

DIVISION III
Esprit de Corps Flower Show
July 2016

Conservation Exhibit
Exposition de preservation

From Rainwater to Rain Gardens

When it rains, water runoff picks up chemicals from lawns, roadways and hard surfaces carrying contaminants into ground water and waterways. This exhibit demonstrates how Rain Gardens filter pollutants to help improve water quality.



PHOTO BY DAVID HYMEL, RAIN DOG DESIGNS

DO YOU KNOW...

WE LIVE ON TOP OF OUR DRINKING WATER?

Long Island's drinking water comes from underground aquifers – layers of sand, gravel, and water formed by retreating glaciers at the ends of the ice ages.

Our aquifers are replenished by rainwater and snow melt which migrate through the layers of soil, sand, and clay beneath the surface, carrying pollutants along with them.

Our aquifers are our only source of clean, fresh drinking water, so we must do everything we can to protect them for our children and future generations of Long Islanders.

Source: LIWater.org

STORMWATER RUNOFF



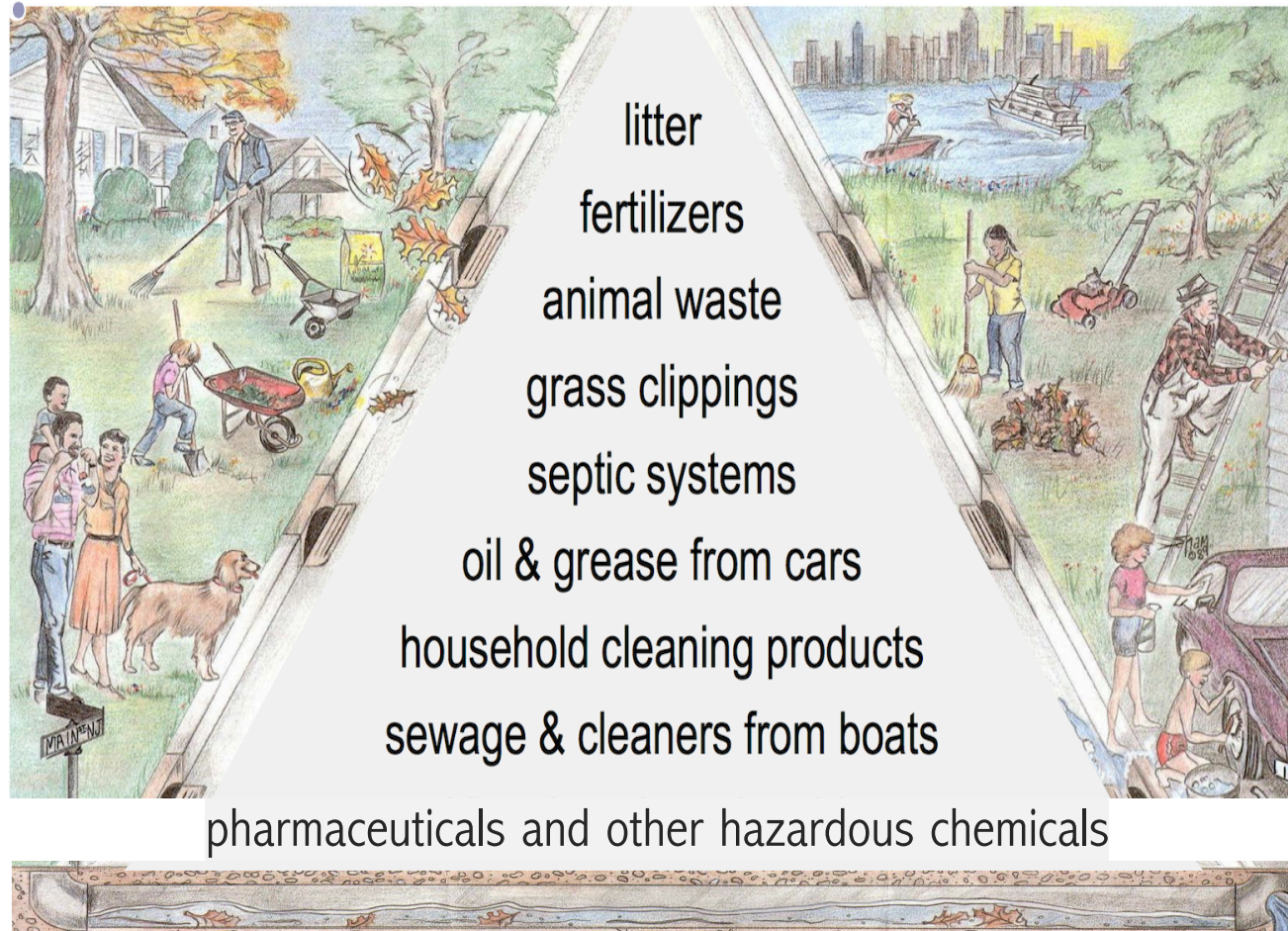


Source: & Photos: Peconic Estuary Program

STORMWATER RUNOFF & POLLUTION

- Stormwater Runoff – Rainfall and snowmelt that flows over hard surfaces like rooftops, roadways, parking lots, driveways, and other paved surfaces that do not allow water to soak into the ground.
- Pollution - Caused by the daily activities of people.
 - Runoff picks up pollutants on the way to our aquifers, ponds, and coastal waters.
- Long Island's Peconic Watershed – 90% of our water is unfiltered and untreated making it particularly sensitive to pollutants in storm water runoff.

WATER POLLUTION SOURCES



These pollutants build up on the land and wash off with stormwater runoff

CLEAN WATER?

Suffolk County's Surface Waters

- The U.S. Environmental Protection Agency considers stormwater pollution the nation's greatest threat to clean water.
- In Suffolk County, DEC currently lists 57 water bodies as impaired by stormwater pollution.
- Suffolk County Health Department projects the closing of 47 beaches and ponds due to stormwater pollution.
- Shell Fishing Bed Closures:
5,222 acres are closed in Peconic Bay.
About 1/3 of Great South Bay is closed to shell fishing.

Source: Suffolk County Stormwater Management

PROTECT OUR WATER



WHAT IS A RAIN GARDEN?

Rain gardens are attractive, affordable, functional landscaped areas designed to capture and filter stormwater before it runs off into storm drains.

They collect water in natural or constructed shallow vegetated depressions and allow it to soak into the ground slowly.

This reduces the potential for erosion and minimizes the amount of pollutants flowing into a storm drain, and ultimately into our waterways.

Rain gardens may also be used as a buffer in shoreline areas to capture runoff before it enters stream, pond, or estuary.

Rain gardens use the concept of bio-retention, a water quality practice in which plants and soils filter pollutants from stormwater.

By reducing stormwater runoff, rain gardens can be a valuable tool to help protect our water resources.

While an individual rain garden may seem like a small thing, collectively they produce substantial environmental benefits for the community.

By capturing runoff in shallow depressions and letting it soak into the ground, rainwater gardens also help recharge stores of groundwater in our aquifers.

Moreover, they filter out sediments and other pollutants by catching the first inch of runoff, which contains the highest concentration of pollutants.

Rain gardens transform stormwater from a destructive carrier of pollution into a source of sustenance for plant and wildlife habitats. The plants thrive on the nitrogen and phosphorous that is picked up, while their roots and stems trap sediment.

Source: Center for Agriculture, Food, and the Environment

RAIN GARDENS . . .

- Improve water quality by reducing and filtering runoff.
- The most polluted runoff occurs in the beginning of a rain shower as water rushes over hard surfaces.
- This water is the first to pick up sediments and pollutants.
- Rain gardens catch the water before entering the storm drainage system.
- Sediments and pollutants settle out of the water and are absorbed by plant roots or treated through chemical processes in the soil, which reduces water pollution.

CAPTURE

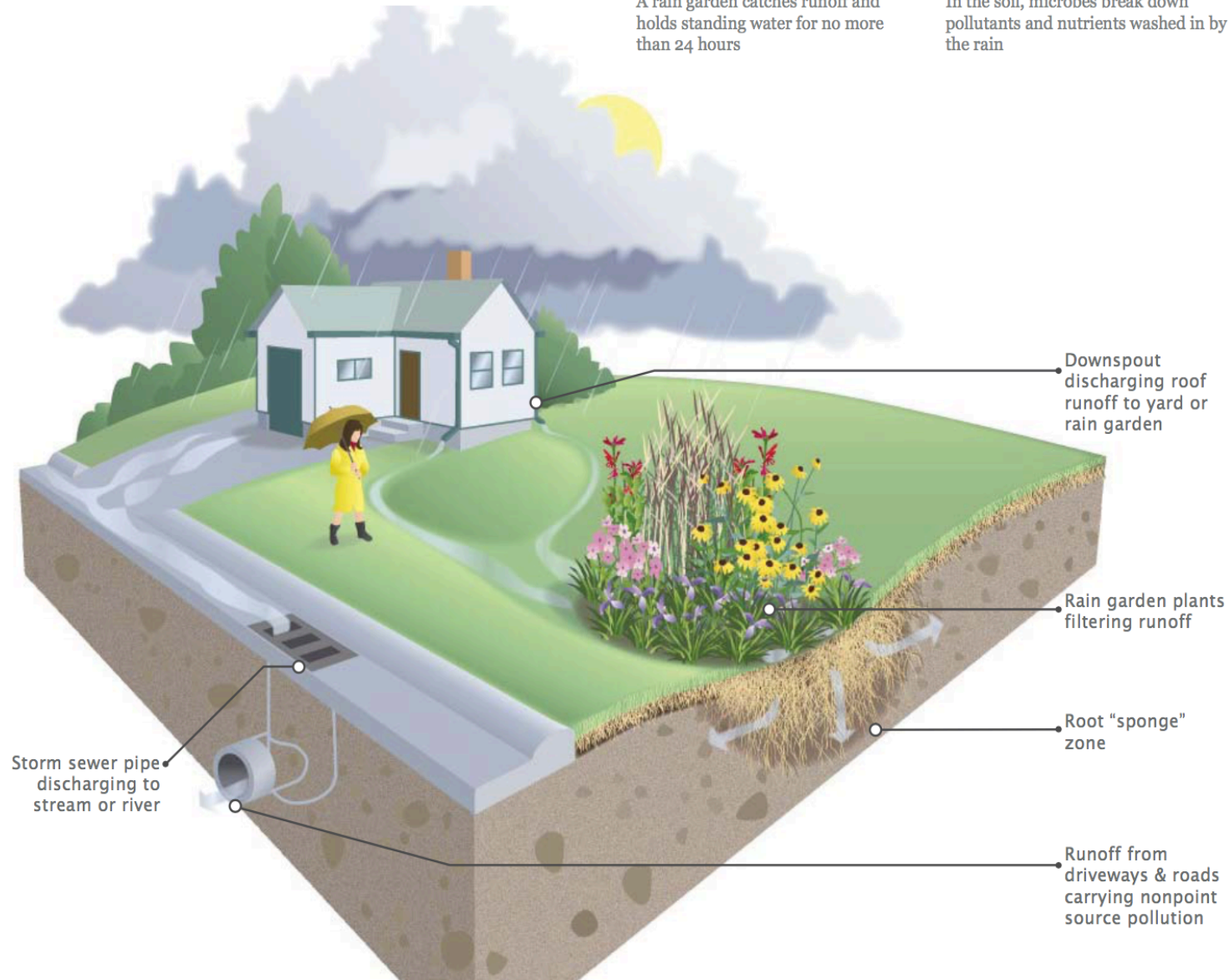
A rain garden catches runoff and holds standing water for no more than 24 hours

FILTER

In the soil, microbes break down pollutants and nutrients washed in by the rain

INFILTRATE

Deep-rooted plants loosen the soil, creating a sponge zone. Water soaks in and groundwater aquifers are recharged



Source: Rutgers – Image: Courtesy of the City of Maplewood, MN

HOW DO RAIN GARDENS REMOVE POLLUTANTS?

Rain gardens use chemical, biological, and physical properties of soils, plants, and microbes to remove pollutants from stormwater through four processes:

- **Settling**
- **Chemical reactions in the soil**
- **Plant uptake**
- **Biological degradation in root zones**

SETTLING:

When runoff enters a rain garden, the water slows down because of the physical depression of the garden and the vegetation in it. The soil and debris that are then deposited cause settling.

The vegetation also traps some of the pollutants attached to the sediment in a process known as filtration. The main pollutants trapped in rain gardens are debris, some microbes, other solids suspended in the water, and soil-particle-bound pollutants such as phosphorus. Because sediments tend to settle on top of the rain garden and clog it, the garden must be maintained regularly to help remove sediments efficiently.

CHEMICAL REACTIONS IN THE SOIL:

The soil in rain gardens interacts with pollutants via two main processes: adsorption and volatilization.

... Adsorption occurs when the pollutants stick to soil particles.

... Volatilization occurs when the pollutants evaporate.

PLANT UPTAKE:

Plants take up nutrients through their roots and use the nutrients for growth and other processes. Plants can be selected for high nutrient uptake.

When the plants die, those nutrients may be released back into the rain garden. To prevent this release, remove the dead plants regularly.

BIOLOGICAL DEGRADATION IN ROOT ZONES:

Microbes in the soil break down organic and inorganic compounds, including oil and grease, and help eliminate disease causing microorganisms, or pathogens. Two microbial processes that remove nitrogen from the soil are nitrification and denitrification:

In nitrification, bacteria convert nitrogen products that are not readily taken in by plants, such as ammonia and ammonium nitrates, into nitrate, which is soluble in water and easily absorbed by the root system.

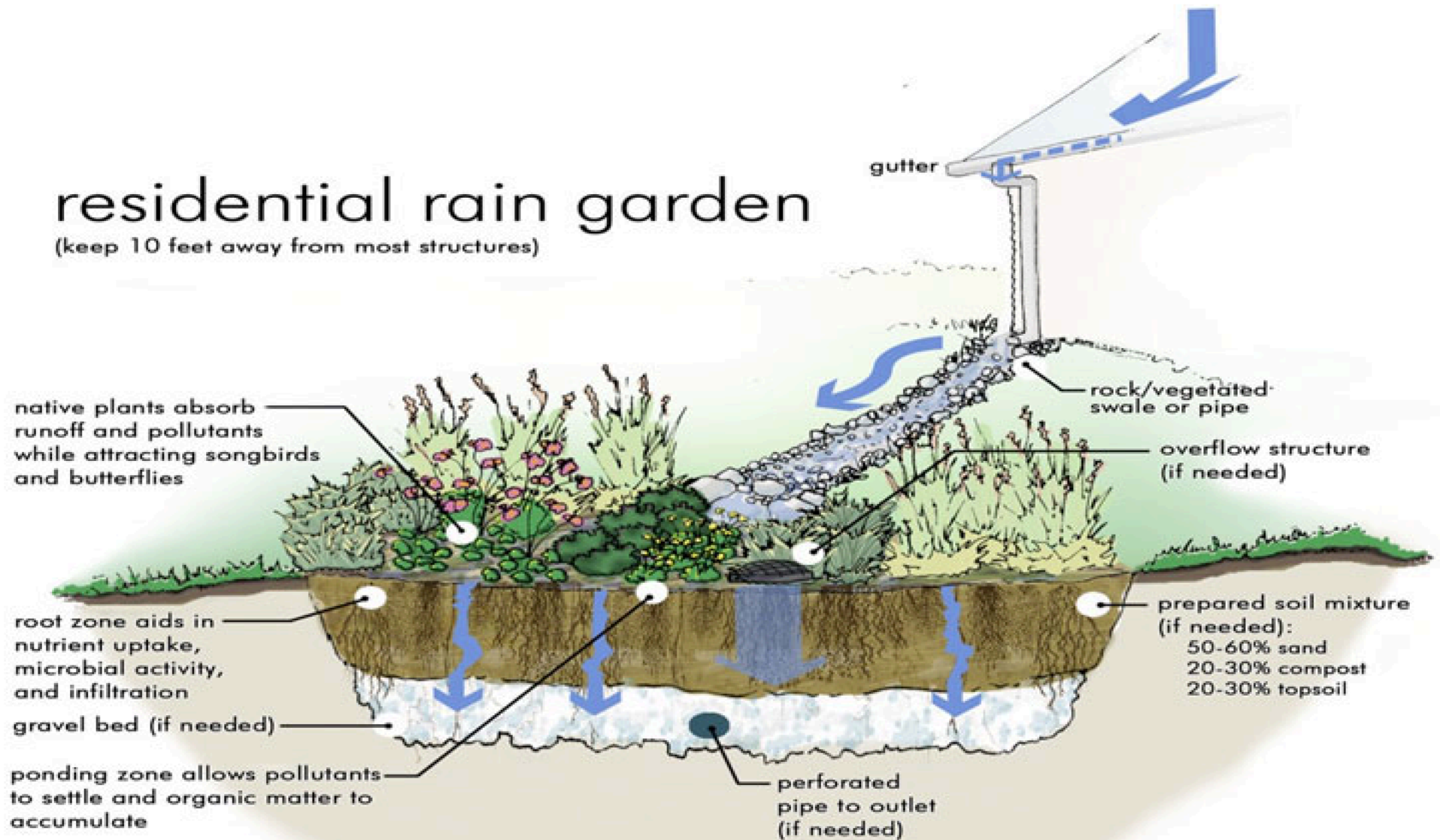
Denitrification occurs when bacteria convert nitrate into gases that are released into the atmosphere.

Source: TEXAS A & M Extension

CROSS SECTION OF A TYPICAL RAIN GARDEN

residential rain garden

(keep 10 feet away from most structures)



WHERE DO THE POLLUTANTS GO?

Volatilization: Pollutants, particularly some of those associated with petroleum or oil and grease, evaporate.

Sedimentation: In the case of standing water, heavier particles settle into the soil below.

Adsorption: Certain dissolved pollutants stick to particles floating in storm-water or settle into the soil.

Absorption: Storm-water and pollutants soak deeper into the soil. Pollutants accumulate in the soil, percolate through it with the water, or dissipate through microbial action, adsorption, or volatilization.

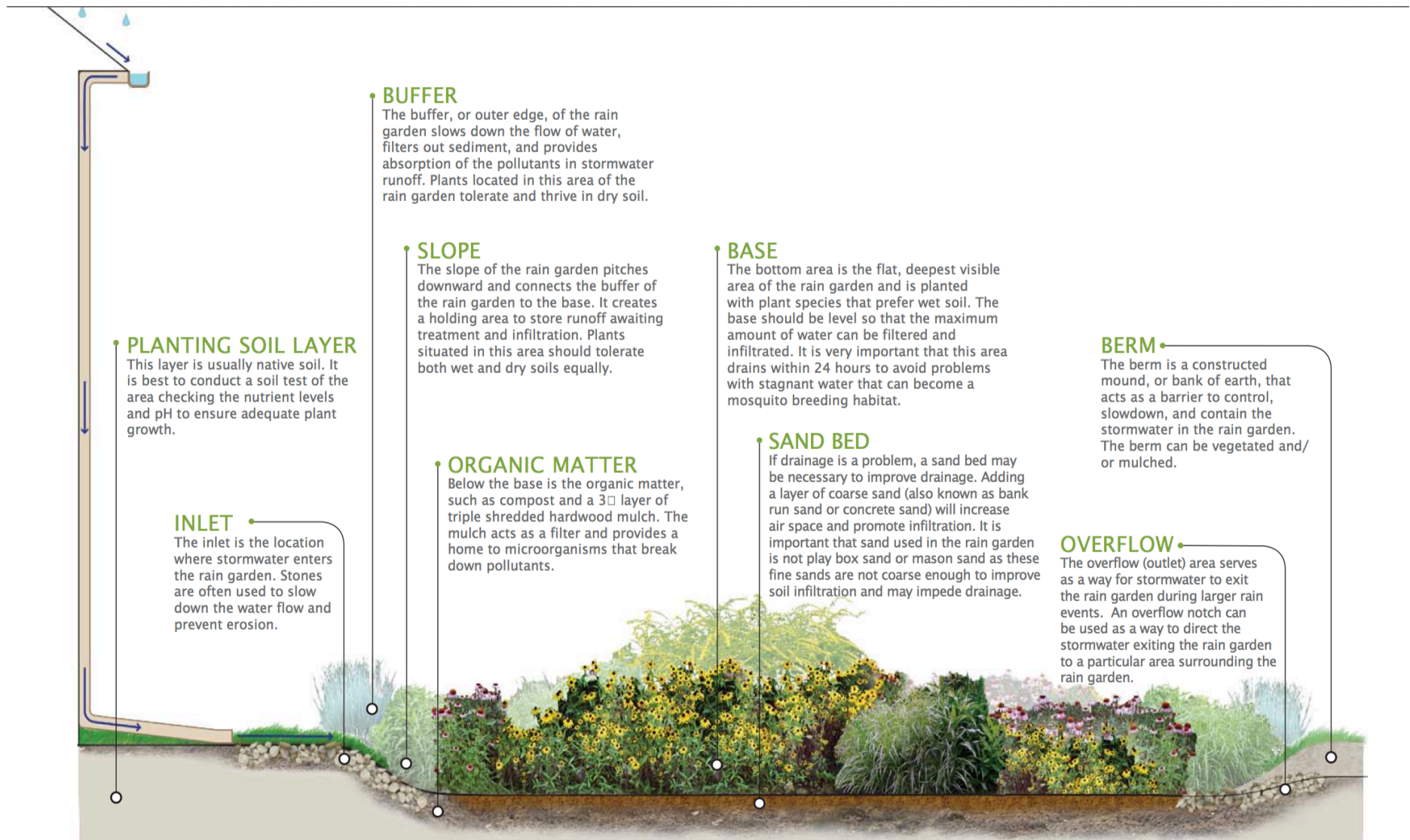
Microbial Action: Bacteria and other microorganisms break down pollutants in the water or soil, into forms that are less environmentally harmful.

Plant Resistance and Uptake: Decaying plant material increases adsorption and provides a good habitat for microbes that gobble pollution. Plants also suck up pollutants from the soil through their roots.

Footnote: **Absorption** is the process in which a fluid is **dissolved** by a liquid or a solid (absorbent).

Adsorption is the process in which atoms, ions, or molecules from a substance **adhere** to a surface.

ANATOMY OF A RAIN GARDEN



Source: Rutgers Rain Garden Manual of New Jersey

BENEFITS OF A RAIN GARDEN

Improve Water Quality

Filter Runoff Pollution

Recharge Local Groundwater Supplies

Protect Our Ponds, Bays, and Oceans

Improve Environment for Fish and other Marine Life

Help Solve Common Drainage Problems and Flooding

Remove Standing Water in your Yard

Reduce Mosquito Breeding

Increase Beneficial Insects that Eliminate Pest Insects

Create Habitat for Birds, Butterflies, and other Pollinators

Enhance Sidewalk Appeal

USE PERMEABLE SURFACES

Surfaces that Allow Water to Seep into the Ground

SURFACES TO AVOID

Impermeable Surfaces

Asphalt
Concrete
Traditional Stone, Brick or
Concrete Pavers

BEST SURFACES TO USE

Permeable Surfaces

Planting Beds
Mulched Beds
Gravel
Permeable Pavers
Turf



DRIVEWAY OF PERMEABLE PAVERS

Source & Photo: Grassroots Motorsports

SAY NO TO IMPERMEABLE SURFACES

Compared to a patch of conventional lawn, a rain garden reduces storm water run-off and allows about 30% more water to soak into the ground. Getting rid of impermeable surfaces will further increase the amount of water that soaks in.

Use porous materials that allow infiltration, such as, decorative pebbles, crushed stone, grass and low ground cover.

Where you need a firmer surface, use precast concrete pavers with wide gaps. They are designed specifically for storm water infiltration. Also, fill gaps between patio stones or pavers with sand or fine gravel instead of concrete.

WARNING

Members of the public should stay away from areas where this toxic bloom has occurred.



Photo Credit: Wikimedia Commons/Riverheadlocal.com

Areas closed in East Hampton are Georgica Pond and Wainscott Pond due to bloom of cyanobacteria (blue-green algae). Also closed, is Forge Pond and Peconic Lake area of the Peconic River, pictured above.

July 2016

"Health officials ask residents not to use, swim or wade in these waters and to keep their pets and children away from the area. Affected water can cause gastrointestinal illness and irritation of the eyes and upper respiratory tract."

Sources: Peconic Estuary Program and The East Hampton Star

WHAT SUFFOLK COUNTY IS DOING TO HELP SOLVE THE PROBLEM

- Upgrading and expanding storm water control methods on County roads and construction sites.
- Reducing and removing sources of storm water pollution from County owned roads, properties, and facilities.
- Identifying, mapping, and monitoring storm water discharges from County roads and properties.
- Providing education and outreach services to Suffolk County residents.

WHAT YOU CAN DO TO HELP SOLVE THE PROBLEM

- Create a Rain Garden in your yard.
- Pick-up pet waste.
- Properly maintain your septic system.
- Use permeable surfaces.
- Don't use chemicals on your lawns.
- Don't flush medicines down your sink and toilets.

PLANT YOUR OWN RAIN GARDEN



Source: Rutgers – Rain Manual

PLANNING AND PLANTING YOUR RAIN GARDEN

Rain gardens don't need to be planted with water loving plants. Because they drain quickly (24-48 hours), the plants only have to be able to tolerate lots of water for short periods, but they also need to be able to withstand periods of drought.

Different areas of your garden can be planted with different kinds of plants. For example, the berm won't be receiving as much water as the low-lying middle, so native arid plants would do better there.

Remember to consider plant height, wildlife attraction, flowering, and sun/shade tolerance when choosing your plants.

Native plants are ideal for landscaping for many reasons.

They have adapted to our area's climate over time, they don't need chemicals to help them grow, can tolerate our high and low temperatures, have very deep roots for drought resistance, have defenses against harmful native insects, and serve as habitats for native wildlife.

The deep roots of native plants also makes them ideal for rain gardens because they create channels in the soil which allow water to soak in quickly.

COMPLETED PROJECT IN EAST HAMPTON

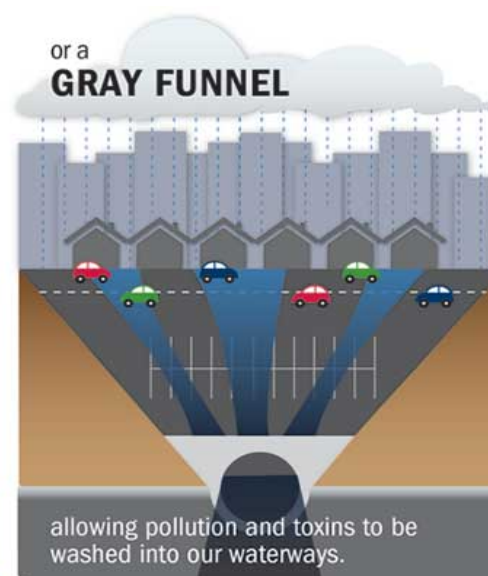
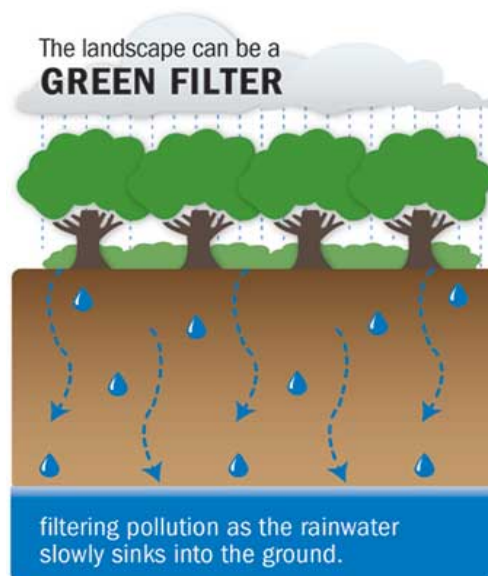
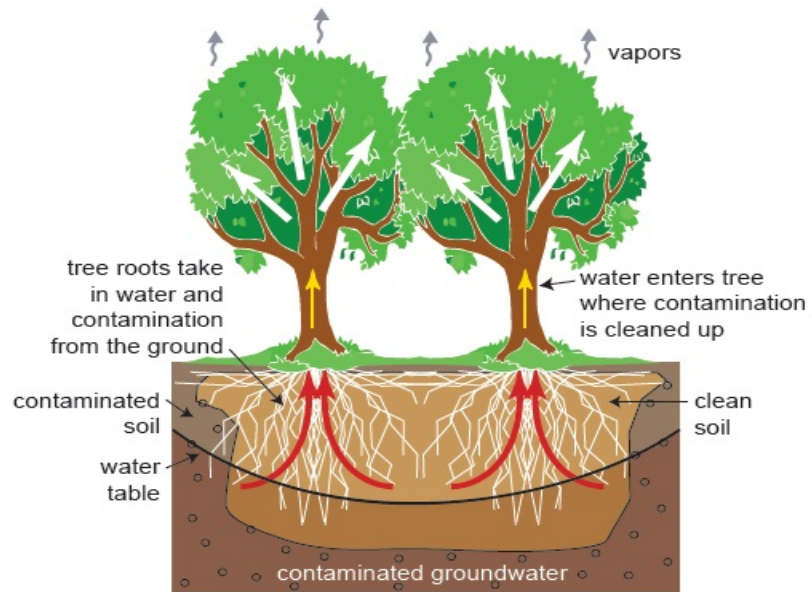


Source: Peconic Estuary Program

DESIGN AND CONSTRUCTION TIPS

Construction Activity and Materials Required to Build a Rain Garden

- Call utility companies to have all utilities located and marked before digging.
Utilities include electricity, gas, phone, water, and other lines.
- Excavation and Hauling of Existing Soil
- Importing New Soil
- Gravel/Sand
- Filter Fabric
- Mulch
- Plants



Rain Garden Plant Lists

PLANTS THAT ARE DEER TOLERANT/RESISTANT

Trees

Ash
Bayberry
Beech
Birch
Carolina allspice
Fetterbush
Great St John's wort
Honeylocust
Hornbeam
Leatherwood
Magnolia
Maple spp
Oak
Serviceberry
Shrubby St John's Wort
Sourgum
Spicebush
Summersweet
Sweetgum
Trumpet Honeysuckle
Viburnum spp
Witchhazel

Perennials

Aromatic Aster
Baneberry
Beardtongue

Black Cohosh
Black-eyed Susan
Blue False Indigo
Bluestar
Blue Vervain
Blue Wood Phlox
Blueflag Iris
Butterflyweed Milkweed
Creeping Phlox
Culver's-root
Dense Blazing Star
Flowering Spurge
Fringed Bleeding-heart
Giant Purple Hyssop
Goat's Beard
Goldenrod spp
Great Blue Lobelia
Jack-in-the-Pulpit
Jacob's Ladder
Mayapple
Monkey Flower
Monkshood
Mountainmint
New England Aster
Obedient Plant
Rose Coreopsis
Skunk-cabbage

Swamp Rose-mallow
Tickseed
Wild Bergamont
Wild Columbine
Wild Ginger
Wild Onion/Leek
Wood Geranium

Grasses

Big Bluestem
Switchgrass

Note: There is no such thing as a plant that is absolutely deer resistant – deer will eat anything if they are hungry enough! This list merely reflects the plants that deer tend to avoid.

Rain Garden Design Samples

DEER TOLERANT RAIN GARDEN

Base

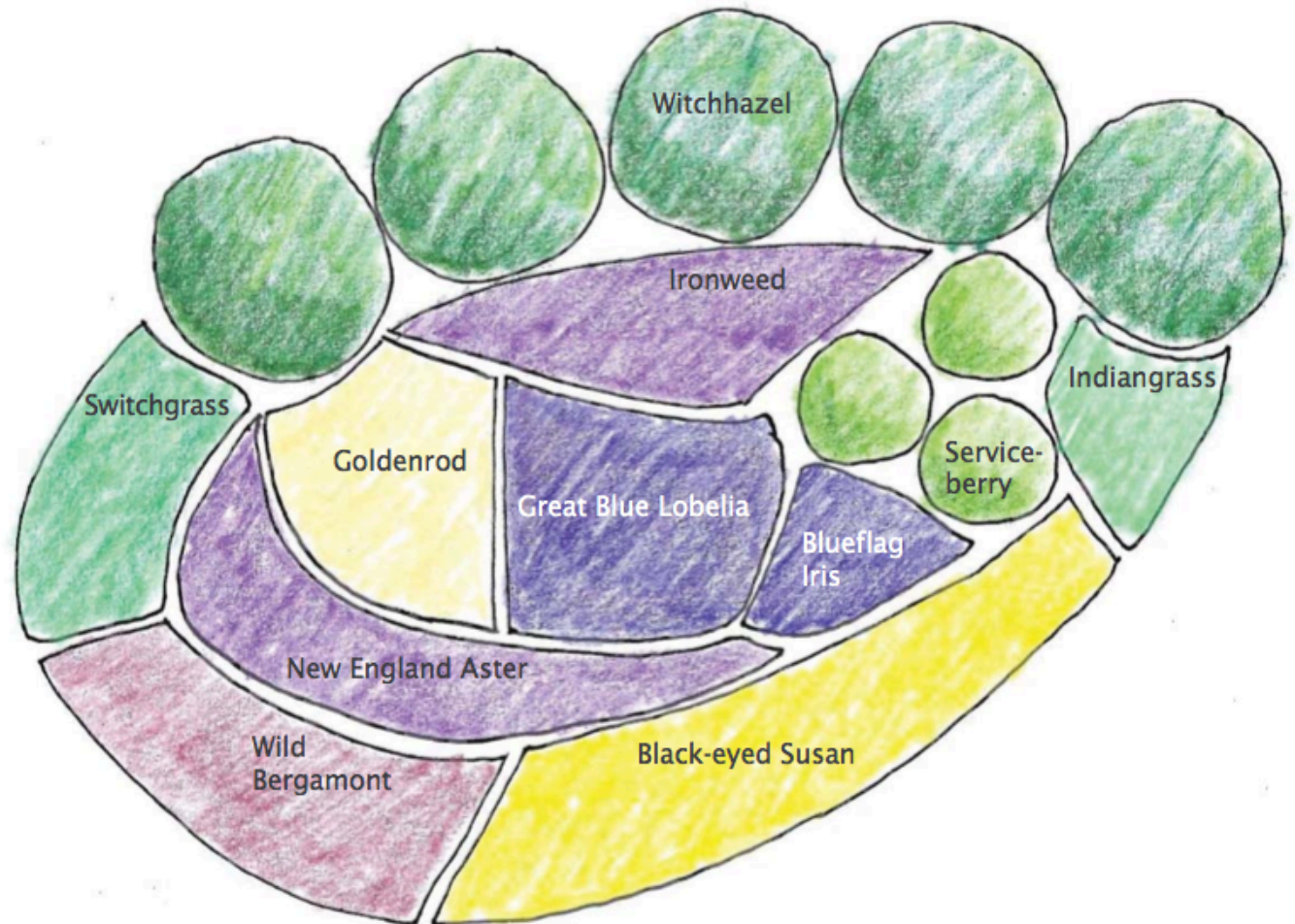
- Blueflag Iris
- Goldenrod
- Great Blue Lobelia

Slope

- Ironweed
- New England Aster
- Serviceberry

Buffer

- Black-eyed Susan
- Indiangrass
- Switchgrass
- Wild Bergamont
- Witchhazel



Rain Garden Plant Lists

PLANTS FOR WILDLIFE HABITAT

Trees

American Holly
Eastern Red Cedar
Hackberry
Serviceberry
Wild Cherry

Shrubs

Arrowwood Viburnum
Bayberry
Black Haw Viburnum
Redosier Dogwood
Spicebush
Winterberry

Perennials

Boneset
Heath Aster
Ironweed

Grasses

Big Bluestem
Indiangrass
Little Bluestem
Switchgrass

PLANTS DEER PREFER TO EAT (Use With Caution)

Trees

Balsam Fir
Cornelian Dogwood
Eastern Redbud
Fraser Fir
Hemlock
Rhododendron

Shrubs

Azalea

Perennials

Clematis	Lily (Lilium)
Cransbill geranium	Meadow rue
Crocus	Pansy
Daylily	Peony
Echinacea	Phlox
English Ivy	Sedum
Hollyhock	Sunflower
Hosta	Trillium
Impatiens	Wood Hyacinth

Rain Garden Design Samples

TREE + SHRUB RAIN GARDEN

Base

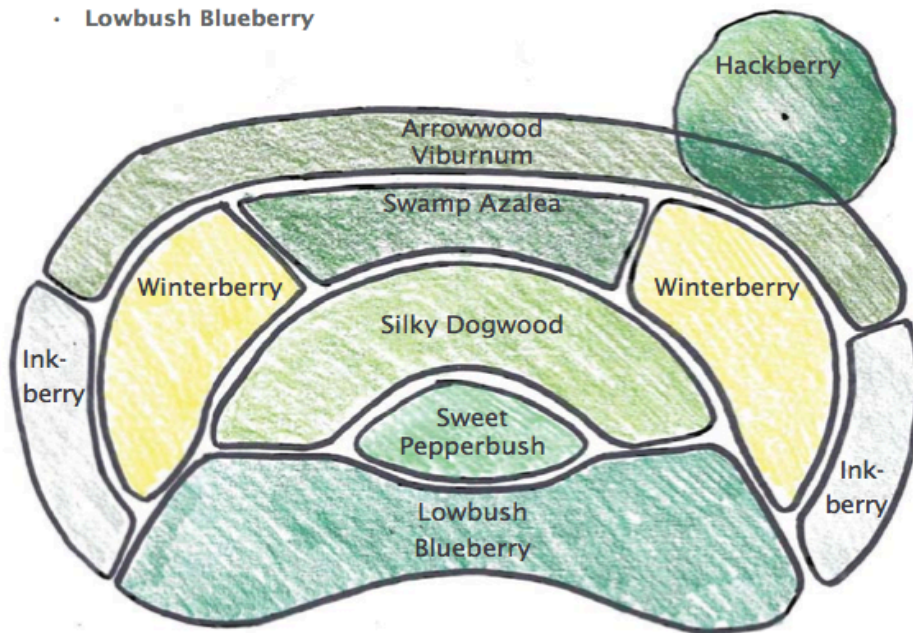
- Silky Dogwood
- Sweet Pepperbush

Slope

- Swamp Azalea
- Lowbush Blueberry
- Winterberry

Buffer

- Arrowwood Viburnum
- Hackberry
- Inkberry
- Lowbush Blueberry



ORNAMENTAL BARK, FLOWERS, AND BERRIES RAIN GARDEN

Base

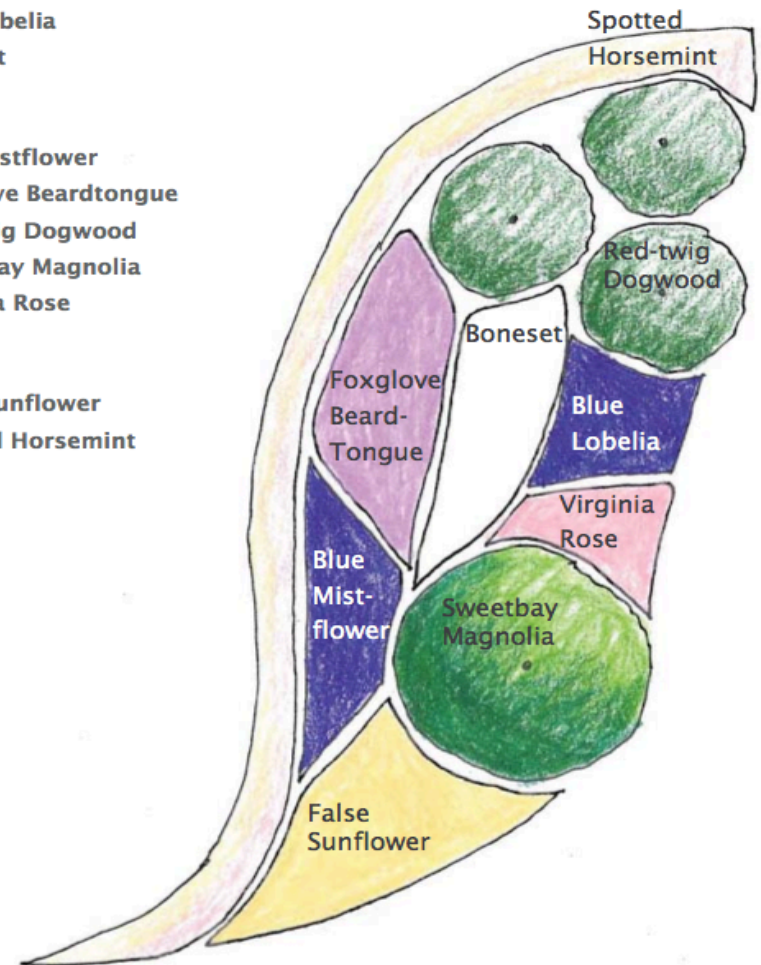
- Blue Lobelia
- Boneset

Slope

- Blue Mistflower
- Foxglove Beardtongue
- Red-twig Dogwood
- Sweetbay Magnolia
- Virginia Rose

Buffer

- False Sunflower
- Spotted Horsemint



Source: Rutgers Rain Garden Manual of New Jersey

Rain Garden Plant Lists

PLANTS FOR WET AREAS

Trees

Black Gum
Black Willow
Green Ash
Red Maple
River Birch
Serviceberry
Swamp White Oak
Sweetgum
Sycamore

Shrubs

American Cranberry Bush
Arrowwood Viburnum
Inkberry
Red Chokeberry
Redosier Dogwood
Silky Dogwood
Spicebush
Summersweet
Winterberry

Perennials

Blue Lobelia
Blueflag Iris
Cardinal Flower
New England Aster
New York Aster
Swamp Milkweed
Wild Bergamont

PLANTS FOR DRY AREAS

Trees

American Hornbeam
Eastern Red Cedar
Hackberry
Honeylocust
Northern Red Oak
Shagbark Hickory
Washington Hawthorn
White Ash
White Oak

Shrubs

Bayberry
Bush Cinquefoil
Jerseytea
St John's Wort

Perennials

Butterflyweed Milkweed

PLANTS FOR SHADY AREAS

Trees

American Holly
American Hornbeam
Eastern Hemlock
Eastern Redbud
Flowering Dogwood
Serviceberry
Sugar Maple

Shrubs

Arrowwood Viburnum
Inkberry
Spicebush
Summersweet
Witchhazel

Perennials

American Columbine
Bleeding Hearts
Cinnamon Fern
Royal Fern
Sensitive Fern
Solomon's Seal
Woodland Phlox

Rain Garden Design Samples

DRY, SANDY SOIL RAIN GARDEN

Base

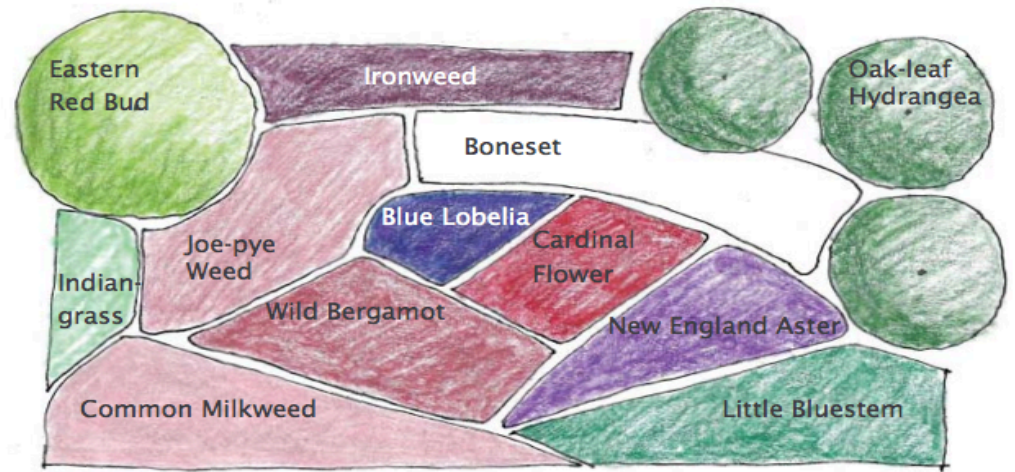
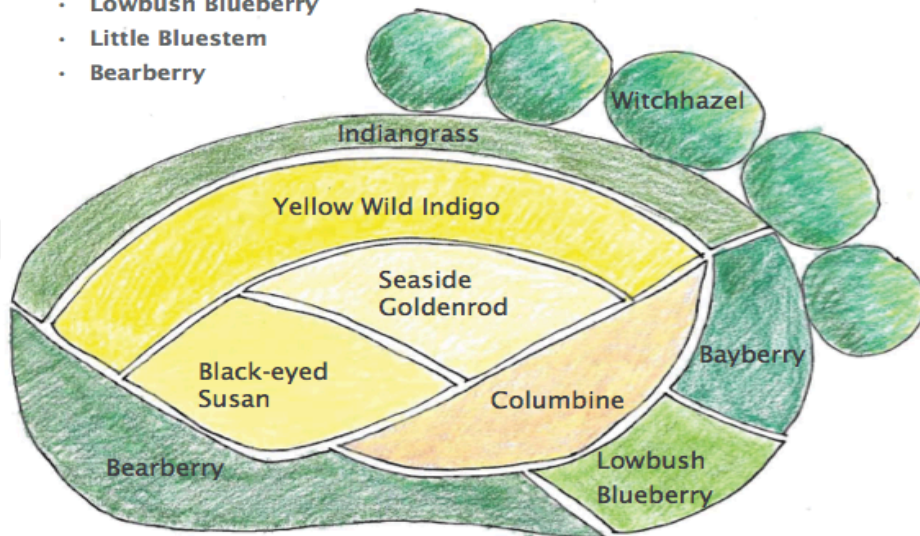
- Seaside Goldenrod

Slope

- Black-eyed Susan
- Columbine
- Yellow Wild Indigo

Buffer

- Bayberry
- Indiangrass
- Lowbush Blueberry
- Little Bluestem
- Bearberry



SUN/PART-SUN RAIN GARDEN

Base

- Blue Lobelia
- Cardinal Flower

Slope

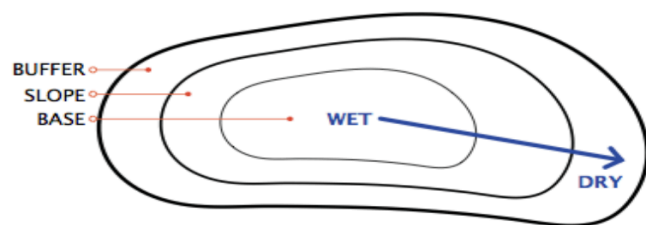
- Boneset
- Joe-pye Weed
- New England Aster
- Wild Bergamot
- Virginia Rose

Buffer

- Common Milkweed
- Indiangrass
- Ironweed
- Little Bluestem
- Oak-leaf hydrangea
- Eastern Red Bud

Rain Garden Plant Lists

PLANTS BY RAIN GARDEN ZONE ... BASE, SLOPE, & BUFFER ... WET TO DRY



Grasses & Groundcovers

BASE

Bluejoint Grass
Sedges
Fowl Mannagrass
Soft Rush

SLOPE

Big Bluestem
Switchgrass
Virginia Wild-rye
Wood Grass

BUFFER

Broomsedge
Deer Tongue
Indiangrass
Little Bluestem
Panic Grass
Switchgrass

Wildflowers & Ferns

BASE

Blue Lobelia
Blueflag Iris
Boneset
Cardinal Flower
Seaside Goldenrod
Marsh Marigold

SLOPE

Blazing Star
Cinnamon Fern
Columbine
Coreopsis
Ironweed

BUFFER

Black-eyed Susan
Butterflyweed Milkweed
Purple Coneflower
Wild Indigo
Wild Bergamont

Monkey Flower
Rose-mallow
Royal Fern
Swamp Milkweed
Turtlehead

Joe-pye Weed
New England Aster
New York Aster
Sensitive Fern

Trees & Shrubs

BASE

Buttonbush
Green Ash
River Birch
Silky Dogwood
Swamp White Oak

SLOPE

Green Ash
Red Maple
Red-twig Dogwood
River Birch
Serviceberry
Sweetpepperbush
Sweetbay Magnolia
Winterberry Holly

BUFFER

American Holly
Bayberry
Hackberry
Red Bud
Red Oak
Witchhazel

Rain Gardens Filter Pollutants

Vegetated depressions clean stormwater runoff by removing sediments, turbidity, heavy metals, and other pollutants. This is accomplished by a variety of complex processes.

Pollutants are removed by vegetation uptake, by natural flocculation from decomposing vegetation, by just slowing the flow down enough for sedimentation to occur, and sometimes by biota consumption and ionic attraction around the root structure.

Source: www.deq.state



\$500 HOMEOWNER REWARDS PROGRAM

**RECEIVE A REIMBURSEMENT FOR INSTALLING
RAIN GARDENS, RAIN BARRELS OR PLANTING
NATIVE PLANTS**

In order to help reduce the amount of pollutants entering our waterways, Peconic Estuary Program is offering homeowners that live within the Peconic Estuary watershed up to \$500.

Visit PeconicEstuary.org to find the application, guidelines and interactive map to see if you qualify. For any questions about the rewards program please e-mail us at rewards@peconicestuary.org



Do your part to
protect our
beautiful bays!



Rain Barrels collect
water that would
otherwise run off
into our bays

Rain Gardens and
Native Plants trap
rain to recharge the
groundwater

**DID YOU MISS
OUR RAIN
GARDEN
LECTURES?**

Watch it online now at

vimeo.com/peconic-estuaryprogram

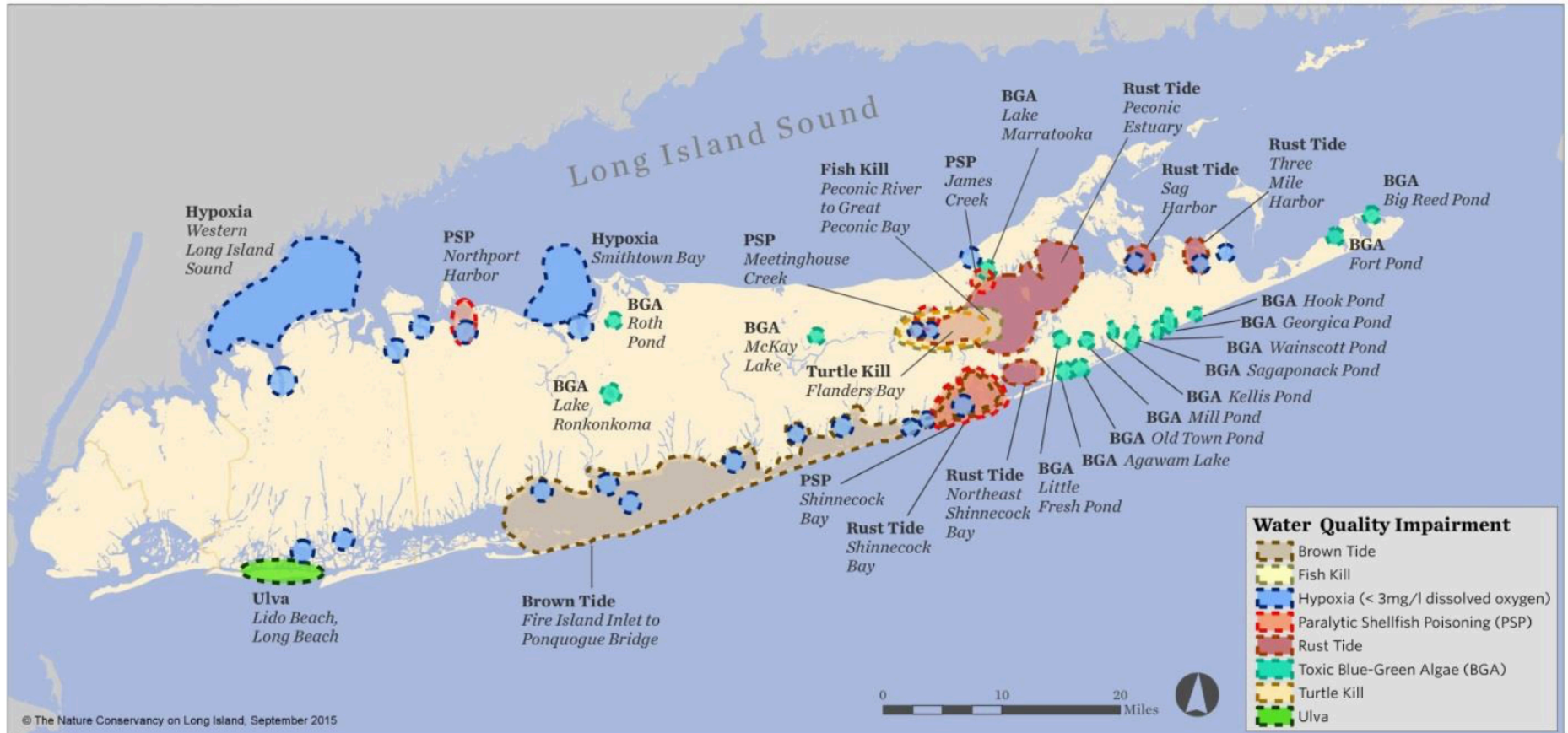
Why Should You Care about a Nitrogen Action Plan?

Simply put, a little nitrogen will make your garden grow, but too much can render drinking water unsafe for babies, trigger conditions that kill fish and poison shellfish, and weaken the wetlands that nurture animal life and help protect us from storms.

In 1975, leaders warned that “[p]erhaps the greatest problem of groundwater contamination in Long Island is by nitrate,” nitrate being a common form of reactive nitrogen. Insufficient action was taken, and nitrogen levels in our Sole Source Aquifer have increased significantly since the 1970s.

In the past few years, we have also seen an increasing number of problems in our bays and harbors because nitrogen-laden groundwater has been flowing into surface waters, elevating the concentration and amount of nitrogen. The Suffolk County Office of Ecology says it takes 1/20th of the amount of nitrogen that would hurt a human to hurt a marine creature or aquatic vegetation.

Long Island Water Quality Impairments, Summer 2015



Summer 2015 saw many problems associated with nitrogen, including paralytic shellfish poisoning.

Is your tap water safe? Public water suppliers distribute water that meets or exceeds the federal standard of 10 mg/l for dissolved nitrate, but the Suffolk County Water Authority warns that the chances for blue baby syndrome may be increased by nitrate at more than 5 mg/l. And some 200,000 people in Suffolk County are served by private wells whose water receives no public treatment.

Where is the nitrogen coming from? In most places, the primary source is **human wastewater**. Some nitrogen comes from fertilizer and atmospheric sources, but research has shown the following:

- **Peconic Estuary:** Wastewater from septic systems and cesspools is the dominant source of nitrogen in more than half of the 43 drainage areas. High levels of nitrogen were responsible for massive fish and wildlife deaths in the western Peconic bays in spring 2015.
- **Great South Bay:** Wastewater from septic systems and cesspools is the dominant source of nitrogen in 28 of 34 drainage areas, as high as 81% in the Hedges Creek area and 80% in Bayport Creek. The NYS Department of Environmental Conservation recently added Great South Bay to its list of impaired waterbodies that require action under the federal Clean Water Act.

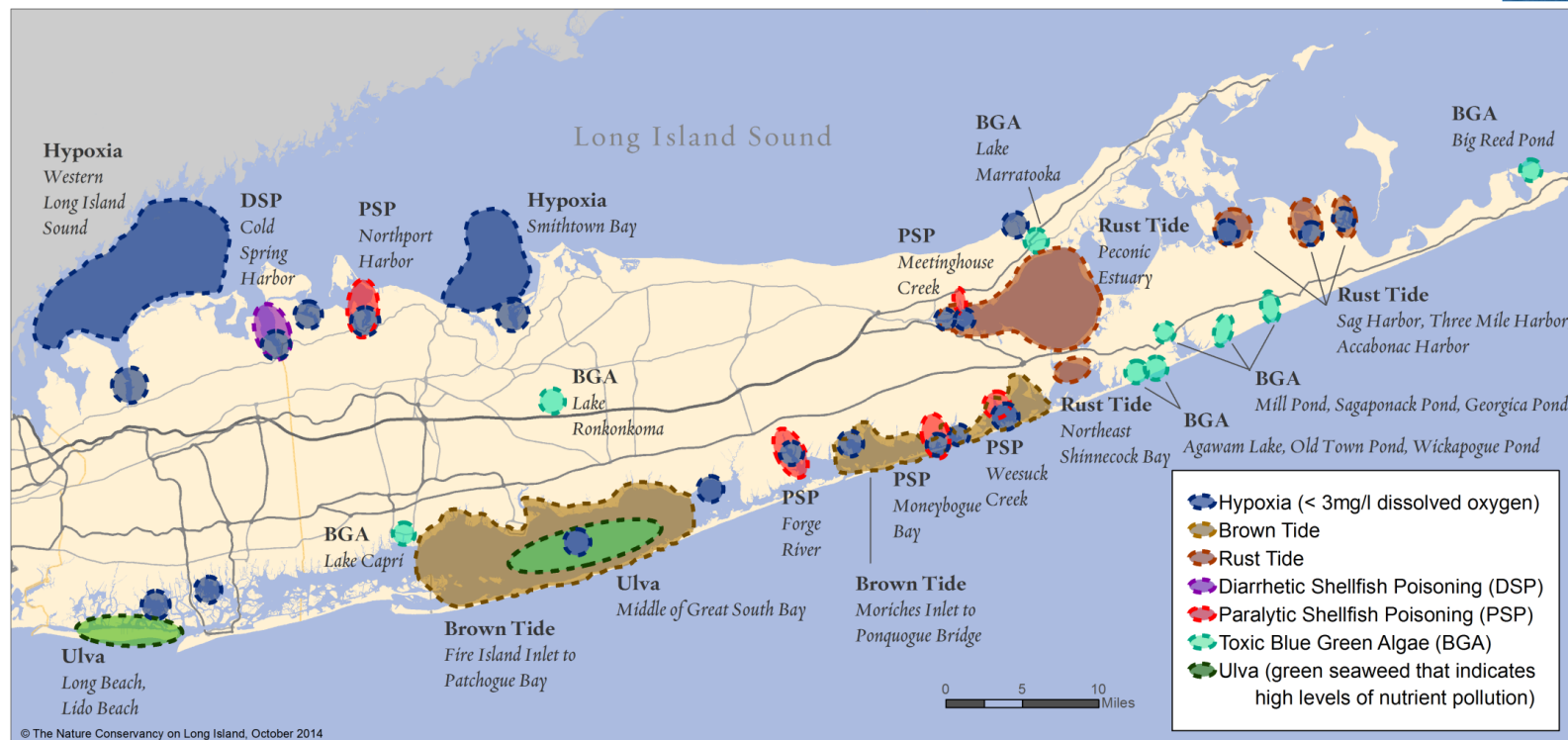
- **North Shore Nassau County**: From Little Neck Bay to Cold Spring Harbor, wastewater from septic systems and cesspools is the major source of land-based nitrogen in all but one of the areas draining to the bays, as high as 87% in Centerport Harbor and 79% in Huntington Bay.
- **South Shore Nassau County**: The outfall of the Bay Park Sewage Treatment Plant deposits by far the largest single nitrogen load to the Western Bays, causing harmful algae blooms in spring, summer, and fall, as well as hypoxia, and noxious macro-algae that covers beaches.

What can be done? Plenty. Nitrogen pollution is everyone's problem, and we can all play a part in solving it by using less fertilizer on our lawns and gardens, upgrading our homes' wastewater treatment technology (by installing a nitrogen-reducing onsite system or hooking up to an expanded sewer system), and advocating for a new ocean outfall pipe and advanced treatment at Bay Park Sewage Treatment Plant. The specific mix of reforms will differ by area, and that is why public participation in creating and implementing the Long Island Nitrogen Action Plan is so important.

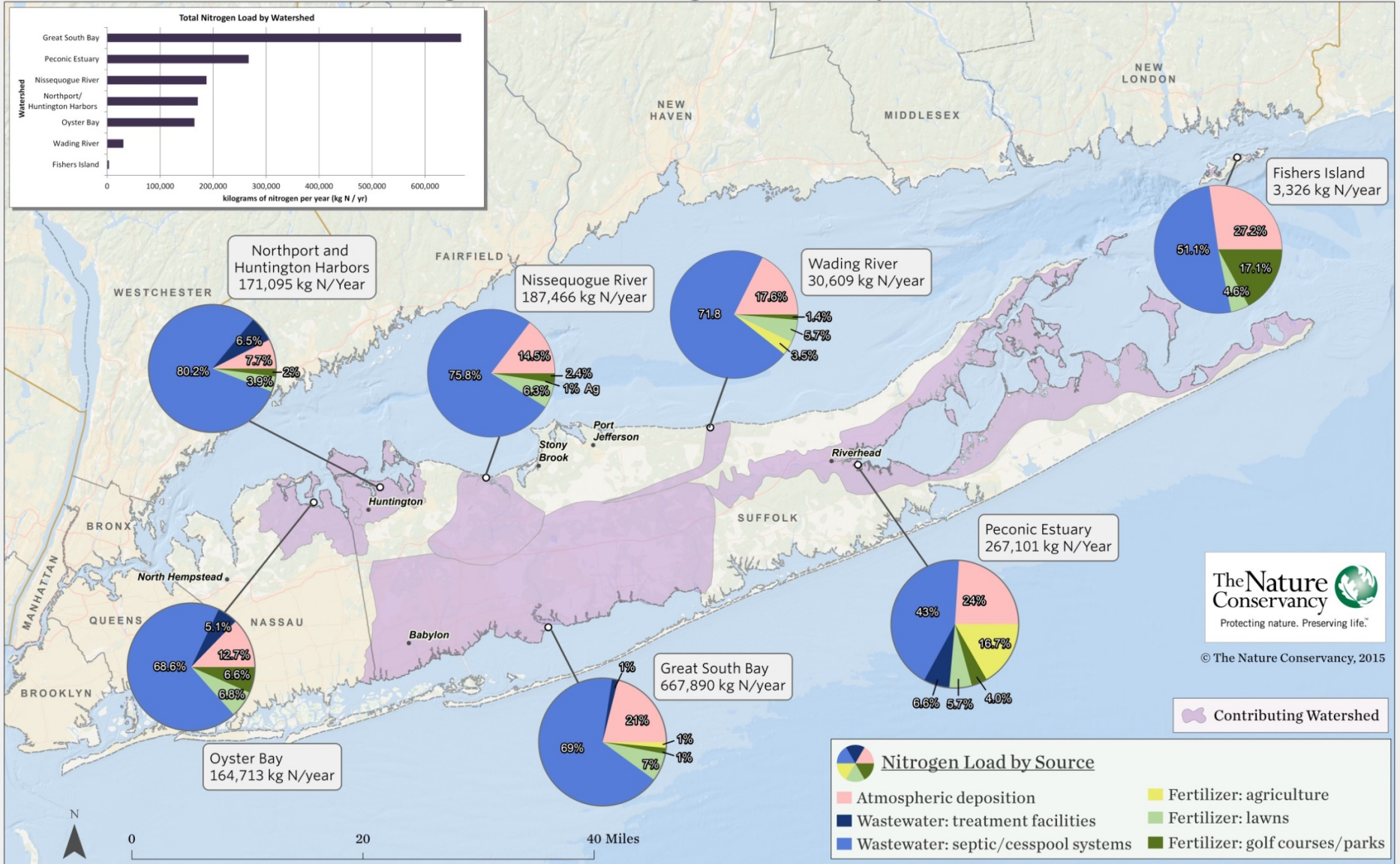
Bottom Line: We need to create and implement a nitrogen action plan that determines where nitrogen is coming from, and sets nitrogen reduction targets that will protect drinking and surface waters for us and future generations.

For more information, visit www.longislandcleanwaterpartnership.org.

Long Island Water Quality Issues, Summer 2014



Long Island Nitrogen Load by Source



The Nature Conservancy: Working to Improve Water Quality

June 2015

