Problem Identification
Routine maintenance operations and the wear and tear of traffic had the cumulative effect of lowering the road elevation in relation to the surrounding terrain (see photo). The resulting entrenched road trapped road drainage. Confined by the road, this water concentrated in parallel ditches and gained velocity. As the volume and velocity increased, more and more valuable road material was washed away, polluting nearby Pine Creek.

Project Objectives
1. Prevent direct discharge of sediment-laden road drainage to Pine Creek.
2. Reduce concentrated drainage from parallel ditches.
3. Filter road runoff using existing roadside vegetation.

Project Considerations
Off right-of-way (ROW) drainage input from an adjacent driveway compounded the problems on Horseshoe Road. Existing drainage structures (ditches and crosspipes) were inadequate to handle flow volumes.

Spring seeps in the road bank drained directly onto the road surface resulting in a soft road base and observable ditchflow year-round.

Adequately addressing drainage on Horseshoe Road required an additional drainage outlet, installation of underdrain, and elevation of the road itself.
**Project Solutions**

**Adding a cross-pipe:** Installing a new cross-pipe on the road provided an extra drainage outlet and shortened the flow length of parallel road drainage. By minimizing the distance water has to travel before it is removed from the road corridor, the velocity and erosivity of the water are reduced.

**Adding perforated underdrain:** Underdrain, or drain tile, was added in the ditch to collect water flowing from spring seeps. This eliminated perennial ditchflow and corrected the soft road base problem.

**Filling the road:** The elevation of the road was raised by filling the road profile. The added elevation eliminated the need for parallel ditches and allowed drainage to sheet flow into the surrounding terrain through vegetated buffers, removing sediment-laden surface flow to Pine Creek.

**Adequate Culvert Size:** A hydrologic & hydraulic analysis was used to determine the proper size of the culvert needed for the stream crossing. The existing 30” round concrete pipe was replaced by a 77” x 52” squash pipe. The road was raised to ensure proper cover over the new pipe.

**Cost Summary**

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<table>
<thead>
<tr>
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<tr>
<td><strong>Total Project Value:</strong></td>
<td>$53,829</td>
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<td><strong>District Funding:</strong></td>
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<td><strong>Materials</strong></td>
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<td><strong>Contracted Work</strong></td>
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<td><strong>Materials</strong></td>
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<td><strong>Labor &amp; Equip.</strong></td>
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*Directions to Horseshoe Road worksite:* From Coudersport: Take U.S. Route 6 east approximately 13 miles to State Highway 449. Follow 449 north to Brookland; just past Brookland veer right at the Y-junction onto SR 1001. Horseshoe Road (T450) is 4/10 of a mile ahead on the left. The project begins at the intersection with SR 1001 and continues for 1600’.

*For More Information*

**The Center for Dirt and Gravel Road Studies**
(814) 865-5355
www.dirtandgravelroads.org

**Potter County Conservation District**
Eric Potter
(814) 274-8411

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After: The road profile was raised eliminating ditchflow on the downslope side of the road. Drainage that was trapped on the entrenched road can now sheet flow freely off the road into surrounding vegetation. Because the water does not have the opportunity to gain velocity, its erosive potential is greatly reduced.

After: The pipe was re-sized and the road raised for proper cover over the new installation.