



Low Impact Development Basics for Water Quality Protection

May 22 & 23
Coastal Studies Institute





LIST OF RESERVES

Great Lakes

1. Lake Superior, Wisconsin
2. Old Woman Creek, Ohio

Northeast

3. Wells, Maine
4. Great Bay, New Hampshire
5. Waquoit Bay, Massachusetts
6. Narragansett Bay, Rhode Island

Mid-Atlantic

7. Hudson River, New York
8. Jacques Cousteau, New Jersey
9. Delaware
10. Chesapeake Bay, Maryland
11. Chesapeake Bay, Virginia

Southeast

12. North Carolina
13. North Inlet-Winyah Bay, South Carolina
14. ACE Basin, South Carolina
15. Sapelo Island, Georgia
16. Guana Tolomato Matanzas, Florida

Gulf of Mexico

17. Rookery Bay, Florida
18. Apalachicola, Florida
19. Weeks Bay, Alabama
20. Grand Bay, Mississippi
21. Mission-Aransas, Texas

West

22. Tijuana River, California
23. Elkhorn Slough, California
24. San Francisco Bay, California
25. South Slough, Oregon
26. Padilla Bay, Washington
27. Kachemak Bay, Alaska

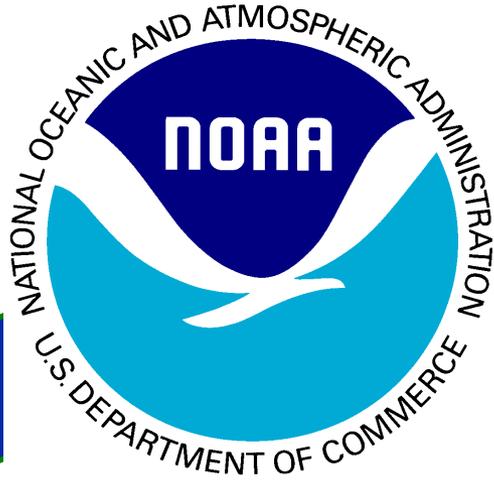
Pacific

28. He'eia, Hawai'i

Caribbean

29. Jobos Bay, Puerto Rico

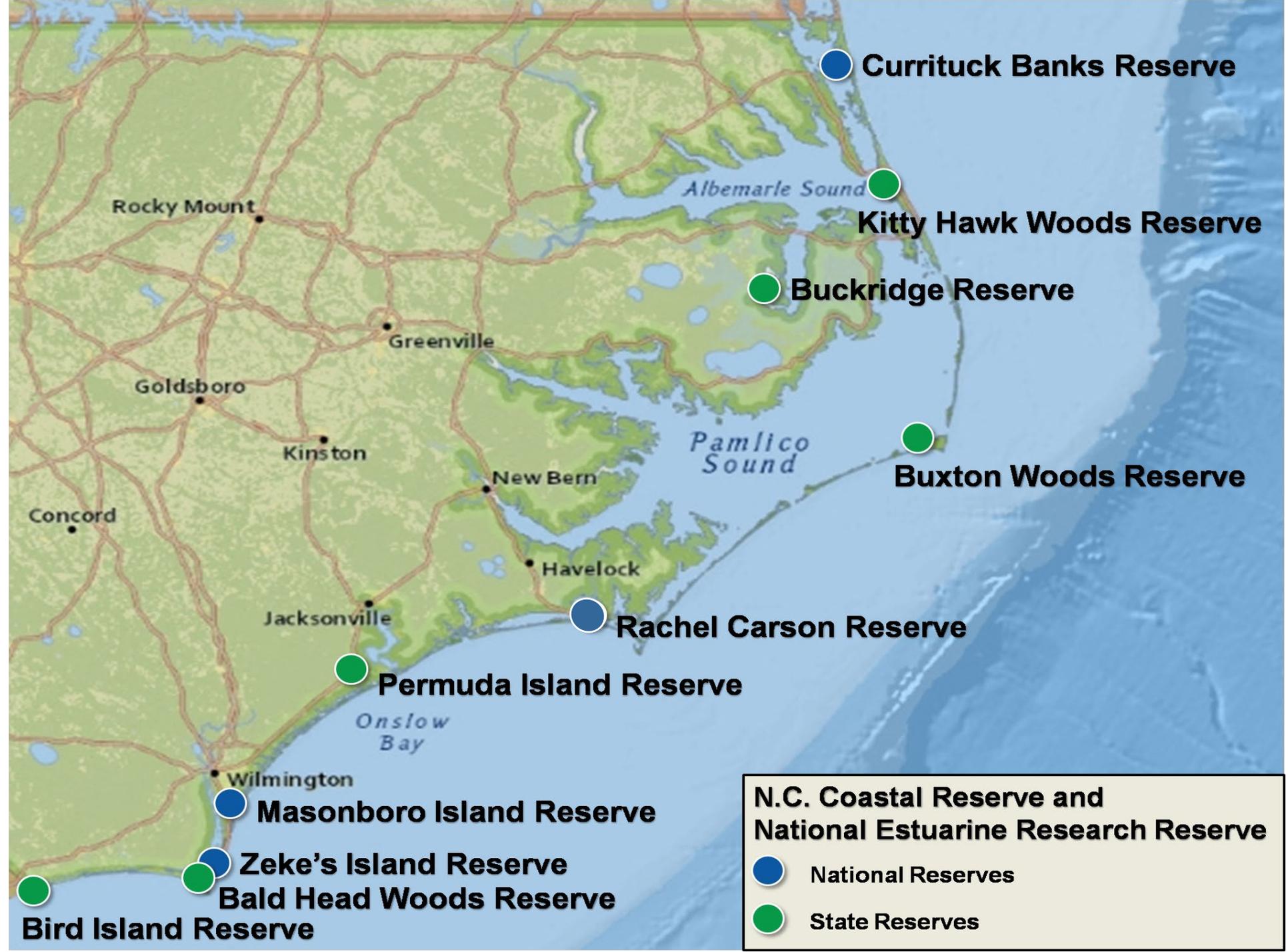




North Carolina Coastal Reserve



**North Carolina
National Estuarine Research Reserve**



Currituck Banks Reserve

Kitty Hawk Woods Reserve

Buckridge Reserve

Buxton Woods Reserve

Rachel Carson Reserve

Permuda Island Reserve

Masonboro Island Reserve

Zeke's Island Reserve

Bald Head Woods Reserve

Bird Island Reserve

N.C. Coastal Reserve and National Estuarine Research Reserve

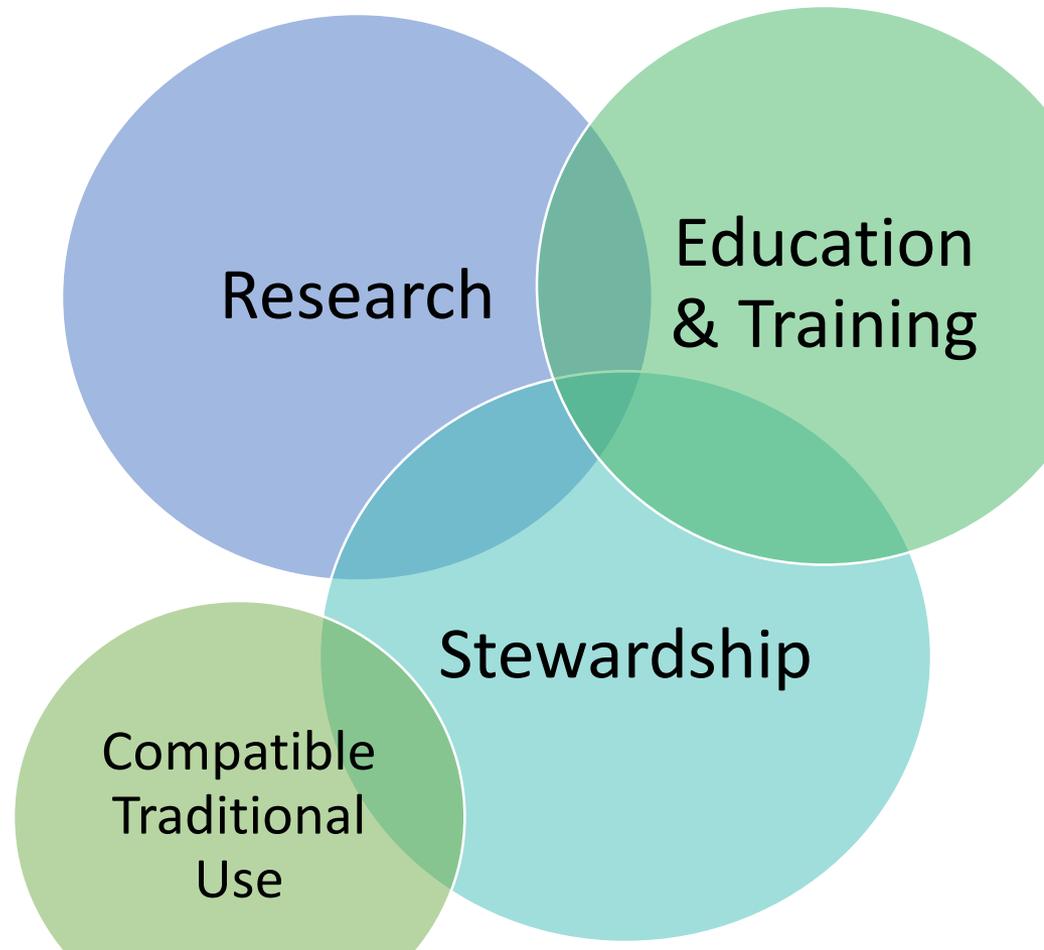
● National Reserves

● State Reserves

Mission



To promote informed management and stewardship of North Carolina's estuarine and coastal habitats through research, education, and example.



Social Media



North Carolina Coastal Reserve



@NCReserve



Presentations Available Online

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[Outreach & Education](#) ▾

[Energy & Climate](#) ▾

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Past Workshop Resources



To obtain additional course documents from past workshops, please contact Coastal Training Program Coordinator [Whitney Jenkins](#) at 252-838-0882.

Coastal Training Program

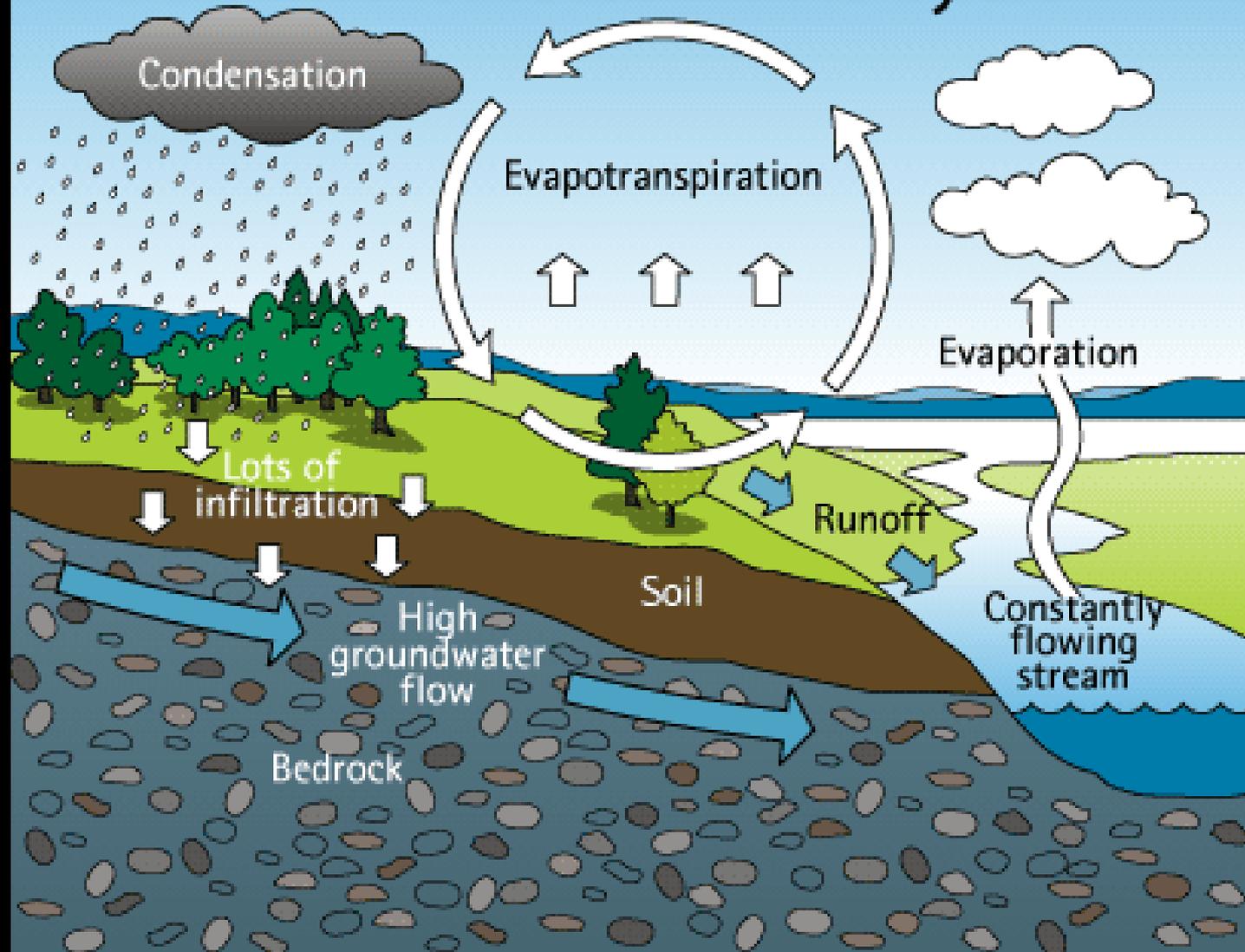
[Scheduled Workshops](#)

[Past Workshops](#)

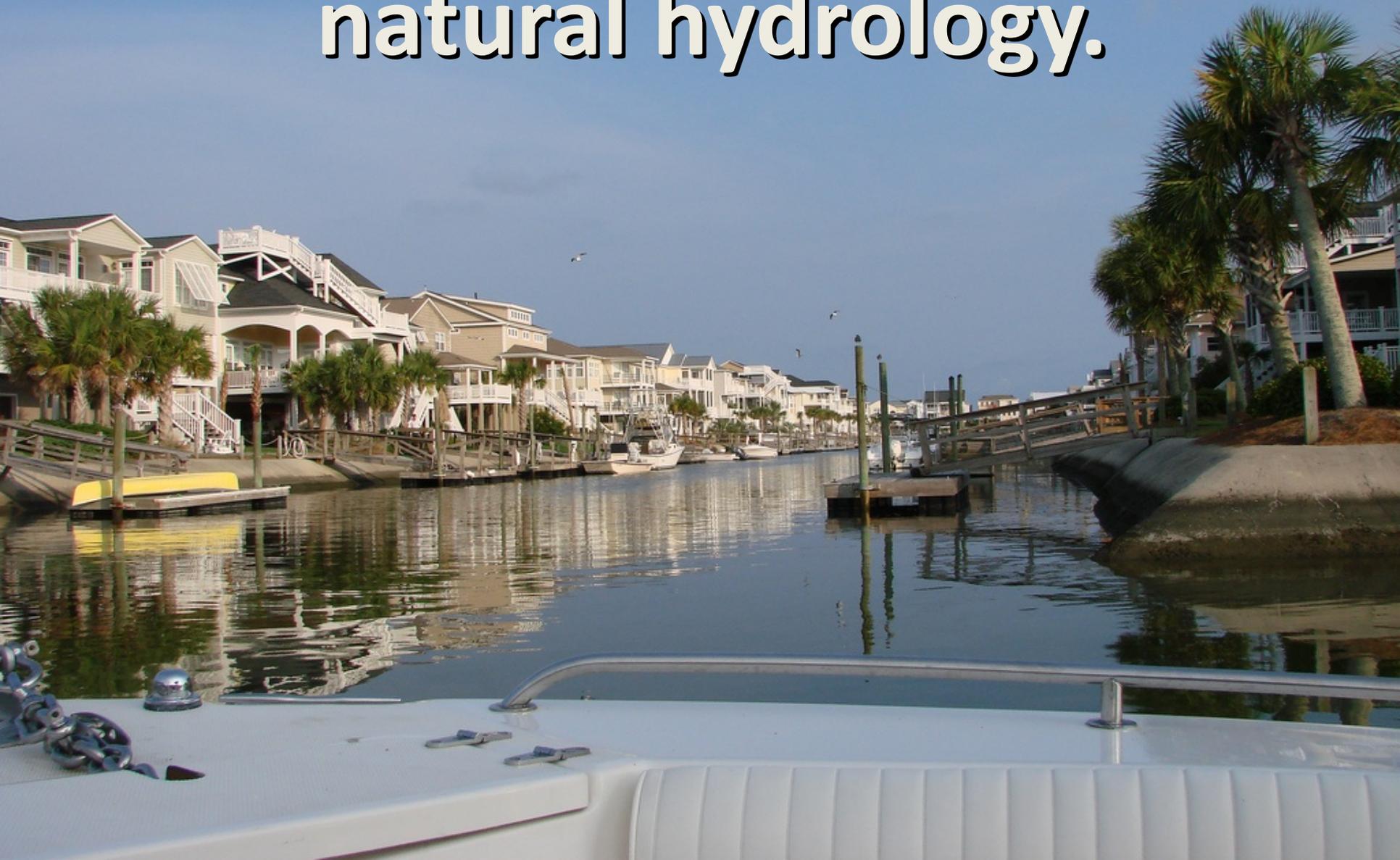
- [Low Impact Development for Water Quality Protection - May 22 & 23, Wanchese](#)

The Land Use – Water Quality Connection

The natural water cycle



**We have changed the
natural hydrology.**



Parking Lots



Parking Lots Continued



Parking Lot & Street Runoff



Ditching





Cul-De-Sacs

Rooftop Runoff



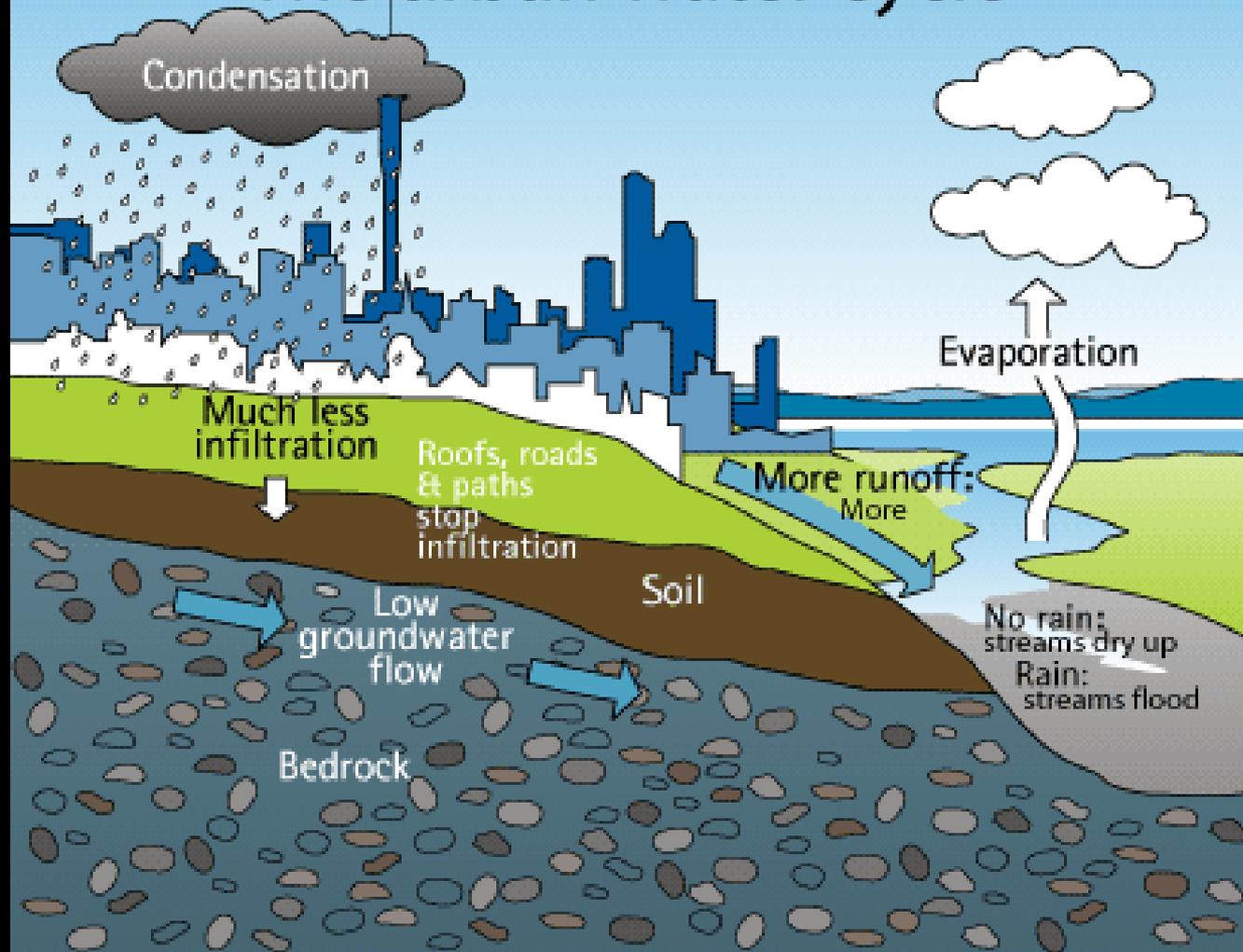
Curbs and Gutters



Vegetated Buffers & Living Shorelines



The urban water cycle



What is a watershed?

An area of land defined by topography, not political boundaries

An area of land that catches rain and drains or seeps into a marsh, stream, river, lake or groundwater

An area of land located within a river basin

All of the above

What is a Watershed?



What North Carolina River Basin do you live in?

Cape Fear

Chowan

Lumber

Neuse

Pasquotank

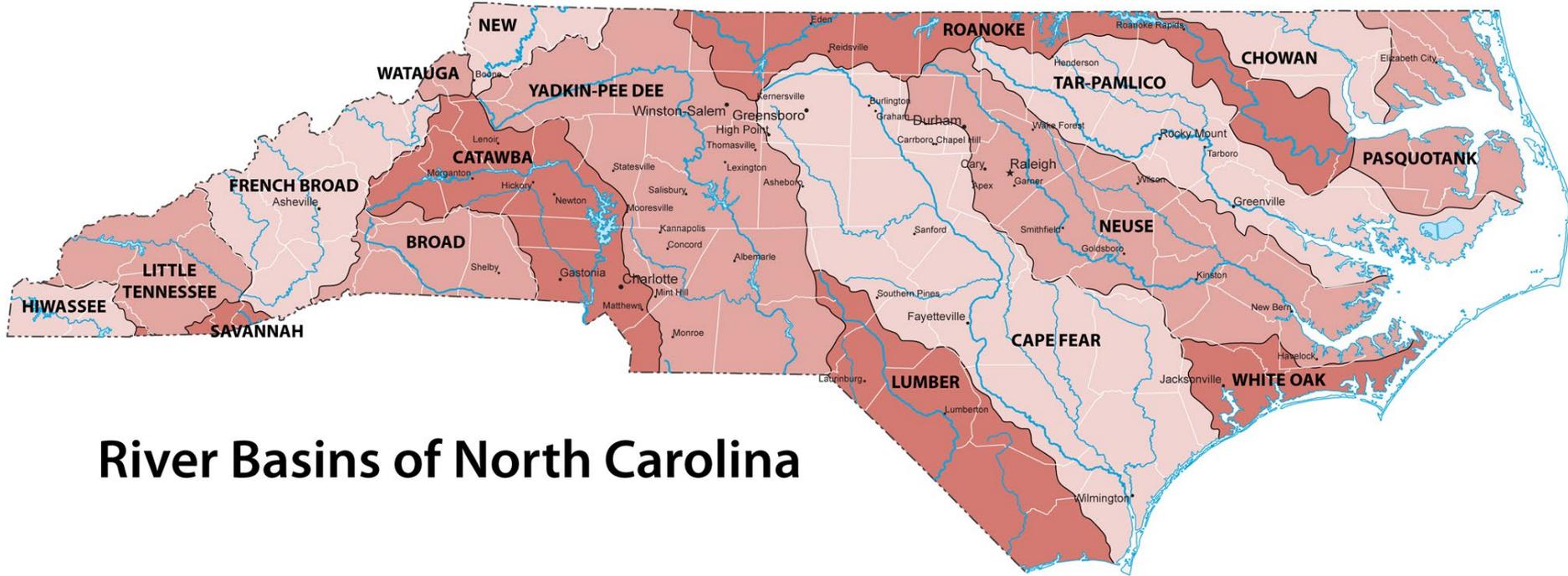
Roanoke

Tar-Pamlico

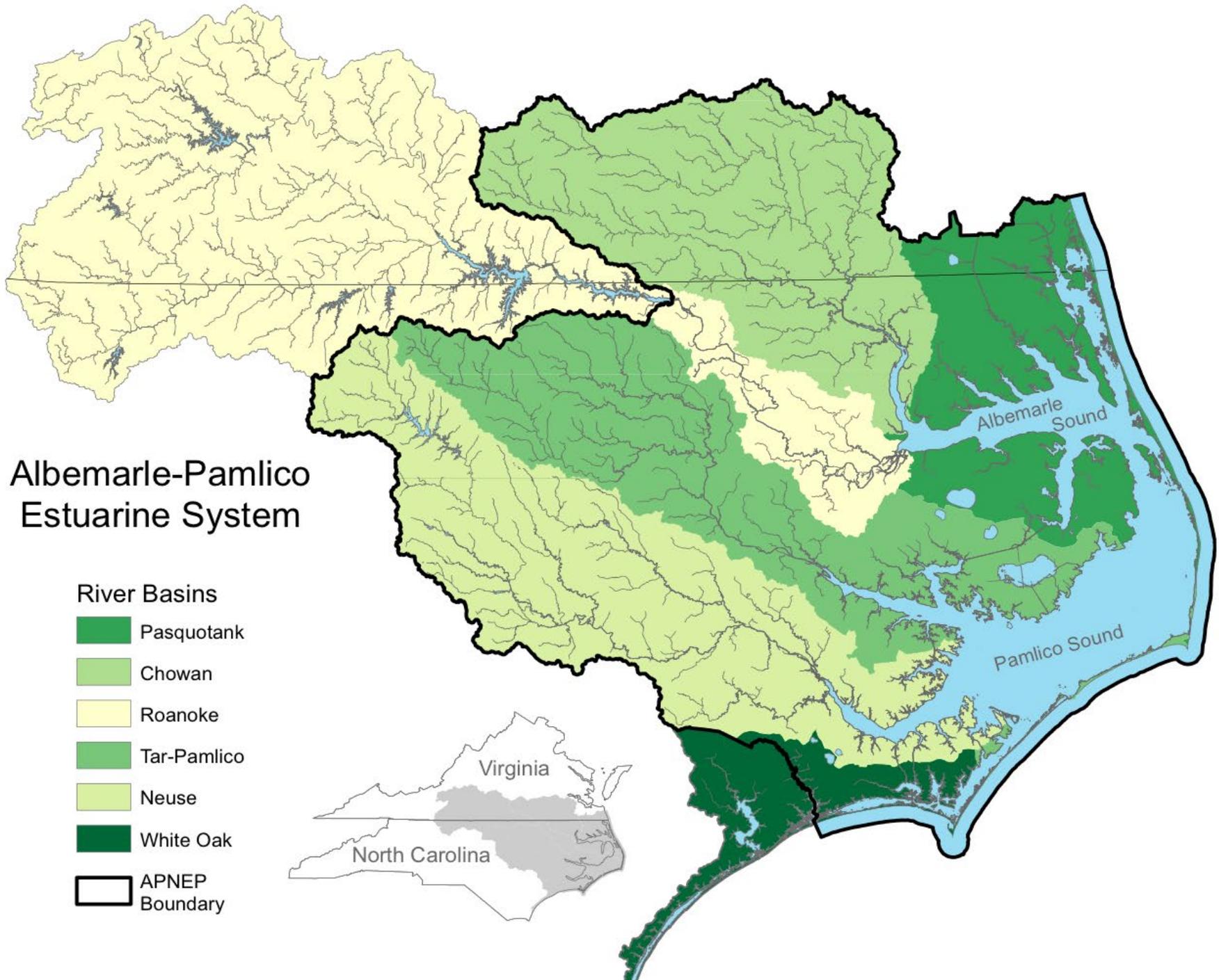
White Oak

Other

Don't Know



River Basins of North Carolina



What are the intended uses of our water resources?

Aquatic life
habitat

Drinking
water

Swimming
Fishing

All of the
above

Intended Uses of Water Resources



- Aquatic life habitat
- Drinking water
- Swimming
- Fishing

What is a Water Quality Impairment?

The inability of a water resource to meet its intended uses.

For example, an estuary is impaired when high levels of bacteria ban the harvesting of oysters.

Shellfish Water Harvest Closure Map

<https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=5759aa19d7484a3b82a8e440fba643aa>

Swimming Advisory Map

<http://portal.ncdenr.org/web/mf/testing-sites>

Pollution Sources: Point Source



Pollution Sources: Nonpoint Source



Pollutants of Concern

- **Nutrients**- nitrogen and phosphorus can lead to algal blooms, eutrophication, and fish kills
- **Microbes**- public health risk, can lead to closure of fishing areas and loss of revenue (i.e. bacteria, viruses, parasites)
- **Sediment**- clogs drainageways, clouds rivers, and degrades aquatic habitat



Nutrients



Nutrients



Eutrophication



Nutrients & Microbes



Nutrients & Microbes



Nutrients & Microbes





Nutrients & Microbes



Nutrients & Microbes



Nutrients & Microbes

Nutrients & Microbes



Nutrients & Microbes



CLOSED AREA

UNLAWFUL TO TAKE OYSTERS,
CLAMS, OR MUSSELS.
SHELLFISH MAY CAUSE
SERIOUS ILLNESS IF EATEN.



NC MARINE FISHERIES



ATTENTION

**SWIMMING IN THIS AREA
IS NOT RECOMMENDED.**

**BACTERIA TESTING
INDICATES LEVELS OF
CONTAMINATION THAT
MAY BE HAZARDOUS TO
YOUR HEALTH. THIS
ADVISORY AFFECTS
WATERS WITHIN 200'
OF THIS SIGN.**

OFFICE OF THE STATE HEALTH DIRECTOR

Sediment



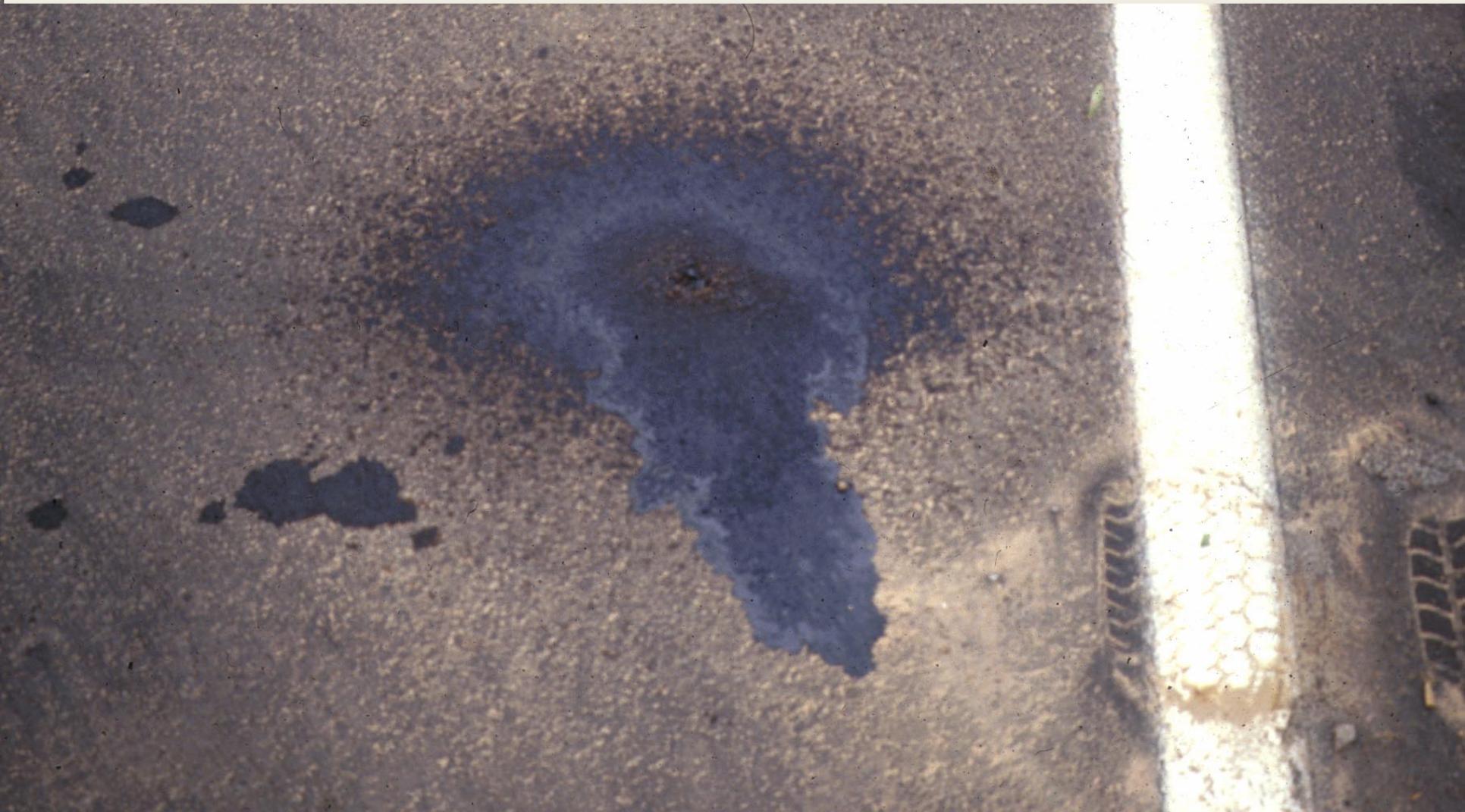


Sediment



Sediment

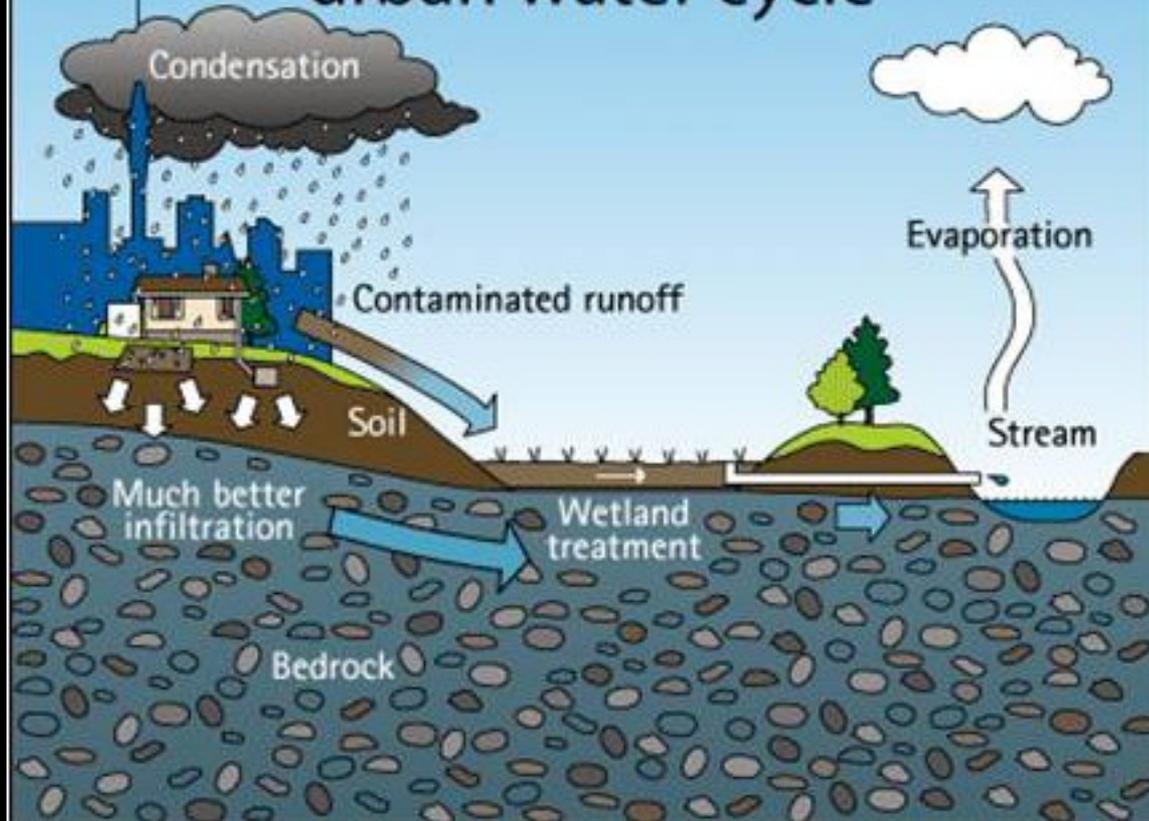
Stormwater pollutants also include any materials that can build up on impervious surfaces: oil, grease, trash, auto fluids, dirt, etc.



So what's the bottom line...

- Everything is connected
- What we do on the land affects...
 - Water quality
 - Animal habitat
 - Our economy (i.e. tourism, commercial fishing)
 - Our quality of life
- It has been proven that conventional development does not protect water quality
- We can develop the land AND protect water quality

Towards a more sustainable urban water cycle



Watershed Game

Overall Goals:

- Introduce concepts
- Be involved in land use decisions
- Wear different hats
- Learn from each other

Watershed Game

- Board is a fictional watershed
- Currently, there are 300 pollution units entering the waterbody, including upstream sources

Algal blooms are occurring periodically and there were fish kills this summer. What can cause this?

Excess nutrients

Bacteria

Viruses

Sediment

All of the above

Submerged aquatic vegetation (or seagrass) has been lost in some areas of the sound because the sunlight cannot reach the plants. What can cause this?

Excess
nutrients

Bacteria

Viruses

Sediment

All of the
above

Oyster beds have been closed to harvesting. This is due to high levels of microbes found in the water. Where is the bacteria coming from?

Pet waste

Wildlife waste

Failing septic systems

Sewer system overflows

Improperly managed livestock

Marinas with no pump-out stations

All of the above

Watershed Game

This waterbody isn't meeting its intended uses!

Watershed Game

- There needs to be a reduction in pollution reaching the waterbody
- **Goal:** Reduce the pollution load to the sound to the pre-established limit of **130 pollution units**
- Local government, businesses, & residents have decided to reduce pollution coming from stormwater before new rules are imposed upon them

Watershed Game

- There are five land uses on this game board
 - Agriculture/Forest
 - Residential
 - Downtown
 - Commercial
 - Park/Golf Course/Undeveloped
- You will be divided into game groups
- Two or three-person teams for each land use
- Each land use has five “solution cards” that can be played to reduce pollution, but all cost “money”

Rules of Game

- Each team gets a budget of 6 candies
- Each team plays 1 solution card per round and explains the card and why it was chosen
- Pay the banker after playing the solution card
- Teams cannot swap solution cards
- After each round the banker will determine the new pollution unit amount for the waterbody
- Goal: reduce pollution (as a group) from 300 to 130 units
- **Have fun!**