MEMORANDUM

TO: District Engineers

THROUGH: Larry Robinson, Engineering Supervisor LR

FROM: Jeff Hermansky, Northwest District Engineer JH

SUBJECT: Flow-fill Encasement, Policies 13.9.11 and 14.14.14

DATE: January 24, ~~1995~~ 1996

This policy is intended as a clarification of the Department of Environmental Quality/Water Quality Division (DEQ/WQD) Chapters XI and XII Regulation's for water and sewer line separation and crossings as well as WQD Policies 13.9.7 and 14.14.10. This policy adds normally constructed sewer lines embedded in flow-fill as an acceptable alternative method to protect water systems from possible contamination from leaking sewer lines when the minimum regulatory separation requirements can't be met. Currently, construction of the sewer line with water line grade pipe or the use of a carrier pipe for one of the lines are the only acceptable methods.

The Water Quality Division regulations require separation of water and sewer lines by ten (10) feet horizontally and eighteen (18) inches vertically. This regulation was derived from the 10 States Standards which were originally developed in the 1950's when clay pipe was the most commonly used sewer pipe. This was prior to the introduction of PVC sewer pipe and better joining systems for other materials which when properly installed, insure a virtually leak free system. The basis of this policy is that when sewers are installed in accordance with manufactures recommendations and then protected from movement, deflection, or damage, by embedment in flow-fill, the sewer will maintain its integrity and remain leak free for the life of the installation. With no leakage, nearby water lines, regardless of the vertical or horizontal separation, will be protected from potential contamination. Repairs or tapping of the lines embedded in flow-fill is possible since flow-fill is designed to be excavated with conventional excavation equipment.

Material

Flow-fill is also known as cement treated fill, non-shrink backfill, no shrink backfill, low density concrete backfill, structural backfill, etc. The mix design for flow-fill can vary greatly provided that it meets a 28 day compressive strength of between 30 and 60 psi. An acceptable design can be found in Section 02510 of the Wyoming Public Works Standard Specifications, "Portland Cement Treated Mixtures". The project engineer may modify this design to allow reject or recycled materials provided that the 28 day compressive strength is confirmed by lab testing to be between 30 and 60 psi. However, non-specification material is not recommended for heavy loading or water and sewer crossings in which structural support depends on the flow-fills shear strength. Air should be entrained at 1.5 to 2.5% to improve workability.

Installation - Pipelines

Assembly must be done under dry conditions with all joints completely cleaned of dirt and contaminants. Pipe ends and joints shall be kept covered until connection with next pipe segment or fitting. All joints shall be lubricated in accordance with the manufactures recommendations and assembled by pushing the spigot into the bell until the reference mark on the pipe barrel is flush with the end of the bell.

The pipe to be embedded in flow-fill can be laid on a 4 to 6 inch bed of washed gravel that has been excavated for the bells so that the pipe is uniformly supported along its entire length or the pipe can be set on 4 inch high blocks spaced no further that every 10 feet. The flow-fill or washed gravel must bear on undisturbed trench bottom. It may be necessary to stake the pipe to prevent lateral movement or floating during the placement of the flow-fill. The flow-fill must be placed carefully under and around the pipe and extend from undisturbed trench sidewall to sidewall. Placement may be by chute, bucket, or other means to assure that the line and grade of the pipe or pipes is maintained. The flow-fill must extend to at least 2 inches above the top of the pipe.

Installation - Pipe Crossings

Wherever possible, the pipes should be laid so there are no joints or taps within 9 feet of the crossing. The flow-fill shall extend from undisturbed earth at the bottom of the lower pipe to at least 2 inches above the top of the upper pipe and extend from one side of the trench to the other. Pipes crossing one another can be separated by as little as 2 inches when embedded in flow-fill according to the provisions of this policy. The block of flow-fill must be wide enough to ensure the structural integrity of the installation. All sewer services crossing over water mains must be encased in flow-fill in accordance with the provisions of this policy.

INSPECTION

It is recommended that full time inspection be performed where flow-fill is to be used. This is critical since pipeline integrity must be assured before the pipe is encased.

Of special concern are situations where sections of existing lines are replaced by new lines without testing before the new pipes are placed in service. If pressure testing is not possible, then the inspector must verify that all gaskets are properly seated (not buckled out of gasket groove). Verification can be performed by inserting a thin metal gauge - similar to a hacksaw blade - between the bell and the spigot around the entire circumference of the joint. The blade must penetrate only to a reference mark on the blade which indicates the depth of a properly seated gasket.

MEMORANDUM

TO: DEQ/WQD District Engineers

THROUGH: Larry Robinson, DEQ/WQD, Cheyenne LR

FROM: Jeff Hermansky, DEQ/WQD, Lander Jeff Hermansky

SUBJECT: Polyethylene (PE) Pipe, ANSI/AWWA C906-90
Policies 13.9.12 and 14.14.15

DATE: January 23, 1996

The DEQ/WQD Chapter XII Water Quality Rules and Regulations, The Design and Construction Standards for Public Water Supplies, were adopted May 24, 1985. Since that time, there have been many changes and additions in materials and equipment in the public water supply industry. Among these is the addition of AWWA Standard C906-90 for Polyethylene (PE) pressure Pipe and Fittings, 4 In. through 63 In., for water distribution. This policy statement is an acceptance of AWWA C906-90 as an authorized pipe material for water transmission and distribution systems as well as for pressure sewers. With this acceptance of AWWA C906-90, the January 17, 1986 letter to Donald Armstrong (Policy 14.14.8) denying approval of PE pipe for use as a public water supply transmission line, is hereby rescinded.

The authorization of high density polyethylene (HDPE) pressure pipe and fittings for water transmission, distribution, and pressure sewer is granted with the following conditions:

1. Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 63 In., for water distribution, must meet all the requirements listed in AWWA C906-90 or the latest revision.

2. All systems must undergo a hydrostatic pressure test at a pressure not exceeding 1.5 times the rated operating pressure of the pipe or lowest rated component in the system. The initial pressure test shall be applied and allowed to stand without makeup pressure for a sufficient time to allow for diametric expansion or pipe stretching to stabilize. This usually occurs within 2-3 hours. After this equilibrium period, the test section can be returned to the 1.5 times operating pressure, the pump turned off and a final test pressure held for 1-3 hours.

   Remember that pressure drop will not only occur due to pressure expansion, but also due to fluctuations in temperature during the test. As the temperature increases, the gauge pressure will decrease. Allowable amounts of makeup water for expansion during the pressure test can be found in Plastic Pipe Institute, PPI Technical Report TR31/9-79. If there are no visual leaks or significant pressure drops during

the final test period, the pipeline passes the test.

The preparations for the pressure test are usually made the afternoon before, the test period run in the morning, and the de-watering with clean-up done after lunch.

Refer to American Society of Mechanical Engineers code for pressure piping B31.8, Appendix N, for a general recommended practice and procedure for hydrostatic testing of HDPE pipe. The pipe manufacturer should be consulted for current written test procedures.

3. Installations must be done in accordance with all the manufacturers recommended procedures. The design engineer must incorporate the necessary procedures into the project specifications.

In addition, the following recommendations and design considerations need to be taken into account:

1. The pressure class required for high density polyethylene (HDPE), PVC, and ductile iron is determined by different AWWA standards. For example, Class 100 PVC is not the same working pressure rating as Class 100 HDPE. Therefore, when determining working pressure rating, consult the AWWA standard appropriate for each material.

2. Bends can be achieved in HDPE pipe by cold sweeping at a minimum radius of 25 times its nominal O.D. size.

3. Permeation - PE is subject to permeation by diesel and gasoline as well as by a number of other chemicals. Despite the absorption of certain chemicals, the pipe still retain's a large measure of its tensile strength and stiffness as evidenced by successful application in crude oil and natural gas gathering lines. In areas where hydrocarbon contamination exists in the ground, special evaluation is warranted for any pipe. For HDPE pressure pipe, it is recommended that an additional 0.5 derating factor be applied to the hydrostatic design stress rating of the pipe when permeation is known to occur. Consult with the pipe manufacturer for specific recommendations for addressing the conditions anticipated.

   In water distribution systems where lines or services may remain relatively stagnant, chemical permeation may result in concentrations of the contaminant above the drinking water MCL. This problem should be compared to permeation potential in other pipe systems where gasket materials may be far more permeable than HDPE. AWWA C906-90 states that "Research has documented that pipe materials such as polyethylene, polybutylene, polyvinyl chloride, and asbestos - cement; and elastomers, such as used in jointing gaskets and packing glands, may be subject to permeation by lower-molecular - weight organic solvents or petroleum products. If a water

pipe must pass through such a contaminated area or an area subject to contamination, consult with pipe manufacturers regarding permeation of pipe walls, jointing materials, and so forth, before selecting material for use in that area."

4. There are many installation requirements for HDPE that differ from either ductile iron or PVC procedures. Is highly recommended that all installations of transmission and distribution system piping be inspected by an engineer or technician familiar with the manufacturers recommended installation practice.

5: HDPE pipe will expand or contract approximately 1.4 inches per 100 feet for each 10 degree F change in temperature. Stresses caused by temperature change are dissipated due to the thermoplastic nature of the material which relaxes and adjusts with time. Direct buried pipe will generally have ample soil friction and interference to restrain movement of the pipe under normal application temperature changes. However, it is a good idea to make the final tie-ins on a system at a temperature which is as close to operating temperature as possible.

JH/jyi

To: DEQ/WQD District Engineers

From: Lou Harmon, Water and Wastewater Section, Program Manager
James Brough, Northwest District Engineer

Lou Harmon

Subject: Very Low Slope Sewer Variance, Policy 13.9.13

Date: April 2, 2010

The minimum slopes values defined in Chapter XI, were established for clay pipe flowing full to obtain a velocity greater than 2 ft/sec to flush or clean a sewer line of deposited solids. Often on sewer mains with few service taps (e.g., less than 100 residential connections), flow rates are seldom great enough to produce a flushing velocity of at least 2 ft/sec at the regulatory minimum slopes. Sewer lines installed today should have less maintenance needs since most of today's sewer materials consist of smoother material (e.g., PVC rather than clay) with fewer joints (e.g., 20-foot spacing rather than 3-foot spacing).

VARIANCE POLICY

This policy grants approval of very low slope sewers that meet the following conditions:

1. The minimum slope permitted for 8-inch pipe will be .002 ft/ft. The minimum slope permitted for 6-inch pipe will also be .002 ft/ft since the low flow velocities are just as high in a 6-inch pipe as in an 8-inch pipe. The minimum slope for larger than 8-inch pipe will be reviewed on a case-by-case basis, but will not be less than one-half (1/2) of the minimum slopes listed in the Chapter XI, Part B, Section 9.

2. A letter must be provided by the municipality or homeowners association that will operate and maintain the very low slope sewer, indicating their approval of the design.

3. The pipe must be bedded with Type 1 bedding material using Type A trench backfill methods or cement treated fill in accordance with the Wyoming Public Works Standard Specifications, Section 02225.

4. The pipe must be installed using a laser to ensure an accurate and uniform grade..

5. Very low slope sewers are granted a variance under this policy to eliminate the need for a lift station, avoid groundwater and excessive dewatering costs or to replace existing sewers installed at less than minimum regulatory grades. They can also be used to prevent sewer line extensions from 'rising out of the ground' too quickly in flat areas.

6. All very low slope sewers should be installed under the supervision of a full time inspector. Wyoming Public Works Standard Specifications should be adhered to for the testing of sewer lines after installation. Very low slope sewer lines should also be inspected with a camera while water is flowing through the sewer.

Any variance requests not in compliance with this policy must be handled on a case-by-case basis.

History

Very low slope sewers are sewer lines installed at less than the minimum slopes listed in Chapter XI, Part B, Section 9. The WQD has received numerous requests for a variance to the minimum slopes listed.

The main reasons for this variance request are:

1. For replacement of existing sewer lines already installed at less than minimum slopes,

2. The avoidance of lift stations, and

3. To prevent sewer line extensions from 'rising out of the ground' too quickly in flat areas. Historically, very low slope sewer variances have been granted on a case-by-case basis. This policy has been developed to provide for the approval of very low slope sewers that meet the design and construction conditions listed at the end of this policy.

Basis for variance

1. There is substantial out-of-state and in-state experience to support the successful use of very low slope sewer lines.

2. A documented example can be found in The Small Flows Clearing House in West Virginia's "Case Study Number 11 - Erickson, Nebraska, Flat Grade Sewers." This case study along with 80 years experience with very low slope sewers in Nebraska have demonstrated that very low slope sewer lines perform well and have not required noticeably more maintenance than conventional sewers.

3. Two experienced, independent sources reported that main causes for sewer maintenance are:

A. Root and grit intrusion through defective joints, and

B. Low area "saddles" due to settling or improper construction, rather than the installation of very low slope sewer lines.

4. Very low slope sewer lines have benefited several communities by avoiding the initial costs of lift stations and dewatering costs.

5. This policy should also help reduce long term operation and maintenance costs and reduce other factors such as infiltration and hydraulic loading on wastewater treatment systems, especially lagoons.