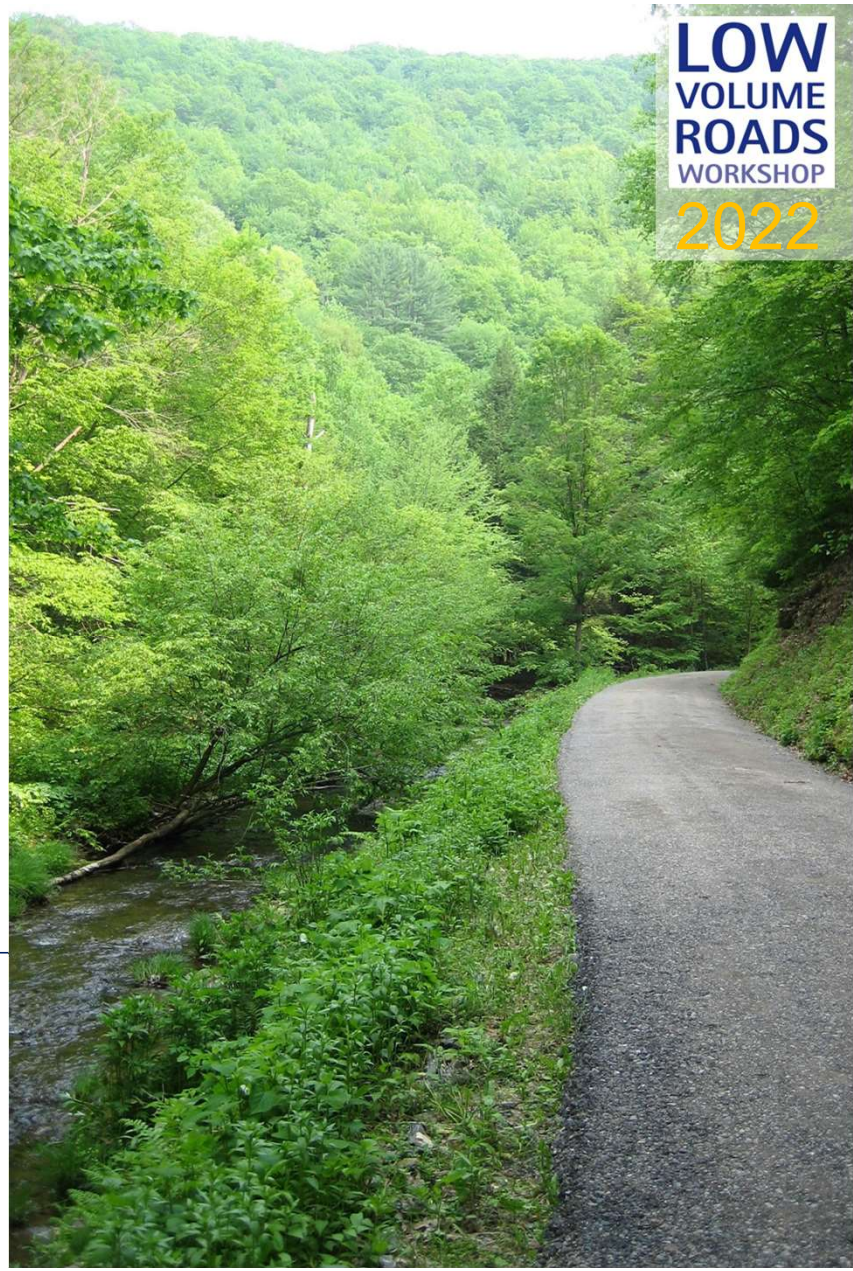
REAAA
Driving Progress
ROAD ENGINEERING ASSOCIATION OF ASIA & AUSTRALASIA (NZ)

Better Roads, Cleaner Streams.

Lessons from Pennsylvania



STEVE BLOSER| PENN STATE UNIVERSITY

LOW VOLUME ROADS WORKSHOP 2022

Steve Bloser

Director: Penn State University Center for Dirt and Gravel Road Studies

With CDGRS since 2001, director since 2013.

Center provides education, outreach, and technical assistance to Pennsylvania's $35M per year "Dirt, Gravel, and Low Volume Road Maintenance Program.

smb201@psu.edu

www.dirtandgravelroads.org

LOW VOLUME ROADS WORKSHOP 2022

Steve Bloser

Director: Penn State University Center for Dirt and Gravel Road Studies

With CDGRS since 2001, director since 2013.

Center provides education, outreach, and technical assistance to Pennsylvania's $35M per year "Dirt, Gravel, and Low Volume Road Maintenance Program.

smb201@psu.edu

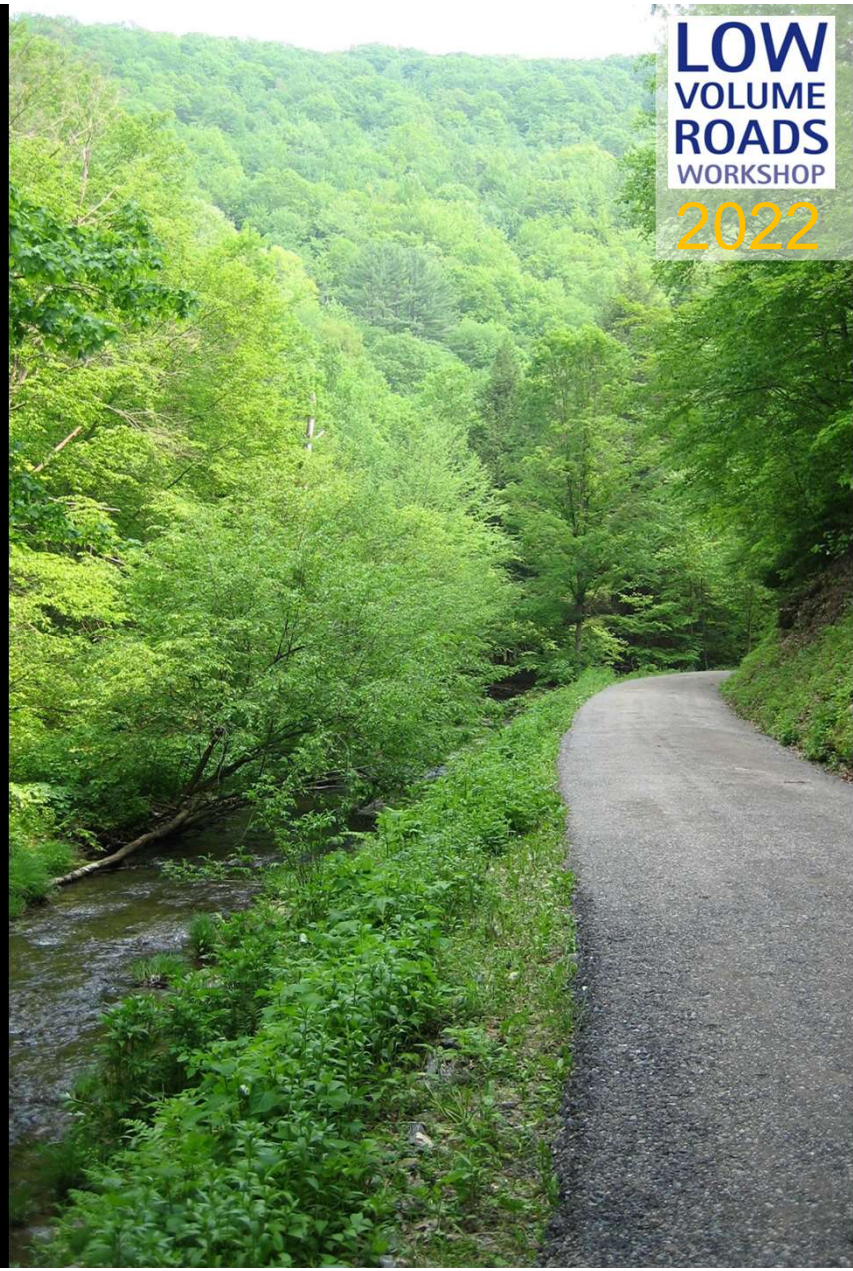
www.dirtandgravelroads.org

PA DGLVR Program:

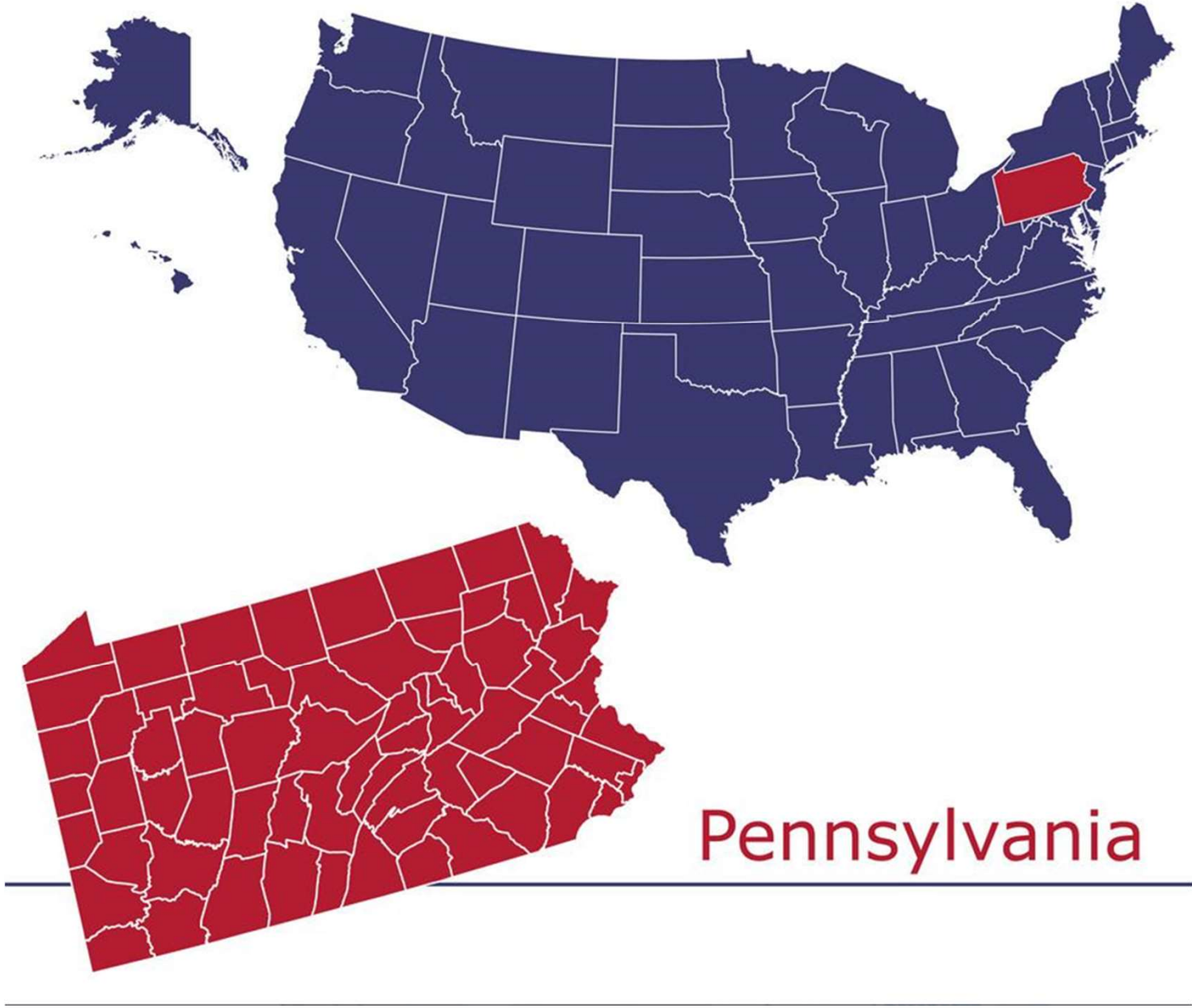
- **Better Roads, Cleaner Stream**
- **Big change using small money**

Presentation Outline

- **Introduction**
- DGLVR Program
  - Purpose
  - History
  - Structure
- Example Projects
- DGLVR Program
  - Current Status
  - Lessons learned – technology transfer
- Research Topics
- Driving Surface Aggregate Primer



Introduction / Overview



Introduction / Overview

Pennsylvania

New Zealand

LOW VOLUME ROADS WORKSHOP 2022

Area:

Population:

All Roads:

Unpaved:

Introduction / Overview

LOW VOLUME ROADS WORKSHOP 2022

	Pennsylvania		**New Zealand**
Area:	119,000 km^2		268,000 km^2 *(x2.25)*
Population:			
All Roads:			
Unpaved:			

Introduction / Overview

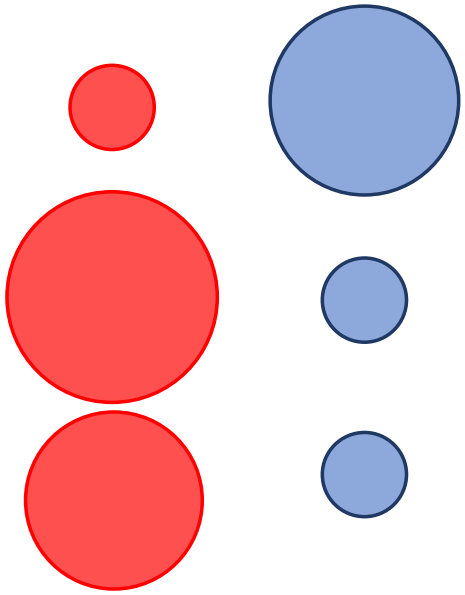
LOW VOLUME ROADS WORKSHOP 2022

	Pennsylvania		**New Zealand**
Area:	119,000 km^2		268,000 km^2 *(x2.25)*
Population:	12.9M *(X 2.5)*		5.1M
All Roads:			
Unpaved:			

Introduction / Overview

LOW VOLUME ROADS WORKSHOP 2022

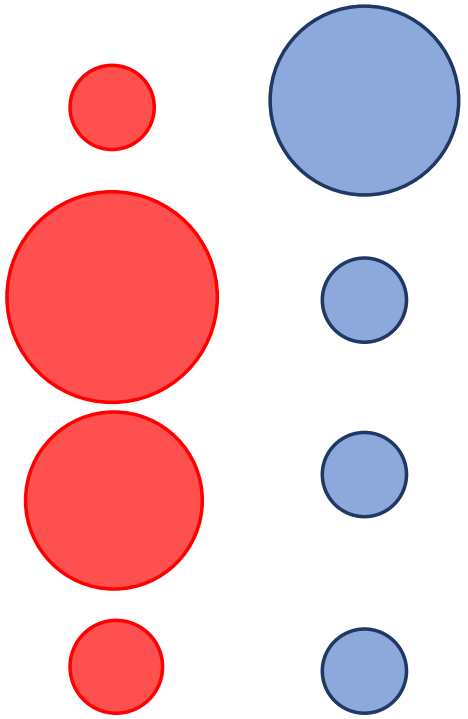
	Pennsylvania	New Zealand
Area:	119,000 km^2	268,000 km^2 *(x2.25)*
Population:	12.9M *(X 2.5)*	5.1M
All Roads:	193,000 km *(X 2.1)*	94,000 km
Unpaved:		



Introduction / Overview

LOW VOLUME ROADS WORKSHOP 2022

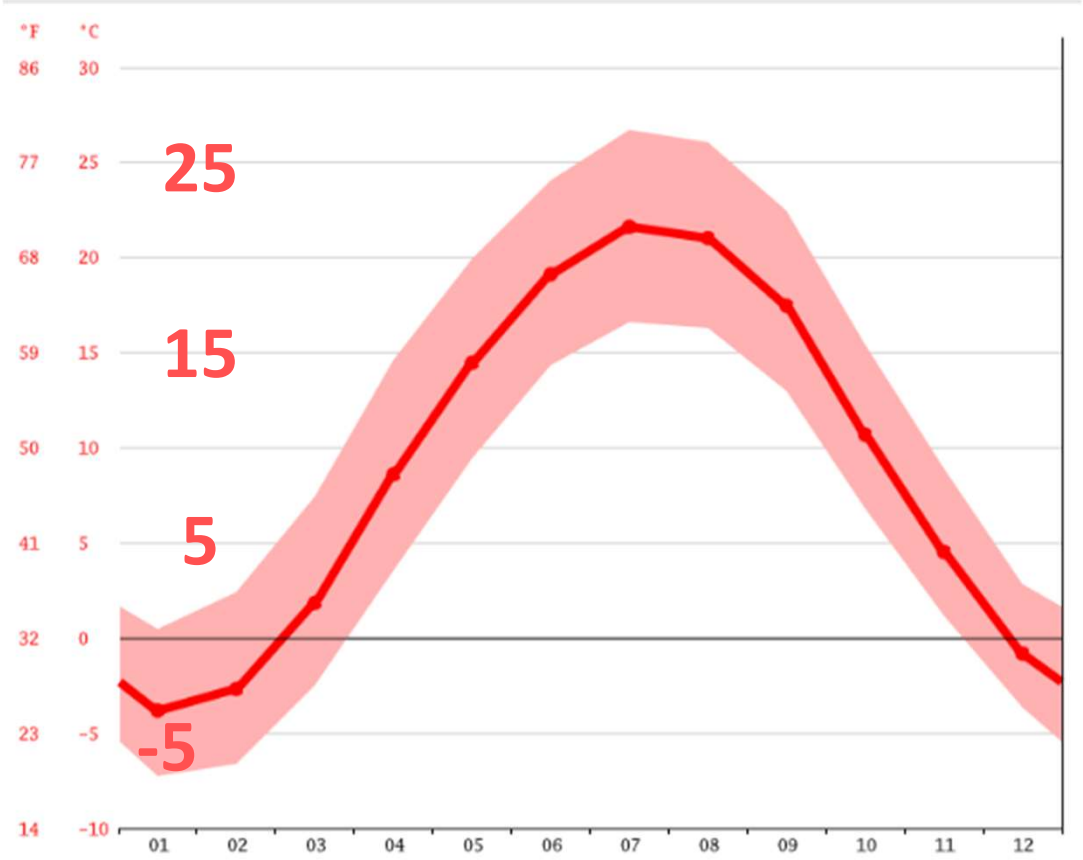
	Pennsylvania	New Zealand
Area:	119,000 km^2	268,000 km^2 *(x2.25)*
Population:	12.9M *(X 2.5)*	5.1M
All Roads:	193,000 km *(X 2.1)*	94,000 km
Unpaved:	35,000 km *(X 1.1)*	31,000 km



Introduction / Overview

LOW VOLUME ROADS WORKSHOP 2022

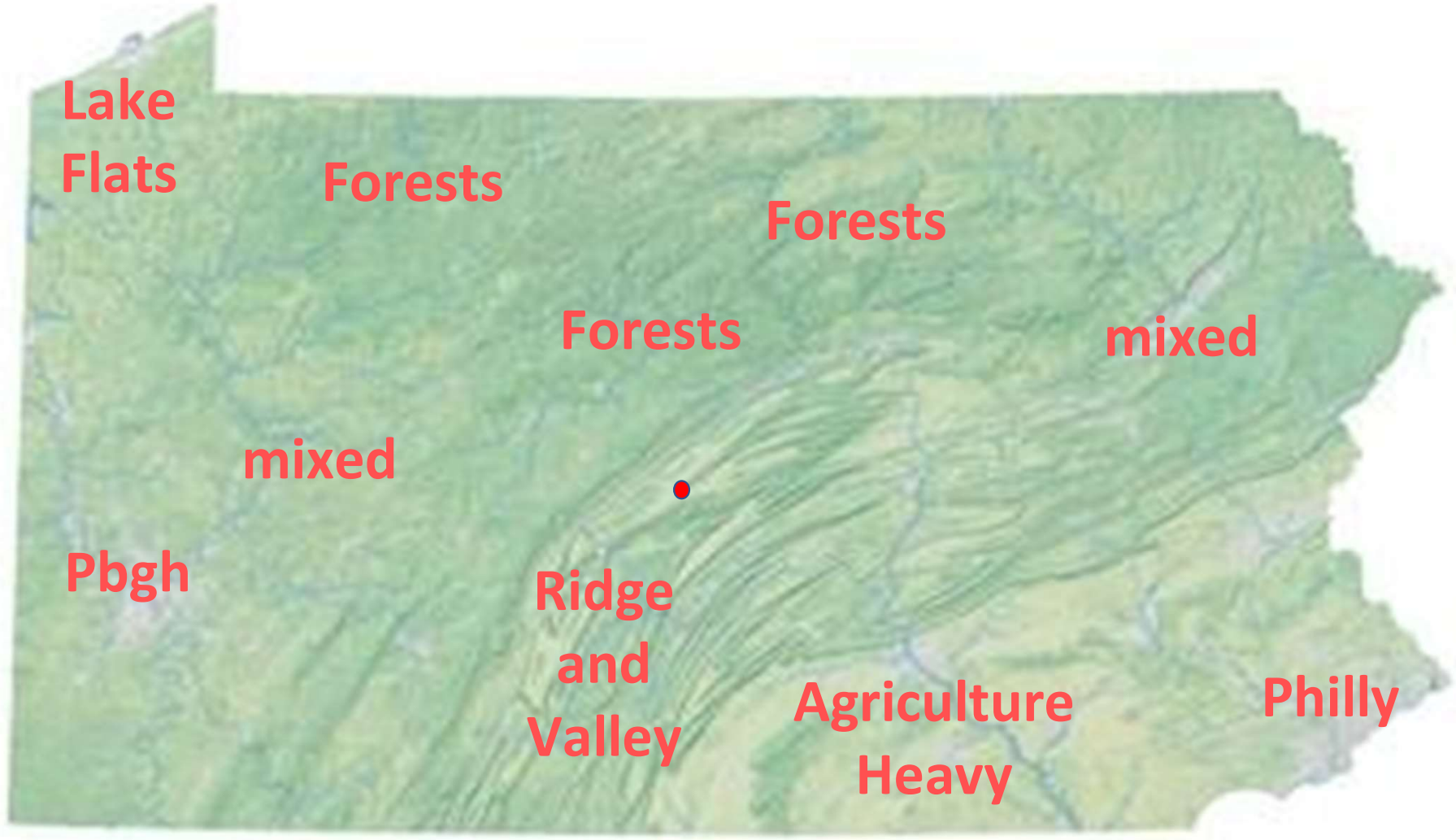
Climate: highly seasonal



Winter frost depth: 12-30 inches

Introduction / Overview

Land Use

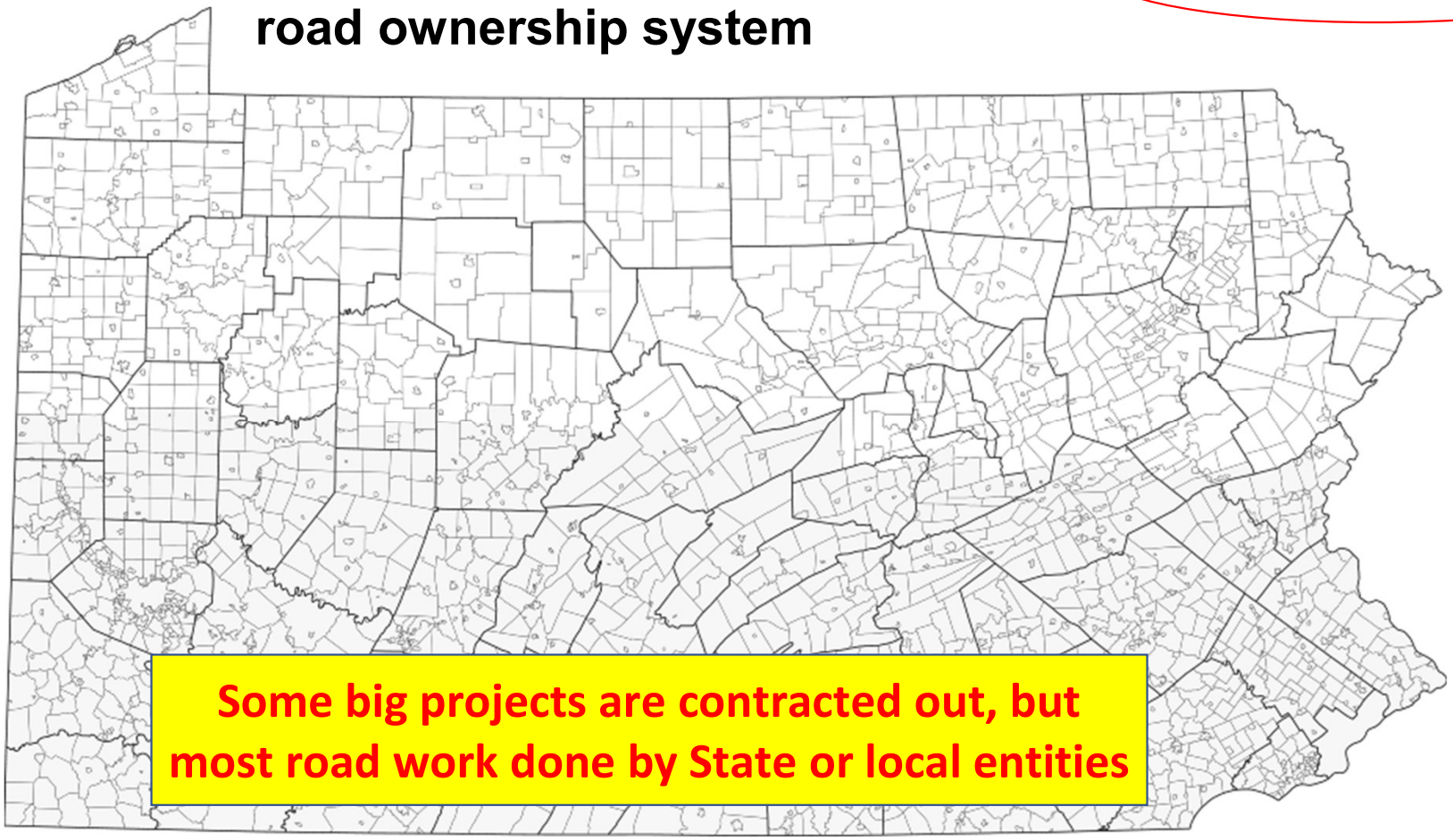


Introduction / Overview

	PA	NZ
State	33%	12%
Local	66%	88%

LOW VOLUME ROADS WORKSHOP 2022

PA and NZ share a fractured road ownership system



Some big projects are contracted out, but most road work done by State or local entities

~2,500+ municipalities own and maintain roads in PA

Small budget
Small crew
Little education

Introduction / Overview

	PA	NZ
State	33%	12%
Local	66%	88%

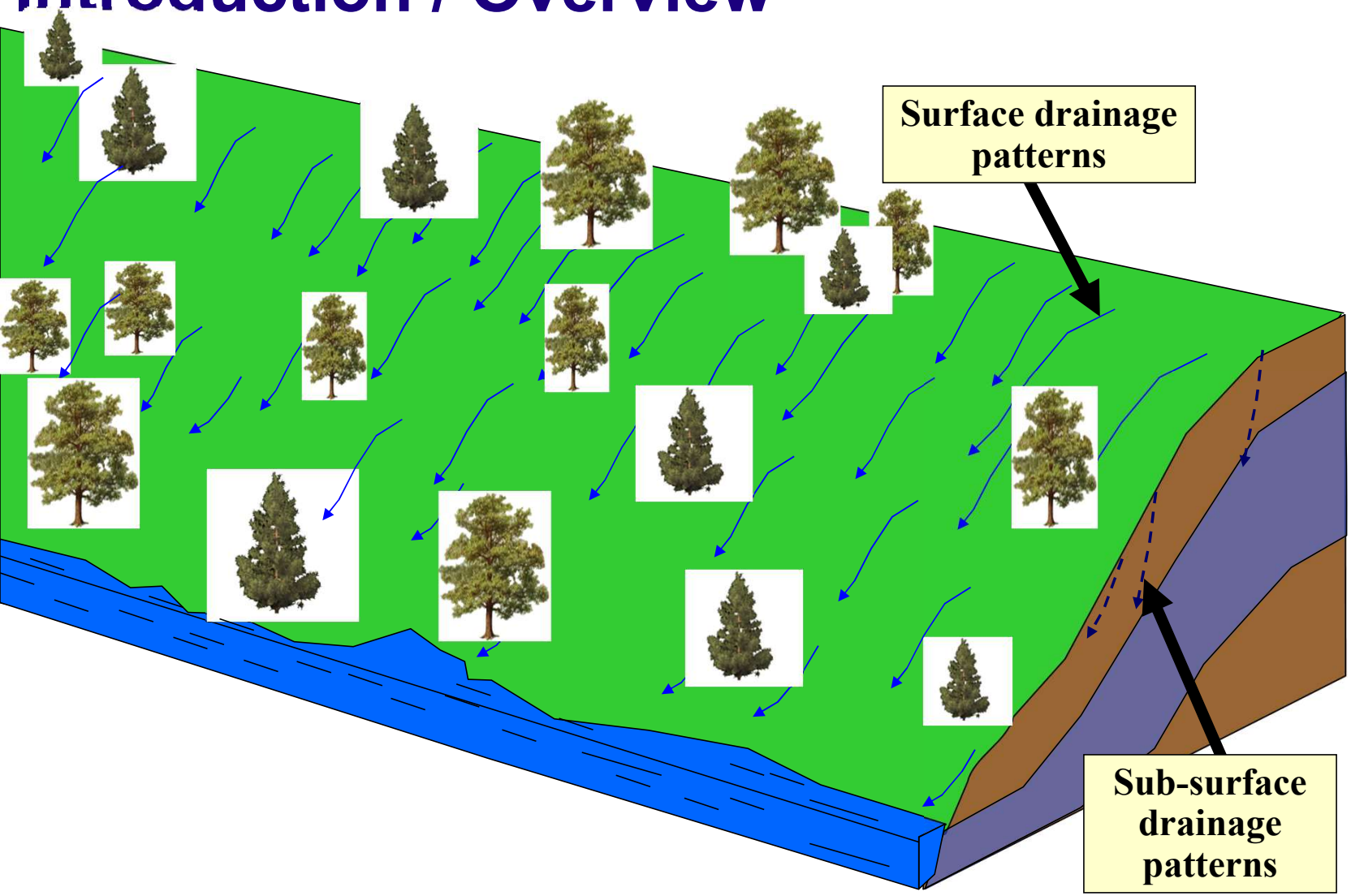
LOW VOLUME ROADS WORKSHOP 2022

Unpaved and Paved LV Roads are often “neglected” as funds are diverted to ever more expensive high traffic roads.

Fractured road ownership has local advantages, but makes any kind of large-scale effort for change or education very problematic

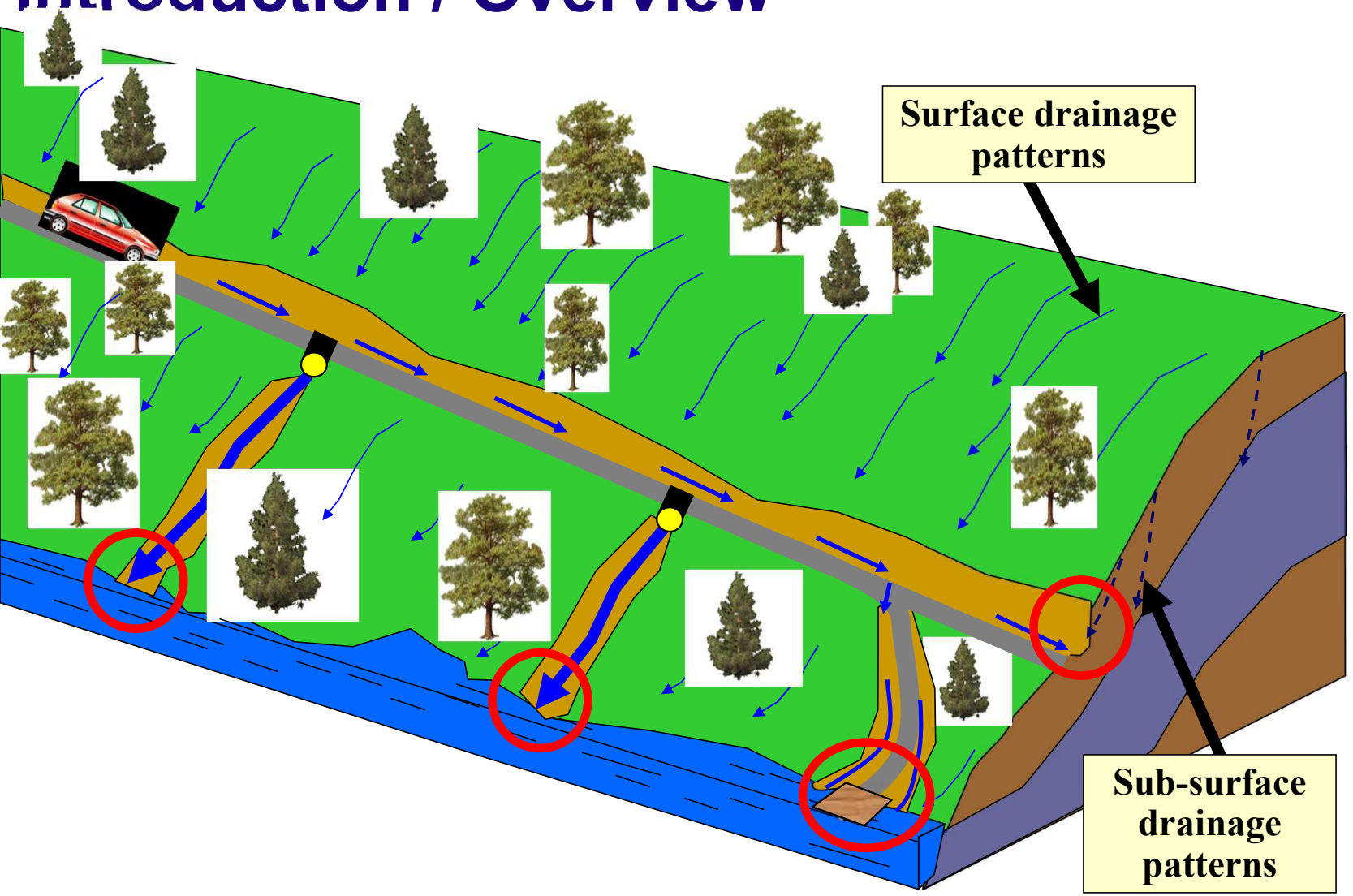
Introduction / Overview

LOW VOLUME ROADS WORKSHOP 2022



Natural Drainage

Introduction / Overview



LOW VOLUME ROADS WORKSHOP 2022

Road Interrupted Drainage

Environmental Impacts of Road Runoff

LOW VOLUME ROADS WORKSHOP 2022

Environmental Impacts of Road Runoff

LOW VOLUME ROADS WORKSHOP 2022

Environmental Impacts of Road Runoff

LOW VOLUME ROADS WORKSHOP 2022

Environmental Impacts of Road Runoff

LOW VOLUME ROADS WORKSHOP 2022

Environmental Impacts of Road Runoff

LOW VOLUME ROADS WORKSHOP 2022

Environmental Impacts of Road Runoff

LOW VOLUME ROADS WORKSHOP 2022

Cornell Local Roads Program

Environmental Im[illegible]unoff

LOW VOLUME ROADS WORKSHOP 2022

Cornell Local Roads Program

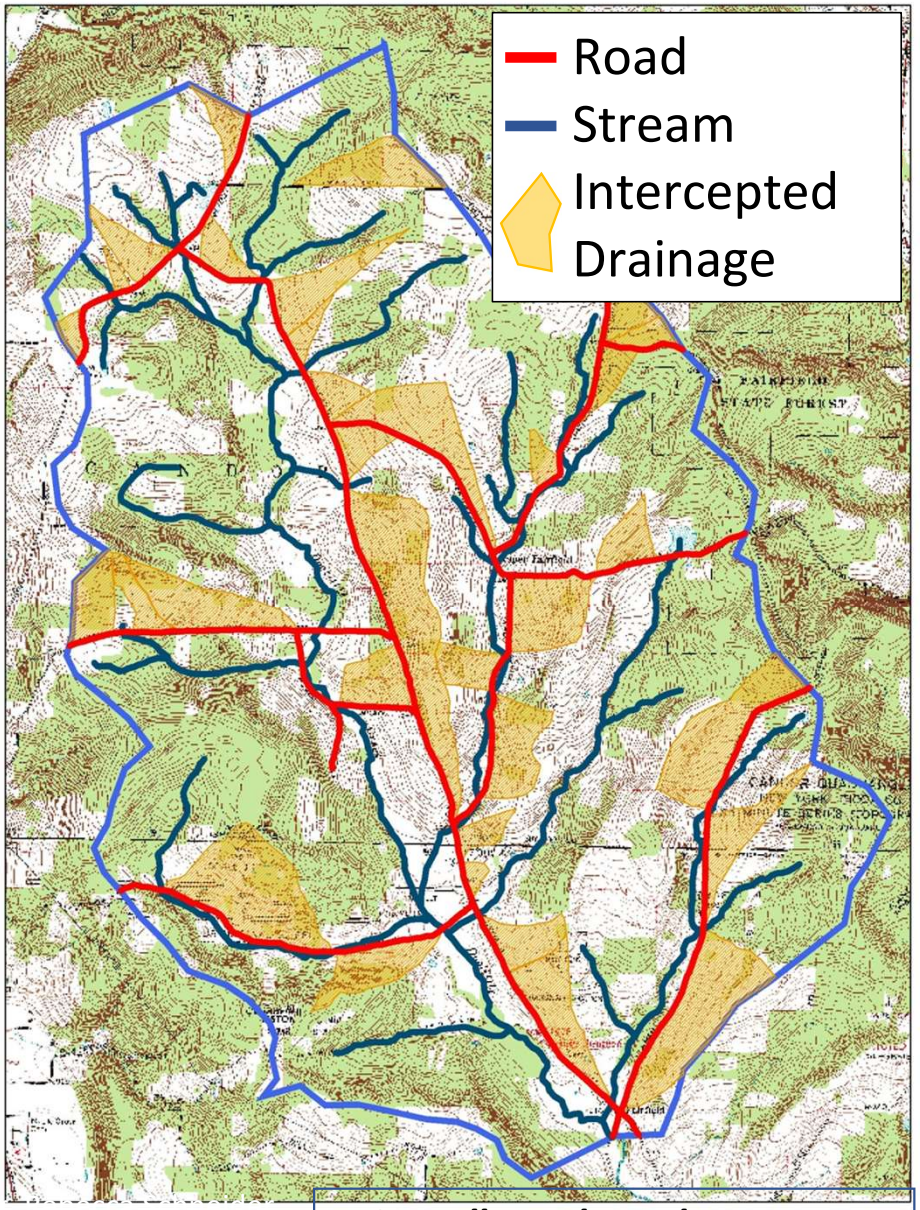

Environmental Impacts of Road Runoff
LOW
VOLUME
ROADS
WORKSHOP
2022

Environmental Impacts of Road Runoff

LOW VOLUME ROADS WORKSHOP 2022

Environmental Impacts of Road Runoff

- Road ditches can intercept up to ¼ of a watershed
- Increase stream flooding
- Funnel sediment/nutrients from adjacent land uses



Cornell Local Roads Program

Traditional stormwater management:

LOW VOLUME ROADS WORKSHOP 2022

- Water collection and transport
- Channel armoring
- Urban practices in a rural setting

Traditional stormwater management:

LOW VOLUME ROADS WORKSHOP 2022

- Water collection and transport
- Channel armoring
- Urban practices in a rural setting

Traditional stormwater management:

LOW VOLUME ROADS WORKSHOP 2022

- Water collection and transport
- Channel armoring
- Urban practices in a rural setting

~~Traditional stormwater management:~~

- ~~Water collection and transport~~
- ~~Channel armoring~~
- ~~Urban practices in a rural setting~~

LOW VOLUME ROADS WORKSHOP 2022

Environmentally Sensitive Maintenance Practice

- Water dispersal
- Sheet flow
- Water infiltration
- Restore natural drainage

The best ditch…is no ditch!

Introduction / Overview

LOW VOLUME ROADS WORKSHOP 2022

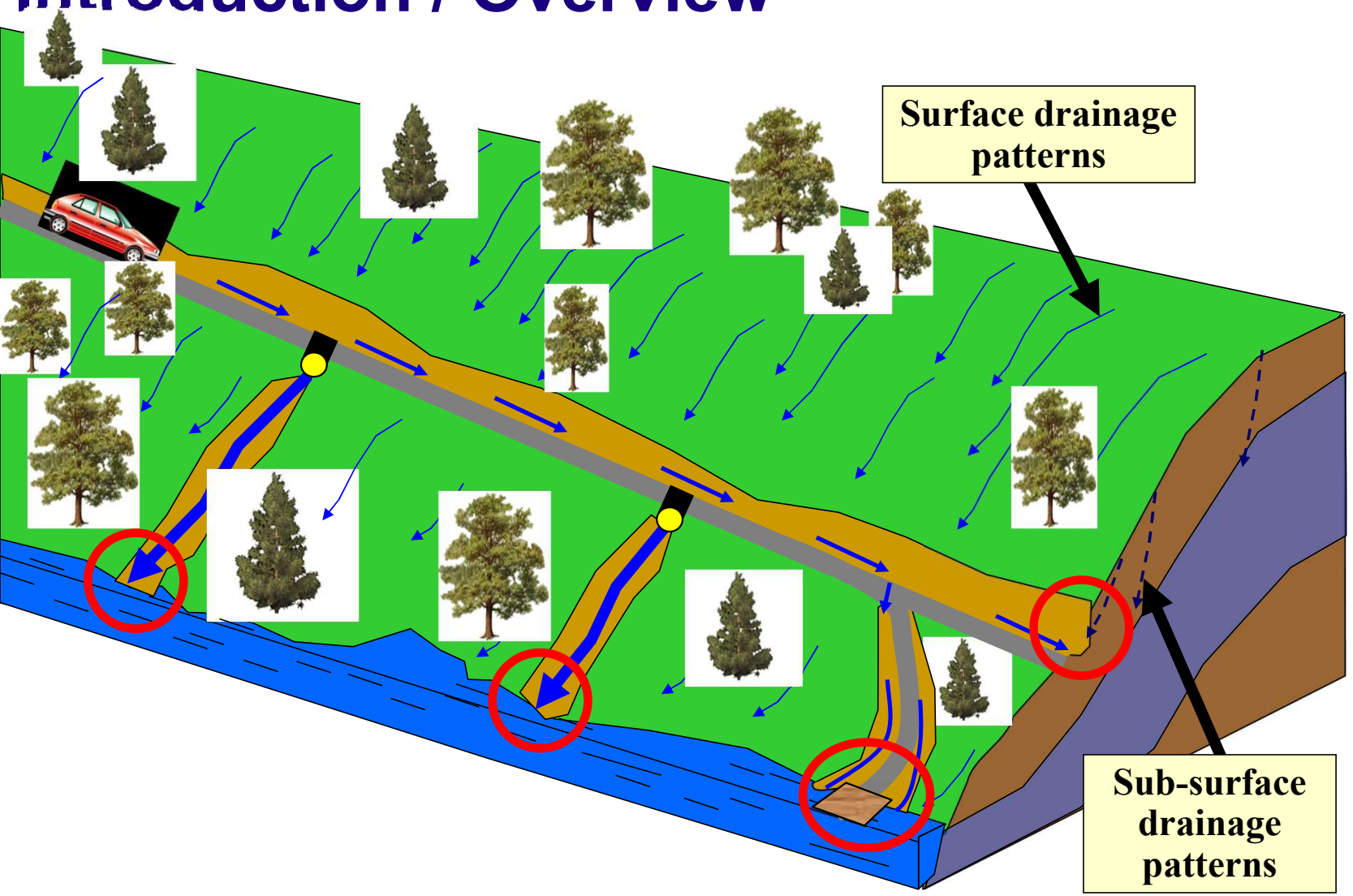
This Program has an environmental improvement focus.

Erosion reduction

Sediment transport reduction

Encourage “natural” drainage.

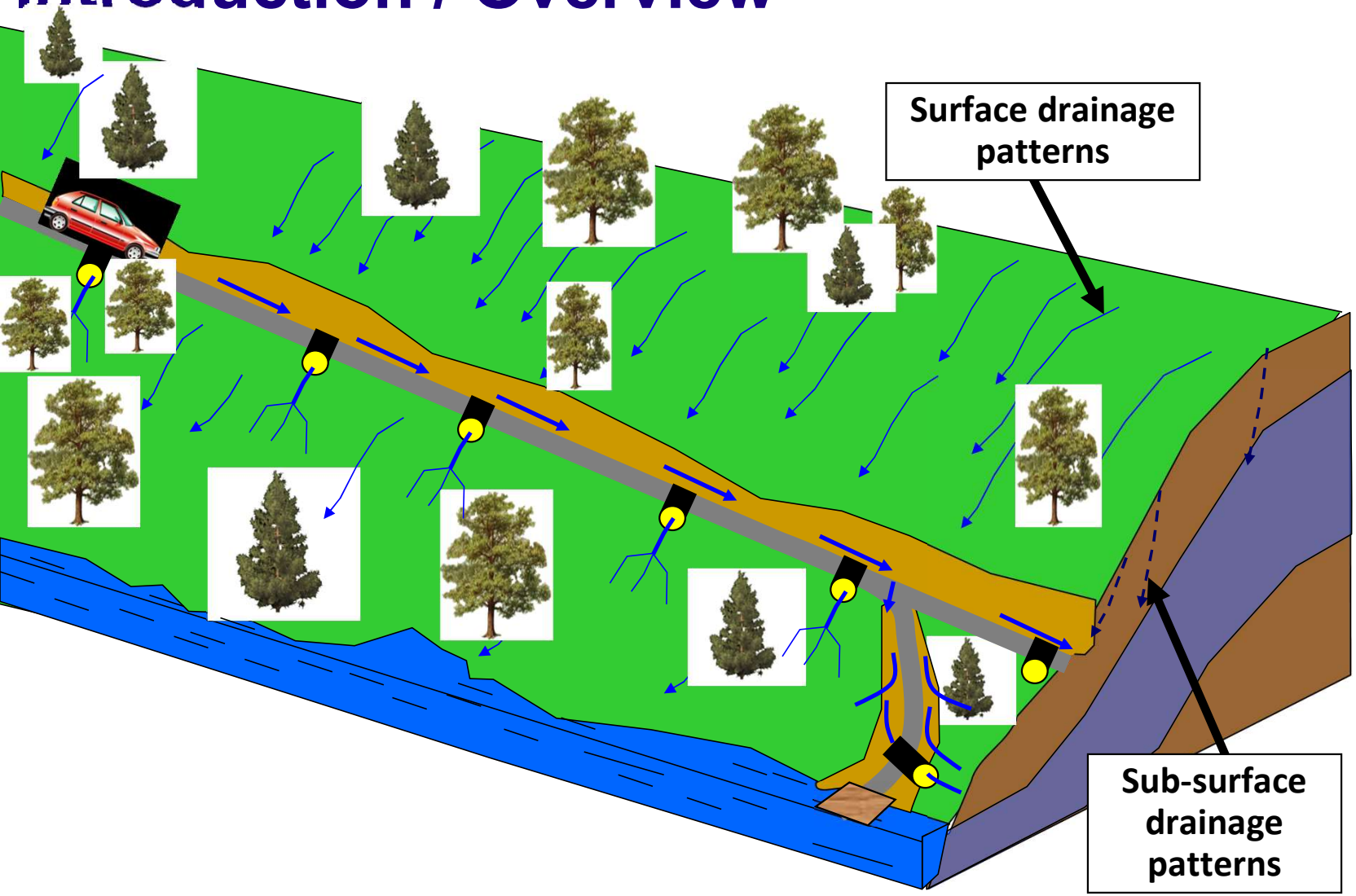
Introduction / Overview



LOW VOLUME ROADS WORKSHOP 2022

Road Interrupted Drainage

Introduction / Overview



LOW VOLUME ROADS WORKSHOP 2022

"Simplified" fix to

<u>Restore Natural Drainage</u>

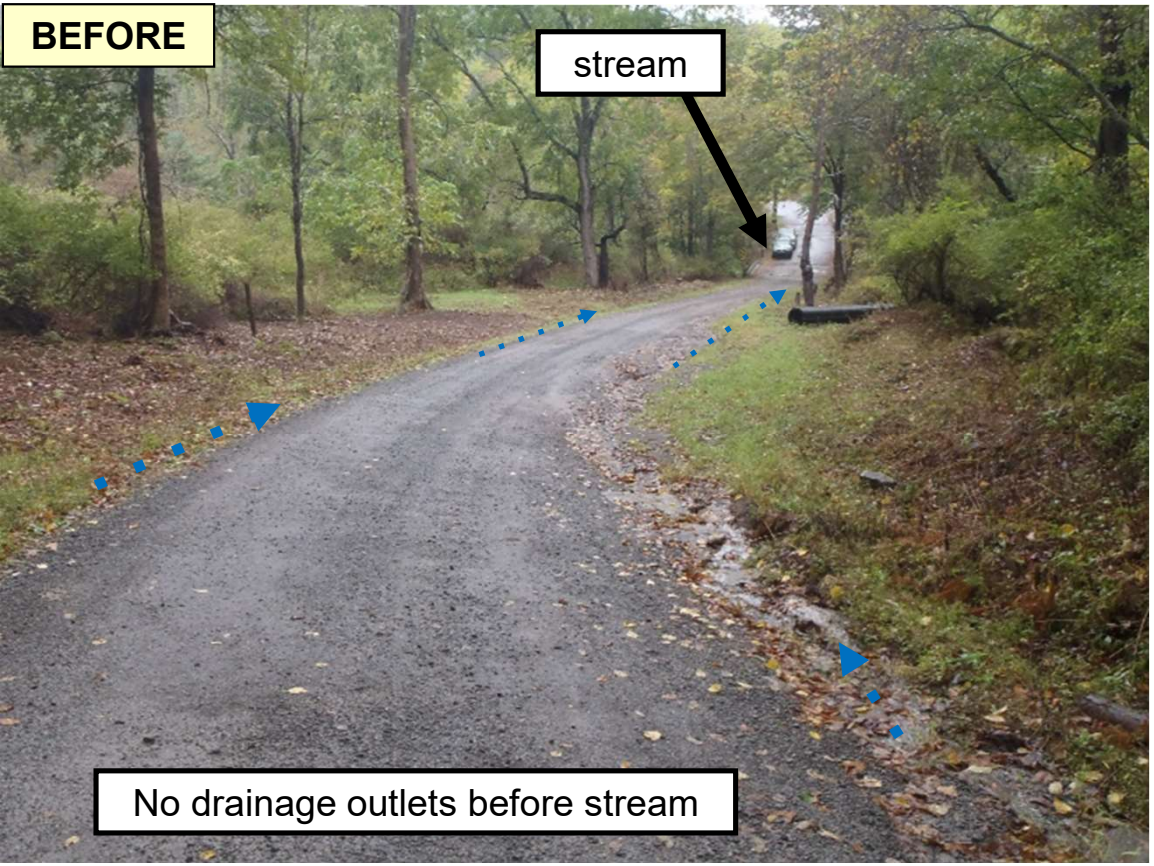
Actual project examples to come

Introduction / Overview

2017 Sample Project

- **$25K Spent, $9K in kind**
- **4 new pipes, several turnouts**
- **Road fill and berm removal**
- **Driving surface aggregate**

LOW VOLUME ROADS WORKSHOP 2022

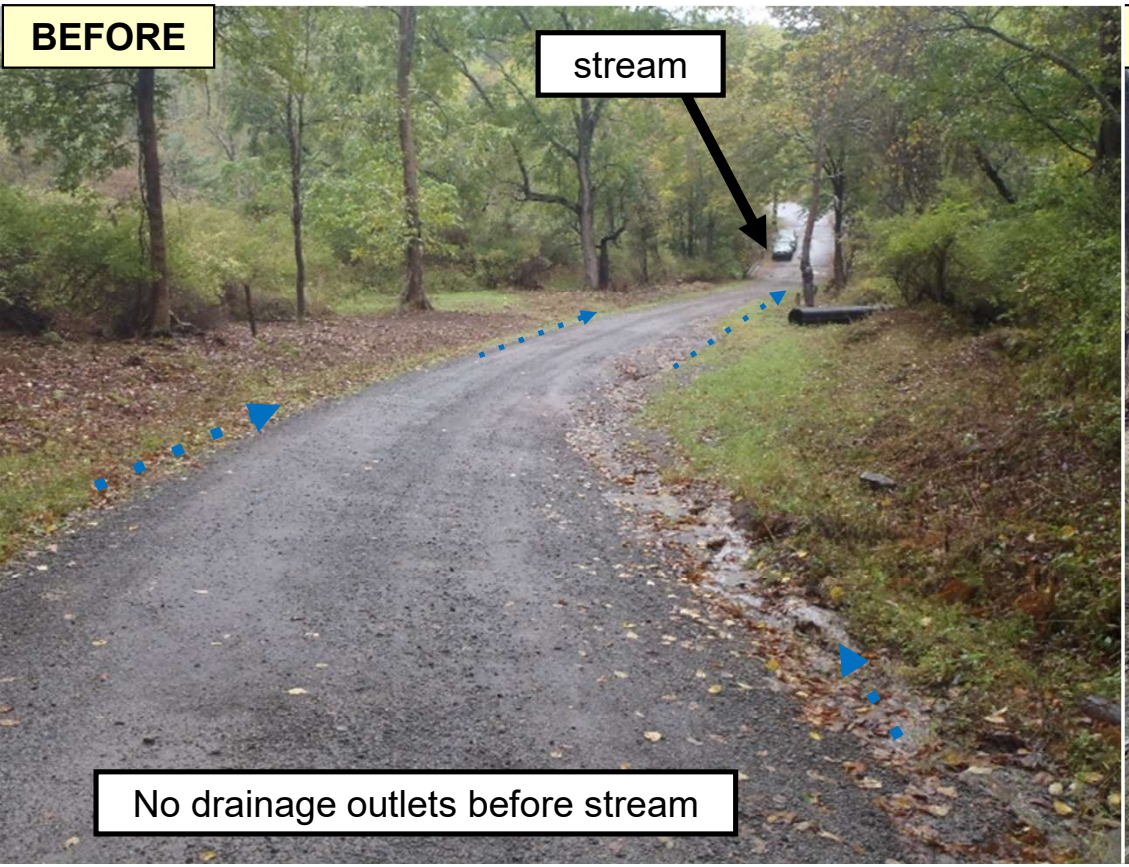


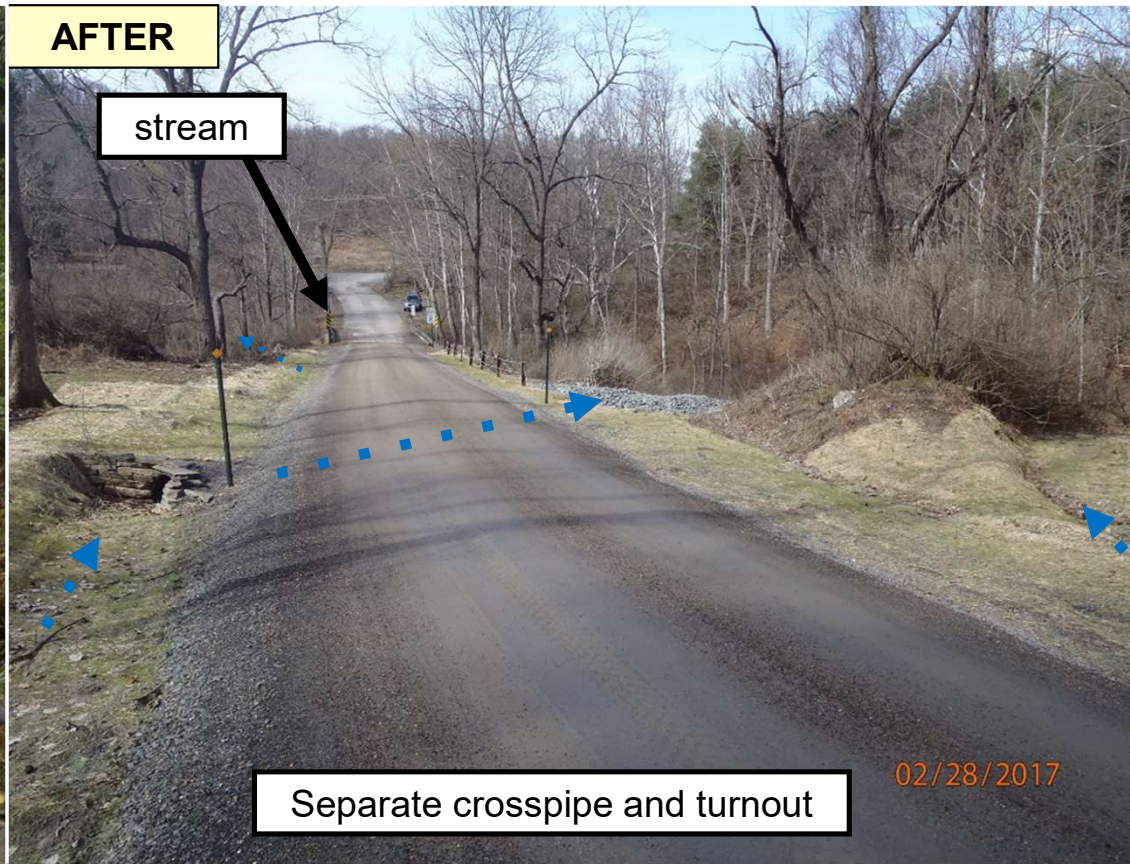
Introduction / Overview

2017 Sample Project

- $25K Spent, $9K in kind
- 4 new pipes, several turnouts
- Road fill and berm removal
- Driving surface aggregate

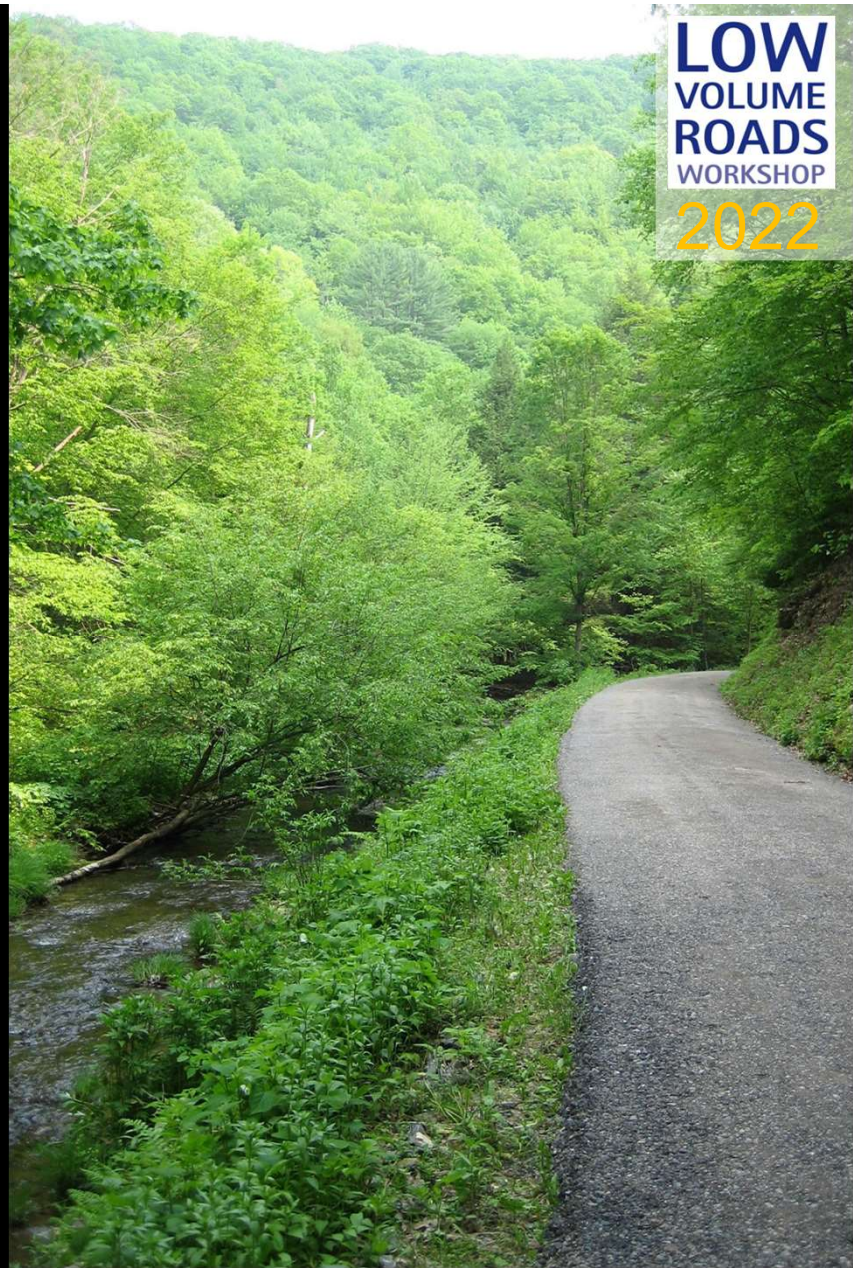
LOW VOLUME ROADS WORKSHOP 2022





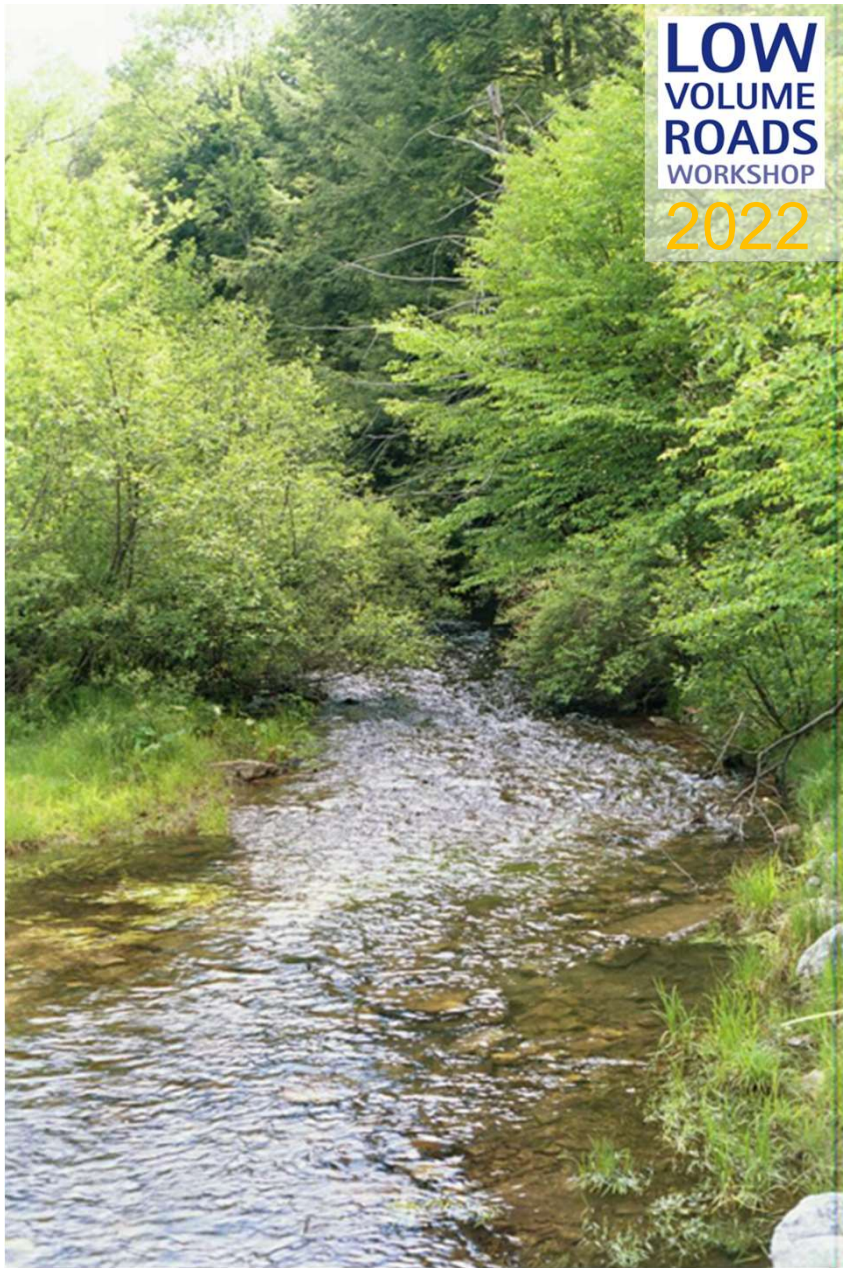
Presentation Outline

- Introduction
- **DGLVR Program**
  - Purpose
  - History
  - Structure
- Example Projects
- DGLVR Program
  - Current Status
  - Lessons learned – technology transfer
- Research Topics
- Driving Surface Aggregate Primer



Program History: Early 1990's

A group of folks were fishing in Central Pennsylvania



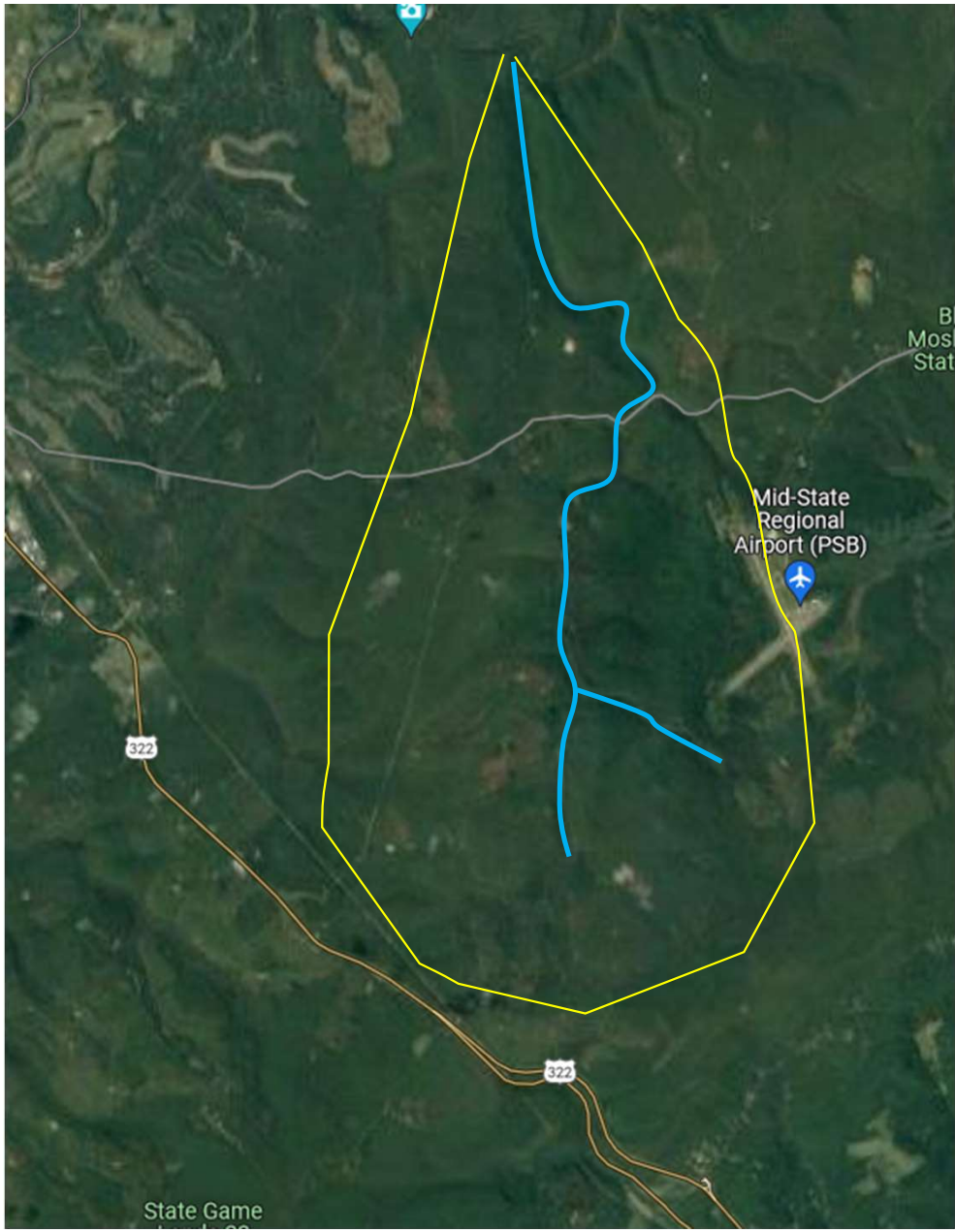
Program History: Early 1990's

Thunderstorms moved through, they went to their cabin for a while, and went back out later that afternoon…

Program History: Early 1990's

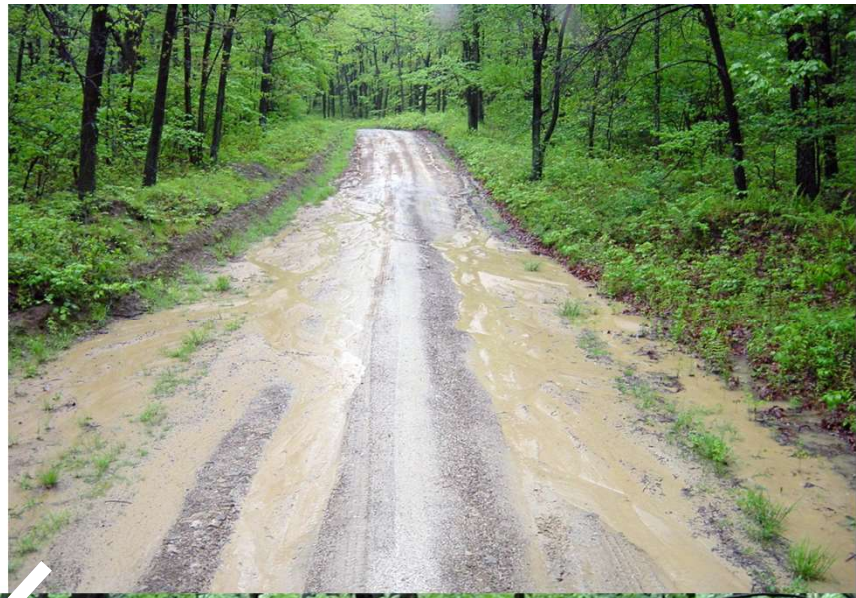
Went investigating:

- Development?
- Logging?
- Clearcut?



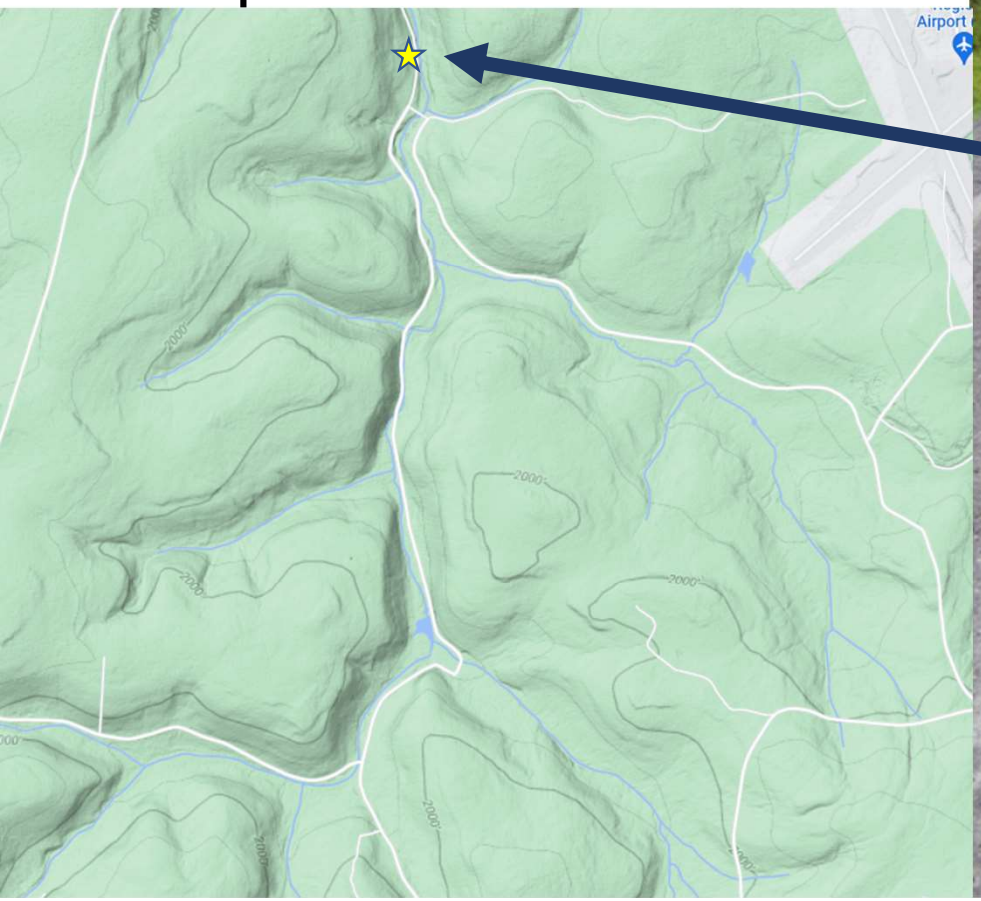
Program History: Early 1990's

The only source of sediment was unpaved roads



Program History: Early 1990's

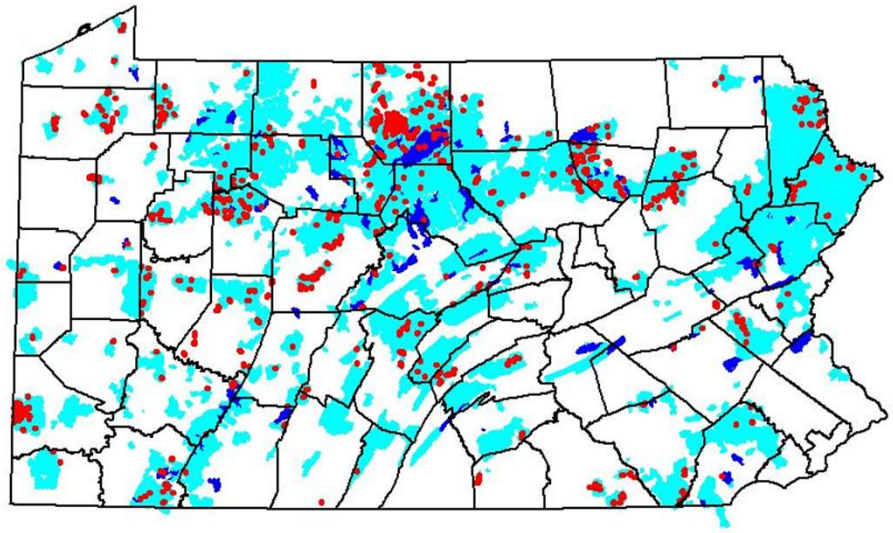
The only source of sediment was unpaved roads



Program History:

Mid 1990s:

- Task force to address problem
- Inventory of protected watersheds

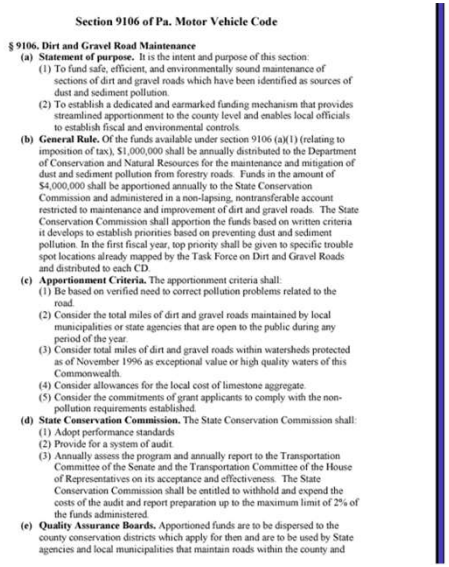


1997:

- DGLVR Program established
- $4Million annual Allocation

2014:

- Funding increased to $28M annually
- Includes $8M for <u>paved</u> LVRs (500ADT)



Section 9106 of Pa. Motor Vehicle Code

§ 9106. Dirt and Gravel Road Maintenance

(a) Statement of purpose. It is the intent and purpose of this section:
(1) To fund safe, efficient, and environmentally sound maintenance of sections of dirt and gravel roads which have been identified as sources of dust and sediment pollution.
(2) To establish a dedicated and earmarked funding mechanism that provides streamlined apportionment to the county level and enables local officials to establish fiscal and environmental controls.

(b) General Rule. Of the funds available under section 9106 (a)(1) (relating to imposition of tax), $1,000,000 shall be annually distributed to the Department of Conservation and Natural Resources for the maintenance and mitigation of dust and sediment pollution from forestry roads. Funds in the amount of $4,000,000 shall be apportioned annually to the State Conservation Commission and administered in a non-lapsing, nontransferable account restricted to maintenance and improvement of dirt and gravel roads. The State Conservation Commission shall apportion the funds based on written criteria it develops to establish priorities based on preventing dust and sediment pollution. In the first fiscal year, top priority shall be given to specific trouble spot locations already mapped by the Task Force on Dirt and Gravel Roads and distributed to each CD.

(c) Apportionment Criteria. The apportionment criteria shall:
(1) Be based on verified need to correct pollution problems related to the road.
(2) Consider the total miles of dirt and gravel roads maintained by local municipalities or state agencies that are open to the public during any period of the year.
(3) Consider total miles of dirt and gravel roads within watersheds protected as of November 1996 as exceptional value or high quality waters of this Commonwealth.
(4) Consider allowances for the local cost of limestone aggregate.
(5) Consider the commitments of grant applicants to comply with the non-pollution requirements established.

(d) State Conservation Commission. The State Conservation Commission shall:
(1) Adopt performance standards
(2) Provide for a system of audit.
(3) Annually assess the program and annually report to the Transportation Committee of the Senate and the Transportation Committee of the House of Representatives on its acceptance and effectiveness. The State Conservation Commission shall be entitled to withhold and expend the costs of the audit and report preparation up to the maximum limit of 2% of the funds administered.

(e) Quality Assurance Boards. Apportioned funds are to be dispersed to the county conservation districts which apply for then and are to be used by State agencies and local municipalities that maintain roads within the county and fulfill certain requirements specified under subsection (g). Within the conservation district a Quality Assurance Board shall be impaneled to establish and administer the grant program. The four member Quality Assurance Board is to be comprised of a nonvoting chairman appointed by the conservation district directors and one local representative appointed by each of the following entities:
(1) The Federal Natural Resource Conservation Service
(2) The Pennsylvania Fish and Boat Commission
(3) The county conservation district
If circumstances require, the chairman may vote to decide a tie vote.

(f) Administration. The Quality Assurance Board's administration of funding shall include:
(1) Adoption of written criteria to assure equal access for all eligible applicants within specified funding categories.
(2) Provision of documentation that application has been made for all required permits.
(3) Adoption of procedures that assure a minimal amount of procedural paperwork.
(4) Adoption of written criteria to specify priorities:
(5) Adoption of funding categories to provide separate budgeting for:
(i) Department of Conservation and Natural Resources, Bureau of Forestry roads.
(ii) Municipal government roads.
(iii) Road demonstration projects.
(iv) Training grants restricted to 15% of funding.
(v) Administrative costs, limited to actual documented costs and restricted to a maximum of 10%.
(6) Adoption of incentives for training road managers and equipment operators.
(7) Adoption of standards that prohibit use of materials or practices which are environmentally harmful.
(8) Adoption of site inspection requirements to verify completion of work.

(g) Grant Application. Each grant application shall:
(1) Be specific to one work site or one type of work except that all State Forest roads within one county and within one Forest District may be authorized on a single grant.
(2) Expedite the approval process by allowing the Quality Assurance Board to insert additional requirements that complete and qualify the grant for approval and which when accepted by the applicant become a binding obligation on the applicant.
(3) Require minimal handwritten information such as location, problem being solved, basis of cost estimate, project work schedule, basis of successful completion, and type and amount of pollution reduced.

The grant application shall not exceed one page with reference to published standards being acceptable.

(Apr. 17, 1997, P.L.6, No.3, eff July1, 1997) **1997 Amendment.** Act 3 added section 9106

Program History:

Over $250,000,000 in projects put on the ground to date

Program Funding is Supplementary, not part of regular road budgets.

Focus on specific project to reduce environmental impact and long term maintenance

Program Structure:

LOW VOLUME ROADS WORKSHOP 2022

- $ 28Million in Supplemental grant funding
- Run through PA Department of Agriculture and County Conservation Districts (non road agencies)
- Environmentally Focused Projects
- Local Control
- Focus on Education

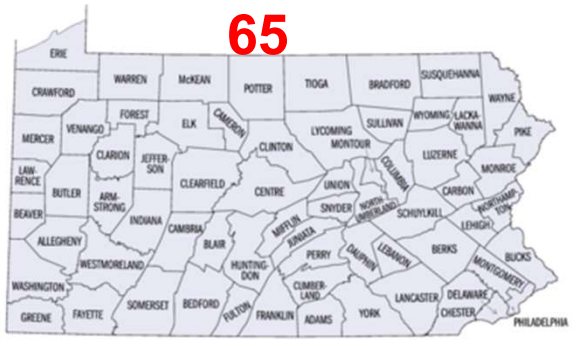
DGLVR Program Structure

State: State Conservation Commission

$

County: Conservation Districts

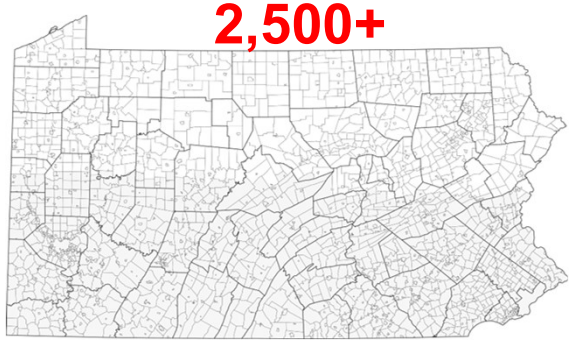
65



$

Local: Townships(90%+)

2,500+



DGLVR Program Structure

2%

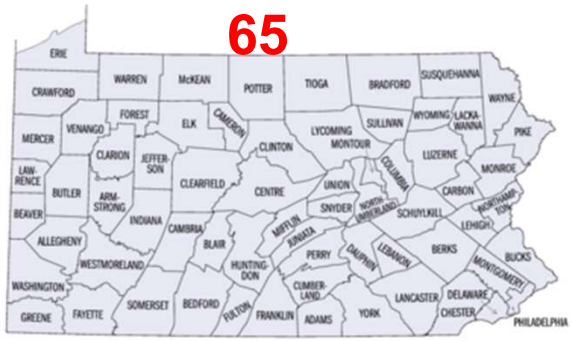
State: State Conservation Commission

- **Administers statewide program.**
- Allocates money to Conservation Districts.
- Develops statewide Program policy
- Quality Assurance Quality Control process.

$

County: Conservation Districts

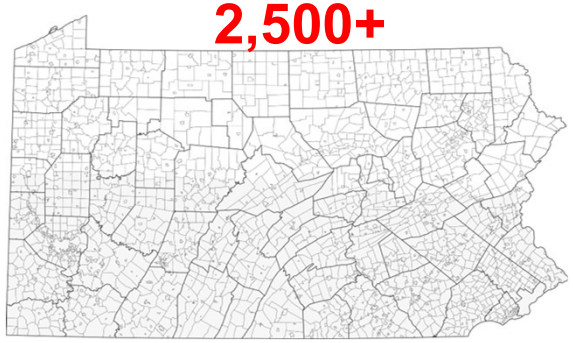
65



$

Local: Townships(90%+)

2,500+



DGLVR Program Structure

2% **State: State Conservation Commission**

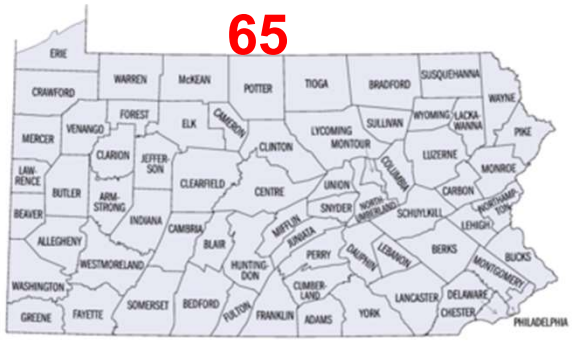
- **Administers statewide program.**
- Allocates money to Conservation Districts.
- Develops statewide Program policy
- Quality Assurance Quality Control process.

$

10% **County: Conservation Districts**

- **Administer Program at county level.**
- Receive money based on roads & pollution sites.
- Work with applicants to develop work plans.
- Provide grants to successful applicants
- Conduct inspection after work is completed.
- Keep records and report to State annually.

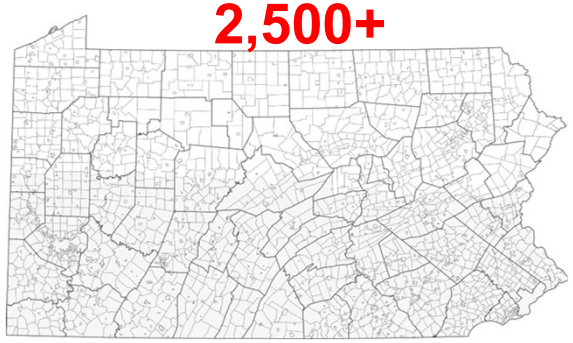
65



$

Local: Townships(90%+)

2,500+



DGLVR Program Structure

7% **State: State Conservation Commission**

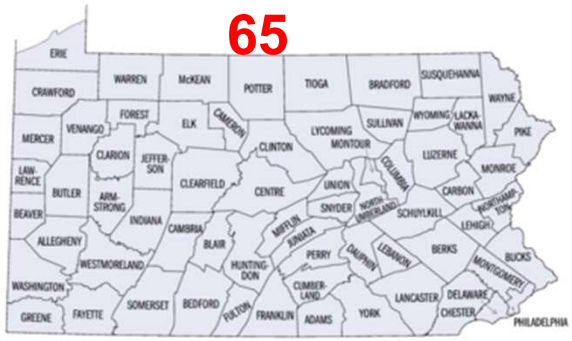
- **Administers statewide program.**
- Allocates money to Conservation Districts.
- Develops statewide Program policy
- Quality Assurance Quality Control process.

$

10% **County: Conservation Districts**

- **Administer Program at county level.**
- Receive money based on roads & pollution sites.
- Work with applicants to develop work plans.
- Provide grants to successful applicants
- Conduct inspection after work is completed.
- Keep records and report to State annually.

65



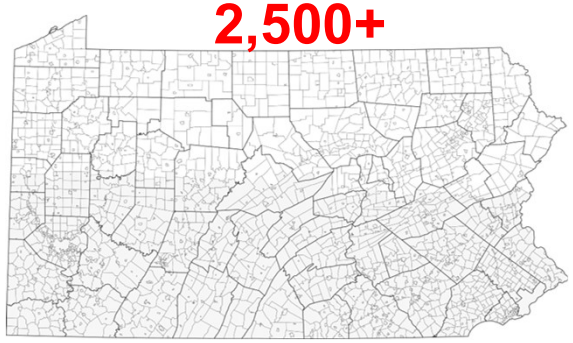
$

+80% of funds go “on the ground”

Local: Townships(90%+)

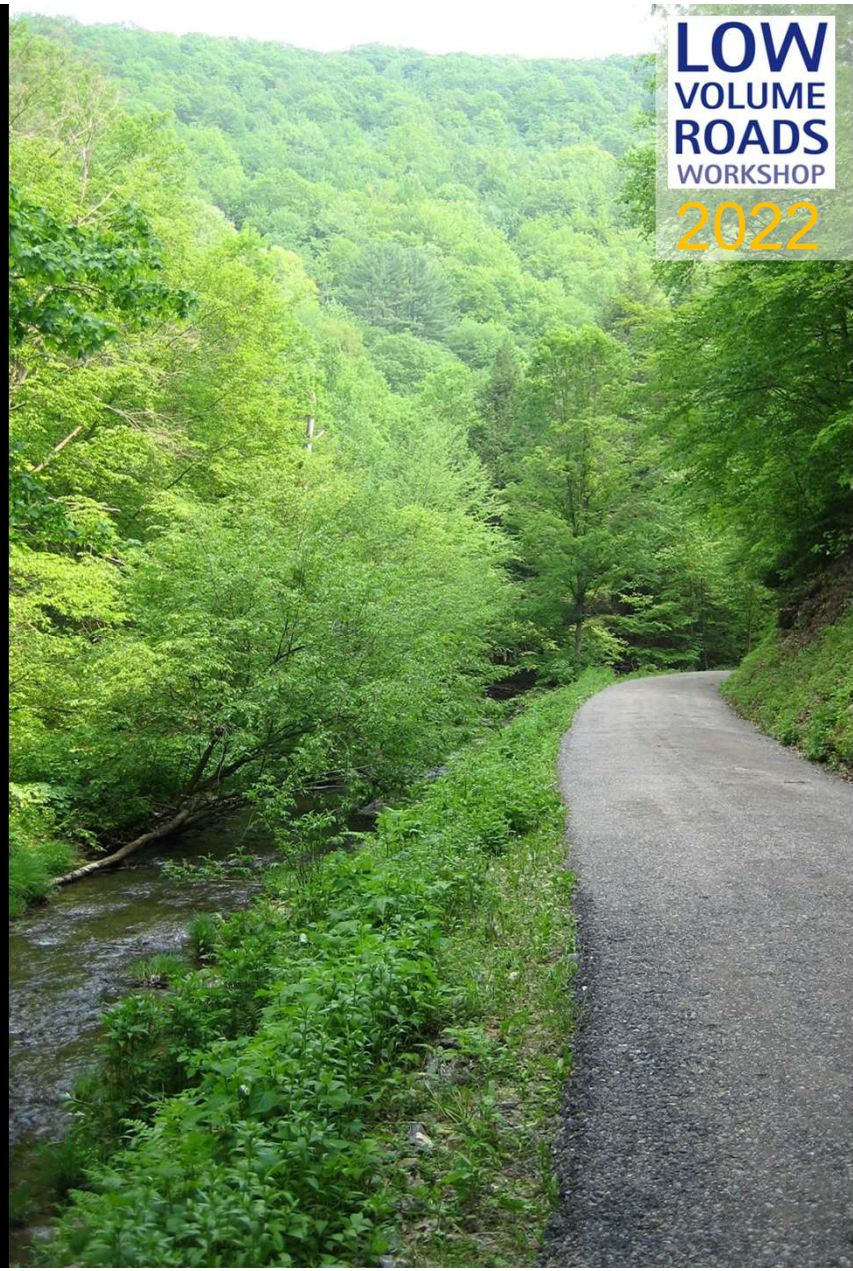
- Boroughs, cities, and state agencies also eligible
- Must attend training within last 5 years.
- **Apply to Conservation District for funding.**
- **Enter into contract with Conservation District.**
- **Complete project work or hire sub-contractors.**

2,500+



Presentation Outline

- Introduction
- DGLVR Program
  - Purpose
  - History
  - Structure
- **Example Projects**
- DGLVR Program
  - Current Status
  - Lessons learned – technology transfer
- Research Topics
- Driving Surface Aggregate Primer



Sample Projects

Wetland created to treat road ditch drainage before stream

DnG Project in Centre County:
$12K Spent, $19 in kind

Sample Projects

Grass swale over new storm sewer

2016 LVR Project in Montgomery County: $24K Spent, $2 in kind

Sample Projects

Extensive road fill, sheet flow and new crosspipes

2016 DnG Project in Bradford County: $107K Spent, $14 in kind

Sample Projects

Stream pipe replacement. Fill, Mattress, new pavement

2017: D&G Project
Cumberland County,
$138K Spent, $43K in kind

Sample Projects

Road shifted away from stream. Bank armoring and in-stream flow controls

Elk County
$60K Grant, 52K In-kind

Sample Projects

French Mattress and road fill.

Centre County
$35K grant

Sample Projects

9,000 tons fill

1,300 ft underdrain

8 new pipes

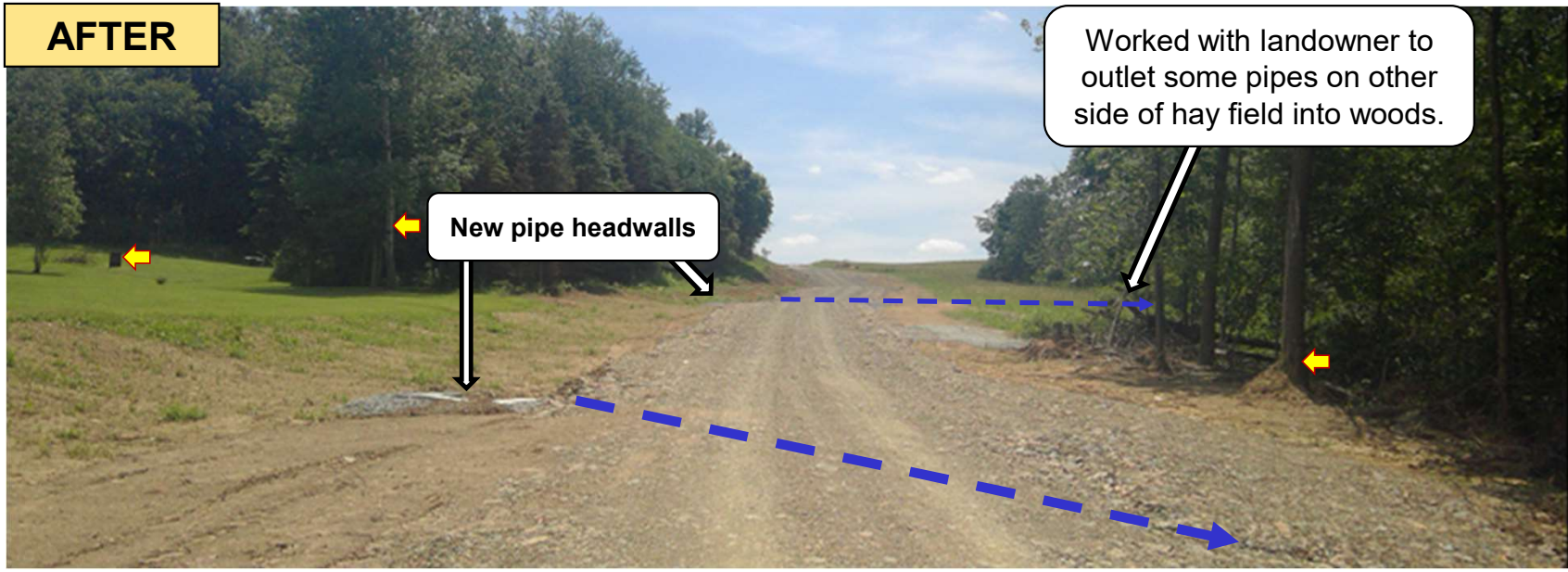
Bradford County
$92K grant, $15K in-kind

Sample Projects

10,000 tons fill

10 new pipes

Armstron County
$56K grant, $56K in-kind



Sample Projects

Base improvement

New surface

10+ new pipes

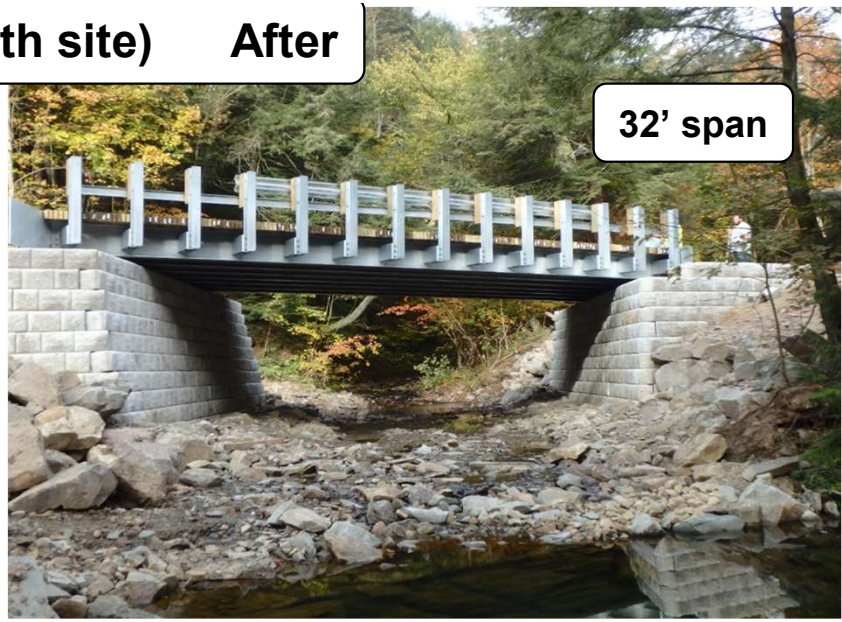
Wayne County
$92K grant, $17K in-kind

Sample Projects

Two new bridges

Opened up 11+ miles of native trout habitat.

Tioga County
$259K grant, $156K in-kind



Better Roads, Cleaner Streams.

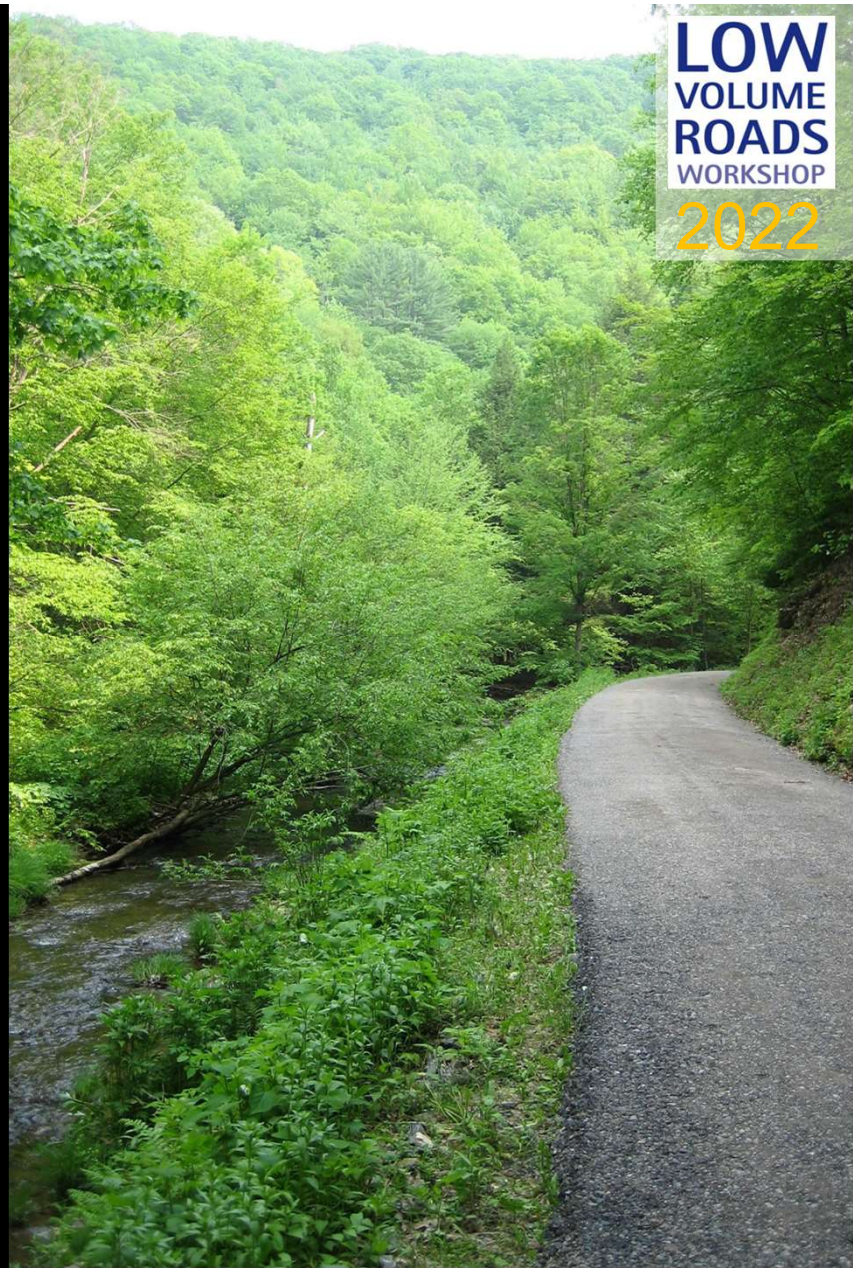
LOW VOLUME ROADS WORKSHOP 2022

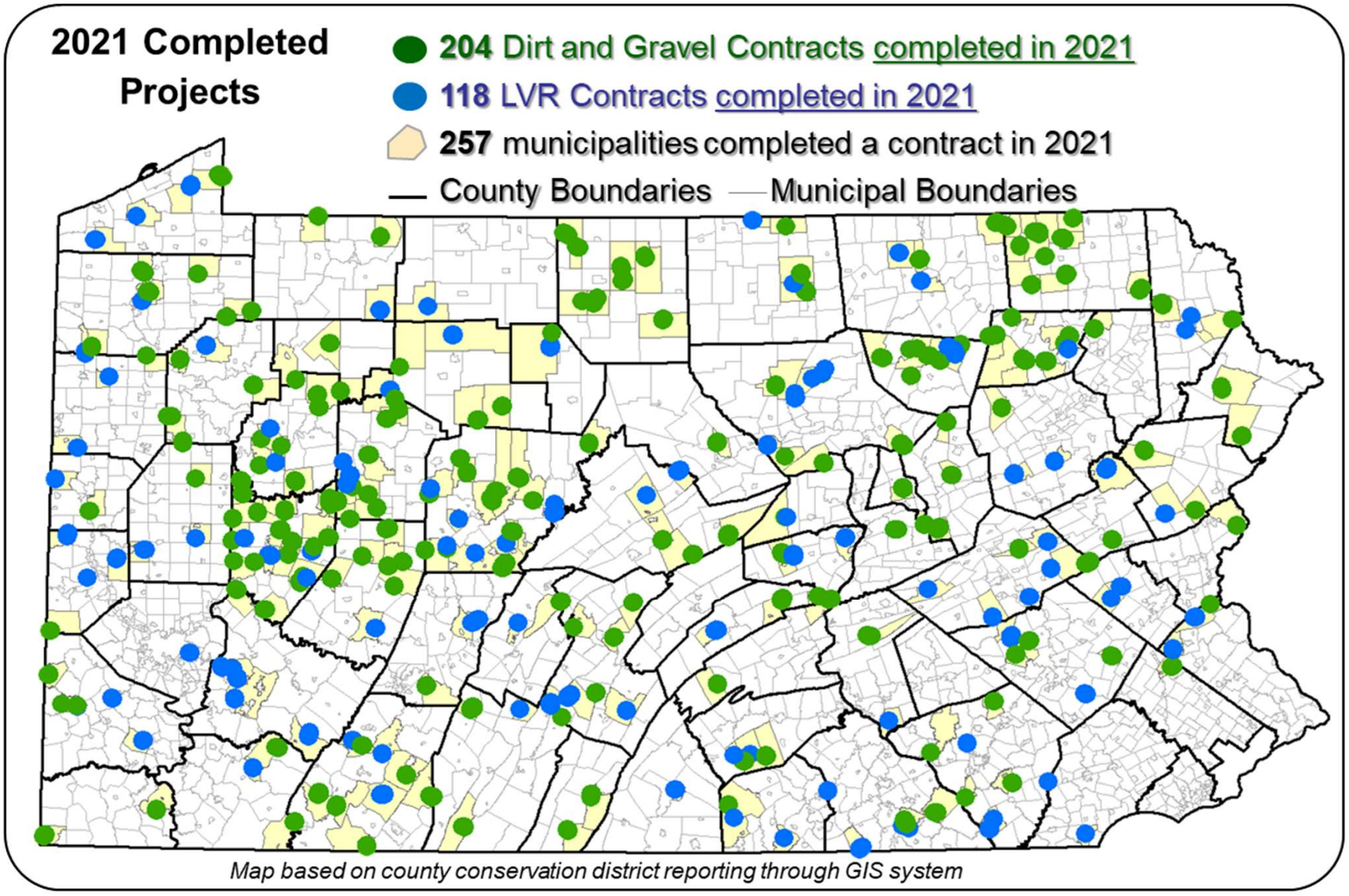
This Program has an environmental improvement focus.

Reducing erosion also saves money and lengthens maintenance cycles

Presentation Outline

- Introduction
- DGLVR Program
  - Purpose
  - History
  - Structure
- Example Projects
- **DGLVR Program**
  - **Current Status**
  - **Lessons learned – technology transfer**
- Research Topics
- Driving Surface Aggregate Primer

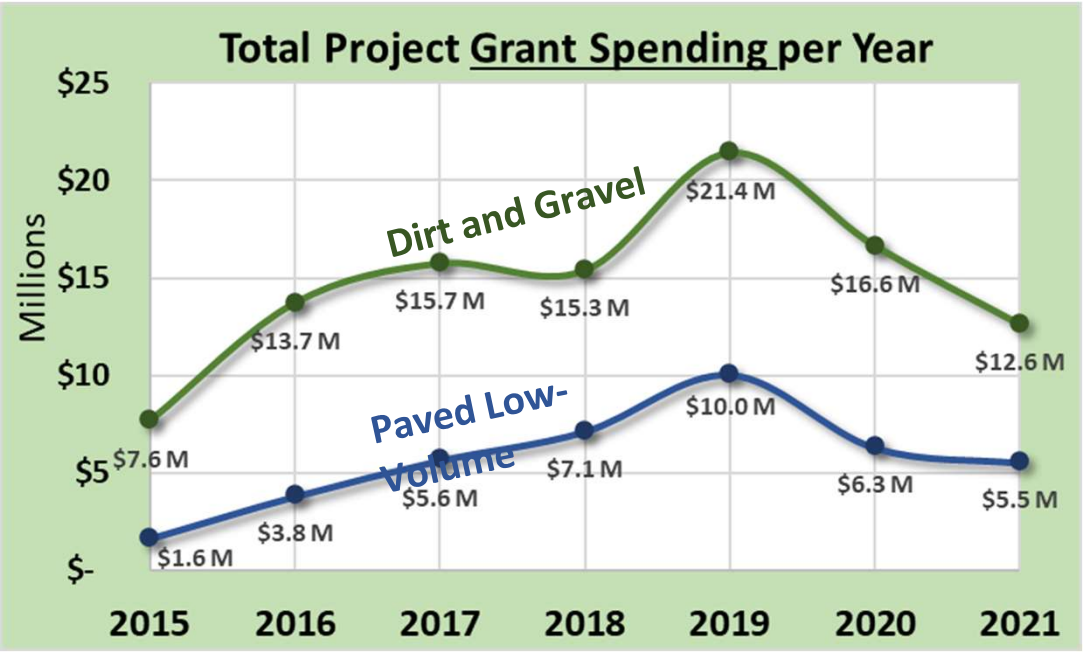




LOW VOLUME ROADS WORKSHOP 2022

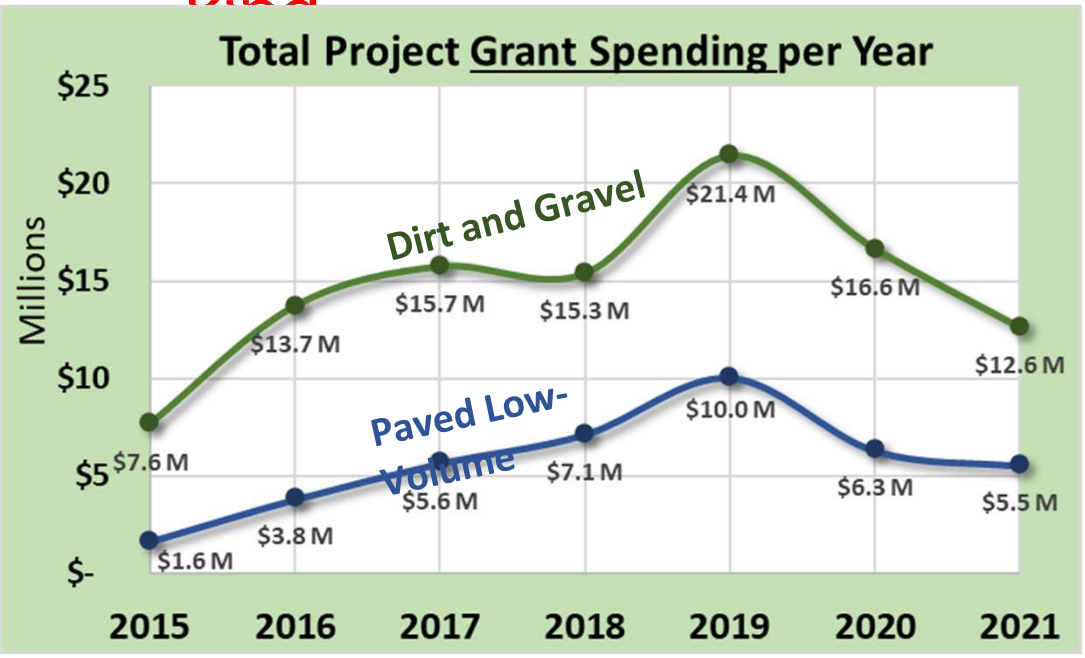
Program Status

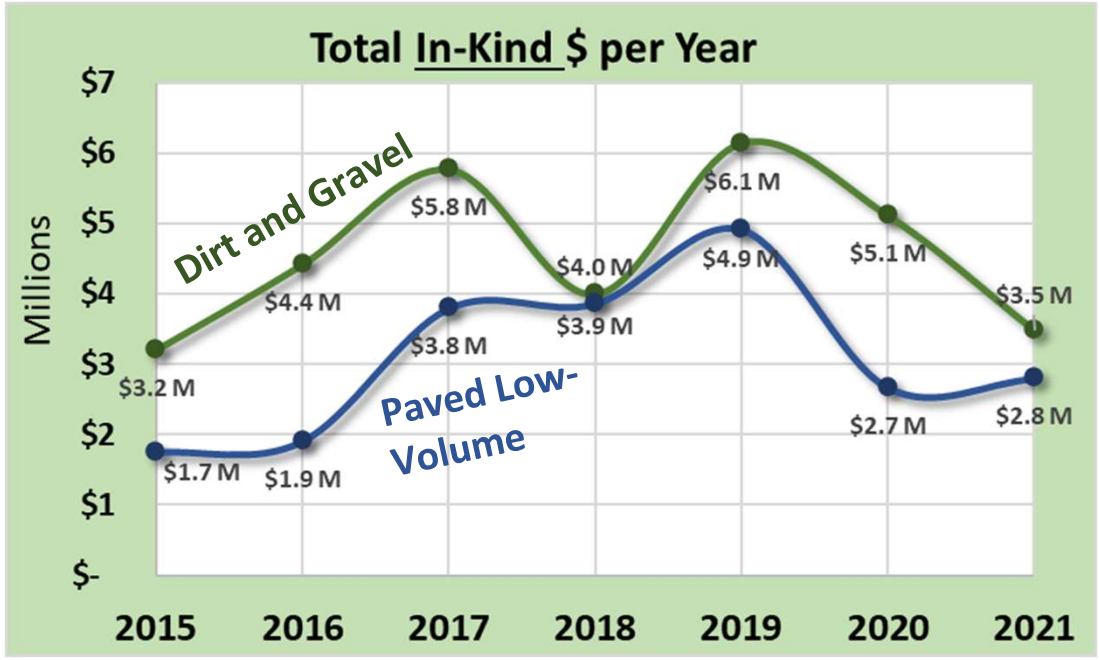
- 300-500 projects completed annually
- $23 Million put “on the ground” annually



Program Status

- 300-500 projects completed annually
- $23 Million put “on the ground” annually
- Additional $6 - $8 Million in-kind annually
- Program is ~110% efficient when including in-kind





Program Status

Average Annually

~250 Unpaved Road Projects
~100 LV Paved Projects

- 700 new crosspipes
- 32 miles of underdrain
- 85 stream crossings
- 120,000 tons Aggregate
  (5,400+ trucks)
- 400,000 tons fill
  (18,000+ trucks)





Program Future:

Current Program Challenges

- **Stream Crossings**
  - Most in PA are undersized and causing issues
  - New Program “Stream Crossing Replacement Standard” adopted in 2022.

- **Retention and turnover at county and local level**

- **Erosion of funding due to costs**

- **Expanding practices to other road-owning entities**

Program Lessons:

What would happen if you gave a large state/federal DOT $35 Million a year?

LOW VOLUME ROADS WORKSHOP 2022

Program Lessons:

LOW VOLUME ROADS WORKSHOP 2022

What would happen if you gave a large state/federal DOT $35 Million a year?

Program Lessons:

LOW VOLUME ROADS WORKSHOP 2022

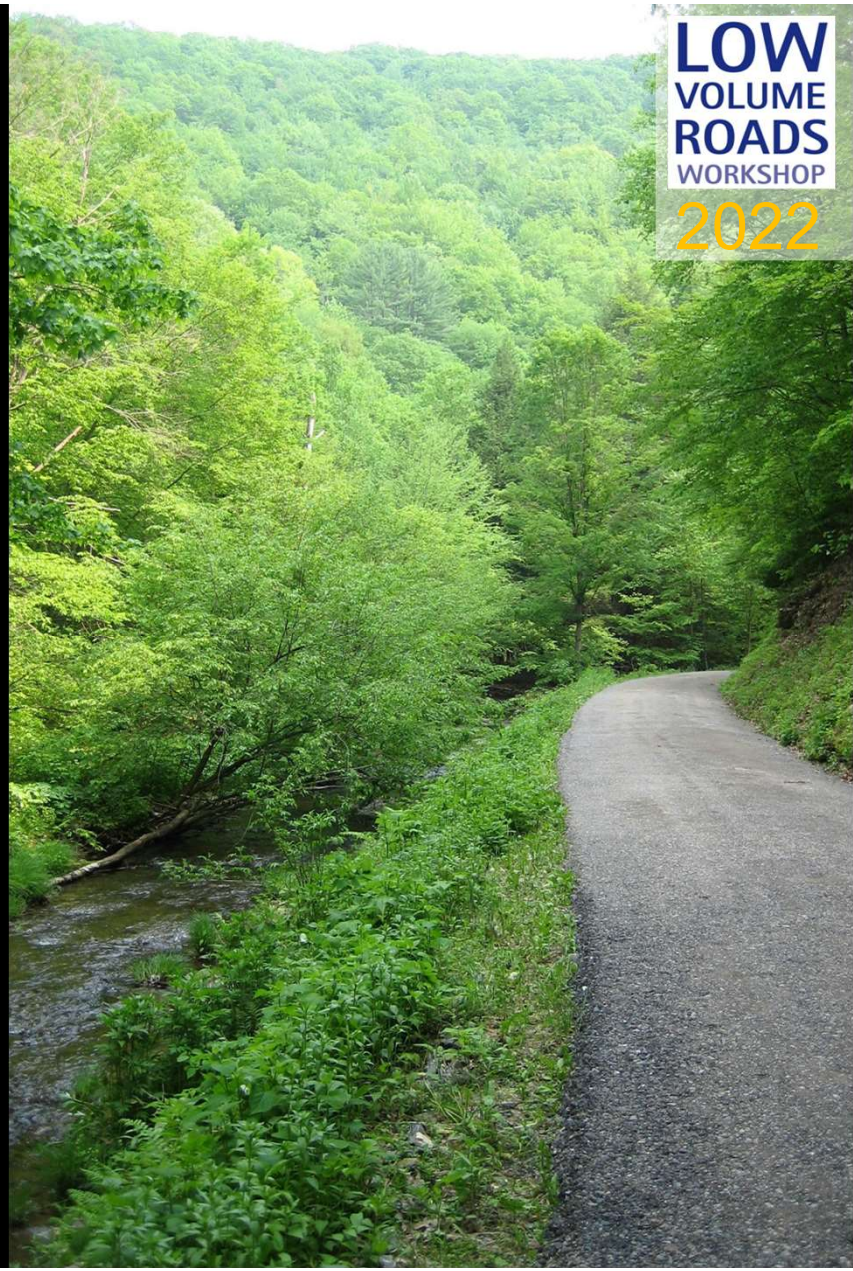
What would happen if you gave a large state/federal DOT $35 Million a year?

You can make impactful change:

- Dedicated focused funding
- Local control
- Education

Presentation Outline

- Introduction
- DGLVR Program
  - Purpose
  - History
  - Structure
- Example Projects
- DGLVR Program
  - Current Status
  - Lessons learned – technology transfer
- **Research Topics**
- Driving Surface Aggregate Primer



Research Efforts

LOW VOLUME ROADS WORKSHOP 2022

Note: just brief one slide summaries

I am available to discuss more details of anything of interest

Research Efforts

Invasive Species

Japanese stilt grass spread by road maintenance practices (grading

Research Efforts

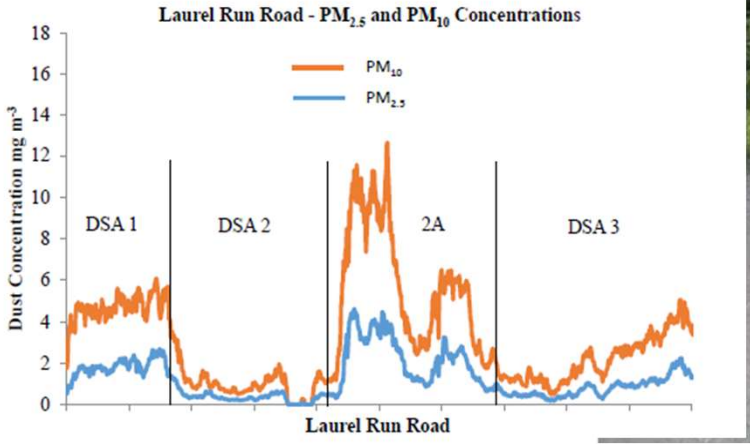
Acid Rain Remediation

Use of road drainage to dose runoff to remediate acid rain impacts.

Research Efforts

Dust Quantification

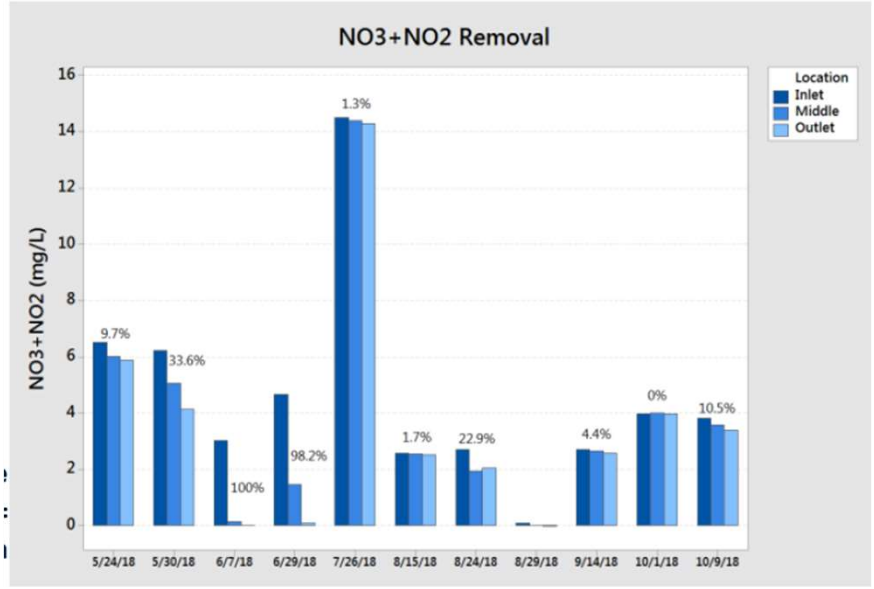
Development of real-time dust monitor system.

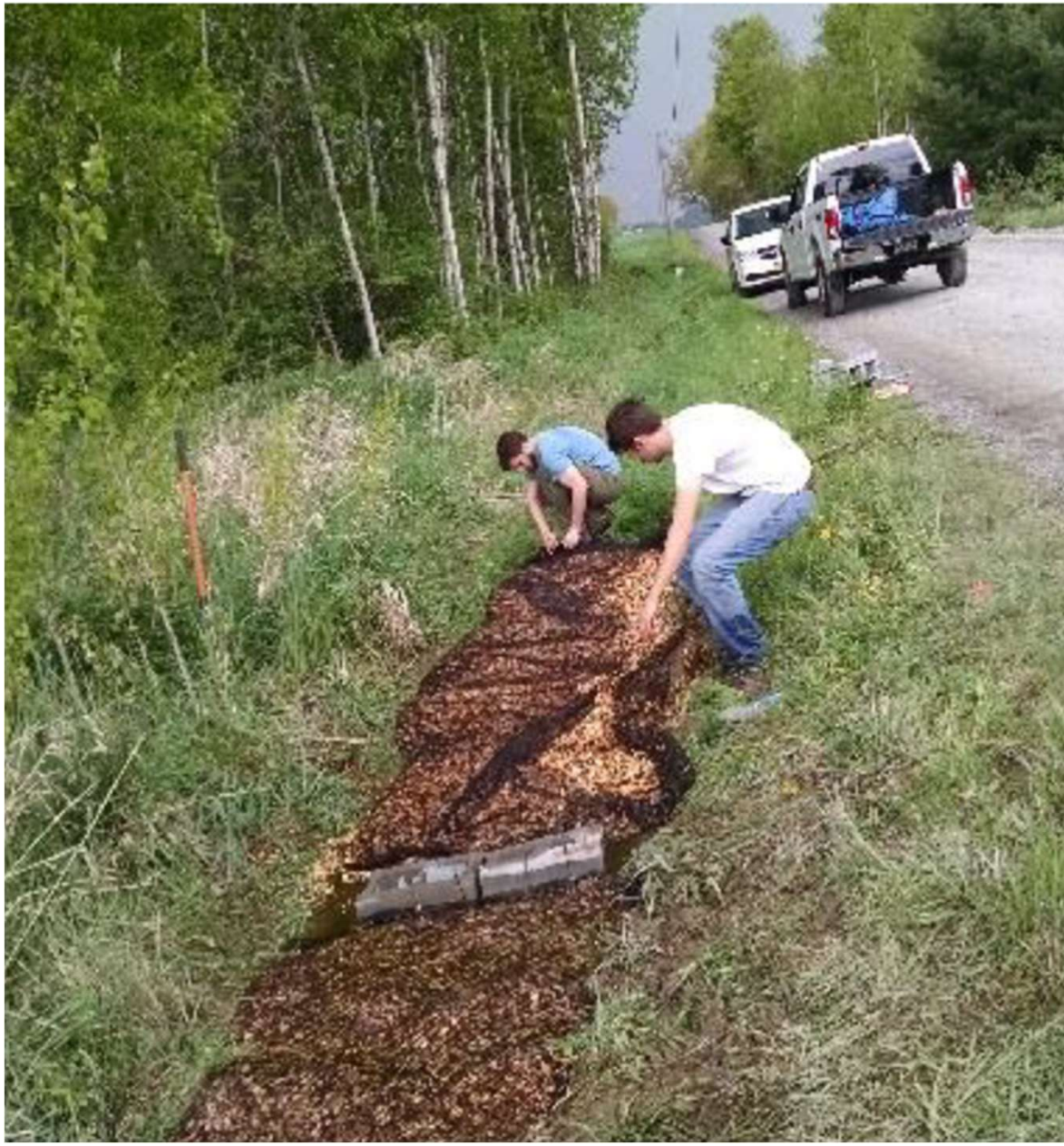


Research Efforts

Road Ditch Bioreactor

- Installed in high use agriculture areas
- Nitrogen removal

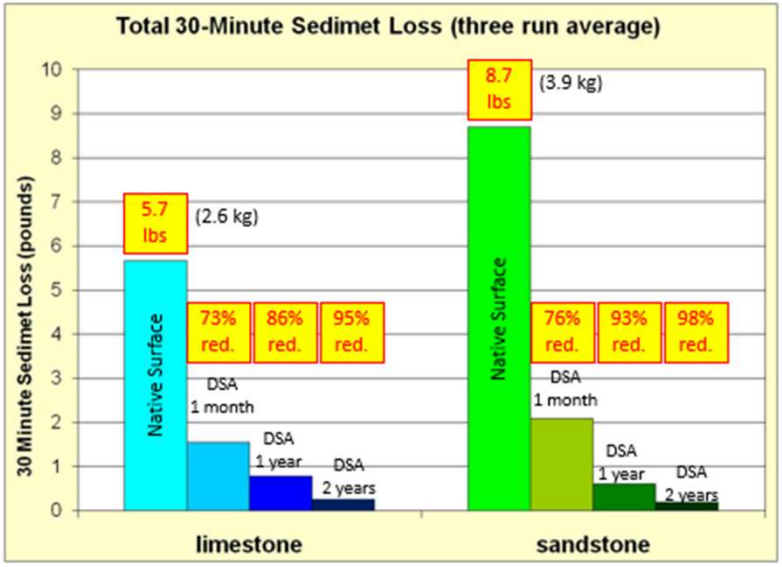




Research Efforts

Mobile Rainfall Simulator

- Controlled rain event on 30M of road
- Sediment runoff quantification



Research Efforts

Aggregate Studies

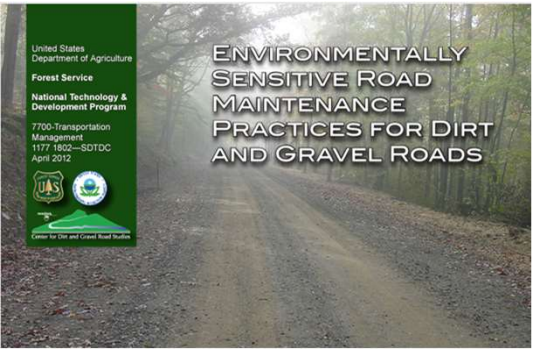
Cost
Durability
Longevity
Sediment production

More information:

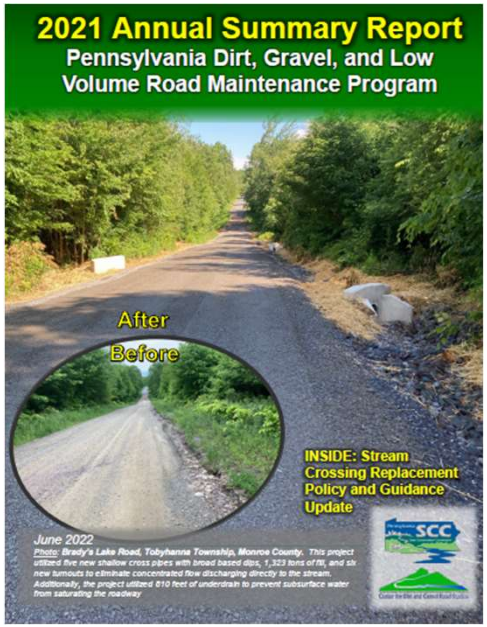
Limited quantities: on registration table

LOW VOLUME ROADS WORKSHOP 2022

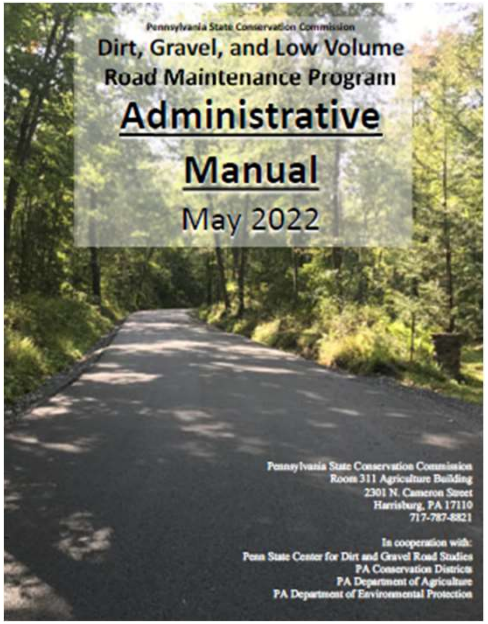
USFS Practice Guide



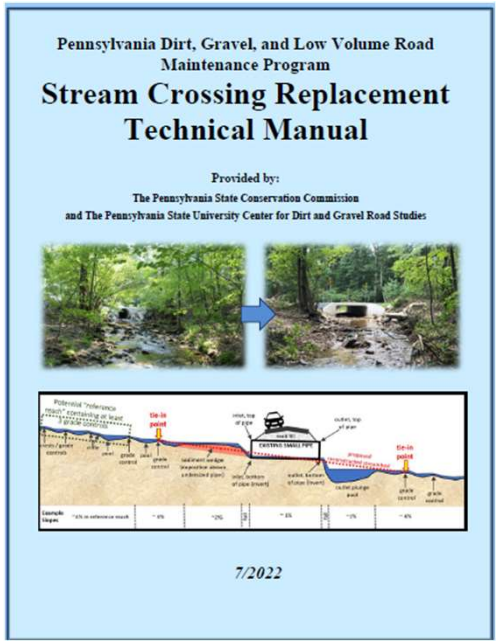
Program Report



Program Details

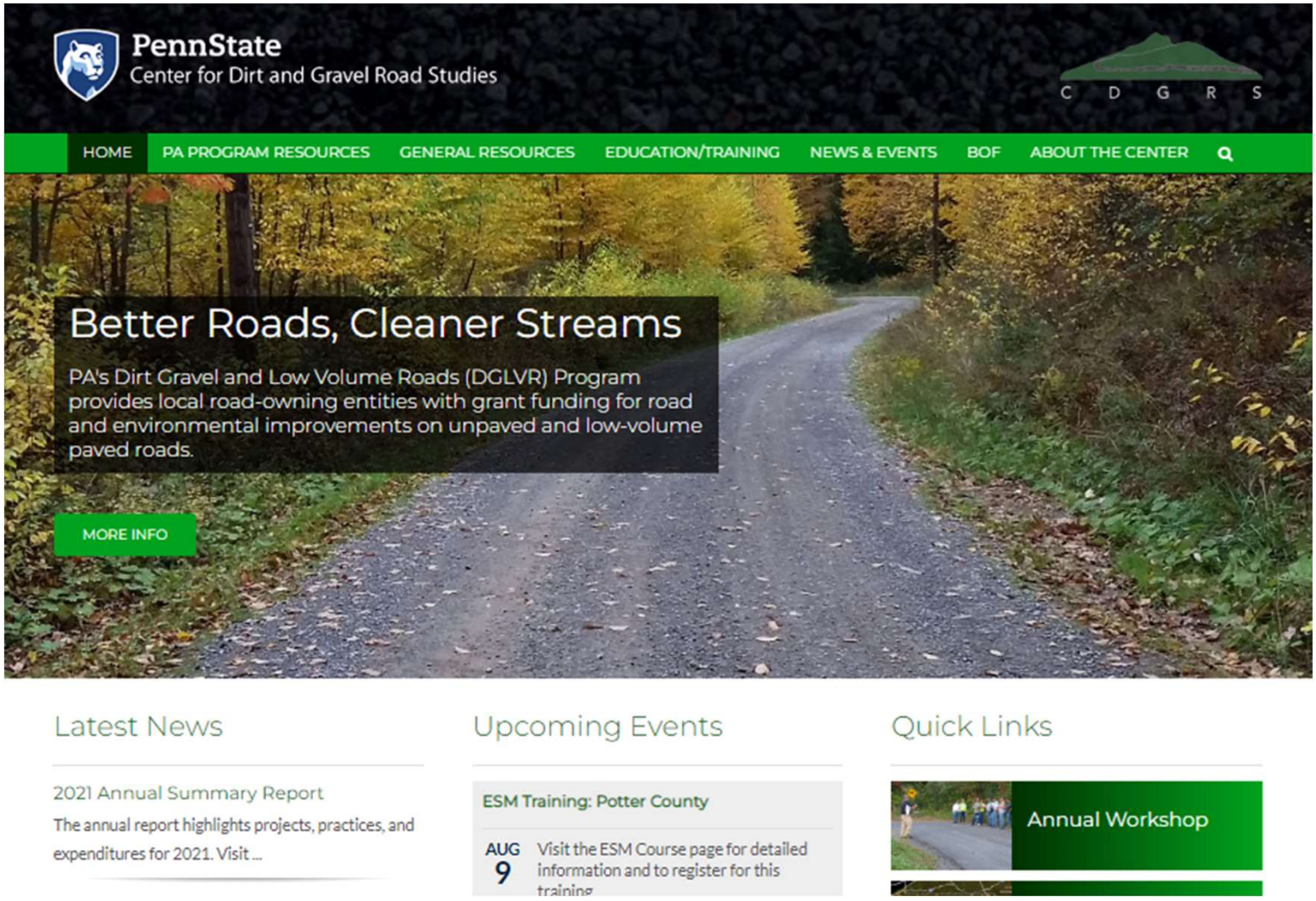


Stream Crossings



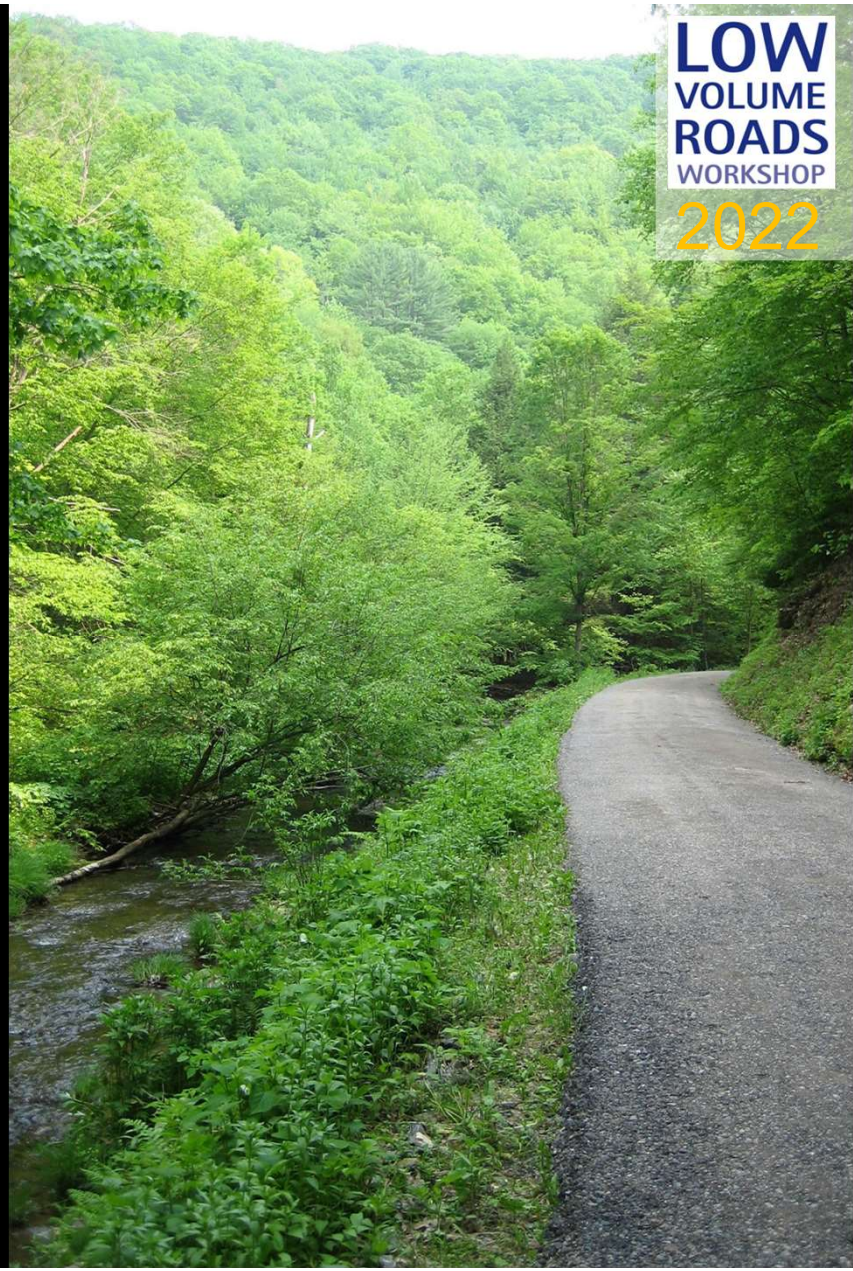
More information: www.dirtandgravelroads.org

LOW VOLUME ROADS WORKSHOP 2022



Presentation Outline

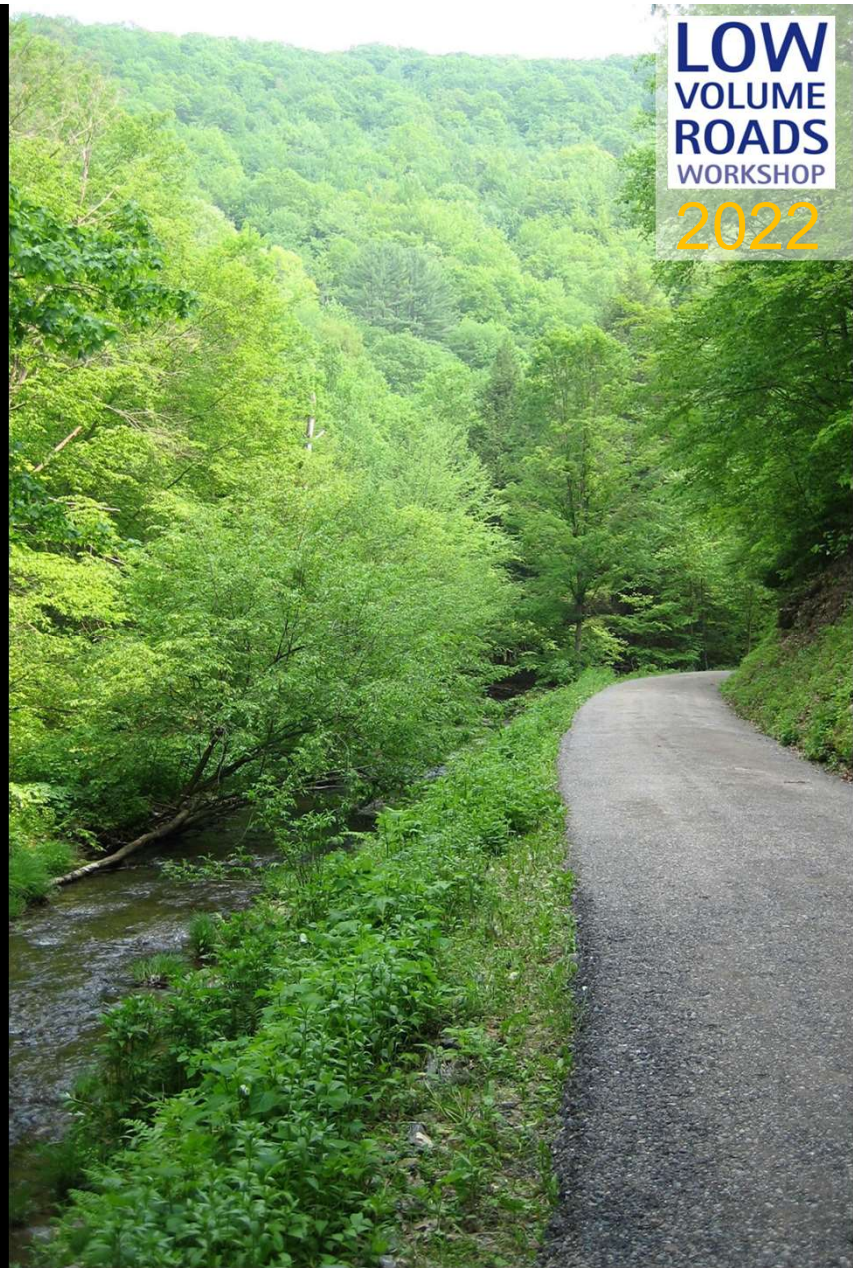
- Introduction
- DGLVR Program
  - Purpose
  - History
  - Structure
- Example Projects
- DGLVR Program
  - Current Status
  - Lessons learned – technology transfer
- Research Topics
- **Driving Surface Aggregate Primer**



Presentation Outline

- Introduction
- DGLVR Program
  - Purpose
  - History
  - Structure
- Example Projects
- DGLVR Program
  - Current Status
  - Lessons learned
- Re
- **Dri Aggregate Primer**

BONUS: DGLVR Effort in Auckland



LOW VOLUME ROADS WORKSHOP 2022

Mahurangi Unsealed Road Project

Auckland Region

Mahurangi East Land Restoration Programme

Auckland Region

LOW VOLUME ROADS WORKSHOP 2022

MELR

- MELR is an MFE Jobs for Nature funded catchment restoration programme. The programme is co-governed by Ngāti Manuhiri Settlement Trust and Auckland Council
- Sediment is ranked the third-highest threat to marine habitats in New Zealand and it is estimated that 21,000 tonnes is lost every year from the Mahurangi catchment.
- $5 million over 5 years to address sedimentation of the harbour.
- 1 area of focus is the sediment resulting from accelerated erosion on the catchments unsealed roads

Project Overview

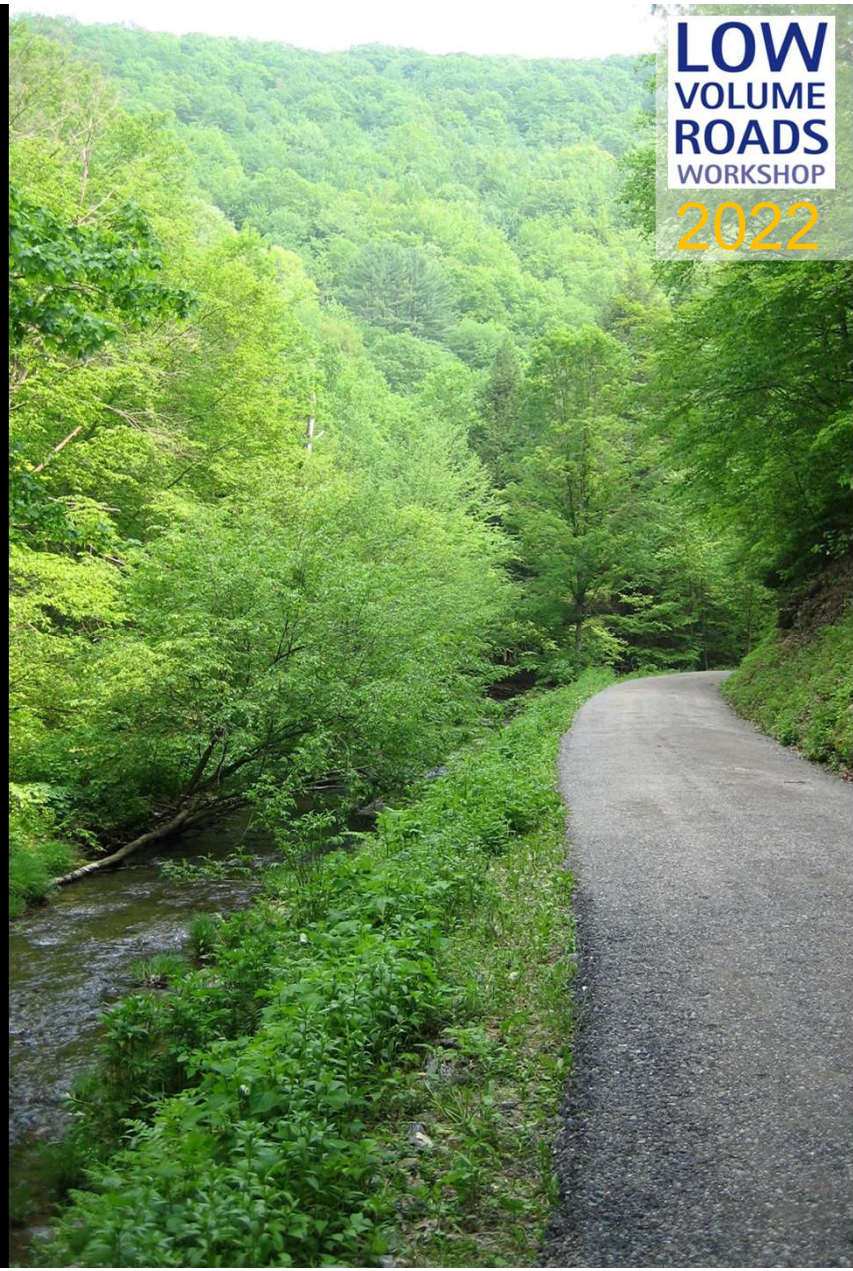
LOW VOLUME ROADS WORKSHOP 2022

- Programme team worked with local community groups and advisory committees to identify key areas and quickly eroding roads that had connectivity to a waterbody (fresh or salt)
- Potential pilot sites were identified, evaluated, and a final pilot site was selected that met programme criteria
- Sites identified all had inadequate drainage, degraded road shape and rapidly eroding drainage channels
- Programme Team is partnering with Auckland Transport to address issues on the selected pilot site
- Project will begin construction in 2023

- The final site selected will receive placement of driving surface aggregate (DSA), improved stormwater drainage, will be re-shaped, and local maintenance teams will receive ESM training for long-term unsealed road asset improvements
- Other issues to be addressed
  - Limitations of additional discharge points onto neighbouring properties
    - Regulatory obstacles involving Overland-flow paths
  - Improve understanding of the role stormwater management plays in the long-term care and function of unsealed roads

Presentation Outline

- Introduction
- DGLVR Program
  - Purpose
  - History
  - Structure
- Example Projects
- DGLVR Program
  - Current Status
  - Lessons learned – technology transfer
- Research Topics
- **Driving Surface Aggregate Primer**



Driving Surface Aggregate

Presentation Friday

Specifically designed as surface for unbound roads

Over 1.1 Million Tones placed by Program (lifetime) - ~55,000 triaxle loads

Tighter specification with more non-clay fines than “traditional” aggregates

Paver placement to reduce segregation

Less dust and longer maintenance intervals


Thank you:
Neil Bennett
Joanne Reddock
Planning Committee
COVID (for canceling the last two times so I could visit in person)

Questions?

Will be here until lunch tomorrow for specific discussions

LOW VOLUME ROADS WORKSHOP 2022

Steve Bloser

Director: Penn State University Center for Dirt and Gravel Road Studies

smb201@psu.edu

www.dirtandgravelroads.org