Proposed Southampton Greenway Trail
Existing Conditions Review of Bridges and Culverts

TO: Michael Buehler, Chair of the Southampton Greenway Committee

FROM: Craig French, P.E. Structural Engineering Manager, Tighe & Bond

COPY: Elizabeth Baldwin, P.E., Vice President, Tighe & Bond

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DATE: November 7, 2017

This memorandum summarizes Tighe & Bond's evaluation of two existing railroad bridges and eleven existing culverts along the proposed Southampton Greenway in Southampton, MA. The purpose of our review was to provide the Southampton Greenway Committee (SGC) with Tighe & Bond's opinion regarding the existing conditions of the structures and to identify structural deficiencies with the bridges and culvert structures.

1.0 Background

The Southampton Greenway is a project proposed to extend the current Manhan Rail Trail through Southampton, MA. The trail would extend from the northeast corner of Southampton at Coleman Road south to College Highway (Route 10) in the vicinity of Moose Brook Road. The trail is proposed to be located along an existing railroad line originally run by Hampshire & Hampden Railroad. The rail stopped carrying passengers in the late 1920s and was a freight line until the 1990s when the rail line stopped operations. Currently, the rail is owned by Pioneer Valley Railroad, a Pinsly Railroad Company.

Along the route through Southampton, the railway crosses two bridges and, from a previous study completed by others, eleven small to mid-size culverts. One bridge is a two-span structure that passes over Gunn Road and then over the Manhan River. The second bridge is also two spans over the Manhan River, adjacent to Sheldon's Ice Cream Shop near Moose Brook Road.

1.1 Documents Reviewed

In preparation for this evaluation, Tighe & Bond reviewed a report titled *Southampton Greenway Feasibility Study* prepared by Pare Corporation in March 2011. The feasibility study contains information on the railway bed from Coleman Road to College Highway, permitting information, proposed design options, and public opinions. The report identified that repairs are necessary to specific deteriorated structural components of both the Manhan River Bridge and the Gunn Road Bridge. In regard to the eleven culverts, the feasibility study mentions that several structures have moderate to severe deterioration or are in need of preventative maintenance.

1.2 Evaluation Ratings

For the purposes of this memorandum, the existing conditions of the structures are generally categorized into three condition groups as follows:

- **GOOD:** Represents elements that are performing well, are sound, adequate or show minimal deterioration. Repairs are generally not required at this time and these items can be expected to remain useful and functioning with regular maintenance.

- **FAIR:** Represents items that have minor deficiencies, but are currently performing adequately. Elements are generally sound but some areas exhibit deterioration. These items generally can be repaired and / or restored to good condition with varying degrees of required modifications. If not repaired or restored, these elements should remain useful with regular maintenance; however, they should be observed for further deterioration.

- **POOR:** Represents items that have significant deficiencies, are not performing well or are failing. Elements show advanced deterioration or appear to be inadequate. Generally, these items will require substantial repairs or replacement of the element in question to remain in service.

1.3 Structural Condition

Manhan River Bridge and the Gunn Road Bridge are located along the proposed Southampton Greenway trail. These structures were inspected to determine their current structural condition and to identify any necessary repairs. See Figure 1 for a map showing the bridge locations. Photos of the structures are included in the Photo Log at the end of this memorandum.

1.3.1 Manhan River Bridge

Adjacent to Sheldon's Ice Cream Shop is an unused railroad bridge that spans over the Manhan River (**Photo 1**). The bridge is oriented from North to South and the Manhan River flows from West to East. This bridge is a two span, built-up riveted steel stringer bridge with two girders. The southern span is the longer span and constructed with deeper girders compared to the northern span. The pier and abutments are constructed of dry-laid, granite blocks with parged mortar joints (**Photos 2-3**). At the north abutment, there are

dry-laid stone masonry wingwalls on either side (**Photo 4**).

Superstructure: The built-up, riveted steel girders of the existing Manhan River Bridge exhibit moderate rusting throughout the webs and flanges. The most advanced areas of rusting are along the bottom flange of both girders. Rivets located closest to the bottom flanges have advanced deterioration and many rivet heads have complete section loss (**Photo 5**). In these locations, it is likely that the entire stem of the rivet has also deteriorated. The existing paint system is failed across the entire structure. Due to the age of the structure, there is a possibility that the coating system contains hazardous materials, such as lead paint.

Due to a buildup of debris on the bearing, the condition of the bearing could not be readily determined (**Photo 6**). Based on the minor rusting on the adjacent steel superstructure, it is likely that the bearings are in similar condition.

Deck: The deck of the existing bridge consists of deteriorated timber ties and a railroad track (**Photo 7**). Trees and brush are growing over the structure at the approaches. At the time of the site visit, a fallen tree was resting on the bridge deck. For the installation of a suitable deck for the proposed rail trail, it will be necessary to demolish the existing timber ties and railroad track.

Substructure: The existing stone masonry abutments and the pier are generally in good condition. The parged mortared joints on the substructure elements have several areas of efflorescence. This likely means that water is migrating from the backfill through the parged mortar joints in the stone masonry abutments. However, none of the granite blocks in the masonry abutments and pier have visible cracks and there were no signs of sections shifting. This is a good indicator that the abutments are stable and not settling. On the northwest side of the pier, there is a 3-foot-deep section of undermining beneath the masonry blocks (**Photo 8**). In general, the base stones that support the center pier do not extend very far beyond the footprint of the stone masonry. This leaves the pier unprotected and at risk for further advancement of the current scour and undermining issue. There are already several foundation supports fully exposed.

Scour Concerns with Dam Removal: Upstream of the Manhan River Bridge, the Lyman Pond Dam is located adjacent to Sheldon's Ice Cream Shop. It is our understanding there is a separate proposed project that includes the removal of this dam. At the time of the inspection, the Manhan River flowed beneath the southern span of the bridge, but there was no active flow under the northern span. This stream path may be altered once the upstream dam is removed. Changes to the stream path may impact the downstream hydrology; potentially worsening the undermining issues occurring at the Manhan River Bridge.

Recommended Repairs: The overall condition of the Manhan River bridge is rated as fair; there are components that are performing well and have little to no deficiencies. However, there are other components in fair to poor condition with moderate deterioration, and although they appear to be performing adequately, should be repaired or monitored for any further deterioration.

The base of the abutments and piers should be protected with additional riprap and scour protection. Since the northwest corner of the pier has a potential undermining issue, repairs to the scour vulnerable areas should be completed to maintain the integrity of the structure. Grouting beneath the center pier to fill the current void created by scour should be completed, and rip-rap added around the pier and both abutments to direct water flow and prevent future erosion issues.

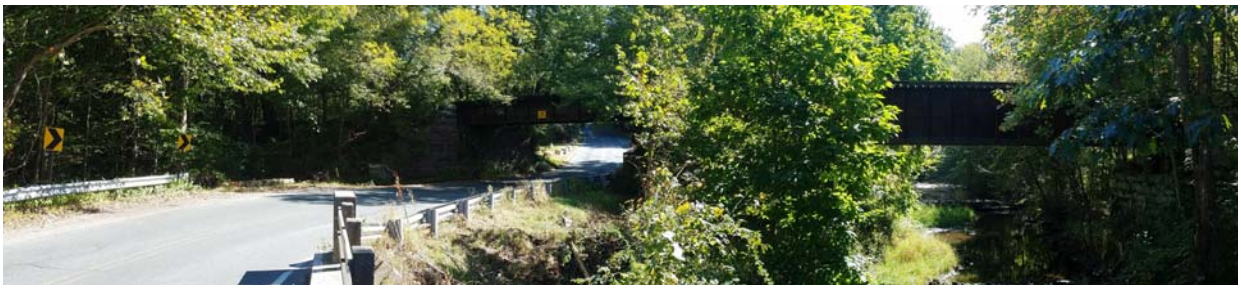
Many of the bearings were not fully visible during our inspection due to a significant amount of debris accumulation, and it is likely that the bridge bearings have some level of deterioration. In order to determine the exact amount of corrosion, an inspection utilizing ladders will be necessary to reach the upper bearings. For the purposes of this technical memorandum, replacement of the bearings is included in the repair cost estimate.

Most of the rivets in the bridge girders are in fair condition; however, many rivets located along the bottom flange of the beams are severely deteriorated. We recommend that rivets with severe section loss be replaced. This can be accomplished by removing the deteriorated rivets, cleaning the hole of remaining rust and debris, and installing new high strength bolts in their place.

We recommend sandblasting the steel superstructure to remove any buildup of rust on the built-up riveted steel, and to remove the failing coating system. Once the rust and existing coating system has been removed, a new layer of protective coating should be applied. This coating will help extend the lifespan of the existing structure.

1.3.2 Bridge over Gunn Road

The second unused railroad bridge spans over Gunn Road and the Manhan River (**Photo 9**). The bridge is oriented from North to South and the Manhan River flows from East to West. Similar to the Manhan River Bridge, this structure is a built-up, riveted steel stringer bridge with two girders. The southern span, over the Manhan River, is the longer span and constructed with deeper girders compared to the northern span. The pier and abutments are constructed of dry-laid, granite blocks with parged mortar joints.



Superstructure: There is consistent surface rusting, and rust flaking throughout the built-up, riveted steel girders of Gunn Road Bridge. The most advanced deterioration is located on the bottom flanges of the girders and on the vertical steel stiffeners (**Photos 10-11**). Many of the steel stiffeners have complete section loss at the bottom of the member. Along the bottom flange, there is a heavy buildup of debris, and the condition of the hidden rivets could not be verified. Based on the corrosion of the adjacent stiffeners, it can be assumed

that some rivets along the bottom edge of the girders are severely deteriorated with advanced section loss.

Throughout the steel superstructure, the existing coating system is flaking and has consistently failed. Due to the age of the structure, there is a possibility that the coating system contains hazardous materials; such as lead paint.

Several of the bearings are in poor condition. The bearing plates on the center pier have cracked diagonally across the corners at the anchor bolts (**Photos 12-13**). This indicates the fixed bearing is experiencing movement of the bridge superstructure from thermal expansion and contraction. A similar situation is occurring at the bearings on the north abutment. However, at the North location, the anchor bolts have tipped towards the north abutment, instead of the bearing plates cracking (**Photo 14**).

Deck: Similar to the Manhan River Bridge, the deck of the existing Gunn Road bridge consists of deteriorated timber ties and a single railroad track (**Photo 15**). Trees and brush are growing over the structure at the approaches. For the installation of a suitable deck for the proposed rail trail, it will be necessary to demolish the existing timber ties and railroad track.

Substructure: The existing dry laid, stone masonry abutments and pier are generally in good condition. There are no visible cracks in the stone and no blocks appear to have shifted in the masonry substructure. There are small voids in the north and south abutment which should be grouted and filled.

Recommended Repairs: Many of the structural components of the Gunn Road bridge are performing well and have little to no deficiencies. However, there are a few areas that have deteriorated to fair or poor condition. Since there are components with moderate to advanced deterioration, the overall rating of the structure is considered to be fair to poor. Even though these deteriorated areas appear to be performing adequately, they should be repaired or monitored for any further deterioration.

For the Gunn Road Bridge, we recommended that the bearings be replaced on the north abutment and the pier due to the cracked bearing plates and tipped anchor bolts. The cause of the bearing failure should be incorporated in the design of the new bearings to prevent a similar issue in the future repairs.

Most of the rivets in the bridge girders are in fair condition; however, there are a few rivets throughout the structure that are severely deteriorated. We recommend that rivets with severe section loss be replaced. This can be accomplished by removing the deteriorated rivets, cleaning the hole of remaining rust and debris, and installing new high strength bolts in their place. There are also several bolted connections that have corroded throughout the structure, specifically, in the connections above the center pier. Any anchor bolts with advanced section loss should be replaced with high strength bolts. Replacing deteriorated rivets and bolts will strengthen essential connections, and extend the life of the structure.

The majority of the riveted steel vertical stiffener plates have severe corrosion near the bottom flange and should be replaced. New stiffener plates can be fabricated to match the existing dimensions and connected to the structure using high strength bolts.

Some riveted panels, specifically around the center pier, have advanced deterioration and should be replaced. New panels can be fabricated to match the existing dimensions and installed using high strength bolts. On riveted panels with minor deterioration, we recommend sandblasting to remove any buildup of rust on the riveted steel and to remove the areas of the failing coating system. Once the rust and existing coating system has been removed a new layer of protective coating should be applied. This coating will help extend the lifespan of the existing structure.

1.3.3 Culverts

Eleven existing culverts along the existing railroad bed were inspected to determine their current structural condition. The culverts were inspected and labeled in sequence from south to north, starting at College Highway near Sheldon's Ice Cream Shop. See Figure 1

for a map showing culvert locations.

1.3.3.1 Culvert 1

Culvert 1 is constructed of dry laid stone, with an opening of 16 inches wide by 27 inches high (**Photo 16**). Water flows from the west to the east side of the structure. The overall structural condition is rated as fair to poor. The east side of structure has completely collapsed; however, there are still signs of water traveling through the culvert (**Photo 17**). Besides the failed portion at the east side, the interior of the culvert is intact and overall in fair condition (**Photo 18**).

Recommended Repair: Since the west side of the structure is in good condition, there are no necessary repairs to that portion of the culvert. However, the collapsed east side of the structure will need to be replaced. We recommended demolishing the entire deteriorated section of the culvert. This portion can then be replaced with a new concrete culvert connected to the remaining section of the existing structure.

1.3.3.2 Culvert 2

Culvert 2 has a middle section built from dry laid stone, and at some point, solid concrete inverts were constructed at either end of the structure (**Photos 19-21**). A joint is visible between the different construction types. The opening of the culvert is approximately 20 inches wide by 30 inches high at both the inlet and outlet. Water is actively flowing through the culvert from west to east. Overall the structure is in good condition.

Recommended Repair: No repairs necessary.

1.3.3.3 Culvert 3

Culvert 3 is constructed with ashlar stone masonry with an opening size of 2 ft. wide by 4 ft. high. Overall the structure is in fair condition. The southwest wing wall has failed due to

the collapse of the upper stone slab (**Photos 22-23**). The interior of the structure has several voids throughout, which are approximately 6 inches to 12 inches in width (**Photo 24**). The upstream side has a minor debris buildup from fallen trees and vegetation. Even with the minor buildup, water is still flowing steadily through the culvert. Note that Culvert 3 is buried far below the railroad tracks and any load changes from the proposed rail trail will have minimal impacts on the structure.

Recommended Repair: The southwest wingwall should be repaired using existing stone block. Localized excavation and clearing of vegetation is necessary to prepare the original area for resetting the wall stone. Patching and grouting the voids on the interior of the structure is also recommended. The dense overgrowth, upstream of the culvert should be cleared to maintain steady stream flow and to prevent debris from traveling through the structure.

1.3.3.4 Culvert 4

Culvert 4 consists of a corrugated steel pipe that is approximately 7 feet in diameter. The culvert spans over Potash Brook, which is an outlet from Lost Pond, and flows west to east. The overall condition of the structure is rated as fair. At the upstream side of the culvert, a large beaver dam has been constructed (**Photo 25**). Due to the retained water behind the beaver dam, there is a difference in water height of approximately 4 feet. The environmental impacts of the dam removal should be considered during the design of the proposed greenway rail trail. The outlet end of the culvert has moderate section loss and rust flaking (**Photos 26-27**). The existing coating system is flaking and has completely failed in most areas.

Recommended Repair: Due to the rusting and failing protective coating, we recommend sandblasting to remove any buildup or rust on the corrugated steel and to remove the areas of the failing coating system. Once the rust and existing coating system has been removed a new layer of protective coating should be applied. This coating will help extend the lifespan of the existing structure. Due to the large beaver dam on the upstream side of the culvert, the environmental impacts of dam removal should be analyzed before any changes are made. It does not appear that the beaver dam is currently adversely affecting the culvert, or its ability to control flow. However, the presence of the dam could be causing increased turbulence and flow velocities at the inlet of the pipe, increasing the risk for scour. In addition, should the dam fail, the debris could clog the pipe and cause flow restrictions.

1.3.3.5 Culvert 5

Culvert 5 is constructed of dry laid stone masonry with an opening of approximately 30 inches wide by 30 inches high (**Photos 28-30**). The structure is in overall good condition; however, the entire culvert is infilled with several inches of sediment. This infill is much heavier on the West side of the culvert, reaching approximately 8 inches. Due to the large amount of sediment, very little flow is visible through the culvert. There are also several small voids on the interior of the structure.

Recommended Repair: The structure of culvert 5 is generally in good condition; however, we recommend that the built-up sediment in the culvert be removed to maintain an open

passageway for steady flow. The larger trees adjacent to the East end of the culvert should also be removed before the roots interfere with the structure. The interior voids between the dry laid stone masonry should be patched and repaired to extend the life of the culvert.

1.3.3.6 Culvert 6

Culvert 6 consists of a 2-foot diameter cast iron pipe with a stone headwall on the upstream side (**Photo 31**). A small stream flows from West to East through the culvert. Based on water staining inside of the pipe, the stream level reaches approximately 2/3 up the culvert during high flow events (**Photo 32**). Overall, the structure is in good condition. The interior of the pipe has minor surface rusting and there is minimal section loss on the downstream pipe end. At the inlet of the pipe, there is a buildup of several inches of debris. At the pipe outlet, flowing water drips directly below the pipe end, forming a hole and slowly undermining the culvert (**Photo 33**).

Recommended Repairs: We recommend that the sediment build-up on the upstream end of culvert 6 be cleared to maintain an open passageway for steady flow through the structure. Since the downstream end is slowly eroding from water flowing out of the cast iron pipe, rip-rap should be installed below the pipe outlet to prevent further undermining of the structure.

1.3.3.7 Culvert 7

Culvert 7 is constructed from dry laid stone masonry with an opening of approximately 24 inches wide by 36 inches high at the culvert's east side. Water flows through the culvert from east to west. At the time of the site inspection, very little water was flowing through the structure. A large amount of embankment has eroded away around the inlet of the culvert; leaving the structure exposed (**Photos 34-35**). It appears that the erosion is caused by water flowing down the steep embankment above the culvert opening. The eroded sediment has been deposited throughout the culvert; reducing the opening on the downstream end to 24 inches high (**Photo 36**). Overall the structure is in fair condition, with several small voids in the structure's interior walls (**Photo 37**).

Recommended Repair: Even though the dry laid stone masonry of culvert 7 is in good condition, we recommend that the embankment surrounding the upstream side of the structure be restored. Since water is also flowing down the embankment and causing erosion, it is recommended that measures be taken to stabilize the slope. Stabilizing the embankment will protect the culvert from further erosion and direct water to the inlet opening instead of through openings in the stone masonry. The voids on the interior of the culvert should be patched and repaired to extend the life of the culvert.

1.3.3.8 Culvert 8

Culvert 8 consists of a 2-foot diameter cast iron pipe with concrete headwalls. Water flows from east to west through the culvert. At the time of the inspection, no active flow was noticeable. The structure is in good condition overall. Minor cracking and efflorescence was noted at each of the concrete headwalls. Several cracks were measured as approximately

¼ inch wide (**Photos 38-40**). There is minor debris and vegetation at the outlet end of the culvert.

Recommended Repair: Since the headwall of Culvert 8 has several cracks, we recommend sealing the cracks to prevent further deterioration. Even though the main structural component of the culvert consists of the cast iron pipe, which is in good condition, repairing the concrete headwalls will extend the life of the overall structure.

1.3.3.9 Culvert 9

Culvert 9 is constructed of dry laid stone masonry, with an invert opening of 36 inches by 30 inches and an outlet opening of 30 inches by 40 inches. Water flows from west to east through the culvert. Overall, the structure is in poor condition. There is a partial collapse of an interior section at the downstream end of the culvert (**Photos 41-42)**. This collapse is diverting water to flow beneath and around the structure, causing severe undermining. Even though there was no water flow observed at the time of this inspection, there is heavy erosion downstream of the culvert (**Photo 43**). Therefore, it can be assumed that the structure experiences high water levels with heavy flow velocities. The interior of the structure on the eastern side is in good condition (**Photos 44-45**).

Recommended Repair: Since the west side of the structure has failed, it will need to be replaced. We recommended demolishing the entire deteriorated section of the culvert. This portion should then be replaced with a new concrete culvert connected to the remaining section of the existing structure. Since water is also flowing down the embankment and causing erosion, we recommend that measures be taken to stabilize the slope. Stabilizing the embankment will protect the culvert from further erosion and direct water to the inlet opening instead of through openings in the stone masonry.

1.3.3.10 Culvert 10

Culvert 10 is constructed of dry laid stone masonry with an upstream opening of 30 inches x 38 inches and a downstream opening of 20 inches x 16 inches (**Photo 46**). At this location, the water flows from east to west through the culvert. Overall the culvert is in fair condition. The southwest wingwall has failed due to the collapse of the stone masonry (**Photo 47**). Even with the collapsed wingwall, the culvert is still open for water to flow. At the upstream end, there is a void in the ceiling of the structure (**Photo 48**).

Recommended Repair: The southwest wingwall should be repaired using existing stone block. Localized excavation and clearing of vegetation is necessary to prepare the original area for resetting the wall stone. The voids on the interior of the culvert should be patched and repaired to extend the life of the culvert.

1.3.3.11 Culvert 11

Culvert 11 consists of an 18-inch diameter cast iron pipe with concrete headwalls. Water flows from east to west through the structure, although at the time of this inspection there was no active water flow. Overall the structure is in good condition. The concrete headwalls have minor cracking throughout (**Photo 49**). At the upstream side, approximately 4 inches of sediment has filled the cast iron pipe (**Photo 50**). It should be

noted that this structure is not embedded very deeply beneath the railroad tracks. The design of the rail trail should consider the elevation of the culvert in the design.

Recommended Repair: We recommend that the sediment build-up on the upstream end of culvert 11 be cleared to maintain an open passageway for steady flow through the structure.

1.4 Opinion of Probable Construction Cost

We have included our opinion on the probable construction costs for the structural repairs that are recommended in this technical memorandum. Our estimate assumes that the recommended repairs will be completed by a qualified general contractor under a single contract.

The opinion of probable construction cost estimate is based on conceptual information and not final design documents. Therefore, the variation range for this level of estimate is very wide. To capture the uncertainty of the schematic level of information, we have included a contingency value, to more accurately represent the anticipated construction costs.

1.5 Conclusions

Both the Manhan River Bridge and the Gunn Road Bridge are both rated between fair and poor condition. Many structural components of these bridges are preforming adequately and would not need immediate repairs to support the proposed Southampton Greenway Trail. However, there are several areas that need to be monitored or repaired to prevent further deterioration. This includes repairs to the bearings, deteriorated sections of the riveted steel girders, and replacement of corroded rivets and bolts. Completing these repairs will increase the lifespan of the structures and make them operational for the proposed Southampton Greenway Trail.

The eleven culverts along the proposed Southampton Greenway Trail range in condition from good to poor. Five of the culverts are in good condition. These culverts are performing well and have minimal deterioration. Minor repairs and regular maintenance are required to keep the structures functioning properly. There are four culverts in fair condition, which are currently performing adequately, but with minor deficiencies. Repairing the deteriorated areas will increase the longevity of the structure and restore the culvert to good condition. Two of the culverts are in poor condition due to significant deficiencies or overall failure of the structure. In order to keep these culverts in service, significant repairs or replacement is necessary.

STRUCTURE LOCATIONS

EASTHAMPTON
SOUTHAMPTON
10
11
10
9
8
7
6
5
4
3
2
1
Gunn Road Bridge
Bridge Over Manhan River
KYLENE CIRCLE
ERIN LANE
HILLSIDE MEADOWS DRIVE
GLENDALE ROAD
COLEMAN ROAD
POMEROY MEADOW ROAD
WOLCOTT ROAD
RIVERDALE ROAD
GUNN ROAD EXTENSION
GUNN ROAD
PARC PLACE
PARSONS WAY
ROSALIE LANE
HELEN DRIVE
LYNN DRIVE
HIGH STREET
PLEASANT STREET
ELM STREET
COLLEGE HIGHWAY
CLARK STREET
EAST STREET
STRONG ROAD
BRICKYARD ROAD
MOOSE BROOK ROAD

LEGEND

- Culvert
- Bridge
- Parcel Boundary
- Town Boundary

1 in = 1,000 ft 1:12,000

0 500 1,000
Feet

N

Tighe&Bond
Engineers | Environmental Specialists

Based on MassGIS Color Orthophotography (2013).
Parcels (2015) downloaded from MassGIS and are approximate.

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FIGURE 1
SITE OVERVIEW

Southampton Greenway Trail
Existing Conditions Review of Bridges and Culverts
Southampton Greenway Committee
Southampton, MA 01073

September 2017

S-2170

PHOTOS

Manhan River Bridge

Photo 1: East Elevation of the Manhan River Bridge

Photo 2: View of the South Abutment

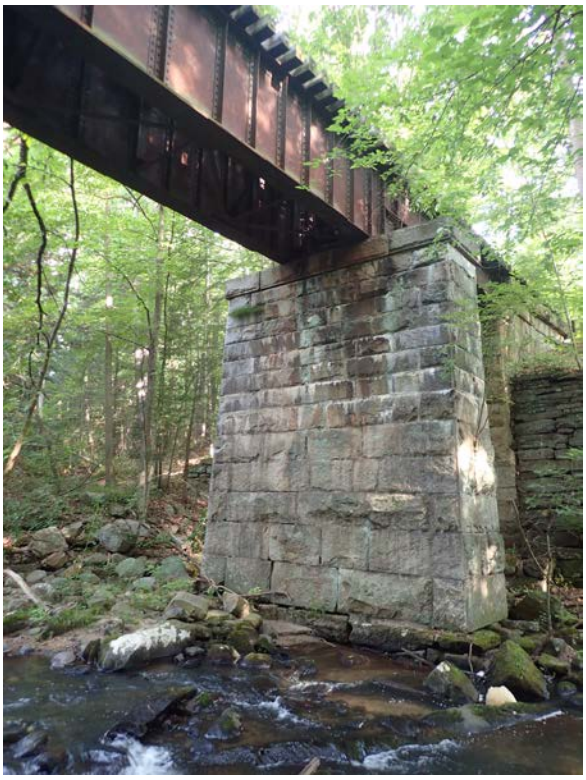

Photo 3: View of the Center Pier

Photo 4: View of the North Abutment

Photo 5: North end of girders, complete section loss of rivet heads

Photo 6: Heavy debris on bearing

Photo 7: Existing timber deck with railroad ties

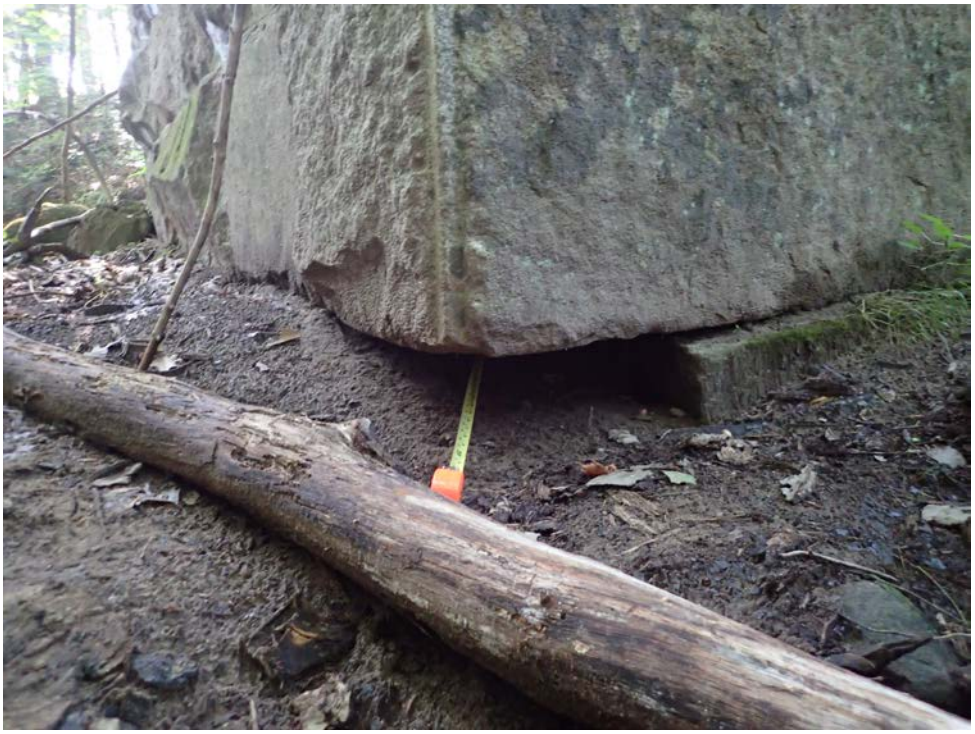

Photo 8: Undermining of center pier

Bridge over Gunn Road

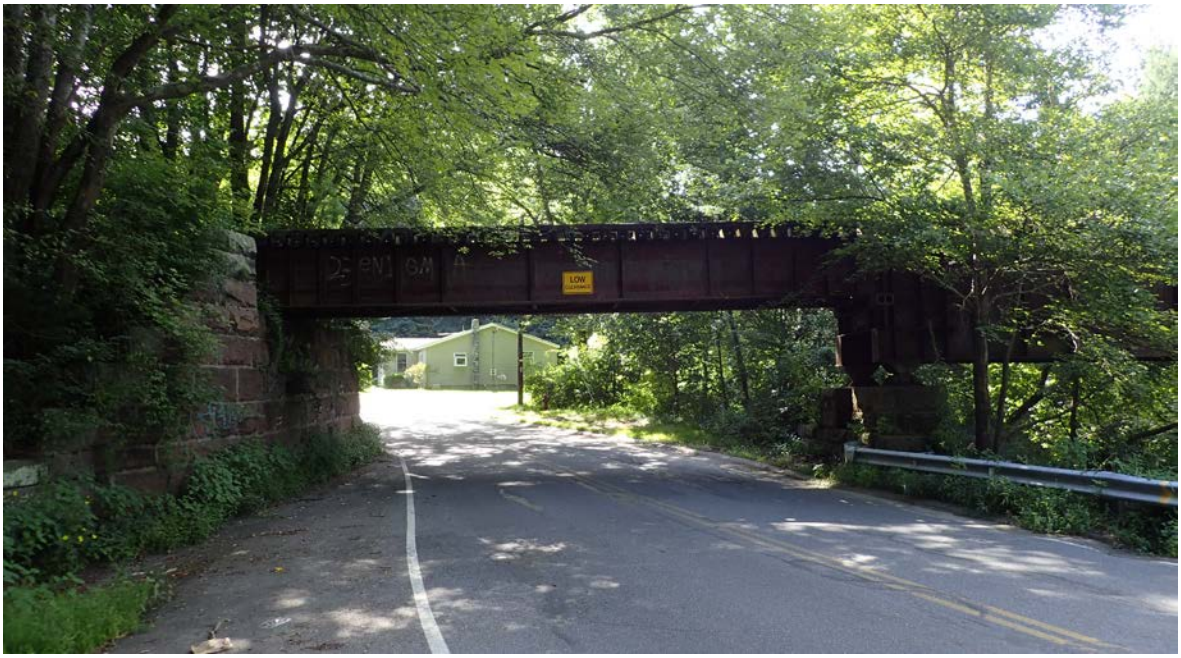

Photo 9: West Elevation of the bridge over Gunn Road

Photo 10: Rusting and deterioration of the steel stiffeners

Photo 11: Rusting of riveted steel panels above the bridge pier

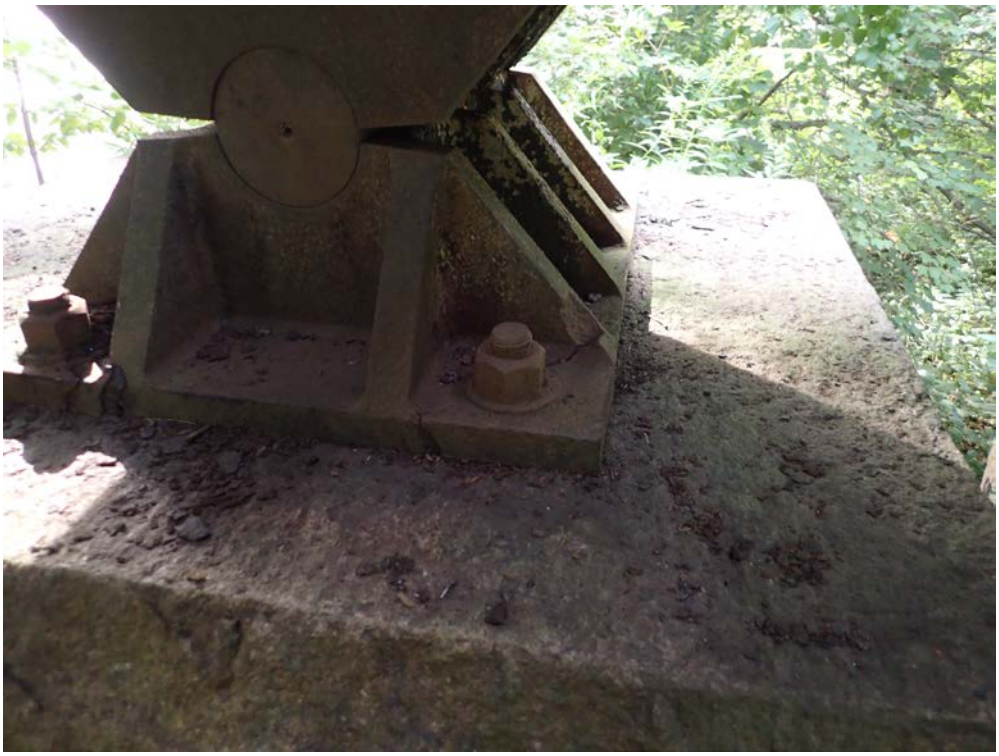

Photo 12: Cracked bearing on the bridge pier

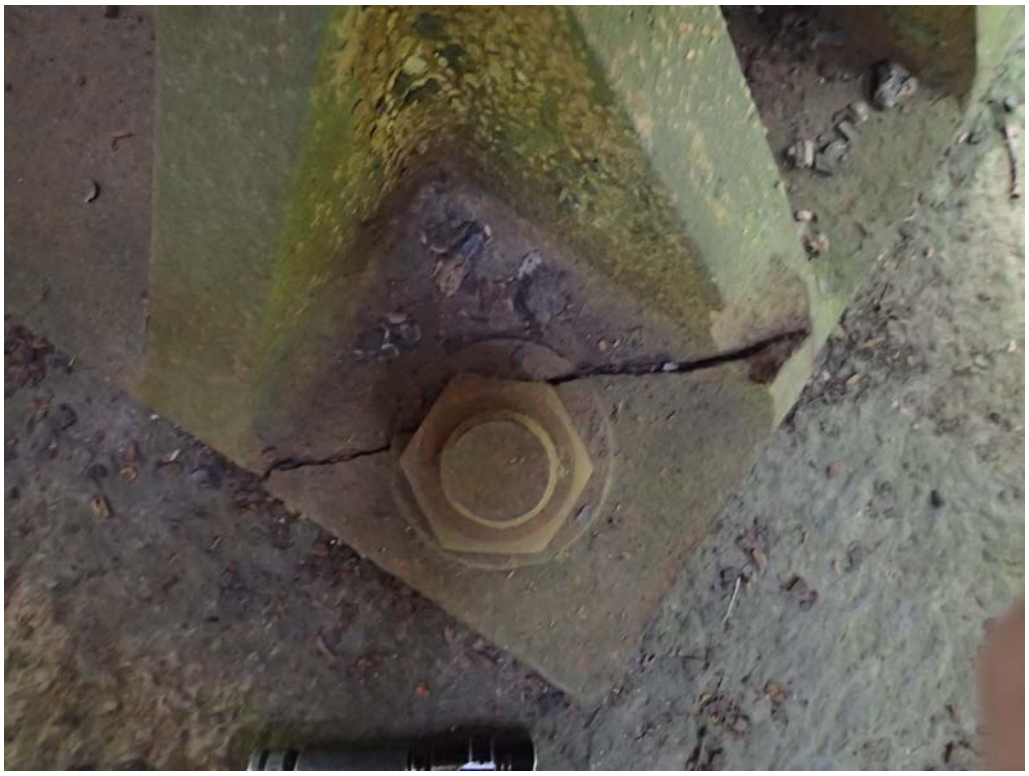

Photo 13: Cracked bearing on the bridge pier

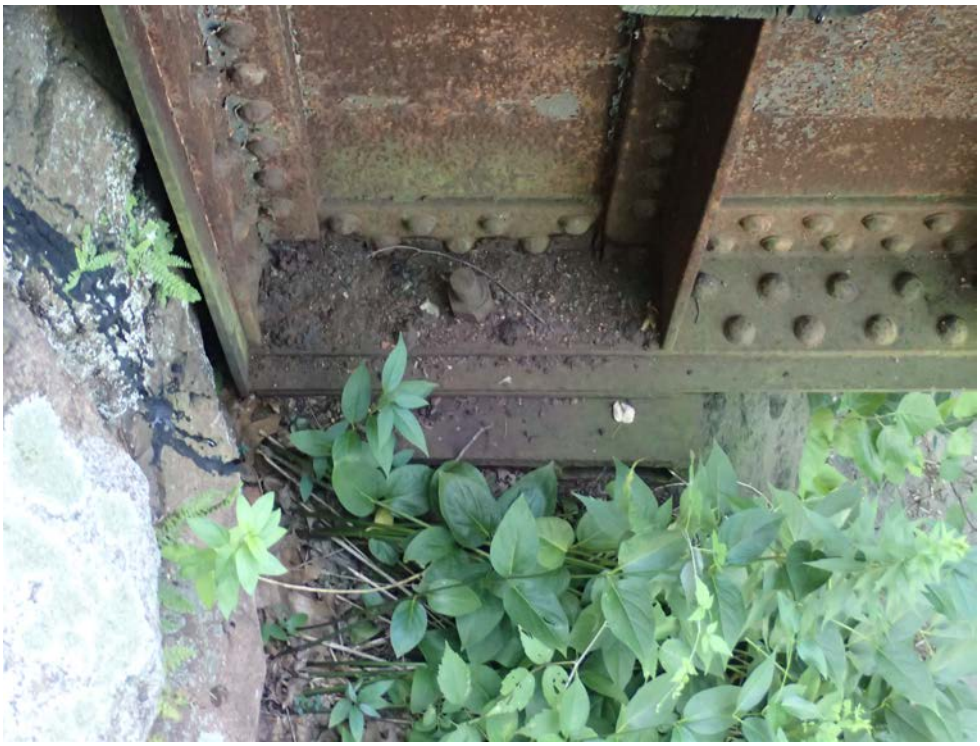

Photo 14: Tipped anchor bolt on the north abutment

Photo 15: Existing timber deck with railroad ties

Culvert 1

Photo 16: West Elevation

Photo 17: East Elevation showing Collapsed Section

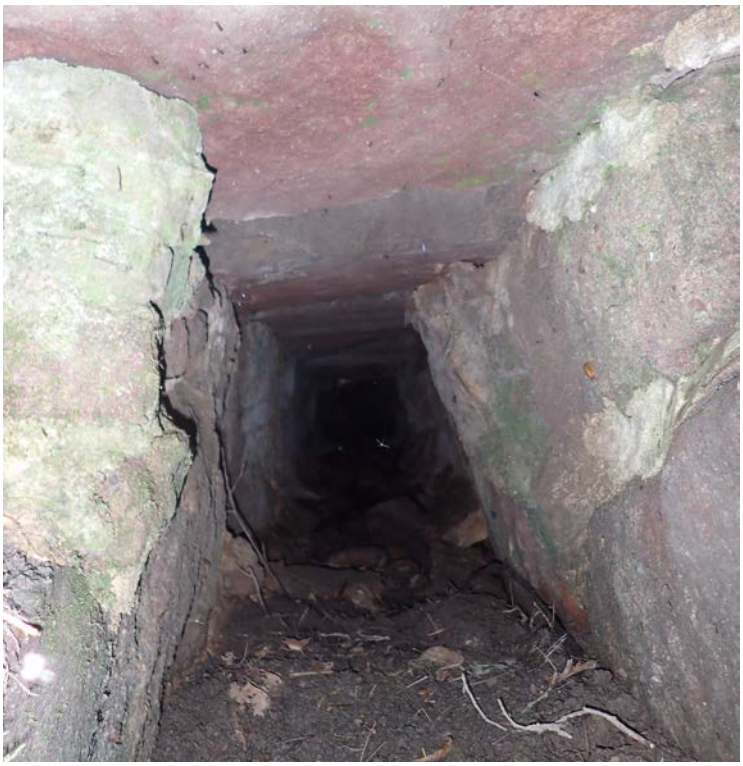

Photo 18: Interior of Culvert 1

Culvert 2

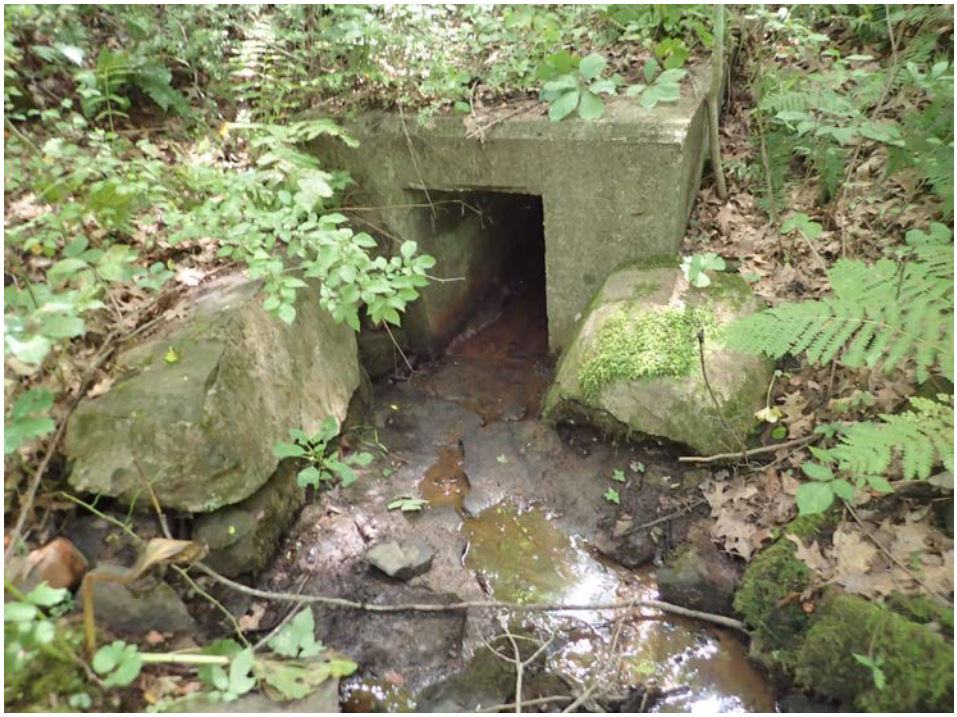

Photo 19: West Elevation

Photo 20: East Elevation

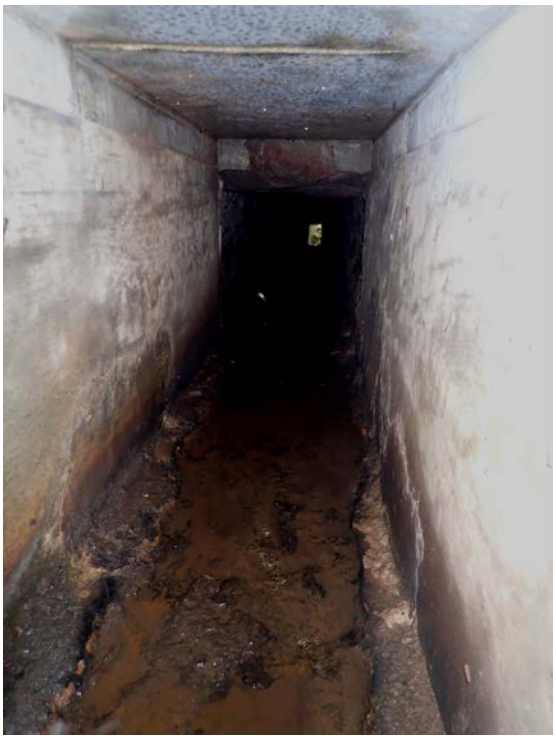

Photo 21: Interior of Culvert 2

Culvert 3

Photo 22: West Elevation Showing Southwest Wingwall Failure

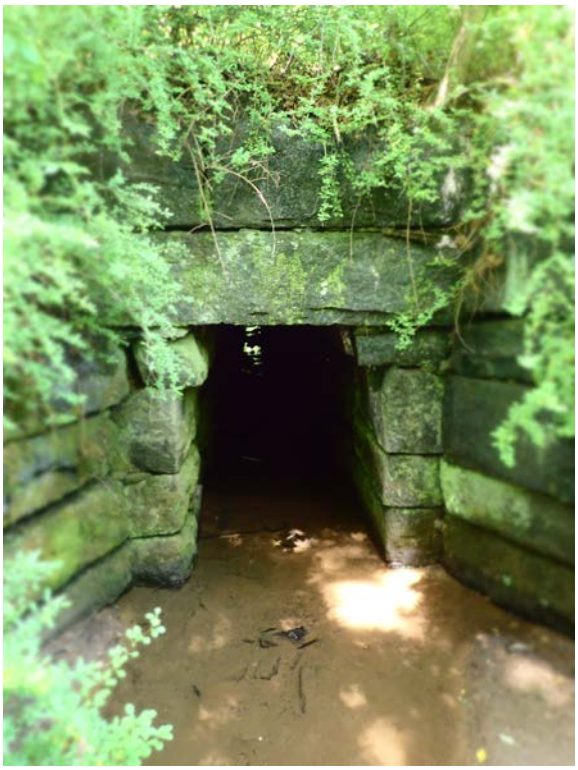

Photo 23: East Elevation

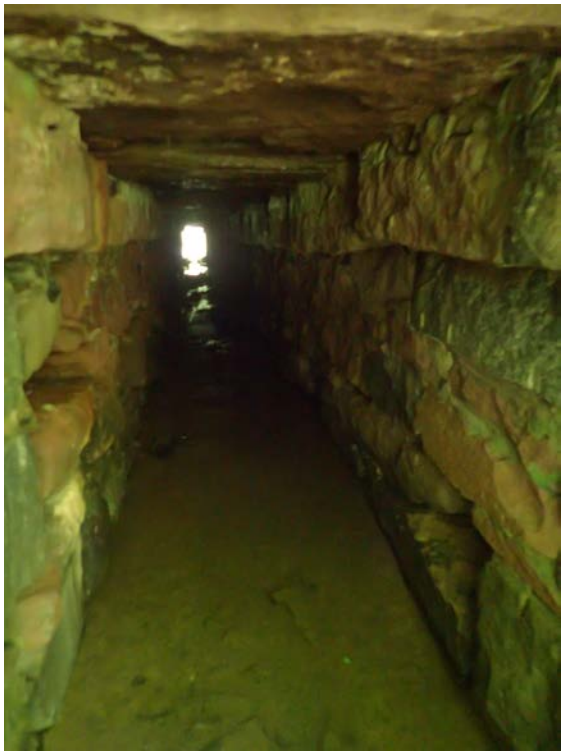

Photo 24: Interior of Culvert 3

Culvert 4

Photo 25: West Side

Photo 26: East Elevation

Photo 27: Interior of Culvert 4

Culvert 5

Photo 28: West elevation

Photo 29: East elevation

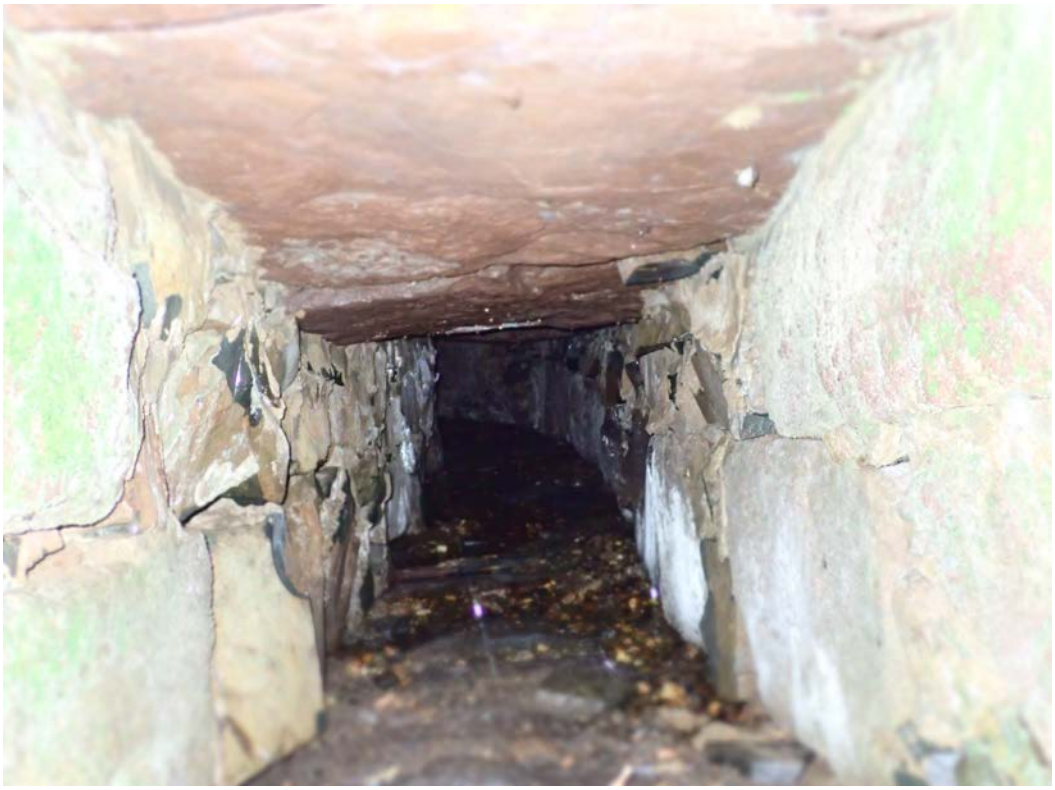

Photo 30: Interior of Culvert 5

Culvert 6

Photo 31: West Elevation

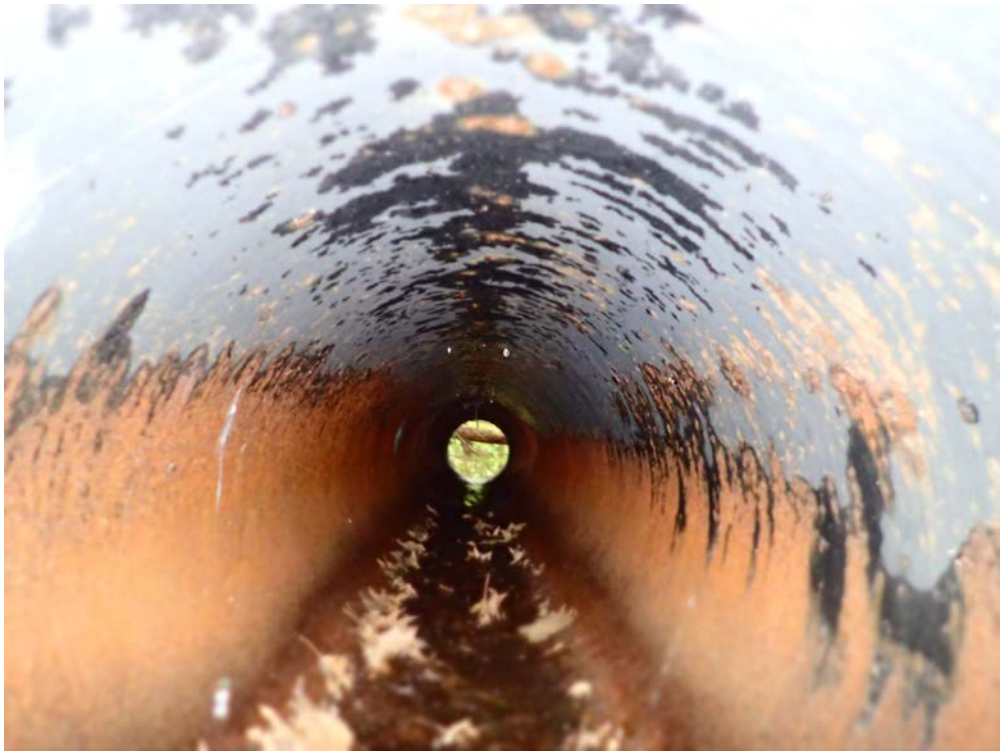

Photo 32: Interior of Culvert 6

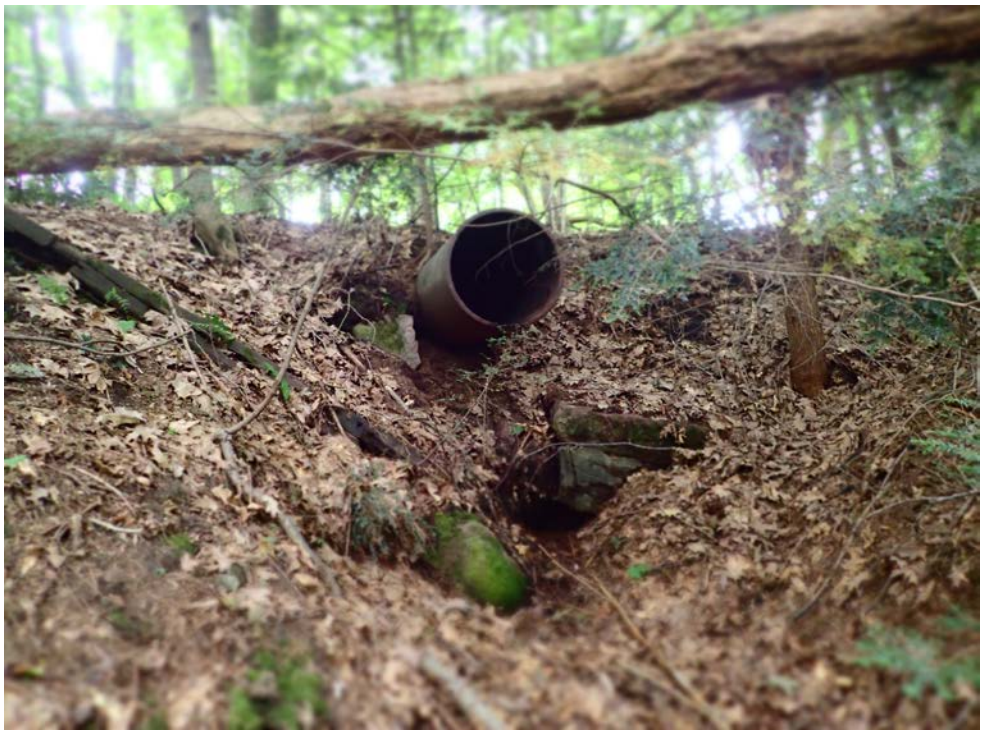

Photo 33: East Elevation

Culvert 7

Photo 34: East Elevation

Photo 35: Erosion at East Side

Photo 36: West Elevation

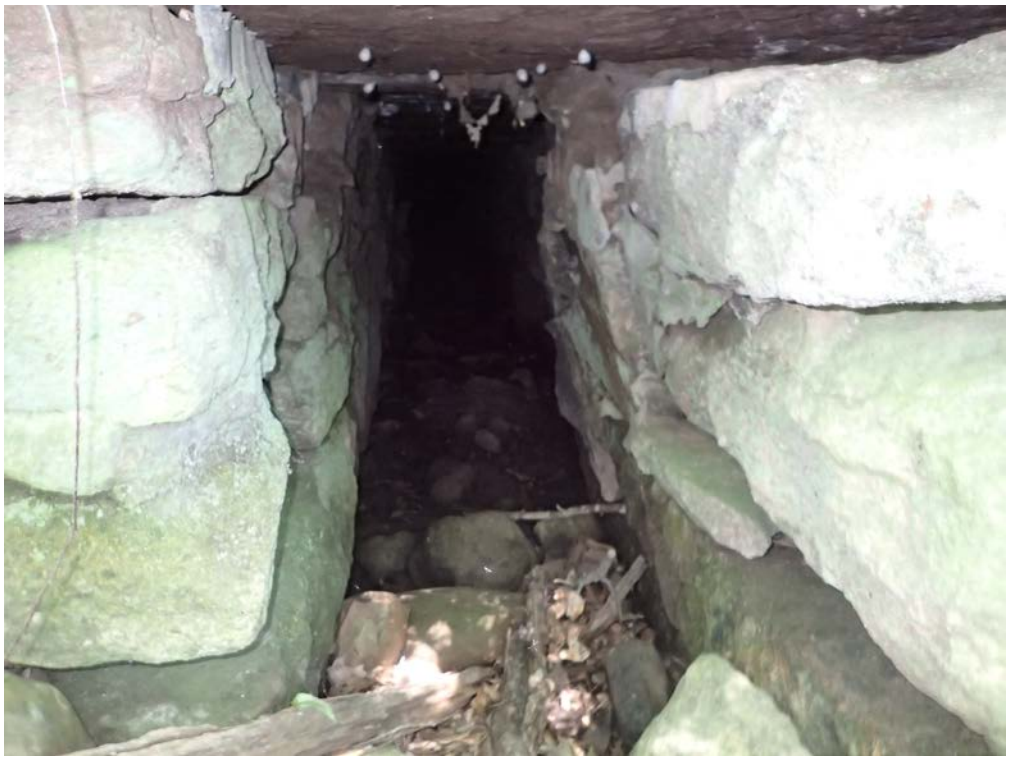

Photo 37: Interior of Culvert 7

Culvert 8

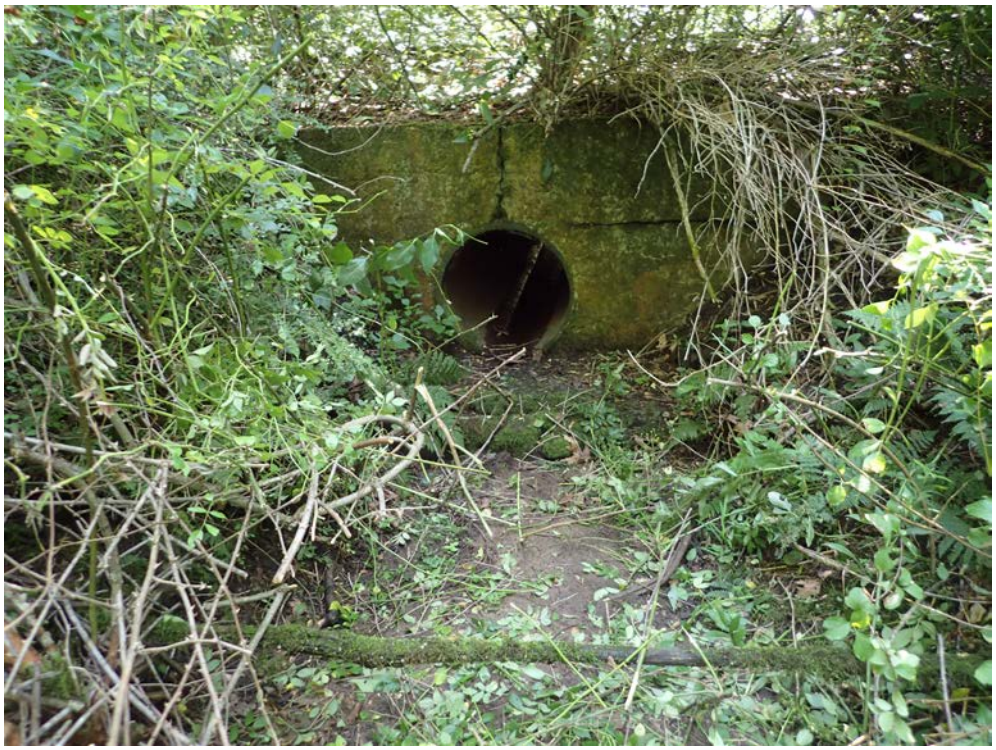

Photo 38: West Elevation

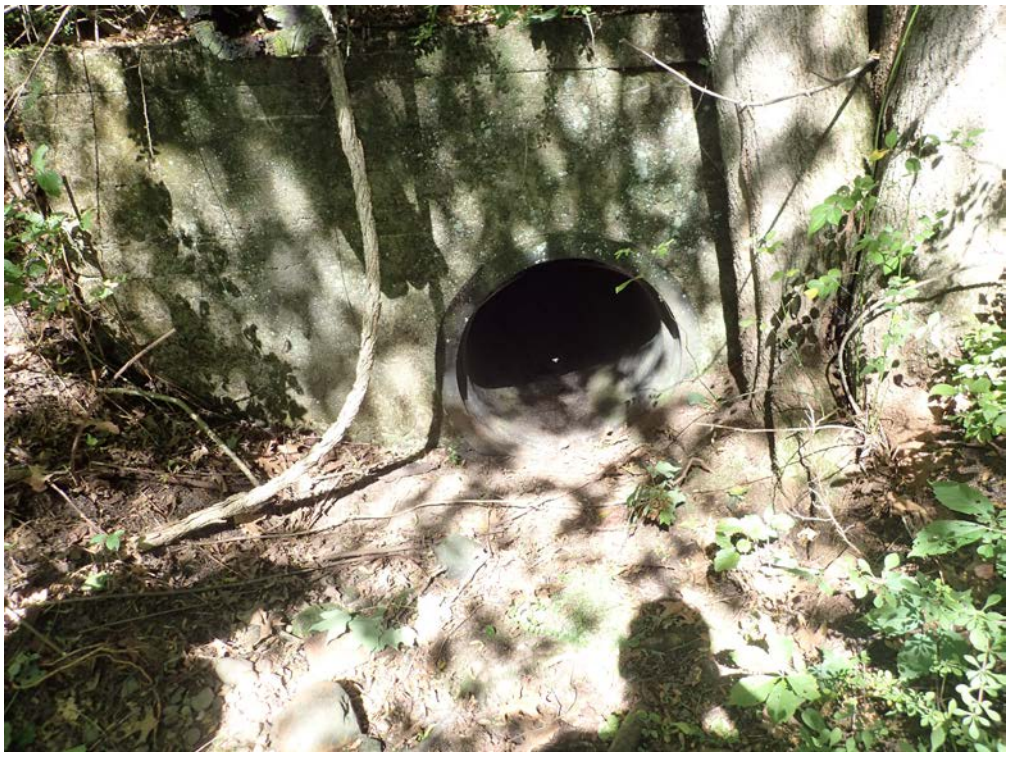

Photo 39: East elevation

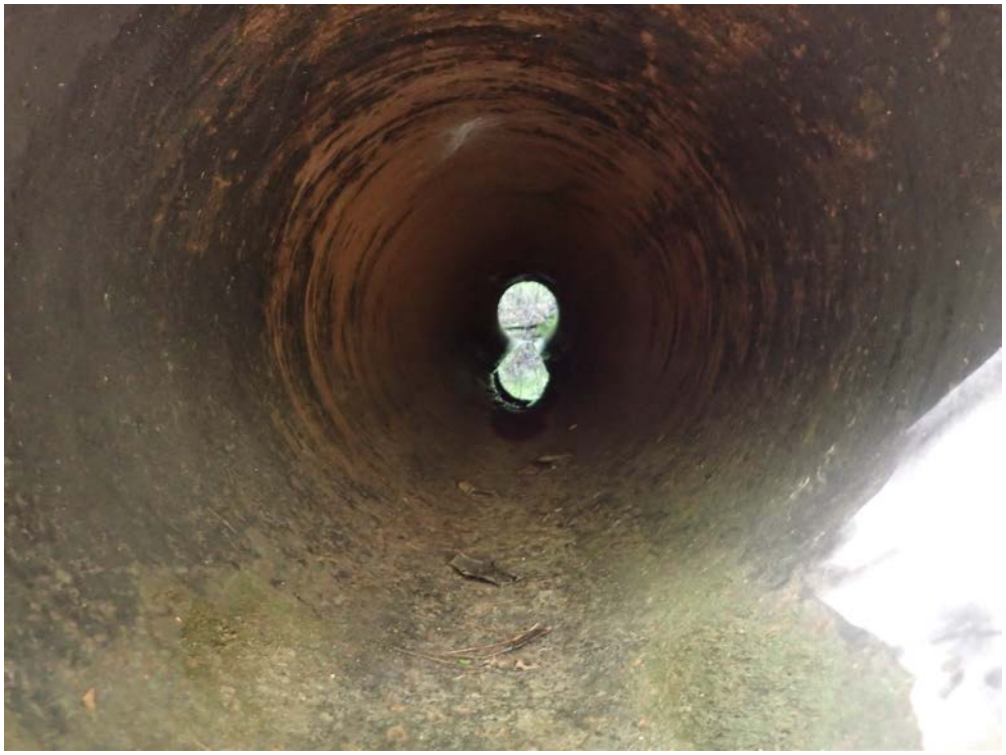

Photo 40: Interior of Culvert 8

Culvert 9

Photo 41: West Elevation

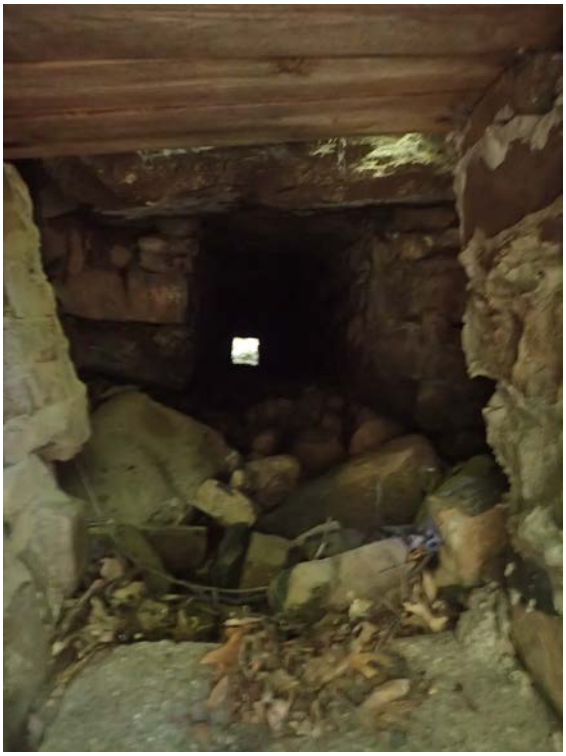

Photo 42: Collapsed Interior

Photo 43: Signs of high water flow

e

Photo 44: East Elevation

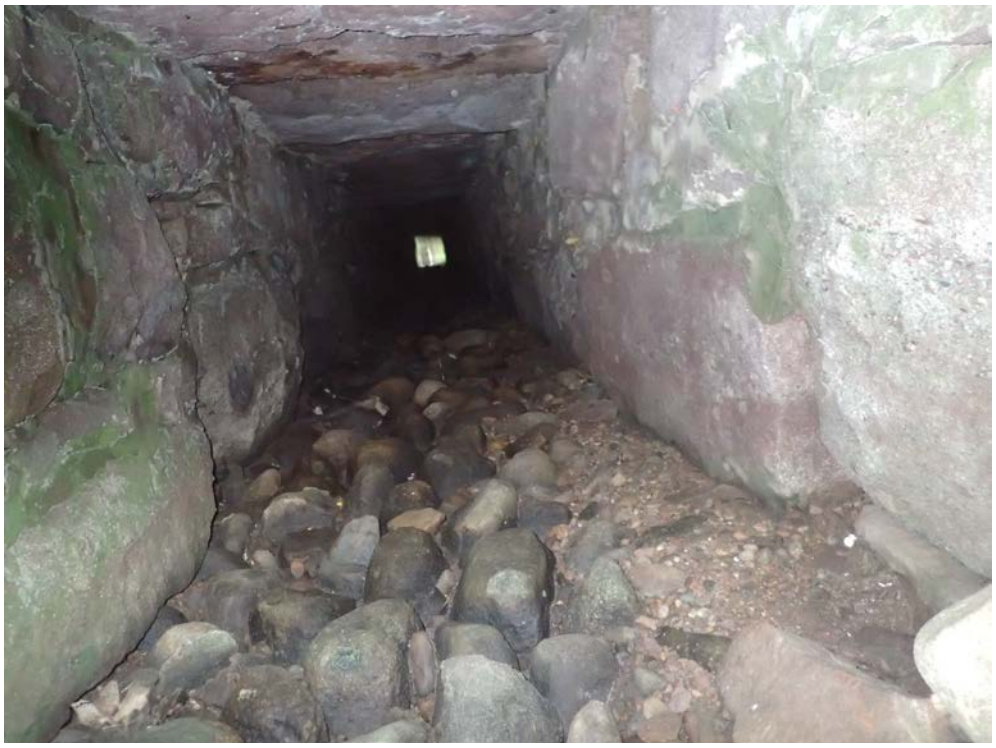

Photo 45: Interior of Culvert 9

Culvert 10

Photo 46: East elevation

Photo 47: West Elevation

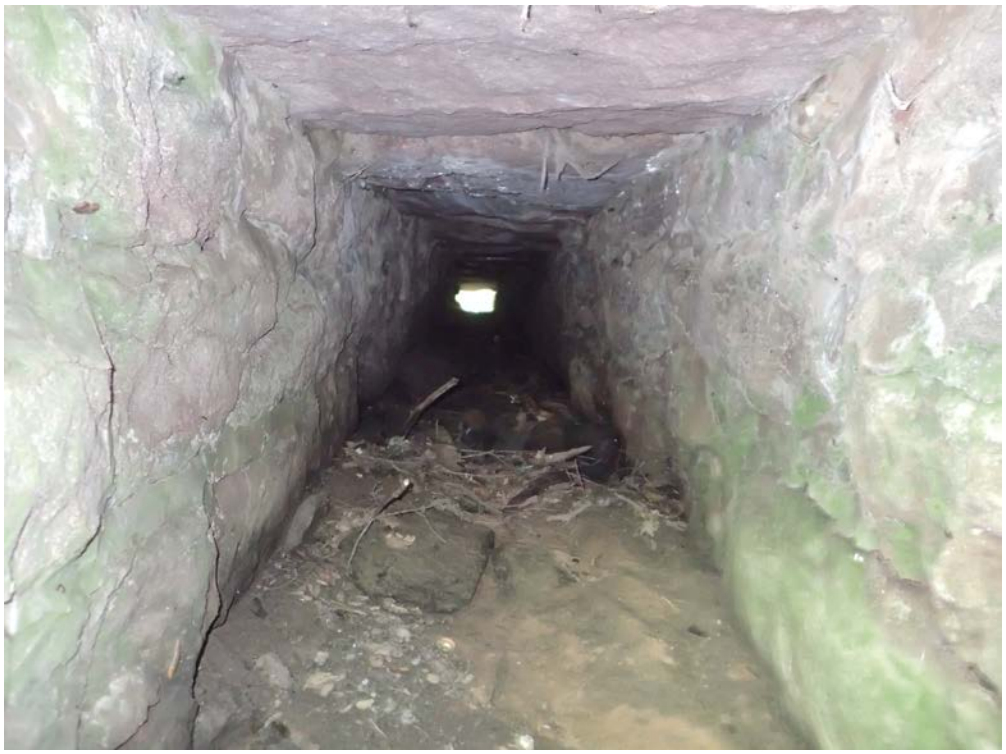

Photo 48: Interior of Culvert 10 with Void in Ceiling

Culvert 11

Photo 49: West elevation

Photo 50: East elevation

OPINION OF PROBABLE CONSTRUCTION COST

Summary Table

Proposed Southampton Greenway Trail

Southampton, Massachusetts

ITEM	DESCRIPTION	Repair Summary	OVERALL CONDITION	REPAIR COST
1.	**General Conditions**			
	Mobilization/Demobilization		-	$39,100
	Contractors OH & P		-	$78,200
2.	**Bridge over the Manhan River**	Infill beneath pier to fix scour concerns Riprap / Scour Protection Structural Steel Repairs and Rivet Replacement Rivet replacements Paint Structural Steel Deck Replacement	Fair	$237,500
3.	**Bridge over Gunn Road**	Bearing replacement Structural Steel Repairs and Rivet Replacement Replace deteriorated steel stiffeners Repair Structural Steel Paint Structural Steel Deck Replacement	Fair / Poor	$403,000
4.	**Culvert 1**	Replace Collapsed Culvert Section	Poor	$37,000
5.	**Culvert 2**	No Repairs Necessary	Good	$0
6.	**Culvert 3**	Repair southwest wingwall Repair interior voids	Fair	$6,800
7.	**Culvert 4**	Paint corrugated pipe Environmental study for dam removal	Fair	$16,800
8.	**Culvert 5**	Dredging and Disposal of Sediment Repair Interior Voids	Good	$5,800
9.	**Culvert 6**	Dredging and Disposal of Sediment Riprap / Scour Protection, Downstream	Good	$3,000
10.	**Culvert 7**	Concrete Headwall Repair Interior Voids	Fair	$11,800
11.	**Culvert 8**	Seal Cracks on Concrete Headwall	Good	$3,000
12.	**Culvert 9**	Replace Collapsed Culvert Section	Poor	$47,800
13.	**Culvert 10**	Reset Southwest Wingwall Stone Repair Interior Voids	Fair	$6,800
14.	**Culvert 11**	Dredging and Disposal of Sediment	Good	$2,800
15.	**Supplemental Design Services**			$65,000
	Contingency	**25%**		$241,100
	Engineering Fees	**15%**		$180,900
			TOTAL PROJECT COST	$1,386,400

Opinion of Probable Construction Cost

Proposed Southampton Greenway Trail

Southampton, Massachusetts

November 7, 2017

ITEM	DESCRIPTION	UNITS	QTY	UNIT PRICE	TOTAL
1.	**General Conditions**				
	Mobilization/Demobilization	LS	5%	$39,100	$39,100
	Contractors OH & P	LS	10%	$78,200	$78,200
2.	**Bridge over the Manhan River**				
	Infill beneath pier to fix scour concerns	CY	10	$1,500	$15,000
	Riprap / Scour Protection	CY	80	$125	$10,000
	Bearing Replacement	EA	6	$3,000	$18,000
	Rivet Replacements	EA	1500	$25	$37,500
	Paint Structural Steel	SF	2000	$20	$40,000
	Deck Demolition and Replacement	SF	1000	$70	$70,000
	Bridge Rail	LF	200	$175	$35,000
	Dewatering	LS	1	$12,000	$12,000
					$237,500
3.	**Bridge over Gunn Road**				
	Bearing replacement	EA	6	$3,000	$18,000
	Rivet and Bolt Replacements	EA	2000	$25	$50,000
	Replace Deteriorated Steel Stiffeners	LB	25000	$5	$125,000
	Repair Structural Steel	LS	1	$65,000	$65,000
	Paint Structural Steel	SF	2000	$20	$40,000
	Deck Demolition and Replacement	SF	1000	$70	$70,000
	Bridge Rail	LF	200	$175	$35,000
					$403,000
4.	**Culvert 1**				
	Excavation	CY	300	$35	$10,500
	Dewatering	LS	1	$8,000	$8,000
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Demolish Existing Collapsed Section	SF	25	$60	$1,500
	Replace Concrete Culvert Section	LS	1	$12,000	$12,000
	Concrete Headwall	CY	2	$1,000	$2,000
	Grading / Backfill	CY	25	$50	$1,250
	Loam & Seed / Final Grading	LS	1	$750	$750
					$37,000
5.	**Culvert 2**				
	No Necessary Structural Repairs	-	-	-	$0
					$0
6.	**Culvert 3**				
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Reset Southwest Wingwall Stone	LS	1	$2,000	$2,000
	Repair Interior Voids	LS	1	$3,000	$3,000
	Loam & Seed / Final Grading	LS	1	$750	$750
					$6,800
7.	**Culvert 4**				
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Paint Corrugated Pipe	SF	500	$15	$7,500
	Environmental Study for Beaver Dam Removal	LS	1	$7,500	$7,500
	Loam & Seed / Final Grading	LS	1	$750	$750
					$16,800
8.	**Culvert 5**				
	Dredging and Disposal of Sediment	CY	5	$200	$1,000
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Repair Interior Voids	LS	1	$3,000	$3,000
	Loam & Seed / Final Grading	LS	1	$750	$750
					$5,800

9.	**Culvert 6**				
	Dredging and Disposal of Sediment	CY	5	$200	$1,000
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Riprap / Scour Protection, Downstream	CY	2	$100	$200
	Loam & Seed / Final Grading	LS	1	$750	$750
					$3,000
10.	**Culvert 7**				
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Slope Stabilization	CY	100	$50	$5,000
	Concrete Headwall	CY	2	$1,000	$2,000
	Repair Interior Voids	LS	1	$3,000	$3,000
	Loam & Seed / Final Grading	LS	1	$750	$750
					$11,800
11.	**Culvert 8**				
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Seal Cracks on Concrete Headwall	LF	25	$50	$1,250
	Loam & Seed / Final Grading	LS	1	$750	$750
					$3,000
12.	**Culvert 9**				
	Excavation	CY	300	$35	$10,500
	Dewatering	LS	1	$8,000	$8,000
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Demolish Existing Collapsed Section	SF	50	$60	$3,000
	Replace Concrete Culvert Section	LS	1	$12,000	$12,000
	Slope Stabilization	CY	150	$50	$7,500
	Concrete Headwall	CY	2	$1,000	$2,000
	Repair Interior Voids	LS	1	$3,000	$3,000
	Loam & Seed / Final Grading	LS	1	$750	$750
					$47,800
13.	**Culvert 10**				
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Reset Southwest Wingwall Stone	LS	1	$2,000	$2,000
	Repair Interior Voids	LS	1	$3,000	$3,000
	Loam & Seed / Final Grading	LS	1	$750	$750
					$6,800
14.	**Culvert 11**				
	Dredging and Disposal of Sediment	CY	5	$200	$1,000
	Clearing of Vegetation	LS	1	$1,000	$1,000
	Loam & Seed / Final Grading	LS	1	$750	$750
					$2,800
				CONSTRUCTION SUBTOTAL	**$ 899,400**
15.	**Supplemental Design Services**				
	Geotechnical	LS	1	$15,000.00	$15,000
	Survey	LS	1	$10,000.00	$10,000
	Permitting	LS	1	$40,000.00	$40,000
					$ 65,000
				SUBTOTAL	**$ 964,400**
		Contingency	**25%**		**$241,100**
		Engineering Fees	**15%**		**$180,900**
				TOTAL PROJECT COST	**$ 1,386,400**