Chemical Grouting:

Stopping Groundwater Infiltration at the Service Connections

By Dick Schantz, P.E.

Chemical grouting of sewer mains to control groundwater infiltration and exfiltration at joints and connections has become the mainstay of many sewer system maintenance and rehabilitation programs. Lining sewer pipes has often not stopped infiltration, only diverted the infiltrating groundwater to manholes and cut out service connections, allowing annular (void space between the old pipe and new liner) infiltration flow to dump into the lined main. Chemical grouting stops all these service lateral cutout infiltration sources.

The chemical grouting process is more than 40 years old and lateral grouting has been done for the past 20 years, demonstrating an effective method for stopping groundwater entry at these well-known sewer system infiltration entry points. The process adapts to almost any main and lateral connection geometry, is not dependent upon a chemical seal or mechanical bond with the host pipe or lining materials and can be done at an economical production rate. Grouting materials are non-proprietary, reasonably priced and the installation equipment and qualified, experienced contractors are readily available.

Chemical Grouting Is a Void Sealing Process

The use of the word grouting in the process description, however, is misleading and often promotes a misunderstanding as to how the process works, why it is so effective and how to contract for the best results. Chemical grouting is not a joint and crack filling or

cementing process. Instead, two water-based chemicals are mixed and injected under pressure at the point of sewer joint failure or infiltration entry. Under pumping pressure, the grouting chemical mix passes through the sewer joint, crack or into the annular space between old pipe and new liner at the service cut out and into the annulus and surrounding soil with back fill materials filling the soil voids and displacing the groundwater. The chemical grout mix rapidly gels in the annulus and adjacent soil, effectively stopping the flow of groundwater. The sewer pipe backfill and pipe bedding soil on the outside of the sewer in the area of the leak is stabilized because the groundwater is no longer flowing into the main and carrying fines into the sewer system. The injection and sealed soil volume exterior to the pipe can often be very large compared to the pipe displacement. Joint leak sealing in 8-in. pipe can take 0.5 to 2 gals of grout, and with 20 percent water to soil material void volume, this amount of grout seals 2.5 to 10 gals of soil around the leak. This large grout ball or soil mass further impedes groundwater flowing outside the old sewer main in the pipe bedding materials.

Understanding Groundwater Flow Patterns Leads to Grouting Solution

This same technique is used for stopping infiltration at lateral service connections in lined sewer pipes. Groundwater present on the outside of the old pipes continues to infiltrate through lined-over leaking pipe joints into the small gap or annular space formed between the old pipe inner wall and the outside of the new liner. When a lateral connection coupon is cut from the liner, this annular space is exposed and infiltration flows immediately into the sewer main, negating the sealing effect the liner had on reducing infiltration.

Secondly, the lining process does not stop the existing flow of groundwater in the old pipe backfill and bedding soil trench; this results in a continuation of the "French Drain" effect that flows groundwater around the outside of the old pipe "downstream" toward any entry point the infiltrating water can find into the sewer service and main piping. While infiltration flow into the sewer is initially reduced by lining, the water table adjacent to the sewer pipe may actually raise over time, increasing pressure and infiltration rates into the main at the lateral connections through many points including lateral service connections and break-in connection taps and adjacent service pipe joints. From this annular space, infiltration flow is being released at the service connection cutout.

Grouting Chemicals Remain Fully Hydrated in Active Sewers

The sealing chemical does not shrink or dry out because it is in contact with the sewer and groundwater, wicking water from both sources and maintaining its water of hydration and effective soil seal volume and plasticity.

A specially built grout delivery packer is easily maintained and effective tool

The chemical injection packer used for lateral grouting forms three seals within the lateral connection structure. The main is blocked off immedi-

ately above and below the lateral connection and a third plug is concurrently launched up the lateral line to a predetermined distance from the main (normally 1 to 8 ft but occasionally as much as 15 to 30 ft). Once the packer is positioned in place, the bladders are inflated and the lateral pipe and connection are isolated.

This isolated volume of air and water captured between the plug ends, referred to as the void area, is the space where the chemical grout is injected, mixes and then under continual pumping pressure flows out of the void into the surrounding soil and into the liner annular space up to a distance of 3 to 5 ft or more. As the sealing chemical is being pressure-injected into the void area, the void pressure is monitored by the operator. As the process continues, the operator will see an increase in void chemical pressure, indicating the sealing chemical is flowing further out into the soil and liner annulus. After a short pumping period, the chemical mix will begin to gel and the void pressure will rapidly rise, signifying to the operator that the grout chemical has gelled and the connection is sealed. At this point, pumping is ceased and the grout is allowed to cure for a period of about one minute.

Chemical Grouting Process Is Adaptive and Effective

The two-part, water-based grouting chemicals are environmentally safe and harmless when correctly handled. The chemicals are initially kept separate by using two independent solution tanks, pumps and a multi tube hose system that delivers the chemicals up to 700 ft away from the grout truck system making most sewer joints and laterals easily accessible from manholes.

Grout Operator Training and Specification Writing Information Available

Training for grouting specification writers, inspectors and equipment operators can be obtained through the training courses run by industry suppliers. These courses and related chemical grouting information can be obtained through the Infiltration Control Grouting Association (ICGA), a Division of the National Association of Sewer Service Companies (NASSCO) at *www.sewergrouting.com*.

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