



Metropolitan Waterfont Alliance
&
The Harbor Education Task Force

Harbor Literacy Points

for Educators, Students & the Public

JULY 12, 2014



Harbor Literacy Points for Educators, Students & the Public

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The Metropolitan Waterfront Alliance works to transform the New York and New Jersey Harbor and Waterways to make them cleaner and more accessible, a vibrant place to play, learn and work with great parks, great jobs and great transportation for all.

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Introduction

Together with a team of more than 50 educators working as the Harbor Education Task Force, Metropolitan Waterfront Alliance is proud to present *Harbor Literacy Points for Educators, Students, and the Public*. Designed to integrate the study of our harbor, rivers, and estuary into the everyday curriculum of elementary, middle, and high school students, *Harbor Literacy Points* outlines key topics, learning opportunities, and resources offered by our proximity to the waters of New York and New Jersey. Focusing on watersheds, estuaries, marine ecosystems, water quality, and harbor history, *Harbor Literacy Points* aims to increase interactive learning with urban waterways.

The *Harbor Literacy Points* curriculum guide is comprised of five topic areas, covering five essential questions. These questions are the framework for research and discussion, giving students an idea of what they will learn as they continue their studies of the harbor:

1. What is a watershed?
2. What is an estuary?
3. How does our estuary function?
4. How do we impact water quality in the estuary?
5. What is the history of the NY/NJ Harbor?

[Resources for Educators](#) is a list of organizations that offer waterfront stewardship, research, and education opportunities in New York and New Jersey. Each resource is paired with at least one of the topic areas from the curriculum guide, making it easy for educators to coordinate research, discussion, or classwork with related excursions and activities. Other components included are a [Glossary](#) of terms and [Bibliography](#) of print and web-based learning materials.

The [Index of Learning Standards](#) shows how the scientific and historical concepts relevant to our local waterways are associated with New York and New Jersey state learning standards, so that educators can incorporate the material into their lesson plans. *Harbor Literacy Points* encourages on-water experiences so that every student—both young and old—in the metropolitan region can understand how to enjoy and care for the harbor.

Harbor Literacy Points

for Educators





1

What is a watershed?

How are we connected to the watershed?

How are activities on land and water interconnected?

The land and water are connected through the [hydrologic cycle](#). This cycle is spatially defined on land by a [watershed](#). A watershed is an area of land that drains into a particular body of water. Stormwater runs off the land and is collected by streams, river, bays, or oceans. All land is part of a watershed. The watershed of the NY/NJ Harbor Estuary encompasses about 16,300 square miles of land, with thousands of small streams feeding into the Hudson, Hackensack, Passaic, Raritan, Shrewsbury, Navesink, and Rahway Rivers. This connection between land and water means that our actions on land have an impact on the water of the [estuary](#). This connection also means that an impact in one location may have effects elsewhere as it follows the flow of water into other communities and habitats in the watershed. Since watersheds often extend over political boundary lines, managing such impacts and protecting water quality from [point source pollution](#) and [non-point source pollution](#) may require collaboration by many government entities, from local communities to state and federal agencies.



Lessons and Activities

- ◆ Participate in relevant professional development opportunities hosted by the many collaborative organizations in this guide.
- ◆ Plan field trips to the nearby water bodies and connect with advocacy organizations to offer complementary programming.
- ◆ Plan field trips to [Queens Museum](#), [South Street Seaport Museum](#), [Museum of the City of New York](#), or any local museums that host exhibitions featuring water topics.
- ◆ Take a walk around your school's community and observe potential sources of pollution. Allow students to make observations on their surroundings.
- ◆ Build [watershed models](#) with your students.
- ◆ Incorporate the weather of the day into discussions on these topics.
- ◆ Introduce additional topics on local flora and fauna. Ask students to journal different kinds of plants and birds that they identify at their local park or waterfront.
- ◆ Create a PSA on the local watershed and students' connection to it to promote conservation and stewardship among students and the community.
- ◆ Build a library of books, articles, and films for students to easily access and research.



2 What is an estuary?

What makes up a living estuary?

Why is the living estuary an important ecosystem for native and migratory species?

The New York/New Jersey Harbor and tidal reaches of the rivers flowing into it are an **estuary** in which salty seawater pushes upriver, and is diluted by freshwater, making it **brackish**. The plants and animals found at any place in the estuary reflect the prevailing **salinity** at that site. This **ecosystem** includes the **watershed**, which, in addition to supplying fresh water, supplies most of the nutrients (carbon, nitrogen, and phosphorus) available to organisms in the estuary. The ecosystem encompasses a variety of **habitats** (tidal marshes, shallows, deep channels and others) that support a great diversity of plants, animals, and other organisms. Fishes exploit the variety of habitats and salinity conditions existing within the estuary, and some **migratory** species travel throughout the system and beyond. The estuary is an important **nursery** for **anadromous** fish, resting stop for birds along the Atlantic flyway, and source of plankton.



Lessons and Activities

- ◆ Plan a trip to the [Liberty Science Center](#), [The River Project](#), [New York Aquarium](#) and other places where you can observe and learn about native aquatic species with your students.
- ◆ Use a hydrometer and other scientific tools to study fresh, salt, and brackish waters.
- ◆ Find a wetland near your school, take your class for a field trip and, in a journal, observe the different species residing at that time of year.
- ◆ Participate in [Day in the Life of the Hudson River](#), an annual water monitoring event held in October.
- ◆ Take students on a trip to a state or local park along the Hudson River, and discover diverse habitats on a nature hike.
- ◆ Learn more about indicator species that inform us about the quality of water.
- ◆ Take a field trip on the water for an environmental education experience with the [Hudson River Sloop Clearwater](#) or the [South Street Seaport Museum's](#) schooner *Pioneer*.



3 How does our estuary function?

What makes an estuary different from other bodies of water (i.e. rivers, lakes)?

How is the estuary vulnerable to ecosystem changes and human activity?

The New York/New Jersey Harbor is an [estuary](#) in which salty seawater pushing in from the Atlantic Ocean is diluted by fresh water, primarily from the [watershed](#) of the Hudson River. Ocean [tides](#) influence the harbor: it typically experiences two high tides and two low tides each day. With its open connection to the ocean, the harbor is also impacted by storm surges associated with coastal storms and rising sea levels caused by climate change. The Hudson and other rivers entering the harbor carry [sediments](#) that settle here, forming [habitat](#) for living things but also creating the need for [dredging](#) to maintain shipping [channels](#) and [berths](#). The harbor consists of 770 miles of waterfront and about 240 miles of shipping channels, as well as anchorages and port facilities, centered on Upper New York Bay. The harbor's main entrance from the Atlantic Ocean lies to the southeast, between Rockaway Point and Sandy Hook; there is another entrance via Long Island Sound and the East River to the northeast.

Lessons and Activities

- ◆ Learn how to use a [tide table](#) and visit the waterfront with your students to observe tides. Have students first estimate the times of high and low tide that day.
- ◆ Study the [maps](#) of the New York/New Jersey Harbor with your students. Where are the navigation channels? Where are the ports? Where are the wetlands?
- ◆ Have students draft their own visual aids or maps to place their location in relation to the estuary, and nearby rivers, canals, or bays.
- ◆ See the harbor from the water on a ferry, water taxi, or tour boat.
- ◆ Ask students to research and write about effects of [climate change](#) and how these might impact the NY/NJ estuary.





4

How do we impact water quality in the estuary?

How clean is the NY/NJ estuary?

How can we help improve water quality in the estuary?

Once badly polluted by human sewage and industrial waste, the NY/NJ Harbor is healthier now. The Clean Water Act, requiring sewage treatment and the regulation of other waste discharges, has greatly improved [water quality](#) throughout the harbor. The federal Superfund program and similar state initiatives address the legacy of toxic contamination from past discharges. [Combined sewer overflows](#) (CSOs) and [stormwater runoff](#) still have significant adverse impacts on the harbor's water quality. Citizens and agencies alike are working to improve water quality by upgrading [wastewater](#) treatment facilities, installing [green infrastructure](#), improving existing wetlands, and installing other stormwater controls. All of these efforts help reduce the water entering the sewer system during storm events. Green infrastructure projects include bioswales, rain barrels, green roofs, and blue roofs.



Lessons and Activities

- ◆ Test the water quality of the nearest water body. Follow up with a visit to another nearby water body and compare observations and results.
- ◆ Use the [“Sewer in a Suitcase”](#) model to teach about CSOs (contact [NYCSWCD](#) for a free loaner model).
- ◆ Green your schoolyard by starting a gardening group (recruit volunteer parents!).
- ◆ Contact your local [community garden](#) to plan a visit and learn about the project.
- ◆ Research [green infrastructure](#) projects in NYC. Learn about the various tools used to mitigate stormwater runoff, including bioswales, green and blue roofs, rain barrels, and more.
- ◆ Walk around your school's community to discover potential green infrastructure project sites.
- ◆ Plan a visit with [NYC DEP](#) to the [Newtown Creek Wastewater Treatment Plant](#) and find out where stormwater and wastewater are treated.
- ◆ Students can use a [water calculator](#) to learn about their average water consumption each day and how they can make efforts to conserve more water.
- ◆ Get involved in caring for your local street trees. Contact [NYC Parks Department](#) and [MillionTreesNYC](#) to learn how.
- ◆ Learn about NYC's vast underground sewer system and why we should keep litter and grease out of it.



5

What is the History of the NY/NJ Harbor?

How has the harbor helped New York City become a hub of economic activity for the region?

How has the activity within the harbor changed over time?

The growth and development of New York and New Jersey is intertwined with the history of New York Harbor. In 1609, the *Half Moon*, a Dutch East India Company ship captained by the English explorer Henry Hudson, sailed into the harbor, searching for a [Northwest Passage](#) to China. The Native Americans already living here used the [estuary](#) and its [tributaries](#) as a source of food and for travel, trade, and communication, as did the settlers who followed in the *Half Moon's* wake. As New York City and the communities of New Jersey grew, the harbor's docks served as an economic engine and a gateway for successive generations of immigrants. Geographically, the city's position at the juncture of [commerce](#) both overseas and inland to the nation's interior via the Hudson River and Mohawk Valley was advantageous. The opening of the Erie Canal in 1824 vaulted the city to its leading role as a world center of finance, trade and industry. New York City's importance as a manufacturing hub reinforced the volume of trade here. Today, the port annually generates about \$20 billion of economic activity for the region. New York Harbor, with its open vistas and strategic setting, also played an important role in national defense and military history.

Lessons and Activities

- ◆ Take your students on a field trip to historical sites within the NY/NJ Harbor.
- ◆ Visit historical sites in Lower Manhattan, including South Street Seaport.
- ◆ Use [Mannahatta: A Natural History of New York City](#) by Eric Sanderson as a teaching guide.
- ◆ Take your students on the Staten Island Ferry to take photographs and journal experiences.
- ◆ Students can research books and articles on the history of the harbor and key topics, including economic activity and trade, the Erie Canal, Hudson River industry and pollution, and Henry Hudson and the Native Americans.





[American Littoral Society](#)

The American Littoral Society promotes the study and conservation of marine life and habitat, protects the coast from harm, and empowers others to do the same. Contact: stevie@littoralsociety.org

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[Bronx River Alliance](#)

The Bronx River Alliance serves as a coordinated voice for the river and works in harmonious partnership to protect, improve and restore the Bronx River corridor. Contact: bronxriver.info@parks.nyc.gov

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[Brooklyn Bridge Park Conservancy](#)

The Brooklyn Bridge Park Conservancy offers diverse and innovative programming for park visitors, including free boating, educational tours, and classes. Contact: brooklynbridgepark@bbpnyc.org

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[Brooklyn College Aquatic Research and Environmental Assessment Center](#)

The AREAC at Brooklyn College is a marine and freshwater research center focusing on the response of marine biota to environmental forcings. They offer tours of their facilities with advanced reservations.

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[City Parks Foundation](#)

City Parks Foundation provides free education opportunities to young people and community members of all ages within NYC parks through programs such as The Coastal Classroom. Contact: Info@CityParksFoundation.org

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[CityScience](#)

CityScience helps teachers and after-school educators use the natural and built environment of NY and NJ as laboratories for active learning through curriculum, professional development and field trips. Contact:

info@cityscience.org

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[East River C.R.E.W.](#)

East River C.R.E.W. promotes stewardship of New York City's East River, and offers a boathouse to facilitate waterfront access and the study of harbor history. Contact: CREWMNHawk@EastRiverCREW.org

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[Gateway National Recreation Area](#)

Gateway National Recreation Area, spanning Jamaica Bay, Staten Island, and Sandy Hook, offers access to the water and educational programming through the National Parks Service.

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[Governors Island National Monument](#)

Hands-on activities and history programming are available at this former military post through the National Parks Service.

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[Hackensack Riverkeeper](#)

Captain Bill Sheehan, a dedicated, active conservationist, founded the Hackensack Riverkeeper in 1997 to advocate for the Hackensack River. Contact:

info@hackensackriverkeeper.org

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[Hudson River Park Trust](#)

Hudson River Park offers recreational and educational activities for local residents and visitors, and plays a critical role in protecting the Hudson River environment. Contact: info@hrpt.ny.gov

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[Hudson River Sloop Clearwater](#)

Clearwater offers hands-on learning programs, such as The Sailing Classroom, that aim to preserve and protect the Hudson River and its tributaries. Contact: office@clearwater.org

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[Liberty Science Center](#)

Liberty Science Center is an innovative learning resource for science, technology, engineering, and mathematics exploration. Dynamic educators and science experts are available to guide these inquiry-based programs. Contact: sales@lsc.org

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[Lower East Side Ecology Center](#)

LES Ecology Center offers public programs and classes in greening, fishing, and water quality for all New Yorkers to learn about how to solve environmental issues facing NYC. Contact: info@leseecologycenter.org

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[MillionTreesNYC](#)

MillionTreesNYC is a public-private partnership with the NYC Parks Department offering opportunities to get involved with tree stewardship for the purposes of climate change mitigation, water quality protection, and improved air quality. Contact: Info@milliontreesnyc.org

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[Museum of the City of New York](#)

The Museum of the City of New York celebrates and interprets the city, educating the public about its distinctive character, especially its heritage of diversity, opportunity, and perpetual transformation. Contact: schoolprograms@mcny.org

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[New Jersey Department of Environmental Protection](#)

NJDEP's core mission is the protection of the air, waters, land, and natural and historic resources of the State to ensure continued public benefit. Contact: Tanya.Oznowich@dep.state.nj.us

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[New Jersey Sea Grant Consortium](#)

The NJ Sea Grant Consortium is an affiliation of universities and other groups committed to advancing knowledge and stewardship of New Jersey's marine and coastal environment. Contact: dburich@njseagrant.org

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[New York Aquarium](#)

New York Aquarium in Coney Island offers a variety of programs that take advantage of the aquarium's state-of-the-art exhibits and resources to weave together key concepts across various disciplines to enhance science curricula. Contact: wcsgroupsales@wcs.org

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[New York City Soil & Water Conservation District](#)

New York City Soil & Water Conservation District conserves natural resources in the city through policy, education and stewardship, hosts an annual outdoor environmental competition for high school students, and offers educational water quality presentations. Contact: info@nycswwcd.net

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[New York State Marine Education Association](#)

NYSMEA holds an annual conference, periodic meetings, lectures, workshops, field trips, and boat trips to promote marine awareness and encourage the exchange of instructional resources. Contact: JoinNYSMEA@nysmea.org

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[NYC Department of Environmental Protection](#)

In addition to supplying clean drinking water, collecting and treating wastewater, and building green infrastructure projects, NYC DEP offers many free educational programs such as field trips, school programs, funding, Trout in the Classroom, and online publications.

Contact: educationoffice@dep.nyc.gov

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[NYC Department of Parks & Recreation GreenThumb](#)

GreenThumb provides programming and material support to over 500 community gardens in New York City. Contact: Ana.Portela@parks.nyc.gov

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[NYC Department of Parks & Recreation Urban Park Rangers](#)

NYC Parks provides recreational and athletic facilities and programs, including The Urban Rangers Program, which connects New Yorkers to the natural world through environmental education and active conservation.

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[NYC H2O](#)

Educational programs and guided tours for school groups about NYC's water and sewer systems including historic reservoirs and aqueducts. Contact: mm1566@nyu.edu

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[NYS Department of Environmental Conservation's NYC Environmental Education Program](#)

NYSDEC is New York State's natural resources and environmental quality agency. It's Region 2 NYC Environmental Education Program focuses on educator professional development workshops, the After School Conservation Club, and curriculum resources. Contact: r2ed@gw.dec.state.ny.us

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[NYS Department of Environmental Conservation's Hudson River Estuary Program](#)

NYSDEC is New York State's natural resources and environmental quality agency. Its Hudson River Estuary Program facilitates estuary education from NY Harbor to Troy with field & school programs, teacher training, and curriculum resources. Contact: hrteach@gw.dec.state.ny.us

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[Queens Museum](#)

The Queens Museum is dedicated to presenting the highest quality visual arts and educational programming that directly relates to the contemporary urban life of people in the New York metropolitan area. Contact:

Mriley@queensmuseum.org

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[Randall's Island Park Alliance](#)

The Randall's Island Park Alliance Waterfront Stewardship Program teaches children about coastal ecology and urban renewal through hands-on exploration in nine acres of restored wetlands. Contact:

Christopher.Girgenti@parks.nyc.gov

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[Rocking the Boat](#)

Rocking the Boat teaches young people challenged by economic, educational, and social conditions to build boats, learn to row and sail, and restore local urban waterways. Contact: info@rockingtheboat.org

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[Scenic Hudson](#)

Scenic Hudson is a non-profit organization dedicated to protecting and restoring the Hudson River and the Hudson River Valley of New York State. Contact: info@scenichudson.org

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[Solar One](#)

Solar One manages Stuyvesant Cove Park and provides an array of urban sustainability and education programs for New Yorkers of all ages. Contact: info@solar1.org

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[South Street Seaport Museum](#)

South Street Seaport Museum's galleries are open by appointment, and the museum offers educational programs and boat tours. Contact: info@seany.org

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[Stevens Institute Of Technology](#)

Stevens Institute Of Technology is a premier, private research university in Hoboken, NJ advancing the frontiers of science and technology to confront global challenges. Contact: dchesley@stevens.edu

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[The River Project](#)

The River Project is a marine science field station on the lower west side of Manhattan used for scientific research, hands-on environmental education, and urban habitat improvement of the Hudson River estuary. Contact: elisa@riverprojectnyc.org

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[Trees New York](#)

TreesNY is an environmental and urban forestry nonprofit organization that preserves and protects New York City's urban forest through initiatives such as their Stormwater Vegetative Control project. Contact: info@treesny.org

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[The Urban Assembly New York Harbor School](#)

The Harbor School is a public high school located on Governor's Island that instills in students the ethics of environmental stewardship and the skills associated with careers on the water. Contact: info@newyorkharborschool.org

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Harbor Literacy Points

for Students





1 What is a watershed?

How are we connected to the watershed?

How are activities on land and water interconnected?

The land and water are connected through the [hydrologic cycle](#). This cycle is spatially defined on land by a [watershed](#). A watershed is an area of land that drains into a particular body of water. Stormwater runs off the land and is collected by streams, river, bays, or oceans. All land is part of a watershed. The watershed of the NY/NJ Harbor Estuary encompasses about 16,300 square miles of land, with thousands of small streams feeding into the Hudson, Hackensack, Passaic, Raritan, Shrewsbury, Navesink, and Rahway Rivers. This connection between land and water means that our actions on land have an impact on the water of the [estuary](#). This connection also means that an impact in one location may have effects elsewhere as it follows the flow of water into other communities and habitats in the watershed. Since watersheds often extend over political boundary lines, managing such impacts and protecting water quality from [point source pollution](#) and [non-point source pollution](#) may require collaboration by many government entities, from local communities to state and federal agencies.

Harbor Literacy Tips

- ◆ Never litter.
- ◆ Observe rivers, bays and other water bodies next time you visit. Can you see sources of pollution?
- ◆ Take advantage of opportunities to view the estuary and its inhabitants first hand at parks, refuges, and environmental centers located on the estuary.
- ◆ How many different kinds of plants can you identify in your local park? On your street?





2 What is an estuary?

What makes up a living estuary?

Why is the living estuary an important ecosystem for native and migratory species?

The New York/New Jersey Harbor and tidal reaches of the rivers flowing into it are an **estuary** in which salty seawater pushes upriver, and is diluted by freshwater, making it **brackish**. The plants and animals found at any place in the estuary reflect the prevailing **salinity** at that site. This **ecosystem** includes the **watershed**, which, in addition to supplying fresh water, supplies most of the nutrients (carbon, nitrogen, and phosphorus) available to organisms in the estuary. The ecosystem encompasses a variety of **habitats** (tidal marshes, shallows, deep channels and others) that support a great diversity of plants, animals, and other organisms. Fishes exploit the variety of habitats and salinity conditions existing within the estuary, and some **migratory** species travel throughout the system and beyond. The estuary is an important **nursery** for **anadromous** fish, resting stop for birds along the Atlantic flyway, and source of plankton.

Harbor Literacy Tips

- ◆ Never litter.
- ◆ Take advantage of opportunities to view the estuary and its inhabitants first hand at parks, refuges, and environmental centers located on the estuary.
- ◆ How many different kinds of plants can you identify in your local park? On your street?
- ◆ Ask to see the fish caught by anglers (with your parents) fishing on piers.
- ◆ Look for birds when you are on the waterfront. How many different kinds of birds can you identify?





3 How does our estuary function?

What makes an estuary different from other bodies of water (i.e. rivers, lakes)?
How is the estuary vulnerable to ecosystem changes and human activity?

The New York/New Jersey Harbor is an **estuary** in which salty seawater pushing in from the Atlantic Ocean is diluted by fresh water, primarily from the **watershed** of the Hudson River. Ocean **tides** influence the harbor: it typically experiences two high tides and two low tides each day. With its open connection to the ocean, the harbor is also impacted by storm surges associated with coastal storms and rising sea levels caused by climate change. The Hudson and other rivers entering the harbor carry **sediments** that settle here, forming **habitat** for living things but also creating the need for **dredging** to maintain shipping **channels** and **berths**. The harbor consists of 770 miles of waterfront and about 240 miles of shipping channels, as well as anchorages and port facilities, centered on Upper New York Bay. The harbor's main entrance from the Atlantic Ocean lies to the southeast, between Rockaway Point and Sandy Hook; there is another entrance via Long Island Sound and the East River to the northeast.

Harbor Literacy Tips

- ◆ Look at the tide level when you are on the waterfront. Can you tell if the tide is high or low?
- ◆ Figure out where you are with respect to the estuary when you are on the waterfront. Are you by the river? A canal? A Bay?





4

How do we impact water quality in the estuary?

How clean is the NY/NJ estuary?

How can we help improve water quality in the estuary?

Once badly polluted by human sewage and industrial waste, the NY/NJ Harbor is healthier now. The Clean Water Act, requiring sewage treatment and the regulation of other waste discharges, has greatly improved [water quality](#) throughout the harbor. The federal Superfund program and similar state initiatives address the legacy of toxic contamination from past discharges. [Combined sewer overflows](#) (CSOs) and [stormwater runoff](#) still have significant adverse impacts on the harbor's water quality. Citizens and agencies alike are working to improve water quality by upgrading [wastewater](#) treatment facilities, installing [green infrastructure](#), improving existing wetlands, and installing other stormwater controls. All of these efforts help reduce the water entering the sewer system during storm events. Green infrastructure projects include bioswales, rain barrels, green roofs, and blue roofs.

Harbor Literacy Tips

- ◆ Start a gardening group at your school.
- ◆ Don't take a shower or a bath when it is raining hard outside.
- ◆ Conserve water all the time! Don't run the water when you brush your teeth.





5 What is the History of the NY/NJ Harbor?

How has the harbor helped New York City become a hub of economic activity for the region?

How has the activity within the harbor changed over time?

The growth and development of New York and New Jersey is intertwined with the history of New York Harbor. In 1609, the *Half Moon*, a Dutch East India Company ship captained by the English explorer Henry Hudson, sailed into the harbor, searching for a [Northwest Passage](#) to China. The Native Americans already living here used the [estuary](#) and its [tributaries](#) as a source of food and for travel, trade, and communication, as did the settlers who followed in the *Half Moon's* wake. As New York City and the communities of New Jersey grew, the harbor's docks served as an economic engine and a gateway for successive generations of immigrants. Geographically, the city's position at the juncture of [commerce](#) both overseas and inland to the nation's interior via the Hudson River and Mohawk Valley was advantageous. The opening of the Erie Canal in 1824 vaulted the city to its leading role as a world center of finance, trade and industry. New York City's importance as a manufacturing hub reinforced the volume of trade here. Today, the port annually generates about \$20 billion of economic activity for the region. New York Harbor, with its open vistas and strategic setting, also played an important role in national defense and military history.

Harbor Literacy Tips

- ◆ Read books on the history of the harbor.
- ◆ Visit historical sites with your parents.



Harbor Literacy Points

for the Public





1 What is a watershed?

How are we connected to the watershed?

How are activities on land and water interconnected?

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Harbor Literacy Tips

- ◆ Use biological controls instead of lawn fertilizers, herbicides or pesticides as much as possible.
- ◆ Dispose of household chemicals appropriately—not down a storm drain.
- ◆ Always pick up pet waste.





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What makes up a living estuary?

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Harbor Literacy Tips

- Follow fishing regulations (season, size, catch limit) and health advisories.
- Reduce pollution throughout the Harbor by properly disposing litter, used motor oil, grease, and other garbage.





3

How does our estuary function?

What makes an estuary different from other bodies of water (i.e. rivers, lakes)?
How is the estuary vulnerable to ecosystem changes and human activity?

The New York/New Jersey Harbor is an [estuary](#) in which salty seawater pushing in from the Atlantic Ocean is diluted by fresh water, primarily from the [watershed](#) of the Hudson River. Ocean [tides](#) influence the harbor: it typically experiences two high tides and two low tides each day. With its open connection to the ocean, the harbor is also impacted by storm surges associated with coastal storms and rising sea levels caused by climate change. The Hudson and other rivers entering the harbor carry [sediments](#) that settle here, forming [habitat](#) for living things but also creating the need for [dredging](#) to maintain shipping [channels](#) and [berths](#). The harbor consists of 770 miles of waterfront and about 240 miles of shipping channels, as well as anchorages and port facilities, centered on Upper New York Bay. The harbor's main entrance from the Atlantic Ocean lies to the southeast, between Rockaway Point and Sandy Hook; there is another entrance via Long Island Sound and the East River to the northeast.

Harbor Literacy Tips

- Find out times of high and low tide when planning visits to the NY Harbor for fishing, boating, or other waterfront activities.
- Check out the [real-time reports and forecasts](#) on the estuary's vital signs, available on the internet.





4

How do we impact water quality in the estuary?

How clean is the NY/NJ estuary?

How can we help improve water quality in the estuary?

Once badly polluted by human sewage and industrial waste, the NY/NJ Harbor is healthier now. The Clean Water Act, requiring sewage treatment and the regulation of other waste discharges, has greatly improved [water quality](#) throughout the harbor. The federal Superfund program and similar state initiatives address the legacy of toxic contamination from past discharges. [Combined sewer overflows](#) (CSOs) and [stormwater runoff](#) still have significant adverse impacts on the harbor's water quality. Citizens and agencies alike are working to improve water quality by upgrading [wastewater](#) treatment facilities, installing [green infrastructure](#), improving existing wetlands, and installing other stormwater controls. All of these efforts help reduce the water entering the sewer system during storm events. Green infrastructure projects include bioswales, rain barrels, green roofs, and blue roofs.

Harbor Literacy Tips

- ◆ Install stormwater controls (rain barrels, rain gardens, green roofs, etc.)
- ◆ Reduce water waste (wash dishes & clothes in full washers, take shorter showers, etc.)
- ◆ Dispose of unused medicines and other potential pollutants properly—never down the drain.





5

What is the History of the NY/NJ Harbor?

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Harbor Literacy Tips

- ◆ Enjoy the harbor's sights from a ferry or in a kayak or rowing boat.
- ◆ Visit some of the many significant historic sites, science centers, and museums that offer insights into the harbor's natural and human history.



Glossary

A - C

Anadromous

Anadromous fish spawn in fresh water and live in seawater, such as the Atlantic sturgeon, American shad, striped bass, and blueback herring.

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Berth

A ship's allotted place at a wharf or dock.

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Brackish

Salty seawater that pushes upriver, and is diluted by freshwater.

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Channel

An open conduit, created either naturally or artificially, which periodically or continuously contains moving water or forms a connecting link between two bodies of water.

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Combined sewer overflow (CSO)

Discharge into public waterways from a combined sewer system (CSS) that is caused by snowmelt or stormwater runoff.

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Combined sewer system (CSS)

Sewer systems that are designed to collect stormwater runoff, domestic sewage, and industrial wastewater in the same pipe and transport it to wastewater treatment plants.

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Commerce

The activity of buying and selling, especially on a large scale.

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D - M

Dredging

The removal of sediment from a channel to produce sufficient depths for navigation.

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Ecosystem

A biological community of interacting organisms and their physical environment.

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Estuary

A body of water in which fresh water and salty seawater meet.

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Green infrastructure

Unlike single-purpose gray stormwater infrastructure, which uses pipes to dispose of rainwater, green infrastructure uses vegetation and soil to manage rainwater where it falls. Green infrastructure projects include bioswales, rain barrels, green roofs, and blue roofs.

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Habitat

An area with a combination of resources (food, cover, water) and environmental conditions (temperature, precipitation, presence or absence of predators and competitors) that promotes occupancy by a given species and allows them to survive and reproduce.

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Hydrologic cycle

The cyclic transfer of water vapor from the Earth's surface via evapotranspiration into the atmosphere, from the atmosphere via precipitation back to earth, and through runoff into streams, rivers, and lakes, and ultimately into the oceans.

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Migratory

A species that travels from one place to another at regular times often over long distances.

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Glossary

N - Se

Non-point source pollution

Indirect or scattered sources of pollution that enter a water system such as drainage or runoff from agricultural fields, airborne pollution from cropdusting, runoff from urban areas (construction sites, etc.).

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Northwest Passage

Historical sea passage of the North American continent, representing centuries of effort to find a route from the Atlantic Ocean to the Pacific Ocean through the Canadian Arctic Archipelago.

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Nursery

A place or natural habitat which breeds or supports animals.

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Point source pollution

Water pollution coming from a single point, such as a sewage-outflow pipe.

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Salinity

A measure of the concentration of dissolved salts in water.

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Sediments

Soil, sand, and minerals washed by rain from land into water that accumulates on the bottom of ditches, streams, rivers and lakes.

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Glossary

St - Z

Stormwater runoff

Water generated from precipitation that flows over land or other impervious surfaces instead of percolating into the ground.

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Tides

The periodic variations in the surface water level of the oceans, bays, gulfs, and inlets that are the result of the gravitational attraction of the sun and the moon on the earth.

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Tributary

A smaller river or stream that flows into a larger river or stream; smaller tributaries often merge to form rivers.

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Wastewater

Water that has been used in homes, industries, and businesses that is not for reuse unless it is treated.

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Water quality

The chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose such as fishing, swimming, or drinking.

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Watershed

An area of land that drains into a particular body of water.

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Bibliography & Further Readings

[Bronx River Forest Tree Identification Guide](#)

Bronx River Alliance

A guide to identifying tree species that grow along the Bronx River is available on the Bronx River Alliance website.

[Bronx River Educator Guide](#)

Bronx River Alliance

The Bronx River Alliance has published this guide in response to the needs of teachers and non-formal educators who want to use the river as a living laboratory.

[Lloyd Ultan's History of the Bronx River](#)

Bronx River Alliance

A history of the Bronx River as told by Bronx Borough Historian, Dr. Lloyd Ultan, is available on the Bronx River Alliance website.

[Clearwater Teacher Resources](#)

Hudson River Sloop Clearwater

Offers lesson plans and resources on the Hudson River to help you prepare and plan for your upcoming Clearwater program.

[Clearwater's Education Program Book](#)

Hudson River Sloop Clearwater

Clearwater's Education Program Book contains a comprehensive overview of educational programs.

[Discover the Hudson River](#)

New York Department of Environmental Conservation

This booklet provides information about the Hudson's watershed, the variety of wildlife the river supports, and the many ways people influence and are influenced by the river. It includes text, maps, games, and activities for kids.

[East River Estuary Guide](#)

East River C.R.E.W.

The East River Estuary Guide is an index of organisms found in the East River published by East River C.R.E.W. with support by Partnerships for Parks.

[How to Build a Model Watershed](#)

Izaak Walton Leage of America

IWLA offers many How To resources, including a model watershed guide for students. The model demonstrates how water picks up sediment and pollutants as it flows, and shows that simple measures can reduce the amount of polluted runoff that ends up in a watershed.

[Hudson River Park Trust Teacher Resources](#)

Hudson River Park Trust

Resources to prepare for or to reinforce lessons learned during your program at Hudson River Park.

Bibliography & Further Readings

[Jamaica Bay Education Resource Directory](#)

New York City Department of Environmental Protection

A teacher's guide to education opportunities in the Jamaica Bay watershed, including organizations, environmental programs, and topics.

[Mannahatta: A Natural History of New York City](#)

Eric W. Sanderson

Authored by Eric W. Sanderson and illustrated by Markley Boyer, this book examines volumes of historic documents and analyzes scientific data to re-create the forests of Times Square, the meadows of Harlem, and the wetlands of downtown.

[NYC DEP Environmental Education](#)

New York City Department of Environmental Protection

NYC DEP Office of Education provides K-12 students and teachers with a wide range of free programs about the City's water resources.

[New York City Water Saver's Workbook](#)

New York City Department of Environmental Protection

Learning activities for water conservation.

[Hands-On Activities for Students](#)

New York City Department of Environmental Protection

Simple hands-on, inquiry-based activities to help students learn about a variety of water and noise related topics.

[Hudson River Lesson Plans](#)

New York Department of Environmental Conservation

The Hudson River Estuary Program has created interdisciplinary lessons that use the river as context to build understandings and skills required by Common Core and New York State standards.

[Scenic Hudson Activity Guides](#)

Scenic Hudson

Explore the unique history surrounding Scenic Hudson's parks in Cold Spring.

[Scenic Hudson Nature Notes](#)

Scenic Hudson

Nature Notes help you learn more about the Hudson Valley's ecology and history.

Index: Learning Standards

The Index of Learning Standards shows how scientific and historical concepts relevant to our local waterways are associated with New York and New Jersey state learning standards. Educators can use this guide to incorporate Harbor Literacy Points material into their lesson plans.

1. What is a Watershed?

NYS Math, Science, & Technology Learning Standards	Standard 4	Science Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.
	Key Idea 7.	Human decisions and activities have had a profound impact on the physical and living environments.
	2b	Demonstrates understanding of life cycles of organisms.
	4a	Demonstrates understanding of big ideas and unifying concepts.
	4b	Demonstrates understanding of the designed world.
	5a	Asks questions about natural phenomena; objects and organisms; and events and discoveries.
	7a	Represents data and results in multiple ways.
	7b	Uses facts to support conclusions.
NJ Core Curriculum Content Standards for Science	Standard 5.3	Life Science
	Strand A.	Organization and Development
	CPI # 5.3.2.A.1	Living organisms
	Strand C.	Interdependence
	CPI # 5.3.2.C.3	Humans can change natural habitats in ways that can be helpful or harmful for the plants and animals that live there.
	CPI # 5.3.4.C.1	Organisms can only survive in environments in which their needs are met. Within ecosystems, organisms interact with and are dependent on their physical and living environment.
	CPI # 5.3.4.C.2	Some changes in ecosystems occur slowly, while others occur rapidly. Changes can affect life forms, including humans.
	CPI # 5.3.6.C.1	Various human activities have changed the capacity of the environment to support some life forms.
	CPI # 5.3.12.C.2	Stability in an ecosystem can be disrupted by natural or human interactions.
	Standard 5.4	Earth Systems Science
	Strand G.	Biogeochemical Cycles
CPI # 5.4.4.G.3	Most of Earth's surface is covered by water. Water circulates through the crust, oceans, and atmosphere in what is known as the water cycle.	
CPI # 5.4.4.G.4	Properties of water depend on where the water is located (oceans, rivers, lakes, underground sources, and glaciers).	

CPI = Cumulative Progress Indicator

Index: Learning Standards

CPI # 5.4.6.G.2	An ecosystem includes all of the plant and animal populations and nonliving resources in a given area. Organisms interact with each other and with other components of an ecosystem.
CPI # 5.4.6.G.3	Personal activities impact the local and global environment.
CPI # 5.4.12.G.1	Natural and human-made chemicals circulate with water in the hydrologic cycle.
CPI # 5.4.12.G.4	Natural and human activities impact the cycling of matter and the flow of energy through ecosystems.
CPI # 5.4.12.G.5	Human activities have changed Earth's land, oceans, and atmosphere, as well as its populations of plant and animal species.

NJ Core Curriculum Content Standards for Social Studies

Standard 6.1	U.S. History: America in the World
Strand B.	Geography, People and the Environment
CPI # 6.1.4.B.1	Compare and contrast information that can be found on different types of maps, and determine when the information may be useful.
CPI # 6.1.4.B.5	Describe how human interaction impacts the environment in New Jersey and the United States.
CPI # 6.1.4.B.8	Compare ways people choose to use and divide natural resources.
CPI # 6.1.4.B.9	Relate advances in science and technology to environmental concerns and to actions taken to address them

2. What is an Estuary?

NYS Living Environment Learning Standards

Key Idea 6	Plants and animals depend on each other and their physical environment.
6.1a	Energy flows through ecosystems in one direction, typically from the Sun, through photosynthetic organisms including green plants and algae, to herbivores to carnivores and decomposers.
6.1d	The number of organisms any habitat can support (carrying capacity) is limited by the available energy, water, oxygen, and minerals, and by the ability of ecosystems to recycle the residue of dead organisms through the activities of bacteria and fungi.
6.1f	Living organisms have the capacity to produce populations of unlimited size, but environments and resources are finite. This has profound effects on the interactions among organisms.
6.2a	As a result of evolutionary processes, there is a diversity of organisms and roles in ecosystems. This diversity of species increases the chance that at least some will survive in the face of large environmental changes. Biodiversity increases the stability of the ecosystem.

Index: Learning Standards

6.3c A stable ecosystem can be altered, either rapidly or slowly, through the activities of organisms (including humans), or through climatic changes or natural disasters. The altered ecosystem can usually recover through gradual changes back to a point of long-term stability.

NJ Core Curriculum
Content Standards for
Science

Standard 5.3	Life Science
Strand A.	Organization and Development
CPI # 5.3.2.A.1	Living organisms: Exchange nutrients and water with the environment. Reproduce. Grow and develop in a predictable manner.
Strand C.	Interdependence
CPI # 5.3.2.C.2	A habitat supports the growth of many different plants and animals by meeting their basic needs of food, water, and shelter.
CPI # 5.3.2.C.3	Humans can change natural habitats in ways that can be helpful or harmful for the plants and animals that live there.
CPI # 5.3.4.C.1	Organisms can only survive in environments in which their needs are met. Within ecosystems, organisms interact with and are dependent on their physical and living environment.
CPI # 5.3.4.C.2	Some changes in ecosystems occur slowly, while others occur rapidly. Changes can affect life forms, including humans.
CPI # 5.3.6.C.1	Various human activities have changed the capacity of the environment to support some life forms.
CPI # 5.3.6.C.2	The number of organisms and populations an ecosystem can support depends on the biotic resources available and on abiotic factors, such as quantities of light and water, range of temperatures, and soil composition.
CPI # 5.3.12.C.1	Biological communities in ecosystems are based on stable interrelationships and interdependence of organisms.
CPI # 5.3.12.C.2	Stability in an ecosystem can be disrupted by natural or human interactions.
Strand E.	Evolution and Diversity
CPI # 5.3.2.E.2	Plants and animals have features that help them survive in different environments.
Strand G.	Biogeochemical Cycles
CPI # 5.4.6.G.2	An ecosystem includes all of the plant and animal populations and nonliving resources in a given area. Organisms interact with each other and with other components of an ecosystem.

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3. How does our estuary function?

NYS Math, Science, & Technology Learning Standards	Standard 2	Information Systems Students will access, generate, process, and transfer information using appropriate technologies.
	Key Idea 1	Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.
	Standard 4	Science Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.
	Key Idea 1	The Earth and celestial phenomena can be described by principles of relative motion and perspective.
	Key Idea 2	Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.
	Key Idea 3	Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.
	Key Idea 4	Energy exists in many forms, and when these forms change energy is conserved.
	Key Idea 5	Energy and matter interact through forces that result in changes in motion.
NJ Core Curriculum Content Standards for Science	Standard 5.1	Science Practices
	Strand B. CPI # 5.1.4.B.2	Generate Scientific Evidence through Active Investigations Tools and technology are used to gather, analyze, and communicate results.
	Standard 5.4	Earth Systems Science
	Strand A. CPI # 5.4.8.A.1	Objects in the Universe The relative positions and motions of the Sun, Earth, and Moon result in the phases of the Moon, eclipses, and the daily and monthly cycle of tides.
	Strand B. CPI # 5.4.6.B.3	History of the Earth Moving water, wind, and ice continually shape Earth's surface by eroding rock and soil in some areas and depositing them in other areas.
	Strand D. CPI # 5.4.6.D.2	Tectonics Earth's landforms are created through constructive (deposition) and destructive (erosion) processes.
	Strand F.	Climate and Weather

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CPI # 5.4.8.F.2	Climate is influenced locally and globally by atmospheric interactions with land masses and bodies of water.
Strand G.	Biogeochemical Cycles
CPI # 5.4.4.G.4	Properties of water depend on where the water is located (oceans, rivers, lakes, underground sources, and glaciers).
CPI # 5.4.6.G.2	An ecosystem includes all of the plant and animal populations and nonliving resources in a given area. Organisms interact with each other and with other components of an ecosystem.
CPI # 5.4.6.G.1	Circulation of water in marine environments is dependent on factors such as the composition of water masses and energy from the Sun or wind.
CPI # 5.4.8.A.1	The relative positions and motions of the Sun, Earth, and Moon result in the phases of the Moon, eclipses, and the daily and monthly cycle of tides.

4. How do we impact water quality in the estuary?

NYS Math, Science, &
Technology Learning
Standards

Standard 2	Information Systems Students will access, generate, process, and transfer information using appropriate technologies.
2a	Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.
Standard 4	Science Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.
4b	Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.
4c	Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity. environment.
4k	Plants and animals depend on each other and their physical environment.
4l	Human decisions and activities have a profound impact on the physical and living

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NJ Core Curriculum Content Standards for Science	Standard 5.3	Life Science
	Strand C.	Interdependence
	CPI # 5.3.2.C.3	Humans can change natural habitats in ways that can be helpful or harmful for the plants and animals that live there.
	CPI # 5.3.6.C.1	Various human activities have changed the capacity of the environment to support some life forms.
	CPI # 5.3.12.C.2	Stability in an ecosystem can be disrupted by natural or human interactions.
	Standard 5.4	Earth Systems Science
	Strand G.	Biogeochemical Cycles
	CPI# 5.4.6.G.3	Personal activities impact the local and global environment.
	CPI# 5.4.8.G.2	Investigations of environmental issues address underlying scientific causes and may inform possible solutions.
	CPI # 5.4.12.G.1	Natural and human-made chemicals circulate with water in the hydrologic cycle.
CPI # 5.4.12.G.6	Scientific, economic, and other data can assist in assessing environmental risks and benefits associated with societal activity.	
NJ Core Curriculum Content Standards Social Studies	Standard 6.1	U.S. History: America in the World
	Strand B.	Geography, People, and the Environment
	CPI # 6.1.4.B.5	Describe how human interaction impacts the environment in New Jersey and the United States.
	CPI # 6.1.4.B.9	Relate advances in science and technology to environmental concerns and to actions taken to address them.

5. What is the history of the NY/NJ Harbor?

NYS Living Environment Learning Standards		Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.
	Key Idea 7	Human decisions and activities have had a profound impact on the physical and living environments.
	7.1a	Demonstrates an understanding that humans depend upon their natural and constructed environments
	7.1b	Demonstrates an understanding that over time, humans have changed their environment by using energy, manufacturing goods, developing means of transportation, changing populations, and carrying out other activities.

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	7.1c	Demonstrates an understanding that humans, as individuals or communities, change environments in ways that can be either helpful or harmful for themselves and other organisms.
NJ Core Curriculum Content Standards for Social Studies	Standard 6.1	U.S. History: America in the World
	Strand B.	Geography, People and the Environment
	CPI # 6.1.4.B.4	Describe how landforms, climate, weather, and availability of resources have impacted where and how people live and work in different regions in New Jersey and the United States.
	CPI # 6.1.4.B.5	Describe how human interaction impacts the environment in New Jersey and the United States
	CPI # 6.1.4.B.7	Explain why some locations in New Jersey and the United States are more suited for development than others.
	CPI # 6.1.4.B.9	Relate advances in science and technology to environmental concerns and to actions taken to address them.
	Content Statement 1:	Three Worlds Meet
	CPI # 6.1.8.B.1.b	Analyze the world in spatial terms, using historical maps to determine what led to the exploration of new water and land routes.
	CPI# 6.1.8.C.1.b	Explain why individuals and societies trade, how trade functions, and the role of trade during this period.
	Content Statement 4:	Expansion and Reform
CPI # 6.1.8.C.4.b	Explain how major technological developments revolutionized land and water transportation, as well as economy, in New Jersey and the nation.	

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