



Upper Valley Lake Sunapee  
Regional Planning Commission

## Memorandum

TO: Town of Lyme Select board  
FROM: Meghan Butts, GIS Coordinator / Planner  
Olivia Uyizeye, GIS Technician / Assistant Planner  
DATE: November 9, 2018  
RE: **Town of Lyme Culvert Inventory Condition Report**

The attached documents contain the results of a Culvert Inventory project completed between May and November 2018. Culverts on Town roads were assessed using Statewide Asset Data Exchange Systems (SADES) field data collection methodology, data processing and software established in partnership by the UNH Technology Transfer Center (T2), NH Department of Environmental Services (DES), NH Department of Transportation (DOT), NH Fish and Game Department, NH Division of Homeland Security and Emergency Management and the Association of NH Regional Planning Commissions. The 2018 culvert team located and assessed 412 culverts. This included 325 drainage, 15 wetlands and 52 streams.

### Data Collection

The data collection was completed by driving to each culvert and collecting data based on criteria in the SADES field manual. Data was collected using a variety of tools and equipment including a measuring tape, measuring rod, an abney level, waders, boots, and an iPad with ArcGIS Collector App. The criteria for drainage culverts primarily consisted of structural categories to assess the pipe condition, including headwall conditions and sediment buildup. Stream culverts required additional data including: culvert and road elevations, bankfull widths, water depth, wildlife, and erosion and aggradation.

### Conditions

The overall condition of the culvert and related performance is assessed using a rank based score in seven variables: Structure Clogged, Condition of Pipe, Upstream Condition of Headwall, Downstream Condition of Headwall, Upstream Scour Undermining Structure, Downstream Scour Undermining Structure, and Undersizing of the Structure. These variables were chosen because they best assess the maintenance needs of the culverts and were agreed upon with the Lyme select board.

As different variables are collected for different structures, each group of variables (referred to as category) is given a different level of influence on the final rating depending on the structure type. The final rating is on a scale of up to one and given a rating category of Good (0.8 to 1.0), Fair (0.6 to <0.8), Poor (0.5 to <0.6) or Very Poor (<0.5). A lower score means a higher priority for maintenance. Those with a Fair rating will likely function for handful or more years, but

require monitoring. Those with a Poor rating require attention within the upcoming season. Those with a Very Poor rating likely need immediate attention.

		# of Headwalls	Category Contribution (%)			
			#1	#2	#3	#4
Structure Type	Drainage	None	100			
		One	80	20		
		Two	60	40		
	Wetland	None	70		30	
		One	50	20	30	
		Two	40	30	30	
	Stream	None	50		30	20
		One	40	15	30	15
		Two	40	30	20	10

	Variable	Grade	Variable	Grade
Category 1	Structure Clogged with Sediment <ul style="list-style-type: none"> <li>• Open</li> <li>• ¼ full</li> <li>• ½ full</li> <li>• ¾ full</li> <li>• entirely full</li> </ul>	<ul style="list-style-type: none"> <li>• 4</li> <li>• 3</li> <li>• 2</li> <li>• 1</li> <li>• 0</li> </ul>	Condition of Structure <ul style="list-style-type: none"> <li>• Good</li> <li>• Fair</li> <li>• Poor</li> </ul>	<ul style="list-style-type: none"> <li>• 4</li> <li>• 2</li> <li>• 0</li> </ul>
Category 2	Condition of Headwall (US) <ul style="list-style-type: none"> <li>• Good</li> <li>• Fair</li> <li>• Poor</li> <li>• NA</li> </ul>	<ul style="list-style-type: none"> <li>• 4</li> <li>• 2</li> <li>• 0</li> <li>• -</li> </ul>	Condition of Headwall (DS) <ul style="list-style-type: none"> <li>• Good</li> <li>• Fair</li> <li>• Poor</li> <li>• NA</li> </ul>	<ul style="list-style-type: none"> <li>• 4</li> <li>• 2</li> <li>• 0</li> <li>• -</li> </ul>
Category 3	Scour Undermining Structure (US) <ul style="list-style-type: none"> <li>• None</li> <li>• Footers</li> <li>• Wing wall</li> <li>• Footers and wing wall</li> <li>• Culvert</li> <li>• Culvert and footers</li> <li>• Culvert and wing wall</li> <li>• Culvert, footers and wing wall</li> <li>• Unknown</li> </ul>	<ul style="list-style-type: none"> <li>• 4</li> <li>• 3</li> <li>• 3</li> <li>• 2</li> <li>• 2</li> <li>• 1</li> <li>• 1</li> <li>• 0</li> <li>• -</li> </ul>	Scour Undermining Structure (DS) <ul style="list-style-type: none"> <li>• None</li> <li>• Footers</li> <li>• Wing wall</li> <li>• Footers and wing wall</li> <li>• Culvert</li> <li>• Culvert and footers</li> <li>• Culvert and wing wall</li> <li>• Culvert, footers and wing wall</li> <li>• Unknown</li> </ul>	<ul style="list-style-type: none"> <li>• 4</li> <li>• 3</li> <li>• 3</li> <li>• 2</li> <li>• 2</li> <li>• 1</li> <li>• 1</li> <li>• 0</li> <li>• -</li> </ul>
Category 4	Undersized Culvert: (Culvert Width ÷ Average Channel Bankfulls) x 100% <ul style="list-style-type: none"> <li>• Beyond Bankfulls, ≥115%</li> <li>• About the Same, &lt;115% to ≥85%</li> <li>• Slightly Undersized, &lt;85% to ≥55%</li> <li>• Moderately Undersized, &lt;55% to ≥30%</li> <li>• Highly Undersized, &lt;30%</li> <li>• NA</li> </ul>	<ul style="list-style-type: none"> <li>• 4</li> <li>• 3</li> <li>• 2</li> <li>• 1</li> <li>• 0</li> <li>• -</li> </ul>		

## Results

The overall pipe conditions of the culverts were ranked highly. Many newer culverts have plastic piping, which eliminates corrosion and lowers deformation of the pipe.

Rating		# of Culverts	% of Culverts
Good	0.8 to 1.0	182	44%
Fair	0.6 to <0.8	83	20%
Poor	0.5 to <0.6	63	15%
Very Poor	<0.5	64	16%
Insufficient Data		20	5%

Overall the lower scores on drainage culverts were because of sediment buildup (particularly on dirt roads), headwall damage and/or pipe deterioration. On stream culverts, lower scores were also a result of the restriction of streams due to pipe size and the related scour damage around the structure.

Note: It is important to consider seasonal differences in amount of rainfall, sediment and debris that can affect the amount and velocity of stormwater reaching and passing through a culvert. The winter and spring, when there is snowmelt and heavier rainfall, could present different results than drier times like the summer and fall. In contrast, the fall, when there is an abundance of leaf litter, could present its own challenge.

### Tabular Report, Maps and Raw Data

The tabular report contains all seven variables used in the condition rating, location details and additional structure information. A series of maps in a mapbook show the location, condition rating and ID label of each culvert. The tabular report and mapbook have been created to function in both the field and in meetings. In addition, there is a poster map depicting the location, condition rating and ID label of each assessed culvert in Lyme. This poster has been created for display and group discussions.

The raw data from the assessment will be provided to the Town of Lyme. This includes all culvert assessment data, photos, excel workbook to track assessed changes in culverts, and map packages of the mapbook and poster documents. The data and document framework allows the Town of Lyme to monitor assessed changes to culvert structures and continue to identify structures that require attention using the rating scale.