

RIVER ROAD SETTLEMENT AREA
CRITICAL HIGHLIGHTS BASED ON TIMELINE

05-08-14	Slump area identified. Field trip by DES, P&ZOS & Road Agent-guard rails recommended
10-02-14	BOS agreed to have CLD Engineering assess. Noted more erosion.
10-16-14	CLD reports concern over critical nature of problem. Considers only viable solution to move the road.
11-13-14	Based on visible digression of condition engineers recommend 1-lane. Police Department concurred and notes there is heavy farm truck traffic over compromised area.
11-20-14	More borings done. One lane road created.
05-26-15	Received notice from CLD advising closure. BOS requests second opinion. Memo from CJ Smith to BOS-asking for state DOT input.
06-18-15	DES & BOS boat trip. CLD reviews options. Considers reroute most sensible.
09-24-15	CLD got second opinion. All engineers consulted (CLD, Golder & Willis) agree that road should be closed for safety reasons. Stability unknown. BOS requests documentation & opinion in writing. Received letter from CLD recommending closure based on Engineering & contractor recommendation.
10-08-15	Reviewed engineer's findings. All recommend road be closed immediately. Police Chief concurs citing safety of vehicle drivers, emergency vehicles & employees using the road. Engineers deemed area unstable; liability issues discussed. Meeting included teleconference with Attorney Steven Whitley (Mitchell Municipal Services) who also recommended closure. Motion was made to close the Slump section of River Road using Jersey barriers. Public advisory done. Email from C J Smith to BOS, AA re: Municipal Liability RSA 231:90, 91, 92 Letter drafted by BOS to RR Neighbors with explanation
10-13-15	Email from S Whitley, legal- requesting feedback from CLD & Willis about conflicting messages. Email from M Willis summarizing previous discussion: 1. Remains concerned about long term stability of this section of road 2. Continued usage of road in present condition should not continue. Paramount that decisions be made asap.
10-20-15	Public Meeting re: closure
10-21-15	Email from S Whitley, legal to BOS complimenting the Board on how contentious meeting was handled. Further, stating that the consensus in his office is to recommend against any public travel on that section of road.
02-11-16	Meeting with CLD & public to receive information and costs for options for address slump problem. #1-Reroute the road to East Thetford Road. Cost estimate \$800,000. Project could be complete in one construction. #2-A complex plan creating a retaining wall, not guaranteed to stay because of inherent condition of area. Much longer to complete at an estimated cost of \$2.5 million.
02-22-16	Appraisal by Capitol Appraisers for TOL on Bear Hill Conservancy land: 1. As is, unencumbered; before \$502,000 2. for eminent domain purposes \$ 31,000
09-28-16	Response from Capitol Appraisers- Appraised value at \$46,000
10-27-16	Communication from D. Roby regarding willingness not to fight reroute if funds are voted at town meeting. If he were to put this in writing, eminent domain proceedings could be stopped. Letter from BOS to D Roby asking for meeting to negotiate cost.
12-29-16	Notification received that reroute land had been sold.
01-05-17	Letter to Lyme Farmland LLC-offer to Purchase \$46,000

Lyme Roads Plan

October 31 2016

Lyme has 13 miles of paved roads and 39 miles of dirt roads. All of these roads are classified as 'Class V roads' in the State of New Hampshire's road system. Almost all of the roads have been in existence for over a century (some much longer) and almost without exception are not well built in terms of supporting material and drainage.

The upgrade of Route 10 in 1965 led to a significant increase in traffic on Lyme's roads because Lyme became an extremely attractive community for people associated with Dartmouth College, the medical center and the various hi-tech firms in the area. This increase in traffic has resulted in increased wear and tear on Lyme's Class V roads. These roads were never built for heavy traffic in the first place.

The nature of traffic has also changed and large trucks and various package delivery vehicles are found on all of the roads. Many of these vehicles have heavy, stiff suspensions and are hard on road surfaces.

The East Thetford bridge is also a significant contributor to problems with River road (and to traffic through Lyme) because it is a major commuter route to and from Vermont. Vehicles from both Hanover and the north use River Road to get to and from East Thetford bridge.

All of this road use has required increased maintenance on the roads and has led to steady deterioration of the town's two longer sections of pavement: River Road and Goose Pond Road. Happily, the shorter sections of pavement on several steep hills and in the village are in relatively good condition.

Over the last couple of years there has been great progress on improving the quality of our dirt roads and improving conditions during mud season. This is due to buying better fill material and also to the purchase of the vibratory roller and the equipment for applying magnesium chloride to the road surfaces. These additions to Lyme's equipment have stabilized dirt road surfaces and made a dramatic reduction in road dust.

In terms of long-term maintenance, one of the most critical parts of the road system is the culverts. For some years, culvert replacement was not a priority, and now there is a significant backlog of work. Also, the more frequent torrential rains that we are having mean that replacement culverts need to be larger in order to be able to handle sudden large flows without having the water back up and wash out the culvert and the road surface above it. The highway department is working steadily on the culverts, but it is limited in what it can do by insufficient funds.

There are two major issues with Lyme's roads that are both difficult and expensive to resolve: the many problems associated with bank collapse along River Road, and the need for a long-term strategy for dealing with deteriorating pavement on both River Road and Goose Pond Road.

The most obvious River Road problem is the closed area south of East Thetford road. The existing road is unstable and a careful and responsible analysis of the situation makes it clear that it is not economically reasonable to attempt to repair it. The only cost-effective alternative is the proposed bypass road. Construction of the bypass road is being held up in eminent domain litigation.

But River Road has many other problems and will continue to be a significant expense for the foreseeable future. It is eroding into the river in several places, and most of it has an unstable

roadbed. Erosion on the steep bank just to the north of North Thetford Road and a slumping area to the south of the Grant Brook bridge are areas of immediate concern.

Major problems with River Road are that parts of it are paved and that much of the pavement is in very poor condition due to age and an unstable roadbed. This year, for example, the town has spent \$40,000 to patch areas of pavement that were so unstable that they could not be plowed. This was done with great reluctance because it does not help to solve the underlying problem: most of the pavement on River Road is aged and unstable because the road bed itself is unstable.

After detailed analysis and long discussion, the Class V Roads Committee has recommended to the Board of Selectmen that the most of the pavement on River Road be milled down over a period of time and that the road be converted to gravel-surface road so that it can be maintained in good condition with the town's existing equipment and maintenance practices. Here is the logic behind this recommendation,

Much of the pavement is old, unstable and breaking up. Re-paving over an unstable base is a waste of money. Current cost estimates for rebuilding roadbed so that it is stable for pavement come to something like \$800,000 a mile for roads that are not threatened with bank erosion. Milling the road surface so that Lyme's highway department has the ability to maintain it and to make repairs on steep banks has a current cost of approximately \$155,000 per mile.

The milling process involves grinding up the pavement, taking the ground pavement offsite and mixing it with crushed stone, repairing culverts as needed and then replacing the mixed material, and finally grading and compacting the new surface. Once the surface has been converted to gravel, it will then be possible to make limited repairs on areas on areas that prove to be unstable. This is not possible when the road is paved.

This solution lets the road crew keep roads in decent shape, for an annual maintenance cost of \$10,700 per mile, but it does not address the problems of basically poor substructure in many areas. Fixing the subsurface to a depth of 12" is almost as expensive as preparing for pavement and would cost about \$500,000 per mile.

The bottom line is simple and sobering: Lyme, as a community, lacks the money to rebuild the road base of the paved sections of River Road and Goose Pond road. We do have the means of maintaining good-quality gravel roads, and we have found that treating the surface of the roads with magnesium chloride minimizes road dust and stabilizes the road surface so that less maintenance is required.

The timing of conversion of sections of paved road to gravel road or from gravel to pavement will be based on input from our road agent and on the Roads Committee's assessment of the most cost-effective course of action given data on the maintenance requirements of the road surface, the volume of traffic and the underlying stability of the road base.

Respectfully submitted by Frank Bowles

April 19, 2016

PROJECT: River Rd. Assessment and repairs

MEETING PURPOSE: meet with engineers and specialist contractor to evaluate options for possible slope stabilization in the slump area on the closed section of River Rd.

ATTENDEES: Sue McKenzie, Steve Williams, Frank Bowles, Robert Barnum, Mike Willis, P.E. (Geotechnical engineer) and Michael J. Lally, Engineer and Vice President, Sea and Shore Contracting Inc.

NOTES: the group met at the slump area. Mike Lally, who had reviewed Mike Willis' data on the slump area, examined the bank and then he and Mike W. discussed possible means of stabilizing the area. Mike W. noted that the ledge is down fairly deep and that it slopes not only downslope under the slump area, but also down to the south, so that there is a sloping surface in two planes. As noted in his reports, Mike had also determined that the soils are very fine, inherently unstable and that groundwater in the area has to be running over the ledge, with a high likelihood that there are channels (piping) in the soil. Mike W. also noted that the material underlying the road is likely the overburden cut from the slope on the landward side to create the roadway. He also observed that the mass of soil sitting on the rock hugely outweighs any traffic load, but that traffic loads and the vibration associated with them are very likely the cause of the slump. The river is also contributing to the instability of the slope by undercutting the unstable soils at the toe of the slope. The slope is quite steep, so undercuts affect a large area of soil. Both engineers also agreed that putting anything heavy vehicles that vibrated very much on the roadway could destabilize the area.

The two engineers and the group reviewed the known options for stabilizing the slope face: sheet piles, soil face stabilization using tiebacks and Sea and Shore's technique of soil column stabilization using high pressure grout pumping. The issue with all of these options is that unless they were tied vertically and horizontally into the bedrock, the whole slope could still move and even then, there would be issues of creating a perched area of stability with a vulnerable underside if the lower portion of the slope collapsed. With sheet pile, there was also concern that water could be trapped behind it in some areas while soil and water flowed through the bottom in areas where the piling system was not in close contact with the ledge. All of these approaches would also be very expensive and might involve sectional barges to allow work to be done from the river. Mobilization costs would be very high.

Mike L. also went over the possibility of cutting back the landward slope, creating a retaining wall and then rebuilding the road inland. His observations were a variant on the plan proposed by CLD. The problem with this approach is as before: no bottom support for the repair, so it is inherently unstable.

Both engineers noted that the basic problem with the site is the 'global stability' of the soil system, which is low, so that it is difficult to create a repair that has an acceptable safety factor. [FPB note: to clarify this concept, it helps to think of global stability as the ability of a retaining structure to withstand the forces on the soil system that might cause it to undergo a failure with a rotational component. This is a method of analysis that takes into account a more complex set of conditions than an analysis that deals only with a sliding failure.]

Both engineers also discussed possible remediation that removed a portion of the soil mass and then created a bridge structure of some sort. Aside from formidable expense, this approach is also subject to having parts of the slope fail around it.

The discussion concluded with Mike Lally's observation that if there is a viable inland route for this section of the road, it is by far the best solution in terms of both road stability and cost.

respectfully submitted by Frank Bowles