

NOVAFORM™
PVC LINER

PROJECT PROFILES



IPEX
Committed to Excellence

Culverts Get New Life with NovaForm™ PVC Liner



Reel is heated with steam to make the PVC flexible to slip through the inside of the culvert

Culverts along Highway 7, west of Lindsay, Ontario, were revitalized using NovaForm™ PVC Liner, a product developed as part of IPEX's trenchless technology product portfolio.

Corrugated steel and concrete culverts are subject to deterioration at the invert of the pipe and at the joints due to corrosion, abrasion and ground movements. Because replacing either steel or concrete culverts is an expensive, time-consuming, and disruptive process, Ontario's Ministry of Transportation chose NovaForm™ PVC Liners to rehabilitate the current culverts instead. The liners provide continuous, seamless, tough, corrosion-free surfaces with a life-span of more than 50 years — without the expense of digging up and removing old culverts and replacing with new.

NovaForm™ PVC Liners are extruded to the lengths required and then coiled on reels that are taken to the worksite. At the Lindsay project, rehabilitation was completed for six 300mm culverts and two 750mm culverts, ranging between 20m and 24m in length. David Ohayon, IPEX Management Inc., adds,

The liners provide continuous, seamless, tough, corrosion-free surfaces with a life-span of more than 50 years — without the expense of digging up and removing old culverts and replacing with new.

"Structural design is done for every project. We input the material properties of the liner along with the conditions on site, including: soil type and density, the depth of the water table, and the type of traffic/live load that is located above the culvert. We use these factors to ensure that the structural thickness of the liner meets and exceeds the requirements of the location."

At the site, the reels are heated with steam to make the PVC flexible to slip through the inside of the

culvert. While the PVC is heating, water flow through the culverts is blocked or diverted with sandbags and pumps, and the interior of the culvert is cleaned of sediment and water. Any sharp edges from damaged pipe are smoothed and any significant missing sections at the invert of the pipe are filled, as the liner will expand into the void.

Once the surface of the inside of the culvert is clean and dry, the now-pliable liner can be pulled through the inside of the culvert. Each end of the liner is plugged with special expandable "pass through" rubber plugs which have outlet ports to connect to hoses that apply steam and air pressure to the inside of the liner. When the liner is fully-expanded, it is completely sealed and tight to the original culvert wall. The liner is then cooled and trimmed, and flow to the culvert is reinstated. The lining for the 300mm culvert has a thickness of 7mm and the 750mm culvert liner has a thickness of 11.5mm and are based on structural calculations.

The advantages of this process are many:

- Money is saved because no major excavations are necessary.
- Road closures and traffic disturbances are short-term. The total time involved to install one liner near Lindsay was approximately 4 hours — a big savings in time over normal culvert replacement.
- If the process has to stop at any time, and the NovaForm™ PVC Liner cools and hardens, it can be heated up again and the process can continue—be it the next day, week or even a year later.
- The NovaForm™ PVC Liner is abrasion resistant, so the invert is protected from degradation from gravel and debris. Because of the smoothness of the liner, there is a net gain in hydraulic performance of between 15 and 20 percent.
- The biggest advantage is the installation's zero-effect on the environment. Because the process of heating the liner on the reel and expanding it within the culvert uses steam and air, only water is released into the environment. There is no odor, no Styrene and no chemical run-off to contain and dispose of. The process is safe for the contractors and the environment.



The engineers at IPEX recognized a need in the field of pipe rehabilitation and responded with NovaForm™ PVC Liner, a product that brings the lasting benefits of factory-made PVC pipe to the North American trenchless pipe rehabilitation industry. Time- and money-saving, tough and long-lasting but kind to the environment, the NovaForm™ PVC liner is the ideal trenchless option for culvert and sewer pipe rehabilitation. Tested to stringent ASTM standards, Nova Form™ PVC Liners are available in sizes ranging from 150mm to 750mm.

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Project Name:

8" NovaForm Pilot Project – Valley Springs, SD

Date/Time:	Weather:	Location:
October 28, 2015 12:00pm to 5:30pm	Cloudy, High Winds, Blowing Snow, Temperature Low/High: 34 °F /42 °F	Broadway Avenue in Valley Springs, small town east of Sioux Falls

Host Pipe and Access Points:

- Host pipe: 8" (200mm) Clay Sanitary Sewer
- Host pipe located under the right side of the roadway
- 4 sanitary services, 6" in size
- Manhole to Manhole length: 317ft
- Manhole A depth: 8.5ft (approx.)
- Manhole B depth: 9.5ft (approx.)
- Manhole material: Brick
- Liner pull direction: Downstream

NovaForm Liner:

- OD/DR: 8" (200mm) / Extruded DR 27.5
- Length: 360' (110m)
- 4' x 8' metal frame reel with center shaft 3" OD

Installation Details:

- 12:00pm – Pre-lining inspection video started while 2 operators positioned the A-Frame at the A-side manhole. The water reservoir was filled on the boiler truck and it was started.
- 1:12pm – Reel is covered with a tarp and the inner end of liner on the reel is steamed in order to insert inflatable plug.
- 1:50pm – Flusher moved from B to A side, and nozzle sent through to the B side to pull back camera to B side.
- 2:20pm – Winch positioned at B-side, roller support plate put in place around manhole and secured under winch feet.
- 2:30pm – Winch rotating head attached to camera and pulled back to A side with flusher nozzle.
- 2:40pm – Roller inserted into B-side manhole and set into position (height above invert, distance from manhole wall).
- 2:50pm – Roller fully secured in manhole, support shaft secured to support plate with gear strap, and top of shaft secured to winch body using straps and ratchet tie down.

Installation Details:

- Liner at steady state temperature (around 150F), and ready for pulling after about 45 minutes.
- B-side crew cuts the liner back to the base of the manhole and inserts plug. B-side control station set up and outlet steam hose connected.
- B-side: Compressed air @ 86F and 15psi and turned OFF. Liner fully processed.
- CCTV inspection started and camera shows excellent liner expansion, revealing joints in original clay host pipe and very well defined and dimpled lateral services.
- Services reinstated by using robotic cutter to cut out PVC liner at dimples.
- Liner installation is finished, crew cleans up and leaves job site.

Images:



Boiler truck/Air compressor and Reel on A-Frame on Flatbed trailer at A-side



Positioning the steam hose at liner inner end to prepare for inflatable plug insertion



Liner de-reeled and pulled through on A-side, showing remaining liner on reel

Images:



Thermocouple taped to liner on A-side for monitoring of temperature during processing



B-side control station monitoring temperature and pressure during expansion /cooling stage



Boiler truck/Air compressor and Reel on A-Frame on Flatbed trailer at A-side

Project Name:

200mm Sanitary Sewer – Alston Place, Santa Barbara, CA

Date/Time:	Weather:	Location:
September 29, 2016 9:00am to 5:00pm	Sunny, Mild Wind Temperature High/Low: 25°C /16°C	Alston Place, intersection Alston Street, Foothills in Santa Barbara, CA

Host Pipe and Access Points:

- Host pipe: 200mm (8") Vitrified Clay Pipe
- Access Point A: Manhole
- Access Point A Depth: 2.5m (approx.)
- Total length to be relined: 69m
- Access Point B: Manhole
- Access Point B Depth: 2.6m (approx.)

NovaForm Liner:

- OD/DR: 200mm (8") | DR 35
- 4' x 8' metal frame reel with center shaft 3" OD
- Length: 80m
- Liner pull direction: Downstream

Installation Details:

- Liner installed on steep slope (15 degrees) on hillside, which made setting up of boiler and other equipment more challenging.
- Conditioning time was 30 minutes, pulling time was 3 minutes.
- Liner is processed and cooled in roughly 80 minutes, with maximum pressure of 6psi for steam and 13psi used for cooling.
- Plug removal and liner end trimming took 30 minutes.
- 6 services total are reinstated by robotic cutter.
- Preparation time and cleanup took the same amount of time (4 hours) as the entire PVC lining procedure.

Images:



Liner pulled through at A-side manhole



Liner emerging from B-side manhole



Plug insertion in a "kangaroo" pocket style on reel (A-side)



Liner starting expansion at A-side



CCTV snapshot of relined host pipe with "dimple" showing at 4" service lateral



CCTV snapshot of reinstating service lateral via robotic cutter

Project Name:

600mm Sanitary Sewer – Downtown St. Catharines, ON

Date/Time:	Weather:	Location:
August 14-15, 2017 8:00am to 6:00pm	Sunny, Mild Wind Temperature High/Low: 26°C /17°C	Ontario Street, intersection Welland Ave. Downtown St. Catharines, ON

Host Pipe and Access Points:

- Host pipe: 600mm (24") Vitrified Clay Pipe
- Access Point A: Manhole
- Access Point A Depth: 4.0m/4.2m (approx.)
- Total length to be relined: 2 sections, 58m each
- Access Point B: Manhole
- Access Point B Depth: 4.2m/4.3m (approx.)

NovaForm Liner:

- OD/DR: 600mm (24") | DR 66
- 8' x 8' metal frame reel with center shaft 3" OD
- Length: 2 liners, 70m each
- Liner pull direction: Downstream

Installation Details:

- Significant bypassing of flow required upstream of the two line segments to be relined. In addition, a 60 unit apartment building was draining into the intermediate manhole between both host pipe sections, so provisions had to be made to control that flow as well.
- Conditioning time for each reel of NovaForm was approximately 4 hours, during which time all preparation was being done.
- Liners pulled through in approximately 3 minutes each.
- Due to liner and plug size being smaller than manhole openings, the plugs were inserted below the road surface/manhole ring and deep enough so that visual clearance of the liner at both host pipe ends was maintained.
- Liner is processed and cooled in roughly 70 minutes for each line segment, with maximum pressure of 11psi used for cooling.

Installation Details:

- Plug removal and liner end trimming is more time consuming than usual due to a 24" liner inside of a 48" manhole making access challenging.
- 6 services total are reinstated by robotic cutter (2 plus 4).

Images:



Liner pull head preparation
(folded liner)



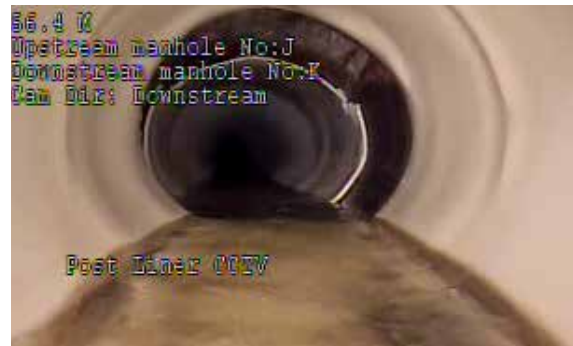
NovaForm liner exits
at B-side manhole



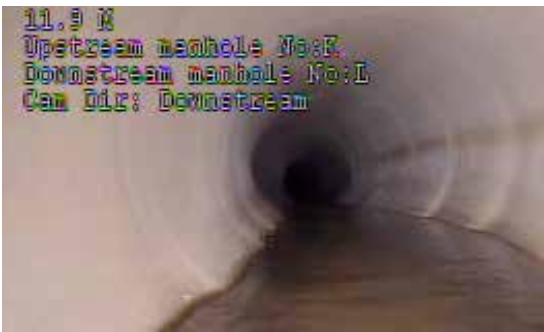
Plug inserted vertically
below surface



Finished and Trimmed NovaForm
liner (at intermediate manhole)



CCTV Snapshot of end of 1st liner and start
of 2nd liner (at intermediate manhole)



CCTV snapshot of relined
host pipe with flow



Active service that has been
reinstated via robotic cutter

Project Name:

600mm Road Drainage Culvert – Stoney Trail/Sarcee Trail, Calgary, AB

Date/Time:	Weather:	Location:
September 19, 2017 8:00am to 3:00pm	Overcast, Mild Wind Temperature High/Low: 12°C / 2°C	South Underpass of Sarcee Trail crossing Stoney Trail Ring Road, Northwest area in Calgary, AB

Host Pipe and Access Points:

- Host pipe: 600mm (24") Corrugated Steel Pipe Culvert
- Access Point A: Ditch/Open outlet
- Access Point A Depth: 2.0m (approx.)
- Total length to be relined: 140m
- Access Point B: Ditch/Open outlet
- Access Point B Depth: 2.0m (approx.)

NovaForm Liner:

- OD/DR: 600mm (24") | DR 66
- 8' x 8' metal frame reel with center shaft 3" OD
- Length: 50m
- Liner pull direction: Upstream

Installation Details:

- Overnight from 9:00pm - 11:00am: Conditioning of Liner with external steam on an A-frame with Tarp cover. This was done due to near-freezing overnight temperatures, to ensure the full length of the liner was thoroughly heated through as this was a full reel with 3,700kg of PVC liner on it.
- 11:00am – 11:07am: Liner is pulled through host pipe upstream with winch boom lowered to bottom of channel to line up properly with Access point A.
- 11:20am – 11:40am: Plugs inserted on both A and B sides of liner.
- 12:30pm – 1:15pm: Liner is processed/expanded using steam reaching a maximum temperature of 225F and 5psi at B-side.
- 1:15pm – 2:00pm: Liner is cooled using compressed air at 7psi on B-side, until temperature is cooled to 100F.
- 2:00pm – 3:00pm: Plugs are removed and liner ends are trimmed and cleaned up.

Images:



Liner conditioning under tarp on A-side



NovaForm liner pull head entering culvert



NovaForm liner pulled through to B-side



Liner expanded on A-side



Finished and Trimmed NovaForm Liner (at outlet)



Inside of finished liner (at 100m)



Inside of finished liner (at outlet)

Project Name:

600mm Road Drainage Culvert – Dawn-Euphemia (Lambton County), ON

Date/Time:	Weather:	Location:
March 9, 2017 8:00am to 4:00pm	Cloudy, Snow flurries, Wind Temperature High/Low: -5°C / -9°C	Diagonally under ON-2 road, near Shetland in Lambton County, ON

Host Pipe and Access Points:

- Host pipe: 600mm (24") Corrugated Steel Pipe Culvert
- Access Point A: Concrete catch basin
- Access Point A Depth: 2.4m (approx.)
- Total length to be relined: 44m
- Access Point B: Concrete catch basin
- Access Point B Depth: 2.5m (approx.)

NovaForm Liner:

- OD/DR: 600mm (24") | DR 66
- 4' x 8' metal frame reel with center shaft 3" OD
- Length: 50m
- Liner pull direction: Downstream

Installation Details:

- 8:00am - 11:00am: Conditioning of Liner with external steam in an enclosed road trailer.
- 11:00am – 11:03am: Liner is pulled through host pipe downstream with winch boom at top of channel at Access point B.
- 11:20am – 12:40pm: Plugs inserted on both A and B sides of liner. Cold ambient temperatures (-6°C) were challenging and auxiliary heat was provided by using a Propane heating rosebud (Tiger Torch) and covering the exposed liner with a tarp.
- 1:00pm – 2:00pm: Liner is processed/expanded using steam reaching a maximum temperature of 228F and 6psi at B-side.
- 2:00pm – 2:40pm: Liner is cooled using compressed air at 10psi on B-side, until temperature is cooled to 100F.
- 2:45pm – 3:30pm: Plugs are removed and liner ends are trimmed and cleaned up.

Images:



B-side catch basin looking upstream to A-side



NovaForm liner pull head entering culvert



Raising liner skin temperature at A-side using Propane torch



Liner expanded on B-side (flared)



A-side invert (before)



A-side invert (after)



B-side invert (before)



B-side invert (after)

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