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EXHIBIT 04

NOTICE OF VIOLATION (NORRIS CITY PUMP STATION)

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March 22, 2016

RECEIVED

MAR 29 2016

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**NOTICE OF VIOLATION**

Mr. Don Delamater  
2501 Stanbridge Street  
East Norriton, PA 19401

EAST NORRITON TOWNSHIP

Re: Clean Water/Operations/Sewage  
Norris City Avenue Pumping Station  
East Norriton Township  
Montgomery County

Copy: Board DE=4-1-16  
Bob - oris  
Doug } Please  
Ken } prepare  
response  
report

Dear Mr. Delamater:

On **02/24/16** a Force Main Break on the East Norriton Township Norris City Avenue Pumping Station 16-Inch Force Main occurred and was discovered around 7: pm. Initially sewage was flowing up through the ground from the damaged force main. East Norriton Township's Stoney Creek Number No. 2 Interceptor flows into the Norris City Ave PS Wet Well and became surcharged. The Norris City Avenue pumping station began overflowing from the wet well and manhole immediately upstream on the interceptor. During the early morning of **02/25/16** East Norriton Township Public Works Department lead by Mr. Doug Jones, Public Works Director began the excavation and observed the hole was filling with water. East Norriton Township Public Works Department assumed the water filling the excavation was coming from the surcharged conditions on the Stoney Creek Interceptor. On **02/25/16** East Norriton Township decided to use 2 8-inch Xylem Pumps to pump sewage from the wet well of the Norris City Avenue Pumping Station to the ground behind the pumping station. The sewage pumped by the 8-inch Pumps flowed on the ground and into the Stoney Creek. This is an unpermitted discharge of sewage and a violation of Section 201 and 202 of the Clean Streams Law.

A discharge of sewage without authorization by a permit issued by Department of Environmental Protection (DEP) constitutes a violation of Sections 201 and 202 of the Clean Streams Law, the Act of June 22, 1937, P.L. 1987, as amended, 35 P.S. §§ 691.1 - 691.1001 (Clean Streams Law). Such violations also constitute unlawful conduct under Section 611 of the Clean Streams Law, 35 P.S. § 691.611, and are subject to the enforcement provisions of Section 605 of the Clean Streams Law, 35 P.S. § 691.605 which includes the assessment of civil penalties.

We request that you submit a report to this office within **15 days** of the date of this letter, describing the cause of noncompliance and the steps being taken to prevent recurrence of the violation along with a correction schedule.

This Notice of Violation is neither an order nor any other final action of the DEP. It neither imposes nor waives any enforcement action available to DEP under any of its statutes. If DEP determines that an enforcement action is appropriate, you will be notified of the action.

If you have any questions, please call me at 484.250.5134.

Sincerely,



Bernard Krasnisky  
Water Quality Specialist  
Clean Water

cc: Mr. Bauer  
Compliance and Monitoring  
East Norriton Township  
File  
Re (GJE16CLW)082-2

**GENERAL INSPECTION REPORT (Non-NPDES)**

Type of Inspection <b>Incident</b>	WQM Permit Number	County <b>Montgomery</b>	Municipality <b>East Norriton Township</b>
Name and Location of Facility or Pollution Incident <b>East Norriton Township Norris City Ave Pumping Station Force Main Break</b>			Entry Time/Date <b>08:27 am 02/25/16</b>
			Exit Time/Date <b>4:00 pm 02/25/16</b>
Name, Address of Responsible Party <b>Doug Jones – East Norriton Township</b>		Title <b>Public Works Director</b>	
<b>2501 Stanbridge Street</b>		Telephone	Contacted
<b>East Norriton, PA 19401</b>		<b>610-275-2800</b>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>SUMMARY OF VIOLATIONS/RECOMMENDATION/COMMENTS:</b>			
<p><b>#1 - On 02/24/16 and 02/25/16 East Norriton Township experienced a force main break on their 16 inch cast iron Interceptor that conveys sewage from their Norris City Pumping Station to a manhole on Hartraff Boulevard where it ties into the East Norriton Plymouth Whitpain JSA Collection System. The force main break initially caused sewage to flow out of crack near Manhole #2 on Norris City Avenue. The Pumping Station was shut down at approximately 11:00 pm on 02/24/16. The pumping station wet well began to overflow and so did multiple manholes in the drainage area of the Norris Ave Pumping Station such as manholes 2A and 43 on the Stoney Creek Interceptor. Two 8 inch Xylem diesel pumps were used to pump sewage from the wet well to Stoney Creek to alleviate surcharged conditions at the pump station and in the Stoney Creek Interceptor that was assumed to be contributing the water filling the excavation. The portable diesel pumps discharged sewage to Stoney Creek from approximately 9:00 am to 3:15 pm on 02/25/16. This is an unpermitted discharge of sewage and a violation of Section 201 and 202 of the Clean Streams Law.</b></p>			
Compliance Assistance Provided <input checked="" type="checkbox"/>			
Pollution Prevention Activity <input checked="" type="checkbox"/>			
Sample No.	Location	Field Measurements and Observations	
Inspector Name <b>Bernard Krasnisky</b>	Inspector Signature <i>Bernard Krasnisky</i>	Title <b>Water Quality Specialist</b>	Date <b>2/25/16</b> Telephone <b>484.250.5134</b>
Name of Person Interviewed <b>Doug Jones</b>	Signature of Person Interviewed	Title <b>Public Works Director</b>	Date <b>2/25/16</b> Telephone <b>610-275-2800</b>
<p>This document is official notification that a representative of the Department of Environmental Protection, inspected the above facility or site. The findings of this inspection are shown above and on any attached pages.</p> <p>Any violations which were uncovered during the inspection are indicated. Violations may also be discovered upon examination of the results of laboratory analyses of the discharge and review of Department records. Notification will be forthcoming, if such violations are noted.</p>			

**GENERAL INSPECTION REPORT (Non-NPDES)**

Name and Location of Facility or Pollution Incident <b>Norris City Ave Pumping Station Force Main Break</b>	County <b>Montgomery</b>	Municipality <b>East Norriton Township</b>
<p>Today I conducted an Incident Inspection of the East Norriton Township Force Main Break on the Force Main for Norris City Avenue Pumping Station. I was accompanied by Mr. David Wolfinger, Water Quality Specialist with the PA DEP, Mr. Doug Jones, Public Works Director with East Norriton Township, Mr. Don Delamater, Township Manager with East Norriton Township, and Tom Davies with T&amp;T who was contracted to repair the force main. I made the following observations:</p> <ol style="list-style-type: none"> <li><b>#1 - The Force Main Break was first observed during the evening of February 24, 2016 at approximately 7:09 pm. The Force Main from the Norris City Avenue Pump Station discharges to a manhole on Hartraff Boulevard located on the opposite side of Swede Road. East Norriton Township Public Works Department opened the manhole and observed the force main was not discharging. East Norriton Township Public Works Director, Dough Jones, reported the incident to the DEP at 7:30 pm on 02/24/16. During the report the East Norriton Township Public Works Department indicated they were pumping and hauling and the Norris City Avenue Pumping Station was their main Pumping Station. During my inspection Mr. Jones stated the Norris City Ave Pumping Station was shut down at 11:00 pm the evening of 02/24/2016 and was overflowing into the wooded area behind it and Stoney Creek. This is an unpermitted discharge of sewage and a violation of Section 201 and 202 of the Clean Streams Law. At 11:15 am the excavation began with a back hoe. The hole was dug near the manhole on the Interceptor that flows into the Norris City PS and is located on Norris City Avenue parallel to the pumping stations discharge force main. The map of the sewer system incorrectly indicated the location of the discharge force main.</b></li> <li><b>The Norris City Avenue PS has a typical operating capacity of 2000 GPM for each of its 2 pumps which is approximately 4.5 MGD of capacity. While conducting the excavation East Norriton Township observed water was flowing into the hole very quickly and filling it up. At 3:30 am Doug Jones with East Norriton Township reported to the DEP that despite their best efforts they were unable to keep up with the flow and the wet well of the Norris City Ave Pumping Station was filled due to wet weather conditions. Mr. Jones also indicated sewage was flowing into Stoney Creek despite pump and haul operations and East Norriton Township assumed the water filling the excavation was sewage escaping the Norris City Ave gravity Interceptor. Mr. Jones requested permission to bring in 2 Xylem Diesel Pumps to pump down the wet well and relieve the surcharged condition on the Norris City Ave Interceptor which were believed to be causing sewage to leave the Interceptor and fill the excavation. East Norriton Township stated if they could not pump down the wet well the repair may take 1.5 days but if the wet well was permitted to be pumped down it would only take until 12:00pm on 02/25/16. Mr. Walt Bair with the DEP's Emergency Response Program discussed options with Mr. Doug Jones and decided to allow East Norriton Township to use Xylem Pumps to pump down the Norris City Ave Wet Well to the ground and Stoney Creek. Mr. Bair contacted me the morning of 02/25/16 regarding the incident. I called Doug Jones and after discussing the situation stated I would be coming on-site to assess the Incident.</b></li> </ol>		
Inspector Name <b>Bernard Krasnisky</b>	Inspector Signature	Date <b>2/25/16</b>

**GENERAL INSPECTION REPORT (Non-NPDES)**

Name and Location of Facility or Pollution Incident <b>Norristown City Pumping Station Force Main Break</b>	County <b>Montgomery</b>	Municipality <b>East Norriton Township</b>
<p>3. When I arrived on-site I learned the Stoney Creek No. 2 24 inch interceptor is the interceptor that flows into the Norris City Avenue PS. The Stoney Creek No. 2 receives wastewater from an 8 inch gravity line on Swede Rd and a 21 inch interceptor from Pacer Lane. I observed manhole 2A was overflowing and is located upstream of manhole #2 on the Stoney Creek Interceptor. Manhole 2A is located in an easement on a resident's property on Pacer Lane and was visibly overflowing into the Unnamed Tributary to Stoney Creek. Manhole 2A's overflow was visible from the edge of Norris City Avenue. Manhole #2 is located on Norris Avenue at the excavation and was surcharged but not overflowing. The excavation contractor was using one 3 inch trash pump to pump the water out of the hole into the adjacent field. The trash pump's suction kept getting clogged with mud and the hole remained filled with water. East Norriton Township procured two 8 inch Xylem Pumps and were pumping out of the manhole behind and in front of the wet well for the Pumping Station. The Xylem Pumps each discharge approximately 2,000 gallons each.</p> <p>4. When Mr. Wolfinger and I arrived on-site Mr. Jones stated that 2 vacuum trucks with AQUA PA were pumping and hauling from manhole 43 on the Stoney Creek No 2. Interceptor located on Meadowbrook Rd and 2 additional trucks were pumping and hauling from the Germantown PS. This because the ability for vacuum trucks to turn around was very limited at the Timberlake PS which pumps into the drainage area that flows to the Stoney Creek No 2.</p> <p>5. Tom Davies with T&amp;T stated he needed to dig the excavation to 14.0 ft. deep and was going to dig a bench trench that does not require the use of shoring. Mr. Tom Davies did not initially have a trac hoe on-site and it became apparent that a trac hoe was going to be needed to finish the excavation. The trac hoe finally made it on-site at 10:08 am and found the 14 inch main.</p> <p>6. Once the Xylem pumps were online for approximately 10-20 minutes the surcharged condition of the Stoney Creek No. 2 Interceptor was relieved. Manhole 2A stopped overflowing. At approximately 10:30 am Mr. Doug Jones and I inspected manhole 2A and observed there was erosion and a path of sewage solids from the manhole down the creek bank into the UNT to Stoney Creek. Manhole 43's level dropped 2.0 ft. at the time of our inspection. Two AQUA vacuum trucks were continuing to suck sewage out of manhole 43. An East Norriton Township employee assisting with the vacuuming at the manhole observed the level was staying around the level of the second bar and would rise back to this level after the vacuum truck stopped removing water. Mr. Doug Jones stationed 2 trucks here until they were no longer able to pump water out of the manhole.</p> <p>7. Mr. Jones and I went back to inspect the excavation and observed there was one portable pump in the excavation hole and the other was in manhole 2. Mr. Davies stated he believed the repair will be finished today. I spoke with my supervisor, Robert Bauer who stated that if the repair is anticipated to go into the evening or the next day, bypass pumping will be required because the DEP is not willing to allow East Norriton to pump to the creek for a much longer. The bypass pumping should be designed to pump sewage from the Norris City Ave Pumping Station wet well to 2 manholes in the Municipality of Norristown's sanitary sewer collection system</p>		
Inspector Name <b>Bernard Krasnisky</b>	Inspector Signature	Date <b>2/25/16</b>

**GENERAL INSPECTION REPORT (Non-NPDES)**

<b>Name and Location of Facility or Pollution Incident</b> <b>Norristown City Pumping Station Force Main Break</b>	<b>County</b> <b>Montgomery</b>	<b>Municipality</b> <b>East Norriton Township</b>
<p>located near the intersection of Chain Street and Johnson Highway. These manholes are located on the opposite side of the PennDOT facility approximately 1500 ft. from the Norris City Pumping Station. Mr. Bruce Kratz with the Municipality of Norristown's Sewer Department stated approval had been granted for East Norriton to discharge into the 2 manholes near Chain Street and Johnson Highway if necessary. The Municipality of Norristown's manholes are on 8 inch lines.</p> <p>8. I inspected the excavation again and spoke with Bruce Jones and Tom Davies who stated East Norriton Township procured the replacement section of 16 inch cast iron force main from PA American Water. Tom Davies stated he planned on attaching the new piece of pipe to the force main with dresher style couplings and 4 couplings were available. T&amp;T Construction picked up the new section of 16 inch cast iron force main from PA American Water's facility on Johnson Highway. The 2 pumps in the excavation were effectively dewatering the hole and I stated T&amp;T should call a vacuum truck to suck the water out of the hole if needed. Mr. Davies' employees discovered the break was a longitudinal crack 10 ft. long and that entire 10.0 ft. section would need to be replaced.</p> <p>9. East Norriton Township contracted Franc Environmental to pump down the excavation with a vacuum truck while the 10.0 ft. section of cracked pipe was being removed and the replacement section was being installed. The replacement force main was installed at 3:09 pm and Dresher Couplings were used to attach the new piece of 16 inch cast iron pipe. The Norris City Avenue PS was immediately and slowly pressurized to test the force main repair while the 2 Xylem Pumps discharging to the creek were taken offline. The East Norriton Township Collection System Operators slowly increased the output of the pumps in the Norris City Avenue Pumping Station.</p> <p>10. The Norris City Avenue Pumping Station has 3 pumps that rated for 350 GPM on Variable Frequency Drives. The 16 inch cast iron force main capacity is rate for the maximum output of 2 of the pumps with the third acting as a back-up. The wet well level and pumps are controlled by a bubbler system. There is a high level alarm float and correspond floats to run the pumps as lead and lag. At 3:15 pm Pump #1 was operating at 97% and Pump #2 at 70% of full capacity to pump down the wet well. The wet well level was at 64 inches and the total output of the 2 pumps online according to the mag meter was 4000 GPM. The wet well was quickly pumped down to 48.8 inches and the total pump discharge rate decreased to under 4000 GPM. The wet well operating level is 24.0 – 48.8 inches. Pump #3 was initially placed on-hand and then taken offline after the operators confirmed it was running correctly. Pump #2 was then placed back online and left in auto control. I inspected the Pumping Station log book which was up-to-date. The pump hours are read approximately 3 times per month and the pumps were greased and had maintenance performed on their seals on 01/27/16.</p>		
<b>Inspector Name</b> <b>Bernard Krasnisky</b>	<b>Inspector Signature</b>	<b>Date</b> <b>2/25/16</b>

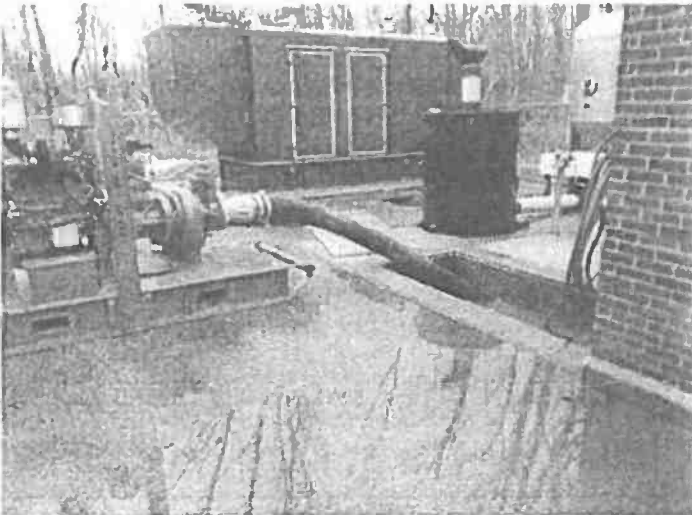
### Photographs



**1. The beginning of the excavation near manhole #2 on the 24 inch Section of the Stoney Creek 2. Interceptor, 02/25/16.**



**2. Portable Pumps pumping water out of the hole to the wood, 02/25/16.**



**3. One of the 8 inch Xylem Pumps pumping raw sewage out of the wet well to the ground and creek, 02/25/16.**



**4. Sewage on the ground due to the manhole located in driveway of the pump station overflowing.**



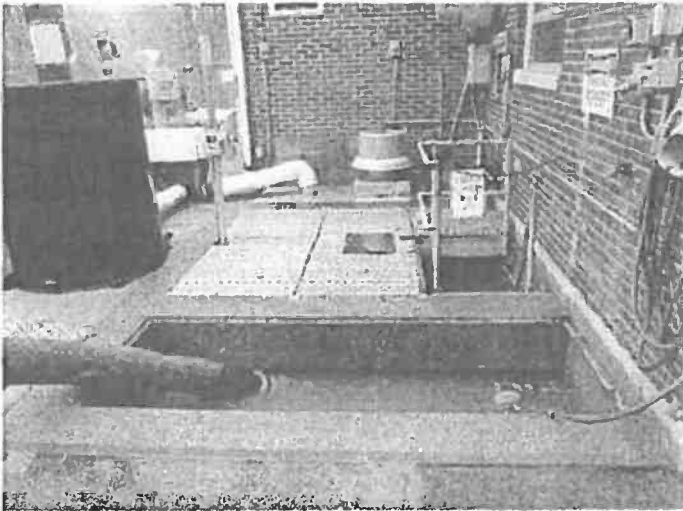
**Photographs**



**5. One of the Xylem pumps discharging to the wooded area behind the pump station and flowing into Stoney Creek, 02/25/16.**



**6. The Xylem Pump set up and discharging from the wet well, 02/25/16.**

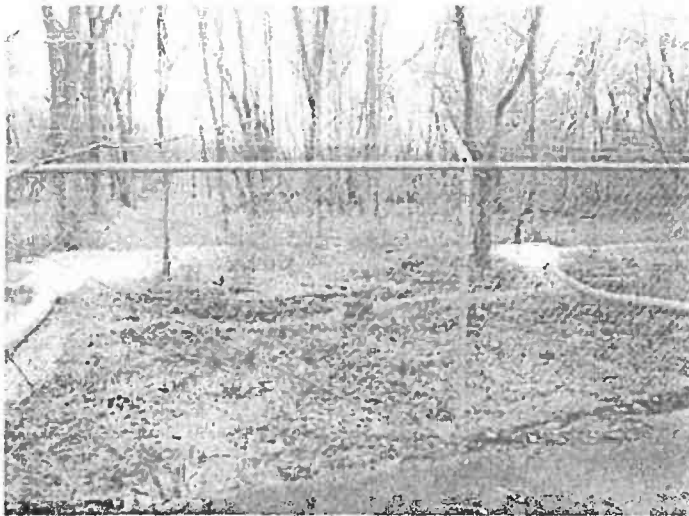


**7. The sewage level in the pumping station at the top of the wet well.**



**8. The second Xylem Pump discharging to the woods and creek from the manhole on the Stoney Creek Interceptor immediately upstream of the wet well.**

**Photographs**



**9. The two 8 inch Xylem Pumps discharging to the ground and Stoney Creek, 02/25/16.**



**10. One of the Xylem Pumps discharging to the ground and Stoney Creek, 02/25/16.**



**11. The Second Xylem Pump discharging from manhole on the Stoney Creek Interceptor in the pump station driveway.**



**12. The excavation of the 16 inch force main with a back-hoe.**

**Photographs**



**13. Manhole 2A overflowing to Stoney Creek, 02/25/15.**



**14. Some sewage solids around the manhole.**



**15. One of the portable pumps in the excavation, 02/25/16.**



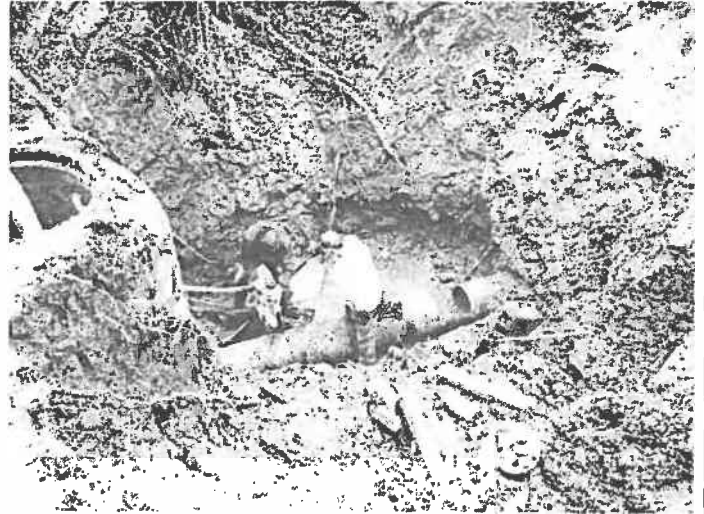
**16. The stream of sewage flowing out of the Xylem Pumps onto the ground and to Stoney Creek.**



**Photographs**



**17. The excavation of the 16 inch force main, 02/25/16.**



**18. The excavation of the 16 inch force main and the contractor cutting the pipe.**



**19. The field below the Penn DOT building and the path the sewer line bypass would have needed to take to discharge to the Municipality of Norristown's manholes near Chain Street and Johnson Highway.**



**GENERAL INSPECTION REPORT (Non-NPDES)**

Type of Inspection <b>Follow-Up Inspection</b>	WQM Permit Number	County <b>Montgomery</b>	Municipality <b>East Norriton Township</b>
Name and Location of Facility or Pollution Incident <b>Stoney Creek East Norriton Township</b>			Entry Time/Date <b>10:00 am 02/26/16</b>
Norris City Ave Pumping Station Force Main Break Follow-Up			Exit Time/Date <b>12:30 am 02/26/16</b>
Name, Address of Responsible Party <b>Mr. Don Delamater - East Norriton Township</b>		Title <b>Township Manager</b>	
<b>2501 Stanbridge Street</b>		Telephone <b>610-275-2800</b>	Contacted Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<b>East Norriton, PA 19401</b>			
<b>SUMMARY OF VIOLATIONS/RECOMMENDATION/COMMENTS:</b>			
No New Violations, Please See Comments Section:			
<b>Compliance Assistance Provided</b> <input checked="" type="checkbox"/>			
<b>Pollution Prevention Activity</b> <input checked="" type="checkbox"/>			
Sample No.	Location	Field Measurements and Observations	
Inspector Name <b>Bernard Krasnisky</b>	Inspector Signature <i>Bernard Krasnisky</i>	Title <b>Water Quality Specialist</b>	Date <b>02/26/16</b> Telephone <b>484-250-5134</b>
Name of Person Interviewed <b>Doug Jones</b>	Signature of Person Interviewed	Title <b>Public Works Director</b>	Date <b>02/26/16</b> Telephone <b>610-275-2800</b>
This document is official notification that a representative of the Department of Environmental Protection, inspected the above facility or site. The findings of this inspection are shown above and on any attached pages.			
Any violations which were uncovered during the inspection are indicated. Violations may also be discovered upon examination of the results of laboratory analyses of the discharge and review of Department records. Notification will be forthcoming, if such violations are noted.			



**GENERAL INSPECTION REPORT (Non-NPDES)**

Name and Location of Facility or Pollution Incident <b>Norris City Avenue PS Force Main Break to Stoney Creek</b>	County <b>Montgomery</b>	Municipality <b>East Norriton Township</b>
<p>Today I conducted a follow-up inspection of the East Norriton Township Norris City Avenue Pumping Station Force Main Break that occurred on 02/24/16 and 02/25/16 and discharged millions of gallons of sewage into the Stoney Creek. The purpose of this inspection was to inspect the condition of the creek, document any damage that has occurred and determine if there has been a fish kill. I made the following observations:</p> <ul style="list-style-type: none"> <li>I inspected Stoney Creek beginning at the Norris City Avenue Pumping Station and walking downstream. At the Norris City Avenue Pumping station the path the sewage took from the discharge of the Xylem Pumps was evident in the flood plain behind the pumping station and created an erosion channel to the creek. There were many wet areas in the flood plain and erosion channel that still contained sewage. The discharge from the portable pumps used in the excavation also created an erosion channel all the way to Stoney Creek.</li> <li>The creek had green coloration in pools and slow moving areas downstream from where the Xylem and portable pumps discharges' flowed into the creek. The water in this section of Stoney Creek was very turbid and green in color and most sections were too cloudy to observe the bottom. The bottom was only visible in several shallow fast moving riffle areas within 100 yards of the pumping station. I inspected the creek downstream for approximately 500-800 yards but did not observe any dead fish. The creek water in many of the downstream pools and especially in a very large pool near the Norristown Elm Street softball and baseball fields were significantly green in color and permitted almost no visibility, obscuring any possible dead fish on the bottom. I discovered a homeless camp in the wooded area near the stream and decided to inspect the section of Stoney Creek further downstream by parking near the Elm Wood Zoo.</li> <li>I parked in the Elm Wood Zoo parking area and inspected the section of Stoney Creek immediately upstream of the zoo. The creek was turbid with light and dark green discolored water. The creek bottom was not visible in any part of this section of the creek. I did not observe any dead or distressed fish.</li> <li>I inspected the section of Stoney Creek adjacent to Elm Wood Zoo and downstream of the zoo for approximately 500 yards. In this section Stoney Creek was still very turbid and light green in color. I inspected the creek all the way to the Norristown Dam and observed the water upstream of the dam was very light green in color and visibility into the water column was near zero.</li> <li>I crossed the Norris City Ave bridge and inspected the opposite bank of Stoney Creek to determine if I could gain a better angle of view and observe any dead fish. I observed turbid green creek water in many of the slower moving sections and pools and could still not see the bottom of the creek due to the turbidity and low visibility.</li> </ul>		
Inspector Name <b>Bernard Krasnisky</b>	Inspector Signature	Date <b>02/26/16</b>

### Photographs



**1. The wooded area on the flood plain behind the Norris City Avenue Pumping Station, 02/16/16.**



**2. The erosion channel from the portable pumps used to pump sewage and water out of the hole dug for the 16 inch Force Main, 02/26/16.**



**3. One of the Xylem Portable Pumps and Discharge lines, 02/26/16.**



**4. The erosion channel and some remaining sewage from the Xylem 8 in. Portable Pumps, 02/26/16.**



**Photographs**



**5. Turbid water in a pool approximately 200 yards downstream from the Xylem pumps erosion channel, 02/26/16.**



**6. Turbid and green colored water in a slow moving pool upstream from a riffle.**



**7. Turbid green water in another slow moving area making Stoney Creek's bottom impossible to see.**



**8. A fast moving section of Stoney Creek upstream of the parking lot for the Norristown Elmwood Zoo, 02/26/16.**

**Photographs**



**9. Sewage and wet ground on Stoney Creek's flood plain located behind the Norris City Ave PS.**



**10. The large erosion channel from the portable pumps used to dewater the excavation, 02/26/16.**



**11. Lime put down on the ground near the Xylem portable pump used to pump out of the last manhole on the Stoney Creek No. 2 Interceptor.**

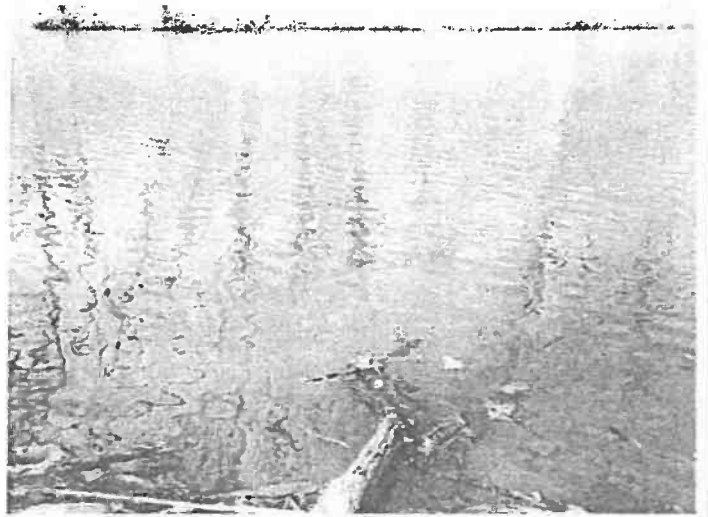


**12. A small Unnamed Tributary to Stoney Creek, 02/26/16.**

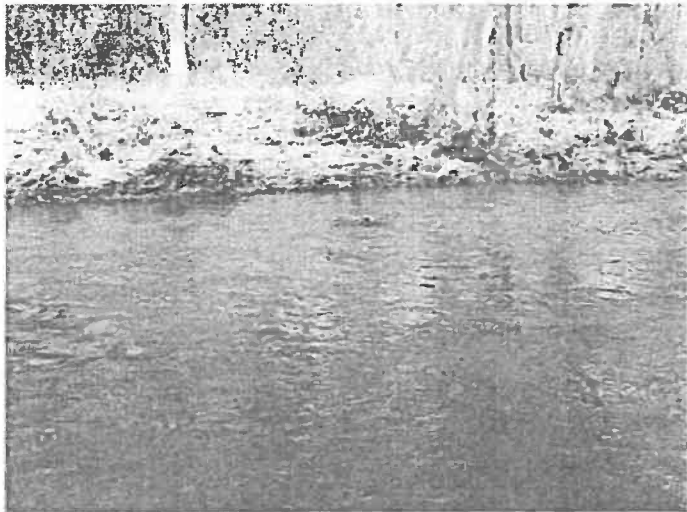
**Photographs**



**13. Stoney Creek upstream of the Elmwood Zoo with very green and turbid water obscuring visibility of the creek substrate, 02/26/16.**



**14. Stoney Creek filled with turbid water approximately 100 yards upstream from the Elmwood Zoo parking lot.**



**15. A fast moving area adjacent to the Elmwood Zoo with green turbid water, 02/26/16**



**16. More green turbid water in Stoney Creek downstream from the Elmwood Zoo, 02/26/16.**

### Photographs



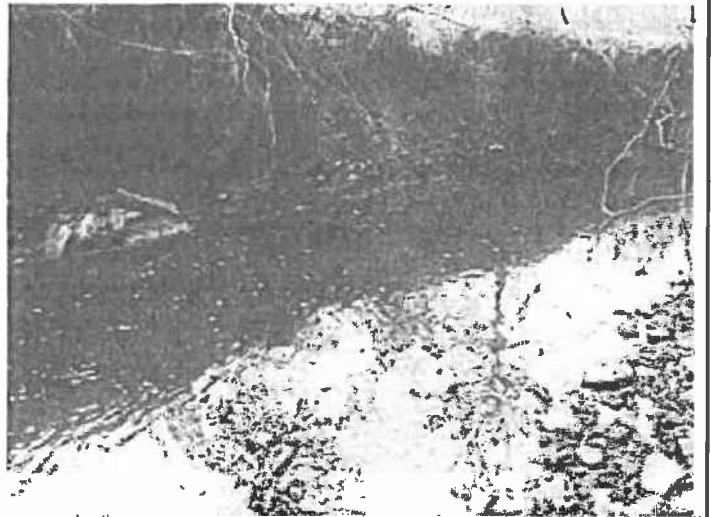
**17. Cloudy Green water upstream and downstream of the Norristown Dam approximately 300 yards downstream of the Elmwood Zoo, 02/26/16.**



**18. Green Cloudy water upstream of the Norristown Dam and downstream of the Elmwood Zoo.**



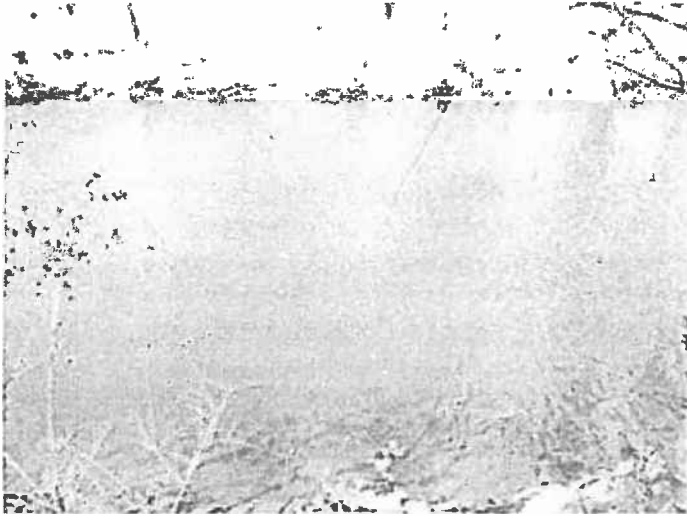
**19. Stoney Creek filled with green turbid water from a location approximately 200-300 yards downstream of the Elmwood Zoo.**



**20. A slow moving pool approximately 300 yards downstream from Norris City Avenue from the opposite bank with very green turbid water.**



### Photographs



**21. Green turbid water in Stoney Creek approximately 300-400 yards downstream from the Norris City Avenue Pumping Station from the opposite bank.**



**22. A fast moving riffle on Stoney Creek approximately 50-100 yards downstream of the Norris City Avenue PS but filled with green water that obscures the bottom in pooled areas.**



BREAKS IN CAST IRON PIPE

DUCTILE IRON PIPE RESEARCH ASSOCIATION  
1301 West 22nd Street, Suite 509  
Oak Brook, Illinois 60521

By 1980, production of cast iron pressure pipe in the United States has virtually ceased. The advantages of the modern successor, ductile iron pipe, have resulted in its dominance in the market place. The main advantage that led to this change is, of course, the tremendous strength of ductile iron. Structural failures in ductile iron pipe are all but unknown.

Cast iron pipe was first used in this country in the early 19th century. It is a testament to the quality and dependability of this material that a great deal of it is still in service. Since cast iron pressure pipe was manufactured and installed until very recently, it is likely that it will remain in service for many years to come.

Cast iron pipe was designed to carry internal pressure and external loads due to earth fill and surface traffic. A reasonable safety factor was used in the design. Comprehensive standards for pipe manufacture, design and installation have for many years assured a top quality pipeline. Still, failures of cast iron pipe in service sometimes occur. It is the purpose of this paper to consider such failures, their frequency, causes, prevention, and the proper method of evaluating or investigating failures which do occur.

With regard to frequency, a number of surveys have been made to learn the cause of breakage in cast iron pipe as well as information on age and the size of pipe affected most. DIPRA surveyed 18 cities in Illinois and Wisconsin with population from 15,000 to 100,000. The average break rate was 0.76 per one hundred miles of pipe per year. Over half occurred in six inch pipe. Other surveys show that larger cities may expect more frequent breakage, which results from a large number of underground utilities, frequent disturbance within street areas, and heavy traffic. One feature, consistent in all surveys, is that the greatest break rate is in small size mains (four inch, six inch, and eight inch.) There are many alleged causes, however, most breaks result from one or a combination of the following:

- (1) Impact damage to the pipe before or during installation.
- (2) Subjecting the pipe structure to loads in excess of those for which it was designed.
- (3) Damage to the pipe by nearby underground construction work.
- (4) Corrosion
- (5) Beam failure due to:
  - (a) Poor construction (uneven bearing)
  - (b) Resting on rock or unyielding structures
  - (c) Disturbance of foundation of pipe
  - (d) Allowing structures to rest on the pipe
  - (e) Expansive soils
  - (f) Frost penetration



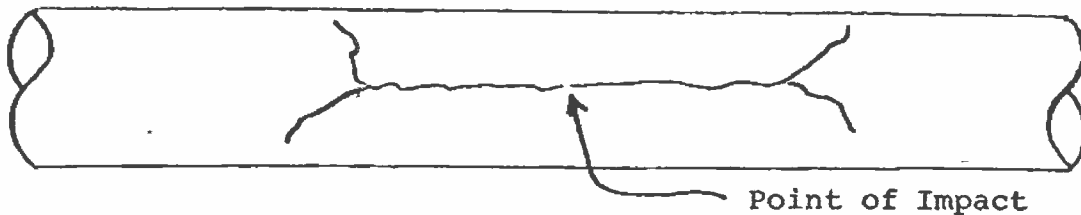
Other important contributors to breakage are:

- (a) Unequal settlement
- (b) Vibrations and shock
- (c) Freezing (water)
- (d) Water and ground temperature changes

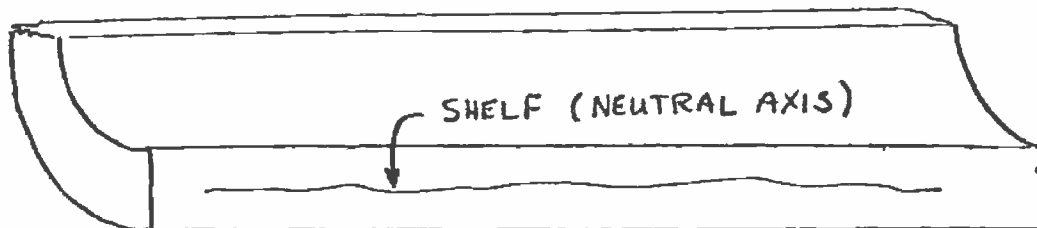
The importance of impact cannot be over-emphasized. To illustrate this, a length of Class 22, eight inch cast iron pipe weighs about 665 lbs. If it is dropped four feet from the back of a truck, the impact would be 10,640 ft.lbs/sec. If the pipe should happen to hit a rigid object, it would be the same as dropping a sledge weighing one third of a ton, from a height of four feet. Of course, cast iron pipe was not designed to stand such shock.

There are many other sources of impact in the course of handling, shipping and delivering pipe. From impact, a cast iron pipe may have been bruised or partially cracked. Any such small crack will generally start from the inside of the pipe. Sometimes a partial crack will not come through to the outside, making it impossible to detect by visual inspection. Cracks cannot be determined by ringing in the case of cement lined pipe because the lining muffles the sound. Therefore, it is best to make sure of careful handling. A partially cracked or bruised pipe will often hold test pressure and may even serve normally for a period of time, depending on the extent of damage. Eventually failure may occur.

To identify this type of break it should be pointed out that the fracture starts at the point of impact and runs in opposite directions following a generally straight line for some distance. At approximately the same distance from the impact point and on both sides, the crack will start to turn off in another direction or split into two or more directions.



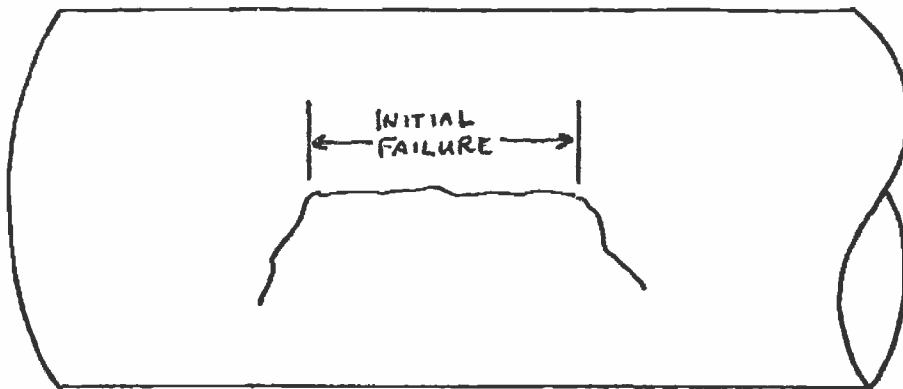
A cross section of the pipe wall at the point of impact sometimes has an unusual appearance when compared to the other metal in the vicinity. The line of fracture may show what appears to be a shelf-like structure.



LONGITUDINAL SECTION THROUGH PIPE WALL

This will help identify the cause of breakage as impact.

In large diameter pipe which are overloaded externally, failure is by crushing since the pipe is exceedingly strong as a beam. In ring crushing, the initial point of failure is longitudinal due to the ring or hoop stress producing it. The crack will continue in this direction until it is carried off the straight line by bending stresses produced by the rupture. The diameter at which overloading causes crushing failure rather than beam failure is about ten inches. Smaller pipe will generally break transversely due to beam action. It is well to note that a great majority of failures in cast iron pipe are beam failures in small diameter pipe. Crushing failures rarely occur.

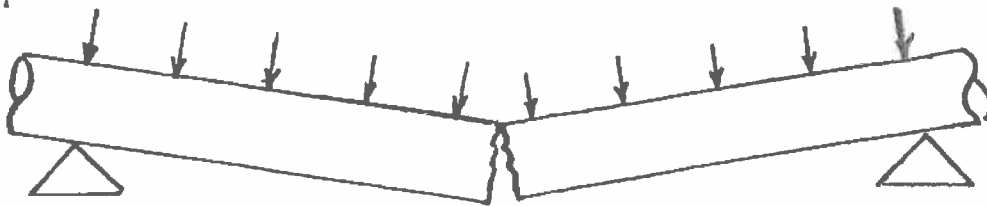
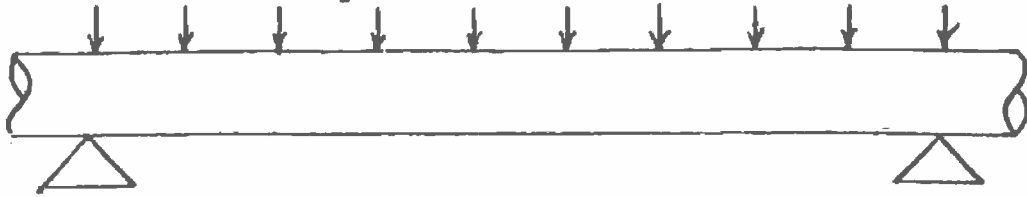


Breaks caused by other underground construction operations, such as, blasting or use of power shovels and heavy construction equipment, can be avoided by carefully inspecting such work in progress, warning the construction crew of the presence of underground pipe, and insisting on the exercise of care in the vicinity of the pipe.

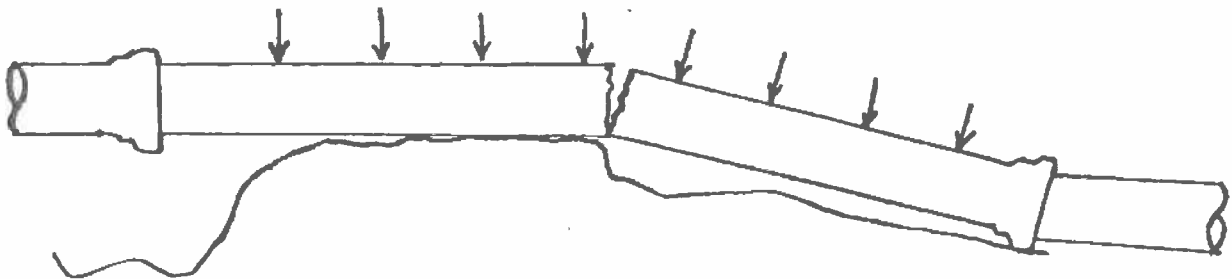
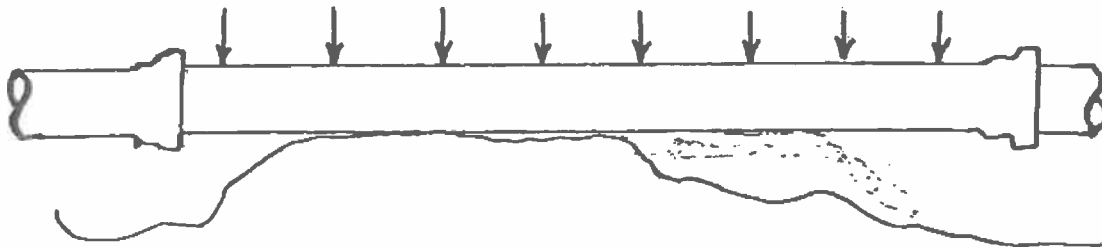
In certain areas, corrosive soils affect the strength of the pipe to the point where the structure is weakened and breakage occurs. This can happen in any system if the pipe is laid through cinders, waste dumps, swamps, or similar corrosive environments, without protection. Measures can be taken to prevent exterior corrosion of pipe, such as, polyethylene wrap. Sometimes corrosion is erroneously suspected as the cause of a break when, in fact, a crack developed first and minor seepage caused a moist condition along the crack which resulted in corrosion. These are sometimes difficult to identify.

As indicated previously, the major cause of in-service breaks in cast iron pipe is beam action in pipe eight inches and smaller in diameter. A pipe properly laid and not disturbed after laying is not called upon to act as a beam and such a pipe, cannot, therefore fail as a beam. The backfill on pipe so laid stresses it as a ring in compression. Smaller diameter cast iron pipe will withstand, as a ring, many times the load that even an excessive depth of trench might transmit to the pipe. On the other hand, a pipe not properly laid may act as a beam for any of several reasons. If blocks are used near the ends of the pipe and the backfill not properly tamped, the load placed on the pipe tends to bend it downward in the middle. If failure occurs with this type of loading,

the breaks will be opened wider at the bottom than at the top.



If the bottom of the trench is wavy with deep and long bell holes, the pipe is supported in the middle and comparatively free at the ends. This pipe will bend downward at the ends and if failure occurs the break will be opened wider at the top than at the bottom.



In either of these cases, the pipe breaks straight across near the middle of a length. Breaks of these types are seldom found in sandy soils since the sand very easily flows around the pipe to form a good foundation and in this manner prevents beam action.

The use of trenching machines for bell hole digging very often results in excessively deep and long bell holes. These are undesirable particularly in clay soils.

If a pipe is so laid that it rests on a rock, other pipe, a conduit or other unyielding object, the pipe is rigidly supported at this point and comparatively unsupported at other places along its length. This may cause beam failure in small pipe, and in larger pipe might cause failure as a ring. The remedy for this trouble is to excavate six inches below the bottom of the pipe where rock is found and then backfill with sand up to the pipe grade. With other underground structures, care should be exercised so that pipe does not rest on them nor should they rest on the pipe.

Because of an increase in frequency of breaks in cold weather, temperature changes are often blamed. This is generally over-emphasized. However, it probably is a contributor to the situation.

When the temperature of water drops, pipes, already stressed by excessive loads, are called upon to take the additional stress of shrinkage. This, on a pipe that is already stressed to a point near failure, may be sufficient to cause rupture. Temperature change alone will not cause stresses large enough to result in breakage. For example, if the temperature of the ground and water dropped to 40°F., the stress due to this change is about 2800 psi tension. The tensile strength of cast iron is over 34,000 psi. This gives a safety factor of twelve against this stress by itself. Another contributor to cold weather failures is loading due to frost. Tests have established that frost penetration can cause as much as twice the normal earth load in a buried pipe. This fact in combination with poor laying conditions as described above is probably responsible for the increased break frequency often noted in the winter months.

In some cases, too much emphasis is placed on the ability of internal pressure and water hammer to cause pipe breaks. In the foundries, sample pipes are tested to destruction by internal pressure on a routine basis. A six inch, Class 150, pipe will hold over 3,000 psi before bursting. A twelve inch pipe will handle over 2,000 psi. Water hammer is assumed to increase internal pressures from seventy to one hundred twenty psi. It is quickly seen that normal internal pressures are not likely to cause pipe breakage with this degree of safety factor involved.

When you are called upon to discuss or investigate a break in cast iron pipe, it is probable that the cause of the break will be one of the situations discussed here. As mentioned, the majority of failures are probably caused by beam action, with the remainder caused by impact, crushing action, and corrosion - in that order. There are several possible causes which have not been discussed because they are not readily identified by inspection. In these cases, it is generally necessary to rely on past experience of someone within the industry for the answer. The methods of prevention are generally included in good handling, inspection, laying practices, and operation.

Any time serious violation of good practice is observed, it is worthwhile to bring it to the attention of the responsible people for mutual protection.







# EAST NORRITON TOWNSHIP

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April 11, 2016

Mr. Bernard Krasnisky  
Water Quality Specialist  
Pennsylvania Department of Environmental Protection  
Southeast Regional Office  
2 East Main Street  
Norristown, PA 19401-4915

RECEIVED  
DEP-SOUTHEAST  
2016 APR 12 AM 9:56

Re: Notice of Violation Letter  
Dated March 22, 2016  
Norris City Avenue Pumping Station Force Main Break

Dear Mr. Krasnisky:

The Township is in receipt of the Pennsylvania Department of Environmental Protection (Department) Notice of Violation letter dated March 22, 2016 (NOV Letter) and DEP General Inspection Reports (non-NPDES) dated February 25, 2016 and February 26, 2016 (“Inspection Reports”), copies of which are attached to this letter. Please note that Mr. Delamater is no longer employed by East Norriton Township (Township).

In response to the NOV Letter, the Township offers the following response regarding the February 24 – 25, 2016 force main break at our Norris City Avenue Pump Station. Information regarding our investigation as to the cause of this break, as well as pump station/force main background information is being provided as requested. For the purposes of providing an accurate response, clarifications to the NOV Letter and the Inspection Report are also being provided.

### Clarifications to NOV Letter & Inspection Reports

The opening paragraph of the NOV Letter indicates that the Township decided to use two 8-inch Xylem pumps to eliminate the surcharge conditions within the Stoney Creek Interceptor. While this statement is factual, the decision to utilize these pumps was not made without first consulting with and securing the consent of the Department. This fact is detailed in Item #2, Page 2 of the February 25, 2016 Inspection Report.

Mr. Bernard Krasnisky  
April 11, 2016  
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Page 1 of the February 25<sup>th</sup> Inspection Report under Item #1 in the Summary of Violations section, states “The pumping station wet well began to overflow and so did multiple manholes...such as manholes 2A and 43 on the Stoney Creek Interceptor.” Please be advised that at no time during the referenced event did MH 43, located on Meadowbrook Road, overflow. This manhole was used as one of the suction points for the Township’s pump and haul operations during this event and while surcharge conditions did exist within MH 43, no overflow occurred.

#### Background Information

The Norris City Avenue Pump Station is the Township’s largest pumping station and conveys sewage from approximately 90% of the Township’s service area. The station, along with its 16-inch cast iron force main, was originally installed in the early 1960s. While the pump station was upgraded in the late 1990s with larger pumps & motors, variable frequency drives (VFD), surge relief valves, hydraulic check valves, a surge relief tank and various other improvements, it was determined at that time that no upgrade was warranted on the force main. In fact, the February 24, 2016 break was the first-ever failure of this 16-inch cast iron force main.

It should be noted that at 6:10 PM on February 24<sup>th</sup>, the exact time of the force main break, the Norris City Avenue Pump Station experienced a brief commercial power failure where one of the three power phases was lost. This power interruption activated the emergency power generator at the station, which triggered an alarm condition thereby notifying Township personnel. The Township’s policy is to investigate any condition involving a pump station emergency generator that is running to ensure normal operations during the interruption of commercial power. This investigation alerted the Township to the force main break as the location was less than 100 feet away from the pump station.

#### Summary of Actions Taken to Address Force Main Break

As noted in the NOV and General Inspection Reports, the Township became aware of the force main break at approximately 7:00 pm on February 24, 2016. By 7:15 pm, the Township’s repair contractor (T&T Contracting) was alerted to the break and began to mobilize their personnel to respond. During that evening there was a tornado watch, along with a severe thunderstorm warning, in effect until approximately 11:00 pm. Due to the location of the break, in a semi-wooded area, the decision was made to not start the repair process until such time as the potential for severe weather had passed as concerns for the safety and wellbeing of those involved in the repair process took precedence. Once the severe weather had passed, the repair process began immediately.

In the interim, however, septage hauling companies were contacted and engaged to pump sewage from the collection system upstream of the pump station and haul it to a manhole on Hartranft

Mr. Bernard Krasnisky  
April 11, 2016  
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Blvd., downstream of the force main discharge. Hauling trucks were added throughout the night and into the next day as they became available.

As previously stated, approximately 90% of the Township's sewer service area flows to, and gets conveyed by, the Norris City Avenue Pump Station. In our attempt to manage the amount of sewage flowing to this station, the following efforts were employed:

1. Pump and haul operations were initiated, as stated above.
2. Timberlake Pump Station was limited to a one-pump operation. Typically during peak flow periods and periods of wet weather, this station operates with two (2) pumps running to manage flows tributary to the station. By utilizing a one (1) pump operation, we minimized the amount of sewage flowing to Norris City Avenue. As expected, the Timberlake collection system became surcharged. Township personnel continually monitored the various manholes where overflows might be expected to ensure widespread impact was not created. While no sewage overflowed from any manhole upstream of the pump station, sewage did "leak" from between the pre-cast joints of MH 1316 as a result of the system surcharge conditions. This was reported as a SSO and Township personnel will make this manhole watertight in the near future. Normal operation had to be resumed when the morning peak flows began on February 25<sup>th</sup>.
3. Storage tank at our Einstein Medical Center Pump Station was utilized to minimize flows to Timberlake. Township personnel diverted all flows that would normally go to Timberlake pump station and pumped that flow into the 281,000 gallon storage tank.
4. Similar operational adjustments were made at the Township's Germantown Pump Station, Sandra Lane Pump Station and Burnside Avenue Pump Station. All of which contribute sanitary sewer flows to Norris City Avenue.

All of the operational modifications to manage and reduce flows to Norris City Avenue were kept in place as long as possible and until such time as either the force main was repaired or the risk of SSOs in other areas of the Township was eminent.

It should be noted that Township personnel were onsite during your follow up site inspection on February 26<sup>th</sup> and to the best of my knowledge, all outstanding issues and concerns expressed by you, have been addressed.

#### Investigation into the Cause of the Break

Upon completion of the repair on February 25, 2016, Carroll Engineering Corporation (CEC) and Delaware Valley Insurance Trust (DVIT), the Township's sewer engineer and insurance carrier respectively, were notified of the force main break and proceeded to investigate.

Mr. Bernard Krasnisky  
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CEC met with Township staff to review the event and discuss possible causes. Consideration was given to the fact that the commercial power failure may have caused a “water hammer” condition that may have caused or contributed to the break, especially in light of the fact that a new VFD was recently installed on one of the pumps at the station. The VFD manufacturer’s representative was brought in and verified that all VFDs were programmed properly and functioned according to the program. The thought was that the power failure to the VFD caused the pumps to either stop or start abruptly thereby creating the water hammer condition.

CEC contacted the Ductile Iron Pipe Research Association (DIPRA), who has done extensive research on cast iron pipe. Mr. Paul H. Hanson, P.E. of DIPRA evaluated pictures taken of the failed section of pipe and suggested that soil samples be taken and analyzed to determine if soil conditions present at the break site might have contributed to the pipe failure. CEC has recently taken samples of the excavated soil stockpile, as well as soil samples at locations in the immediate vicinity of the break. These samples have been sent to DIPRA for analysis. The Township will include the results of this analysis in any follow up correspondence with the Department.

The Township has also provided information to CEC regarding the design of the pump station. Specifically, CEC will be evaluating the various anti-surge components installed at the station, such as the surge relief valve, anti-surge tank, and the hydraulic check valves. The goal is to determine if any of these components could have contributed to the force main break.

In its investigation of this event from an insurance claim perspective, DVIT has contracted with Mr. Gregory Paulson, P.E. of CED Investigative Technologies, Inc. (CED) to try and determine the cause of the break. Mr. Paulson was onsite on March 24<sup>th</sup> to look at the pipe and the break site. The Township has also provided Mr. Paulson with information regarding the pump station and flow information at the time of the break for his analysis.

### Summary

On behalf of the Township, CEC and DVIT are conducting parallel investigations to determine the cause of the Norris City Avenue Pump Station force main break that occurred on February 24, 2016. Currently, several possible scenarios as to the cause of the failure are being investigated, although neither the Township, CEC nor DVIT has ruled out the possible reasons at this time.

One is that the brief commercial power failure created a “water hammer” condition within the 16-inch cast iron force main whereby the pressure wave caused the break. While the pump station has all the appropriate features to eliminate, or at the very least minimize, water hammer conditions from occurring, the question is whether all these features were functioning properly at the time of the power failure.

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The second scenario is that soil conditions in the area of the break created a corrosive environment that, over time, weakened the cast iron pipe.

Scenario number three is that the failed section of pipe experienced some type of impact damage before or during installation that would have led to the break. DIPRA has provided the Township with a paper from 1980 entitled BREAKS IN CAST IRON PIPE (Paper), which details various possibilities as to cast iron pipe failures. A copy of this Paper is attached for your reference. Pages 2 through 4 of the Paper discuss the causes of breaks and impact damage specifically. Page 3 of the Paper states "A partially cracked or bruised pipe will often hold test pressure and may even serve normally for a period of time, depending on the extent of damage. Eventually failure may occur." Page 4 shows an illustration of a typical pipe fracture caused by impact damage. As you can see from the attached picture of the failed section of our Norris City Avenue force main, the fractures appear to be similar.

The fourth scenario under consideration is that some combination of the above scenarios contributed to the force main break at Norris City Avenue Pump Station.

While these investigations are active and ongoing, currently, no definitive timetable is available for the completion of the investigations. The Township would be willing to submit monthly progress reports to keep the Department informed as to our ongoing investigative efforts.

I trust you will find the information provided to be comprehensive and satisfactory. Please do not hesitate to contact me should you need anything additional.

Very truly yours,  
EAST NORRITON TOWNSHIP



Robert R. Hart  
Township Manager

Attachments

Cc: Board of Supervisors  
Sean P. Kilkenny, Law Offices of Sean Kilkenny, LLC  
Jonathan H. Spergel, Manko, Gold, Katcher & Fox, LLP  
Kenneth E. Heydt, P.E., Carroll Engineering  
Douglas R. Jones