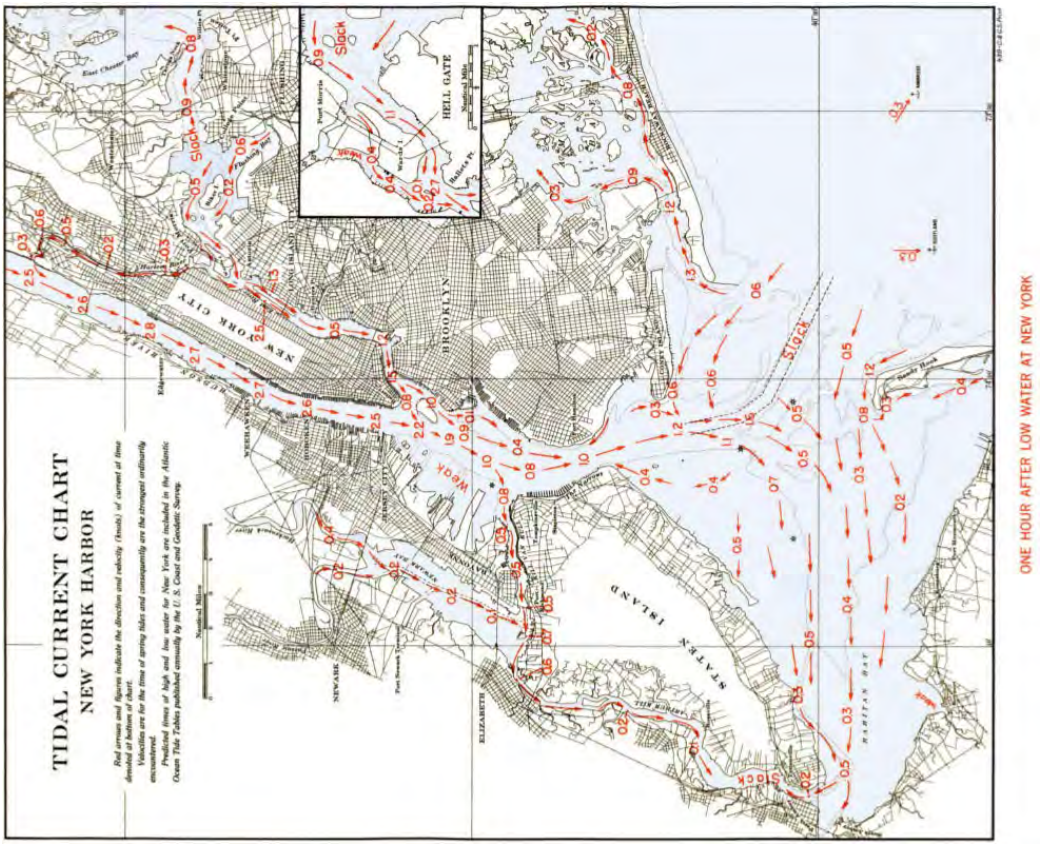


Tidal Current Charts

Low Tide at the Battery

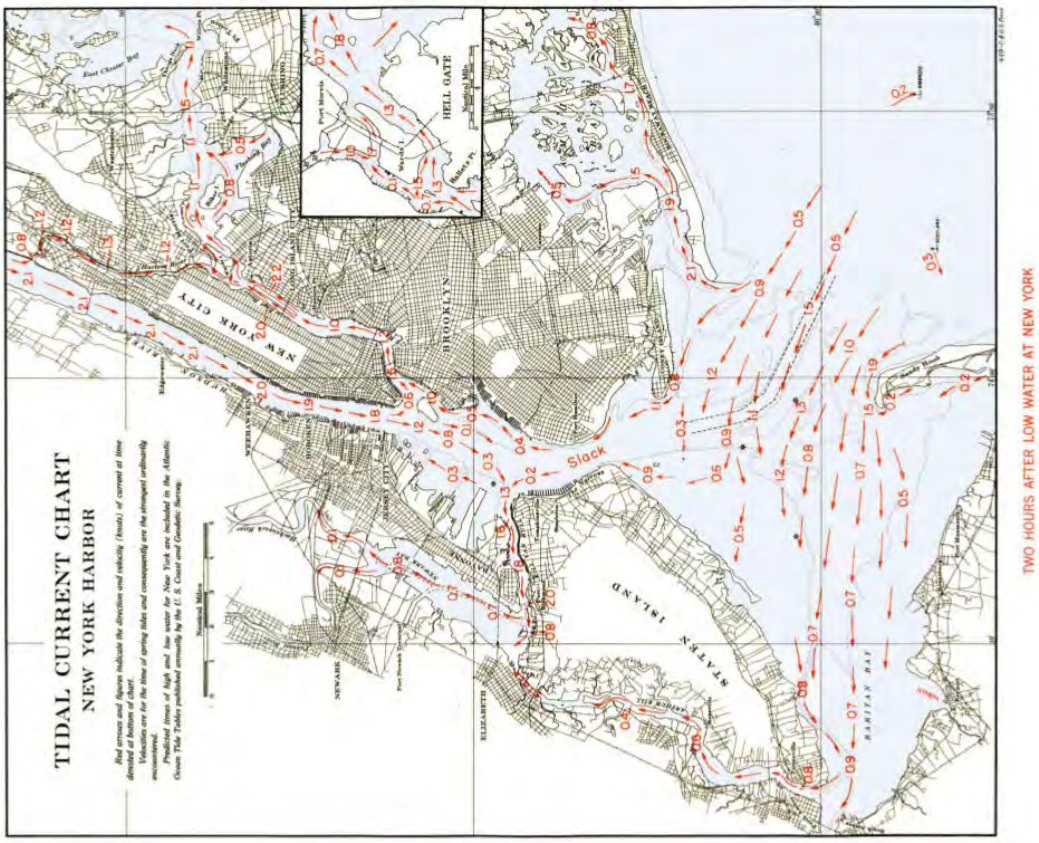


One Hour after Low Tide

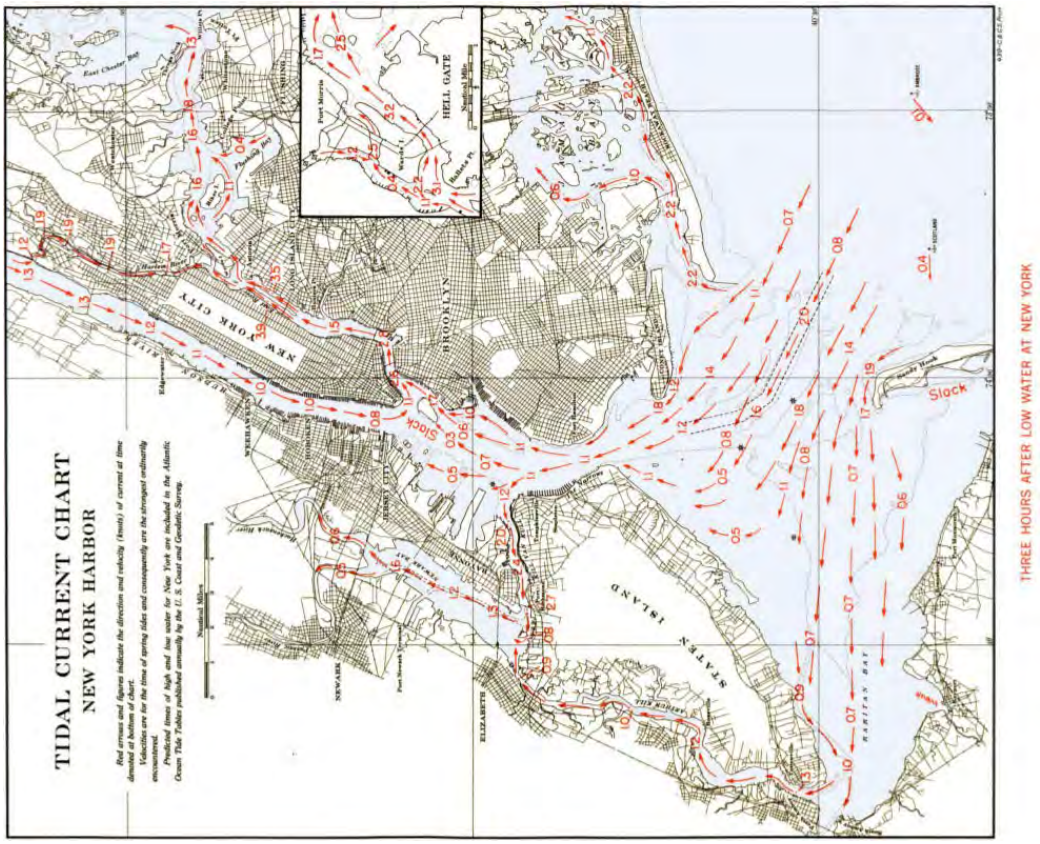


Tidal Current Charts

Two Hours after Low Tide

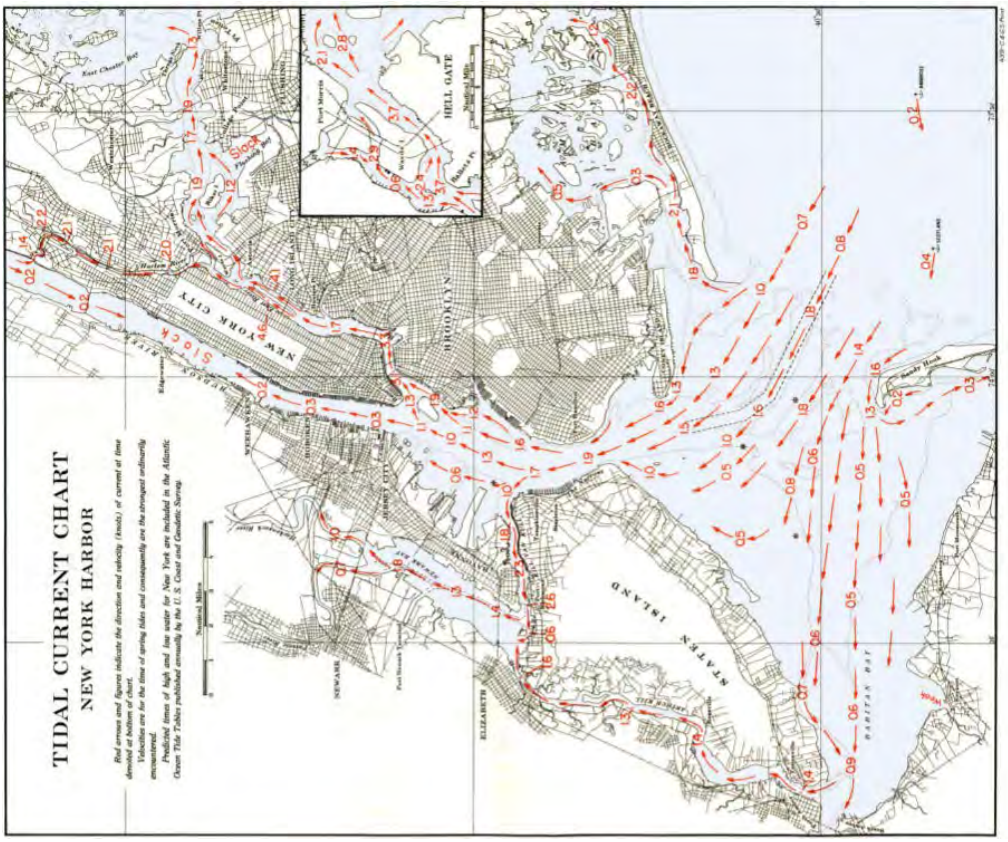


Three Hours after Low Tide

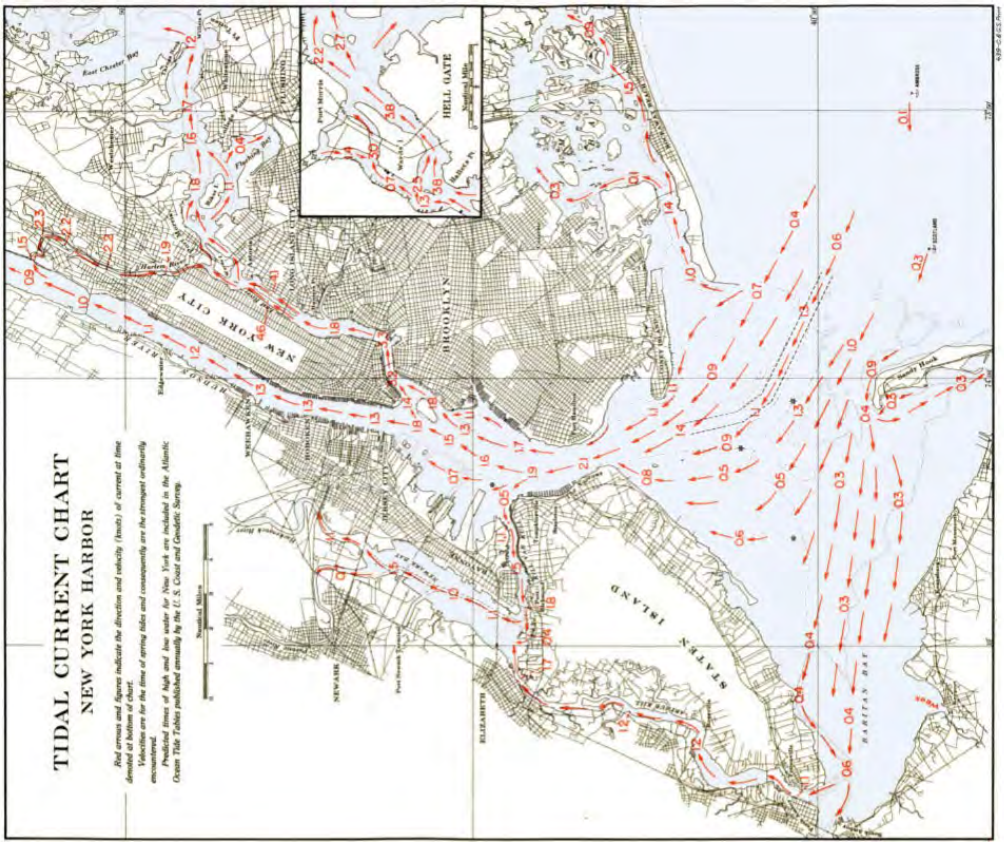


Tidal Current Charts

Four Hours after Low Tide



Five Hours after Low Tide



Tide Tables

Tides at the Battery, 2024

January

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 M	05:24 AM	0.7 21	16 Tu	05:57 AM	-0.2 -6
	11:44 AM	4.1 125		12:03 PM	4.6 146
	06:11 PM	0.4 12		06:27 PM	-0.5 -15
2 Tu	12:34 AM	3.7 113	17 W	12:42 AM	4.7 143
	06:11 AM	0.9 27		07:03 AM	0.1 3
	12:25 PM	3.9 119		12:59 PM	4.5 137
	06:55 PM	0.6 18		07:24 PM	-0.3 -9
3 W	01:16 AM	3.8 116	18 Th	01:37 AM	4.7 143
	07:12 AM	1.1 34		08:12 AM	0.2 6
	01:06 PM	3.7 113		01:57 PM	4.1 125
	07:44 PM	0.7 21	◐	08:25 PM	-0.1 -3
4 Th	01:58 AM	3.8 116	19 F	02:34 AM	4.6 140
	08:21 AM	1.1 34		09:19 AM	0.2 6
	01:51 PM	3.5 107		02:59 PM	3.9 119
◑	08:36 PM	0.7 21		09:25 PM	0.0 0
5 F	02:41 AM	3.9 119	20 Sa	03:35 AM	4.6 140
	09:22 AM	0.9 27		10:20 AM	0.1 3
	02:42 PM	3.4 104		04:05 PM	3.7 113
	09:26 PM	0.6 18		10:21 PM	0.1 3
6 Sa	03:29 AM	4.1 125	21 Su	04:38 AM	4.6 140
	10:17 AM	0.7 21		11:16 AM	0.0 0
	03:44 PM	3.4 104		05:10 PM	3.7 113
	10:15 PM	0.5 15		11:14 PM	0.1 3
7 Su	04:22 AM	4.3 131	22 M	05:37 AM	4.7 143
	11:08 AM	0.4 12		12:08 PM	-0.1 -3
	04:47 PM	3.4 104		06:07 PM	3.9 119
	11:03 PM	0.3 9			
8 M	05:14 AM	4.6 140	23 Tu	12:05 AM	0.1 3
	11:59 AM	0.1 3		06:28 AM	4.8 146
	05:44 PM	3.6 110		12:57 PM	-0.2 -6
	11:53 PM	0.1 3		06:56 PM	4.0 122
9 Tu	06:04 AM	4.9 149	24 W	12:54 AM	0.0 0
	12:49 PM	-0.2 -6		07:13 AM	4.8 146
	06:34 PM	3.9 119		01:43 PM	-0.3 -9
				07:40 PM	4.1 125
10 W	12:44 AM	-0.1 -3	25 Th	01:40 AM	0.0 0
	06:51 AM	5.2 158		07:54 AM	4.8 146
	01:38 PM	-0.5 -15		02:26 PM	-0.3 -9
	07:21 PM	4.1 125	○	08:23 PM	4.1 125
11 Th	01:36 AM	-0.4 -12	26 F	02:24 AM	0.0 0
	07:38 AM	5.4 165		08:33 AM	4.8 146
	02:26 PM	-0.7 -21		03:06 PM	-0.3 -9
●	08:08 PM	4.3 131		09:04 PM	4.1 125
12 F	02:26 AM	-0.6 -18	27 Sa	03:04 AM	0.0 0
	08:26 AM	5.5 168		09:11 AM	4.7 143
	03:13 PM	-0.9 -27		03:43 PM	-0.2 -6
	08:58 PM	4.4 134		09:46 PM	4.1 125
13 Sa	03:16 AM	-0.7 -21	28 Su	03:42 AM	0.1 3
	09:17 AM	5.5 168		09:48 AM	4.5 137
	03:59 PM	-1.0 -30		04:18 PM	-0.1 -3
	09:52 PM	4.5 137		10:27 PM	4.1 125
14 Su	04:06 AM	-0.6 -18	29 M	04:18 AM	0.3 9
	10:11 AM	5.4 165		10:24 AM	4.3 131
	04:46 PM	-0.9 -27		04:50 PM	0.0 0
	10:49 PM	4.6 140		11:06 PM	4.0 122
15 M	04:59 AM	-0.4 -12	30 Tu	04:53 AM	0.4 12
	11:07 AM	5.1 155		11:00 AM	4.1 125
	05:34 PM	-0.8 -24		05:19 PM	0.2 6
	11:46 PM	4.7 143		11:43 PM	4.0 122
			31 W	05:30 AM	0.6 18
				11:35 AM	3.9 119
				05:45 PM	0.4 12

February

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Th	12:18 AM	4.0 122	16 F	01:08 AM	4.8 146
	06:14 AM	0.8 24		07:48 AM	0.2 6
	12:13 PM	3.6 110		01:37 PM	4.0 122
	06:13 PM	0.6 18	◐	07:54 PM	0.3 9
2 F	12:53 AM	4.0 122	17 Sa	02:06 AM	4.6 140
	07:19 AM	0.9 27		08:57 AM	0.4 12
	12:56 PM	3.4 104		02:40 PM	3.7 113
◑	06:59 PM	0.7 21		08:59 PM	0.5 15
3 Sa	01:33 AM	4.0 122	18 Su	03:09 AM	4.4 134
	08:36 AM	0.9 27		10:00 AM	0.4 12
	01:47 PM	3.3 101		03:47 PM	3.6 110
	08:19 PM	0.8 24		10:00 PM	0.5 15
4 Su	02:24 AM	4.1 125	19 M	04:16 AM	4.3 131
	09:41 AM	0.8 24		10:56 AM	0.3 9
	02:51 PM	3.3 101		04:53 PM	3.7 113
	09:33 PM	0.7 21		10:56 PM	0.5 15
5 M	03:28 AM	4.3 131	20 Tu	05:19 AM	4.4 134
	10:38 AM	0.5 15		11:48 AM	0.2 6
	04:07 PM	3.4 104		05:50 PM	3.9 119
	10:34 PM	0.5 15		11:48 PM	0.4 12
6 Tu	04:38 AM	4.5 137	21 W	06:12 AM	4.5 137
	11:32 AM	0.2 6		12:35 PM	0.1 3
	05:17 PM	3.6 110		06:38 PM	4.1 125
	11:31 PM	0.1 3			
7 W	05:41 AM	4.9 149	22 Th	12:36 AM	0.2 6
	12:25 PM	-0.2 -6		06:56 AM	4.7 143
	06:14 PM	4.0 122		01:19 PM	-0.1 -3
				07:21 PM	4.3 131
8 Th	12:26 AM	-0.2 -6	23 F	01:20 AM	0.1 3
	06:35 AM	5.3 162		07:35 AM	4.7 143
	01:15 PM	-0.6 -18		01:59 PM	-0.1 -3
	07:04 PM	4.4 134		08:00 PM	4.4 134
9 F	01:20 AM	-0.6 -18	24 Sa	02:02 AM	0.0 0
	07:24 AM	5.5 168		08:11 AM	4.8 146
	02:04 PM	-0.9 -27		02:36 PM	-0.2 -6
●	07:52 PM	4.7 143	○	08:37 PM	4.5 137
10 Sa	02:12 AM	-0.8 -24	25 Su	02:42 AM	0.0 0
	08:13 AM	5.7 174		08:45 AM	4.7 143
	02:50 PM	-1.1 -34		03:11 PM	-0.2 -6
	08:41 PM	4.9 149		09:13 PM	4.5 137
11 Su	03:03 AM	-0.9 -27	26 M	03:19 AM	0.0 0
	09:02 AM	5.6 171		09:18 AM	4.6 140
	03:36 PM	-1.2 -37		03:43 PM	-0.1 -3
	09:32 PM	5.1 155		09:47 PM	4.5 137
12 M	03:53 AM	-0.9 -27	27 Tu	03:54 AM	0.1 3
	09:54 AM	5.4 165		09:50 AM	4.3 131
	04:20 PM	-1.1 -34		04:11 PM	0.1 3
	10:25 PM	5.1 155		10:18 PM	4.4 134
13 Tu	04:44 AM	-0.7 -21	28 W	04:28 AM	0.3 9
	10:47 AM	5.1 155		10:21 AM	4.1 125
	05:06 PM	-0.9 -27		04:35 PM	0.3 9
	11:19 PM	5.1 155		10:47 PM	4.4 134
14 W	05:39 AM	-0.4 -12	29 Th	05:01 AM	0.5 15
	11:43 AM	4.8 146		10:54 AM	3.9 119
	05:55 PM	-0.5 -15		04:56 PM	0.5 15
				11:17 PM	4.3 131
15 Th	12:14 AM	5.0 152			
	06:40 AM	0.0 0			
	12:39 PM	4.4 134			
	06:51 PM	-0.1 -3			

March

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 F	05:37 AM	0.6 18	16 Sa	01:40 AM	4.9 149
	11:32 AM	3.7 113		08:23 AM	0.4 12
	05:23 PM	0.7 21		02:20 PM	4.0 122
	11:54 PM	4.3 131		08:24 PM	0.7 21
2 Sa	06:27 AM	0.8 24	17 Su	02:38 AM	4.6 140
	12:18 PM	3.6 110		09:31 AM	0.6 18
	06:04 PM	0.8 24		03:21 PM	3.8 116
			◐	09:34 PM	0.9 27
3 Su	12:42 AM	4.3 131	18 M	03:41 AM	4.3 131
	07:50 AM	0.9 27		10:35 AM	0.6 18
	01:13 PM	3.5 107		04:25 PM	3.8 116
◑	07:12 PM	1.0 30		10:39 PM	0.9 27
4 M	01:39 AM	4.3 131	19 Tu	04:49 AM	4.2 128
	09:08 AM	0.8 24		11:31 AM	0.6 18
	02:20 PM	3.4 104		05:30 PM	3.9 119
	09:01 PM	0.9 27		11:35 PM	0.8 24
5 Tu	02:50 AM	4.4 134	20 W	05:53 AM	4.3 131
	10:11 AM	0.6 18		12:20 PM	0.5 15
	03:38 PM	3.6 110		06:26 PM	4.1 125
	10:12 PM	0.6 18			
6 W	04:09 AM	4.6 140	21 Th	12:26 AM	0.7 21
	11:07 AM	0.2 6		06:46 AM	4.4 134
	04:52 PM	3.9 119		01:05 PM	0.3 9
	11:13 PM	0.2 6		07:14 PM	4.3 131
7 Th	05:19 AM	5.0 152	22 F	01:12 AM	0.5 15
	11:59 AM	-0.2 -6		07:30 AM	4.6 140
	05:53 PM	4.4 134		01:46 PM	0.2 6
				07:55 PM	4.5 137
8 F	12:09 AM	-0.2 -6	23 Sa	01:56 AM	0.3 9
	06:16 AM	5.3 162		08:08 AM	4.7 143
	12:49 PM	-0.5 -15		02:25 PM	0.1 3
	06:45 PM	4.8 146		08:32 PM	4.7 143
9 Sa	01:04 AM	-0.6 -18	24 Su	02:38 AM	0.2 6
	07:06 AM	5.6 171		08:44 AM	4.7 143
	01:38 PM	-0.9 -27		03:01 PM	0.0 0
	07:33 PM	5.2 158		09:06 PM	4.9 149
10 Su	01:57 AM	-0.8 -24	25 M	03:18 AM	0.1 3
	08:55 AM	5.7 174		09:17 AM	4.6 140
	03:24 PM	-1.1 -34		03:36 PM	0.1 3
●	09:20 PM	5.5 168	○	09:37 PM	4.9 149
11 M	03:48 AM	-1.0 -30	26 Tu	03:56 AM	0.1 3
	09:43 AM	5.6 171		09:49 AM	4.5 137
	04:09 PM	-1.1 -34		04:07 PM	0.2 6
	10:08 PM	5.7 174		10:06 PM	4.9 149
12 Tu	04:38 AM	-0.9 -27	27 W	04:32 AM	0.1 3
	10:34 AM	5.4 165		10:19 AM	4.3 131
	04:53 PM	-0.9 -27		04:35 PM	0.3 9
	10:58 PM	5.6 171		10:32 PM	4.9 149
13 W	05:28 AM	-0.7 -21	28 Th	05:07 AM	0.2 6
	11:27 AM	5.0 152		10:50 AM	4.1 125
	05:38 PM	-0.6 -18		05:00 PM	0.5 15
	11:51 PM	5.5 168		10:58 PM	4.8 146
14 Th	06:20 AM	-0.4 -12	29 F	05:41 AM	0.4 12
	12:23 PM	4.7 143		11:25 AM	4.0 122
	06:26 PM	-0.2 -6		05:25 PM	0.6 18
				11:32 PM	4.7 143
15 F	12:45 AM	5.2 158	30 Sa	06:18 AM	0.6 18
	07:18 AM	0.0 0		12:07 PM	3.8 116
	01:21 PM	4.3 131		05:57 PM	0.8 24
	07:20 PM	0.3 9			
			31 Su	12:17 AM	4.7 143
				07:06 AM	0.8 24
				12:59 PM	3.7 113
				06:41 PM	1.0 30

Tide Tables

Tides at the Battery, 2024

April

	Time	Height			Time	Height	
	h m	ft	cm		h m	ft	cm
1	01:13 AM	4.6	140	16	03:11 AM	4.3	131
	08:21 AM	0.9	27		10:03 AM	0.8	24
M	01:59 PM	3.7	113	Tu	03:58 PM	4.0	122
	07:53 PM	1.1	34		10:11 PM	1.3	40
2	02:17 AM	4.6	140	17	04:13 AM	4.2	128
	09:40 AM	0.8	24		10:58 AM	0.8	24
Tu	03:06 PM	3.8	116	W	04:57 PM	4.1	125
◑	09:42 PM	1.0	30		11:07 PM	1.1	34
3	03:28 AM	4.6	140	18	05:14 AM	4.2	128
	10:44 AM	0.6	18		11:45 AM	0.7	21
W	04:19 PM	4.0	122	Th	05:52 PM	4.3	131
	10:55 PM	0.7	21		11:57 PM	1.0	30
4	04:44 AM	4.8	146	19	06:08 AM	4.3	131
	11:40 AM	0.2	6		12:27 PM	0.5	15
Th	05:30 PM	4.3	131	F	06:40 PM	4.5	137
	11:56 PM	0.3	9				
5	05:54 AM	5.0	152	20	12:44 AM	0.8	24
	12:31 PM	-0.1	-3		06:55 AM	4.4	134
F	06:31 PM	4.8	146	Sa	01:07 PM	0.4	12
					07:21 PM	4.8	146
6	12:52 AM	-0.1	-3	21	01:28 AM	0.6	18
	06:53 AM	5.3	162		07:35 AM	4.5	137
Sa	01:21 PM	-0.5	-15	Su	01:45 PM	0.4	12
	07:23 PM	5.3	162		07:58 PM	5.0	152
7	01:47 AM	-0.5	-15	22	02:11 AM	0.4	12
	07:45 AM	5.5	168		08:12 AM	4.5	137
Su	02:09 PM	-0.7	-21	M	02:22 PM	0.3	9
	08:11 PM	5.7	174		08:31 PM	5.1	155
8	02:40 AM	-0.7	-21	23	02:52 AM	0.2	6
	08:34 AM	5.5	168		08:47 AM	4.5	137
M	02:56 PM	-0.8	-24	Tu	02:58 PM	0.3	9
●	08:57 PM	6.0	183	○	09:01 PM	5.2	158
9	03:31 AM	-0.8	-24	24	03:32 AM	0.1	3
	09:23 AM	5.4	165		09:20 AM	4.4	134
Tu	03:42 PM	-0.8	-24	W	03:32 PM	0.4	12
	09:43 PM	6.0	183		09:28 PM	5.2	158
10	04:21 AM	-0.8	-24	25	04:11 AM	0.1	3
	10:14 AM	5.2	158		09:53 AM	4.3	131
W	04:27 PM	-0.6	-18	Th	04:05 PM	0.5	15
	10:31 PM	5.9	180		09:55 PM	5.2	158
11	05:11 AM	-0.6	-18	26	04:49 AM	0.2	6
	11:08 AM	4.9	149		10:28 AM	4.1	125
Th	05:13 PM	-0.2	-6	F	04:36 PM	0.6	18
	11:23 PM	5.6	171		10:27 PM	5.1	155
12	06:01 AM	-0.3	-9	27	05:27 AM	0.3	9
	12:06 PM	4.6	140		11:08 AM	4.0	122
F	06:00 PM	0.2	6	Sa	05:09 PM	0.7	21
					11:08 PM	5.0	152
13	12:18 AM	5.2	158	28	06:09 AM	0.4	12
	06:55 AM	0.1	3		11:58 AM	3.9	119
Sa	01:04 PM	4.3	131	Su	05:48 PM	0.9	27
	06:53 PM	0.7	21				
14	01:14 AM	4.9	149	29	12:01 AM	4.9	149
	07:55 AM	0.5	15		07:00 AM	0.6	18
Su	02:01 PM	4.1	125	M	12:56 PM	3.9	119
	07:55 PM	1.1	34		06:39 PM	1.0	30
15	02:12 AM	4.6	140	30	01:02 AM	4.9	149
	09:01 AM	0.7	21		08:05 AM	0.7	21
M	02:59 PM	4.0	122	Tu	01:56 PM	4.0	122
◐	09:05 PM	1.3	40		08:00 PM	1.1	34

May

	Time	Height			Time	Height	
	h m	ft	cm		h m	ft	cm
1	02:06 AM	4.8	146	16	03:30 AM	4.2	128
	09:14 AM	0.6	18		10:15 AM	0.8	24
W	02:58 PM	4.2	128	Th	04:18 PM	4.2	128
◑	09:29 PM	1.0	30		10:32 PM	1.3	40
2	03:12 AM	4.8	146	17	04:24 AM	4.1	125
	10:16 AM	0.4	12		11:01 AM	0.8	24
Th	04:03 PM	4.4	134	F	05:10 PM	4.4	134
	10:38 PM	0.7	21		11:24 PM	1.2	37
3	04:21 AM	4.8	146	18	05:19 AM	4.1	125
	11:11 AM	0.1	3		11:43 AM	0.7	21
F	05:07 PM	4.8	146	Sa	05:58 PM	4.6	140
	11:39 PM	0.4	12				
4	05:28 AM	4.9	149	19	12:11 AM	0.9	27
	12:02 PM	-0.1	-3		06:11 AM	4.1	125
Sa	06:07 PM	5.2	158	Su	12:23 PM	0.7	21
					06:41 PM	4.9	149
5	12:35 AM	0.0	0	20	12:56 PM	0.7	21
	06:29 AM	5.1	155		06:57 AM	4.2	128
Su	12:51 PM	-0.3	-9	M	01:02 PM	0.6	18
	06:59 PM	5.7	174		07:20 PM	5.1	155
6	01:30 AM	-0.3	-9	21	01:41 AM	0.5	15
	07:24 AM	5.1	155		07:39 AM	4.2	128
M	01:40 PM	-0.5	-15	Tu	01:41 PM	0.6	18
	07:48 PM	6.0	183		07:54 PM	5.2	158
7	02:23 AM	-0.5	-15	22	02:25 AM	0.3	9
	08:15 AM	5.1	155		08:17 AM	4.2	128
Tu	02:29 PM	-0.5	-15	W	02:21 PM	0.6	18
	08:34 PM	6.1	186		08:26 PM	5.3	162
8	03:15 AM	-0.6	-18	23	03:08 AM	0.2	6
	09:05 AM	5.1	155		08:54 AM	4.2	128
W	03:17 PM	-0.3	-9	Th	03:01 PM	0.6	18
●	09:20 PM	6.1	186	○	08:57 PM	5.4	165
9	04:05 AM	-0.6	-18	24	03:50 AM	0.1	3
	09:57 AM	4.9	149		09:31 AM	4.2	128
Th	04:04 PM	-0.1	-3	F	03:41 PM	0.6	18
	10:08 PM	5.9	180		09:31 PM	5.4	165
10	04:53 AM	-0.4	-12	25	04:32 AM	0.1	3
	10:51 AM	4.7	143		10:12 AM	4.2	128
F	04:51 PM	0.2	6	Sa	04:21 PM	0.6	18
	10:59 PM	5.5	168		10:11 PM	5.4	165
11	05:42 AM	-0.1	-3	26	05:14 AM	0.1	3
	11:48 AM	4.5	137		10:59 AM	4.1	125
Sa	05:38 PM	0.5	15	Su	05:02 PM	0.6	18
	11:53 PM	5.2	158		11:00 PM	5.3	162
12	06:32 AM	0.2	6	27	05:59 AM	0.2	6
	12:45 PM	4.3	131		11:55 AM	4.2	128
Su	06:28 PM	0.9	27	M	05:49 PM	0.7	21
					11:57 PM	5.2	158
13	12:49 AM	4.9	149	28	06:49 AM	0.3	9
	07:26 AM	0.5	15		12:53 PM	4.2	128
M	01:40 PM	4.2	128	Tu	06:45 PM	0.8	24
	07:25 PM	1.2	37				
14	01:44 AM	4.6	140	29	12:58 AM	5.1	155
	08:25 AM	0.8	24		07:46 AM	0.3	9
Tu	02:33 PM	4.2	128	W	01:50 PM	4.4	134
	08:30 PM	1.4	43		07:57 PM	0.9	27
15	02:37 AM	4.4	134	30	01:57 AM	5.0	152
	09:23 AM	0.9	27		08:47 AM	0.3	9
W	03:25 PM	4.2	128	Th	02:46 PM	4.6	140
◐	09:35 PM	1.4	43	◑	09:14 PM	0.9	27
				31	02:56 AM	4.9	149
					09:47 AM	0.2	6
				F	03:44 PM	4.8	146
					10:21 PM	0.7	21

June

	Time	Height			Time	Height	
	h m	ft	cm		h m	ft	cm
1	03:58 AM	4.8	146	16	04:23 AM	3.9	119
	10:42 AM	0.0	0		10:55 AM	0.9	27
Sa	04:43 PM	5.1	155	Su	05:08 PM	4.6	140
	11:22 PM	0.4	12		11:36 PM	1.1	34
2	05:03 AM	4.7	143	17	05:19 AM	3.8	116
	11:33 AM	-0.1	-3		11:37 AM	0.9	27
Su	05:42 PM	5.4	165	M	05:54 PM	4.8	146
3	12:19 AM	0.1	3	18	12:24 AM	0.8	24
	06:07 AM	4.7	143		06:14 AM	3.8	116
M	12:24 PM	-0.1	-3	Tu	12:19 PM	0.8	24
	06:37 PM	5.7	174		06:37 PM	5.0	152
4	01:14 AM	-0.1	-3	19	01:10 AM	0.6	18
	07:05 AM	4.7	143		07:03 AM	3.9	119
Tu	01:14 PM	-0.1	-3	W	01:03 PM	0.7	21
	07:27 PM	5.9	180		07:17 PM	5.2	158
5	02:07 AM	-0.3	-9	20	01:57 AM	0.4	12
	07:59 AM	4.7	143		07:47 AM	4.0	122
W	02:05 PM	-0.1	-3	Th	01:48 PM	0.6	18
	08:15 PM	5.9	180		07:55 PM	5.4	165
6	02:59 AM	-0.4	-12	21	02:43 AM	0.2	6
	08:50 AM	4.7	143		08:29 AM	4.2	128
Th	02:55 PM	0.0	0	F	02:35 PM	0.5	15
●	09:02 PM	5.8	177		08:34 PM	5.5	168
7	03:48 AM	-0.3	-9	22	03:29 AM	0.0	0
	09:41 AM	4.7	143		09:11 AM	4.3	131
F	03:44 PM	0.2	6	Sa	03:22 PM	0.4	12
	09:49 PM	5.6	171	○	09:16 PM	5.6	171
8	04:35 AM	-0.2	-6	23	04:14 AM	-0.1	-3
	10:33 AM	4.5	137		09:56 AM	4.3	131
Sa	04:31 PM	0.4	12	Su	04:08 PM	0.3	9
	10:38 PM	5.4	165		10:02 PM	5.6	171
9	05:21 AM	0.0	0	24	04:58 AM	-0.2	-6
	11:27 AM	4.4	134		10:47 AM	4.4	134
Su	05:17 PM	0.6	18	M	04:55 PM	0.3	9
	11:30 PM	5.1	155		10:54 PM	5.5	168
10	06:07 AM	0.2	6	25	05:43 AM	-0.2	-6
	12:21 PM	4.4	134		11:43 AM	4.5	137
M	06:03 PM	0.9	27	Tu	05:45 PM	0.4	12
					11:50 PM	5.4	165
11	12:22 AM	4.8	146	26	06:30 AM	-0.1	-3
	06:53 AM	0.4	12		12:40 PM	4.7	143
Tu	01:12 PM	4.3	131	W	06:41 PM	0.5	15
	06:52 PM	1.2	37				
12	01:11 AM	4.6	140	27	12:47 AM	5.2	158
	07:43 AM	0.7	21		07:22 AM	-0.1	-3
W	02:00 PM	4.3	131	Th	01:34 PM	4.8	146
	07:48 PM	1.4	43		07:46 PM	0.7	21
13	01:57 AM	4.4	134	28	01:43 AM	5.0	152
	08:34 AM	0.8	24		08:18 AM	0.0	0
Th	02:47 PM	4.3	131	F	02:28 PM	5.0	152
	08:51 PM	1.5	46	◑	08:57 PM	0.7	21
14	02:43 AM	4.2	128	29	02:39 AM	4.8	146
	09:24 AM	0.9	27		09:17 AM	0.1	3
F	03:33 PM	4.3	131	Sa	03:22 PM	5.2	158
◐	09:51 PM	1.4	43		10:04 PM	0.6	18
15	03:31 AM	4.0	122	30	03:39 AM	4.6	140
	10:11 AM	0.9	27		10:14 AM	0.1	3
Sa	04:20 PM	4.5	137	Su	04:20 PM	5.3	162
	10:46 PM	1.3	40		11:06 PM	0.4	12

Tide Tables

Tides at the Battery, 2024

July

	Time	Height			Time	Height	
	h m	ft	cm		h m	ft	cm
1 M	04:43 AM	4.4	134	16 Tu	04:24 AM	3.6	110
	11:08 AM	0.1	3		10:51 AM	1.1	34
	05:20 PM	5.4	165		04:59 PM	4.7	143
					11:51 PM	1.0	30
2 Tu	12:03 AM	0.2	6	17 W	05:29 AM	3.7	113
	05:49 AM	4.3	131		11:40 AM	1.0	30
	12:01 PM	0.2	6		05:52 PM	4.9	149
	06:18 PM	5.5	168				
3 W	12:58 AM	0.1	3	18 Th	12:40 AM	0.7	21
	06:51 AM	4.4	134		06:28 AM	3.8	116
	12:54 PM	0.2	6		12:30 PM	0.8	24
	07:12 PM	5.6	171		06:43 PM	5.2	158
4 Th	01:51 AM	0.0	0	19 F	01:30 AM	0.4	12
	07:46 AM	4.5	137		07:19 AM	4.0	122
	01:46 PM	0.2	6		01:22 PM	0.6	18
	08:01 PM	5.6	171		07:31 PM	5.4	165
5 F	02:42 AM	-0.1	-3	20 Sa	02:18 AM	0.2	6
	08:36 AM	4.5	137		08:05 AM	4.3	131
	02:37 PM	0.3	9		02:13 PM	0.4	12
●	08:48 PM	5.6	171		08:16 PM	5.6	171
6 Sa	03:30 AM	-0.1	-3	21 Su	03:05 AM	-0.1	-3
	09:25 AM	4.6	140		08:50 AM	4.5	137
	03:25 PM	0.4	12		03:04 PM	0.2	6
	09:33 PM	5.4	165	○	09:02 PM	5.8	177
7 Su	04:14 AM	-0.1	-3	22 M	03:51 AM	-0.3	-9
	10:13 AM	4.5	137		09:37 AM	4.7	143
	04:11 PM	0.5	15		03:54 PM	0.0	0
	10:18 PM	5.3	162		09:50 PM	5.8	177
8 M	04:57 AM	0.0	0	23 Tu	04:36 AM	-0.5	-15
	11:02 AM	4.5	137		10:28 AM	4.9	149
	04:54 PM	0.6	18		04:43 PM	0.0	0
	11:03 PM	5.1	155		10:41 PM	5.7	174
9 Tu	05:37 AM	0.2	6	24 W	05:20 AM	-0.5	-15
	11:50 AM	4.5	137		11:22 AM	5.0	152
	05:36 PM	0.8	24		05:34 PM	0.1	3
	11:49 PM	4.8	146		11:35 PM	5.6	171
10 W	06:17 AM	0.4	12	25 Th	06:06 AM	-0.4	-12
	12:37 PM	4.4	134		12:17 PM	5.2	158
	06:19 PM	1.0	30		06:28 PM	0.2	6
11 Th	12:33 AM	4.6	140	26 F	12:31 AM	5.3	162
	06:56 AM	0.6	18		06:54 AM	-0.2	-6
	01:22 PM	4.4	134		01:11 PM	5.3	162
	07:05 PM	1.2	37		07:30 PM	0.4	12
12 F	01:15 AM	4.3	131	27 Sa	01:27 AM	5.0	152
	07:37 AM	0.8	24		07:48 AM	0.0	0
	02:03 PM	4.4	134		02:05 PM	5.3	162
	08:01 PM	1.4	43		08:38 PM	0.6	18
13 Sa	01:56 AM	4.1	125	28 Su	02:24 AM	4.7	143
	08:21 AM	1.0	30		08:47 AM	0.2	6
	02:44 PM	4.4	134		03:00 PM	5.3	162
◐	09:04 PM	1.5	46	◑	09:47 PM	0.6	18
14 Su	02:39 AM	3.9	119	29 M	03:24 AM	4.4	134
	09:10 AM	1.1	34		09:49 AM	0.4	12
	03:25 PM	4.5	137		03:58 PM	5.3	162
	10:04 PM	1.4	43		10:50 PM	0.5	15
15 M	03:27 AM	3.7	113	30 Tu	04:29 AM	4.2	128
	10:01 AM	1.1	34		10:48 AM	0.5	15
	04:09 PM	4.6	140		05:01 PM	5.2	158
	10:59 PM	1.2	37		11:48 PM	0.4	12
				31 W	05:37 AM	4.2	128
					11:45 AM	0.5	15
					06:04 PM	5.2	158

August

	Time	Height			Time	Height	
	h m	ft	cm		h m	ft	cm
1 Th	12:42 AM	0.3	9	16 F	12:12 AM	0.8	24
	06:39 AM	4.3	131		05:55 AM	3.9	119
	12:38 PM	0.5	15		12:06 PM	0.9	27
	07:00 PM	5.3	162		06:15 PM	5.2	158
2 F	01:34 AM	0.2	6	17 Sa	01:02 AM	0.4	12
	07:33 AM	4.4	134		06:52 AM	4.2	128
	01:30 PM	0.5	15		01:00 PM	0.5	15
	07:49 PM	5.4	165		07:09 PM	5.5	168
3 Sa	02:22 AM	0.1	3	18 Su	01:51 AM	0.1	3
	08:21 AM	4.6	140		07:42 AM	4.6	140
	02:20 PM	0.5	15		01:54 PM	0.2	6
	08:33 PM	5.4	165		07:57 PM	5.8	177
4 Su	03:07 AM	0.1	3	19 M	02:39 AM	-0.2	-6
	09:05 AM	4.7	143		08:28 AM	5.0	152
	03:06 PM	0.5	15		02:46 PM	-0.1	-3
●	09:14 PM	5.3	162	○	08:44 PM	6.0	183
5 M	03:49 AM	0.0	0	20 Tu	03:25 AM	-0.5	-15
	09:48 AM	4.7	143		09:15 AM	5.3	162
	03:49 PM	0.5	15		03:37 PM	-0.2	-6
	09:54 PM	5.2	158		09:31 PM	6.0	183
6 Tu	04:27 AM	0.1	3	21 W	04:09 AM	-0.7	-21
	10:31 AM	4.7	143		10:03 AM	5.5	168
	04:30 PM	0.6	18		04:28 PM	-0.3	-9
	10:32 PM	5.0	152		10:21 PM	5.8	177
7 W	05:03 AM	0.2	6	22 Th	04:53 AM	-0.7	-21
	11:13 AM	4.7	143		10:55 AM	5.6	171
	05:09 PM	0.7	21		05:19 PM	-0.2	-6
	11:11 PM	4.8	146		11:15 PM	5.6	171
8 Th	05:37 AM	0.4	12	23 F	05:38 AM	-0.5	-15
	11:55 AM	4.6	140		11:49 AM	5.6	171
	05:47 PM	0.9	27		06:12 PM	0.0	0
	11:50 PM	4.5	137				
9 F	06:08 AM	0.6	18	24 Sa	12:11 AM	5.2	158
	12:35 PM	4.6	140		06:25 AM	-0.2	-6
	06:26 PM	1.1	34		12:45 PM	5.6	171
					07:12 PM	0.3	9
10 Sa	12:30 AM	4.3	131	25 Su	01:10 AM	4.9	149
	06:36 AM	0.8	24		07:18 AM	0.2	6
	01:12 PM	4.5	137		01:40 PM	5.5	168
	07:11 PM	1.3	40		08:18 PM	0.6	18
11 Su	01:09 AM	4.0	122	26 M	02:09 AM	4.5	137
	07:02 AM	1.0	30		08:20 AM	0.5	15
	01:48 PM	4.5	137		02:37 PM	5.3	162
	08:11 PM	1.4	43	◑	09:28 PM	0.7	21
12 M	01:51 AM	3.8	116	27 Tu	03:11 AM	4.3	131
	07:38 AM	1.2	37		09:27 AM	0.8	24
	02:26 PM	4.5	137		03:39 PM	5.1	155
◐	09:20 PM	1.4	43		10:33 PM	0.7	21
13 Tu	02:39 AM	3.7	113	28 W	04:17 AM	4.1	125
	08:48 AM	1.3	40		10:32 AM	0.9	27
	03:11 PM	4.6	140		04:45 PM	5.0	152
	10:23 PM	1.3	40		11:31 PM	0.6	18
14 W	03:37 AM	3.6	110	29 Th	05:24 AM	4.2	128
	10:07 AM	1.3	40		11:30 AM	0.8	24
	04:07 PM	4.7	143		05:49 PM	5.0	152
	11:20 PM	1.1	34				
15 Th	04:47 AM	3.7	113	30 F	12:24 AM	0.5	15
	11:10 AM	1.1	34		06:25 AM	4.3	131
	05:12 PM	4.9	149		12:23 PM	0.7	21
					06:46 PM	5.1	155
				31 Sa	01:12 AM	0.4	12
					07:16 AM	4.5	137
					01:13 PM	0.6	18
					07:32 PM	5.2	158

September

	Time	Height			Time	Height	
	h m	ft	cm		h m	ft	cm
1 Su	01:57 AM	0.3	9	16 M	01:22 AM	-0.1	-3
	08:01 AM	4.7	143		07:18 AM	5.0	152
	02:00 PM	0.6	18		01:35 PM	0.0	0
	08:13 PM	5.2	158		07:36 PM	5.8	177
2 M	02:39 AM	0.2	6	17 Tu	02:09 AM	-0.4	-12
	08:41 AM	4.9	149		08:05 AM	5.5	168
	02:44 PM	0.5	15		02:28 PM	-0.3	-9
	08:50 PM	5.2	158		08:23 PM	5.9	180
3 Tu	03:18 AM	0.1	3	18 W	02:55 AM	-0.6	-18
	09:19 AM	5.0	152		08:51 AM	5.8	177
	03:25 PM	0.5	15		03:20 PM	-0.4	-12
●	09:26 PM	5.1	155	○	09:10 PM	5.9	180
4 W	03:53 AM	0.2	6	19 Th	03:41 AM	-0.7	-21
	09:56 AM	5.0	152		09:37 AM	6.0	183
	04:04 PM	0.5	15		04:11 PM	-0.5	-15
	10:00 PM	5.0	152		10:00 PM	5.7	174
5 Th	04:27 AM	0.3	9	20 F	04:25 AM	-0.7	-21
	10:32 AM	5.0	152		10:27 AM	6.0	183
	04:42 PM	0.6	18		05:02 PM	-0.4	-12
	10:34 PM	4.7	143		10:54 PM	5.4	165
6 F	04:57 AM	0.5	15	21 Sa	05:11 AM	-0.4	-12
	11:06 AM	4.9	149		11:20 AM	5.9	180
	05:18 PM	0.8	24		05:55 PM	-0.1	-3
	11:08 PM	4.4	134		11:52 PM	5.0	152
7 Sa	05:23 AM	0.7	21	22 Su	05:58 AM	0.0	0
	11:39 AM	4.8	146		12:17 PM	5.7	174
	05:53 PM	0.9	27		06:52 PM	0.2	6
	11:44 PM	4.2	128				
8 Su	05:44 AM	0.9	27	23 M	12:54 AM	4.7	143
	12:11 PM	4.7	143		06:52 AM	0.4	12
	06:31 PM	1.1	34		01:16 PM	5.4	165
					07:56 PM	0.5	15
9 M	12:24 AM	4.0	122	24 Tu	01:55 AM	4.4	134
	06:08 AM	1.1	34		07:55 AM	0.8	24
	12:47 PM	4.7	143		02:16 PM	5.1	155
	07:21 PM	1.3	40	◑	09:06 PM	0.7	21
10 Tu	01:10 AM	3.8	116	25 W	02:58 AM	4.2	128
	06:44 AM	1.3	40		09:07 AM	1.1	34
	01:31 PM	4.6	140		03:19 PM	4.9	149
	08:35 PM	1.4	43		10:12 PM	0.8	24
11 W	02:03 AM	3.7	113	26 Th	04:02 AM	4.2	128
	07:41 AM	1.4	43		10:14 AM	1.1	34
	02:25 PM	4.6	140		04:24 PM	4.8	146
◐	09:49 PM	1.3	40		11:09 PM	0.7	21
12 Th	03:05 AM	3.7	113	27 F	05:06 AM	4.2	128
	09:31 AM	1.4	43		11:13 AM	1.0	30
	03:29 PM	4.7	143		05:27 PM	4.8	146
	10:50 PM	1.1	34				
13 F	04:16 AM	3.8	116	28 Sa	12:00 AM	0.6	18
	10:46 AM	1.2	37		06:03 AM	4.4	134
	04:40 PM	4.9	149		12:04 PM	0.9	27
	11:44 PM	0.7	21		06:22 PM	4.8	146
14 Sa	05:27 AM	4.1	125	29 Su	12:45 PM	0.4	12
	11:46 AM	0.8	24		06:53 AM	4.7	143
	05:48 PM	5.2	158		12:52 PM	0.7	21
					07:07 PM	4.9	149
15 Su	12:34 AM	0.3	9	30 M	01:26 AM	0.3	9
	06:27 AM	4.5	137		07:35 AM	4.9	149
	12:41 PM	0.4	12		01:36 PM	0.6	18
	06:45 PM	5.5	168		07:47 PM	5.0	152

Tide Tables

Tides at the Battery, 2024

October								November								December							
	Time		Height		Time		Height		Time		Height		Time		Height		Time		Height		Time		Height	
	h m		ft	cm	h m		ft	cm	h m		ft	cm	h m		ft	cm	h m		ft	cm	h m		ft	cm
1	02:05 AM	0.3	9	16	01:39 AM	-0.5	-15	1	02:40 AM	0.3	9	16	01:49 AM	-0.6	-18	1	01:45 AM	0.3	9	16	02:21 AM	-0.5	-15
	08:13 AM	5.1	155		07:41 AM	5.8	177		08:47 AM	5.2	158		07:53 AM	6.1	186		07:47 AM	5.1	155		08:27 AM	5.5	168
Tu	02:19 PM	0.5	15	W	02:11 PM	-0.4	-12	F	03:15 PM	0.3	9	Sa	02:38 PM	-0.7	-21	Su	02:33 PM	0.0	0	M	03:12 PM	-0.7	-21
	08:23 PM	5.0	152		08:02 PM	5.6	171	●	09:03 PM	4.4	134		08:25 PM	4.9	149	●	08:15 PM	3.9	119		09:05 PM	4.4	134
2	02:42 AM	0.2	6	17	02:26 AM	-0.7	-21	2	03:14 AM	0.4	12	17	02:38 AM	-0.5	-15	2	02:24 AM	0.3	9	17	03:09 AM	-0.3	-9
	08:48 AM	5.2	158		08:27 AM	6.1	186		09:15 AM	5.2	158		08:41 AM	5.9	180		08:19 AM	5.1	155		09:17 AM	5.3	162
W	03:00 PM	0.4	12	Th	03:03 PM	-0.6	-18	Sa	03:54 PM	0.2	6	Su	03:29 PM	-0.6	-18	M	03:14 PM	0.0	0	Tu	03:59 PM	-0.5	-15
●	08:57 PM	4.9	149	○	08:50 PM	5.6	171		09:35 PM	4.2	128		09:19 PM	4.7	143		08:51 PM	3.9	119		09:59 PM	4.3	131
3	03:17 AM	0.3	9	18	03:13 AM	-0.7	-21	3	02:47 AM	0.5	15	18	03:26 AM	-0.3	-9	3	03:02 AM	0.3	9	18	03:56 AM	-0.1	-3
	09:21 AM	5.2	158		09:13 AM	6.2	189		08:42 AM	5.1	155		09:33 AM	5.6	171		08:54 AM	5.0	152		10:09 AM	5.0	152
Th	03:39 PM	0.4	12	F	03:54 PM	-0.6	-18	Su	03:32 PM	0.3	9	M	04:19 PM	-0.4	-12	Tu	03:54 PM	0.0	0	W	04:46 PM	-0.3	-9
	09:29 PM	4.7	143		09:41 PM	5.3	162		09:08 PM	4.0	122		10:17 PM	4.5	137		09:31 PM	3.8	116		10:53 PM	4.1	125
4	03:49 AM	0.4	12	19	03:59 AM	-0.6	-18	4	03:19 AM	0.6	18	19	04:15 AM	0.1	3	4	03:40 AM	0.4	12	19	04:43 AM	0.2	6
	09:51 AM	5.2	158		10:01 AM	6.2	189		09:10 AM	5.0	152		10:30 AM	5.3	162		09:36 AM	4.9	149		11:02 AM	4.7	143
F	04:17 PM	0.5	15	Sa	04:45 PM	-0.5	-15	M	04:10 PM	0.4	12	Tu	05:10 PM	-0.1	-3	W	04:36 PM	0.1	3	Th	05:33 PM	0.0	0
	10:01 PM	4.5	137		10:35 PM	5.1	155		09:44 PM	3.9	119		11:18 PM	4.3	131		10:20 PM	3.8	116		11:47 PM	4.0	122
5	04:19 AM	0.5	15	20	04:46 AM	-0.3	-9	5	03:49 AM	0.8	24	20	05:06 AM	0.4	12	5	04:21 AM	0.5	15	20	05:32 AM	0.5	15
	10:19 AM	5.1	155		10:54 AM	5.9	180		09:47 AM	4.9	149		11:29 AM	4.9	149		10:27 AM	4.8	146		11:53 AM	4.4	134
Sa	04:53 PM	0.6	18	Su	05:37 PM	-0.3	-9	Tu	04:50 PM	0.6	18	W	06:05 PM	0.2	6	Th	05:22 PM	0.1	3	F	06:22 PM	0.2	6
	10:33 PM	4.3	131		11:35 PM	4.7	143		10:30 PM	3.8	116						11:17 PM	3.8	116				
6	04:45 AM	0.7	21	21	05:35 AM	0.1	3	6	04:24 AM	0.9	27	21	12:16 AM	4.1	125	6	05:09 AM	0.6	18	21	12:38 AM	4.0	122
	10:45 AM	5.0	152		11:52 AM	5.6	171		10:35 AM	4.8	146		06:03 AM	0.8	24		11:25 AM	4.7	143		06:26 AM	0.8	24
Su	05:29 PM	0.7	21	M	06:32 PM	0.1	3	W	05:37 PM	0.7	21	Th	12:27 PM	4.6	140	F	06:14 PM	0.2	6	Sa	12:41 PM	4.2	128
	11:07 PM	4.0	122						11:28 PM	3.7	113		07:04 PM	0.5	15						07:14 PM	0.4	12
7	05:09 AM	0.9	27	22	12:37 AM	4.5	137	7	05:08 AM	1.0	30	22	01:12 AM	4.0	122	7	12:15 AM	3.9	119	22	01:27 AM	3.9	119
	11:17 AM	4.9	149		06:28 AM	0.5	15		11:35 AM	4.7	143		07:07 AM	1.0	30		06:12 AM	0.7	21		07:28 AM	1.0	30
M	06:06 PM	0.9	27	Tu	12:53 PM	5.2	158	Th	06:37 PM	0.8	24	F	01:21 PM	4.4	134	Sa	12:24 PM	4.7	143	Su	01:29 PM	3.9	119
	11:49 PM	3.9	119		07:32 PM	0.4	12						08:04 PM	0.6	18		07:13 PM	0.2	6	◑	08:06 PM	0.5	15
8	05:37 AM	1.1	34	23	01:39 AM	4.3	131	8	12:29 AM	3.7	113	23	02:06 AM	4.0	122	8	01:12 AM	4.1	125	23	02:15 AM	3.9	119
	11:59 AM	4.7	143		07:30 AM	0.9	27		06:13 AM	1.1	34		08:14 AM	1.1	34		07:32 AM	0.7	21		08:31 AM	1.0	30
Tu	06:52 PM	1.1	34	W	01:54 PM	4.9	149	F	12:39 PM	4.7	143	Sa	02:14 PM	4.2	128	Su	01:22 PM	4.6	140	M	02:17 PM	3.7	113
					08:39 PM	0.7	21		07:46 PM	0.7	21	◑	08:59 PM	0.6	18	◐	08:14 PM	0.1	3		08:56 PM	0.6	18
9	12:41 AM	3.7	113	24	02:39 AM	4.1	125	9	01:31 AM	3.9	119	24	03:00 AM	4.1	125	9	02:09 AM	4.3	131	24	03:04 AM	4.0	122
	06:17 AM	1.3	40		08:41 AM	1.2	37		07:50 AM	1.1	34		09:14 AM	1.1	34		08:47 AM	0.6	18		09:29 AM	1.0	30
W	12:54 PM	4.7	143	Th	02:54 PM	4.6	140	Sa	01:43 PM	4.7	143	Su	03:08 PM	4.0	122	M	02:23 PM	4.5	137	Tu	03:11 PM	3.5	107
	08:01 PM	1.2	37	◑	09:43 PM	0.7	21	◐	08:49 PM	0.5	15		09:46 PM	0.5	15		09:11 PM	-0.1	-3		09:43 PM	0.6	18
10	01:42 AM	3.7	113	25	03:38 AM	4.1	125	10	02:33 AM	4.2	128	25	03:53 AM	4.2	128	10	03:08 AM	4.6	140	25	03:54 AM	4.1	125
	07:16 AM	1.4	43		09:49 AM	1.2	37		09:07 AM	0.8	24		10:08 AM	1.0	30		09:51 AM	0.3	9		10:21 AM	0.8	24
Th	01:56 PM	4.7	143	F	03:54 PM	4.5	137	Su	02:47 PM	4.7	143	M	04:02 PM	4.0	122	Tu	03:27 PM	4.4	134	W	04:08 PM	3.4	104
◐	09:18 PM	1.2	37		10:39 PM	0.7	21		09:44 PM	0.2	6		10:29 PM	0.5	15		10:05 PM	-0.3	-9		10:27 PM	0.6	18
11	02:46 AM	3.8	116	26	04:38 AM	4.2	128	11	03:35 AM	4.5	137	26	04:42 AM	4.4	134	11	04:08 AM	5.0	152	26	04:43 AM	4.3	131
	09:08 AM	1.4	43		10:48 AM	1.1	34		10:09 AM	0.5	15		10:56 AM	0.8	24		10:50 AM	0.0	0		11:10 AM	0.6	18
F	03:03 PM	4.7	143	Sa	04:53 PM	4.4	134	M	03:52 PM	4.8	146	Tu	04:54 PM	4.0	122	W	04:32 PM	4.4	134	Th	05:04 PM	3.5	107
	10:21 PM	0.9	27		11:27 PM	0.6	18		10:34 PM	-0.1	-3		11:09 PM	0.4	12		10:56 PM	-0.4	-12		11:10 PM	0.5	15
12	03:54 AM	4.0	122	27	05:33 AM	4.4	134	12	04:35 AM	5.0	152	27	05:27 AM	4.6	140	12	05:07 AM	5.3	162	27	05:29 AM	4.5	137
	10:26 AM	1.1	34		11:39 AM	0.9	27		11:06 AM	0.1	3		11:41 AM	0.6	18		11:45 AM	-0.3	-9		11:56 AM	0.4	12
Sa	04:13 PM	4.9	149	Su	05:47 PM	4.5	137	Tu	04:54 PM	4.9	149	W	05:41 PM	4.0	122	Th	05:34 PM	4.4	134	F	05:54 PM	3.5	107
	11:15 PM	0.5	15						11:22 PM	-0.4	-12		11:48 PM	0.3	9		11:47 PM	-0.5	-15		11:53 PM	0.4	12
13	05:01 AM	4.3	131	28	12:10 AM	0.4	12	13	05:29 AM	5.5	168	28	06:07 AM	4.8	146	13	06:00 AM	5.5	168	28	06:11 AM	4.6	140
	11:27 AM	0.7	21		06:22 AM	4.6	140		12:01 PM	-0.3	-9		12:25 PM	0.4	12		12:40 PM	-0.6	-18		12:42 PM	0.1	3
Su	05:20 PM	5.1	155	M	12:26 PM	0.8	24	W	05:51 PM	5.0	152	Th	06:24 PM	4.0	122	F	06:30 PM	4.5	137	Sa	06:39 PM	3.7	113
					06:34 PM	4.5	137																
14	12:04 AM	0.1	3	29	12:49 AM	0.3	9	14	12:11 AM	-0.6	-18	29	12:27 AM	0.3	9	14	12:39 AM	-0.6	-18	29	12:37 AM	0.3	9
	06:01 AM	4.8	146		07:04 AM	4.9	149		06:19 AM	5.8	177		06:43 AM	5.0	152		06:51 AM	5.7	174		06:50 AM	4.8	146
M	12:23 PM	0.3	9	Tu	01:10 PM	0.6	18	Th	12:54 PM	-0.5	-15	F	01:09 PM	0.2	6	Sa	01:32 PM	-0.7	-21	Su	01:27 PM	0.0	0
	06:20 PM	5.4	165		07:15 PM	4.6	140		06:43 PM	5.1	155		07:03 PM	4.0	122		07:22 PM	4.5	137		07:18 PM	3.8	116
15	12:52 AM	-0.3	-9	30	01:27 AM	0.3	9	15	01:00 AM	-0.7	-21	30	01:06 AM	0.3	9	15	01:30 AM	-0.5	-15	30	01:21 AM	0.2	6
	06:53 AM	5.4	165		07:41 AM	5.1	155		07:06 AM	6.1	186		07:16 AM	5.0	152		07:39 AM	5.7	174		07:27 AM	4.9	149
Tu	01:17 PM	-0.1	-3	W	01:53 PM	0.4	12	F	01:47 PM	-0.7	-21	Sa	01:51 PM	0.1	3	Su	02:23 PM	-0.7	-21	M	02:11 PM	-0.2	-6
	07:12 PM	5.6	171		07:53 PM	4.5	137	○	07:34 PM	5.0	152		07:40 PM	4.0	122	○	08:13 PM	4.5	137	●	07:56 PM	3.9	119
				31	02:04 AM	0.3	9													31	02:05 AM	0.0	0
					08:15 AM	5.2	158														08:05 AM	5.0	152
				Th	02:34 PM	0.3	9													Tu	02:54 PM	-0.3	-9
					08:29 PM	4.5	137														08:33 PM	4.0	122

Lunar Phases

Lunar Phases, 2024

Lunation	New Moon		First Quarter		Full Moon		Third Quarter		Duration
1237					Jan 6	6:07 pm	Jan 14	9:10 pm	29d 10h 36m
1238	Jan 21	3:53 pm	Jan 28	10:18 am	Feb 5	1:28 pm	Feb 13	11:00 am	29d 10h 13m
1239	Feb 20	2:05 am	Feb 27	3:05 am	Mar 7	7:40 am	Mar 14	10:08 pm	29d 10h 17m
1240	Mar 21	1:23 pm	Mar 28	10:32 pm	Apr 6	12:34 am	Apr 13	5:11 am	29d 10h 49m
1241	Apr 20	12:12 am	Apr 27	5:19 pm	May 5	1:34 pm	May 12	10:28 am	29d 11h 41m
1242	May 19	11:53 am	May 27	11:22 am	Jun 3	11:41 pm	Jun 10	3:31 pm	29d 12h 44m
1243	Jun 18	12:37 am	Jun 26	3:49 am	Jul 3	7:38 am	Jul 9	9:47 pm	29d 13h 55m
1244	Jul 17	2:31 pm	Jul 25	6:06 pm	Aug 1	2:31 pm	Aug 8	6:28 am	29d 15h 06m
1245	Aug 16	5:38 am	Aug 24	5:57 am	Aug 30	9:35 pm	Sep 6	6:21 pm	29d 16h 02m
1246	Sep 14	9:39 pm	Sep 22	3:31 pm	Sep 29	5:57 am	Oct 6	9:47 am	29d 16h 15m
1247	Oct 14	1:55 pm	Oct 21	11:29 pm	Oct 28	4:24 pm	Nov 5	3:36 am	29d 15h 32m
1248	Nov 13	4:27 am	Nov 20	5:49 am	Nov 27	4:16 am	Dec 5	12:49 am	29d 14h 05m
1249	Dec 12	6:32 pm	Dec 19	1:39 pm	Dec 26	7:33 pm			29d 12h 25m

All times are local time for New York. Times is adjusted for DST when applicable.

Lunar Perigee & Apogee, 2024

The Lunar Perigee is when the Moon is closest to the Earth during its monthly orbit. The Lunar Apogee is when the Moon is furthest from Earth. Generally, the Moon looks about 14% larger and 30% brighter at its perigee compared to its apogee.

Closest Approach (Perigee)

Date	Local Time	Distance in km	Distance in miles
Jan 13	5:34 am	362,267 km	225,102 mi
Feb 10	1:52 pm	358,088 km	222,506 mi
Mar 10	3:04 am	356,895 km	221,764 mi
Apr 7	1:50 pm	358,850 km	222,979 mi
May 5	6:04 pm	363,163 km	225,659 mi
Jun 2	3:16 am	368,102 km	228,728 mi
Jun 27	7:30 am	369,286 km	229,464 mi
Jul 24	1:41 am	364,917 km	226,749 mi
Aug 21	1:02 am	360,196 km	223,815 mi
Sep 18	9:23 am	357,286 km	222,007 mi
Oct 16	8:51 pm	357,175 km	221,938 mi
Nov 14	6:14 am	360,109 km	223,762 mi
Dec 12	8:20 am	365,361 km	227,025 mi

* Distances are approximate. Closest Approach (Perigee) is highlighted.

Furthest Apart (Apogee)

Date	Local Time	Distance in km	Distance in miles
Jan 1	10:28 am	404,909 km	251,599 mi
Jan 29	3:14 am	405,777 km	252,138 mi
Feb 25	9:59 am	406,312 km	252,470 mi
Mar 23	11:45 am	406,294 km	252,460 mi
Apr 19	10:10 pm	405,623 km	252,043 mi
May 17	2:58 pm	404,640 km	251,432 mi
Jun 14	9:35 am	404,077 km	251,082 mi
Jul 12	4:11 am	404,362 km	251,259 mi
Aug 8	9:31 pm	405,297 km	251,840 mi
Sep 5	10:53 am	406,211 km	252,408 mi
Oct 2	3:39 pm	406,516 km	252,597 mi
Oct 29	6:50 pm	406,161 km	252,377 mi
Nov 26	6:55 am	405,314 km	251,850 mi
Dec 24	2:24 am	404,485 km	251,335 mi

* Distances are approximate. Furthest Apart (Apogee) is highlighted.

Impact on Tides

- Tides are higher/lower during full or new moon (by about two inches).
- Tides are higher/lower when Moon is closer to Earth.

Sources

- Air Temperature:
  http://www.thither.com/nyc-packing-list
- Bathymetry:
  https://maps.ngdc.noaa.gov/viewers/bathymetry/
- Beaches:
  http://www.newyorkharborbeaches.org/main.htm
- Boating Groups:
  http://www.nycwatertrail.org/boating_groups.html
- CSOs:
  http://www.nj.gov/dep/dwq/cso-sewer-maps.htm
  https://data.ny.gov/Energy-Environment/Combined-Sewer-Overflows-CSOs-Map/i8hd-rmbi/data
- Current Tables:
  http://tidesandcurrents.noaa.gov/noaacurrents/Stations?g=458
- Daylight:
  https://weatherspark.com/averages/30639/New-York-United-States
- Eddies:
  https://en.wikipedia.org/wiki/Eddy_(fluid_dynamics)
- Events:
  http://www.iboatnyharbor.com/Harbor%20Events.htm
- Ferry NYC Routes:
  https://www.ferry.nyc/routes-and-schedules/
- Ferry Terminals:
  http://www.iboatnyharbor.com/Wakes-sensitive%20Areas.htm#FerryTerminals
- Fog:
  https://en.wikipedia.org/wiki/Fog
- Fog on Harbor:
  https://nauticalcharts.noaa.gov/publications/coast-pilot/index.html
- Hypothermia Times:
  http://www.pfdma.org/choosing/hypothermia.aspx
- Heat Index:
  https://www.weather.gov/ama/heatindex
- Hell Gate Transit:
  https://captbbrucato.wordpress.com/2009/05/17/new-york-citys-east-river-and-hell-gate/
- Kayak Launch Sites:
  https://www.nycgovparks.org/facilities/kayak
- Local Magnetic Disturbance:
  https://nauticalcharts.noaa.gov/publications/coast-pilot/index.html
- Lunar Perigee & Phases:
  https://www.timeanddate.com/moon/phases/usa/new-york
  https://www.timeanddate.com/astronomy/moon/distance.html
- Magnetic Fields & Declination:
  https://www.ngdc.noaa.gov/geomag-web/#igrfwmm
  https://en.wikipedia.org/wiki/Magnetic_declination
- No Wake Areas:
  http://www.goingcoastal.org/nowake.htm
- NOAA Charts:
  http://www.charts.noaa.gov/

- Notice to Mariners:
  https://www.navcen.uscg.gov/?pageName=lnmDistrict&region=1
- NYC Parks Permits & Rules:
  https://www.nycgovparks.org/facilities/kayak/rules
  https://www.nycgovparks.org/rules/section-2-06
- NYC Sewers:
  http://www.nyc.gov/html/dep/html/stormwater/sewer_system_types.shtml
- Sandy Hook Pilots:
  https://www.sandyhookpilots.com/
- Rail Freight Barges:
  http://untappedcities.com/
- Roosevelt Island Tidal Energy (RITE) Project:
  https://www.verdantpower.com/projects
- Seaplane Runway:
  https://www.dot.ny.gov/divisions/operating/opdm/aviation/directories/seaplane
- Security Zones:
  http://www.iboatnyharbor.com/Security%20Zones.htm
  https://www.law.cornell.edu/cfr/text/33/165.169
  https://www.law.cornell.edu/cfr/text/33/165.164
- Shipwrecks:
  http://wrecks.nauticalcharts.noaa.gov/viewer/
- Spuyten Duyvil:
  https://en.wikipedia.org/wiki/Spuyten_Duyvil_Bridge
- Standing Wave:
  https://libertyyachtclub.org/2016/07/25/transiting-hell-gate/
- Sulfuric Acid Discharges:
  https://theicct.org/publications/global-scrubber-discharges-Apr2021
  https://www.marineinsight.com/tech/scrubber-system-on-ship/
  https://ww3.arb.ca.gov/ports/shorepower/shorepower.htm
  https://en.wikipedia.org/wiki/MARPOL_73/78
- Tide Charts:
  https://catalog.hathitrust.org/Record/011421935
- Tide Tables:
  http://tidesandcurrents.noaa.gov/tide_predictions.html
- Wakes:
  http://www.iboatnyharbor.com/Wakes-sensitive%20Areas.htm#WakesInjuries
  http://www.iboatnyharbor.com/SLOW%20White%20Paper.pdf
- Waste Transfer:
  http://www.newtowncreekalliance.org/waste-transfer-stations/
- Water Advisories:
  http://www.nyc.gov/html/dep/html/harborwater/nyc_waterbody_advisory_program.shtml
- Water Temperature:
  https://www.nodc.noaa.gov/dsdt/cwtg/all_meanT.html
- Waves:
  http://www.soest.hawaii.edu/oceanography/courses_html/OCN201/littlepages/waves.html
  http://hyperphysics.phy-astr.gsu.edu/hbase/watwav.html#c3
- Weather for NYC:
  https://weatherspark.com/averages/30639/New-York-United-States
- Whales:
  https://whalemap.ocean.dal.ca/

http://www.nmfs.noaa.gov/pr/laws/mmpa/anniversary/whalesense.htm
https://www.greateratlantic.fisheries.noaa.gov/shipstrike/doc/compliance_guide.pdf

- Wind-chill Chart:
  http://www.nws.noaa.gov/om/winter/windchill.shtml
- Wind Direction:
  http://www.wcc.nrcs.usda.gov/climate/windrose.html
- Wind Speed/Power:
  http://www.vftt.org/forums/showthread.php?55436-An-Explanation-of-Wind-Speed-and-Power

Terminology

Names

- The *Hudson River* is also called the *North River*.
- The *Harbor* between the Narrows and the Battery is also called *Upper New York Bay*.
- The *Lower New York Bay* is on the ocean side of the Verrazano Narrows.
- The *Harlem River* is not a river. It is a tidal estuary.
- The *East River* is not a river. It is a tidal estuary.

Tides

- A *spring tide* occurs on a new moon or a full moon.
- A *neap tide* occurs halfway between a full and a new moon.
- A *rip tide* is not a tide. It is a current going out from a beach.
- A *flood tide* is coming in from the ocean.
- An *ebb tide* is flowing out to the ocean.
- A *slack tide* or *slack current* is when the tidal current is changing direction.
- In New York Harbor, *high tide* does not correspond to *slack current*.

Directions

- The *wind direction* is where wind is coming from.
- The *current direction* is where it is going to.

Distances and Speed

- One *nautical mile* equals 1.15 land-measured (or statute) miles.
- One *knot* equals one nautical mile per hour
- One *knot* equals 0.51 meters per second.
- A *fathom* is a nautical unit of measurement and is equal to six feet.

Nautical Depths

- *Mean low water* is the average low water over a tide cycle.
- *Mean high water* is the average high water over a tide cycle.
- *Mean range of tide* is difference in height between mean high water and mean low water.

Nautical Speeds

- Current *velocities* are for surface currents.
- Current *velocities* are for spring tides.

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