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## GANNETT FLEMING MEMORANDUM

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**Date:** January 27, 2016

**To:** Radnor Township

**From:** Gannett Fleming

**Re:** Chamounix Road Culvert Field View

A field view was performed on November 23, 2015 of the above-referenced culvert located just west of Fenimore Woods Park which carries Chamounix Road, over Gulph Creek in Radnor Township, Delaware County. The field view was performed to determine the need for the structure's repair, rehabilitation, or replacement. The field view was limited to observation of the above ground, visible and accessible elements. Elements below waterline or ground line were not assessed. Load ratings and structural plans of the existing bridge were not available at the time of field viewing.

### Structure Description

The twin concrete arch barrel culvert with masonry spandrel walls carries Chamounix Road over Gulph Creek. Chamounix Road is on a slight curve over the culvert and carries one 9'-0" northbound lane and one 11'-0" southbound lane. The clear span of each concrete barrel is approximately 6'-3". The stone masonry spandrel walls act as bridge barriers and are approximately 1'-6" (min) wide x 2'-4" (min) tall (above roadway), there is no guide rail treatment at any of the bridge corners. The curb-to-curb distance is approximately 20'-0" and there is a 5" diameter gas line attached to west (upstream) fascia of the culvert.

Gulph Creek flows west to east through the culvert with a change of alignment at both upstream and downstream. The upstream and downstream natural embankments are stable and well vegetated. A long 1'-0" wide stone retaining wall is located along the downstream south quadrant that define the edge of the channel.



*General View of Culvert – Looking North*



*Downstream Elevation (upstream similar)*

Just north of this structure along Chamounix Road is a newly constructed bridge. The newly constructed bridge has a 5' sidewalk on the east side and features PennDOT standard bridge barrier with formliner.



*Sidewalk on a Newly Constructed Bridge along Chamounix Road over Branch of Gulph Creek*



*Bridge Barrier on a Newly Constructed Bridge along Chamounix Road over Branch of Gulph Creek*

### **Structure Findings**

The concrete arch barrels are in fair condition with minor honeycombing occasionally. Scour and undermining are noticed along the north barrel footings about 10' total length. In addition, there is a large scour hole about 2'-6" deep at the inlet of culvert. Heavy debris accumulation is present in both barrels. Findings on the culvert and the retaining wall are summarized as follows:

#### ***Culvert***

The concrete arch barrels are in fair condition with localized honeycombing and exposed aggregate. No signs of distress, spalls, cracks or exposed reinforcing steel are noted within the concrete arch barrels. Heavy scale is observed along the waterline in both concrete arch barrels. The end 2 feet of each arch barrel consist of the masonry spandrel walls (headwalls) and masonry barriers. There are large areas of missing stones and mortar present within the masonry spandrel walls.





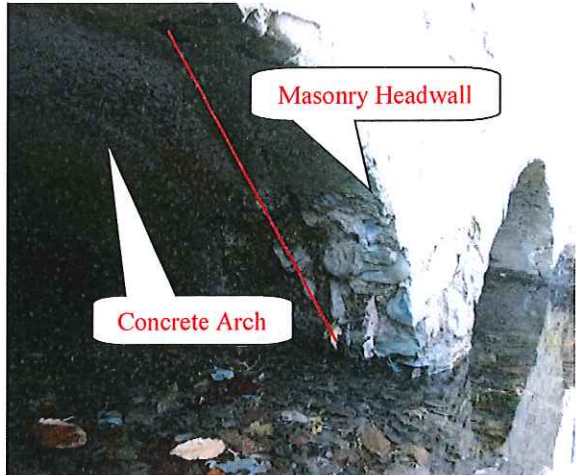
*View of Concrete Arch South Barrel*



*View of Concrete Arch North Barrel*



*1'-0" Undermining at Outlet*



*View of Downstream Pier End*



*Spall and Missing Stones in Upstream Masonry Headwall of North Barrel*



*Spall and Missing Stones in Upstream Masonry Headwall of South Barrel*





*Undermining and Spall in Upstream Pier Footing*



*Failing Upstream Headwall in South Barrel*



*Scour and Exposed Footing at Upstream North Barrel*



*Large Scour Hole/Pond formed at Culvert Inlet*

### ***Downstream Retaining Wall***

There is a stone masonry retaining wall that defines the edge of channel on the downstream south quadrant. The top width of retaining wall is 1'-0" wide and the height of retaining wall measured from streambed is approximately 4'-6" tall. The bottom 2'-6" of the wall has advanced deterioration with large area of undermining and missing stone and jointing along the length.





*Downstream Retaining Wall – Looking Upstream*



*Downstream Retaining Wall – Looking Downstream*



*Retaining Wall Elevation - 1*



*Retaining Wall Elevation - 2*

### ***Conclusions***

The concrete portions of twin arch barrels are in fair condition. There is undermining up to 1'-0", along north barrel with a total length of 10'. Heavy scaling is noted along the water surface line and there is heavy debris accumulation in both barrels. There is a large scour hole at inlet of the culvert.

The masonry headwalls are in poor condition. The upstream headwall has large areas of missing stones and mortar.

The masonry retaining wall along the downstream embankment is in serious condition with large areas of undermining and missing stone and jointing along the length.

## **Safety Features**

No guide rail is present in the vicinity of the bridge, the stone masonry barriers do not meet current PennDOT's standards. Positive protection for the blunt ends of the bridge barrier is not provided. Only hazard markers denote the location on each of the four approaches.

The trunk of the large tree on the northeast corner of the bridge is currently protruding into the roadway.

## **Environmental**

Chamounix Road crosses Gulph Creek which supports protected water uses for Warm Water and Migratory Fishes (WWF/MF) according Title 25, Chapter 93 of Pennsylvania State Code. The stream is not trout-stocked nor does it support a naturally reproducing trout population. A PNDI database search was conducted and no state or federal endangered species were identified as a result of the search. No known historic or archaeological sites are known to exist at or near the site of the bridge according to the Pennsylvania State Historic Preservation Office's Cultural Resources GIS website.

It appears that rehabilitation of the bridge, including the addition of scour protection would require a PADEP General Permit #11 for Maintenance, Testing, Repair, Rehabilitation or Replacement of Water Obstructions and Encroachments. It is assumed that federal authorization for this activity can be authorized by PASPGP-4 that will be issued by PADEP.

If wetlands are present, and greater than 0.05 acres of impacts are expected, GP-11 does not apply and A Joint Chapter 105/Section 404 Permit may be required.

## **Geotechnical**

A Site Geology Map, extracted from the Geologic Quadrangle Maps of Pennsylvania, indicates that the Chamounix Road structure is underlain by mica schist of the Wissahickon Formation (Xw). According to *Engineering Characteristics of the Rocks of Pennsylvania*, the Wissahickon Formation (Xw) is described as an oligoclase-mica schist that is coarsely crystalline.

The existing twin concrete arch barrel culvert will be rehabilitated and therefore no geotechnical investigation is necessary for the bridge. However, the retaining wall adjacent to the downstream side of the culvert is recommended to be replaced and will require geotechnical investigation. The geotechnical investigation will consist of drilling two borings to a maximum depth of 25 ft below the ground surface. Rock will be cored for 5 ft if encountered. Laboratory testing will be conducted on the recovered samples as necessary. Following the subsurface investigation and the laboratory testing GF will prepare a brief memo with recommendations.

## Recommendations

Based on the field assessment and finding, it is recommended to rehabilitate the existing culvert and replace the entire downstream retaining wall. The major works are listed below:

- Replace the existing masonry spandrel walls and barriers at both ends of the culvert to meet current PennDOT Standards.
- For consistency with roadway cross section with nearby newly constructed bridge, extend the existing arch barrels to accommodate a 5'-0" wide sidewalk.
- Provide formliner on headwalls and barriers to aesthetically blend with the newly constructed adjacent bridge.
- Remove and rebuild the downstream retaining wall.
- Underpin the footings and fill the scour hole at the inlet with riprap.
- Remove the tree at northeast corner.
- Install guide rail on non-sidewalk side if directed by the Township.
- Install Type M inlet and drainage.

A conceptual construction cost estimate and estimate of engineering cost is provided for the recommended work.

**Chamounix Road over Gulph Creek Culvert Rehabilitation**

**Construction Item Estimate:**

	Unit	Qty	Unit \$	Item Cost	
<b>Bridge</b>					
1	Bypass Pumping	LS	1	\$7,000	\$7,000
2	Remove Existing Spandrel Walls/Headers	LS	1	\$2,000	\$2,000
3	Class A Cement Concrete for New Spandrel Wall/Headers	CY	15	\$1,000	\$15,000
4	Class AA Cement Concrete for Barriers and Moment Slabs	CY	42	\$650	\$27,300
5	Reinforcement Bars, Epoxy Coated	LB	11400	\$2	\$17,100
6	Formliner	SF	515	\$15	\$7,725
7	Class 3 Excavation (culvert)	CY	95	\$65	\$6,175
8	Structure Backfill	CY	45	\$50	\$2,250
9	Under Pin Undermined Footings.	CY	3	\$1,500	\$4,500
10	Riprap at Inlet	CY	50	\$80	\$4,000
11	Temporary Excavation Support and Protection System	LS	1	\$0	\$0
1	Remove Existing Retaining Wall	LS	1	\$5,000	\$5,000
2	Class 3 Excavation (Retaining Wall)	CY	262	\$35	\$9,170
3	Structure Backfill (Retaining Wall)	CY	130	\$55	\$7,150
4	Redi-Rock Wall Material (Quote) (Per 100 ft)	LS	1	\$16,186	\$16,186
5	Redi-Rock Wall Construction	LS	1	\$24,279	\$24,279
			Total Str. Cost:		<u>\$154,835</u>
<b>Roadway</b>					
1	Clearing and Grubbing (incl 1 large tree removal)	LS	1	\$5,000	\$5,000
2	Class 1 Excavation	CY	75	\$25	\$1,875
3	Approach Pavement	SY	150	\$55	\$8,250
4	Type M inlet and drainage	LS	1	\$4,600	\$4,600
5	Guide rail (on non-sidewalk side)	LS	1	\$9,250	\$9,250
6	Traffic Control	LS	1	\$2,500	\$2,500
			Total Roadway Cost:		<u>\$31,475</u>
			Total Construction Cost:		<b>\$186,310</b>
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			Total Construction Cost:		\$186,310
			+ 5% Mobilization		
			+ 20% Contingency		
			Construction Total:		<b>\$233,000</b>
			Engineering Fee:		<b>\$100,500</b>
			Total Project Cost:		<b>\$333,500</b>