Environmentally Sensitive Maintenance for Dirt, Gravel, and Low-Volume Roads

Presented by:

PENNSTATE

Center for Dirt and Gravel Road Studies

Funding through:

Pennsylvania SCC State Conservation Commission

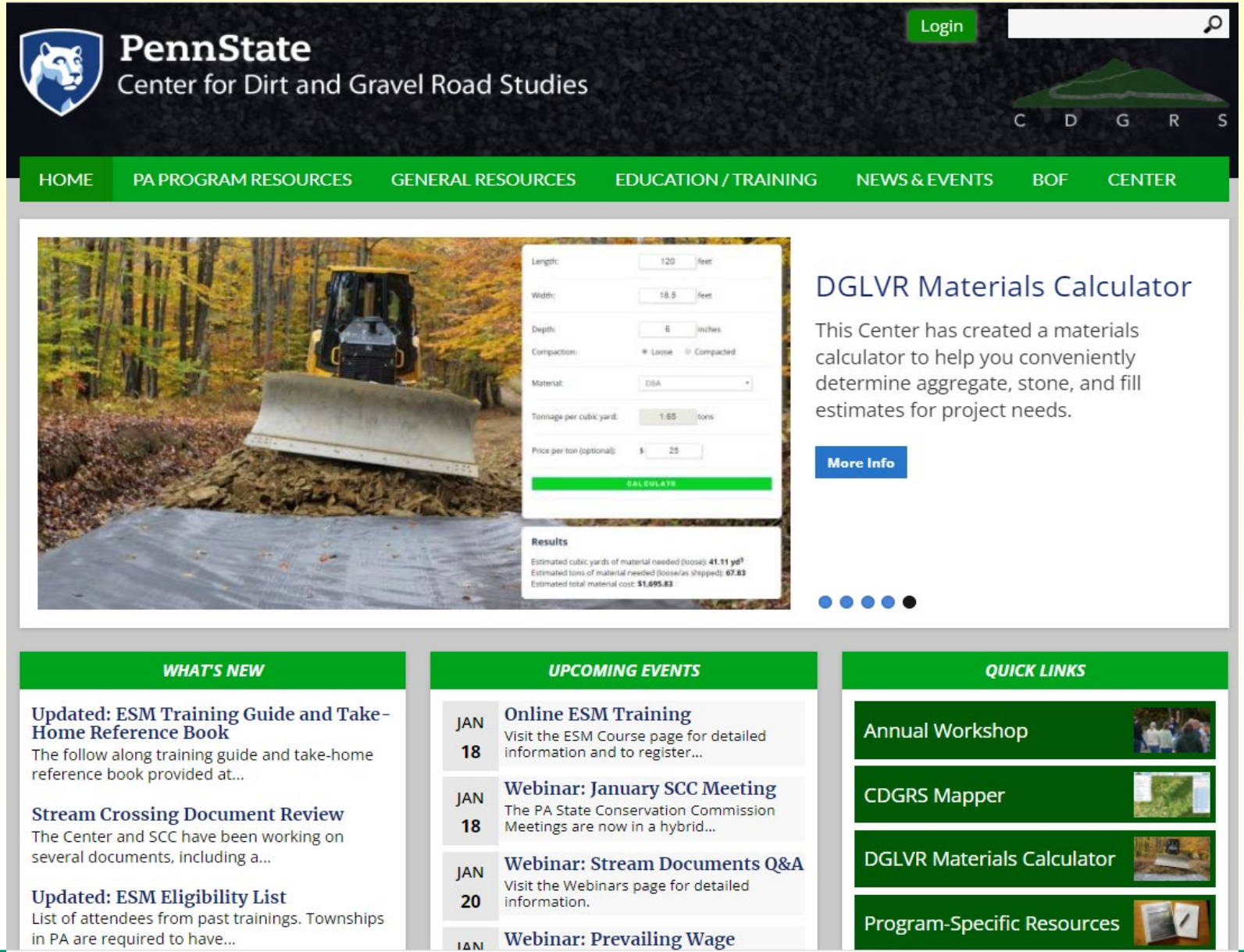
Pennsylvania DCNR FORESTRY

This training is part of the education, assistance, and funding program provided by the PA State Conservation Commission and Bureau of Forestry in cooperation with Penn State University's Center for Dirt & Gravel Road Studies.

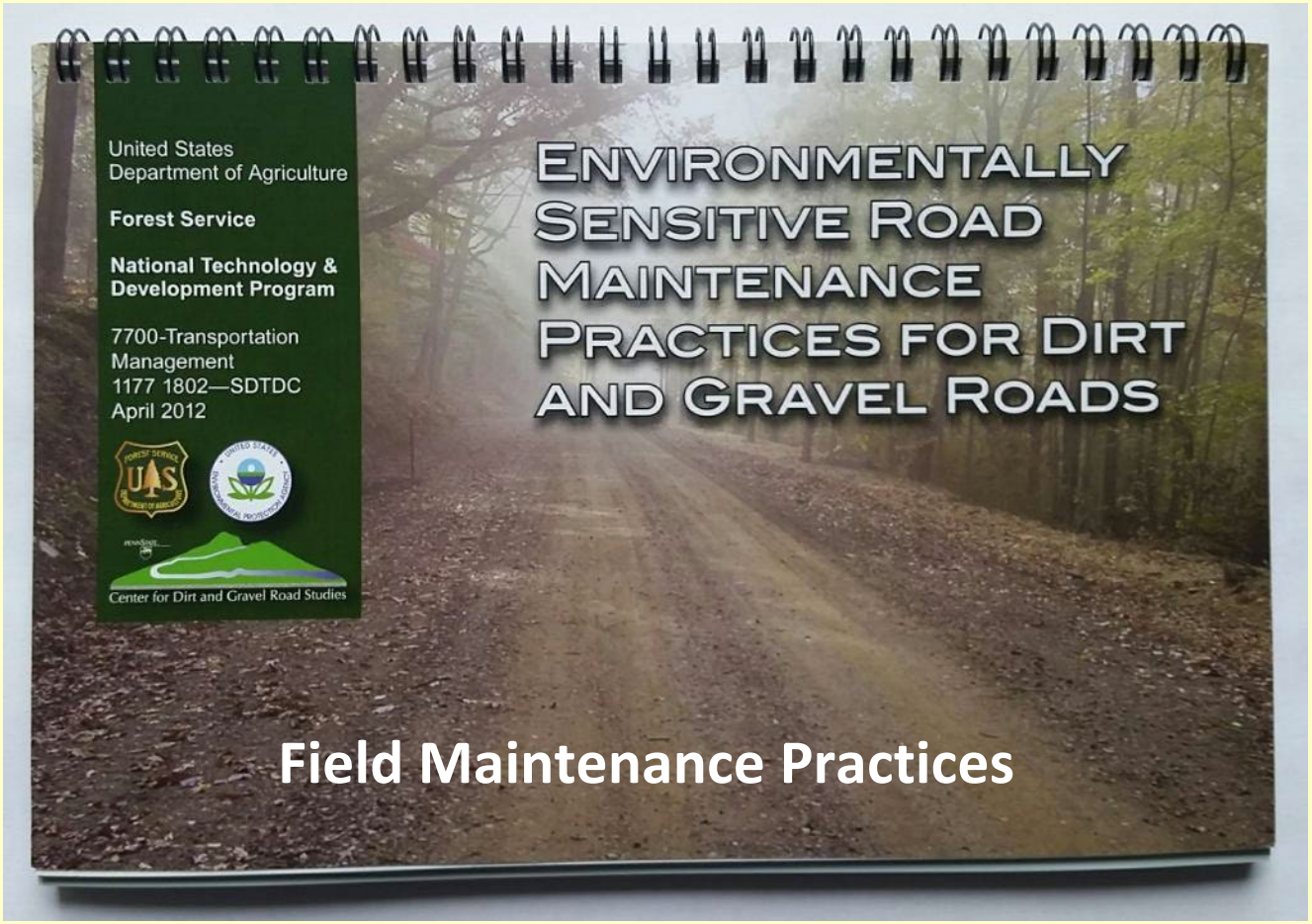
Schedule:

- Introduction and Environmentally Sensitive Maintenance Practices (EMSPs)
- ESMPs: Off Right-of-Way
- ESMPs: Geo-Synthetics
- ESMPs: Road Base
- ESMPs: Entrenched Roads
- ESMPs: Banks
- ESMPs: Surface Maintenance & Drainage
- ESMPs: Ditches
- ESMPs: Ditch Outlets
- ESMPS: Structural Infiltration Practices
- ESMPs: Road Surface

www.dirtandgravel.psu.edu/



Reference for you!



History

- **Early 1990s:** Trout Unlimited identified issues
- **Mid-1990s:** Task Force advocates for funding
- **1997:** Legislators allocate $5M to DGLVR Program
- **1997-2013:** Program allocates ~$60 Million throughout PA (DG only)
- **2014:** Funding increase from $5M to $35M. $8M for paved Low Volume Roads.
- **2025:** ~$340 Million has been allocated since the Program began and an average of 600 road improvement projects are completed annually.

Center for Dirt and Gravel Road Studies

Task Force Members:

pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

PENNSYLVANIA GAME COMMISSION 1895

PENNDOT

PennState

USDA NRCS

Pennsylvania DCNR FORESTRY

PENNSYLVANIA FISH & BOAT COMMISSION

Road Owner Goal - Better roads through proper practices and procedures.

Program's Goal – Better environment through proper practices and procedures.

"Improved maintenance techniques will benefit both roads and the environment."

28 years has proven that
DIRT AND GRAVEL PROGRAM is a Win-Win

PA State Conservation Commission

PA Conservation Districts

Dirt, Gravel, and Low Volume Road Program

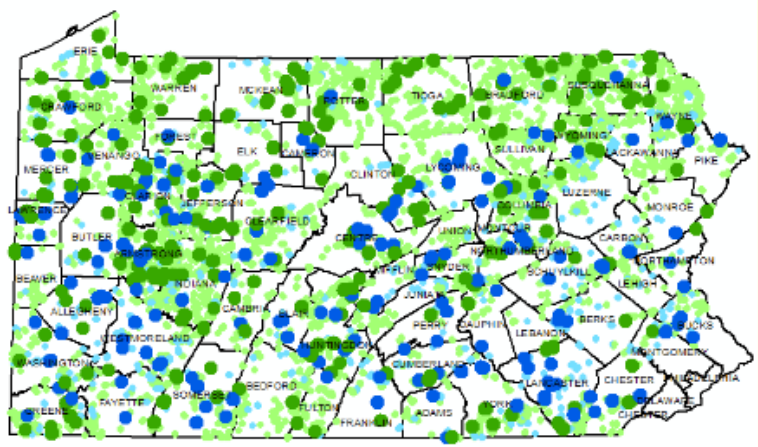
$28,000,000 Annual Allocation:

- SCC allocates money to Conservation Districts, who provide grants to applicants
- Districts and applicants must attend this course
- CDGRS staff available for technical assistance

Emphasizes “Local Control”

DGLVR Program

- ~400-500 projects completed annually
- Most project focus on drainage, fill, and base & surface improvements (traditional practices)
- ~20 stream crossing replacement annually



1,000+Completed LVR Projects

5,000+ Completed DnG Projects

pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES

Dirt, Gravel, and Low Volume Road Program

Of the $35M Total Program Allocation…

$7,000,000 Annual Allocation:

- ~$3,500,000 to State Parks
- ~$3,500,000 to Bureau of Forestry

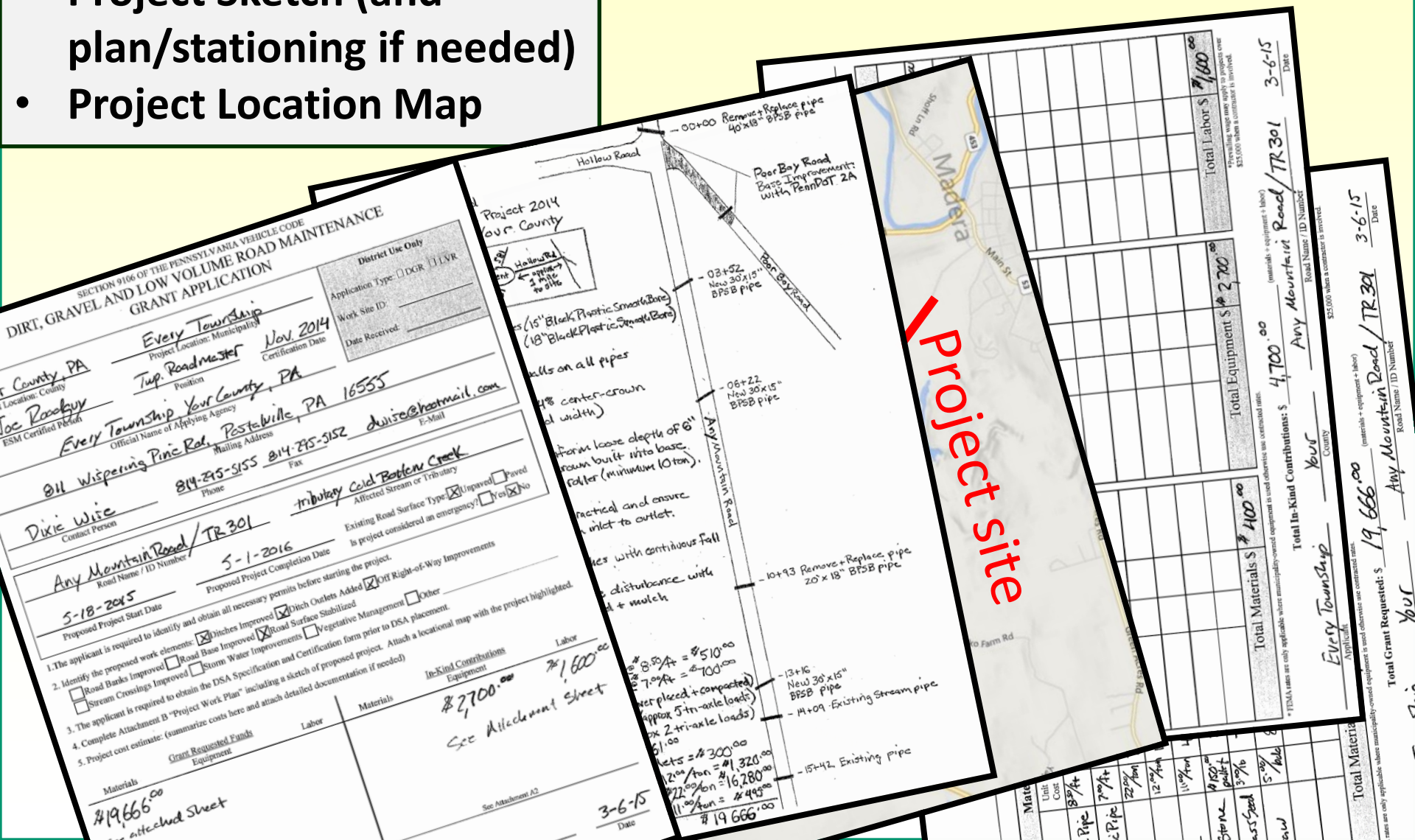
For more information:

Ryan Ling|Infrastructure Program Specialist
Mobile: 814-592-9768
Email: ryling@pa.gov

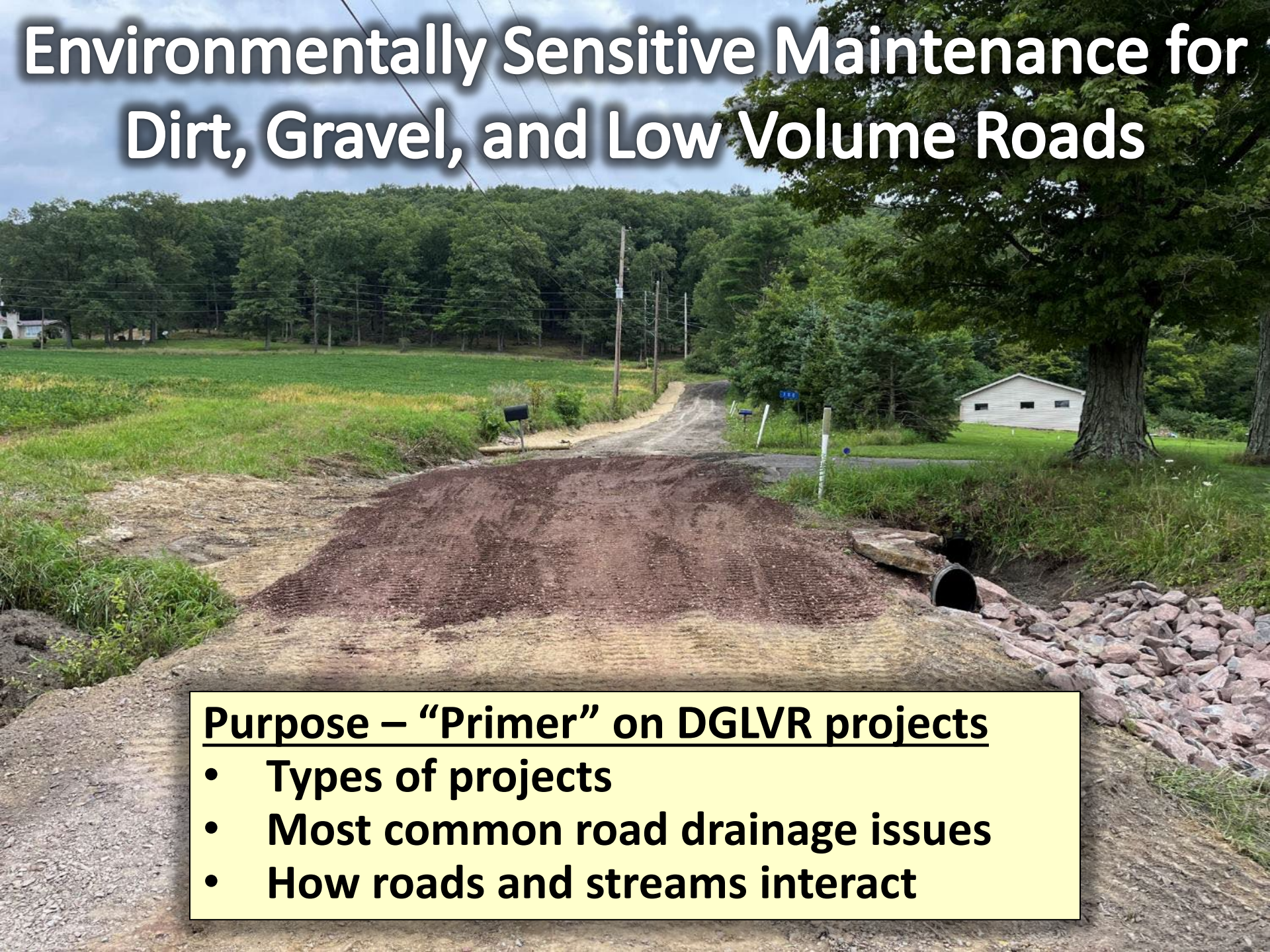
DGLVR Application Procedure

- **Grant Application**
- **Cost Sheets (optional)**
- **Project Sketch (and plan/stationing if needed)**
- **Project Location Map**

Single page application



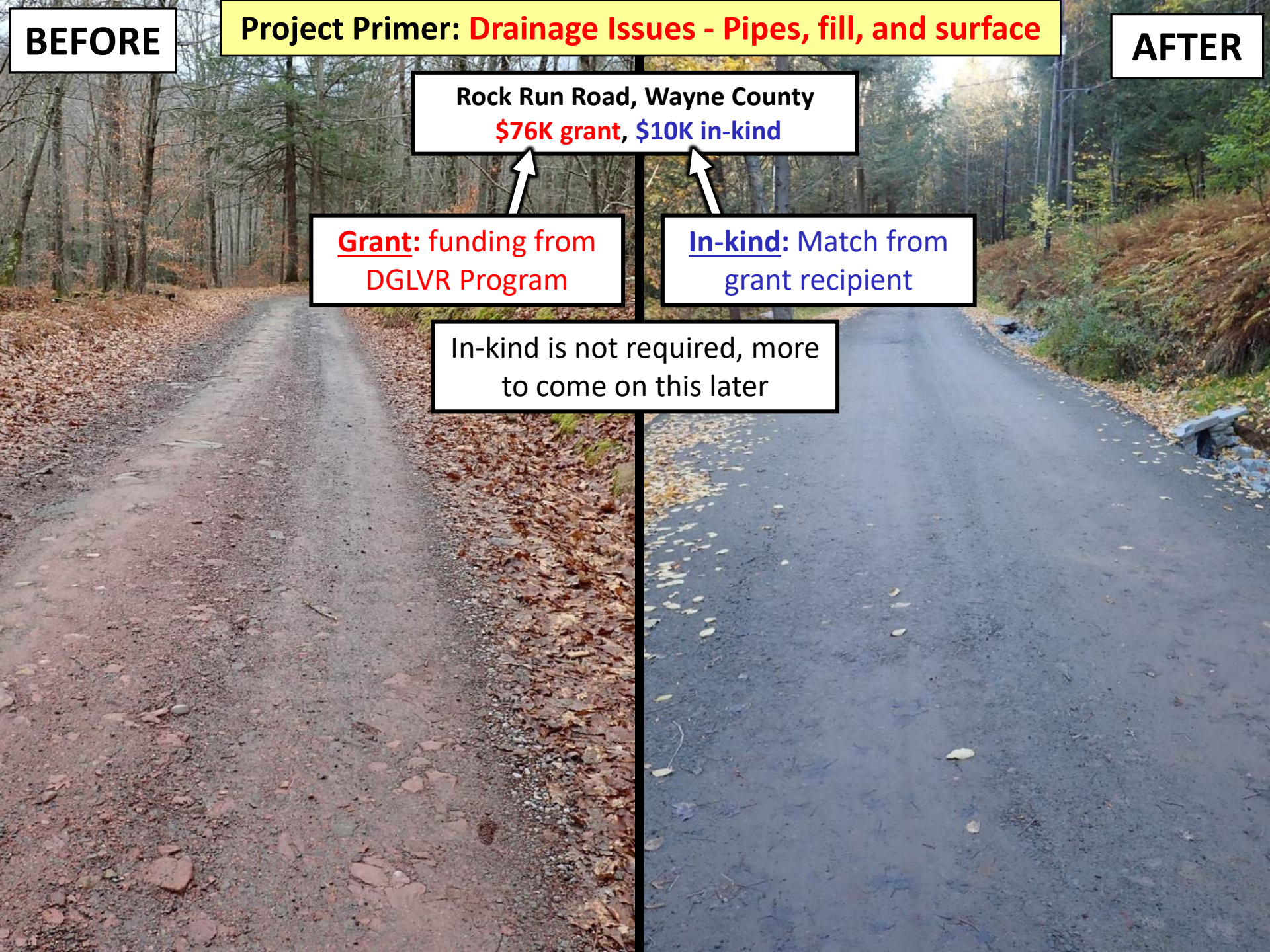
Environmentally Sensitive Maintenance for Dirt, Gravel, and Low Volume Roads



Purpose – "Primer" on DGLVR projects

- **Types of projects**
- **Most common road drainage issues**
- **How roads and streams interact**


BEFORE
Project Primer: Drainage Issues - Pipes, fill, and surface
AFTER
Rock Run Road, Wayne County
$76K grant, $10K in-kind


BEFORE
Project Primer: Drainage Issues - Pipes, fill, and surface
AFTER
Rock Run Road, Wayne County
$76K grant, $10K in-kind
Grant: funding from DGLVR Program
In-kind: Match from grant recipient
In-kind is not required, more to come on this later

Project Primer: Drainage Issues - Road Base, Pipes and Fill

Project Primer: Stream Crossings

BEFORE

BEFORE

Stoltz Rd, Crawford County
$140K grant, $25K in-kind

AFTER

19.5’ with invert

Project Primer: Drainage Issues – Roadside Springs/Wet Ditches

Bear Swamp Rd, Wayne County
$39K grant, $6K in-kind


BEFORE
Project Primer: Drainage issues – Ditches, Fill, Surface
Whittaker Rd, Pike County
$96K grant, $4K in-kind
AFTER

Project Primer: Drainage Issues – Base and Surface

BEFORE

AFTER

Benzie Rd, Clearfield County
$135K grant, $6K in-kind

Project Primer: Urban Drainage Issues

BEFORE

AFTER

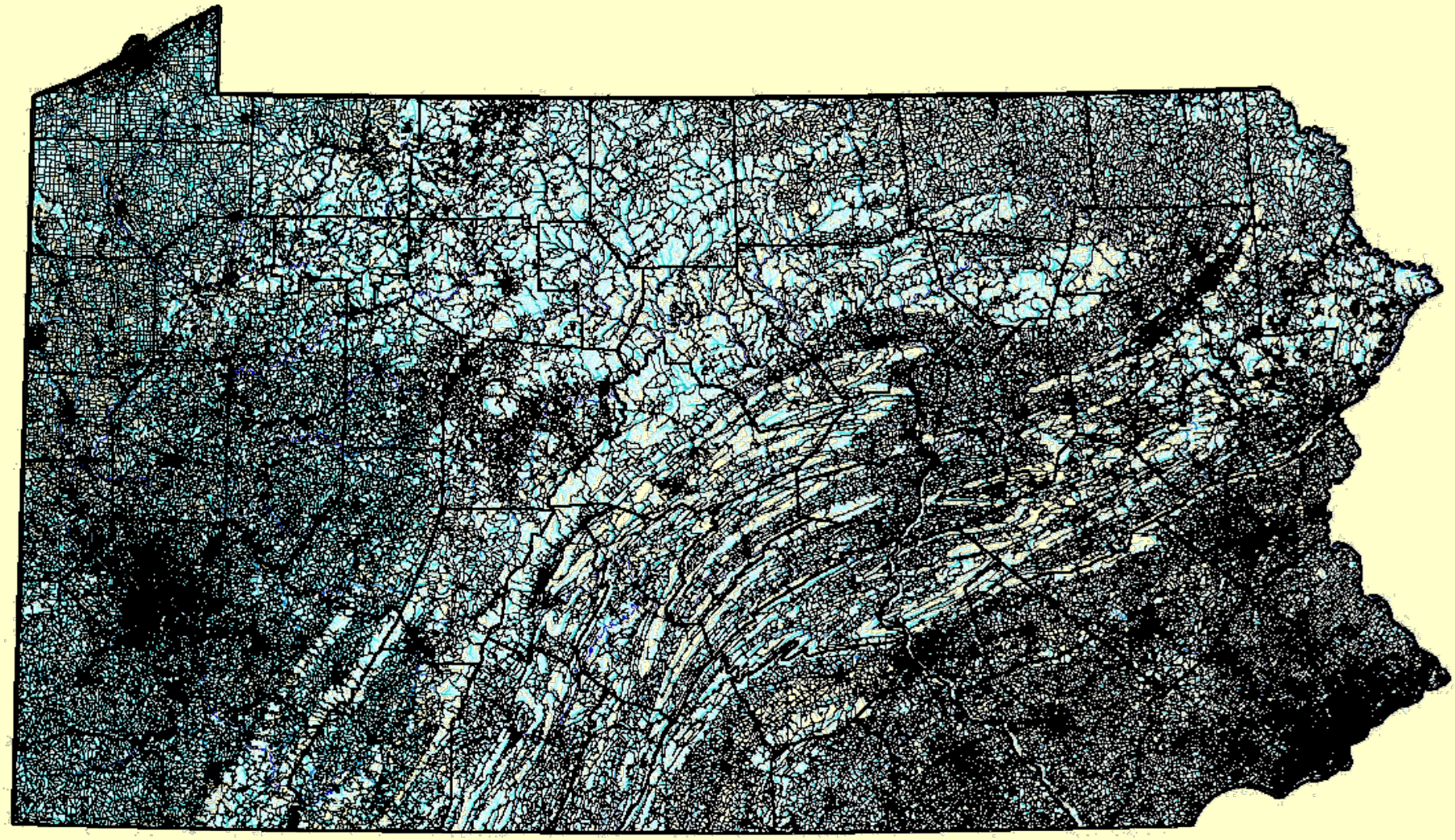
Limekiln Alley, York County
$28K grant, $9K in-kind

Project Primer: Slide/Road Bank issues

Introduction

- **Background**
- Erosion
- Streams/Lakes
- Wetlands

PA Streams & Roads



83,000 miles of streams

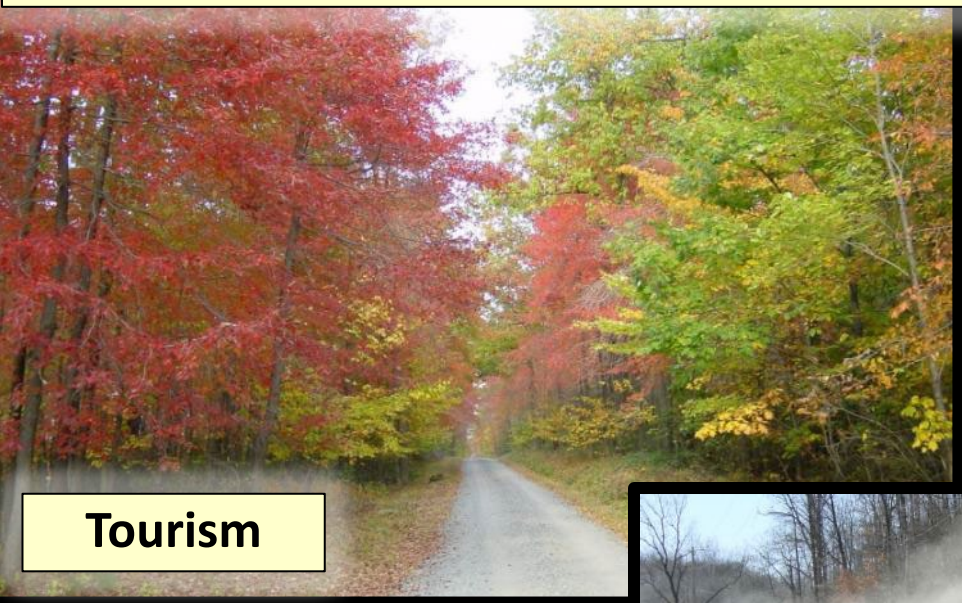
-American Rivers

120,000 miles of public roads

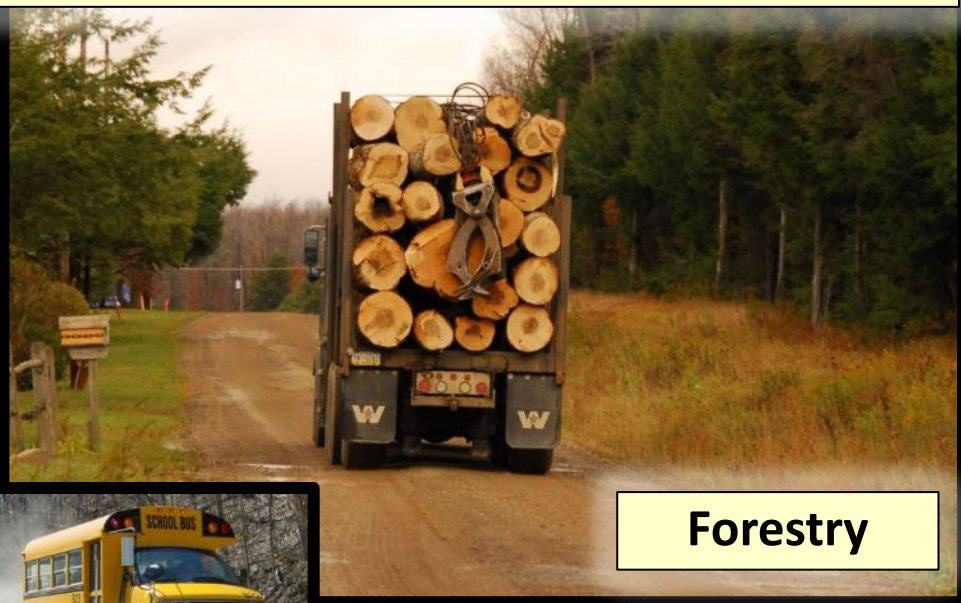
-PennDOT

Importance of PA's Dirt Roads

Provides Vital Service to 3.3+ Million Residents & PA's major industries:



Tourism



Forestry

Energy

Agriculture

WATER

Traffic Loads

Subgrade Quality

Environment (Climate)

Road Structure

Vegetation

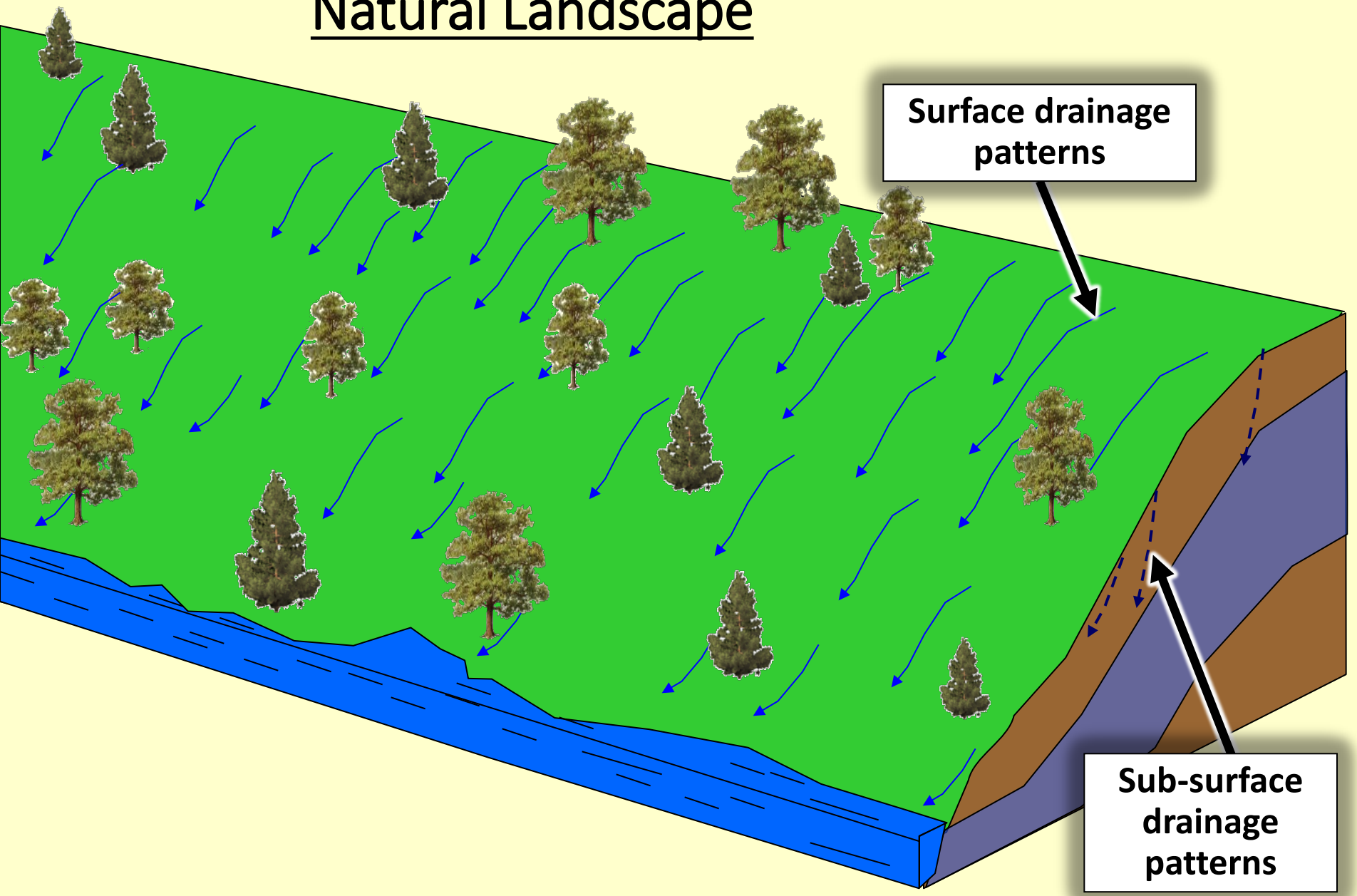
Quality of Road Materials

Maintenance Practices

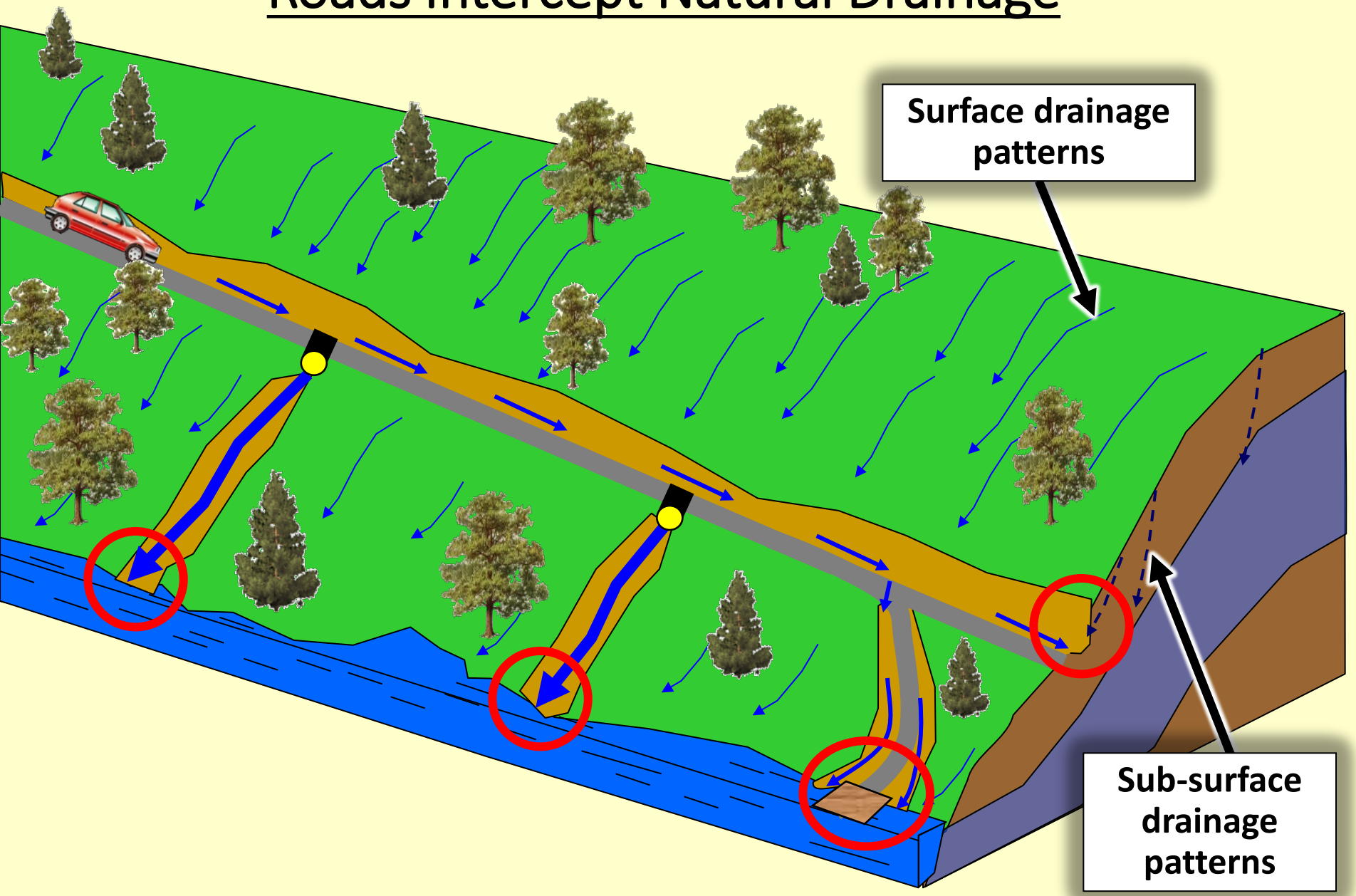
What Can You Control?

- Interrupt natural drainage patterns
- Unstable roads and concentrated runoff lead to accelerated erosion
- Runoff transports excess sediment and chemicals into streams

Natural Landscape



Roads Intercept Natural Drainage



“Sediment is, by volume, the largest pollutant of the waters of Pennsylvania, and the United States.”

“We need not only to keep the stream out of the road, but also to keep the road out of the stream!”

Sediment in water usually results from ***Erosion***.

- Science Encyclopedia: http://science.jrank.org/pages/7312/Water-Pollution.html

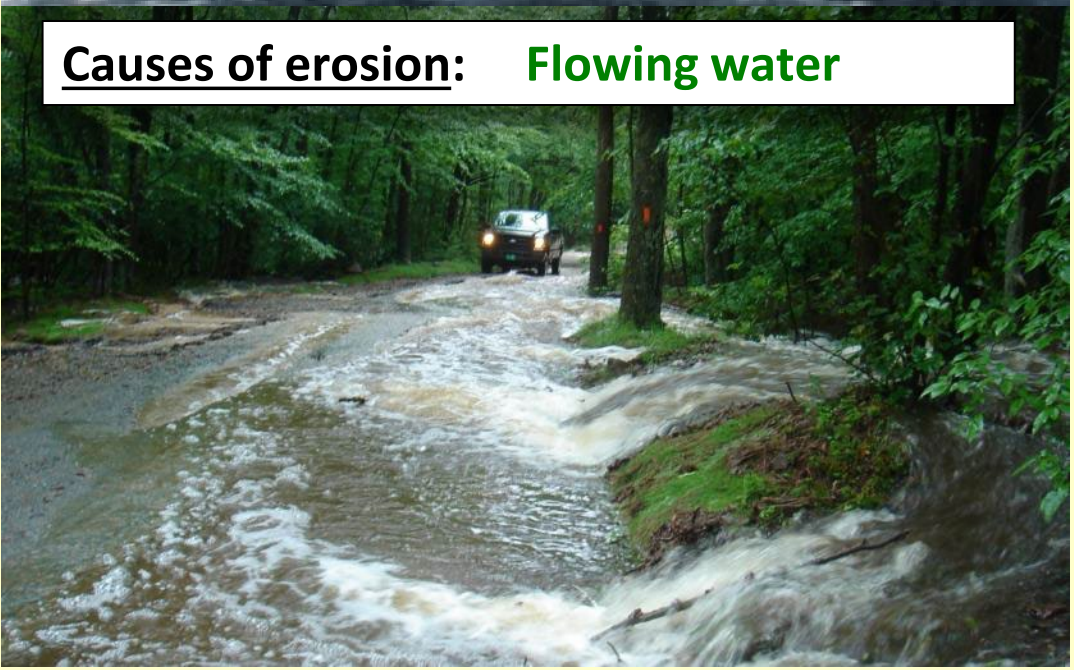
Introduction

- Background
- **Erosion**
- Streams/Lakes
- Wetlands

EROSION occurs in Nature.

Our Activities…

can ACCELERATE Erosion!



On roads our biggest concern is with Rain Impact and Flowing Water!

Factors that determine erosion potential on a site...

- Types of Soils
- Severity of Slopes
- Stabilizing Cover
- Volume/Velocity of Flowing Water on the Road

Introduction

Erosion

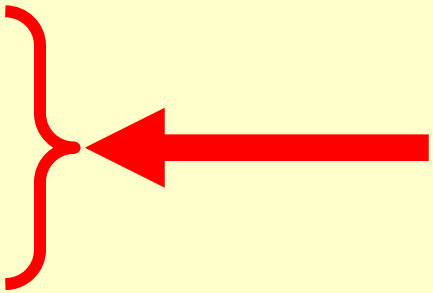
Erosion potential depends on:

Soil

Slope

Cover

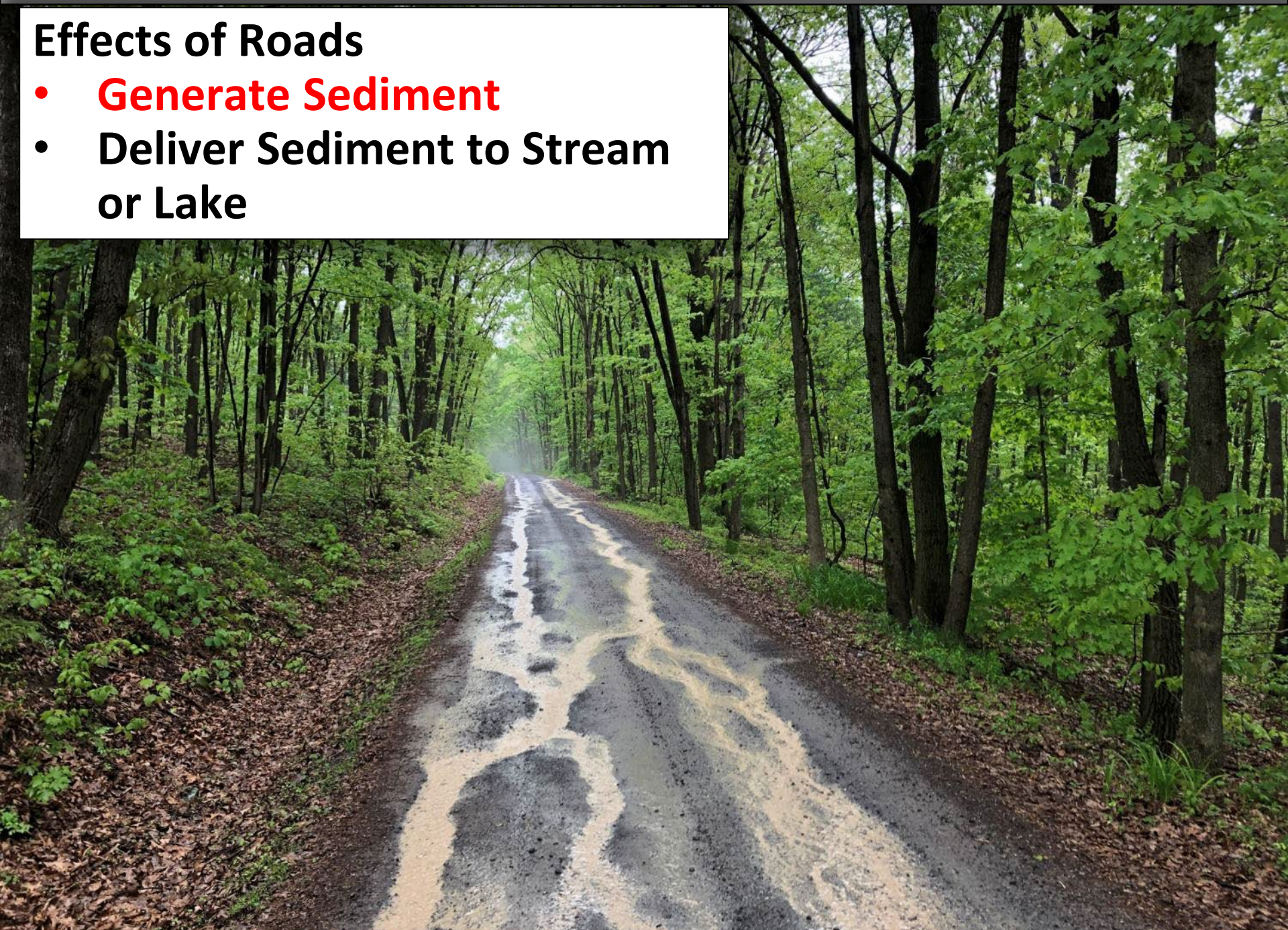
Water



These are the most readily controlled!

Effects of Roads

- Generate Sediment
- Deliver Sediment to Stream or Lake



Effects of Roads

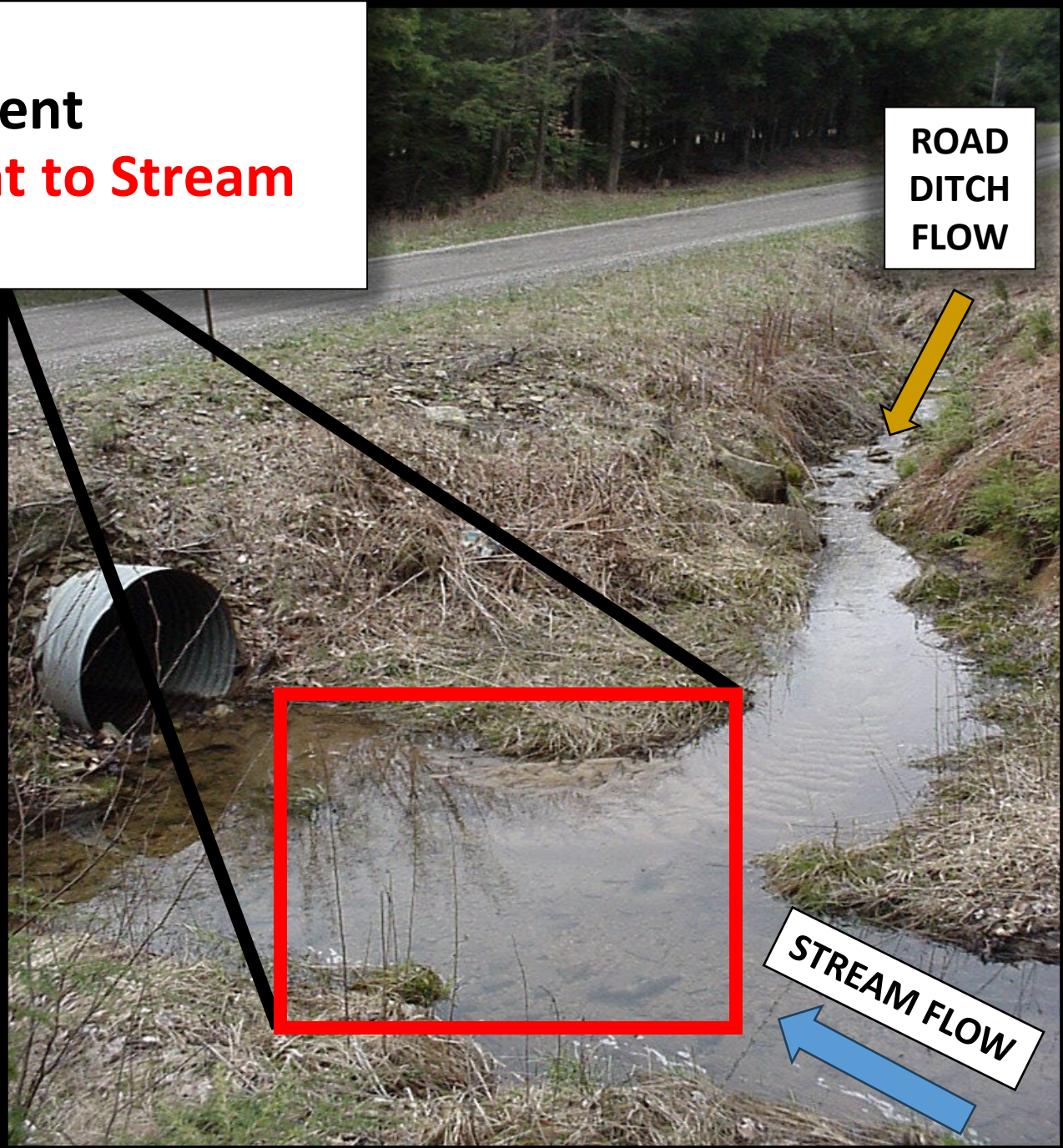
- Generate Sediment
- Deliver Sediment to Stream or Lake

Effects of Roads

- Generate Sediment
- Deliver Sediment to Stream or Lake

Effects of Roads

- Generate Sediment
- Deliver Sediment to Stream or Lake




STREAM FLOW
ROAD DITCH FLOW
Road drainage is too often connected to a stream or lake

Introduction

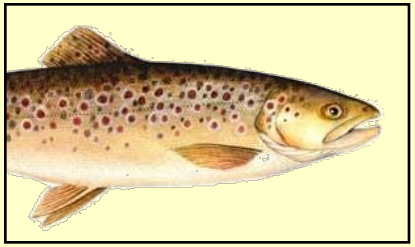
- Background
- Erosion
- **Streams/Lakes**
- Wetlands

How does sediment affect aquatic habitats?

Aquatic Food Web

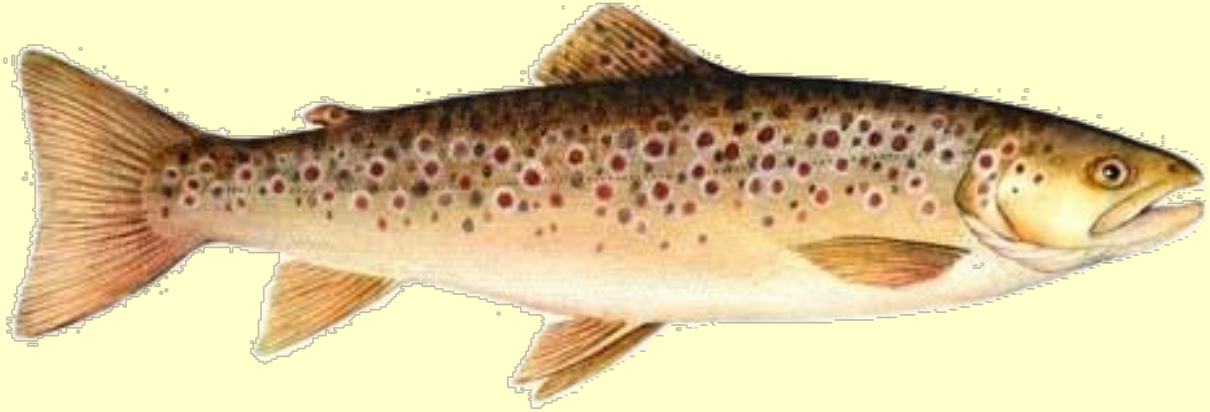

ALGAE & PLANTS –Live off nutrients in water and sunlight


BUGS –Live off algae and plants and outside inputs (leaves, etc.)




FISH and BUGS – Live off other fish and bugs (predators)

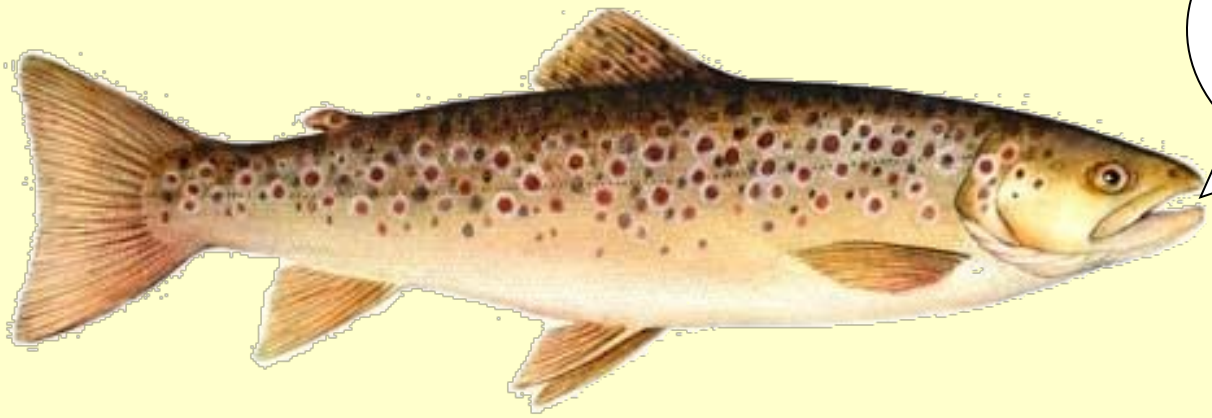

OTHERS – Many other animals eat aquatic life and fish, including us.



Trout Unlimited started the Dirt and Gravel Road effort.

Program's original emphasis was on high quality waters.

So, why are we so concerned with TROUT?



TROUT are an "Indicator Species"

<u>INDICATOR SPECIES</u>: signal the biological condition in a watershed or ecosystem and are a warning system that pollution has entered the food web.

Even If You Don't Fish!

Recreational fishing is a $1.8 billion business in Pennsylvania.

Outdoor Recreation provides 415,000 jobs across PA.[1]

[1] Estimating the Economic Contributions of Outdoor Recreation in Pennsylvania: An analysis of 2020 state-level economic contributions made by hunting, fishing, and other outdoor recreation activities. Theodore Roosevelt Conservation Partnership (2022)

Effects of sediment on aquatic life:

Limits

- Sunlight
- Food
- Visibility

WEAKENS FOOD WEB

No Sun =

No Plants or Algae =

No insects =

No fish!

Sediment also...

CHANGES HABITATS

Fills in “small spaces” where fish breed and find food

Sediment also...

CARRIES OTHER POLLUTANTS

Organics, oils, salts, pesticides, etc.

Sediment also...

LIMITS OXYGEN

Organic matter & chemicals carried in water use oxygen

Introduction

- Background
- Erosion
- Streams
- **Wetlands**

What do you think of when you hear the word “wetland”?

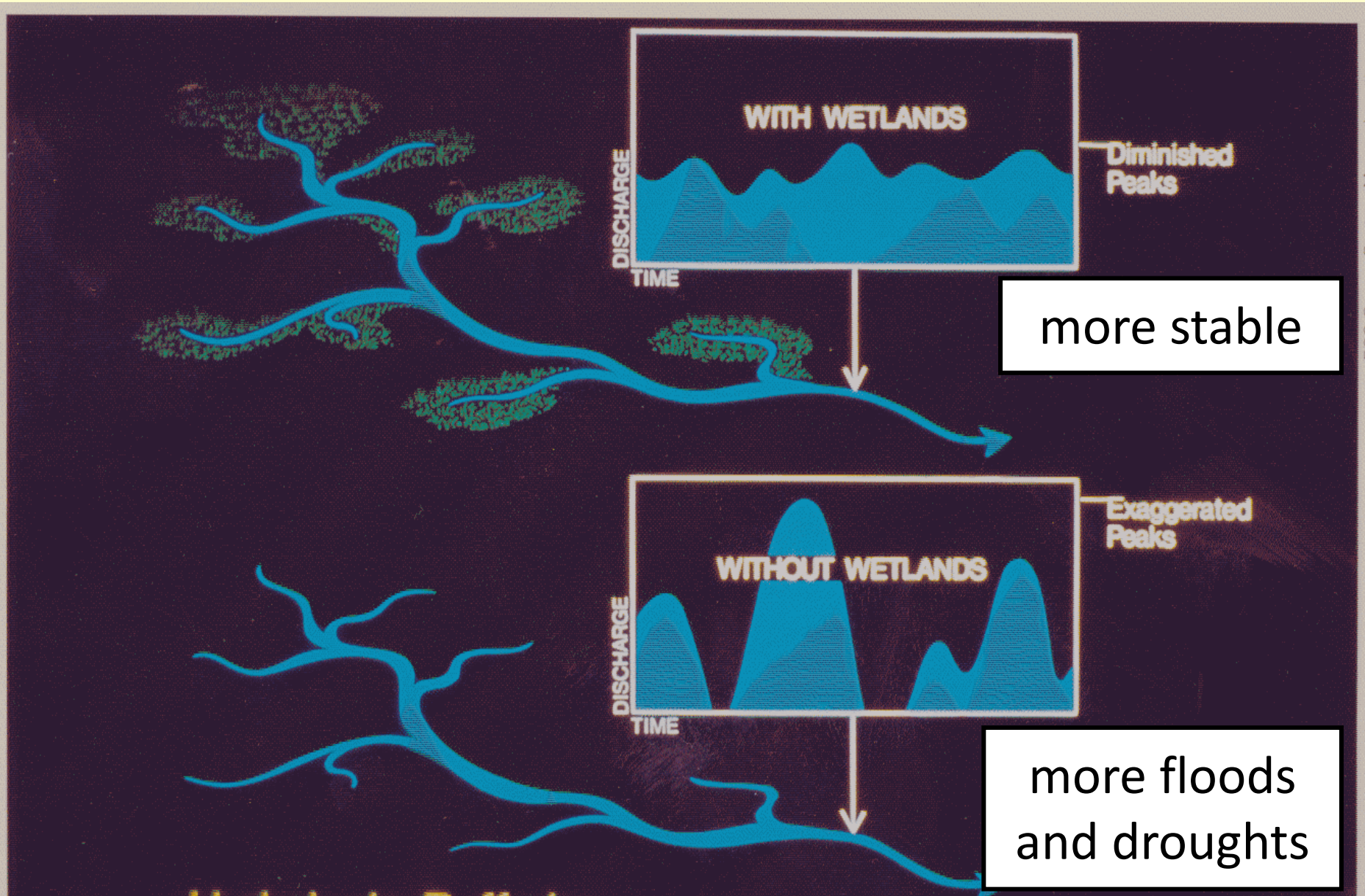
You don’t have to see water for it to be a wetland!

WETLAND: An area that is wet enough to saturate the soil and grow plants that are adapted to wet conditions.

The Value of Wetlands:

STORES WATER AND FILTERS POLLUTANTS

The Value of Wetlands: STORES WATER



It is important to recognize wetland indicators.

Wetlands are important areas to protect and can be among the most difficult areas to maintain a road.

Environmentally Sensitive Maintenance for Dirt, Gravel, and Low-Volume Roads

PennState
Center for Dirt and Gravel Road Studies

PA State Conservation Commission

PA Dept. of Conservation and Natural Resources
Forestry

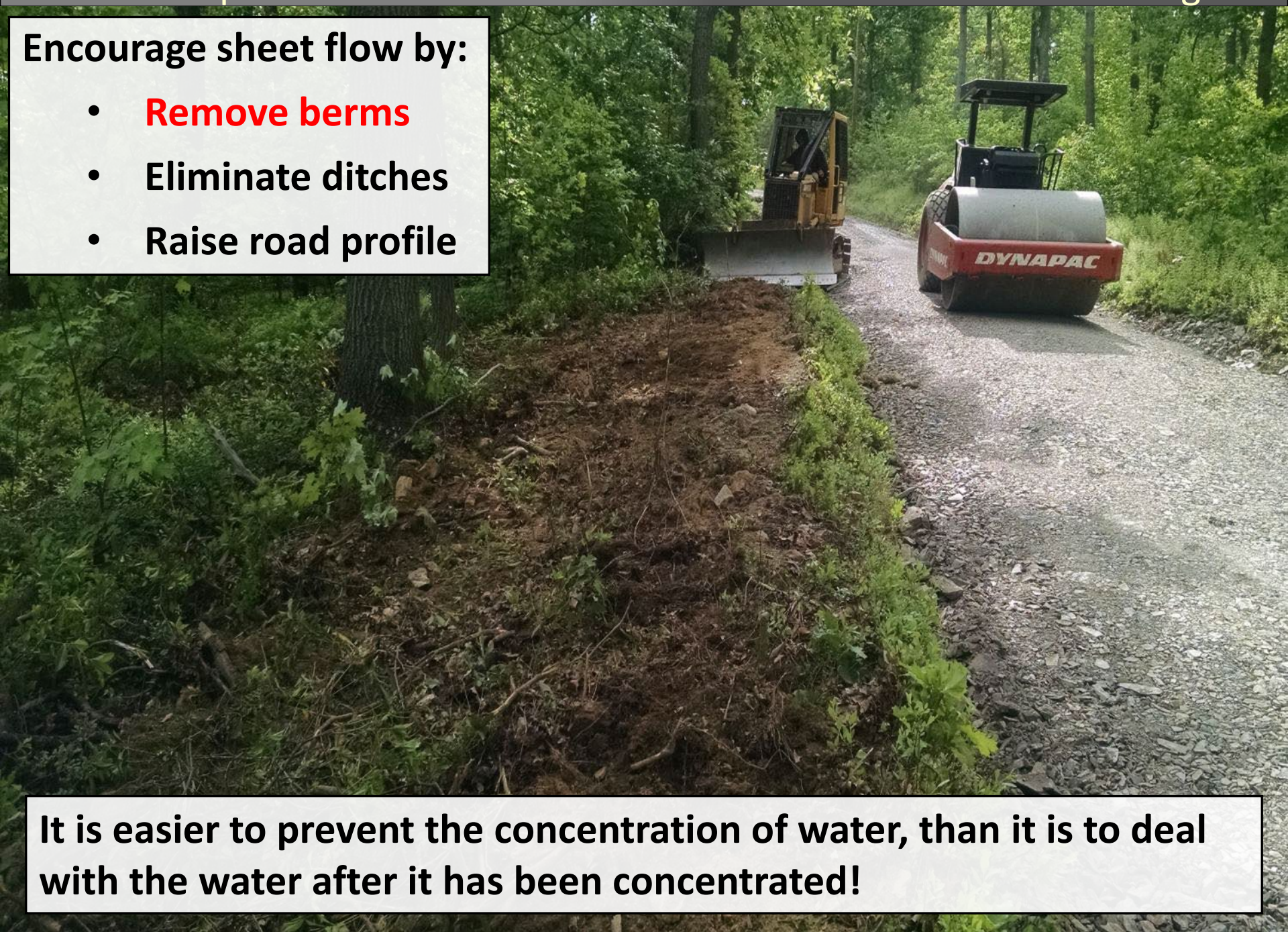
Principles of Environmentally Sensitive Maintenance Practices

Environmentally Sensitive Maintenance Practices

ESMP: A maintenance practice or technique that works with natural systems to create a better road, and a better environment.

1. Avoid Concentrating Drainage

Avoid Concentrated Drainage



Encourage sheet flow by:

- **Remove berms**
- **Eliminate ditches**
- **Raise road profile**

It is easier to prevent the concentration of water, than it is to deal with the water after it has been concentrated!

Avoid Concentrated Drainage

Encourage sheet flow by:

- **Remove berms**
- **Eliminate ditches**
- **Raise road profile**

It is easier to prevent the concentration of water, than it is to deal with the water after it has been concentrated!

Avoid Concentrated Drainage

Encourage sheet flow by:

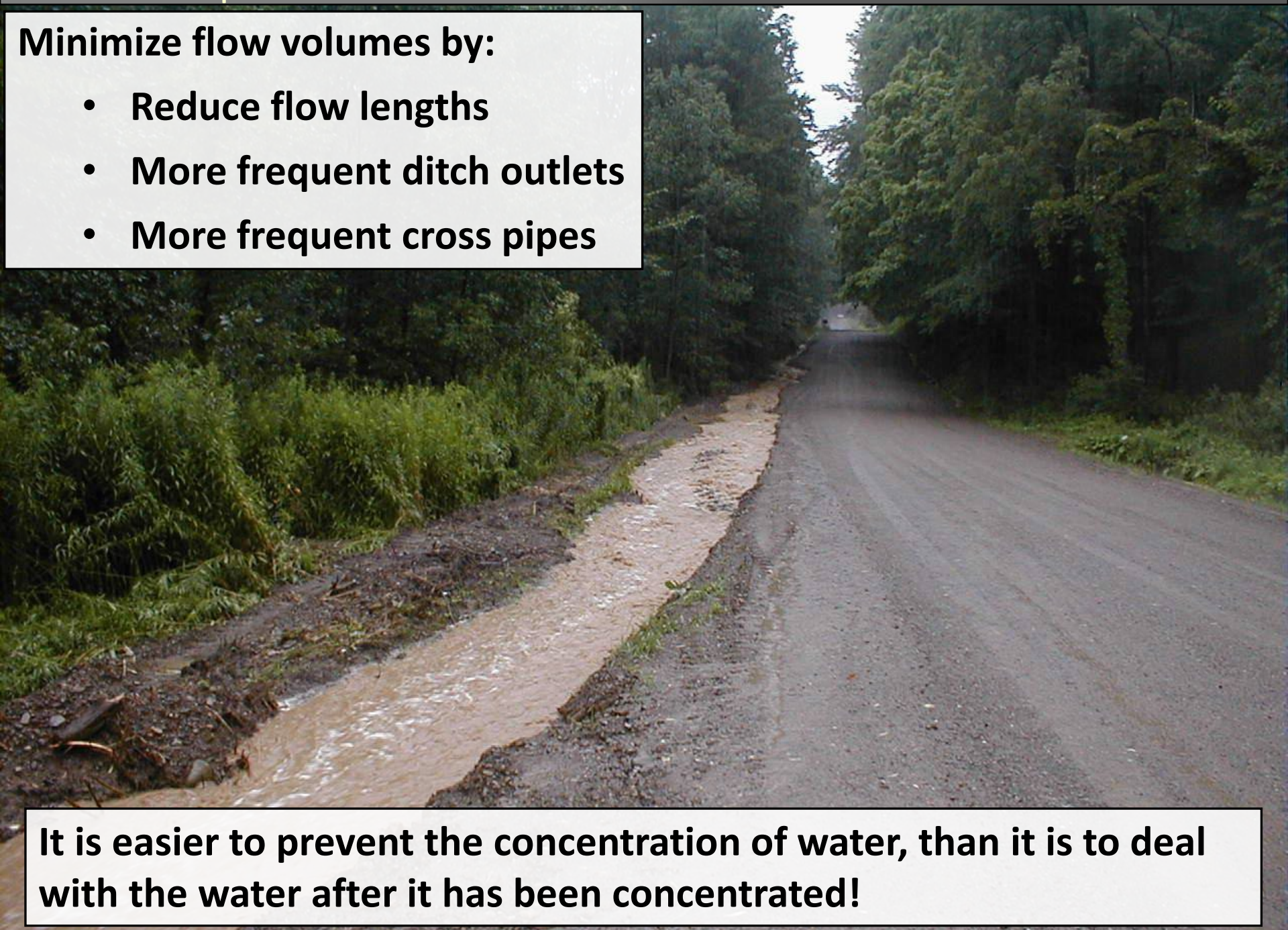
- **Remove berms**
- **Eliminate ditches**
- **Raise road profile**

It is easier to prevent the concentration of water, than it is to deal with the water after it has been concentrated!

Environmentally Sensitive Maintenance Practices

1. Avoid Concentrating Drainage
2. **Minimize Flow Volumes**

Minimize Flow Volumes



Minimize flow volumes by:

- **Reduce flow lengths**
- **More frequent ditch outlets**
- **More frequent cross pipes**

It is easier to prevent the concentration of water, than it is to deal with the water after it has been concentrated!

Minimize Flow Volumes

Minimize flow volumes by:

- **Do not route springs into road ditch**
- **Use underdrains to capture spring seeps / subsurface flow**

Minimize Flow Volumes

Minimize flow volumes by addressing off Right-of-Way sources of water.

Environmentally Sensitive Maintenance Practices

1. Avoid Concentrating Drainage
2. Minimize Flow Volumes
3. **Reduce Effects of Concentrated Drainage**

Reduce Concentrated Drainage

Reduce concentrated drainage by:

- **Wider, shallower ditches**
- **Create stabilized ditches**

Reduce concentrated drainage by:

- **Outlet drainage to stable filter area**
- **Outlet protection**

Environmentally Sensitive Maintenance Practices

1. Avoid Concentrating Drainage
2. Minimize Flow Volumes
3. Reduce Effects of Concentrated Drainage
4. **Prevent Surface Erosion**

Prevent Surface Erosion

Prevent surface erosion by:

- **Vegetative cover over soil**
- **Road surface improvements**
- **Follow Steps 1-3 to reduce concentrated flow!**

Environmentally Sensitive Maintenance Practices

1. Avoid Concentrating Drainage
2. Minimize Flow Volumes
3. Reduce Effects of Concentrated Drainage
4. Prevent Surface Erosion
5. **Reduce Cost and Frequency of Road Maintenance**

BENEFITS:

- **Encourage infiltration / Recharge groundwater**
- **Lower flood flows**
- **Reduce surface water volumes you have to handle in ditches and waterways**
- **Reduce erosion in ditches and outlets**
- **Reduce maintenance**
- **Save money!**

ENVIRONMENTAL VIEWPOINT:

Erosion = Pollution

MAINTENANCE VIEWPOINT:

Erosion =

Frequent Maintenance =

Higher Co$t

Some Traditional Maintenance Causes Erosion

Erosion causes More Frequent Maintenance

Introduction

ADDITIONAL RESOURCES:

- Your Conservation District
- Your Municipal Engineer
- www.dirtandgravelroads.org