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Water Resources  
Consultant



# STORMWATER MANAGEMENT



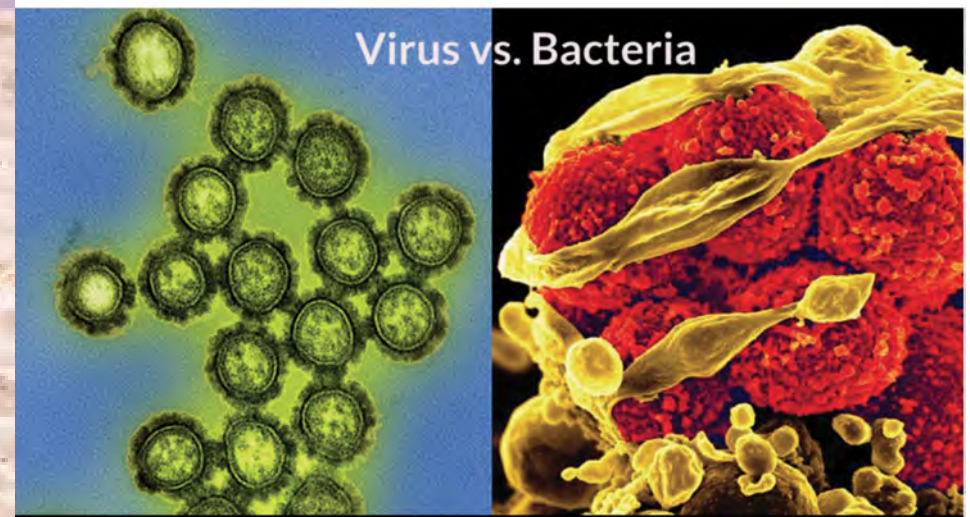
# Summary of Stormwater Runoff Pollutant Effects

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- Sediment
- Thermal Stress
- Nutrients
- Oxygen-Demanding Organics
- Toxic Substances
- Pathogens
- Stream Discharge







# Atmospheric Deposition

Pollutants carried away by wind and traffic

Pollutants emitted from motor vehicles

Runoff from adjacent lands

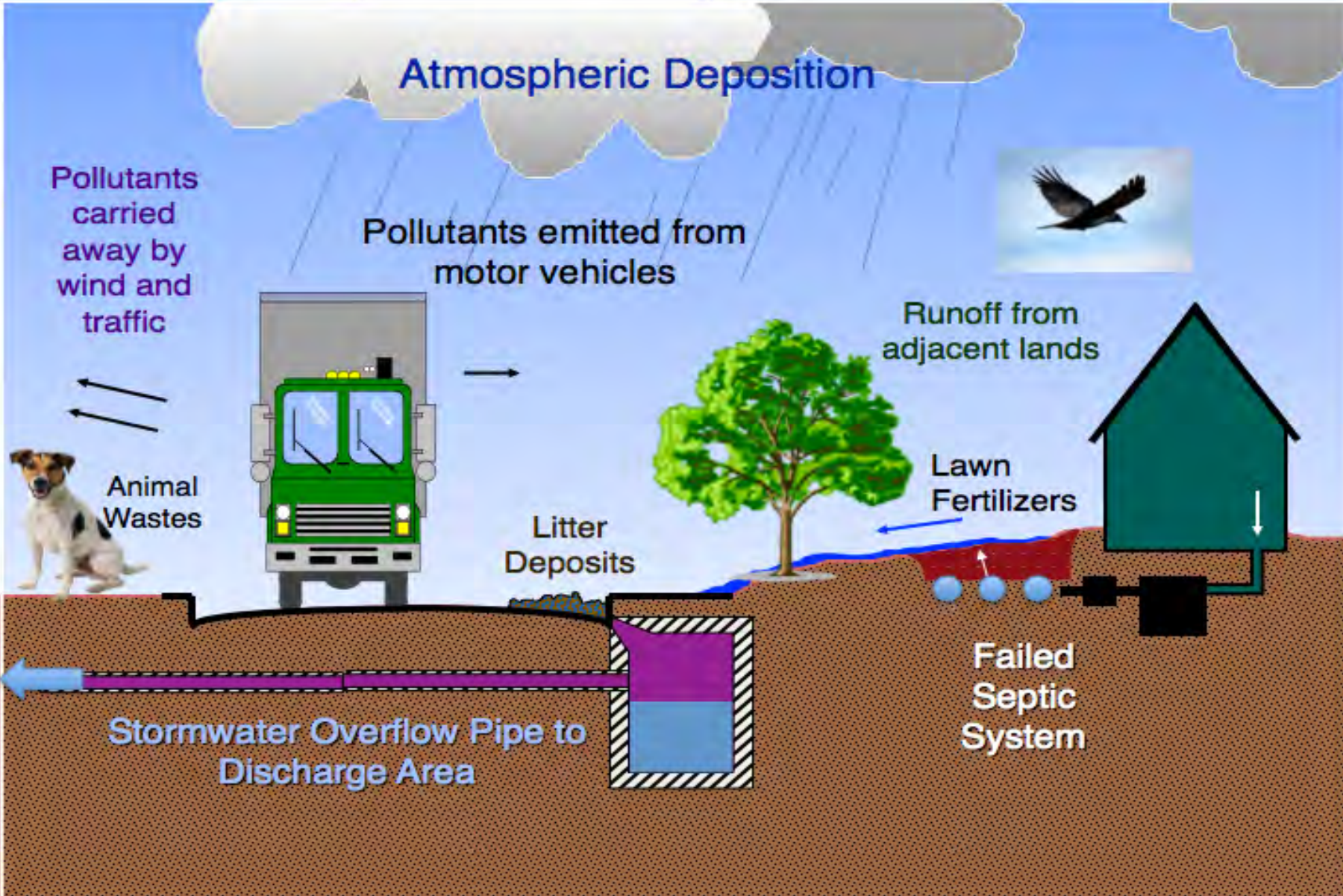
Animal Wastes

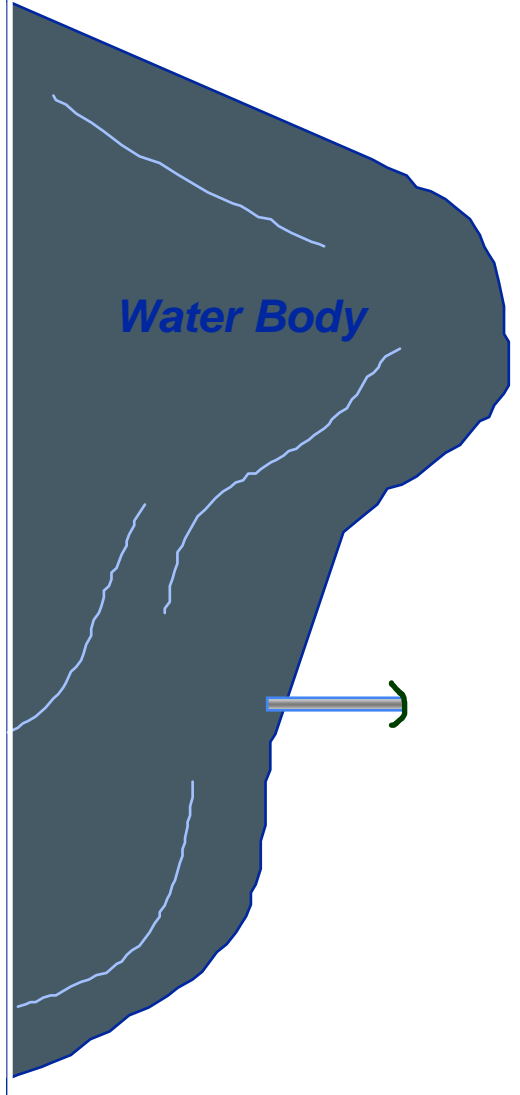
Litter Deposits

Lawn Fertilizers

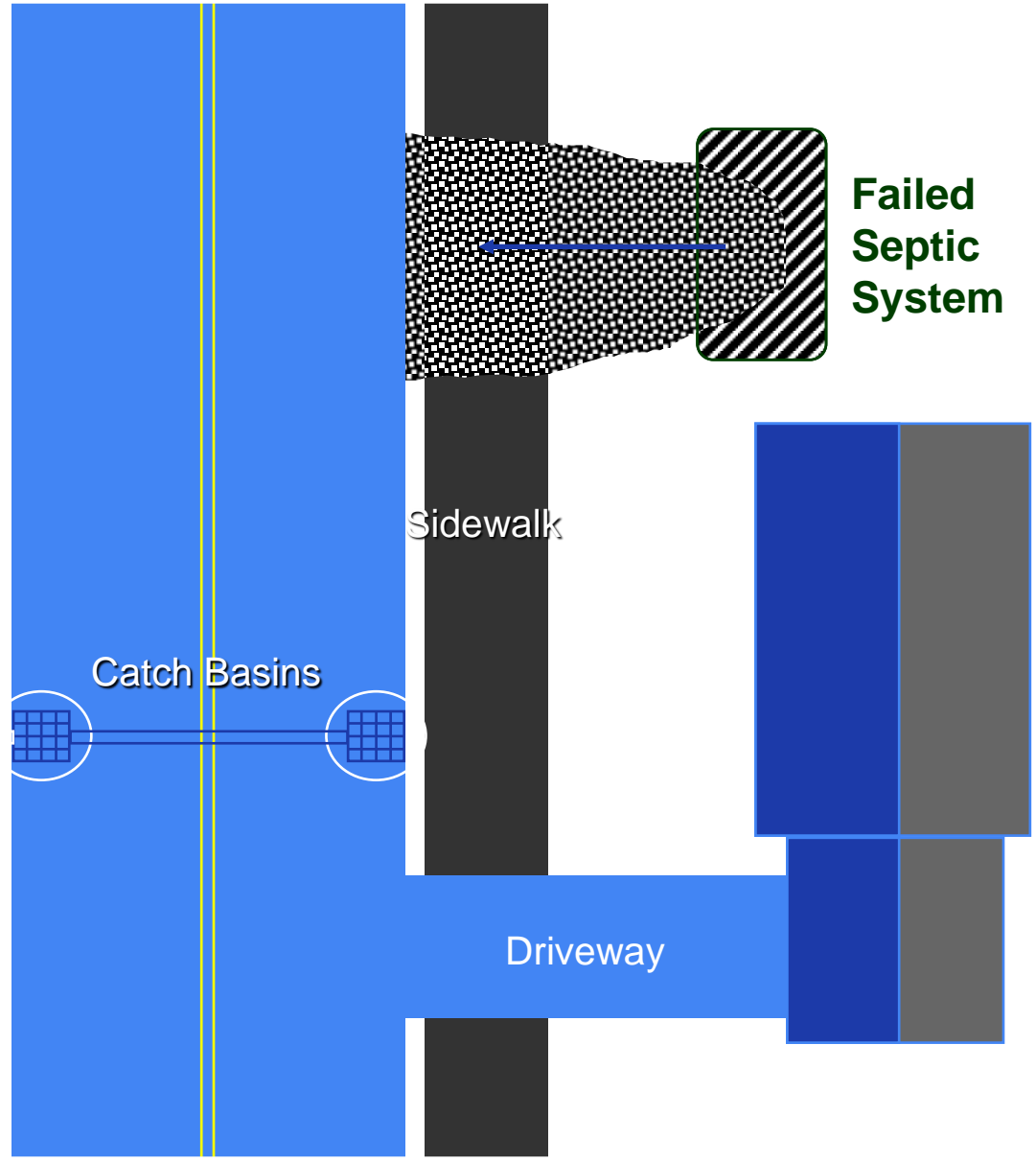
Failed Septic System

Stormwater Overflow Pipe to Discharge Area





Water Body

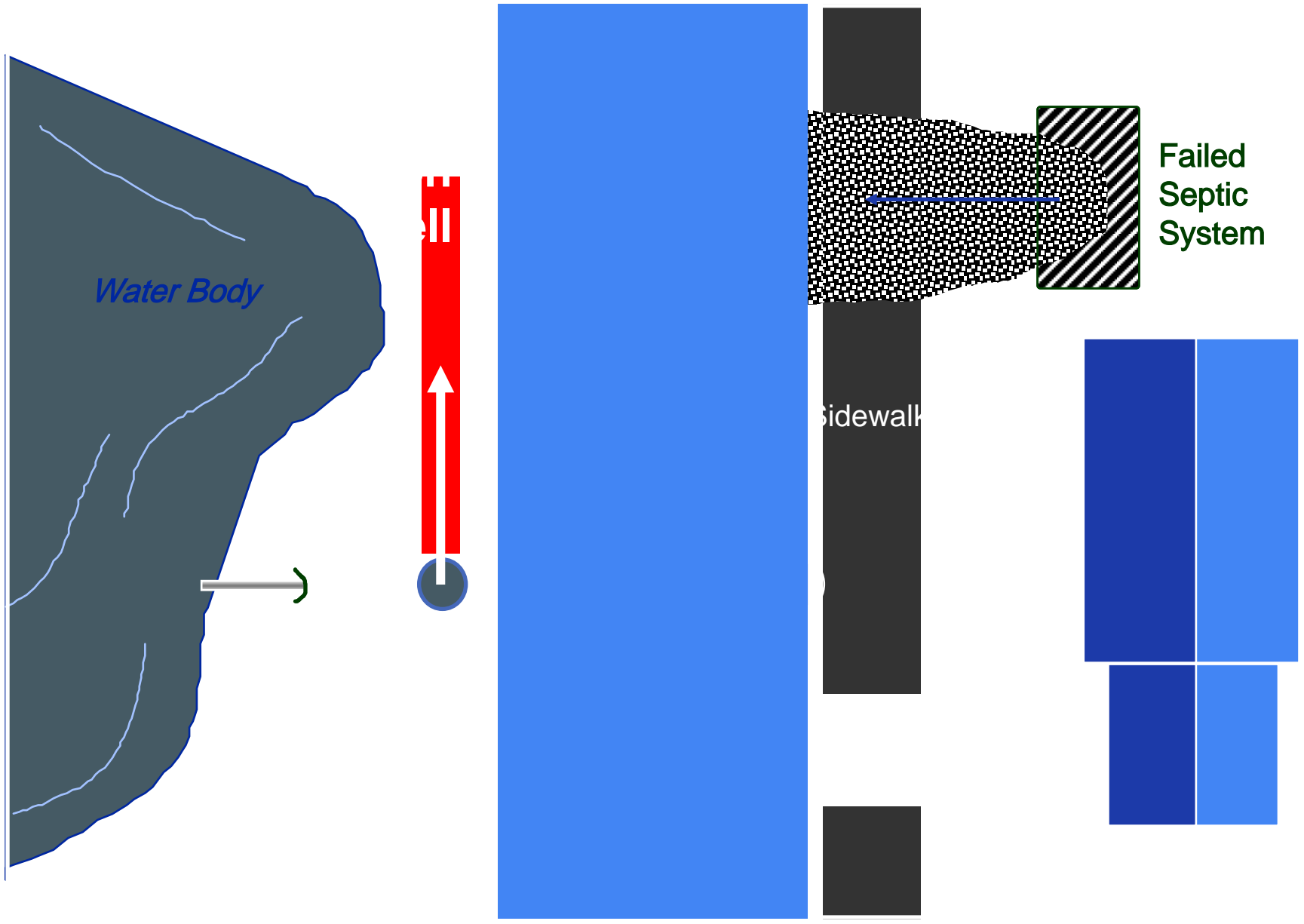


Catch Basins

Sidewalk

Driveway

Failed Septic System





# Nitrogen & Pathogen Sources that contribute to stormwater

Can we control them at their source?



# PooPrints™

## Swab Instructions



D305-3508

### BEFORE YOU BEGIN

Ensure all Resident Information has been entered into the DNA World Pet Registry before mailing a swab to the lab. Please collect DNA from one dog at a time. If you have multiple pets, separate them one hour prior to swabbing and keep them from eating, using shared toys, or shared water bowls during this time.

*Please read all instructions and Helpful Hints before you begin to ensure a successful collection.*

### SWAB YOUR PET

A) DNA is found in the cheek cells, not in the saliva of the dog. To ensure you collect these cells, and not just saliva, the swab must be inserted between the cheek and the gum of the dog. The upper back corner of the cheek is a good place to start.



B) Using one swab at a time, rub the swab in a circular motion between the dog's gum and cheek for about 10 seconds. Use your hand to gently press the outside of the cheek to ensure good contact with cheek cells. Repeat with second swab.



C) Allow the swabs to air-dry for 15-30 minutes or more, as some dogs produce more drool than others. Once completely dry, return the swabs to the paper sleeve and label the sleeve with the pet's name.



#### Helpful Hints

1. DNA is found in cheek cells, not saliva. Ensure swabs are used between the dog's cheek and gum. Swabs should appear slightly discolored after collecting a quality sample.
2. If you don't think you've collected enough cheek cells, repeat with the same swab in the same dog's cheek. Do not use the swab on a different dog.
3. Swabs must be completely dry before placing in the paper sleeve. If swabs are placed back in their paper sleeves still damp, bacteria may grow on the swabs, destroying the DNA.
4. Some dogs' mouths are wetter and some are dryer than others. Please allow for extra swabbing and/or drying time when necessary.
5. If your dog's mouth is too dry, offer a drink of water or dampen the swab tip prior to collection.
6. It is suggested that residents swab their own pets, assisted by community management, a PooPrints Distributor or other trained staff member.

**Next Steps:** Ensure the Resident Information has been entered into the DNA World Pet Registry before mailing a swab to the lab. Give this Thank You card to your resident.

*Don't forget the green tag!*



The Community Admin will mail the dry swabs with the Resident Information Card to BioPet Vet Lab for processing.

# PooPrints™





The Solution for Responsible Dog Owners



## Thank You!

Thank you for **going green** and registering your dog with the **PooPrints** eco-friendly pet waste management program!

Enjoy these features FREE with your pet registration:

-  Discounts and coupons for pet supplies!
-  Print a unique **DNA Profile** color map\*
-  Secure, **online pet record** storage
-  **Pet Lost-and-Found** using DNA

### DNA Collection Kit

Includes materials to register one dog:

#### Instructions (see reverse side)

- Resident Information Card
- Pet Collar ID Tag
- Return Envelope
- 2 Sterile Swabs

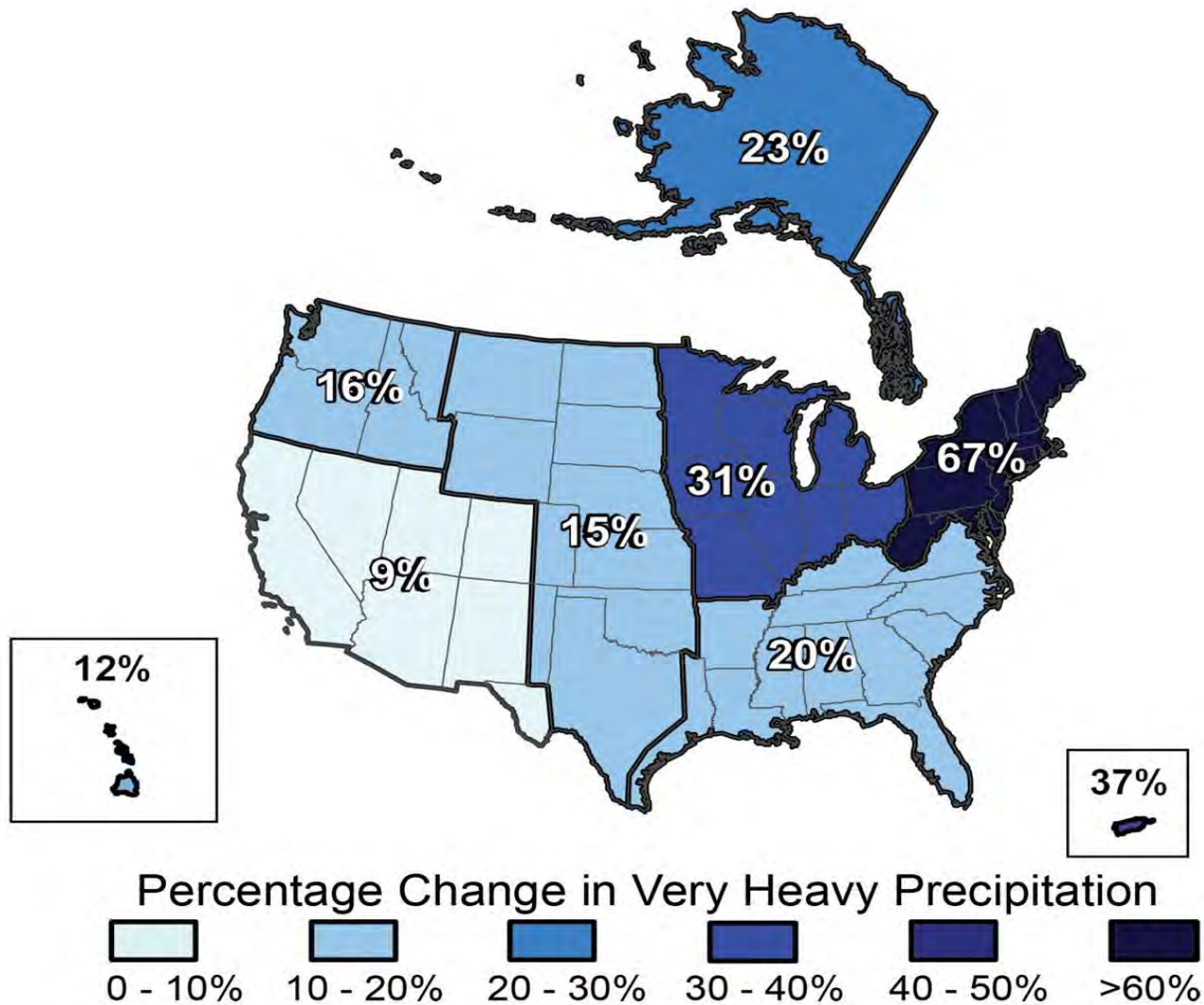


\*Please Note: The DNA Profile color map is a colored representation of your pet's unique gene makeup. This does not provide any breed-specific, mixed breed, or health information about your pet.



865.246.0514 • [www.biopetvetlab.com](http://www.biopetvetlab.com)  
6701 Baum Drive, Suite 110  
Knoxville, Tennessee 37919

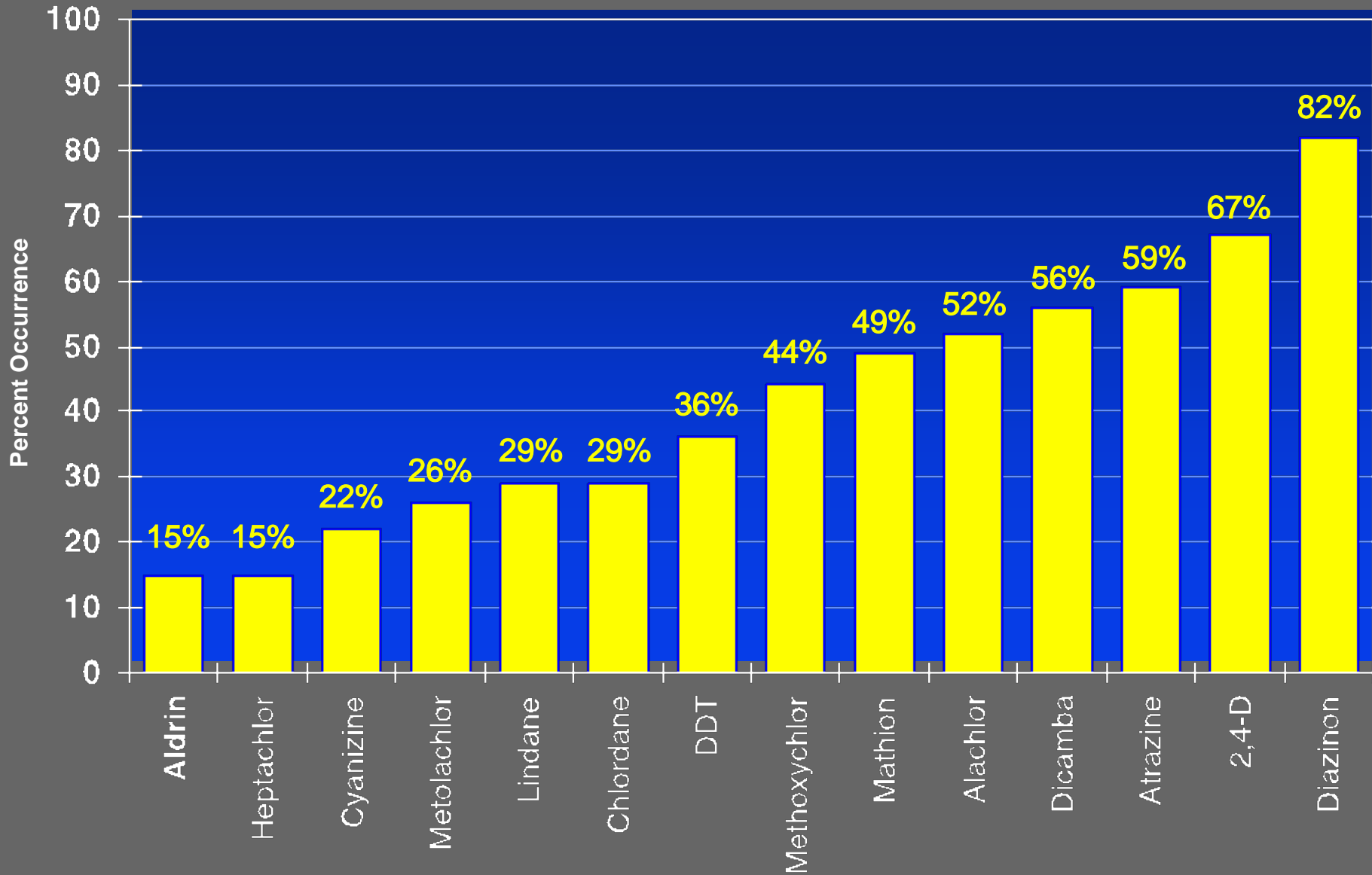




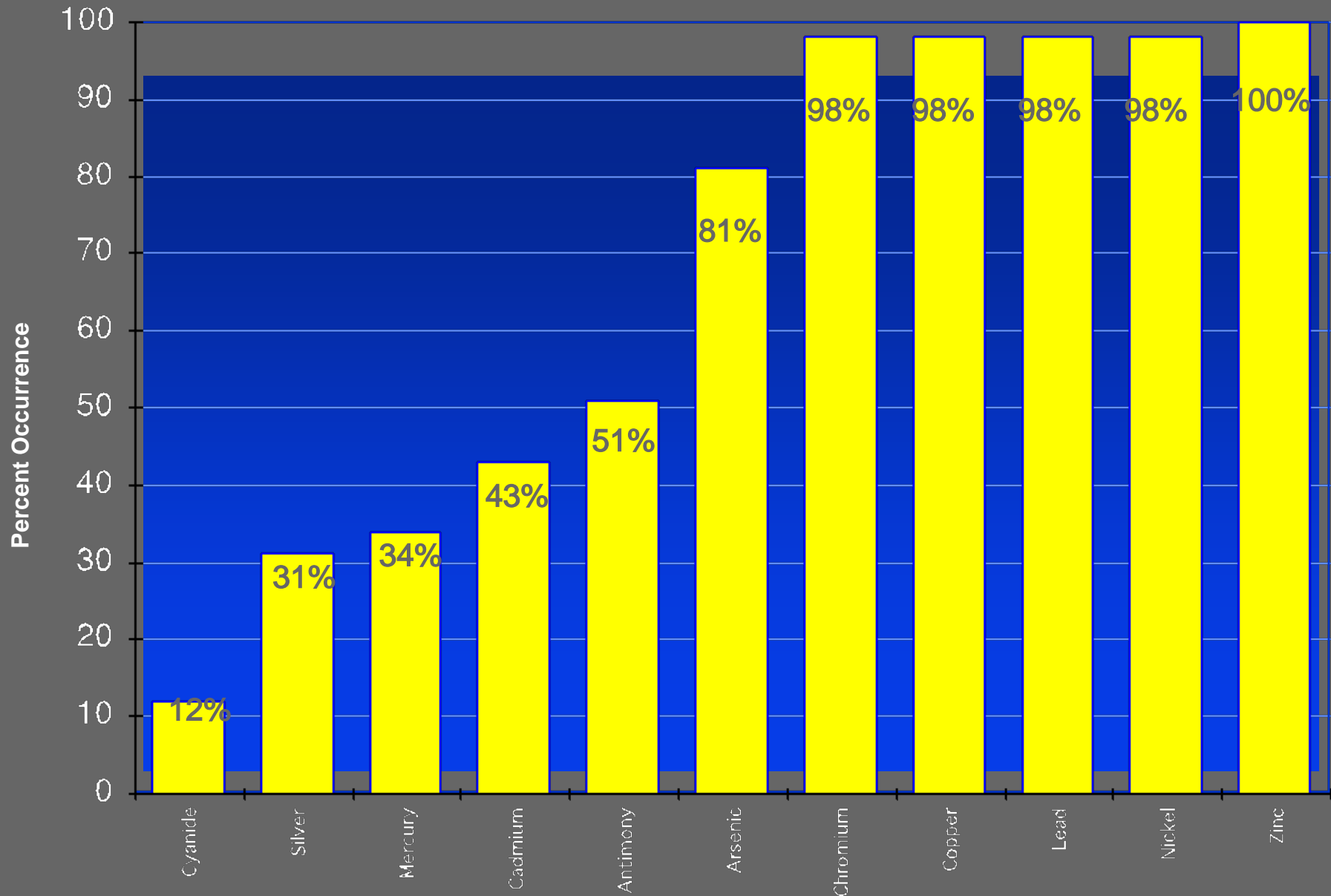
Updated from Groisman *et al.*<sup>113</sup>

The map shows the percentage increases in very heavy precipitation (defined as the heaviest 1 percent of all events) from 1958 to 2007 for each region. There are clear trends toward more very heavy precipitation for the nation as a whole, and particularly in the Northeast and Midwest.

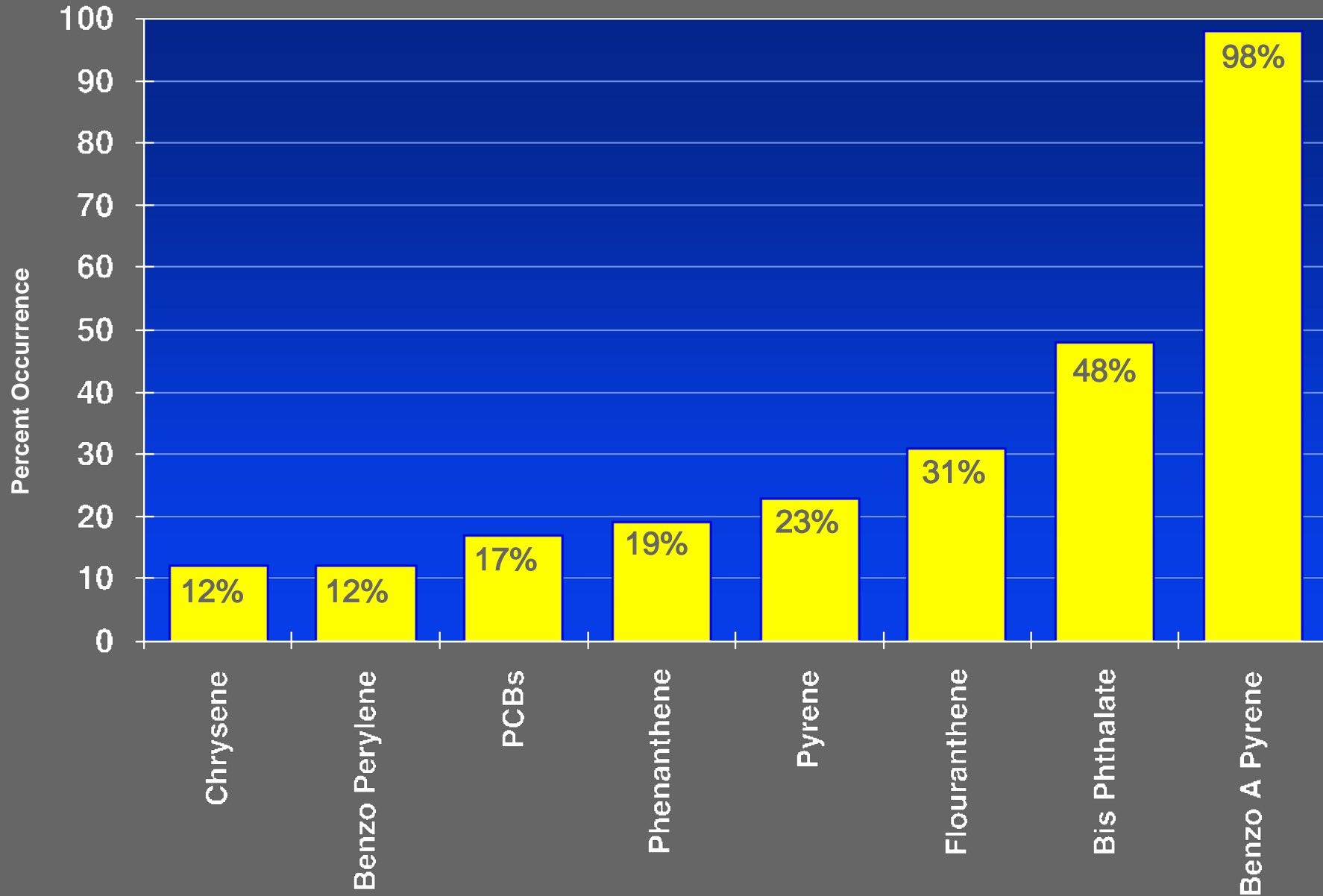
# Pollutants in Urban Runoff - Pesticides



# Pollutants in Urban Runoff - Metals & Inorganics



# Pollutants in Urban Runoff - PAHs, PCBs & Plasticizer



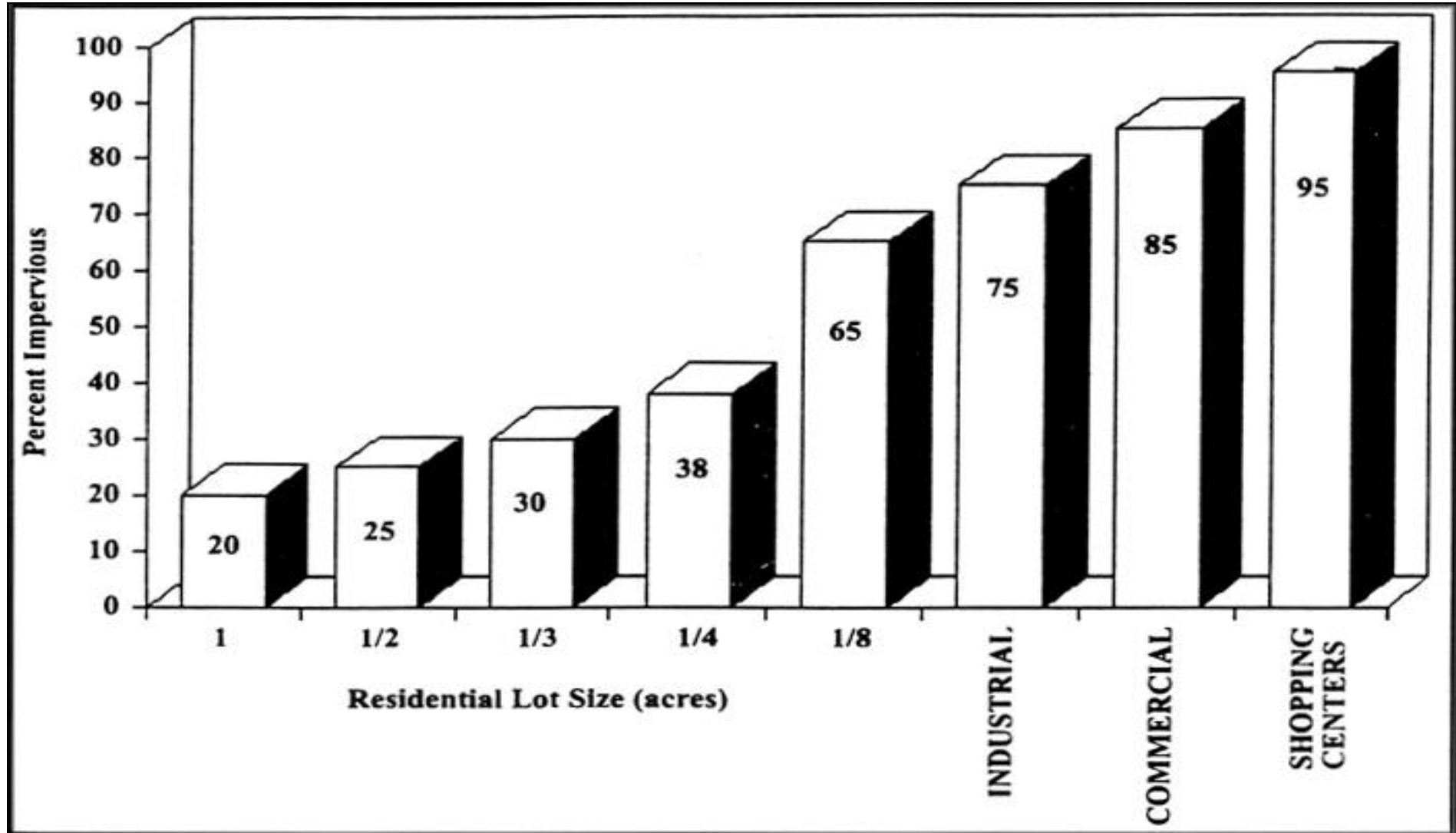






**Reduce Impervious Surfaces**

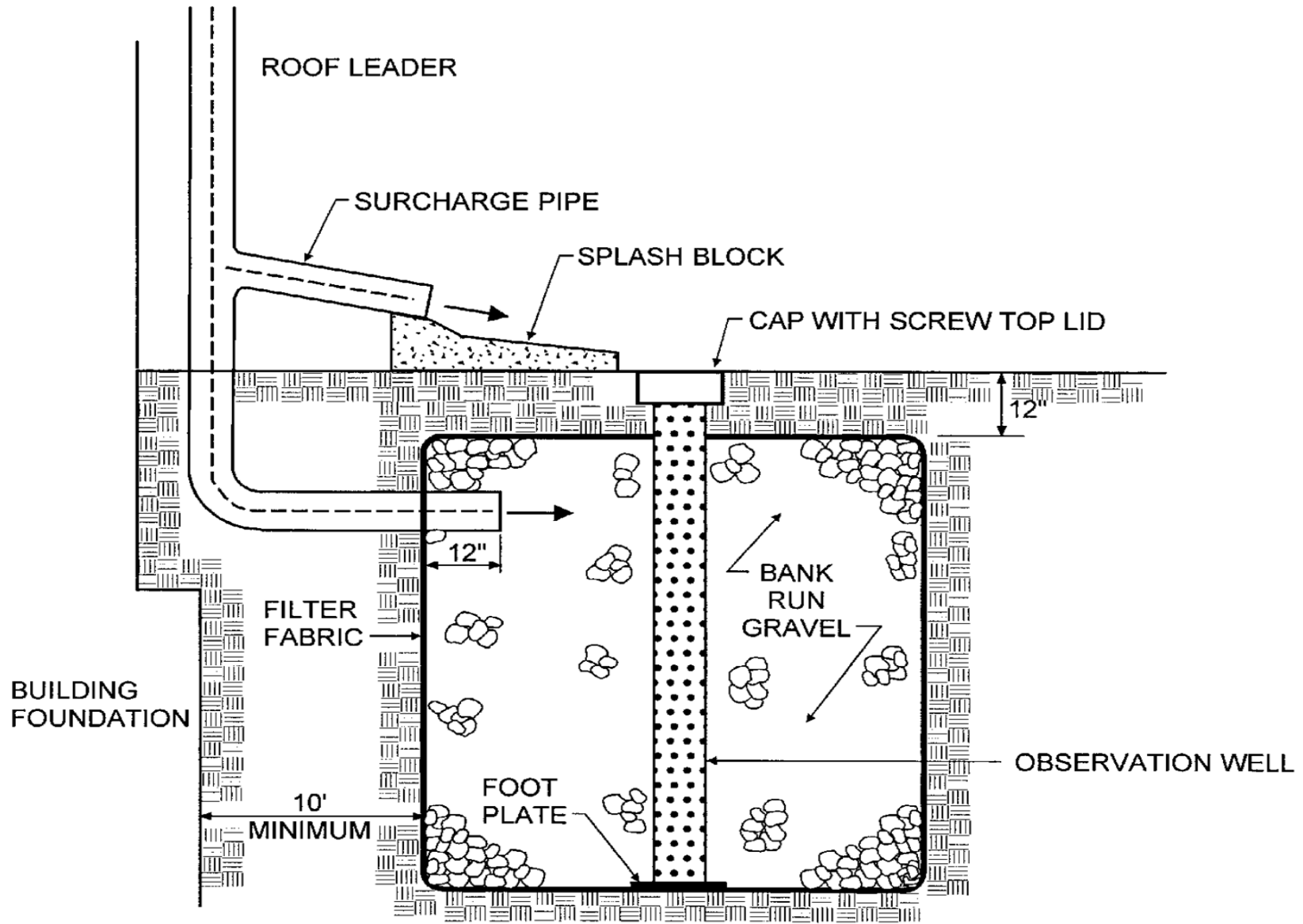
# Impervious Area and Types of Development





connected  
impervious surfaces  
increase volumes and  
rates of stormwater  
runoff



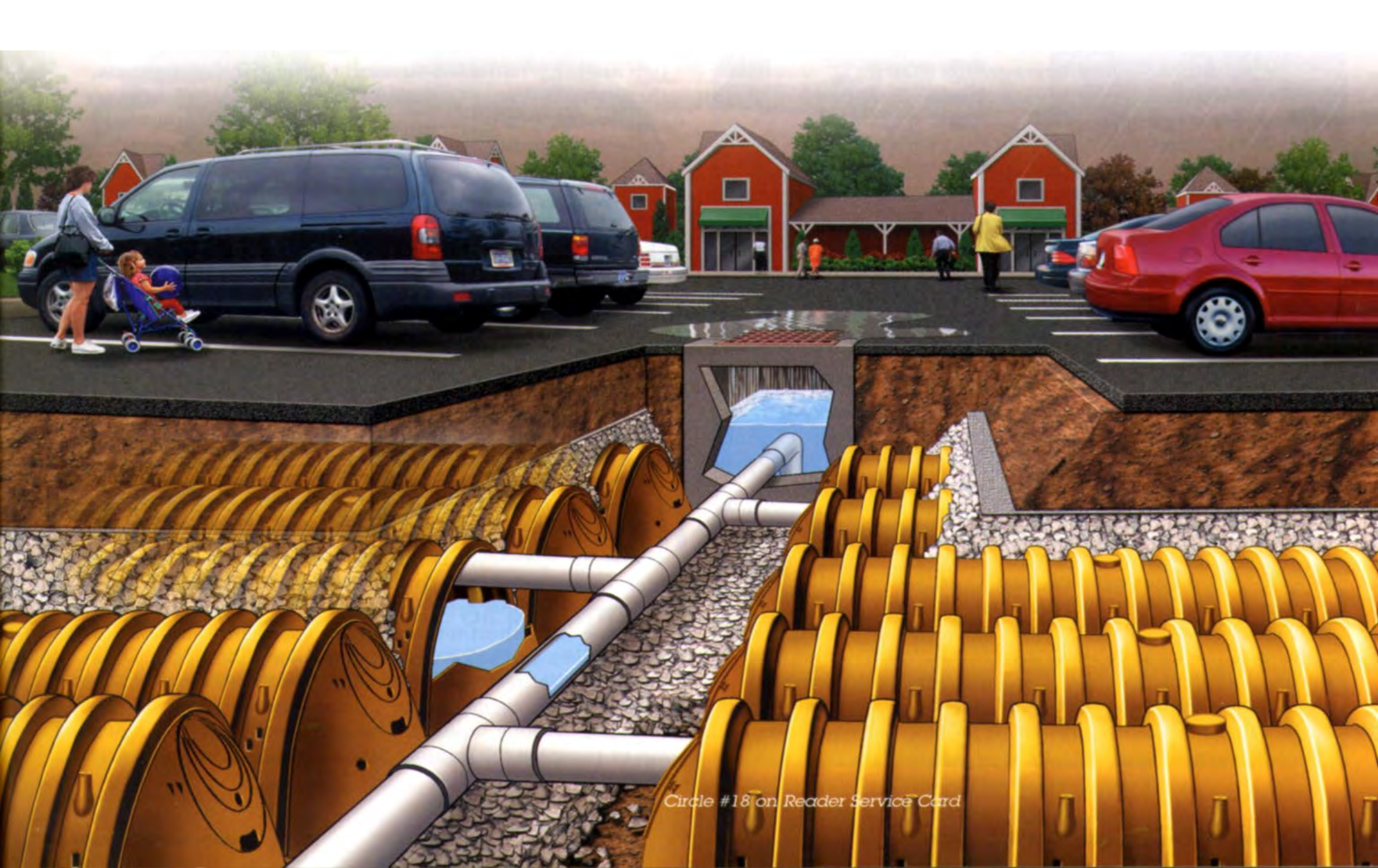


# Dry Well Infiltration of Roof Runoff



Disconnection of Rooftop  
Runoff to Vegetated Swale





Circle #18 on Reader Service Card

# Permeable Pavement



# Vegetated Swales

## Conveyance, Treatment, Infiltration

- Roadside swales (“country drainage”) for lower density and small-scale projects
- For small parking lots
- Mild side slopes and flat longitudinal slopes
- Provides area for snow storage & snowmelt treatment





# Bioretention Applications

- Parking lot islands
- Median strips
- Residential lots
- Office parks





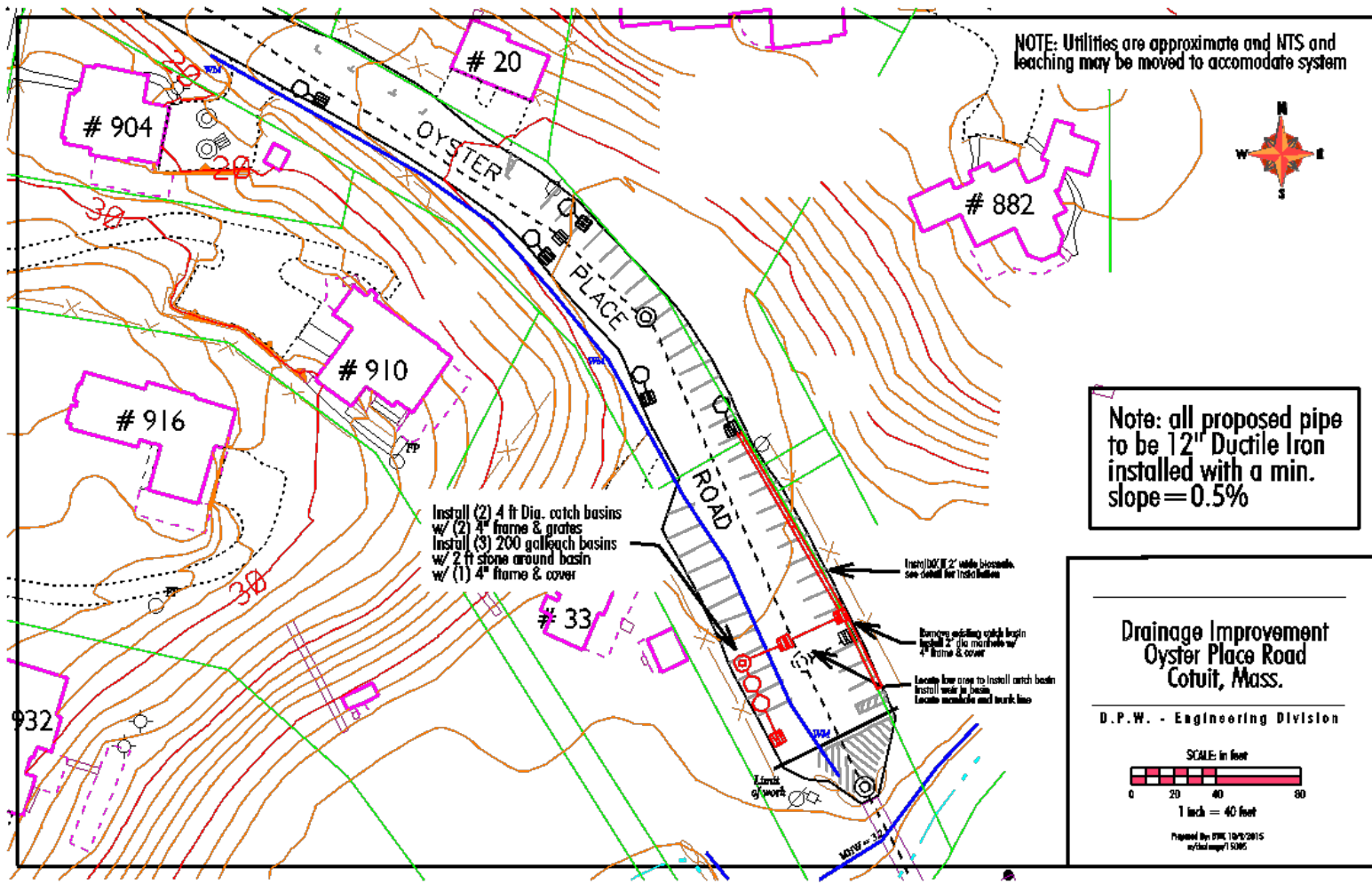




# Case Study: Bioretention - Cotuit Town Dock



Cotuit Town Dock Swales ~ Mary Kocol



NOTE: Utilities are approximate and NTS and leaching may be moved to accommodate system

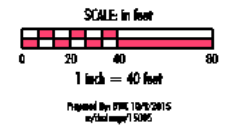


Note: all proposed pipe to be 12" Ductile Iron installed with a min. slope = 0.5%

Install (2) 4 ft Dia. catch basins w/ (2) 4" frame & grates  
 Install (3) 200 gallon catch basins w/ 2 ft stone around basin w/ (1) 4" frame & cover

- Install 100' x 2' wide biosand. see detail for installation
- Remove existing catch basin install 2' dia manhole w/ 4" frame & cover
- Locally low slope to install catch basin install seal in basin locate manhole and mark line

**Drainage Improvement  
 Oyster Place Road  
 Cotuit, Mass.**  
 D.P.W. - Engineering Division















RESERVED PARKING  
FOR THE DISABLED  
BY THE STATE OF CALIFORNIA  
SECTION 50809.5, VEHICLE REGISTRATION  
AND SALES TAX LAWS

### CITY OF HAWAII - RAIN GARDEN



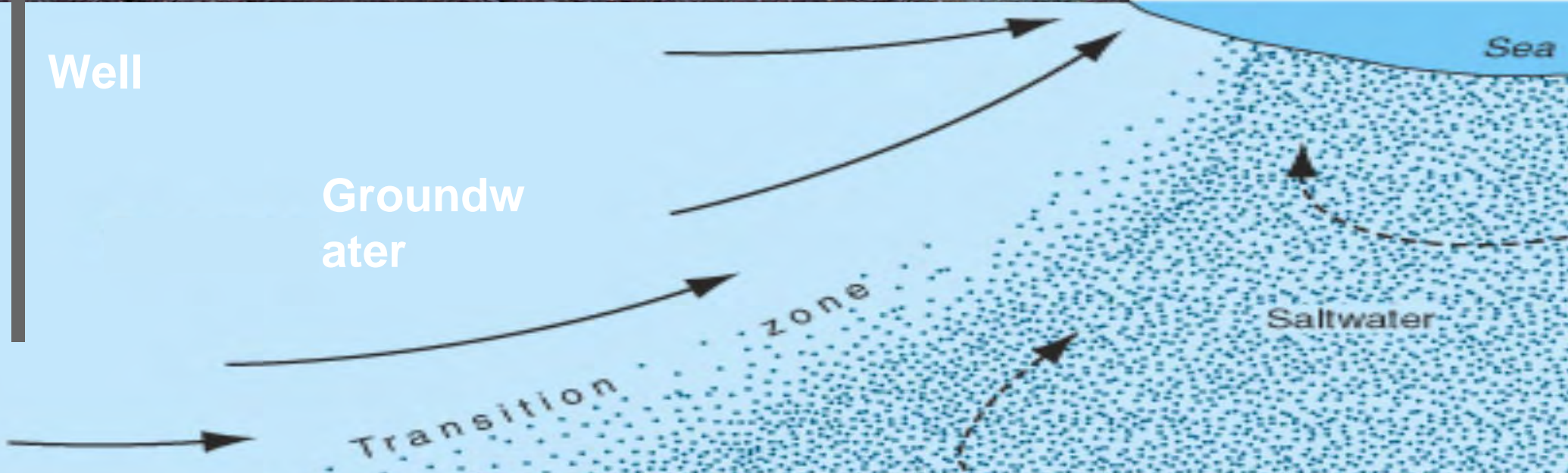
This linear strip of vegetation is an example of "green infrastructure" that is designed to help reduce and protect Cayan Bay. This bio-retention system, also known as a "rain garden," intercepts stormwater runoff that flows across the parking area during rain events and treats it using a combination of physical filtration through its soils, uptake into the plants, and microbial breakdown in the treatment with a rain-powered water pump. This provides for multiple passes through the treatment system and irrigation for the plants.

These types of treatment systems have been demonstrated to be effective in removing pollutants (nitrogen and iron), nutrients (nitrogen and phosphorus), and hydrocarbons (petroleum products) that are commonly found in stormwater runoff. Additional information can be found at [www.3bays.org](http://www.3bays.org).



**THREE BAYS**  
TELECOMMUNICATIONS, INC.





# Stormwater Practices for Smaller Projects (Residential)



Infiltration of Roof  
Runoff

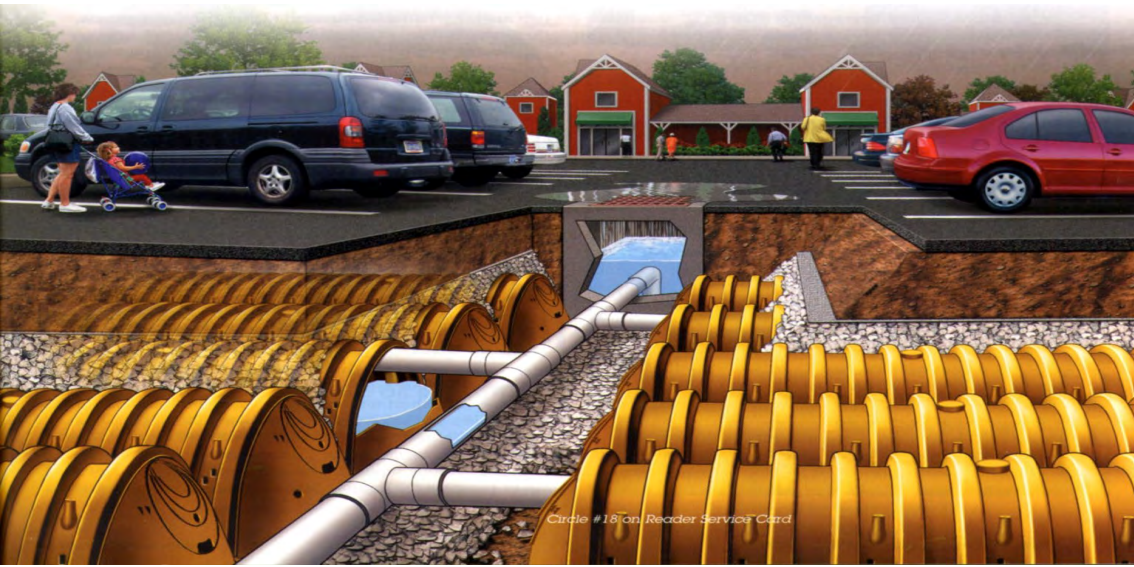


Rain Garden



Rain Barrel – Use  
for Irrigation

# Stormwater Practices for Larger Projects (Businesses, Roads)



Infiltration  
(Subsurface  
Chambers)

Vegetated Practices  
(Bioretention,  
Constructed Wetlands)





Mill Pond Road

Country Drainage





