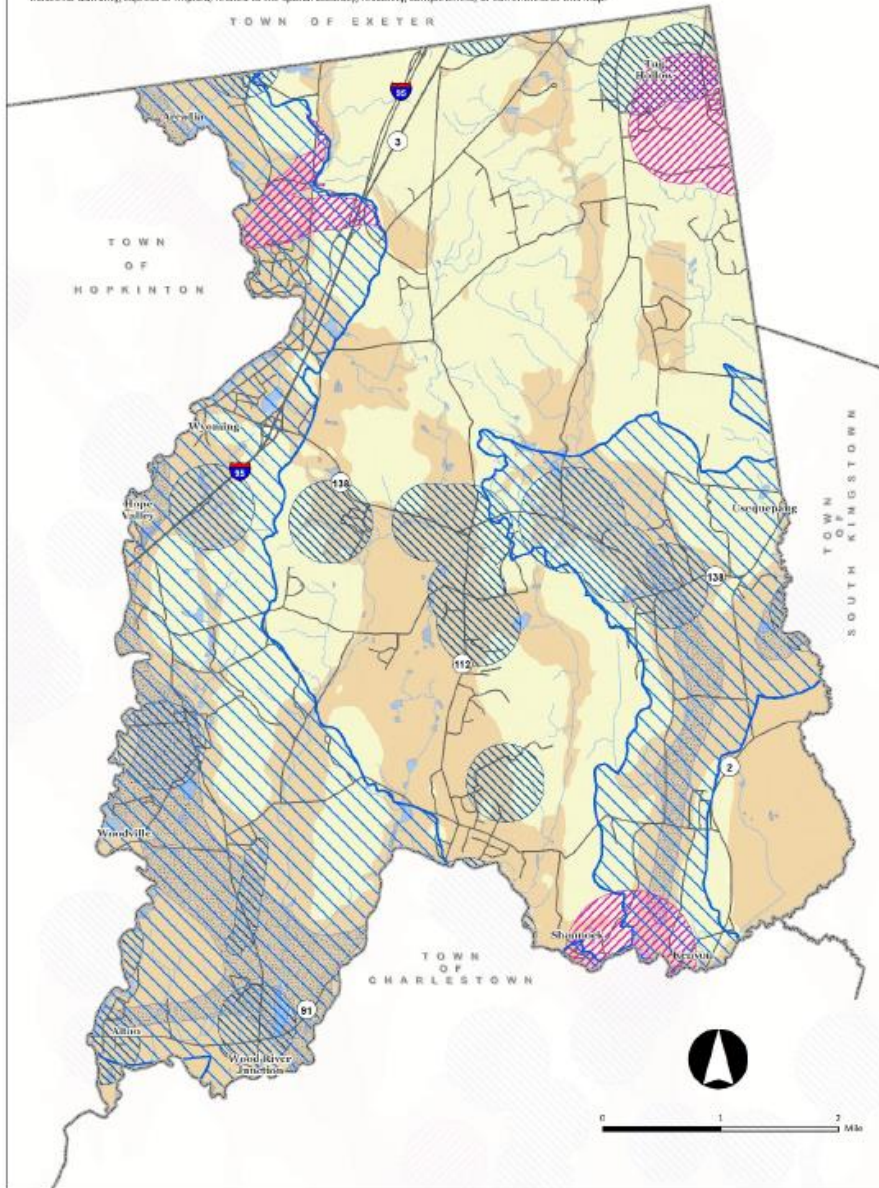


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Richmond's Groundwater Resources

January 11, 2022

Lorraine Joubert, URI
Cooperative Extension

RICHMOND COMPREHENSIVE COMMUNITY PLAN 2021

Map 3 - Geology and Groundwater

THE
UNIVERSITY
OF RHODE ISLAND



Nonpoint Education for Municipal Officials

URI NEMO provides training and technical support to local decision makers in managing impacts of land use on local water resources.

URI NEMO is part of the RI Cooperative Extension Water Quality Program. We are funded by RI HEALTH, the SNEP Network and URI Cooperative Extension

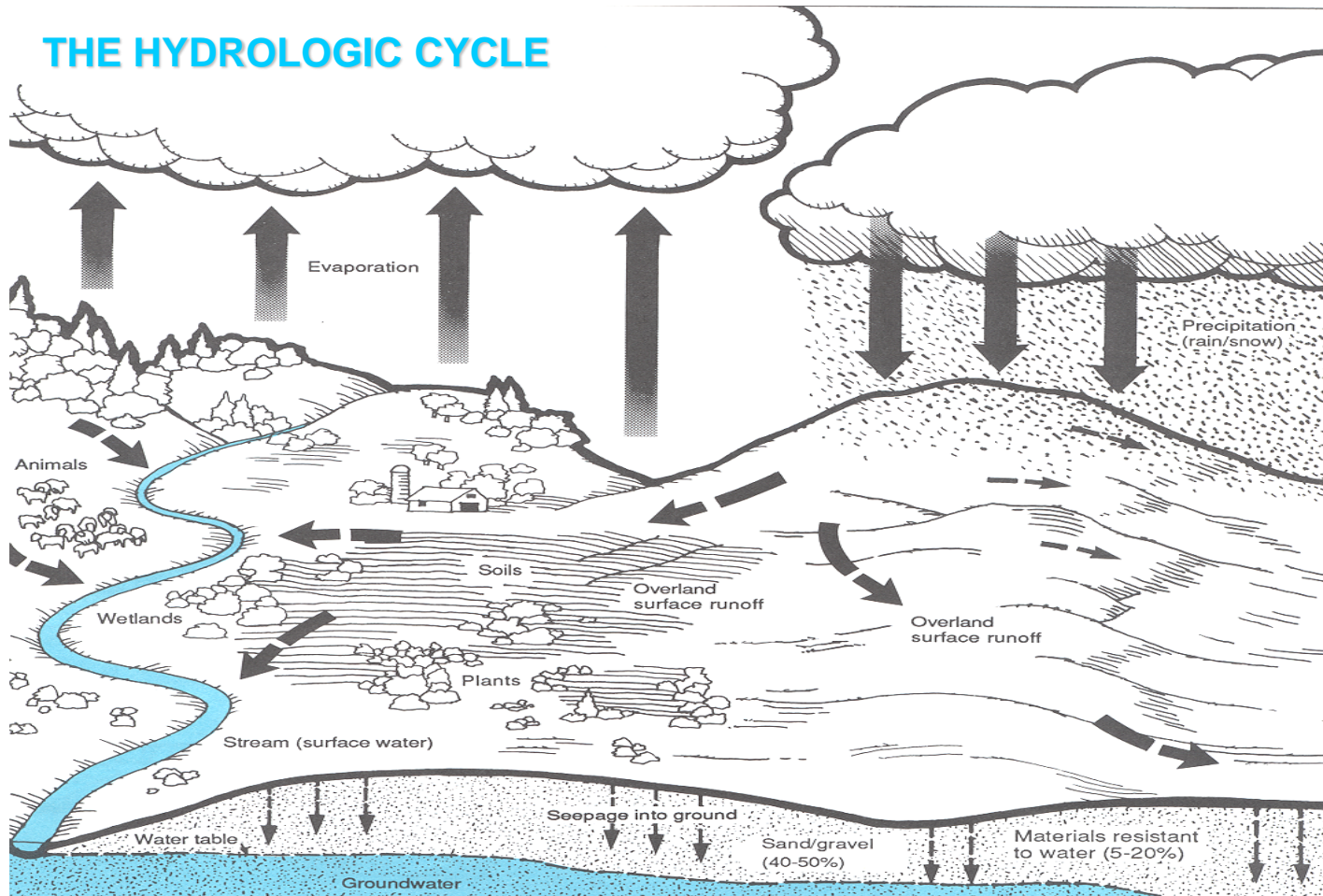


Topics:

- **Groundwater Resources**
- **Threats to Groundwater Quality**
- **State & Local Roles in Protection**
- **Discussion**

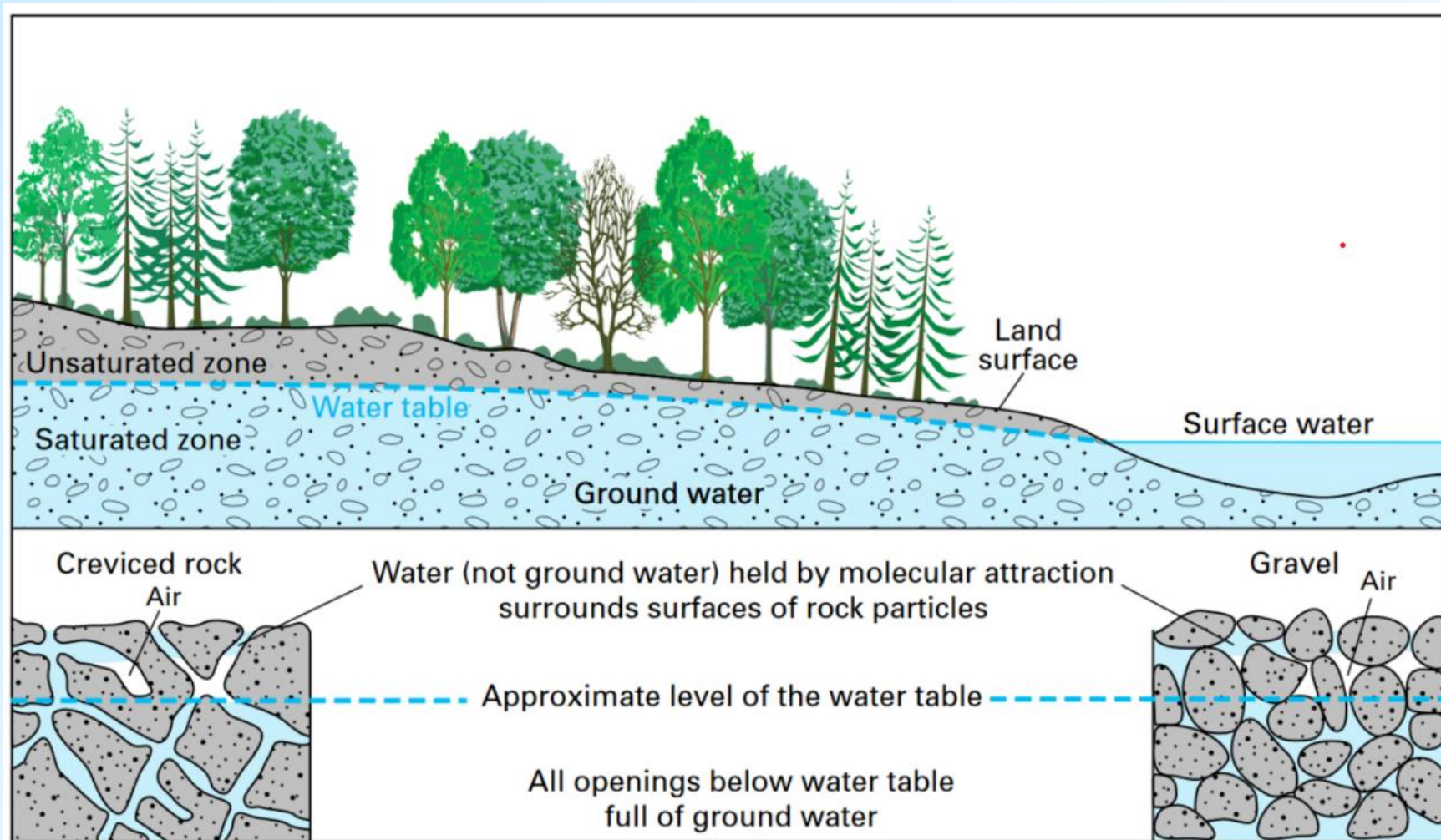
WATERSHED

The area of land that drains to a lake, stream or bay.



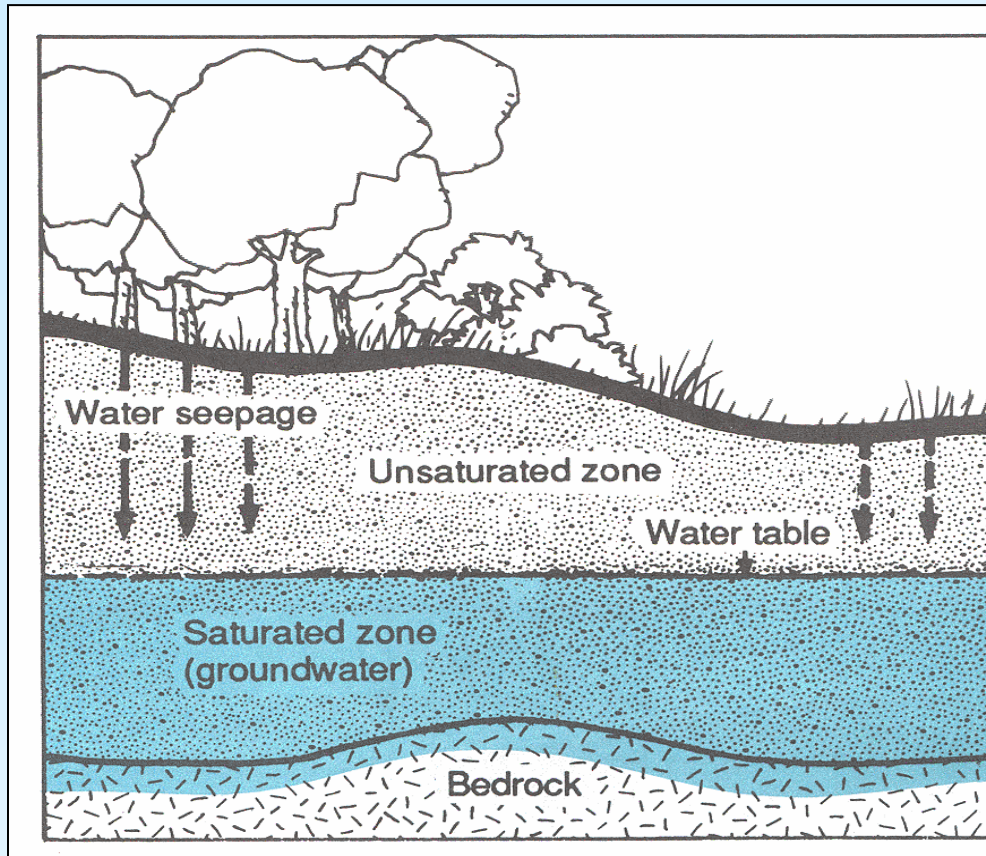
Within a watershed groundwater is connected as one resource.

Groundwater is subsurface water that fully saturates pores or cracks in soils and rock.



Source: USGS Water Resources, Groundwater Basics. March 2, 2019.

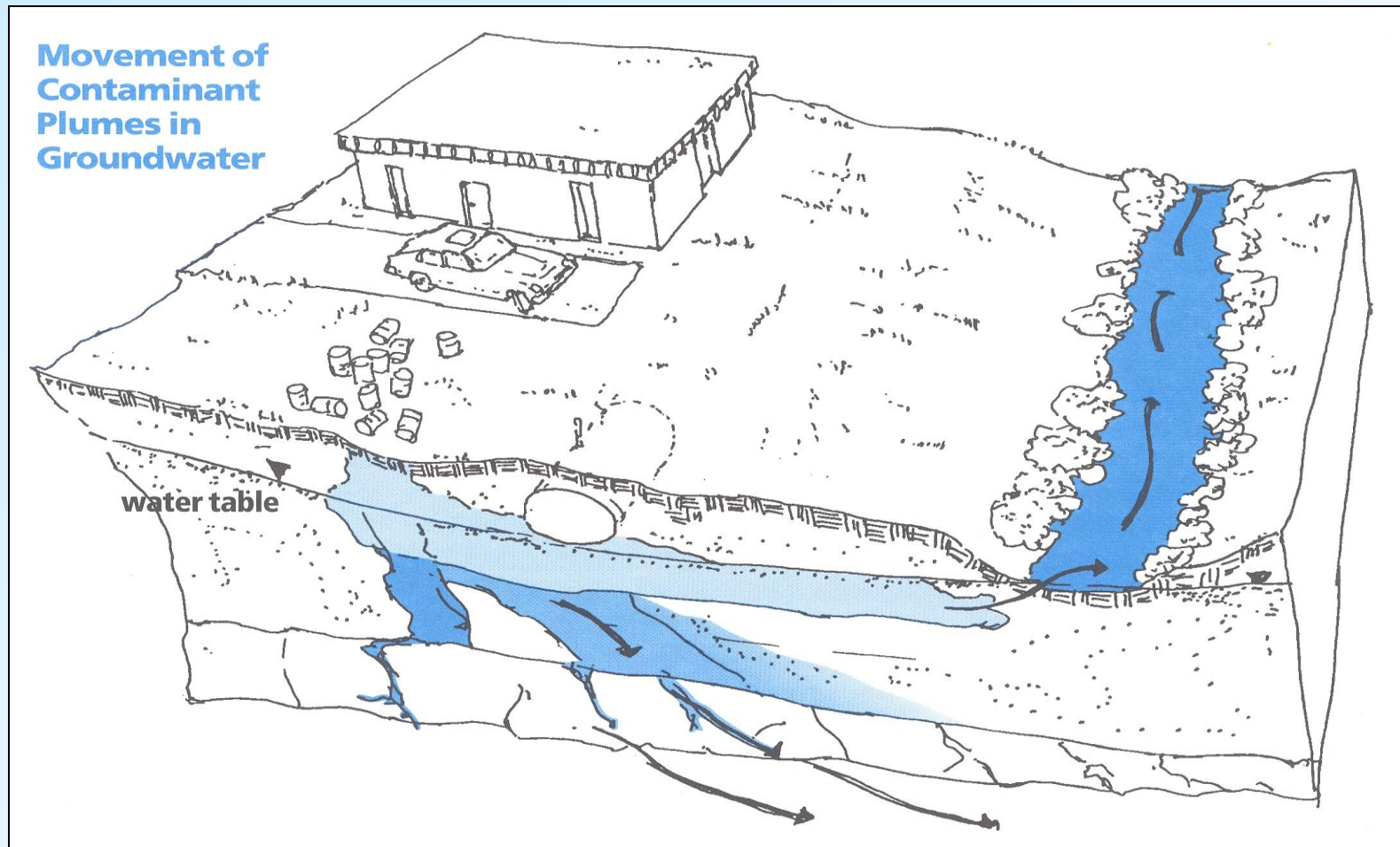
Aquifers are the water-bearing soil and rock formations beneath the land surface that provide significant water.



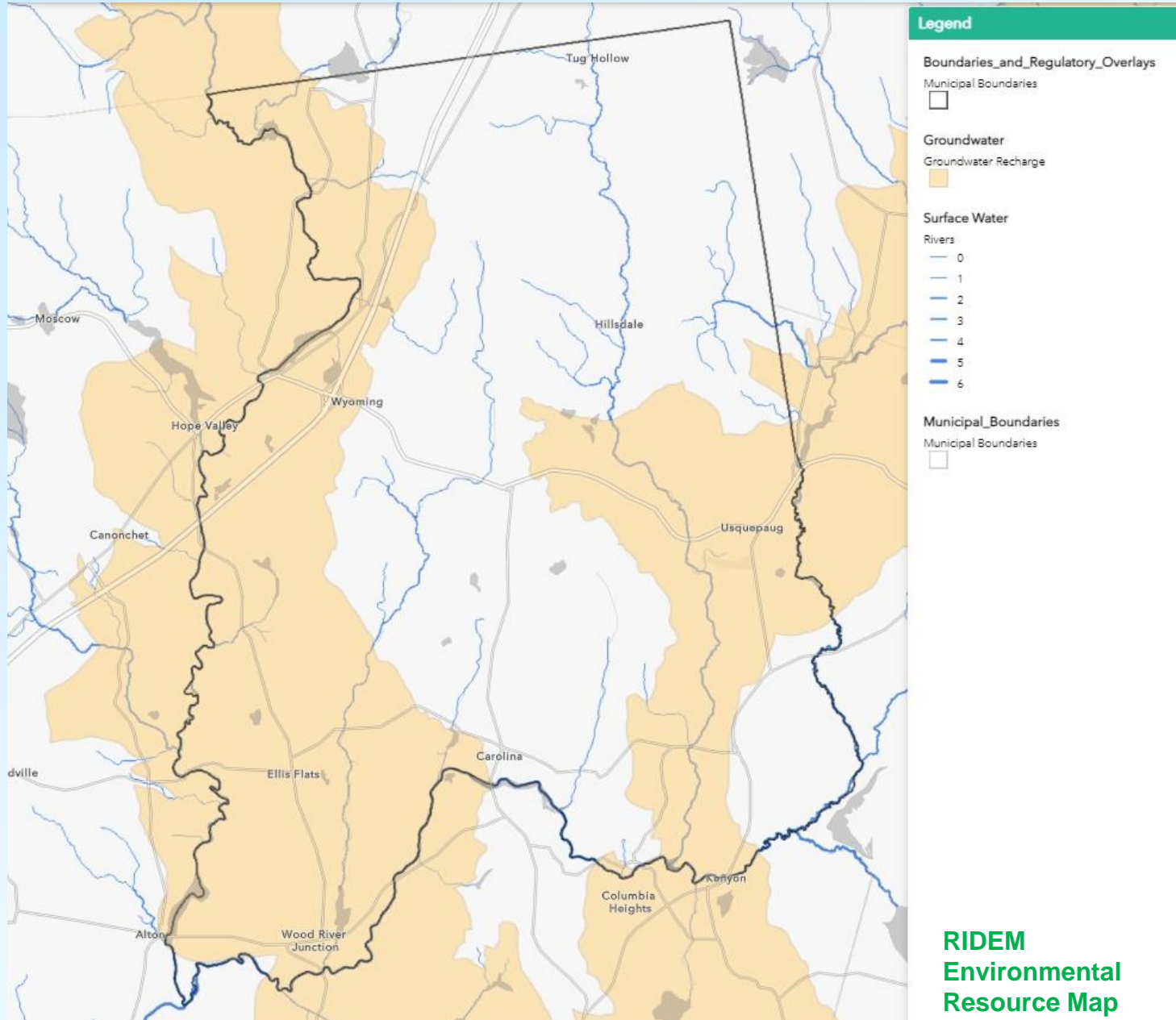
- Groundwater is recharged from the overlying **pervious** land.
- Sand and gravel (outwash) aquifers have high yield but are unconfined, without a protective layer, and highly susceptible to contamination.

Bedrock Aquifers - Store water within fractures

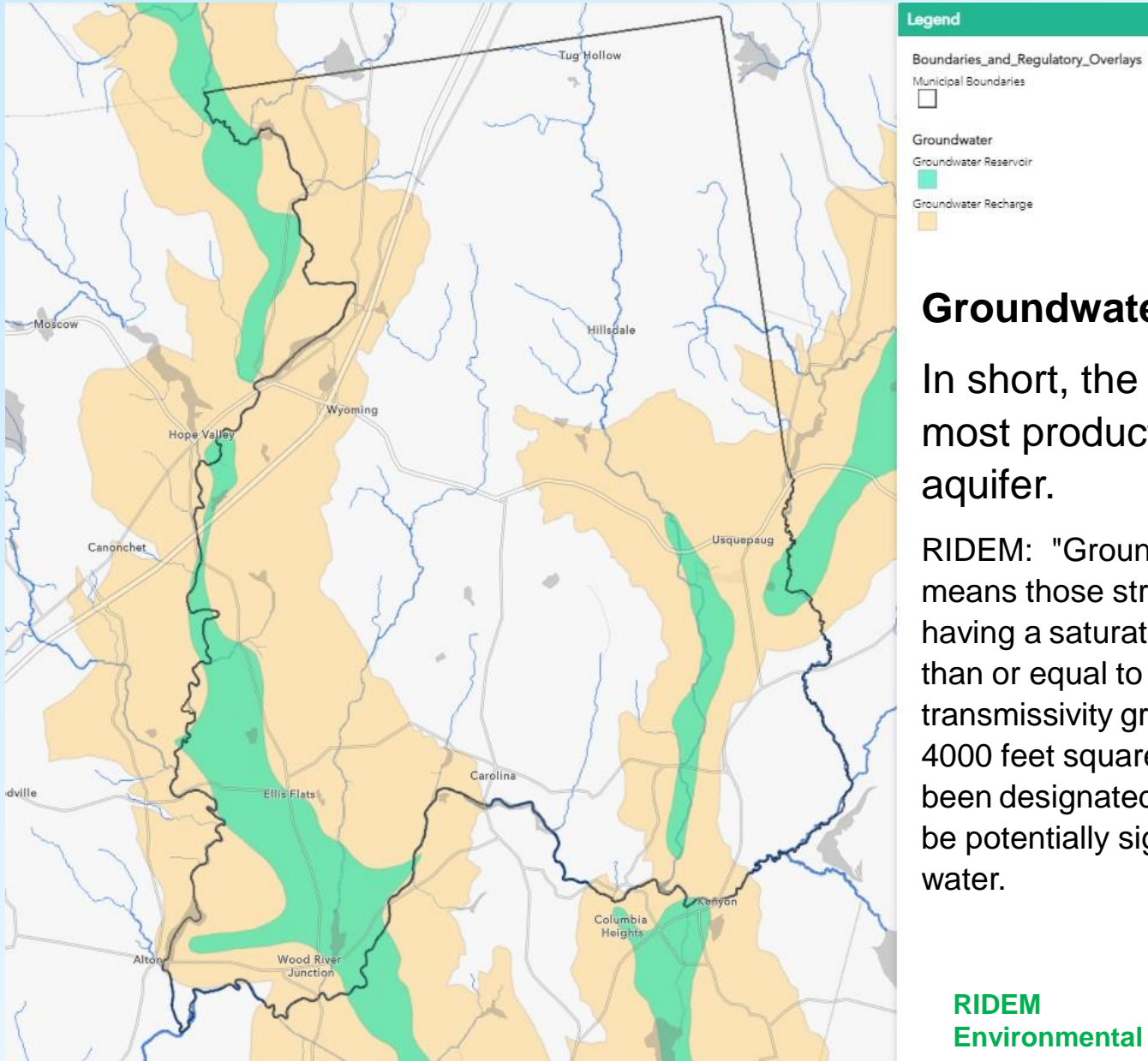
- Yield and direction of water flow highly unpredictable
- Depends on size, amount and orientation of fractures



Richmond Groundwater Recharge Areas



Richmond Groundwater Reservoirs



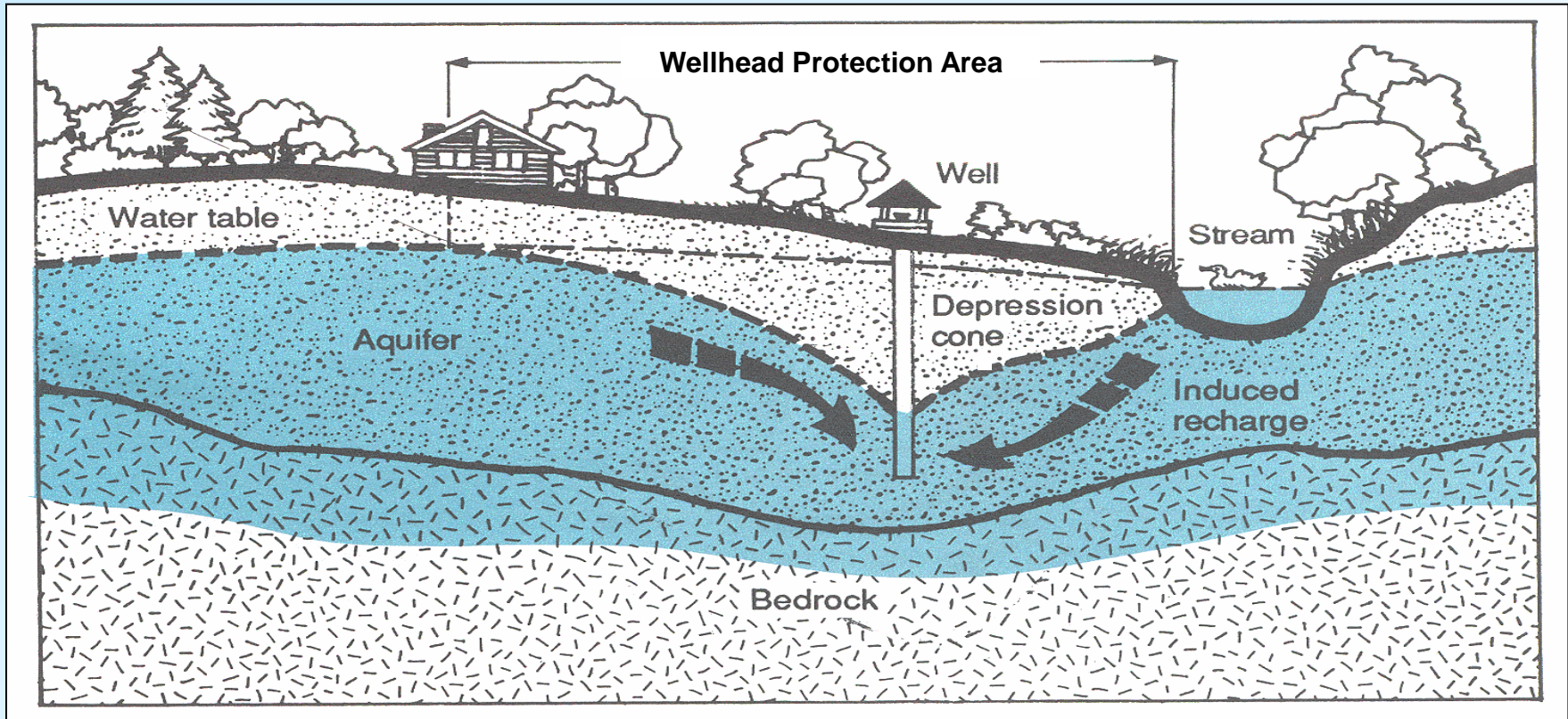
Groundwater Reservoir:

In short, the deepest and most productive portion of the aquifer.

RIDEM: "Groundwater reservoirs" means those stratified drift deposits having a saturated thickness greater than or equal to 40 feet and a transmissivity greater than or equal to 4000 feet squared per day which have been designated by the Director to be potentially significant sources of water.

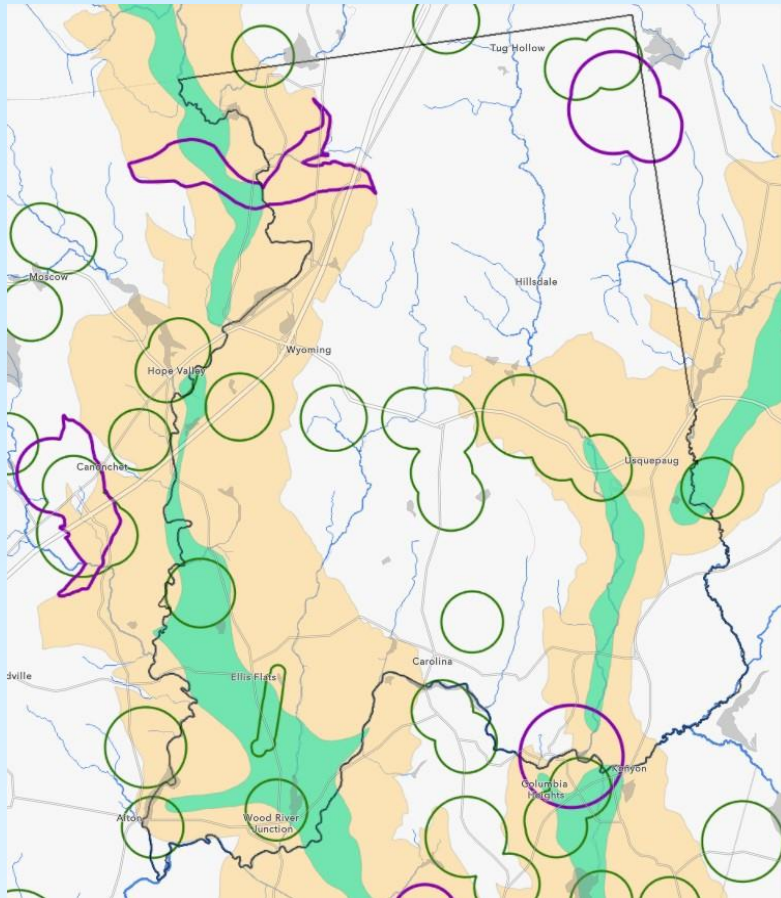
RIDEM
Environmental Resource Map

Wellhead Protection Area - The overlying land surface that contributes water to a pumping well.



- **Land use** in this area **directly** influences groundwater quality and quantity.
- Overpumping wells can result in low stream flow and impacts to fish, including loss of coldwater fish.

WHPAs are delineated for Public Water Systems



Public Water Systems

Have at least 15 connections or 25 people served, for at least 60 days per year.

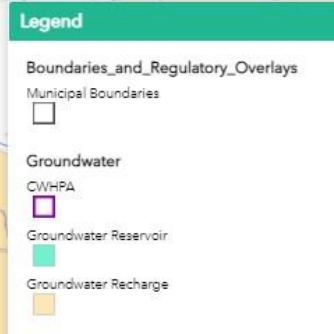
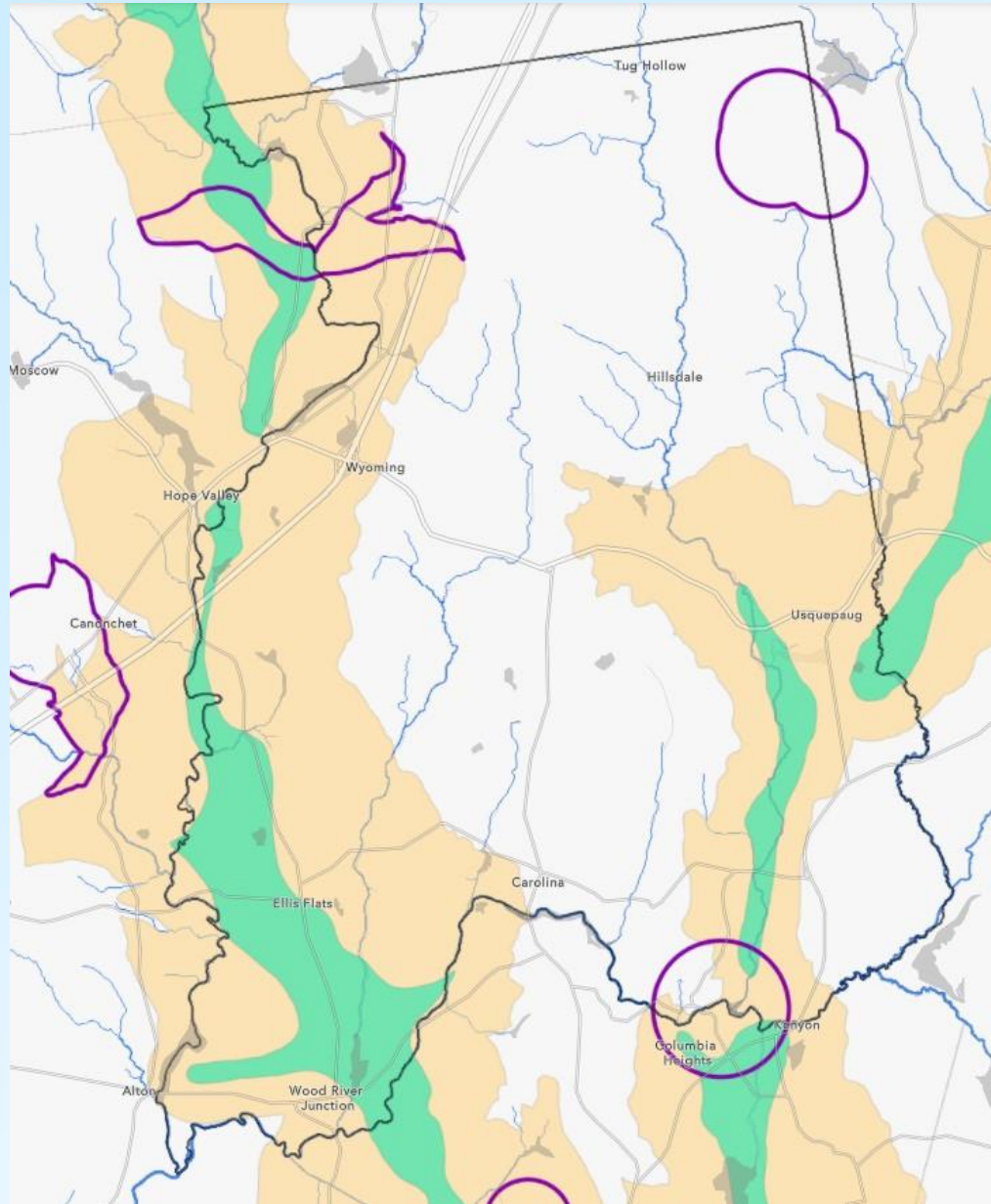
3 Types of Public Systems

- Community Systems
- Non-transient-non-community
- Transient-non-community

WHPA shape based on:

- Fixed radius based on pumping rate and other factors, or
- Refined groundwater flow modeling for Community wells

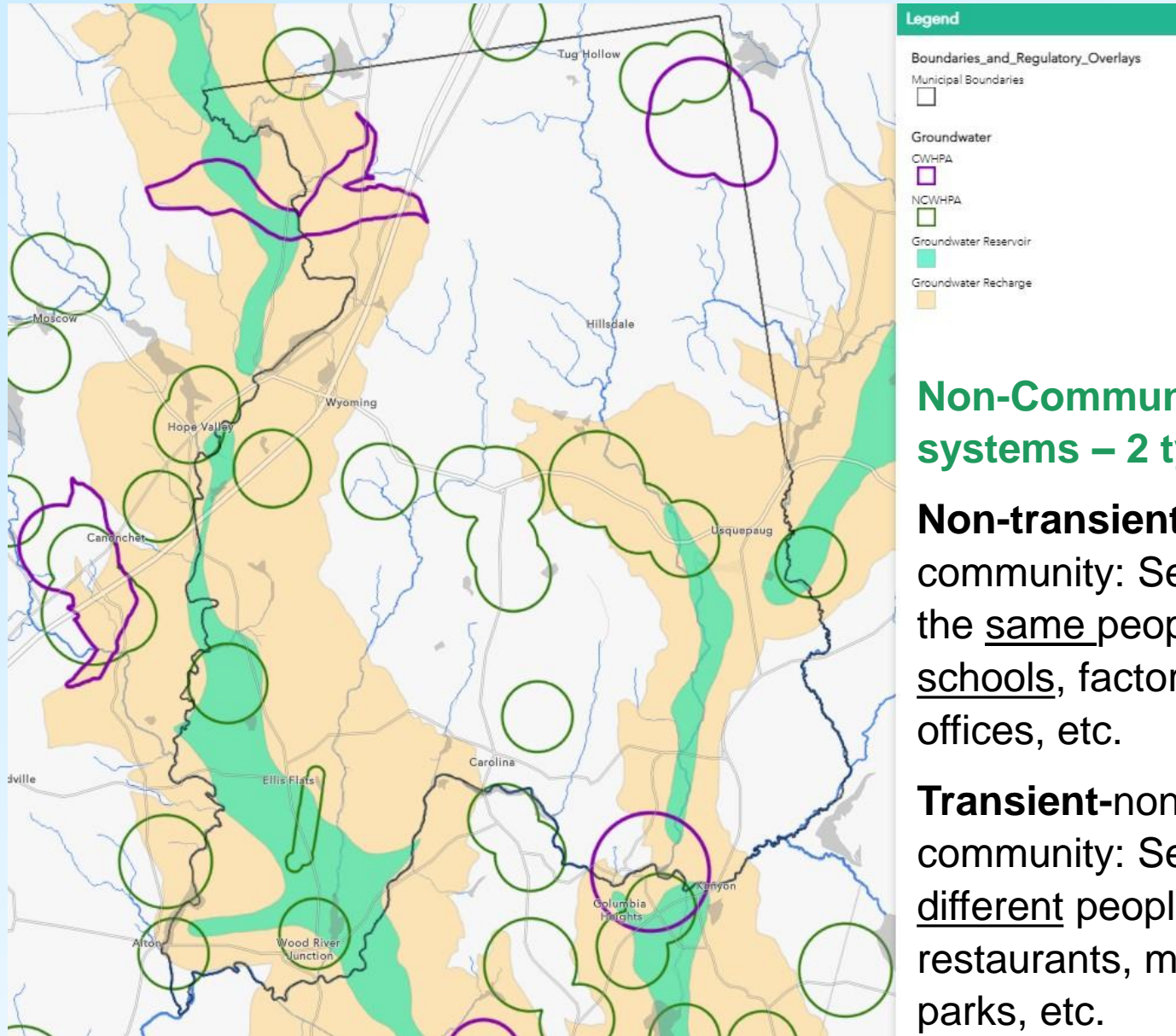
Richmond Community Wellhead Protection Areas



Community water systems

Serve houses, mobile home parks, apartment buildings, nursing homes, etc.

Richmond Non-Community Wellhead Protection Areas



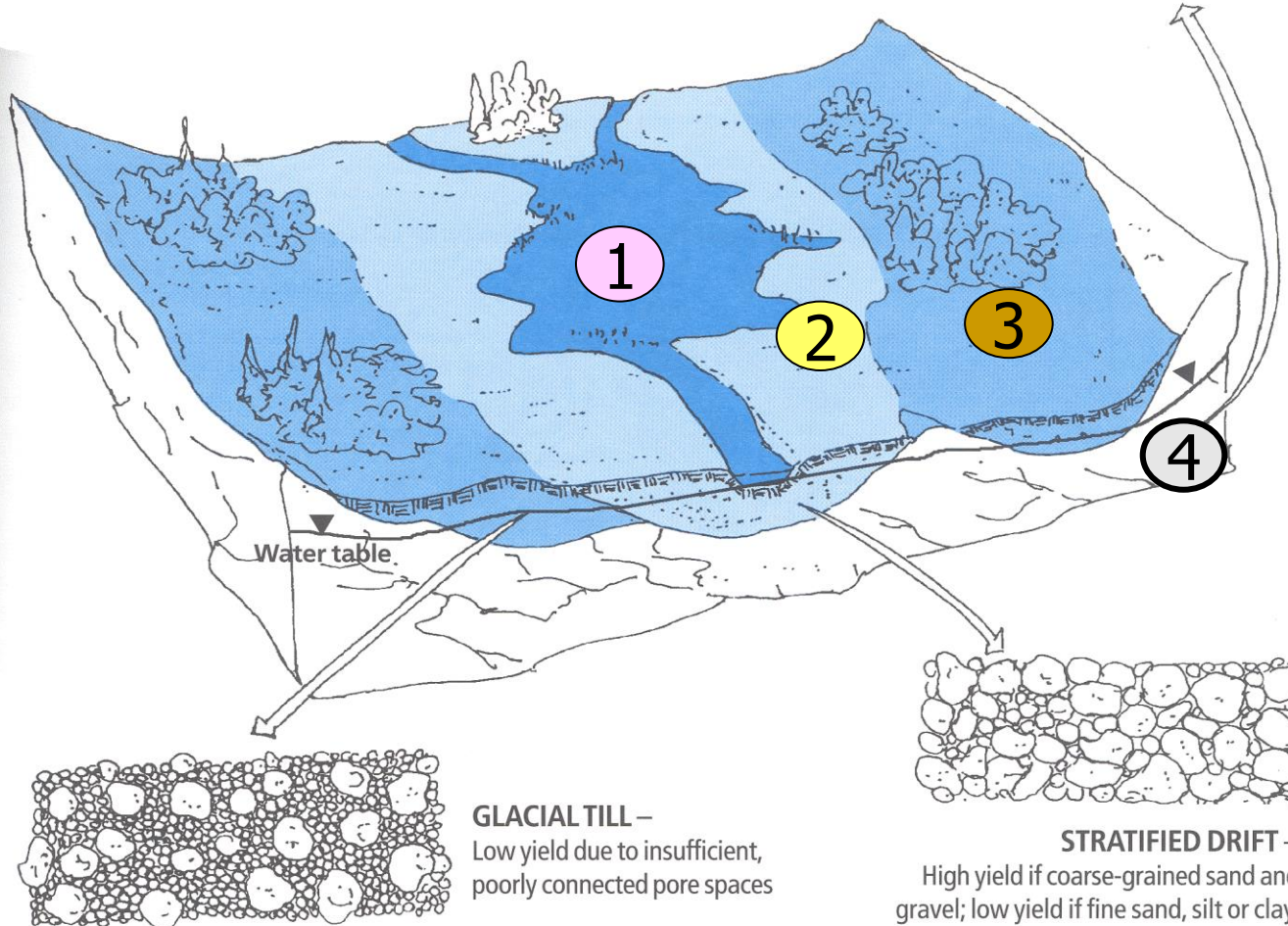
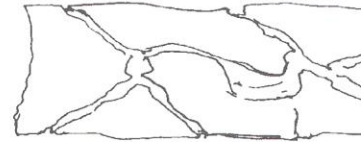
Non-Community water systems – 2 types:

Non-transient-non-community: Serves mostly the same people at schools, factories, and offices, etc.

Transient-non-community: Serves mostly different people at restaurants, motels and parks, etc.

Putting it all together - Aquifer Types and Recharge Zones

BEDROCK – High yield if large spaces or cracks; low yield if few interconnected cracks.



Aquifer Recharge areas include:

- 1 Groundwater reservoir, deepest sand and gravel, highest yield
- 2 Aquifer recharge area with other outwash deposits.
- 3 Adjacent less permeable glacial till areas contribute runoff to the aquifer.
- 4 Bedrock

Topics:

- Groundwater Resources
- Threats to Groundwater Quality
- State & Local Roles in Protection
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Threats to groundwater

Common contaminants and stresses in RI wells

- Petroleum products
- Organic solvents -15 to 30% of wells report VOC detects.
- Road salt
- Nitrate
- Pesticides
- Loss of recharge

Sources

- Leaking underground fuel tanks -*leading cause of new contamination.*
- Hazardous and industrial waste disposal sites.
- Spills & improper waste disposal.
- Septic systems.
- Fertilizer and pesticide application.
- Increased runoff and water withdrawals

Threats to surface water

Surface Water Contaminants

- **Bacteria**
- **Nutrients** –*Nitrogen in coastal waters, Phosphorus in fresh water*
- **Low oxygen**
- **Metals**

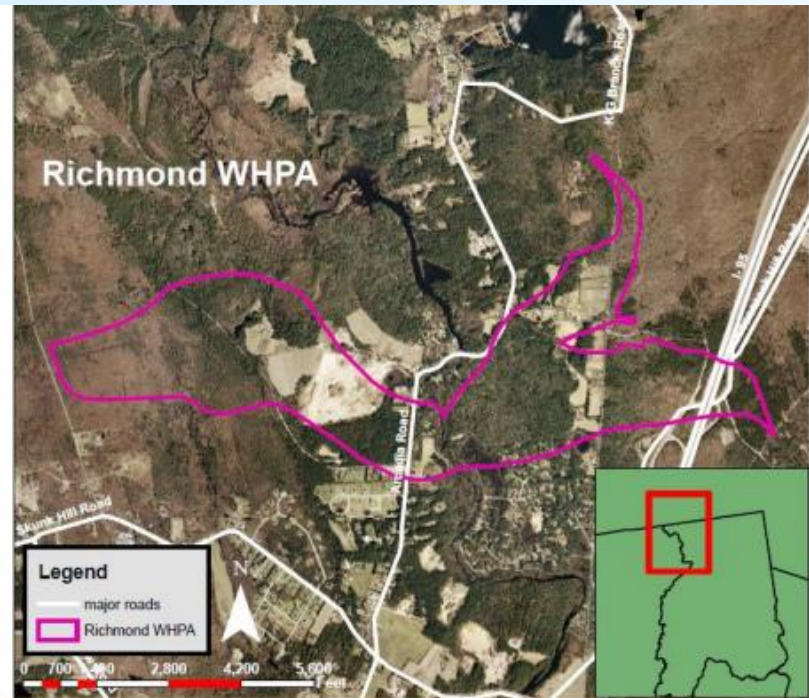
Sources

- Runoff
- Septic systems
- Fertilizers
- Water withdrawals and other changes in flow.

Look familiar?
All of these sources
are the same as
groundwater!

How safe are our public water supplies from contamination?

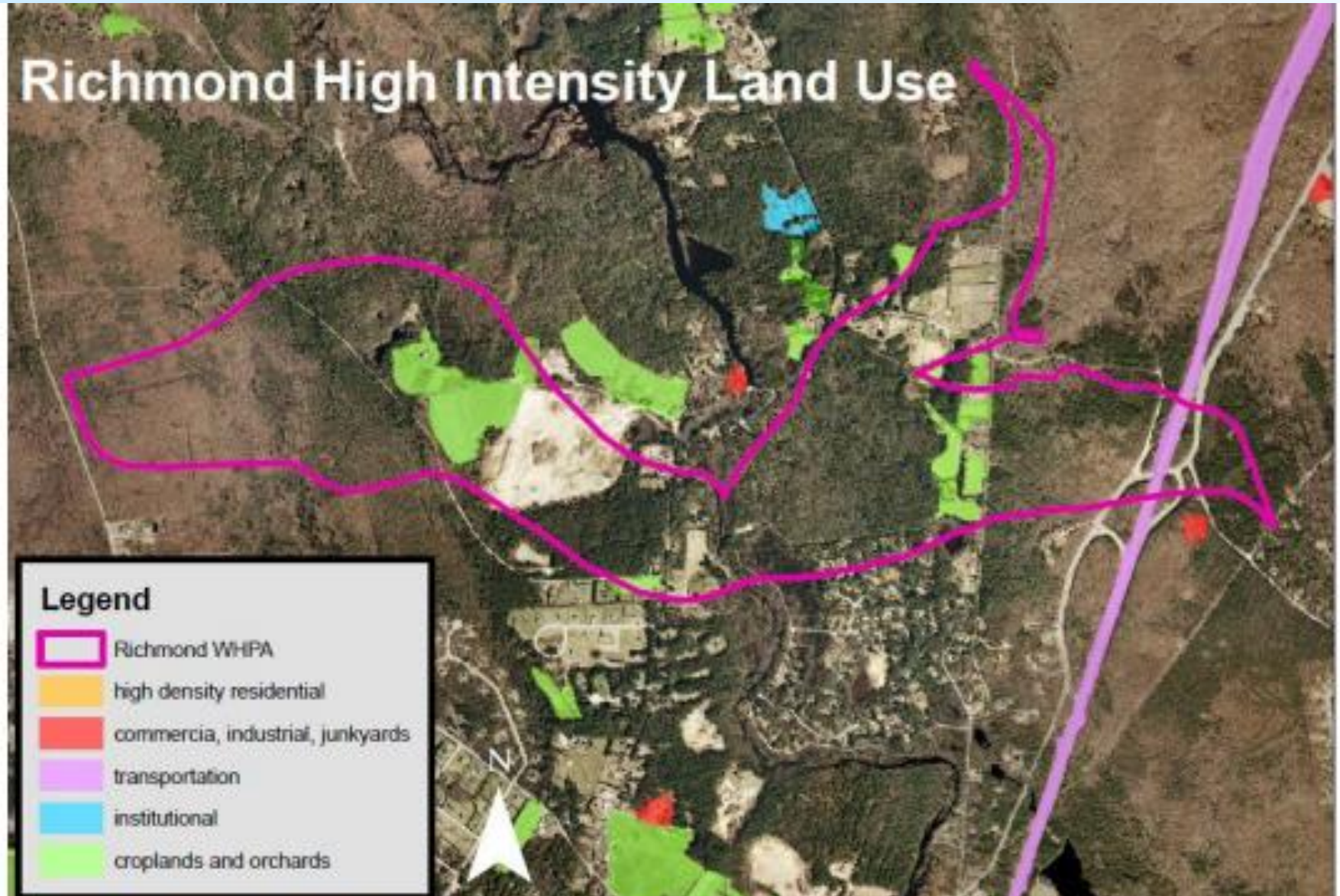
- Any water supply can become contaminated but WHPA land use is a key factor.



2008 Source Water Assessment, RICHMOND WELLHEAD PROTECTION AREA, URI Cooperative Extension, NEMO program.

http://cels.uri.edu/rinemo/assessments/2006-2010/RichmondSWAP_Final.pdf

High intensity land use increases pollution risk



Topics:

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- **State & Local Roles in Protection**
- **Discussion**

State & Local Roles in Protection

State:

- Identify critical water resources, set standards - DEM
- Regulate Pollution Sources – DEM
- Regulate Public Water Systems, private well testing at time of sale – Health Dept.

Municipalities:

- Local land use planning
- Enforcement of building codes
- Low Impact Development stormwater standards

Source and highly recommended reading for more information on local groundwater protection:

Ernie Panciera, RIDEM Groundwater Program, North Kingstown Groundwater Resources, April 16, 2015

<http://www.dem.ri.gov/programs/benviron/water/quality/prot/pdfs/nkground.pdf>

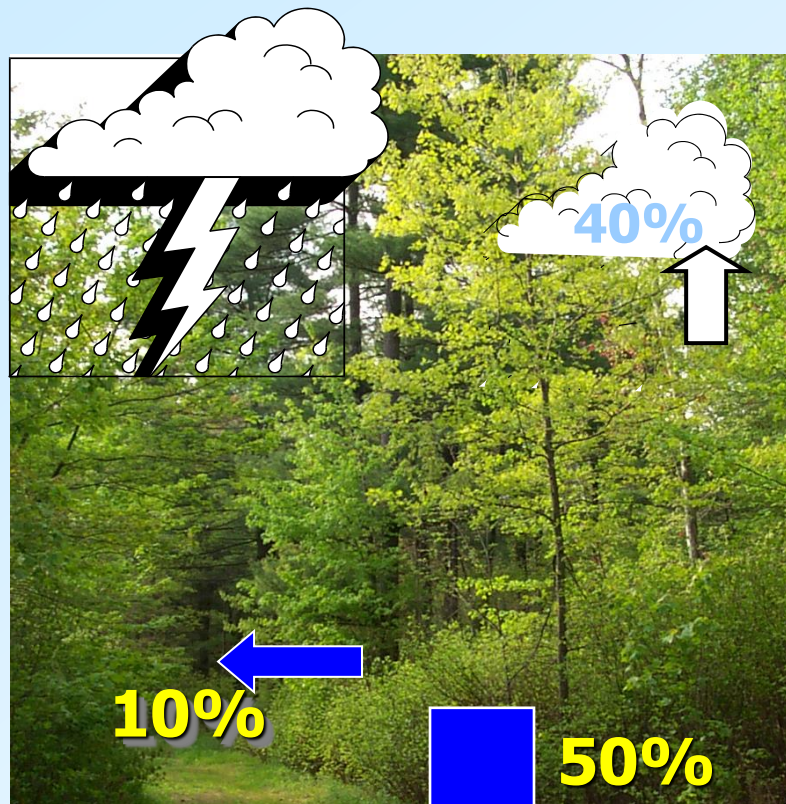
What about promoting growth in village centers within WHPAs?

Higher density can preserve surrounding open space but requires greater oversight OWTS, etc.

Actions NK has taken:

1. Formed Groundwater committee
2. Grwater Protection Plan and Overlay zone
3. 5 mg/l nitrate discharge limit for OWTS
4. Wastewater mgt ordinance with maintenance requirements, education and enforcement
5. Numerous and ongoing public education efforts,
- speaking in schools, festivals, newsletters with water bill .
6. Police enforcement of water bans.
7. Open space land acquisition.

LID Site Design and Stormwater Management Principles



Natural Landscape
✓ Low runoff
✓ High infiltration

Retain, Restore the Natural Landscape

...by promoting Infiltration

First steps:

Avoid disturbance of natural areas.

Reduce impervious cover.

Manage impervious area by small scale stormwater practices such as bioretention.

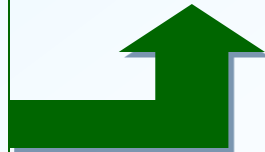
Minimize land disturbance in low-density areas through conservation development

Scenario 1 - Conventional large lot development.



Benefits \geq 50% open space protected, farmland protected, wetland buffers increased, forest unfragmented, pedestrian friendly-growth.

Scenario 2 – New development sited on small lots in suitable areas.



Low Impact Development stormwater mgt

A local responsibility

–DEM relies on towns to address LID site design through the Master Plan Stage.

- Reviews the engineering plans at Preliminary, when it is too late to make major changes.

LID Resources – LID basics, LID municipal assessment checklist, and short webinar:

<http://snepnetwork.org/2020/05/06/got-lid-a-municipal-self-assessment-tool-for-rhode-island-communities/>

<https://web.uri.edu/nemo/lid-and-gi/low-impact-development-green-infrastructure/>

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Thank you!

Contacts:

**Lorraine Joubert Tel: 874-2138 ljoubert@uri.edu
Lisa DeProspero Philo Tel: 874-5687 lphilo@mail.uri.edu
University of Rhode Island, Natural Resources Science**

