INSPECTION REPORT OF 60-YEAR OLD 4-INCH CAST IRON PIPE ENCASED IN LOOSE POLYETHYLENE LAFOURCHE PARISH WATER DISTRICT NO. 1 LAFOURCHE PARISH, LOUISIANA AUGUST 7, 2018

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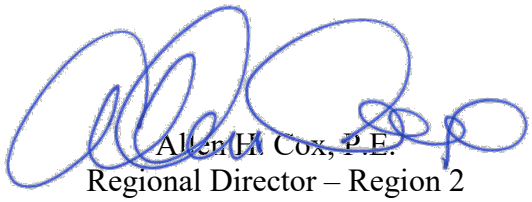

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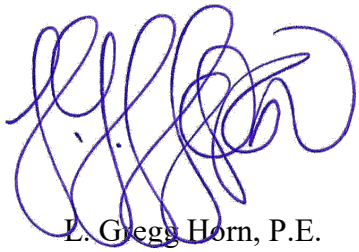

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INSPECTION REPORT OF 4-INCH CAST IRON PIPE ENCASED IN LOOSE POLYETHYLENE LAFOURCHE PARISH, LOUISIANA

INTRODUCTION

In 1958 the Lafourche Parish Water District No. 1 ("LPWD#1") installed approximately12,000 feet of 4-inch cast iron pipe. This pipeline is the first known installation to use loose polyethylene encasement as protection from a corrosive environment. On August 7, 2018 the pipeline was inspected for the eighth time to evaluate the condition of the pipe after 60 years of service in an extremely corrosive soil. The main was carefully exposed at two locations some 390 feet apart along Delta Farms Road - LA 657 (see Exhibit I). The pipe has push-on type joints and conveys potable water at approximately 65-70 psi.

The following people were present at the inspection:

LPWD#1
- Brian Shelvy, Distribution Manager
- Derick Harrington, Foreman
- Bradonn Ezell, Foreman
- Reid O'Quinn, Crewman
- Alex Duplantis, Crewman

American Cast Iron Pipe Company
- Jeff Slaughter, Research Engineer

McWane Ductile
- Jerry Regula, Product Engineer

U.S. Pipe
- Greg Key, Dir. of Technology & Product Development

Ductile Iron Pipe Research Association
- L. Gregg Horn, P.E., V.P. – Technical Services
- Allen H. Cox, P.E., Regional Director
- Paul H. Hanson, P.E., Regional Director
- Norman DeAgostinis, eng., Senior Regional Engineer
- Josh Blount, P.E., Regional Engineer
- Richard Pousard, P.E., Regional Engineer

INSPECTION PROCEDURES

Excavations of approximately six to eight feet of the water line at each location were conducted by the LPWD#1. The locations were approximately 613 and 1,003 feet, respectively, northwest of a flood gate on Delta Farms Road - LA 657 (see project map, Exhibit I). The locations were selected by LPWD#1 for ease of accessibility. At each location, the full circumference of the pipe was exposed to facilitate a thorough inspection.

About five to seven feet of the polyethylene film was removed and sent to TRI Environmental, Inc., of Austin, Texas for physical testing. The exposed pipe sections were thoroughly cleaned and inspected for evidence of corrosion. A steel wire brush was used to clean any surface oxidation and a geologist hammer was used to sound the pipe surface for any indication of pitting and/or graphitization. Prior to backfilling, the exposed pipe was encased in V-Bio® enhanced polyethylene.

SOIL ANALYSIS

Representative soil samples were procured from each of the two excavation sites and tested for corrosivity. The soils were in a saturated state. Each sample was a dark gray clay mixed with dark brownish-black peat with the following properties:

	Site #1	Site #2
Resistivity:	320 ohm-cm	480 ohm-cm
pH:	6.6	6.9
Redox:	- 40	- 30
Sulfides:	Positive	Positive
Chlorides:	Positive	Positive
Moisture:	Wet	Wet

These test confirmed the soil to be extremely aggressive to cast and/or ductile iron piping products.

POLYETHYLENE ANALYSIS

The polyethylene film was a sleeve that had been wrapped around the pipe. This method provided for a snug fit around the full circumference of the pipe with no sagging of the film that would leave voids between the film and the pipe surface. Physical testing of the film resulted in the following results, which are compared to the minimum values set forth in the initial 1972 revision of ANSI/AWWA C105/A21.5. As this was the first use of polyethylene encasement to control corrosion of a cast iron pipeline, this installation predated the standard by 14 years.

The average results of the tests compared to standard values are as follows:

	Transverse	Longitudinal	1972 Standard (minimum)
Thickness (in.)	0.007	0.007	0.0072
Tensile (psi)	1,671	1,260	1,200
Elongation (%)	550	169	300

OBSERVATIONS

Prior to DIPRA arriving at the inspection sites, the LPWD#1 conducted preliminary excavation of the existing 4-inch main at the two locations (see Site Map, Exhibit I). As the excavation approached the depth of the pipeline, hand excavation minimized potential damage to the polyethylene film. Pumping was required to control water seeping into the excavations.

Once soil was removed around the full circumference of the pipe, the encasement was cleaned and secured at its ends to facilitate removal of the film and replacement with new film prior to backfilling (see photographs A & E, Exhibit II). When the film was removed, considerable oxidation was observed along the entire exposed pipe surface (see photographs B & F, Exhibit II). The pipe was cleaned using a steel wire brush and water, and all of the oxidation was removed, proving it to be superficial. The surface of the pipe was then thoroughly sounded using a pointed steel hammer. No evidence of pitting or graphitization was found (see photographs C & G, Exhibit II). The pipe was then encased with new V-Bio® enhanced polyethylene (see photographs D & H, Exhibit II) prior to backfilling.

CONCLUSIONS

The results of this investigation confirmed the efficacy of polyethylene encasement in the protection of iron pipe in a highly aggressive soil environment.

By:

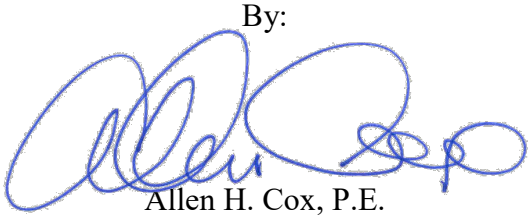

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EXHIBIT I: Location of Sites

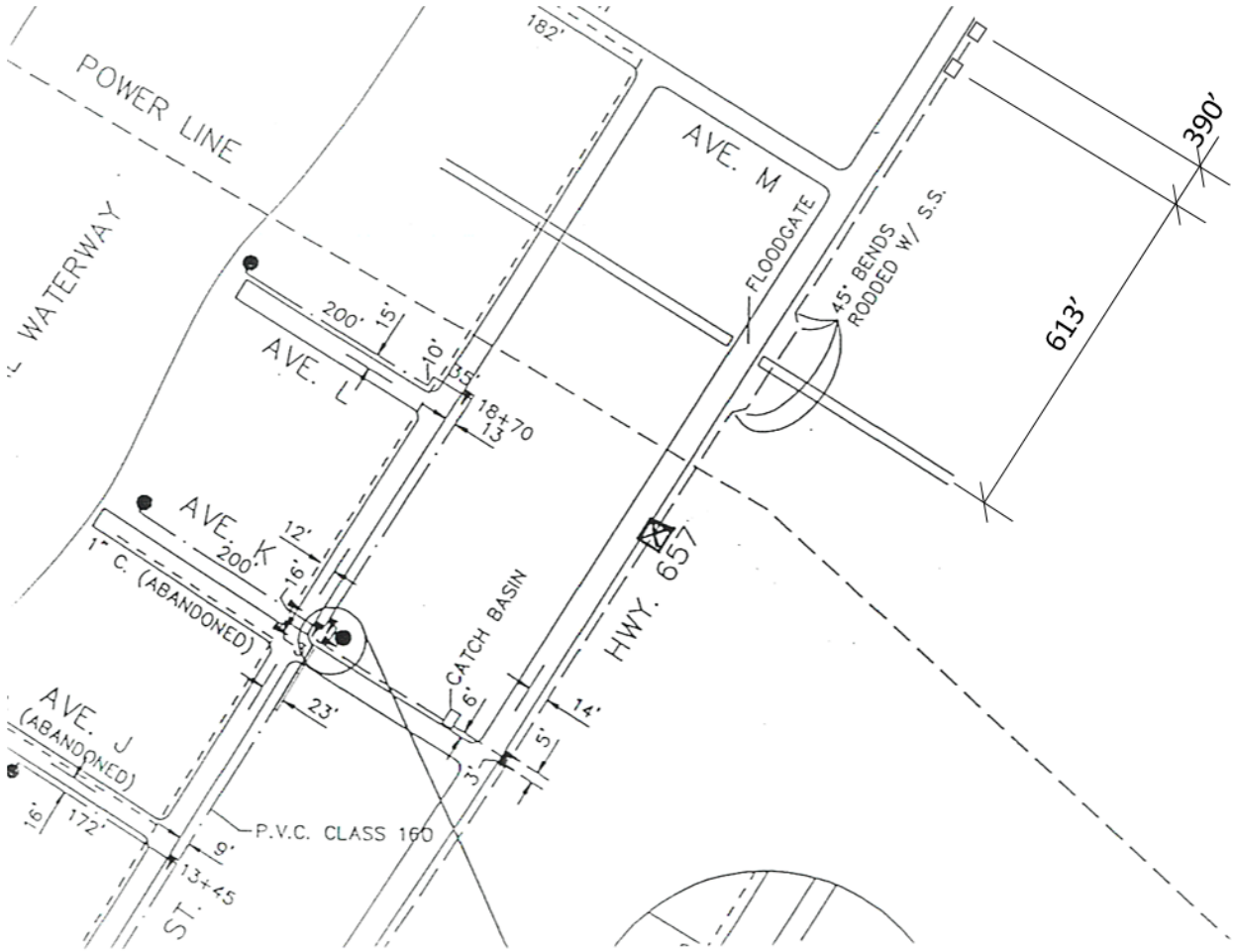

EXHIBIT II: Site 1

A: Pipe exposed prior to removal of polyethylene film

B: Polyethylene sleeving partially removed

EXHIBIT II: Site 1, continued

C: Encasement removed; after cleaning and sounding of the pipe surface. The oxidation was found to be completely superficial, with no pitting observed at any point along the exposed length of pipe.

EXHIBIT II: Site 2

D: Site 2 - Prior to removal of polyethylene film

E: Polyethylene removed, prior to cleaning exterior of pipe

EXHIBIT II: Site 2, continued

F: After cleaning and sounding of the pipe surface

G: Pipe encased in V-Bio® enhanced polyethylene encasement prior to backfilling