

# What's Under That House?

## What's Under That Graveyard?

By: Tonia Jurbin, PEng

Like something out of a Charles Dickens novel, the City of Victoria (the City), has about 10kms of large brick storm sewers that were built between the late 1800s and the 1930s. These large brick sewers were built in a variety of shapes including tear drop, egg, arch and even a few circles that range in sizes of up to 2,100mm wide and up to 1,200mm tall depending on the shape and application. Many of the brick sewers were built when filling in historical creeks and streams. Today all of these sewers are all used for storm water though historically some of them were used as sanitary sewers. The City only awards trenchless rehabilitation work on the brick sewers to prequalified contractors.

Sometime in the mid 2000s the City started investigating the brick conduits using camera inspections and assigning ratings from 1 to 5. To date they are almost half way through the program having completed almost 4kms and all of the sewers that were rated a '5'. As the program continues new technology is constantly being reviewed. In some cases, full segment lining or rehabilitation may not be necessary. Where the consequences of failure are lower a cementitious or geopolymer spray might be the rehabilitation method of choice. Where the consequences of failure are high, especially for the larger pipes, CIPP or sliplining using the Glass Reinforced Pipe (GRP) is being used.

The deterioration is not just a matter of failing mortar, some of the worst pipes have significant, even alarming, deformation and are close to collapse. Differential loading and cracking failures longitudinally along the crown have the highest priority for rehabilitation as there are houses sitting above some of these

*Victoria's brick sewers were built in a variety of shapes*



*Condition of the crown put this section high on the City's rehab priority list*



*Main service pit was relocated due to utility conflicts with site access was very tight in this predominantly residential neighbourhood*

big old pipes. In some cases, the pipes are so badly deformed it's impossible to line them with anything close to the original size. There are also a few unique sections where the pipe goes through or near rock and there is no brick where the rock becomes a part of the conduit.

The GRP liners supplied by Channeline International—GRP Structural Lining Systems have a smooth 1.5mm thick corrosion resistant inner lining on their approximately 25mm walls that significantly increases the flow when compared with the turbulent flow through a very rough and aged surface that also has considerable sediment and debris deposits. The outside of the GRP liner is treated with a bonded graded aggregate to enhance adhesion to the annular grout required after the liner installation is complete.

Consultant for the City Eric Leydon, P. Eng. with Aecom Canada Limited elaborates, "In some cases the liner is much smaller than the host pipe, for example we did one in 2018 where the host pipe was 1006mm tall by 1600mm wide but it was so deformed the GRP liner we used was 760mm tall by 1500mm wide. With such a reduced flow area there is often a



*Brick pipes cleaned out using high pressure water, and debris removed by hydrovac*



Correctly sized pipe segments were delivered to the site from Dubai

“There was no open cut option to carry out this work because of the existing properties above.”

capacity reduction however the intent of this particular program is structural rehabilitation. In this specific example an earlier diversion was installed to manage the majority of the flow that previously went through this stretch of pipe.”

In parts of Victoria just outside of the downtown core there are homes in older neighbourhoods that are directly above some of the brick conduits. The initial camera inspection in the

neighbourhood under discussion revealed enough dips and cracks in the crown of the pipe for the City to put this section high on the priority rehab list and was rated as a ‘4’. The big concern at this site was because of the additional loading of the single family dwellings over the alignment, and another five properties that were at risk of developing sink holes.

There are few trenchless rehabilitation contractors in the Capital Regional District (CRD). PW Trenchless of Surrey BC easily prequalified for this work as they have been growing their experience with GRP liners for storm sewer applications and most recently completed a first in BC, having rehabilitated a 1500mm sanitary conduit live – that is without building a bypass or interrupting the flow.

With their growing experience of using this product they were awarded the contract to line a 120m section of a 1930s 1070mm high by 1860mm wide brick storm sewer. The GRP



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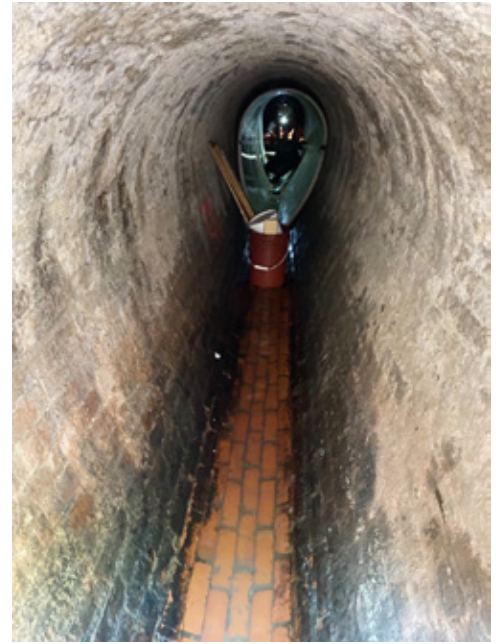
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*GRP liners conform to the unique shape of the existing pipe*

used for this project was 1020mm high by 1770mm wide using one service pit on the street outside a home. The liner was pushed 100m in one direction directly under three houses and other properties to an existing manhole, and then another 20m in roughly the opposite direction to another existing manhole.

Once a contract for rehabilitation using GRP is awarded the pipe that needs to be rehabilitated must be properly surveyed so that the correct size of pipe can be ordered from the manufacturer in Dubai. The waiting period is up to 10 weeks. The pipes were cleaned out using high pressure water, the debris removed by hydrovac.

After the pipes are cleaned out a custom-built mandrill was used to determine the internal diameter of the pipes – after which time the GRP liners were ordered. Towards the end of the waiting period the equipment is mobilized, the bypass set up, service pits might be excavated and other preparatory tasks are managed. An above ground 200mm bypass had to be installed which took about five days. Because this is a storm sewer there is an overall lower risk as small leaks would not be catastrophic but flooding is still a risk so the bypass must be installed with care.



*Each 2.4m segment of GRP was carefully pushed together for a watertight joint*



*Each GRP segment was maneuvered into place using an electronic motorized cart*



Each seam had internal gasket and external seal



GRP segments are treated with bonded graded aggregate material to enhance adhesion to the annular grout



Man entry was necessary prior to grouting

*“The big concern at this site was because of the additional loading of the single family dwellings.”*

The soil fortunately could take a vertical cut in dry weather so shoring cages worked well at this site. Once the excavation was set up a 3m access hole was cut into the crown of the brick pipe long enough to accept the 2.4m GRP segments.

Utility conflicts made it necessary to relocate the main service pit. The original location was too close to the sanitary, gas and water. Like so many trenchless projects contractors have to be nimble since you just don't know what you have until there's a shovel in the ground.



Annular grouting completed the construction process



*Intent of the sliplining program is a fully structural rehabilitation*



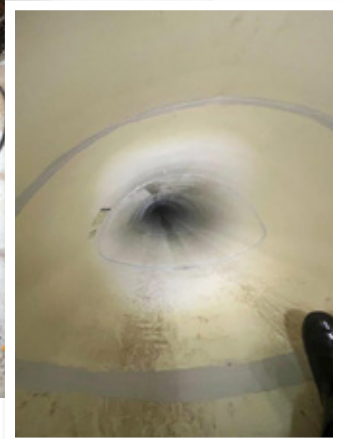
*Laterals were located and cut*



*There is growing experience with using GRP liners for storm sewer applications, with an ability to be installed through major vertical and horizontal bends in the host pipe*



*Project was successfully completed with minimal disruption*



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The GRP was dropped into the service pit and then 'chauffeured' into place by the crew lead using an electronic motorized cart. The next pipe was fitted with a gasket then lined up and carefully pushed together for a watertight joint. This description is a little vague as the contractor has some trade secrets to protect. The whole process took about 7 weeks including the bypass, set up, installation, grouting and final testing. There was no open cut option to carry out this work because of the existing properties. All property owners were notified and kept well informed so the project was successfully completed with minimal disruption. †

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