



Received



VTrans
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FY17 Vermont Better Roads Grant Application

Please complete this page ONCE and return with your Grant Category Application(s)

Town/Organization: Lincoln Contact Person(s): Will Sipsey

Address: 62 Quaker Street Lincoln 05443
Street Address Town Zip

Email: Willsipsey@gmail.com Phone: (802) 453-3605

DUNS #: 074878856 Fiscal Year End Month (MM): 06

Accounting System: Automated Manual Combination

Please use the suggested documentation checklist below to ensure that all of the relevant items regarding your application have been included.

- Grant application cover sheet (Only submit one)
- Grant application form (One per category/project)
- Itemized Cost estimate for labor, equipment, and materials (see enclosed Cost Estimate Worksheet). If applicable, please break down funding by source (i.e. different grant sources)
- Project Location Map (please show location of affected water)
- Sketch of proposed erosion control measures or other management practices, including distances in feet
 Also show approximate location of town/other right-of-way and/or property lines
- Photo(s) of the project area
- Letters of Support (RPC, VTrans District Technical Staff, ANR Rivers and Streams Engineers, etc.)
- If Category C River/Road Conflict or Category D River/Stream Structure or Culvert, you must attach ANR/ACOE consultation



Received

7/20/03 1:07



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Vermont Better Roads Grant Program Application

Please complete one application per category and/or project you are applying for. You may make copies of the application for multiple applications per category and/or multiple categories.

Please check the Category you are applying for:

- B. Correction of a Road Related Erosion Problem and/or Stormwater Mitigation Retrofit for both gravel and paved roads
- C. Correction of a Stream Bank or Slope Related Problem
- D. Structure/culvert upgrades

Town/Organization: Town of Lincoln

Project Name: York Hill, West Hill, Gove Hill

Road Name: York Hill, West Hill, Gove Hill TH #: 6 Structure # (if applicable): _____

Road Type: Unpaved Uncurbed
Class 3

Watershed: New Haven River

Please provide a thorough description of the problem (ex. Roadway has steep slope with no ditch which is causing roadway erosion):

See attached description.

Description of Project and how you plan to complete the work (ex. Stone line 500' of ditch by reshaping ditch and stone lining, working from the top of the project down to the bottom):

See attached description.

Expected Effects (+ & -) on water quality (ex. Erosion will be eliminated by placing the stone ditch):

The project will decrease water turbidity and phosphorous run off by curtailing soil and road erosion at the intersection.



Distance from end of project to nearest water (stream, lake, or stormwater system that outlets directly to water). 250'+

Progress to Date:

recognition of the problem, applying for this grant

Is there an emergency reason this project must be completed quickly? If yes, please explain:

We picked this project because there are a number of projects below this one in elevation closer to the New Haven River. It makes sense to do this one first.

Has this project been identified through a municipal road inventory, capital budget plan, tactical basin plan, culvert inventory, or other management plan? If yes, please list which.

Yes: This intersection is in our FY15-16 Cat A report

No

Please list any professionals you may have contacted for assistance with this project (ANR River Management Engineer, Army Corps of Engineers, VTrans District Technical staff, Basin Planner etc.):
none

Is the project located in the town "Right of Way?" Yes, No, Both (if "Both" please explain further).

Project is located in the Town ROW.

Will the town road crew complete this work? Yes, No, Some (if "some" please explain further).

We expect some participation by the Road Crew. However, because of the scope of the project we will put it out to bid.



Describe how the grant funds will be spent and/or attach a project budget:
See attached budget.

How do you plan to meet the required 20% match on this grant?:
We will budget six thousand dollars for this project

Requested Grant Amount (\$20,000 max Category B, \$40,000 max Categories C & D): \$ 20,000.00
Estimated Total Project Cost (including 20% local match): \$ 25,804.00
Estimated Completion Date: 01/10/2017

REQUIRED ATTACHMENTS:

- Itemized Cost Estimate (labor, equipment, materials)
(For assistance, call Better Backroads at 802-828-4585)
- Project Location Map
(Please show location of affected water; 1:12,000 USGS map, if possible)
- Sketch of proposed erosion control measures, including:
 - Distances (ft.)
 - Estimate of waste & borrow quantities
 - Approx. location of town/other right-of-way and/or property lines
- Photo(s) of the project area.
- Agreement for Entry and/or Deed of Easement (if project is outside Town ROW).
- If project involves stream or river/road conflict, include documentation of consultation with a River Management Engineer.
- Other appropriate supporting documents.

By signing this application I certify that all the information provided is accurate to the best of my knowledge. We will comply with all the requirements of the grant including making our books available for audit if required.

SIGNATURE OF APPLICANT: (Must be Town Administrator/Manager or Select Board Chair)

Name: W.H. Quinn Title: Select Board Chair

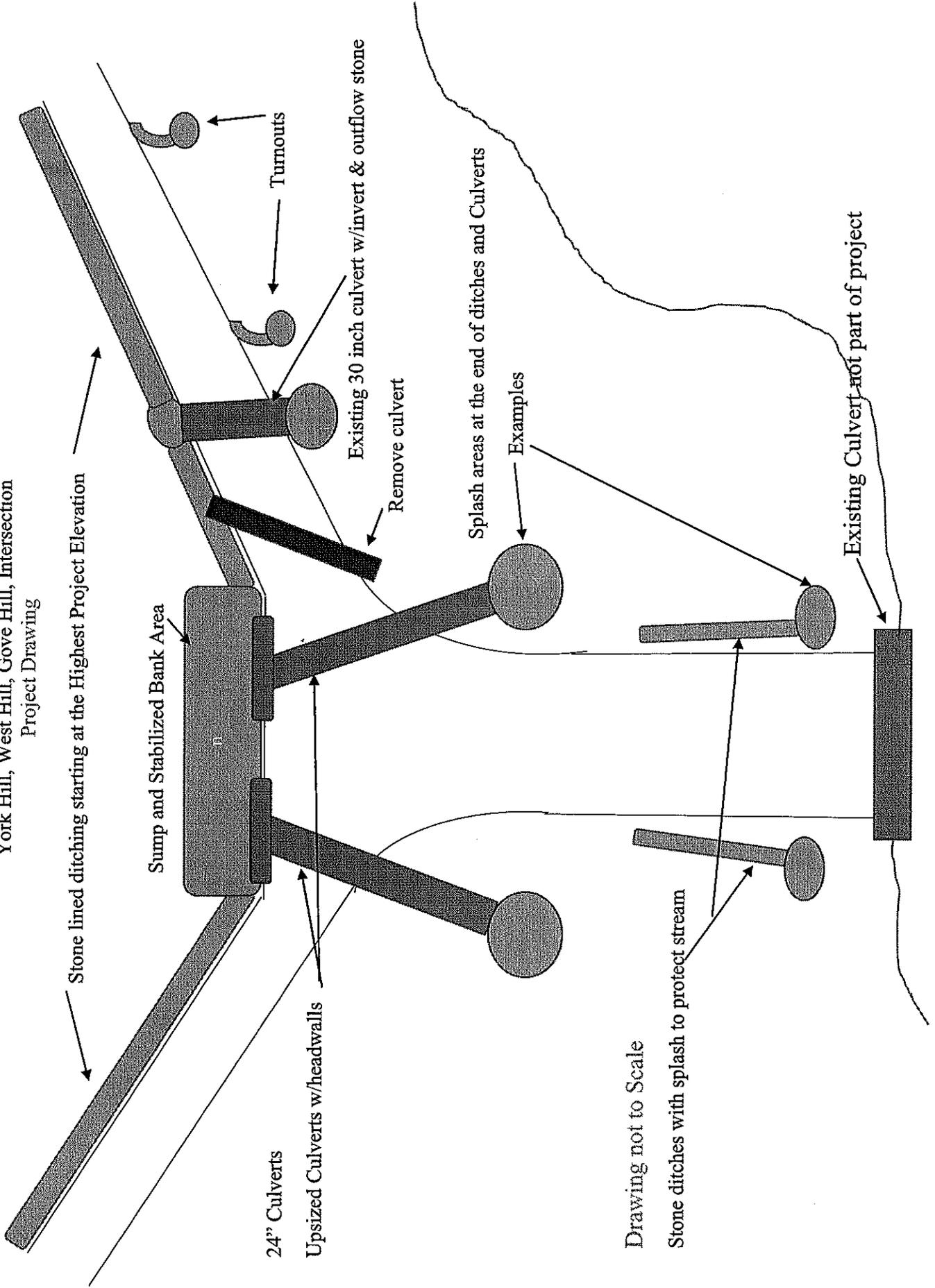
Please provide a thorough description of the problem:

The project is at the intersection of Town Highway 6, locally West Hill Road to the south and York Hill to the west, and Town Highway 9, locally Gove Hill Road. The intersection of these roads descends on a steep grade toward a nearby branch stream feeding into the New Haven River. York Hill and West Hill descend to the intersection meeting with Gove Hill Road which forms the tail of this "Y" shaped intersection. Gove Hill continues to descend down toward the Lincoln Village. Gove Hill has locations where grades exceed 10 %. Gove hill crosses a branch stream less than 500 feet below the three road intersection. The stream will parallel the road at varying distances until both the road and stream intersect with the New Haven River at the base of the Hill. The culverts around the intersection are poorly installed. The ditches at and around the intersections appear to be accidents of erosion and have no stone lining. In places storm water runs in the road until it reaches the feeder stream of the New Haven River. There is no erosion control in place despite the steep grades.

Description of Project and how you plan to complete the work:

- Install 1000 feet of stone lined ditch on York Hill on steep grade approaching intersection. This primary ditch is on the invert side of the road's cross culverts.
- Provide a stone armored invert sump and an outflow splash area at 30-inch metal culvert on York Hill.
- Install two turnouts on outflow side of York Hill Road.
- Remove the existing 18-inch plastic culvert that crosses from the base of York Hill to the radius of York Hill and Gove Hill. Reposition, upsize (24-inch) and lengthen the culvert. Install a concrete headwall.
- Replace, lengthen, and upsize (24-inch) primary culvert accepting run-off from York and West Hill Roads. Install a concrete Headwall.
- Install 900 feet of stone lined ditch on West Hill Road on steep grade approaching intersection
- Install Rip Rap for Bank stabilization partially on the approach from West Hill and into the backside of the intersection (approximately 75 feet).
- Install stone ditching on Gove Hill Road from the intersection down to the branch stream below. Each side of the road will have 400 feet of ditching for a total of 800 feet.
- Install splash areas at the end of Gove Hill ditches just before stream.

York Hill, West Hill, Gove Hill, Intersection
Project Drawing



Stone lined ditching starting at the Highest Project Elevation

Sump and Stabilized Bank Area

24" Culverts

Upsized Culverts w/headwalls

Existing 30 inch culvert w/invert & outflow stone

Remove culvert

Turnouts

Splash areas at the end of ditches and Culverts

Examples

Drawing not to Scale

Stone ditches with splash to protect stream

Existing Culvert - not part of project

Consultant's Description of Project and Goals

This project is designed to collect and disperse run-off in a way that prevents concentrated flow from depositing directly to the stream. The two upper most elevation roads (West Hill and York Hill) will have run-off collected and distributed into wooded areas that provide buffering from the stream. The ditches on each road will send flow to a sump area. Two 24 inch culverts will redistribute the water flow from the sump to the wooded buffer area.

On York Hill Road, an existing 30 inch culvert is being erosion protected by stone at the invert and outflow.

Two crude grader turnouts on York Hill are being replaced with, properly excavated, stone lined turnouts.

On Gove Hill Road, below the intersection, roadside ditching will be defined and lined with stone. Each ditch will deposit into a splash area. Each splash area has a vegetated buffer separating the splash pool from the stream.

The road surface will be regraded upon completion to direct water to designated run-off locations.

The town will use proper construction techniques as specified by the Better Roads Program. The town and the hired consultant have continuing communication with program coordinator, Alan May, as questions arise.

The ANR erosion risk mapping shows this project to contain both medium and high risk portions of road. West and York Hill have a medium rating while all of the Gove Hill section is rated as High risk for erosion.

Prepared by:
David Antone
Municipal Public Works Consulting
Roadtech005@gmail.com

802-355-8215

Addison County Regional Planning Commission

14 Seminary Street Middlebury, VT 05753 www.acrpc.org Phone: 802.388.3141 Fax: 802.388.0038

April 8, 2016

Alan May
Agency of Transportation
Municipal Assistance Bureau
1 National Life Drive
Montpelier, VT 05633

Dear Alan,

I am writing to express the Addison County Regional Planning Commission's support of the Town of Lincoln's Category B application to the FY17 Vermont Better Roads Grant Program for the correction of a gravel road related erosion problem. After review of the application, I am confident that the proposed project will result in important water quality benefits that this program strives to achieve.

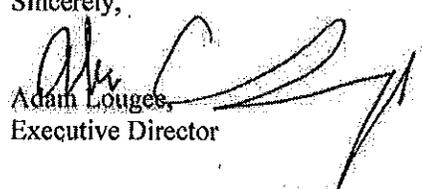
The proposed project is identified in the "Lincoln, Vermont Road and Culvert Inventory – 2015" prepared by David Antone of Municipal Public Works Consulting, LLC, which inventoried and prioritized road, culvert, and drainage erosion problems that may potentially impair water quality during erosion events. This report identifies the proposed project as one of Lincoln's "highest priority projects." Furthermore, the Vermont Agency of Natural Resources, Natural Resources Atlas assigns the stretch of Gove Hill Road leading north out of the intersection at issue both "moderate" and "high risk" road erosion risk rankings, indicating the potential for erosion along the three roads leading into this intersection during erosion events.

This project is also supported by several goals, objectives and recommended actions set forth in the Transportation Section of the Addison County Regional Plan (available here: <http://acrpc.org/resources/regional-plan/>):

- *Reduce roadway impacts on water quality* and improve disaster preparedness (p. 6-8);
- *Encourage municipalities to adopt hazard mitigation plans and implement best management practices for stormwater culvert and ditch design* (p. 6-9); and
- *Avoid negative impacts to the environment* and minimize greenhouse gas emissions (p. 6-12).

The Town of Lincoln recognizes this as a key opportunity to work with VTrans to both address an important need of the town and fulfill its commitment to protecting and preserving its transportation infrastructure and natural resources within its borders and throughout the region. It has the full support of ACRPC in these efforts. Please do not hesitate to contact me if you have any questions regarding this letter or if I may offer you any further assistance. I can be reached at 802-388-3141 or alougee@acrpc.org.

Sincerely,


Adam Lougee,
Executive Director



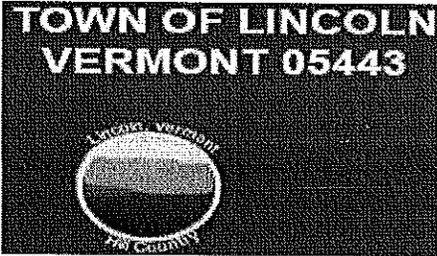
Addison County
Regional Planning Commission

Addison Bridport Bristol Cornwall Ferrisburgh Goshen
Leicester
Lincoln Middlebury Monkton New Haven Orwell Pantton

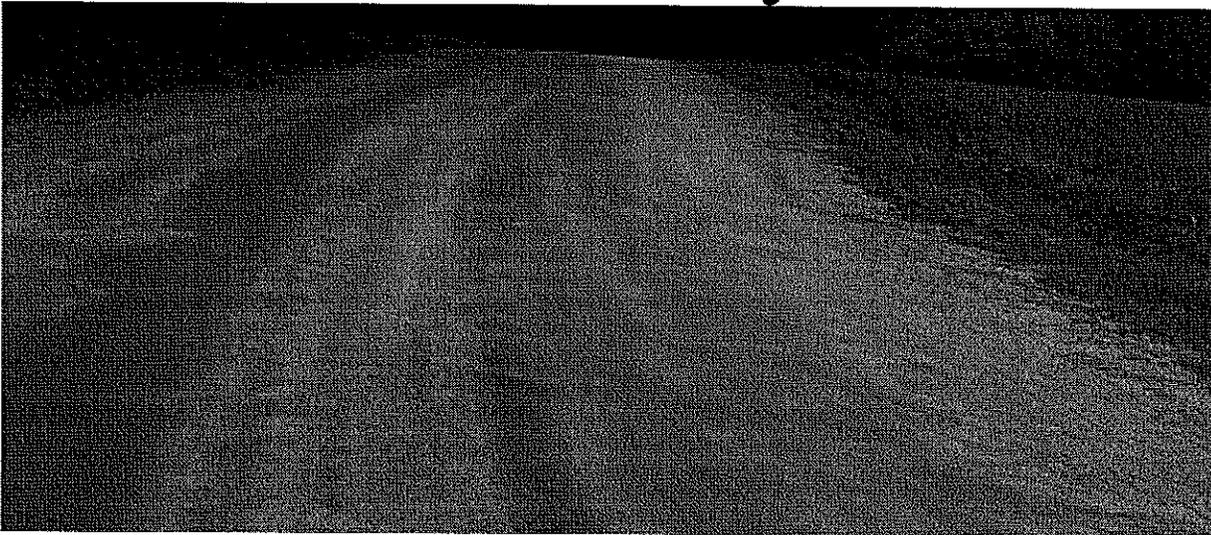
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JUN 15 2015

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Lincoln, Vermont Road and Culvert Inventory-2015



Category- A, Vermont Better Backroads Planning Grant-2014:

The purpose of this report is to provide an inventory of Road, Culvert, and Drainage Erosion problems that may potentially impair water quality during erosion events. The report will list and prioritize problems, recommend project solutions, provide estimated cost of solutions and consolidate information into a recommended capital plan.

Prepared By:
David Antone
Municipal Public Works Consulting, LLC

Report Date:
June 15, 2015

Town of Lincoln, Vermont

The Town of Lincoln is located in Addison County along the New Haven River. The town's center is located along the river's edge and the river meanders through the lower elevations of the town. As you follow town roads away from the town center, you experience rising elevation as a good percentage of the roads travel upward. The hilly landscape surrounding the lower river valley consist of rural gravel roads and a spider's web of mountain streams most of which flow into the New Haven River.



It is difficult to find any road that doesn't have a branch stream and many roads have multiple stream crossings. The multiple stream crossings and steep terrains increase the opportunity for erosion to carry from smaller to larger streams. The generally poor ditching network also increases the opportunity for damaging erosion to occur. In addition to the multiple streams, the Town of Lincoln has a vast network of ponds supporting a large and varied body of wildlife.

Current Maintenance and Materials:

The town's crew of four full time highway staff maintains a constant effort to keep roads in good travel condition. Lincoln is using a good processed gravel in all of their road surfacing activities. The town has recently hired an additional employee to oversee road grading. In the past, the Road Foreman was trying to split the duties of grading an overseeing operations. The roads are generally kept in good traveling condition. Based on information collected to date, the roads are not always well shaped to shed water and lack adequate base gravel in many places. It is possible that the frequency of maintenance could be reduced by a more strategic road improvement plan that would save money during mud-season by improving roads during the summer. This strategy would work within current budget dollars and provide more value for money spent.

The invert side shows some of the eroding material settled in the ditch-line and scattered along the shoulder.



Invert feed ditch

An additional photo of the outflow side shows some need for bank stabilization:



CAPITAL IMPROVEMENT PLAN SUMMARY

Please note: Project details can be found on pages following this summary. Projects are listed in the same order on those pages as in this summary.

| Road Name(s) | Project Number or Location | Cost Estimate Total |
|---------------------------------|--------------------------------------|----------------------------|
| Atkins Road | Project #1 | \$ 9,188.00 |
| Atkins Road | Project #2 | 10,612.00 |
| York Hill Road | Project #1 | 13,234.00 |
| York Hill Road | Project #2 | 13,630.00 |
| York Hill Road | Project #3 | 15,350.00 |
| York Hill Road | Project #4 | 3,942.00 |
| York Hill Road | Project #5 | 10,796.00 |
| York Hill, West Hill, Gove Hill | Three road intersect | 25,804.00 |
| Gove Hill Road | Varney road to blacktop seam | 22,446.00 |
| Quaker Street | Blacktop seam to top of hill | 30,070.00 |
| Quaker Street | Intersection with Downingsville Road | 9,426.00 |
| Forge Hill and Quaker Street | Intersection and Forge Hill Ditch | 11,612.00 |
| Downingsville Road | Project # 1 | 5,831.00 |
| Downingsville Road | Project # 2 | 13,860.00 |
| Colby Hill Road | Atkins Intersect to Isham Intersect | 20,150.00 |
| Colby Hill Road | Isham Intersect to Plow Turn | 39,000.00 |
| Lincoln Gap Road | 60 inch culvert-upper gap road | 15,596.00 |
| Lincoln Gap Road | 36 inch culvert-utility pole # 33 | 8,476.00 |
| Ripton Road Project | Project #1 | 5,318.00 |
| Ripton Road Project | Project #2 | 9,094.00 |
| Ripton Road Project | Project #3 | 7,750.00 |
| French Settlement Road | Bus turnaround to plow turn | 14,430.00 |

Total Estimate for projects listed above..... = \$315,615.00

Estimated matching funds based on average project cost= \$ 90,000.00

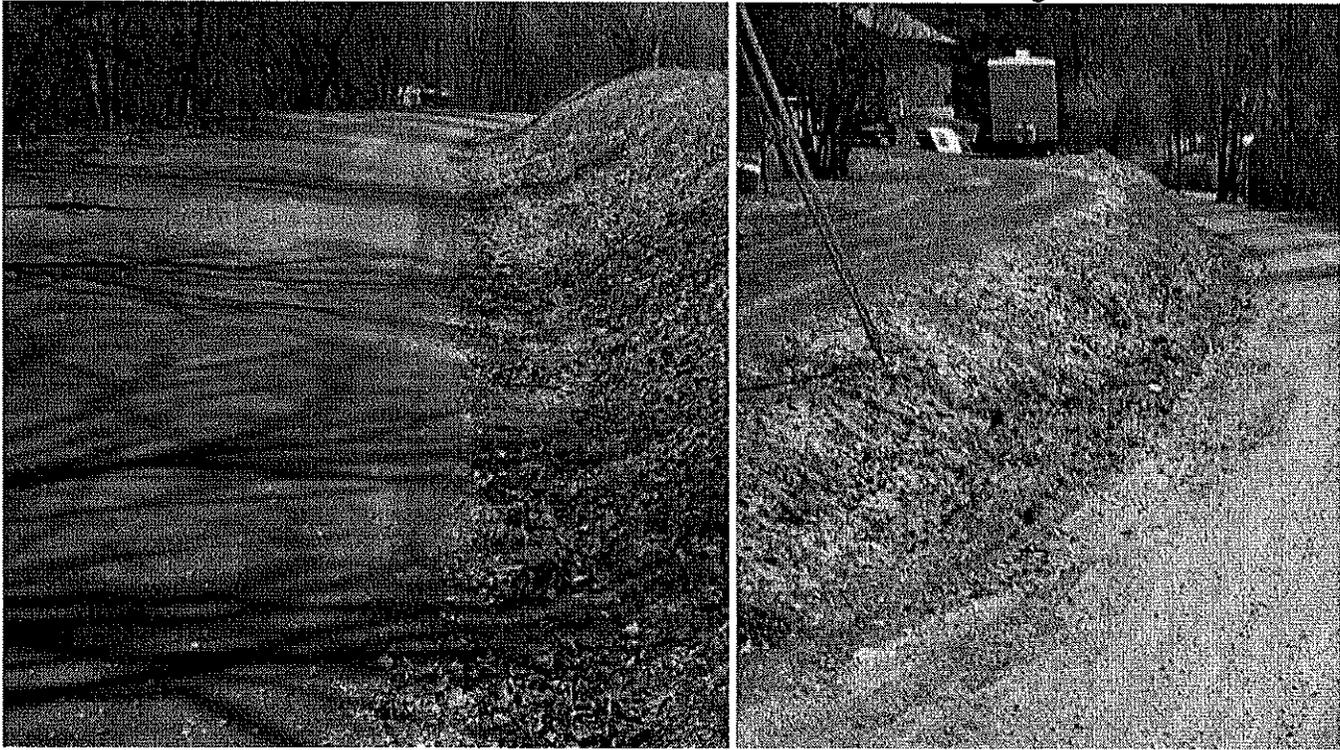
Grant Funded Cost = \$225,615.00

Note: Some of the single projects or road sections may be eligible for other sources of grant funding such as structures grants or class two highway funding. This is factored into the recommendation of establishing a timeline for the Capital Plan.

Term of Capital Plan (10-YEAR)

Taking into account that some other grant funding may be utilized, town road crews will likely bring down the cost of estimates with less expensive in-kind work, and some work scopes may be reduced by regular maintenance activities, the consultant-recommended Capital Plan goal would be to complete projects over a ten year timeline. This also assumes that one grant project is funded annually by the Better Backroads Program.

This first project on Atkins Road will excavate and stone line over 600 feet of ditching.



Atkins Road levels off just beyond the yellow guide wire anchor in the above right-hand photo.

In the next picture (below) is a driveway culvert where the first of two projects on this road will terminate.



Drive culvert at pole 40

This damaged drive culvert will be replaced as part of Project 1 on Atkins road

Flowing rain water tends to drag loose ditch material out into the road where the ditch is shallow. Ditches are inadequate for even moderately high run-off situations. Sediment traveling down the road brings large sediment deposits closer to the stream. In many locations sediment pushes out into the road and stays there because of roadside berms existing below the point of water entering the road.

The landscape lends itself to easily resolving these problems with stone line ditching, some turnouts, and berm removal. Also, the field drive access, now blocking the ditch can receive a culvert to accommodate the new ditch. At the stream crossing, a sump area will be established at the invert and road banks will be stabilized on both sides. The stream crossing culvert does not need replacement at this time.

Atkins Road Project Details-Project #2:

- Stabilize road bank (Rip-Rap) on outflow side of road culvert
- Rip-Rap Header and sump area on invert side of road culvert
- Install 18 x 20 culvert in field drive access
- Install 550 feet of stone lined ditch on the invert side of road
- Install 250 feet of stone lined ditch on the outflow side of road
- Install to turnouts on the outflow side of the road

Project Estimate:

| Description | Units | Unit Cost | Cost |
|-------------------------------|----------|---------------|--------------------|
| Rip Rap | 24 yds. | 15.00 per yd. | \$ 360.00 |
| 6 to 8 inch minus stone | 220 yds. | 12.00 per yd. | 2,640.00 |
| 18 inch HI-P Culvert | 20 feet | 13.00 per ft. | 260.00 |
| Seed/Mulch/Fabric/Misc. | | | 600.00 |
| Excavation | 32 hours | 110.00 | 3,520.00 |
| Trucking | 32 hours | 85.00 | 2,720.00 |
| Labor | 32 hours | 16.00 | 512.00 |
| Project Estimate Total | | | \$10,612.00 |

York Hill Road Project #1-York Hill Road begins where a bridge crosses the New Haven River from West River Road to the start of York Hill. The road begins to ascend immediately and continues up a steep grade for the first half mile. The ditching system carries from the top of this steep grade directly to the New Haven River below.



York Hill Road Project details-Project #1:

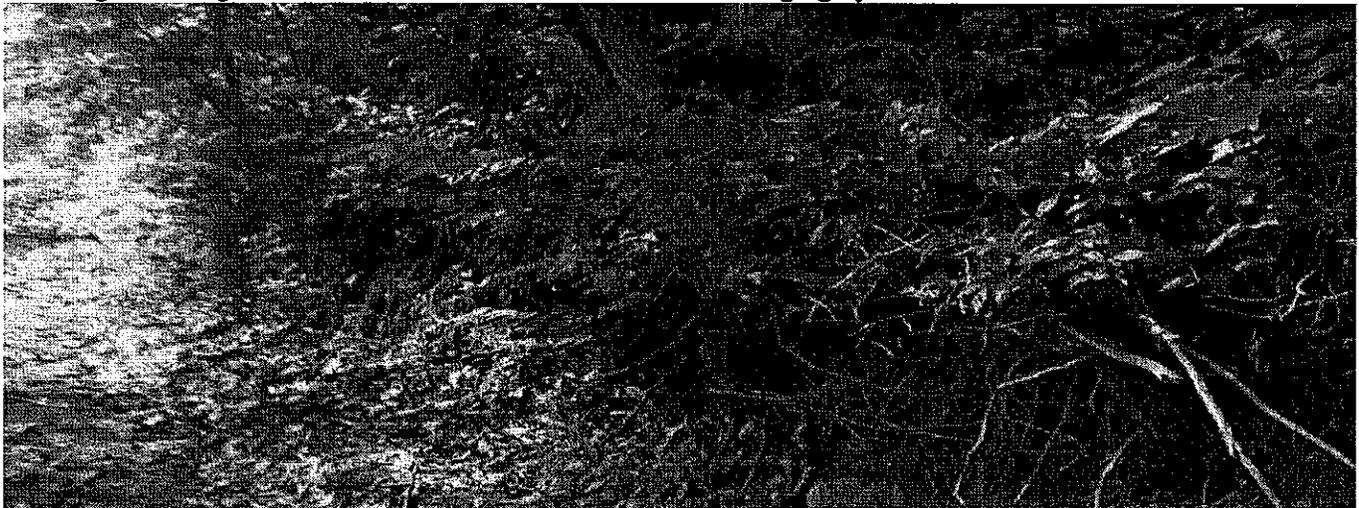
- Install short stone lined entry ditch and splash area on either side of bridge junction with York Hill Road
- Improve road surface resilience and elevation by adding gravel where ditch is restricted and improve ditch erosion resistance by cutting narrow box ditch and filling with stone
- Replace cross culvert under road 370 feet uphill from bridge
- Install concrete headwall at invert and splash area at outflow
- Add Rip Rap as needed at invert side of culvert

Project Estimate:

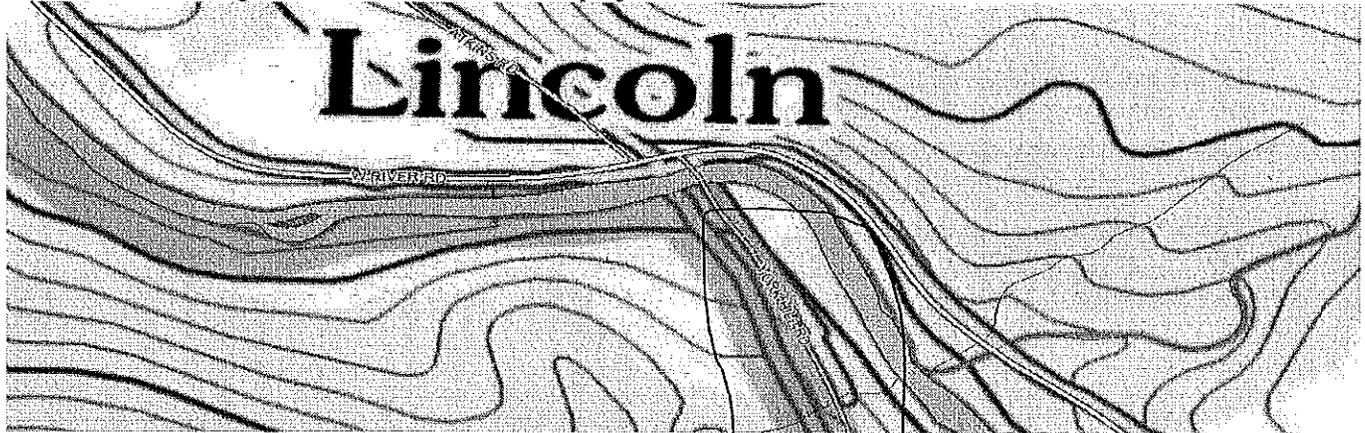
| Description | Units | Unit Cost | Cost |
|-------------------------------|----------|----------------|---------------------|
| Rip Rap | 40 yds. | 15.00 per yd. | \$ 600.00 |
| 6 to 8 inch minus stone | 60 yds. | 12.00 per yd. | 720.00 |
| ¾ minus processed grvl. | 90 yds. | 12.00 per yd. | 1,080.00 |
| 2 inch stone | 24yds. | 13.50 per yd. | 324.00 |
| 30 inch metal culvert | 60 feet | 34.00 per ft. | 2,040.00 |
| Headwall | | | 2,000.00 |
| Excavation/Grading | 30 hours | 110.00 per hr. | 3,300.00 |
| Trucking | 30 hours | 85.00 per hr. | 2,550.00 |
| Labor | 20 hours | 16.00 per hr. | 320.00 |
| Seed/Mulch/Fabric/Misc. | | | 300.00 |
| Project Estimate Total | | | \$ 13,234.00 |

York Hill Road-project #2-The second project on York Hill Road starts right at the end of the first project. With an adequate cross culvert in place at the base of the hill, project two can proceed to improve uphill ditches.

As soon as the road passes beyond the new cross culvert, ditching and cross culverts on the hill above are in need of improvement. Ditching is crude and some of the culverts are inadequate. The first photo shows some of the ditching that is typically undermining trees. Most of the ditching occurs on the side of the road that borders an uphill slope. There is adequate room to install a ditch but stone lining and bank stabilization are needed. Ditching on the right hand side of the road is made more challenging by trees close to the ditch-line.



On the opposite side of the road from the primary drainage ditch, water sheds off the road in most places without many erosion issues occurring. However, there are a few places where some significant erosion occurs and, although York Hill leaves the New Haven River at a right angle, the river turns with the road and parallels York Hill within sight distance for most of this project area.



York Hill Project Area- Red Border

There are several locations where some short ditching and turnouts are necessary to protect the river. In the photo below is one location where a residential property has created a crude turnout that sends significant amounts of eroding material to the slope descending to the river.

In the **picture below**, this residential property is located on the river side of the road. At the top of the hill, a good deal of water is crossing the road into the front yard above this driveway. The drive culvert is too small. Water coming through the culvert is cutting an erosion ditch that turns and goes out to the slope carrying run-off toward the river. The river is visible from the top of the slope. Some erosion is occurring above the mailbox and has the potential of plugging the undersized culvert which could lead to failure. This could create much more significant erosion of the driveway and the road.



This project will address these erosion cuts by removing road base along this edge, filling gaps in the large stone with a bed of smaller stone, covering the smaller stone with fabric, and then replacing the road gravel and leaving a strip of clear stone as a border between the road and the large rock. Also, some work will be done along the shoulder to encourage water to shed from the road before reaching this low point in the road. These minor improvements will help with the ongoing erosion that has been frequently occurring since this bank was stabilized.

In addition to fixing minor erosion currently occurring, additional work is needed to address the original flooding problems. This culvert crossing (uphill from aforementioned location) accommodates a very small branch stream that flows under the road and eventually connects with the larger branch discussed on the previous page. This 36 round culvert is adequate most of the time as the stream flows at a trickle except during storm events or spring run-off. However, this culvert is installed in such a way that it can be easily plugged by debris and sediment. The culvert sets down in a bowl-like area and surrounding banks are loose gravely material. The culvert should be upsized using and an arch style culvert to give it more width and minimal height. The culvert should have a headwall and banks should be well armored with Rip Rap material.



In addition to this culverts deficits, it appears that ditching between the two culverts was likely a contributing factor to the volume of water going into the road. This project will improve the width and depth of ditching and provide stone lining between the two culverts and on the upper side of the uphill culvert. The ditching improvements between the culverts will increase the amount of overflow contained within the ditch-line while improvements to this culvert will reduce the chance of an overflow occurring.

This photo shows the branch stream that the cross culvert flows into.



44.109510. 73.014129.

The culvert will be replaced to correct potential problems and ditching coming into this culvert will be stone lined for approximately 100 feet. The invert and outflow areas will have some Rip-Rap installed.

York Hill Project #4-Project Details:

- Replace 18 inch metal culvert with 18 inch High Performance Plastic Culvert resetting to a proper depth
- Install 120 feet of stone lined ditch
- Add Rip Rap to invert and outflow areas

Project Estimate:

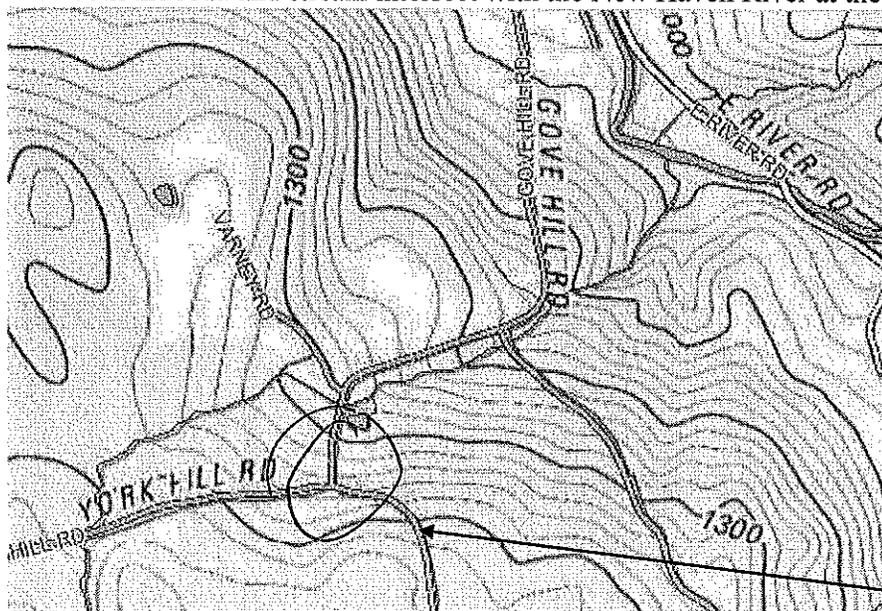
| Description | Units | Unit Cost | Cost |
|-------------------------------|----------|----------------|--------------------|
| 18 inch Hi-P plastic culvert | 50 feet | 13.00 per ft. | \$ 650.00 |
| 6 to 8 inch minus stone | 30 yards | 12.00 per yd. | 360.00 |
| Rip Rap | 10 yards | 15.00 per yd. | 150.00 |
| Excavation | 12 hours | 110.00 per hr. | 1,320.00 |
| Trucking | 12 hours | 85.00 per hr. | 1,020.00 |
| Labor | 12 hours | 16.00 per hr. | 192.00 |
| Seed/Mulch/Fabric/Misc. | | | 250.00 |
| Project Estimate Total | | | \$ 3,942.00 |

York hill road-project #5-Project number 5 on York Hill Road is at a location where the road parallels a fair sized branch stream. At this project location, the stream is only 250 feet from the two road culverts highlighted in this project. The two culverts are in very good condition but the installation of both culverts leaves out best practices for stream protection and one culvert is poorly installed at a much too short length. Both of the culvert outflows are creating significant erosion ditches all the way down to the stream which can be seen from the road. The short culvert is also showing erosion on the embankment above the culvert outflow. Also, in the road, the steep hill that feeds down to these culverts needs roadside ditches to be excavated and stone lined.

Project Estimate:

| Description | Units | Unit Cost | Cost |
|-------------------------------|-----------|----------------|---------------------|
| Rip Rap | 20 yards | 15.00 per yd. | \$ 300.00 |
| 18 inch metal culvert | 12 feet | 17.00 per ft. | 204.00 |
| 6 to 8 inch minus stone | 270 yards | 12.00 per yd. | 3,240.00 |
| Excavation | 32 hours | 110.00 per hr. | 3,520.00 |
| Trucking | 32 hours | 85.00 per hr. | 2,720.00 |
| Labor | 32 hours | 16.00 per hr. | 512.00 |
| Seed/Mulch/Fabric/Misc. | | | 300.00 |
| Project Estimate Total | | | \$ 10,796.00 |

York Hill Road, West Hill Road, and Gove Hill Road intersection-The next project involves the intersection of three roads that descend on a steep grade toward a nearby branch stream feeding into the New Haven River. York Hill and West Hill descend from the east and west sides of the intersection meeting with Gove Hill Road which forms the tail of this Y shaped intersection. Gove Hill continues to descend down toward the Lincoln Village. Gove Hill has locations where grades exceed 10%. Gove Hill crosses a branch stream less than 500 feet below the three road intersection. The stream will parallel the road at varying distances until both the road and stream intersect with the New Haven River at the base of the Hill.



West Hill Road

The project begins on the steep hills that feed the intersection from the east and west. York Hill and West Hill are both in need of ditching improvements to reduce sediment reaching the intersection. Erosion and sediment deposits are prevalent in roadside ditching on both roads. Hillside banks on the backside of ditching are unstable on West Hill approaching the intersection and in the intersection between West and York Hills.

This first photo (**below**) is the view looking up West Hill from the Intersection. The photo was taken while standing near the culvert invert that accepts flow from the West Hill and York Hill ditches. The culvert sends water underneath the intersection to the Gove Hill Road ditch-line.



This next photo shows the same view a little standing further into the intersection just beyond the culvert:



The culvert in the above photo is not visible because it is too short and is tucked into the road shoulder. There is a good deal of sediment piling up in front of the culvert invert. The sediment comes from both the West Hill and York Hill ditch-lines. There is also some sediment washing off the hillside bank behind this intersection which is better seen in the first photo. The culvert is not large enough to handle high run-off events and can be easily plugged.

This culvert outflow (below) is at the base of York Hill a little into the intersection radius. It is both too shallow and too short. During storms, water flows from this outflow and back into the road just downhill. This culvert needs to be removed and may not be needed if ditching and other culvert improvements are implemented.



The culvert is causing erosion in the road below the outflow

The culverts are not well installed at the intersection. There are no measures to prevent erosion at the inverts or outflows and the primary culvert carrying water from York Hill and West Hill ditches is not big enough to handle the flow from even moderate rain events. The culvert in the above photo was likely installed as an overflow because of water backing up from the primary culvert. Replacing and upsizing the primary culvert with the addition of a headwall will likely eliminate the need for the culvert in the above photo.

This three road intersection is located less than 500 feet above the branch stream shown in the photo below:



York Hill, West Hill, and Gove Hill Project Details:

- Install 1000 feet of stone lined ditch on York Hill on steep grade approaching intersection. This primary ditch is on the invert side of the road's cross culverts
- Install two turnouts on the opposite side of this same road section
- Provide a stone armored invert sump and an outflow splash area at 30 inch metal culvert on York Hill
- Install two turnouts on outflow side of York Hill Road
- Remove 18 inch plastic culvert crossing from the base of York Hill to the radius of York and Gove Hill (The primary culvert accepting water from York Hill and West Hill must be upsized before removing this culvert or the culvert can be relocated to an improved outflow area)
- Replace, lengthen, and upsize primary culvert accepting run-off from York and West Hill Roads. Install a concrete Headwall
- Install 900 feet of stone lined ditch on West Hill Road on steep grade approaching intersection
- Install Rip Rap for Bank stabilization partially on the approach from West Hill and into the backside of the intersection (approximately 75 feet)
- Install stone ditching on Gove Hill Road from the intersection down to the branch stream below. Each side of the road will have 400 feet of ditching for a total of 800 feet
- Install splash areas at the end of Gove Hill ditches just before stream

Project Estimate:

| Description | Units | Unit Cost | Cost |
|-------------------------------|-----------|----------------|---------------------|
| 6 to 8 inch minus stone | 550 yards | 12.00 per yd. | \$ 6,600.00 |
| 24 inch Hi-P plastic culvert | 60 feet | 19.00 per ft. | 1,140.00 |
| 18 inch HDPE plastic culvert | 40 feet | 10.00 per ft. | 400.00 |
| Rip Rap | 70 yards | 15.00 per yd. | 1,050.00 |
| Concrete Headwall | | | 2,000.00 |
| Seed/Mulch/Fabric/Misc. | | | 600.00 |
| Excavation | 64 hours | 110.00 per hr. | 7,040.00 |
| Trucking | 70 hours | 85.00 per hr. | 5,950.00 |
| Labor | 64 hours | 16.00 per hr. | 1,024.00 |
| Project Estimate Total | | | \$ 25,804.00 |

Note: The above project would likely be completed in two phases. There has also been some discussion about placing a catch basin in the island but that would not be determined until part of the project has been completed. The pricing for the catch basin would be added in the second phase. If other improvements can successfully reduce water from entering this intersection, as they should, there will be no need for the catch basin to be installed.



The ditching on Gove Hill is consistently poor for the entire length of the Gove Hill Road and needs improvement. The ditching photos are from both the first 1300 ft. section that parallels the branch stream and last 1200 feet that meets with the Blacktop just prior to the New Haven River. There is a need to improve ditching on both sides of the road in the first 1300 feet. The second section is mostly on one side of the road except for one location where three drive culverts need upsizing and resetting (see photo below).



Two culverts appear in the picture but there are three total that have some problems. The ditching will be stone lined between the culverts. The culverts are now very short, too shallow, and too close to the road. Two culvert replacements and one reset are included in the estimate for this project.

Gove Hill road ditching has been hastily performed in a way that may actually promote erosion along this road. Part of the problem is that the Highway Department does not possess excavation equipment that is conducive to producing good ditching on a large scale. Performing this project would take away problems that could potentially wash this road out in large storm and also relieve some of the large burden of ongoing maintenance that steep roads like Gove Hill present for this small highway department.

This project starts here at the bottom of the gravel road hill on the stream side of the Quaker Street.



The **photo above** shows the roadside ditch that follows down the stream side of Quaker Street. In the foreground the ditch is turning toward the stream.

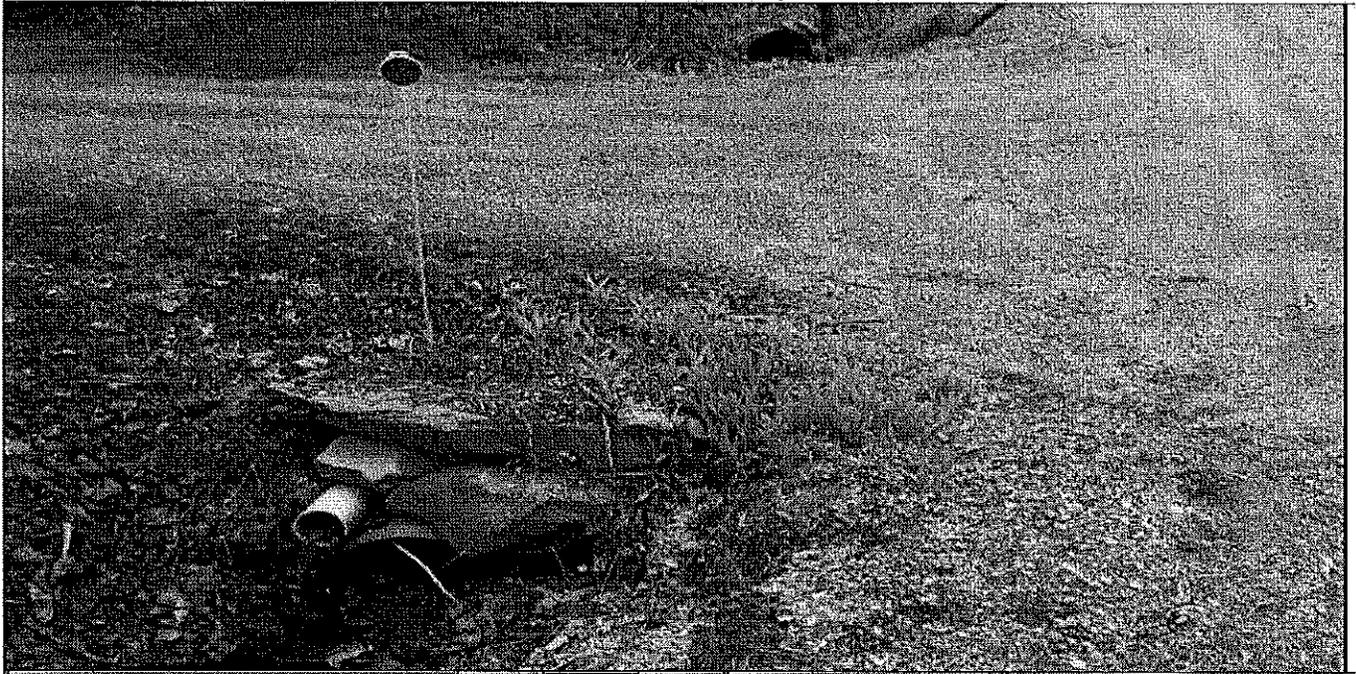
The **next photo** shows the erosion ditch being cut by water dispersed by this ditch. On this steep hill, erosive action is evident in the ditch photo above and the photo below.



This erosion ditch makes its way to the stream through a short wooded area. The stream is visible from the road.

There are several problems on Quaker Street that are typical in other projects. Ditches and outflows are not protected against erosion which has a high probability of occurrence due to the steep grade of the road. A branch stream crossing the road has a poorly installed culvert that promotes bank erosion at both the invert and outflow sides of the culvert. In addition, there are several driveway accesses that are not installed to perform well in high run-off events and some present ongoing maintenance issues. The current ditching is well establish and keeps water from the road but erosive action continually moves sediment down the hill plugging culverts and flowing into the stream. Starting on the next page, photos taken on this project site show some critical culverts half filled with sediment and other concerns.

Two driveway access culverts close together and a third also very close (not shown)



In the following photo, a branch stream culvert crosses under Quaker Street and empties into the collector stream on the opposite side of the road. This culvert is much too short to provide adequate shoulders on both sides of the road. The invert and out flow banks are prone to erosion.



The culvert does not protrude from the bank. The end is inside the grass under the road shoulder. Road gravel is constantly running off into this stream.



Although there is grass on some of the ditch slopes, the bottom where most water flows is eroding. This photo was taken at the base of the hill just beyond blacktop and gravel road seam. The road has leveled out but erosion still occurs at this point.

Quaker Street Project Details:

- Install 1000 feet of stone line ditching on the stream side of the road and install a turnout with splash area at the base of the gravel road portion of the hill.
- Install 800 feet of stone lined ditch on the opposite side of the road
- Replace two driveway access culverts
- Replace access culvert for private road (Bull Run) and fix ditch approaches to roadside ditch
- Improve the branch stream crossing locate 2/3 of the way up the hill (mailbox # 1045). Install a new culvert with concrete headwall per State of Vermont consultation (estimating 48 inch arch culvert)
- Consider relocating/resetting multiple drive accesses at address 1199. Add stone sump areas

Project Estimate:

| Description | Units | Unit Cost | Cost |
|-------------------------------|-----------|----------------|---------------------|
| 6 to 8 inch minus stone | 240 yards | 12.00 per yd. | \$ 2,880.00 |
| Rip Rap | 300 yards | 15.00 per yd. | 4,500.00 |
| 18 inch HDPE plastic culvert | 60 feet | 10.00 per ft. | 600.00 |
| 48 inch arch culvert | 50 feet | 67.00 per ft. | 3,350.00 |
| Concrete Headwall | | | 3,500.00 |
| Seed/Mulch/Fabric/Misc. | | | 800.00 |
| Excavation | 64 hours | 110.00 per hr. | 7,040.00 |
| Trucking | 72 hours | 85.00 per hr. | 6,120.00 |
| Labor | 80 hours | 16.00 per hr. | 1,280.00 |
| Project Estimate Total | | | \$ 30,070.00 |

Note: This project will likely be completed in two or more phases.

The picture **below** shows cross culvert outflow area. Water in the foreground is from the Quaker Street roadside ditch and is flowing into the stream.



In the photo below, water from the cross culvert is flowing to the stream. The distance from culvert to stream is less 100 feet.



This short section of blacktop road at the base of Quaker Street is strategically connected to the work being performed on the gravel portion of Quaker Street. There is a good argument for getting this done before some of the other work slated for Quaker Street.

The center point of this project is a cross culvert at the base of Forge Hill Road that goes under Forge Hill Road and empties into the stream.



Forge Hill is a gravel road that ascends up a hill as it leaves this intersection. The ditch on this hill is neither vegetated or stone protected. The ditch tucks into the side of a hill and is bordered by unstable banks for the first 150 feet and then continues for 500 feet to the top of Forge Hill Road.



In addition to the two ditches shown, the road cross culvert is accepting water from this branch stream on the slope directly behind the culvert.



None of the sources feeding water to this culvert invert have been protected from bank erosion. The two ditch sources have very vulnerable banks at the base of steep hills. The small branch stream behind the culvert has several mini-branches and turns created by erosion. This project will protect the incoming feeder sources and armor the invert and outflow of the culvert. The culvert is in good condition and does not need replacing. A headwall may not be necessary with proper Rip Rap installed.

Forge Hill and Quaker Street Project Details:

- Stone line Forge Hill ditch for 650 feet from cross culvert to the top of hill
- Rip Rap the hillside of ditch for the last 150 feet before culvert
- Rip Rap culvert sump area to include the approach of branch stream on slope behind culvert
- Rip Rap the culvert outflow on stream side
- Rip Rap 300 feet of Quaker Hill ditch on the approach to Forge Hill cross culvert

Project Estimate:

| Description | Units | Unit Cost | Cost |
|-------------------------------|-----------|----------------|---------------------|
| 6 to 8 inch minus stone | 130 yards | 12.00 per yd. | \$ 1,560.00 |
| Rip Rap | 200 yards | 15.00 per yd. | 3,000.00 |
| Seed/Mulch/Fabric/Misc. | | | 300.00 |
| Excavation | 32 hours | 110.00 per hr. | 3,520.00 |
| Trucking | 32 hours | 85.00 per hr. | 2,720.00 |
| Labor | 32 hours | 16.00 per hr. | 512.00 |
| Project Estimate Total | | | \$ 11,612.00 |

The picture below shows the culvert that is in the area of the steep bank.



The cross culvert above goes under the road and empties directly to the stream bank. The sump is inadequate and the approach needs stone in both directions. One side needs bank stabilization for about 175 feet. The other side is flatter and can simply be stoned line for 90 feet.

There is approximately 180 feet of ditch that is difficult to clean and maintain because of its close proximity to the slope. Material frequently washes down the slope filling the ditch and passing through the culvert.



Downingsville Road Project Details-Project #1:

- Excavate ditch to extent possible without cutting more into bank
- Rip Rap 180 feet of ditch and slope. Add Rip Rap in culvert sump area
- Stone line 90 feet ditch
- Rip Rap culvert outflow

This road has no definitive ditching and much of the sediment travels on the road edges until it meets crude grader constructed turnouts as seen below.

The photo illustrates a grader turnout that is cut toward the stream bank at the base of the Hill. The road and shoulders are made up of a loose gravely material that is easily pushed down the hill.

That lack of definitive ditching means that water is held in the road by berms and runs out wherever relief points exist cutting erosion paths in many places.



Colby Hill Project (Atkins to Isham Road)-This project is another very steep hill that has a stream at the base of the hill and another branch stream part way up the hill. The stream at the bottom of the hill accepts all run off from this project area. Roadside ditches on the hill are not well defined or protected. There is a 60 inch culvert at the stream crossing. The stream culvert is also unprotected from erosive run-off.

Following are several pictures of the culvert and stream crossing:

This first photo shows the outflow side of the culvert into the stream.



The culvert invert is shown below:



This is the ditch starting up the hill



Following are several ditch photos randomly taken as ascending the hill. The pictures are very expressive of characteristics of overall ditching going up this hill to the top of the grade (1700 ft.)



The branch stream located part way up the hill is pictured below:



Branch stream coming from Colby hill to NHR @ .1 mi up hill

Colby Hill Project Details (Atkins to Isham Road):

- Install stone splash area at the base of the hill before reaching the stream
- Stabilize the road bank with Rip Rap at the stream crossing on the invert side of the 60inch culvert
- Stone line the roadside ditch on one side of the road all the way to the top of the hill (1700 feet)
- Install three small turnouts on the opposite side of the road where water sheds
- Install an additional cross culvert under the road at one of the turnout areas
- Relocate one driveway access culvert that is out alignment and undersized

Project Estimate:

| Description | Units | Unit Cost | Cost |
|-------------------------------|-----------|----------------|---------------------|
| Rip Rap | 90 yards | 15.00 per yd. | \$ 1,350.00 |
| 6 to 8 inch minus stone | 420 yards | 12.00 per yd. | 5,040.00 |
| 18 inch Hi-P plastic culvert | 50 feet | 13.00 per ft. | 650.00 |
| Seed,Mulch,Fabric,Misc. | | | 450.00 |
| Excavation | 60 hours | 110.00 per hr. | 6,600.00 |
| Trucking | 60 hours | 85.00 per hr. | 5,100.00 |
| Labor | 60 hours | 16.00 per hr. | 960.00 |
| Project Estimate Total | | | \$ 20,150.00 |

Note: This project will likely be completed in two phases.



This photo shows the very small shoulder area for this 60 inch culvert:



A close up from another angle shows recent erosion occurring at the road shoulder above this culvert.

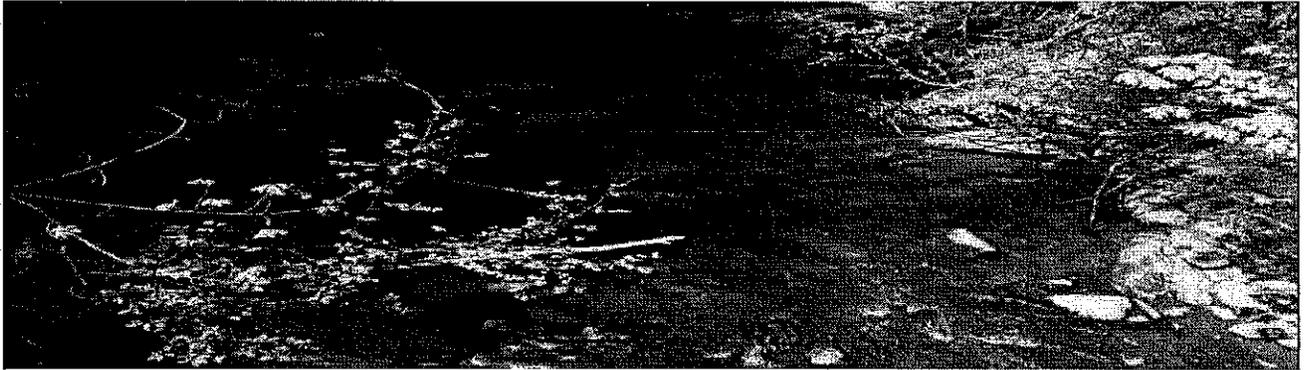


Photos of the 36 inch culvert indicate a similar problem where stream culvert is too short and the Highway Department has made repeated attempts to stabilize this culvert crossing:



Attempts have been repeated to add headwall protection but there is really not adequate shoulder space to be successful. The culvert is in fair condition and can likely be reused.

This is the stream viewed from the box culvert:

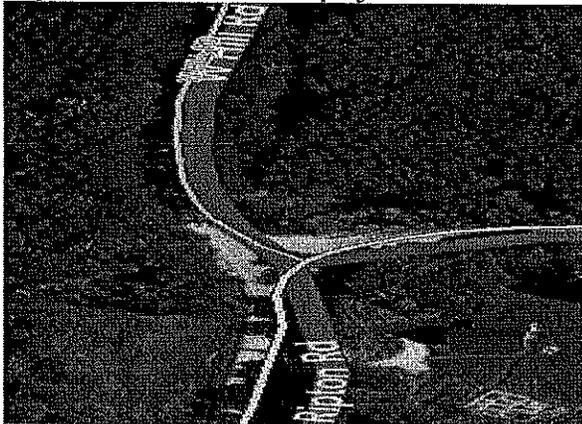


This is the view (below) from the woods standing halfway between the stream and driveway. In the foreground is a large pile of sediment pushed toward the stream.



The picture above shows erosion at the culvert invert above the driveway

The photo below shows the project site location in relation to the stream:



Ripton Road Project Details-Project #2:

- Stone line the roadside ditch on both sides of West Hill Road (750 feet total)
- Stone line one side of Ripton Road ditch (350 feet)
- Replace driveway access culvert at the at the base of the ditch nearest stream (mail box 1717)
- Add two splash areas for stream protection

Project Estimate Total:

| Description | Units | Unit Cost | Cost |
|-------------------------------|-----------|----------------|-----------------|
| 6 to 8 inch minus stone | 240 yards | 12.00 per yd. | \$ 2,880.00 |
| Rip Rap | 40 yards | 15.00 per yd. | 600.00 |
| 18 inch HDPE plastic culvert | 30 feet | 10.00 per ft. | 300.00 |
| Seed/Mulch/Fabric/Misc. | | | 250.00 |
| Excavation | 24 hours | 110.00 per hr. | 2,640.00 |
| Trucking | 24 hours | 85.00 per hr. | 2,040.00 |
| Labor | 24 hours | 16.00 | 384.00 |
| Project Estimate Total | | | 9,094.00 |

Ript on Road Pr oject #3-The third project on Ripton Road occurs approximately .3mi south of the Ripton and West Hill intersection on the steepest portion of a hill. The project involves a culvert that goes under the road just above where a branch stream crosses the road.

Project site:



The road culvert is located less than 100 feet up hill from this stream crossing. The invert side is constantly filling with sediment which can reach the stream from the outflow side. Also, on the other side of the road there is one drainage turnout that is close to the stream and needs to be addressed because sediment is leaving the road at this location.

When standing on the edge of the road, you can see the stream from this turnout.

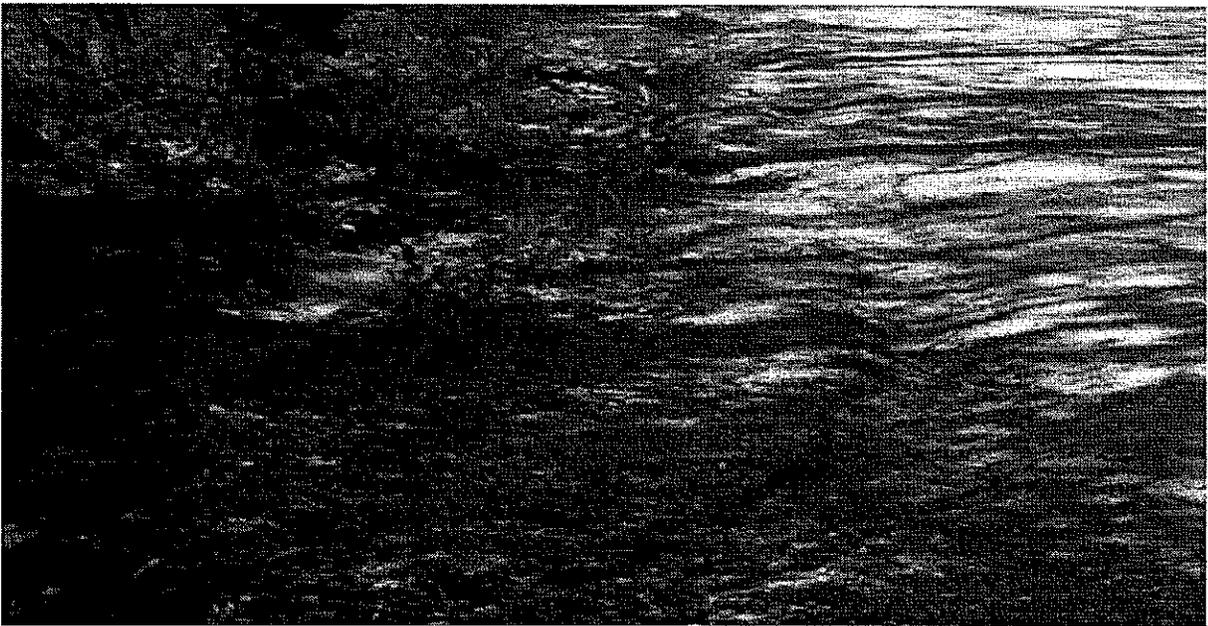


Above is a photo of the branch stream that first parallels the project area and then crosses the road downhill from the work site.

Ripton Road Project Details-Project #3:

- Replace the cross culvert with an 18 inch metal arch culvert (50 feet)
- Install end section on invert side
- Stone line the uphill ditch fully on the invert side (500 feet)
- Stone line ditch (200 feet) and install stone two stone turnouts on the outflow side
- Rip Rap in turnouts and outflow of new culvert

The road has several issues with erosion cutting into the road because of the lack of defined ditching.



This section of road surface is not at the same standard as the rest of the road below this project site. The road needs ditching, stone lining, and culvert replacements to contain the sediment now reaching the stream.