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Strategic Trenchless Rehabilitation Technologies for Water Loss Reduction

21 JULY 2026

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WEBINAR INFORMATION – HOUSEKEEPING RULES

- This webinar will be **recorded and made available "On-demand"** on the IWA Website and the IWA Connect Plus platform with relevant information.
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WEBINAR INFORMATION – HOUSEKEEPING RULES

- **'Chat' box**: please use this for general requests and for interactive activities.
- **'Q&A' box**: please use this to send questions to the panelists. (We will answer these during the discussions)

Please Note: *Attendees' microphones are muted. We cannot respond to 'Raise Hand'.*

AGENDA

- **Introduction to the Webinar and poll**
  Gary Wyeth, Chair, IWA Water Loss Specialist Group

- **Reducing Water Loss in Aging Pipelines: Flexible Fabric Reinforced Pipes (FFRP) – Applications and Case studies**
  Ari Gashi, Regional Sales representative, Radlinger primus line GmbH

- **Water Network Rehabilitation Using Cured-in-Place Pipe (CIPP) - An Overview with References**
  Ivo Raphael Hemsing, Head of Business Development, SAERTEX

- **Advances in Spray-In-Place Pipe (SIPP) Pressure Pipe Rehabilitation: Technology Developments and Case Studies**
  Prof Mark Knight, Chief Technology Officer, SIPP Americas

- **Panel Discussion and Q&A**
  Speakers and Moderator

- **Closing Remarks**
  Gary Wyeth, Chair, IWA Water Loss Specialist Group

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Introduction

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IWA'S VISION AND MISSION

Our Vision

- A world in which water is wisely managed to satisfy the needs of human activities and ecosystems in an equitable and sustainable way.

Our Mission

- To **inspire change** and service IWA members, the community of professionals concerned with water, external organisations and opinion leaders in being the **international reference** and **global source of knowledge,** experience and leadership for **sustainable urban and basin-related water solutions**

WATER LOSS SPECIALIST GROUP

- Chair: Gary Wyeth – Thailand
- Secretary: Anna Bojko – French Guyana
- Management Committee – 22 members 17 countries
- Over 1500 IWA Connect WLSG members
- Over 4500 active members promoting Water Loss
- Represented in over 60 countries

www.iwawaterloss.com

ABOUT ISTT

- *The International Society for Trenchless Technology (ISTT) is a non-profit organization dedicated to advancing trenchless technology worldwide.*

Global Community	Connecting professionals, organizations, and industry leaders across the globe.
Knowledge & Education	Providing resources, training, and events to support continuous learning.
Collaboration	Promoting collaboration and the sharing of best practices.
Sustainable Future	Driving innovation for sustainable and resilient infrastructure.

Contact us for more information at: info@istt.com

TODAY'S PRESENTERS

Ari Gashi
Regional Sales Representative
Rädlinger primus line GmbH

Ivo Raphael Hemsing
Head of Business Development
SAERTEX

Prof Mark Knight
Chief Technology Officer
SIPP Americas

Presentation Titles

1. *Reducing Water Loss in Aging Pipelines: Flexible Fabric Reinforced Pipes (FFRP) - Applications and Case studies*
2. *Water Network Rehabilitation Using Cured-in-Place Pipe (CIPP) - An Overview with References*
3. *Advances in Spray-In-Place Pipe (SIPP) Pressure Pipe Rehabilitation: Technology Developments and Case Studies*

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Reducing Water Loss in Aging Pipelines: Flexible Fabric Reinforced Pipes (FFRP)

HOW TRENCHLESS REHABILITATION HELPS UTILITIES REDUCE WATER LOSSES AND EXTEND ASSET LIFE

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THE GLOBAL WATER LOSS CHALLENGE

EVERY DROP COUNTS

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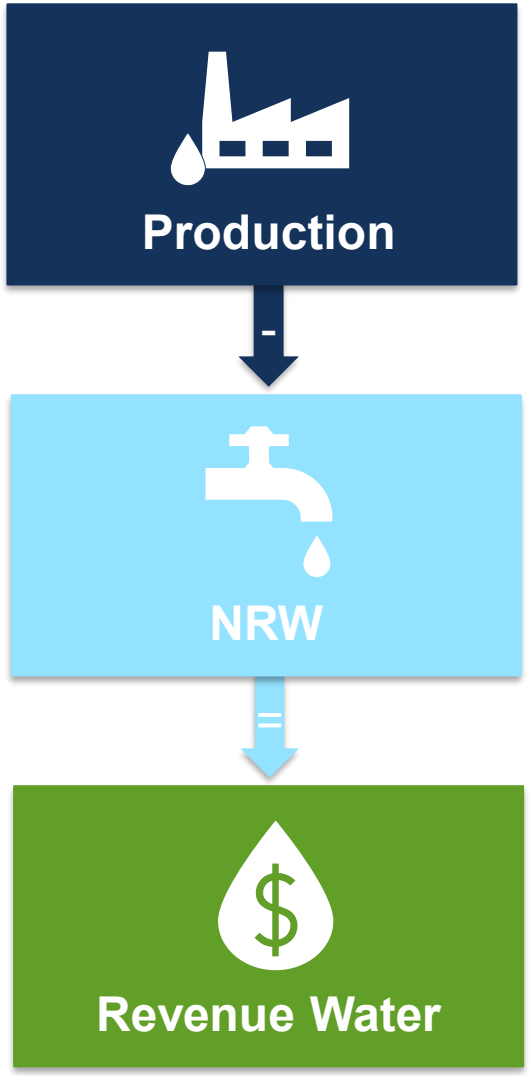
Key Facts:

- More than **30% of treated drinking water** is lost globally before reaching consumers.
- Around **126 billion m³** of water is lost annually through leakage.
- Water loss represents lost resources, lost energy and lost revenue.

➢ **126 Billion m³ / year**

Source: Liemberger & Wyatt (2018), *Water Supply*; International Water Association (IWA); World Bank (2016).

WHERE DOES NRW COME FROM?



Breakdown

Physical Losses:

- Leakage
- Pipe bursts
- Joint failures

Commercial Losses:

- Meter inaccuracies
- Illegal connections

➢ **Physical losses often represent the largest share of NRW**

WHY PIPELINES FAIL

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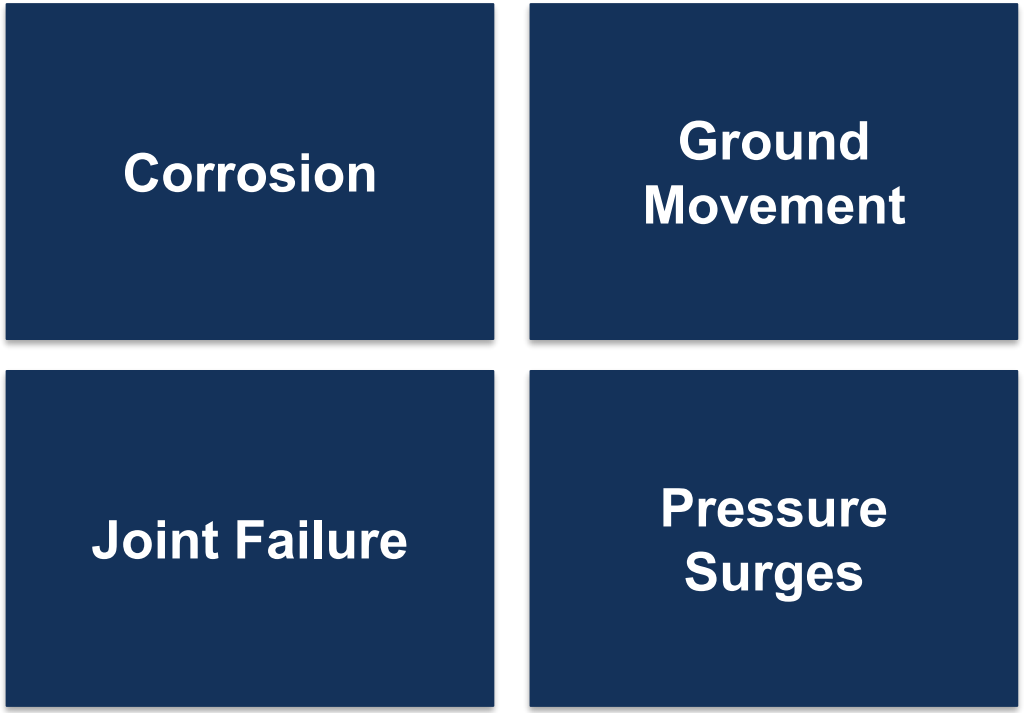
The Main Drivers of Water Loss:



- Aging infrastructure is one of the leading causes of water loss

THE UTILITY DILEMMA

Replace Or Rehabilitate?

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Open Cut Replacement

- High excavation costs
- Traffic disruption
- Long construction time
- High carbon footprint

Trenchless Rehabilitation

- Minimal excavation
- Limited disruption
- Faster implementation
- Lower enviromental impact

➢ Utilities need solutions that restore pipeline performance without major disruption

TRENCHLESS TECHNOLOGY

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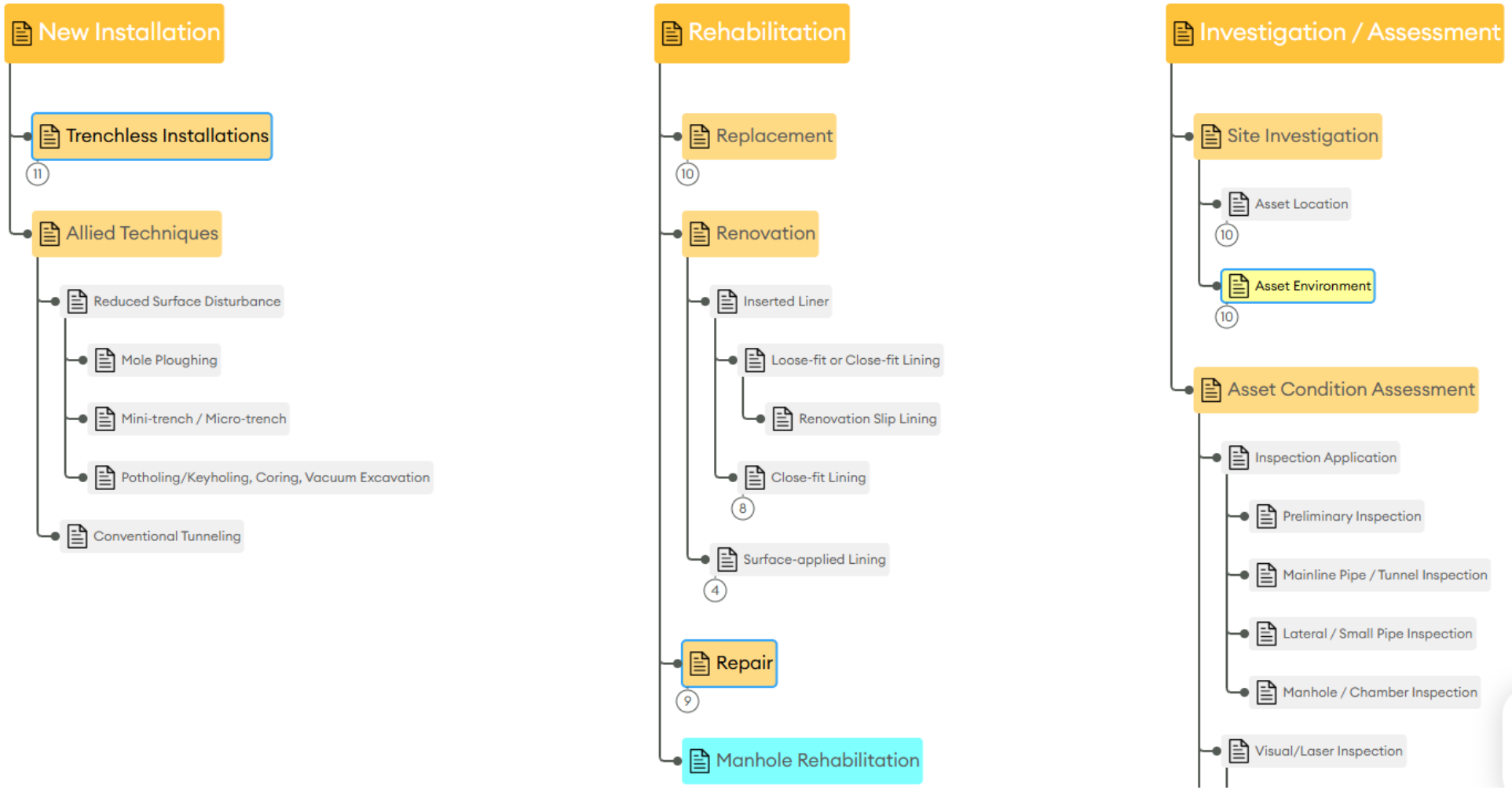
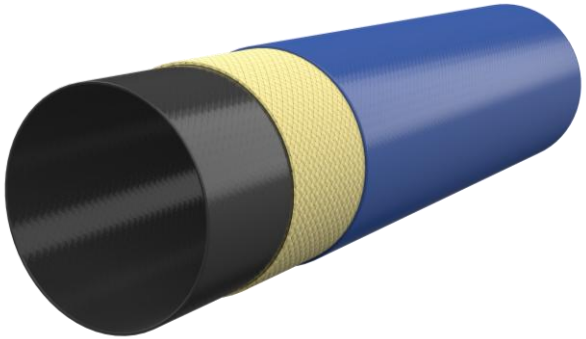
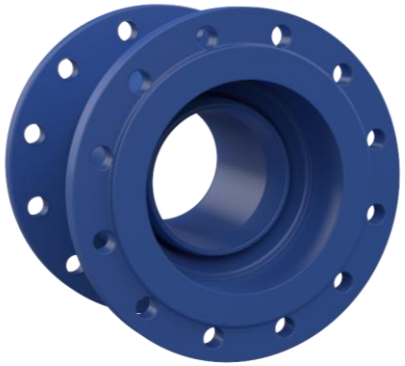


FLEXIBLE FABRIC REINFORCED PIPES

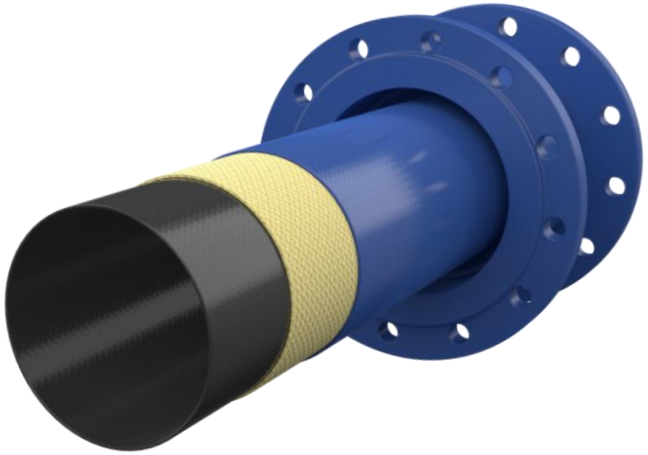
PRIMUS LINE® REHAB



composite liner



leak-free connector



flexible rehab pipe

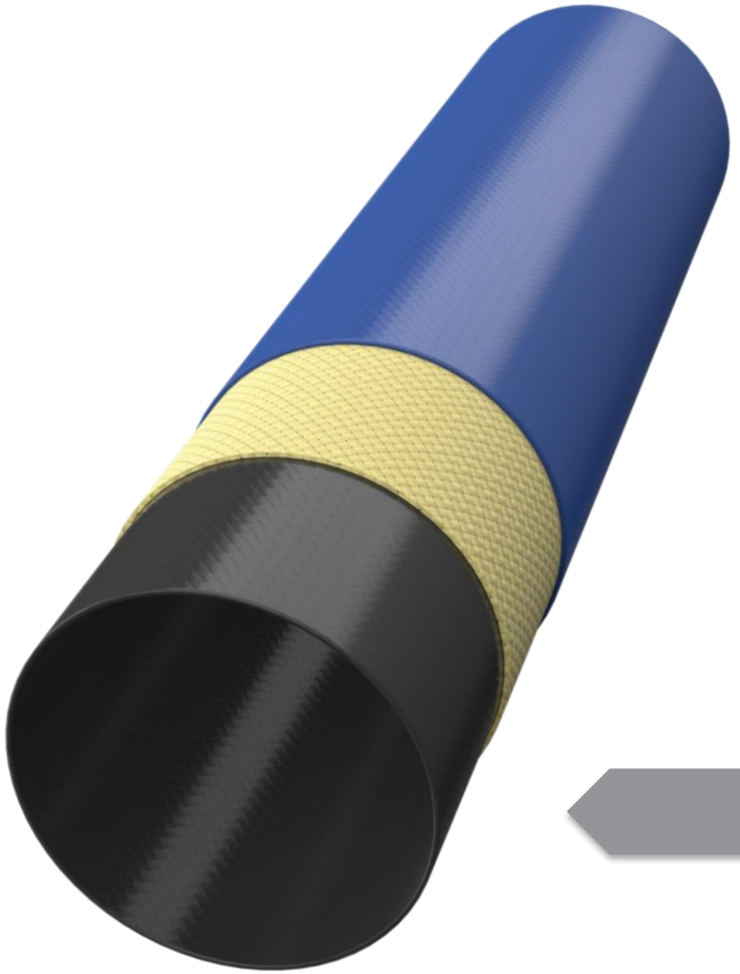
TECHNICAL COMPOSITE LINER DETAILS

- PE
- High abrasion resistance
- Protection of the fabric during the installation and operation

Outer layer

- One- or two-layered Kevlar® fabric
- Absorption of the tractive forces during insertion
- Accommodates the operating pressure by itself
- Up to 10 times stronger than steel of equal weight

Reinforcement

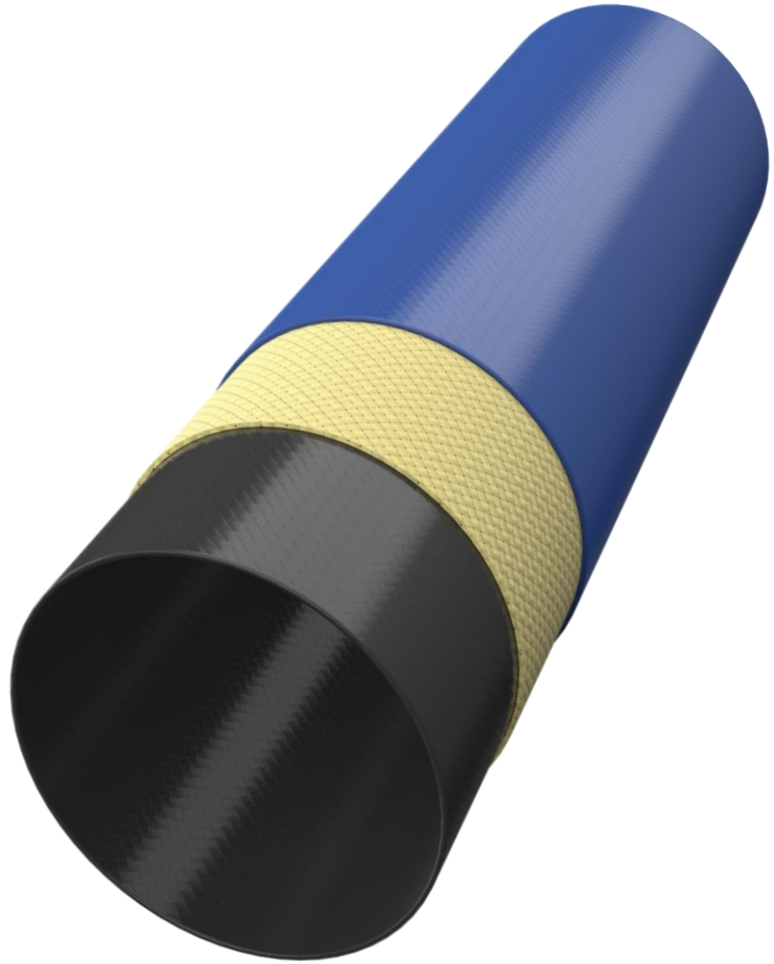


- PE
- Sealing the reinforcement against the transported fluid
- Hygienic

Inner layer

FURTHER TECHNICAL DETAILS

- Available in nominal diameters from DN 150 to DN 550
- Transport of up to 2,000 m of liner on one transport reel (depending on diameter)
- Small pits, minor installation footprint
- Maximum capacity (low wall thickness of 6 mm for PN 16)
- Operating pressures of up to 82 bar (depending on diameter)
- Installation speeds of up to 10 metres per minute
- Increase operating pressure independently of host pipe
- Traverse bends of up to 45 degree (90 degree case by case) – also multiple bends
- Referenced under ASTM F3708-25; complies with 15 international hygienic approvals for drinking water



LEAK-FREE CONNECTORS

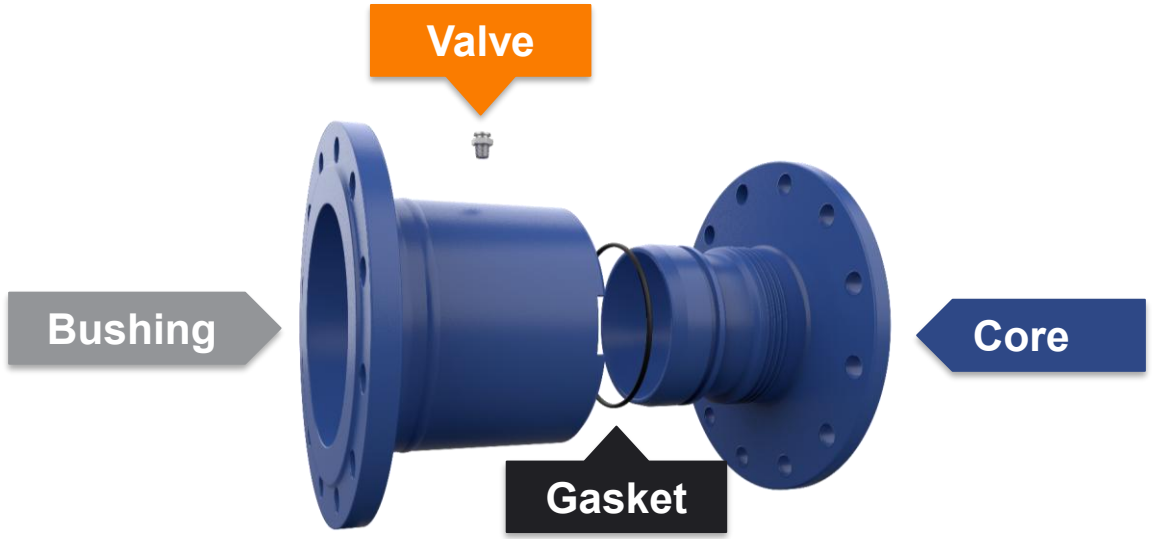
R-connector

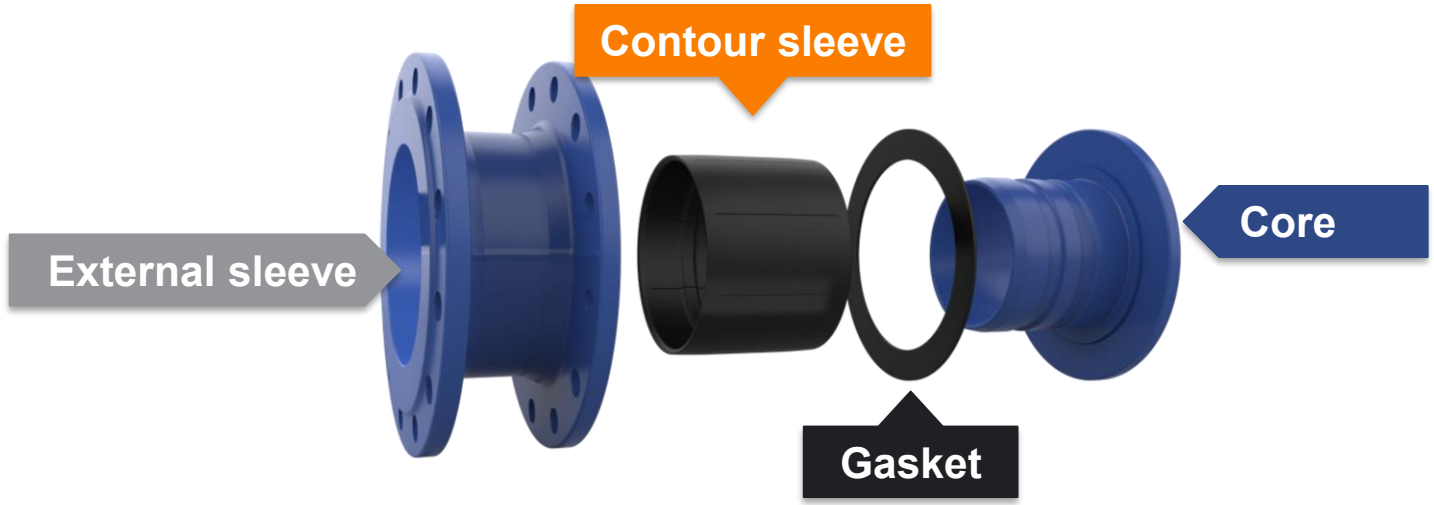
W-connector

M-connector

LEAK-FREE CONNECTORS

Resin Connector



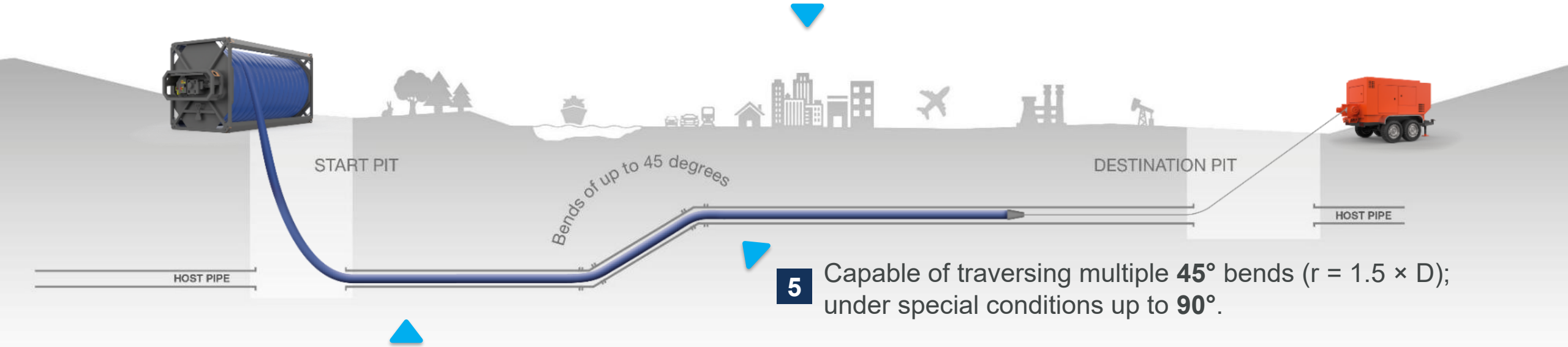


Mechanical Connector

INSTALLATION PROCESS

INSTALLATION

1 Trenchless installation significantly reduces social and environmental impact



5 Capable of traversing multiple **45°** bends (r = 1.5 × D); under special conditions up to **90°**.

2 Annulus space design releases the host pipe from internal operating pressure

3 Liner carries the full operating pressure independently of the host pipe, and the host pipe remains in place only to support ground and traffic loads.

4 Enables long installation lengths exceeding **2,500 m**

CREATE PITS

Start pit

WORKING SPACE:

- min. 1.50 m for DN 150 to 200
- min. 2.00 m for DN 250 to 500

End pit

WORKING SPACE:

- min. 1.50 m for DN 150 to 200
- min. 2.00 m for DN 250 to 500

PULLING FORCE:

- < 4 tons max. 30 degrees
- > 4 tons max. 10 degrees

CAMERA INSPECTION AND PIPE CLEANING

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CCTV inspection:

Pipe cleaning:

SETTING UP THE EQUIPMENT

↑ Place winch and installation equipment

↑ Set up reel (e.g. T210 reel on racks)

Placement according to installation requirements and site conditions:

- Transport reel
  - up to 5,700 m for DN 150
  - up to 1,675 m for DN 500
- Pulling winch
- Installation tools

LINER INSERTION

Liner insertion via pulling head

Navigation through bends

LINER INFLATION

Inflating the Liner:

- Inflation using compressed air
- Pipe stopper to close the liner
- Pipe stopper with bypass to inflate
- Installation with annular space:
  No heating, steaming, curing processes

CONNECTOR INSTALLATION AND PRESSURE TEST

←Connector + "multi-joint"

Connectors installation

Pressure test procedure + Disinfection

PROJECTS

REHABILITATION OF DN 300 WATER PIPES AT VAN DON BRIDGE IN VIETNAM

- Host pipe: DN 300 steel pipe unlined
- Transported fluid: Potable water
- Pressure rating: 6 bar; test pressure: 9 bar
- Primus Line® system: DN 300
- Total length: 840 m

Van Don Island, Vietnam

PROJECT HIGHLIGHTS

Situation:

- The DN 300 steel water main was affected by corrosion and required rehabilitation to secure drinking water quality and extend the asset's service life.

Challenge:

- The pipeline was located inside a bridge structure and traditional pipe replacement cost would have been extremely high.

Solution:

- The pipeline was rehabilitated using **840 m of Primus Line®**, allowing a trenchless installation with minimal disruption. Each liner section was installed in less than one hour by a locally trained contractor and supervised by **Primus Line®**.

Outcome:

- The rehabilitation secured the drinking water supply, extended the pipeline's service life by **50 years**, and was completed without excavation.

REHAB OF AN AC TRUNK WATER MAIN IN SPAIN

- Host pipe: DN 250 Asbestos Cement
- Transported fluid: Drinking water
- Pressure rating: 7 bar
- Primus Line® system: DN 250 PN 15
DN 200 PN 18
- Total length: 10,345 m

River Saja, a treatment plant in Ruente

PROJECT HIGHLIGHTS

Situation:

- The 10 km asbestos cement water main was in critical condition, causing frequent pipe failures and water losses of approximately 25%.

Challenge:

- The pipeline crossed environmentally sensitive areas, roads and railways, making conventional open-cut replacement highly disruptive and environmentally challenging.

Solution:

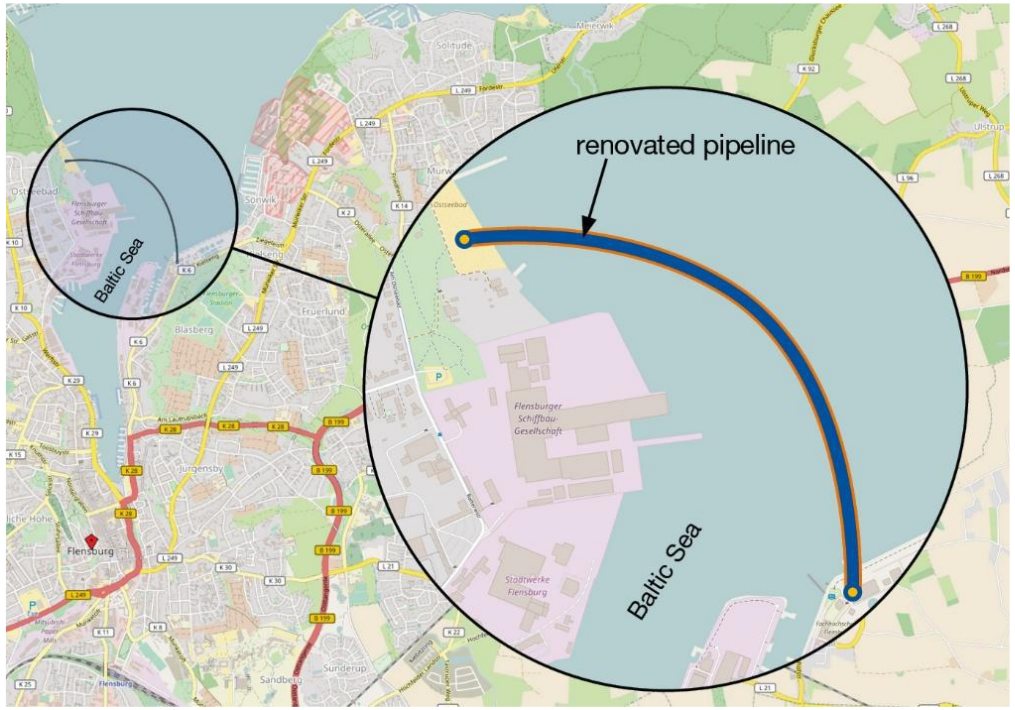
- The water main was rehabilitated using more than 10 km of **Primus Line®** in 20 trenchless installation sections, avoiding extensive excavation and reducing construction time.

Outcome:

- The project reduced the construction period from 12 to 4 months, achieved up to 30% cost savings compared to open-trench replacement, and restored a reliable drinking water supply.

REHABILITATION OF SIPHON WITH A LENGTH OF 1,240 M IN GERMANY

- Laying: Installed inside an existing DN 300 PE 80 drinking water siphon beneath the Flensburg Fjord
- Transported fluid: Drinking water
- Pressure rating: 10 bar
- Primus Line® system: DN 250
- Total length: 1,240 m in 1 installation section



PROJECT HIGHLIGHTS

Situation:

- A **1,240 m drinking water siphon** beneath the Flensburg Fjord, installed in the 1970s, is a key part of the city's water supply. Replacing the pipeline beneath the fjord would have been technically difficult and economically impractical.

Challenge:

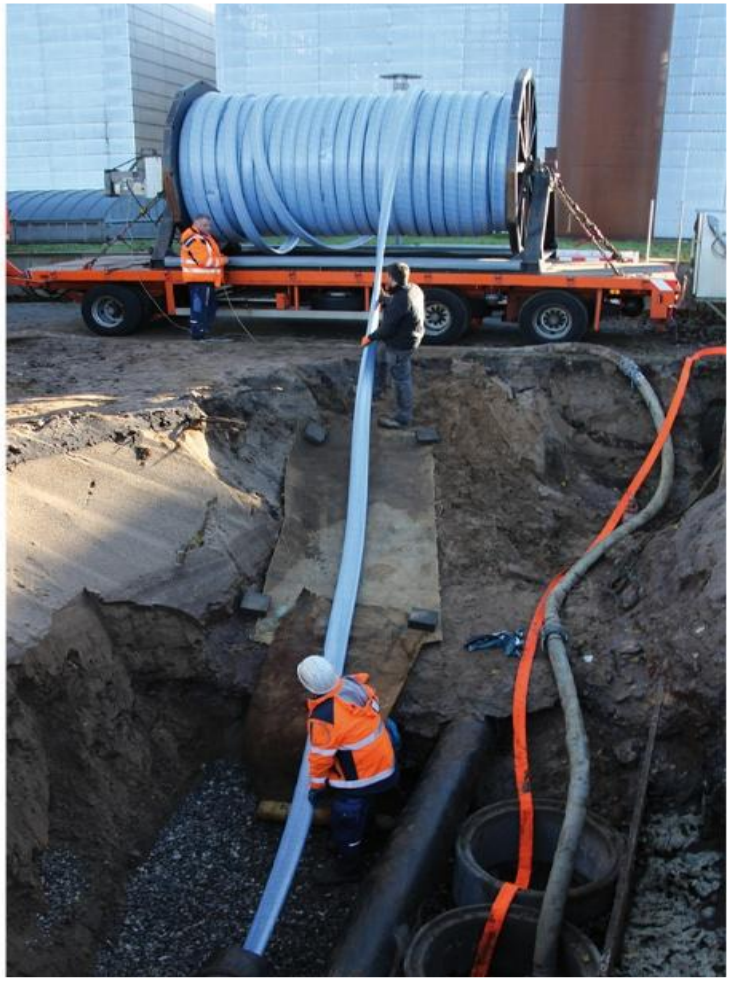
- Rehabilitate the existing pipeline with a single length of 1,240 m. There was no possibility for additional access.

Solution:

- The pipeline was CCTV inspected, cleaned by pigging, and rehabilitated using the **Primus Line® system**. The **liner** was installed in a single pull and connected using the **Primus Line® connector system** and inflated with water instead of air.

Outcome:

- At the time, this was the longest single **Primus Line®** installation in Germany. Installation was completed in 8 working days, with the liner pulled in within approx. 3 hours.



EMERGENCY WATER SUPPLY FLOWN IN BY HELICOPTER IN FRANCE

- Laying: On the ground alongside a street and 120 m in a PVC pipe stretching across the river Le Boréon
- Transported fluid: Drinking water
- Pressure rating: 10 bar
- Primus Line® system: DN 150 PN 25
- Total length: 1,340 meters including the riverbed crossing in a PVC pipe

In the municipality of Saint-Martin-Vésubie, France, 2022

PROJECT HIGHLIGHTS

Situation:

- **A historic flood** destroyed the riverbed and infrastructure in Saint-Martin-Vésubie, disrupting water supply.

Challenge:

- The urgent need to restore drinking water to the flood-damaged area, coupled with the difficult terrain, presented a significant challenge.

Solution:

- **Primus Line® system** was used to install a free-floating pipeline across the riverbed and connect to existing networks via land-based pipelines.

Outcome:

- The water supply was restored to the affected area within 4 days without requiring any on-site hoisting equipment.

FROM AGING PIPES TO MODERN SOLUTIONS – LET’S DISCUSS!

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Water Network Rehabilitation Using Cured-in-Place Pipe (CIPP)

AN OVERVIEW WITH REFERENCES

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Source: www.noz.de

SITUATION IN GERMANY

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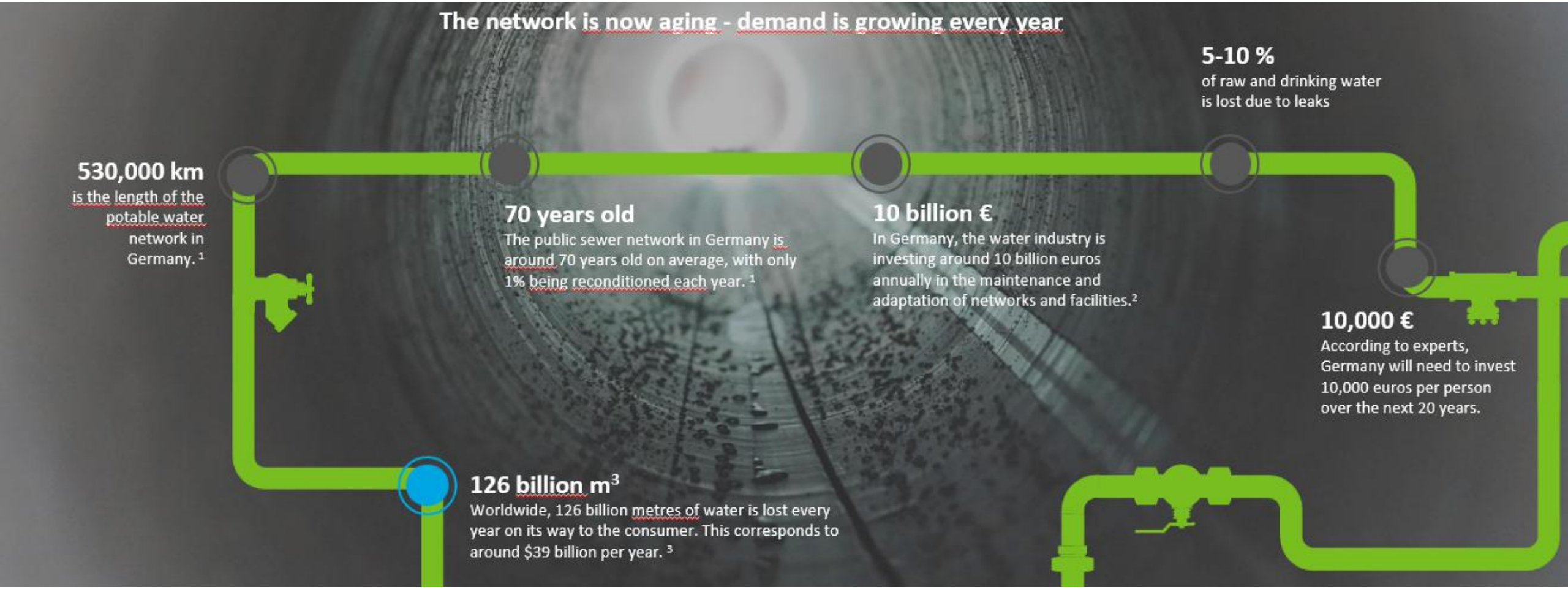

Source 1 https://www.dvgw.de/themen/wasser/wasser-impuls/substanz-und-werterhalt-der-wasserinfrastruktur
Source 2 https://www.zeit.de/politik/2025-03/wasser-abwasser-investitionen-sanierung-deutschland
Source 3 https://www.academia.edu/112269700/Quantifying_the_global_non_revenue_water_problem

MINOR DAMAGE, MAJOR CONSEQUENCES

- Frequent problems with water pipe systems:
  - Corrosion
  - Joint Leakage
  - Cracking
  - Structural Deformation
  - Pressure Surge Damage

MINOR DAMAGE, MAJOR CONSEQUENCES

CLASSIFICATION – UV GRP CIPP

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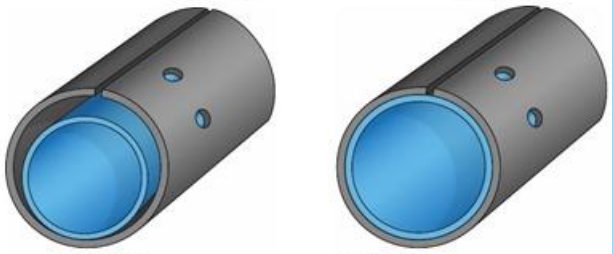
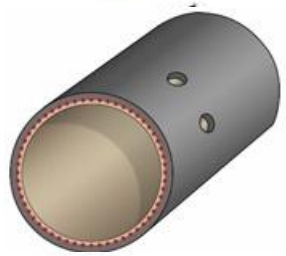
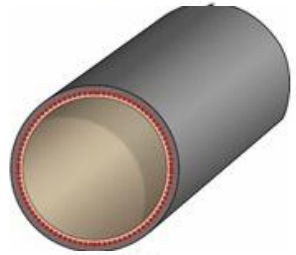
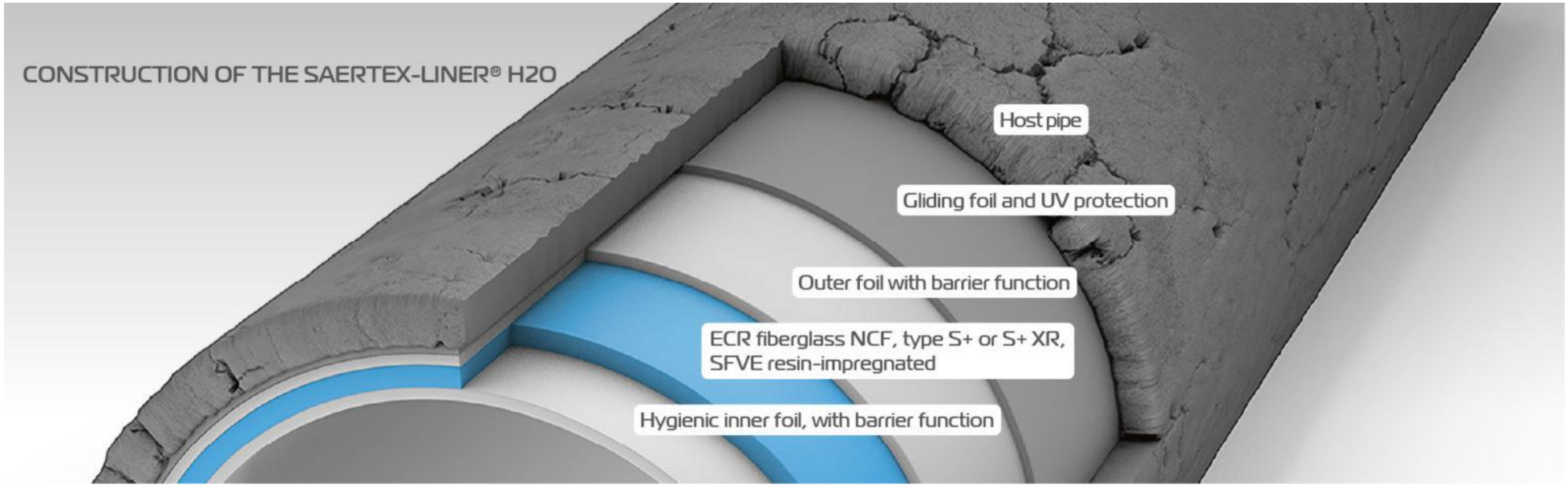
<tr><td colspan="2">  </td><td>  </td><td>  </td><td>  </td></tr>
<tr><td colspan="2">Independent</td><td colspan="3">Interactive</td></tr>
<tr><td colspan="2">Fully structural</td><td colspan="2">Semi-structural</td><td>Non-structural</td></tr>
<tr><td>Lining with continuous pipes</td><td colspan="3">—</td><td rowspan="6">This document is not applicable</td></tr>
<tr><td>Lining with discrete pipes</td><td colspan="3">—</td></tr>
<tr><td rowspan="3">—</td><td colspan="2">Lining with close-fit pipes</td><td>—</td></tr>
<tr><td colspan="3">Lining with cured-in-place pipes</td></tr>
<tr><td colspan="2">—</td><td>Lining with adhesive-backed hoses</td></tr>
<tr><td>—</td><td>—</td><td>Lining with sprayed polymeric materials</td><td>—</td></tr>
</table>

- ISO 11295-4

DESIGN OF STANDARD DRINKING WATER UV CIPP SYSTEMS



Source https://www.saertex-multicom.de/en/products/grp-liner-supply/saertex-linerr-h2o

TESTS AND CALCULATION OF THE MAXIMUM OPERATING PRESSURE OF THE UV CIPP LINER

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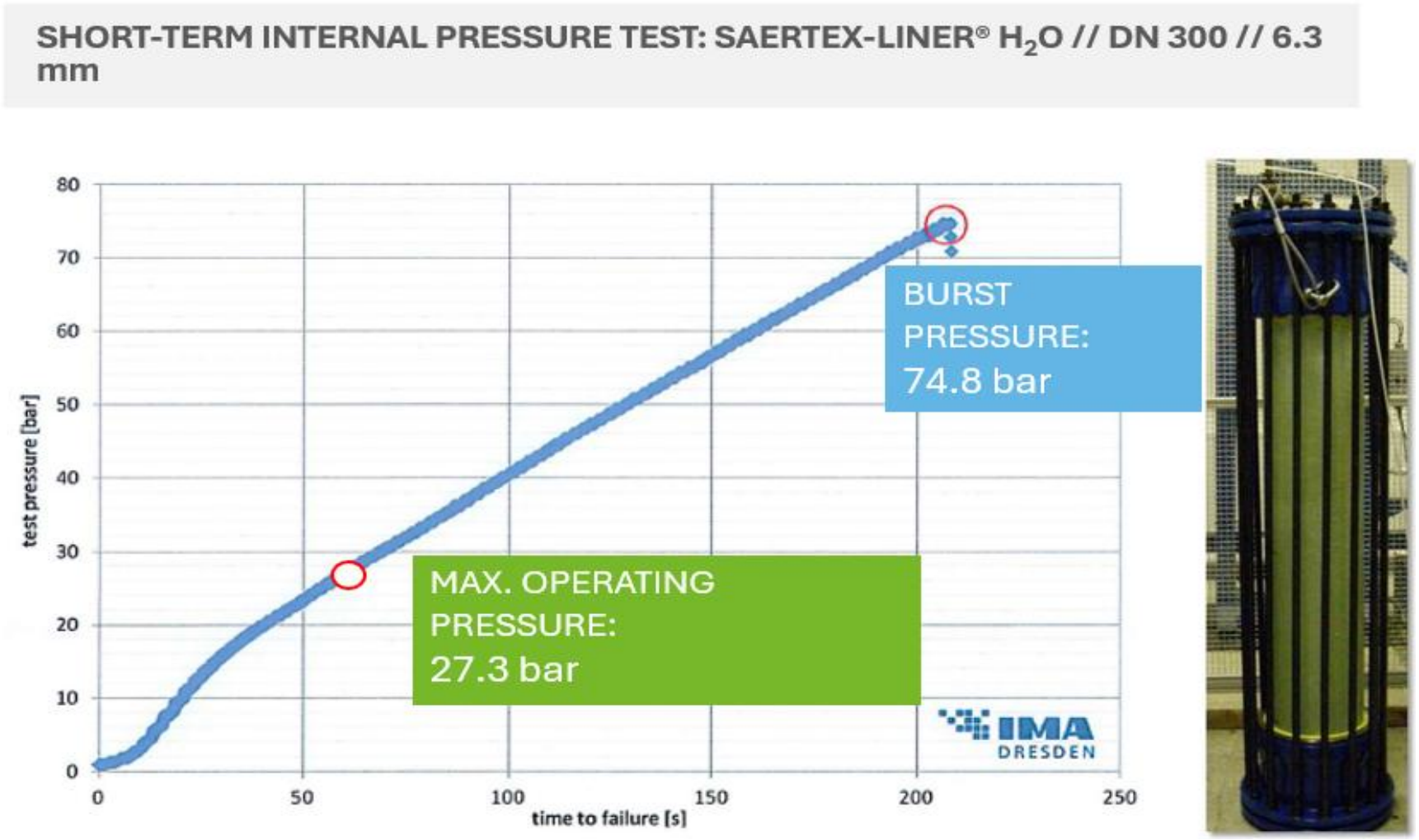

MAXIMUM PRESSURES DEPENDING ON DIMENSIONS AND WALL THICKNESS

DIAMETER [MM]	DESIGN WALL THICKNESS [MM]	MAX.OPERATING PRESSURE [BAR]
250	4,3	33,0
300	4,3	27,3
400	4,3	18,2
500	4,3	14,4
600	5,3	11,6
700	6,3	10,7
800	7,3	8,8
900	8,3	7,9
1.000	9,3	7,1
1.100	10,3	6,5
1.200	11,3	5,8

- Based on long-term internal pressure tests (10,000 h)
- Can absorb all internal and external loads
- Project-related calculation of the wall thickness
- Also withstands negative pressure (-0,8 bar)

CERTIFICATES AND APPROVALS

AWQC | Deutsches Institut für Bautechnik DIBt | NSF | UBA

ISO

International Organization for Standardization
ISO

GENERAL

- ISO 11295: Plastic piping systems used for rehabilitation - Classification and overview of strategic, tactical and operational activities

WASTEWATER

- ISO 11296-4: Plastic piping systems for the renovation of underground non-pressure drainage networks (gravity sewers) - Part 4: In-situ CIPP lining
- ISO 11297-4: Plastic piping systems for the renovation of underground pressure sewers - Part 4: In-situ CIPP lining

DRINKING WATER

- ISO 11298-4: Plastic piping systems for the renovation of buried water supply networks - Part 4: In-situ CIPP lining
- AWWA M28: Rehabilitation of Water Mains (3rd Edition, 2014 (the 4th edition will be published this year)

STANDARDS

GSTT / iSTT

GSTT Info 20-1: Rehabilitation of pressure pipelines

RSV

RSV M 1.3: Rehabilitation of drinking water pipes with pressure pipe liners

ASTM

ASTM F2019: Standard practice for the rehabilitation of existing pipelines and conduits by the pull-in-place installation of glass fiber reinforced plastic Cured-in-Place (GRP-CIPP) using the UV light curing method

DVGW

DVGW GW 302: Qualification criteria for companies involved in the trenchless laying and rehabilitation of pipelines that are not in operation

DWA

DWA-A 143-2: Structural design for the rehabilitation of drainage systems and sewers using lining and installation methods

DWA-A 143-3: Rehabilitation of drainage systems outside buildings – Part 3 CIPP

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REFERENCE GERMANY

- **Show construction site for planning engineers**
- Torgau, Saxony 2021
- DN 600
- Max. Operating pressure = 3.5 bar
- Length = 60 m below a dam
- host pipe = Ductile iron pipe

MILLING WORK ON THE HOST PIPE

PULLING IN UV CIPP LINER

INSTALLATION PACKER

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TESTING AND POSITIONING THE UV LIGHT TRAIN

CURING THE LINER AND FULL CONTROL OF THE PARAMETERS

CUTTING BACK THE CURED LINER

DIRECT INSPECTION OF THE LINER

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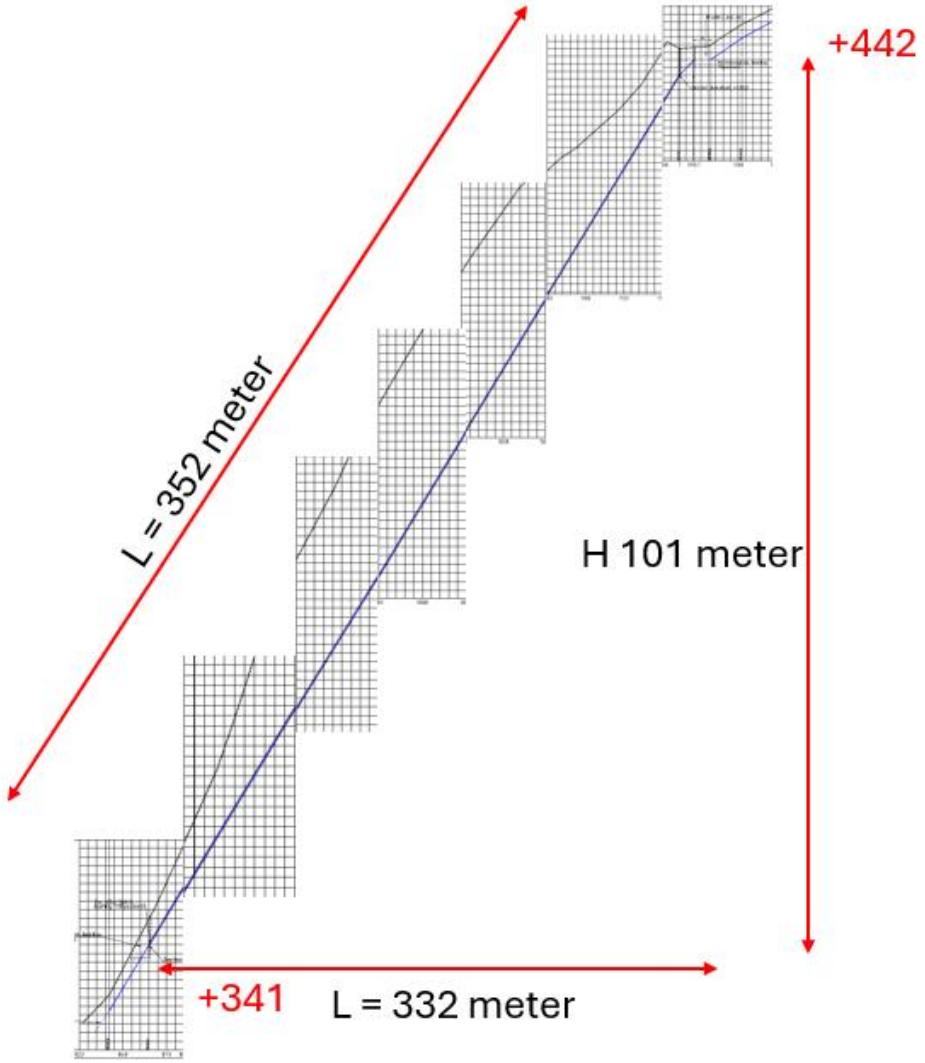
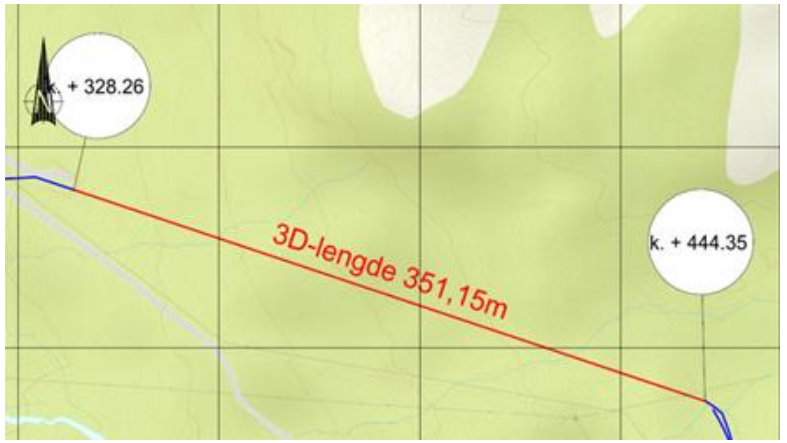
INSTALLING THE LINER END SEAL

REFERENCE NORWAY

- DN 250
- Liner Design Wall Thickness = 5.3 mm
- Max. Operating Pressure = 33 bar
- Length = 352 m (one liner)
- Host pipe = Ductile Iron Pipe

CHALLENGES


+442
L = 352 meter
H 101 meter
+341
L = 332 meter


k. + 328.26
3D-lengde 351,15m
k. + 444.35

MOBILE UV CURING UNIT

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GRADIENT OF UP TO 45°

PULLING IN THE LINER

CURING SPEED = 1.5 METRES PER MINUTE

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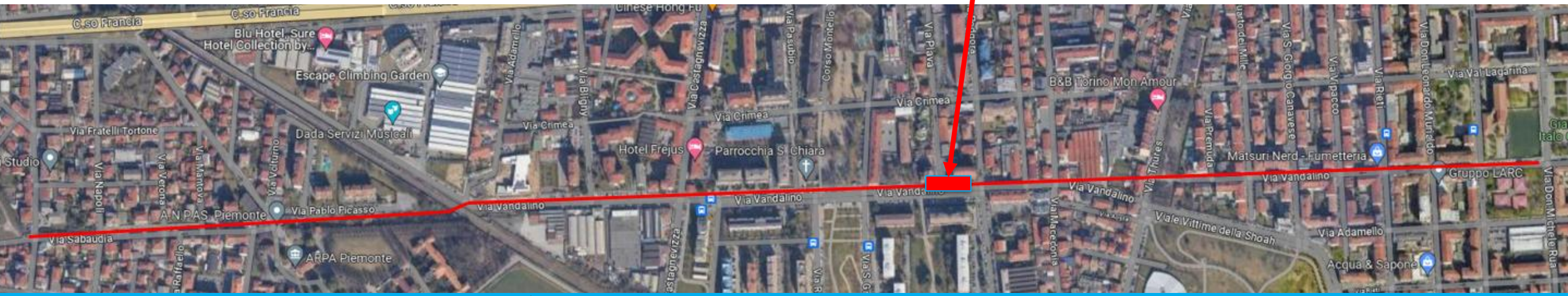
INSTALLATION OF THE LINER END SEAL IN A NEW PIPE SECTION

READY FOR THE 35-BAR PRESSURE TEST

REFERENCE ITALY

- DN 1000
- Liner Wall Thickness = 9,3 mm
- Host pipe = steel
- Max. Operating Pressure = 4 bar
- Total length = 2,44 km



Source: Google Maps

THANK YOU VERY MUCH FOR YOUR ATTENTION !

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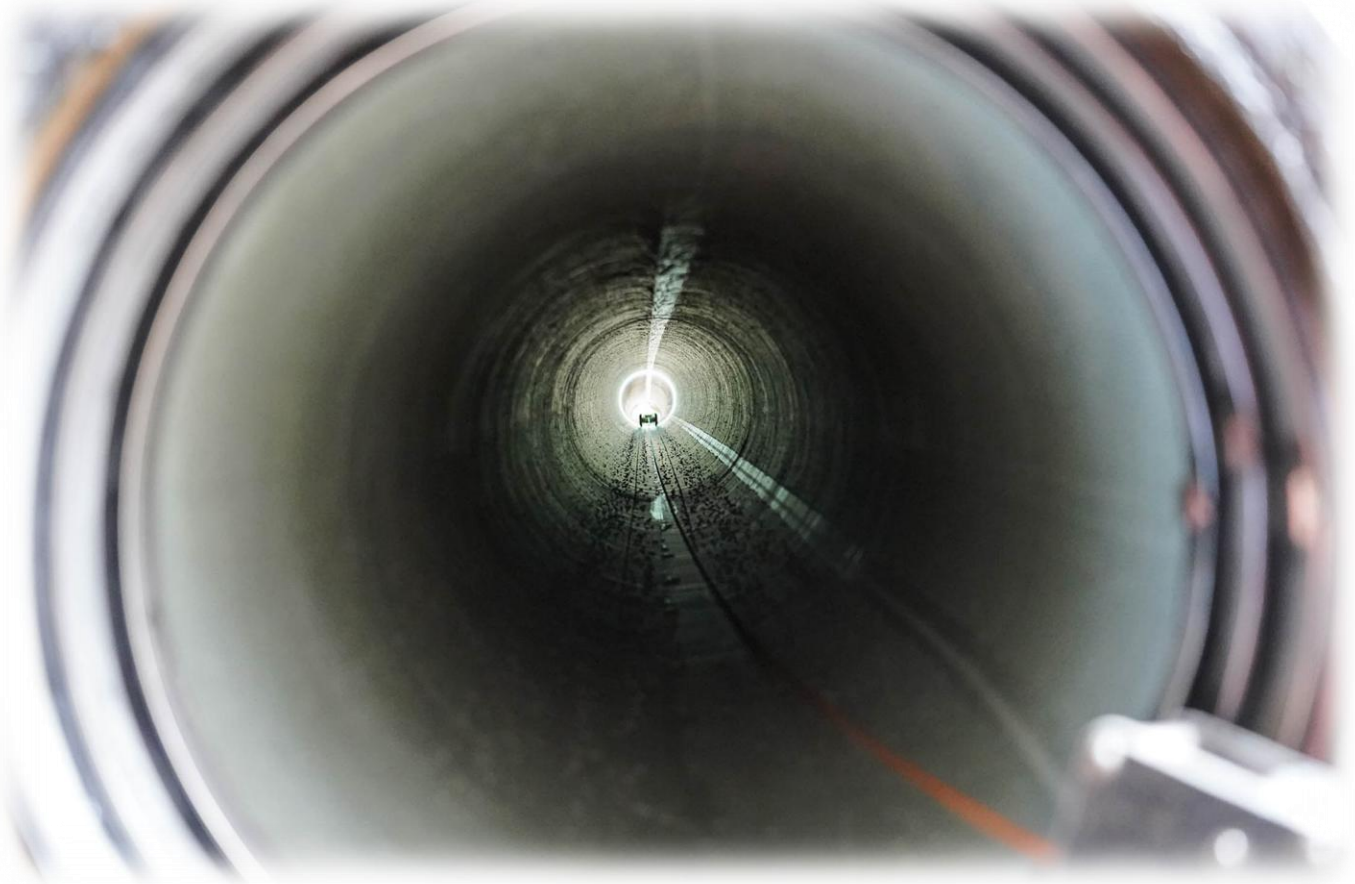

THE FUTURE IS TRENCHLESS

Ivo Hemsing (M.Eng)

Head of Business Development

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DR. MARK KNIGHT

- **Chief Technology Officer** SIPP Americas LLC
- **Professor in Department of Civil and Environmental Engineering**, University of Waterloo for over 27 years.
  - Research focus: Pressure and Gravity pipeline rehabilitation, asset management, trenchless pipe construction.
- **International Standards and Best Practice/Manual Development**:
  - Chair Canada's ISO Mirror Committee ISO/TC 138/SC 8 - Rehabilitation of pipeline systems
  - Chair AWWA Standard C623-22 Cured-In-Place Pipe (CIPP) Rehabilitation of Pressurized Potable Water Pipelines, 4 In. (100 mm) and Larger.
  - Chair AWWA M28 4th edition Watermain Rehabilitation Manual to be published November 2026.
- **Software Developer:**
  - (WWW.PPIPACE.COM, WWW.HDPEAPP.COM, WWW.PPIBOREAID.COM, WWW.WEAKLINKAPP.COM, ETC)
- **Retained Expert:**
  - Pressure liner design, challenging trenchless construction projects, litigation, third party evaluation reviews, Value Engineering Studies, failure analysis, etc)

Advances in Spray-In-Place Pipe (SIPP) Pressure Pipe Rehabilitation: Technology Developments and Case Studies

DR. MARK KNIGHT CTO, SIPP AMERICAS LLC

inspiring change

SIPP LINING MEANING

- Sprayed in Place Pipe - Common term
- Spray-in-Place **Polymeric** – AWWA C620 standard

- SAPL = Spray Applied **Polymeric** Lining - Gravity pipes

Alternative construction method to Cured-in-Place-Pipe (CIPP) Lining

40 years of Continuous Development

the international water association

Resins, Equipment and Processes:

1980's

UK First Slow Cure **Epoxy** linings

(1 to 2mm) and Development of Schur-BPH Spray Rigs

1990's

UK First Rapid Cure linings (1 to 2mm) and first Same Day Return to Service

2000's

UK First High Build Rapid Cure

(2 to 3mm)

Development of Schur-BPH computer-controlled Spray Rigs and Steri-Kleinze

2010

Development of abrasive stone cleaning and continual Spray Rig innovation

2019

First fast set **Aliphatic Isocyanate Polyurea** developed in the UK

(1 to 14mm)

15-minute CCTV and 60-minute Return to Service

2023

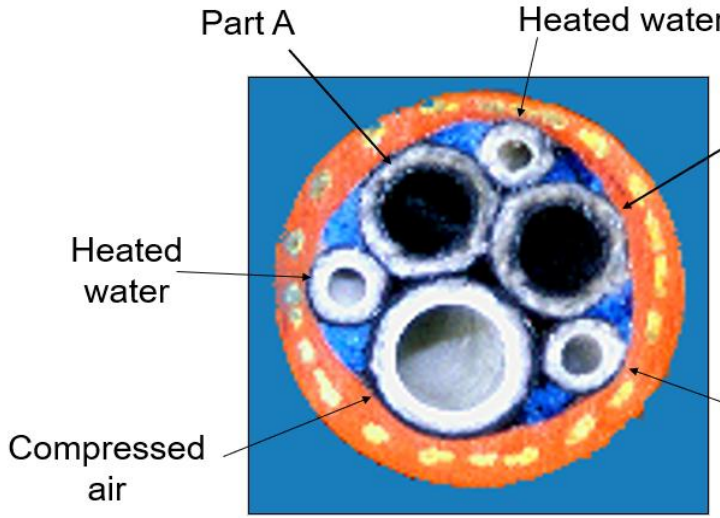
Aliphatic Isocyanate Polyurea brought to USA, CANADA, EUROPE, AUSTRALIA, CHILE, etc.

NOT ALL SIPP RESINS ARE THE SAME

RESIN CHOICE MUST BE IS FIT FOR THE PURPOSE

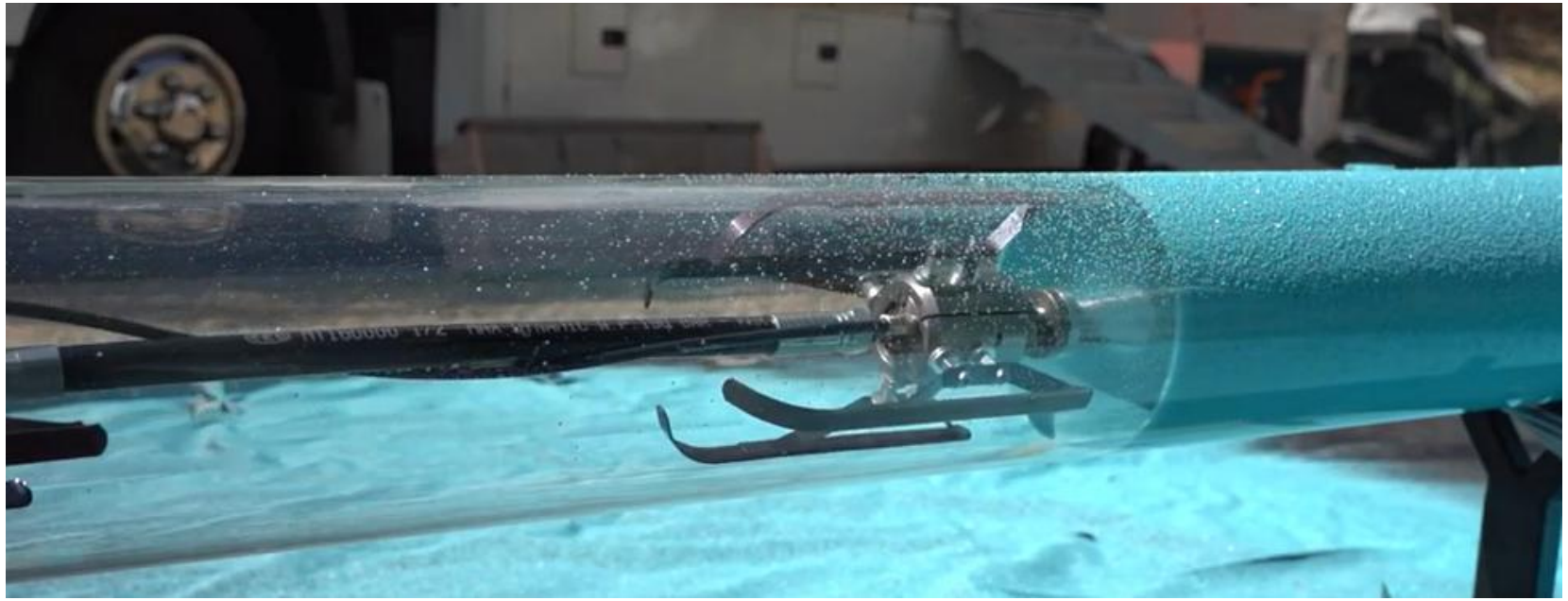
- **Epoxy** – Slow cure (hours) that is temperature dependent and limited thickness build thickness. Good wet and dry mechanical properties but high liner shrinkage.
- **Aromatic Polyurethanes** – Fast cure but water sensitive (i.e. can foam and soften over times in water), high dry but low wet mechanical properties and high liner shrinkage.
- **Aromatic Polyurea** – fast cure but water sensitive, High dry but low wet mechanical properties, and high liner shrinkage.
- **Aliphatic Isocyanate Polyurea** – rapid cure and high build, high wet and dry mechanical properties, and low shrinkage. – Developed for water main pipe rehabilitation.

SIPP Lining Process

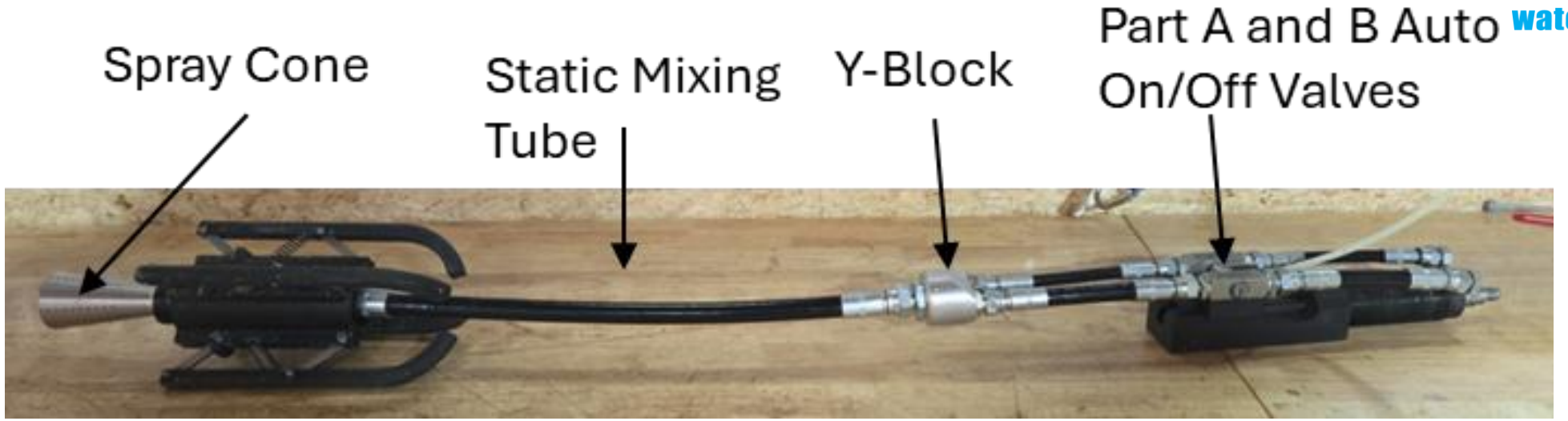


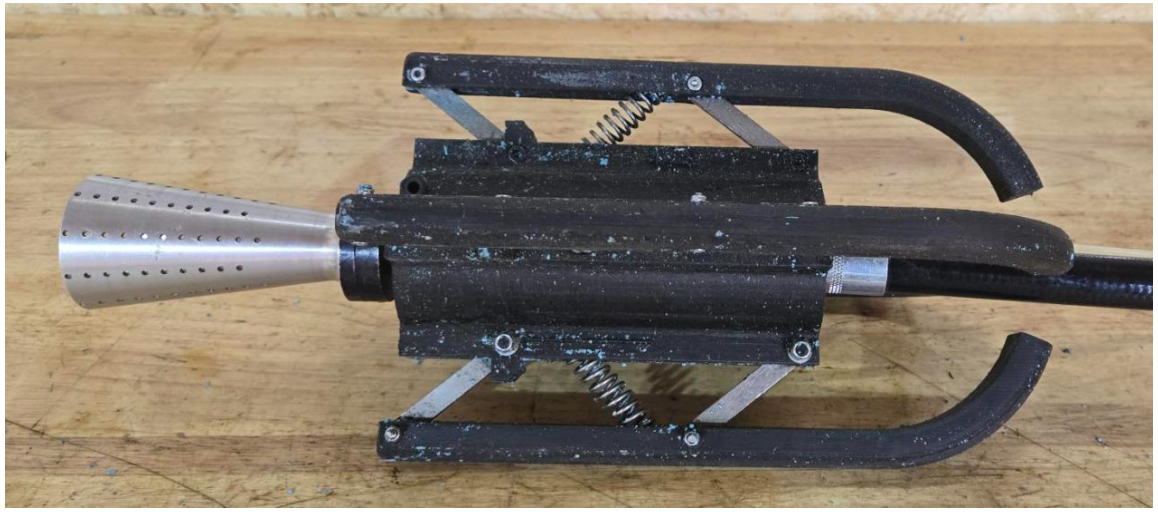
SIPP Lining

- Build a new pressure pipe using the old pipe as a form by Spin Casting droplets of resin onto the pipe wall



80 TO 150M (260 TO 500 FEET)
UMBILICAL LIMITS THE LINING LENGTH





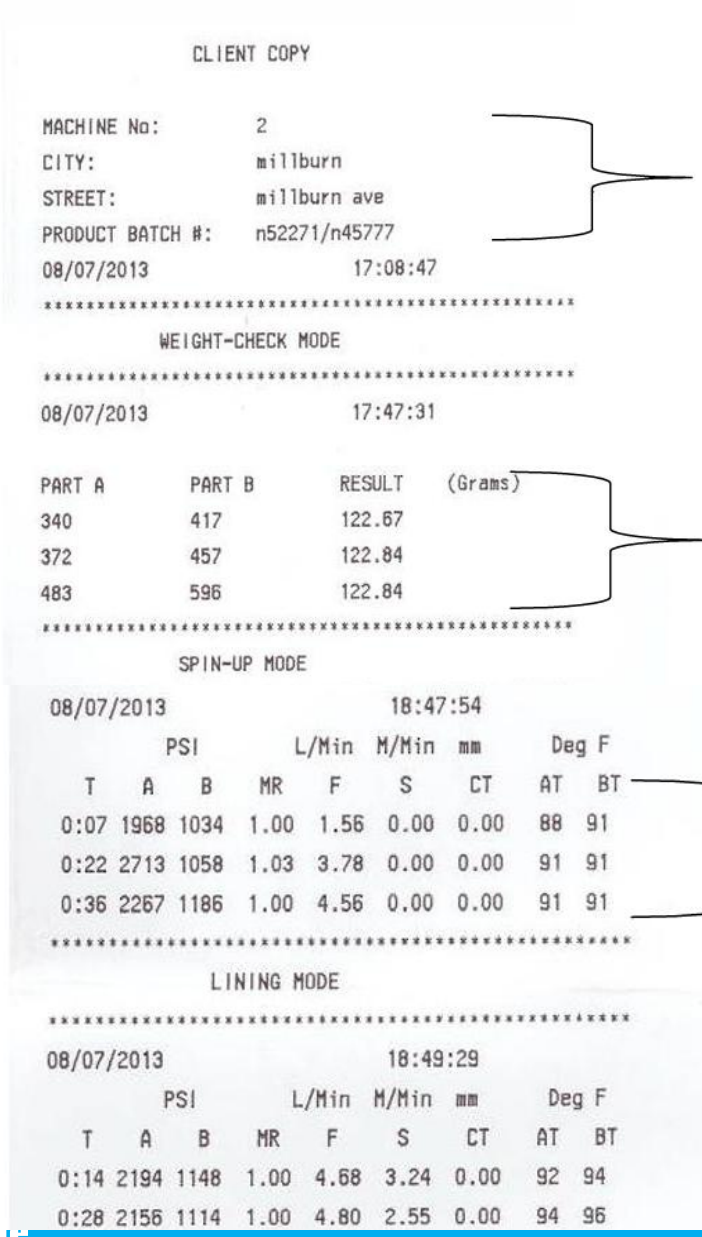
Computer Controlled Spray Rig

- **Temperature controlled Resin Part and B**

- **Computer controlled resin flow**
- **Computer controlled pull back**

- **Constant weight check and mix ratio**

RISK MANAGEMENT QA/QC PROCESS



```
CLIENT COPY

MACHINE No:        2
CITY:              millburn
STREET:            millburn ave
PRODUCT BATCH #:   n52271/n45777
08/07/2013                 17:08:47
************************************************
        WEIGHT-CHECK MODE
************************************************
08/07/2013                 17:47:31

PART A      PART B      RESULT    (Grams)
340         417         122.67
372         457         122.84
483         596         122.84
************************************************
          SPIN-UP MODE
08/07/2013                 18:47:54
          PSI          L/Min  M/Min  mm     Deg F
  T     A     B     MR     F      S      CT     AT   BT
 0:07 1968  1034  1.00   1.56   0.00   0.00   88   91
 0:22 2713  1058  1.03   3.78   0.00   0.00   91   91
 0:36 2267  1186  1.00   4.56   0.00   0.00   91   91
************************************************
          LINING MODE
************************************************
08/07/2013                 18:49:29
          PSI          L/Min  M/Min  mm     Deg F
  T     A     B     MR     F      S      CT     AT   BT
 0:14 2194  1148  1.00   4.68   3.24   0.00   92   94
 0:28 2156  1114  1.00   4.80   2.55   0.00   94   96
```

This information includes:

- lining rig number
- project location
- access pit numbers
- material batch numbers
- date & time.

The Part A and B weights are entered by the rig operator after the weight checks have been completed. The "RESULT" is calculated by the PLC.

The PLC begins printing lining data after "Spin-Up" mode is entered. A new line of data is printed every 14 seconds until the lining is complete.

"T" Elapsed time since lining mode started

"A" Pressure in psi of Part A recorded at the flow meter

"B" Pressure in psi of Part B recorded at the flow

Spray Rig Advancements

- **Automatic Valve Operating System**
- **Lining Vision** –camera fitted at the end of the umbilical hose to view the lining application in real time.
- **Dial-A Flow** - Fully automatic set and forget lining process.
- **Non-Contact Flow Meters** - zero maintenance / zero failures = zero lost linings due to spurious readings.
- **Smart Weight Check** - integrity of weight checks, making it impossible to cheat the process.

400 TO 2340MM (16 TO 92”) DIA. PIPES USING A POWER TROLLEY

- Lining lengths up to 400m (1300) feet are possible using only using two access pits and the SR3000 Schur-BPH rig

- 800m (2600 feet) is possible with two access pits
  - Line half the pipe one day the other half the next.

SIPP and CIPP Liner Design is the Same Construction methods are very different

SIPP and CIPP use the:

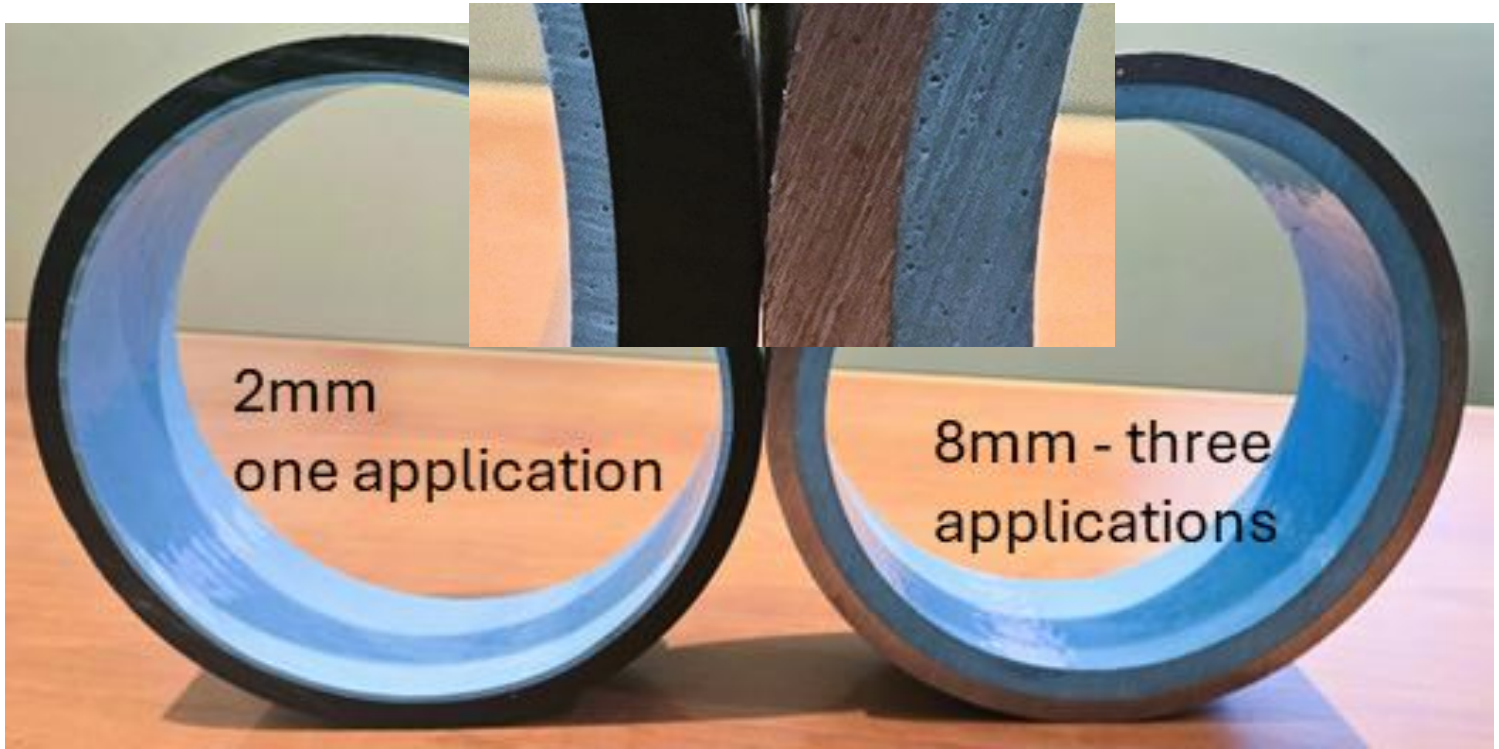
1) Same design equations, and
2) Same material properties developed using the same ISO/ASTM Standards

- SIPP and CIPP have very different construction methods.

Contact Specifications should be performance based not construction method based.

Build the Liner Thickness You Need Fast

- Resiline 320 has 8-hour recoat window
- Resiline 320 NSF/ANSI/CAN 61 approval 1 to 14mm
- Excellent inter coat bond with no seam with no preparation required between 3 to 3.5mm thick coats



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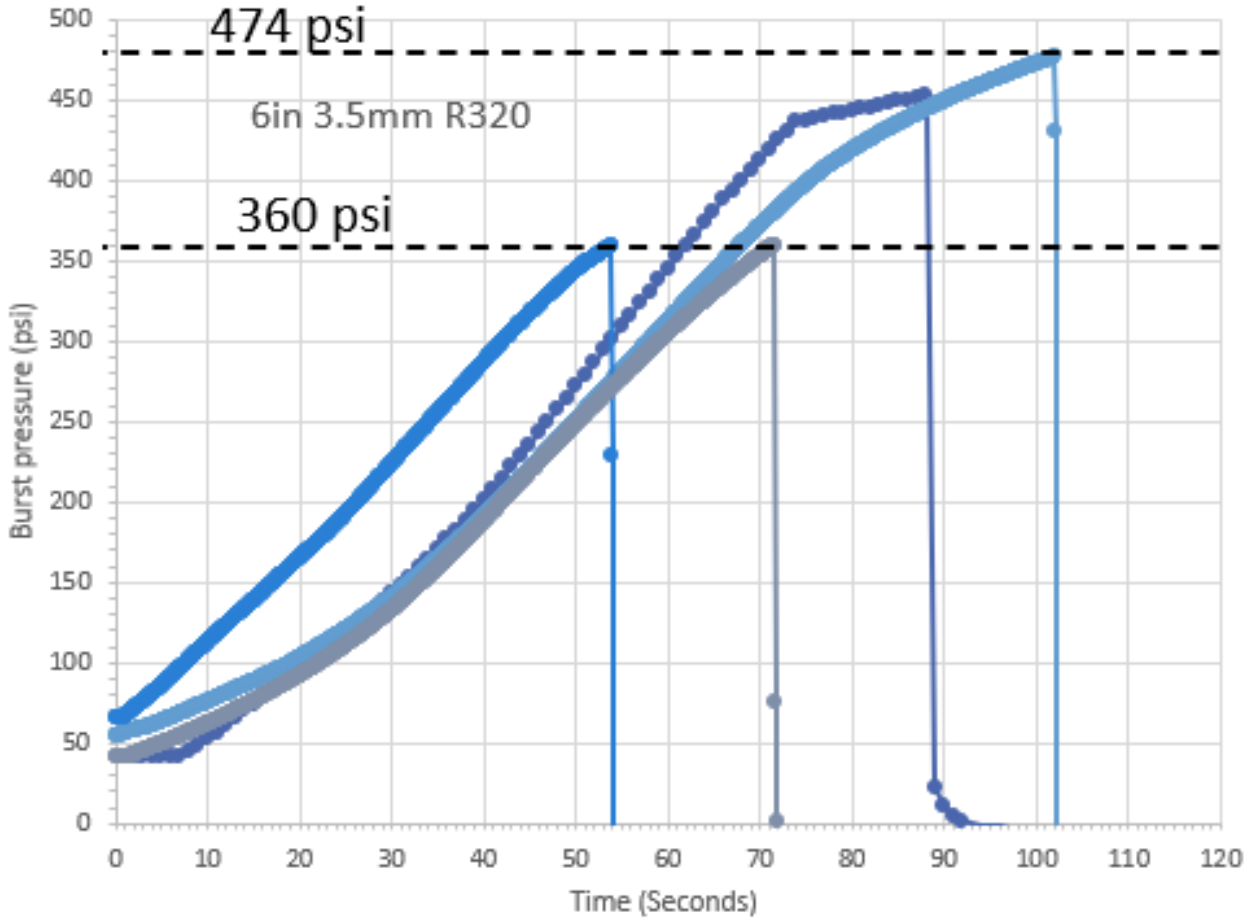
Excellent Short and Long-term Mechanical Properties

Material Design Property	Resiline 320	PVC[1]	HDPE[2]
ASTM D638 Tensile Strength @ 5 percent Strain (MPa)	43	41 to 48.3	21 to 24
50-year Tensile Strength Retention Factor	0.31	0.4	0.2
50-year Tensile Strength (MPa)	13.5	17.6	5 to 8

[1] PVC 12454 ASTM D1784 [2] PPI Handbook 2nd Edition

BUILD THE BURST PRESSURE YOU NEED

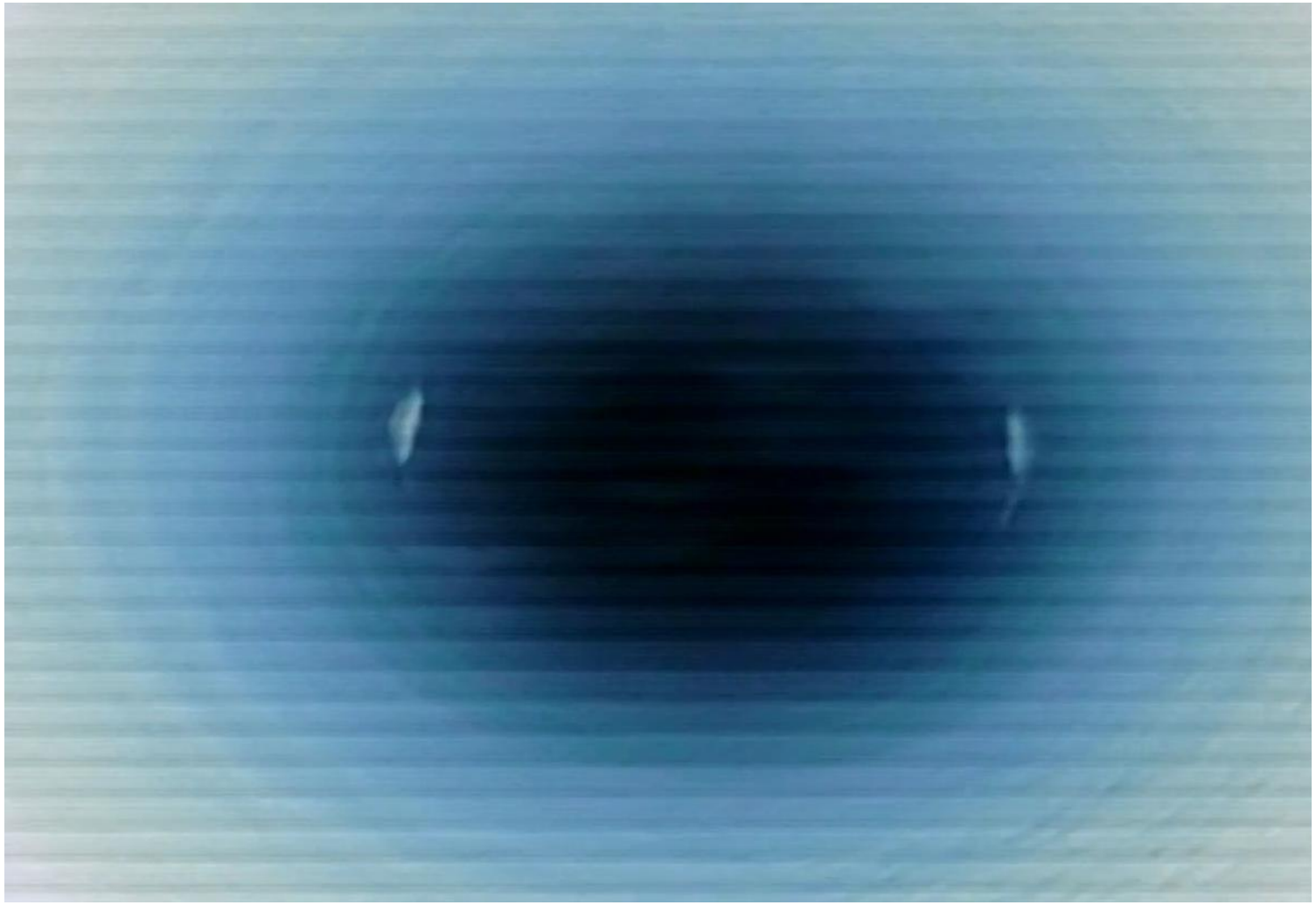


150mm dia. Resiline 320 SIPP liner

3.5mm Short-term Burst Pressure= 2.5 MPa (360psi)

4.1mm = 3.45 MPa (500psi)

SERVICES CONNECTIONS ARE NOT BLOCKED AND SEALED WATERTIGHT



CONTINUOUS WATERTIGHT LINER WITH NO FOLDS OR WRINKLES

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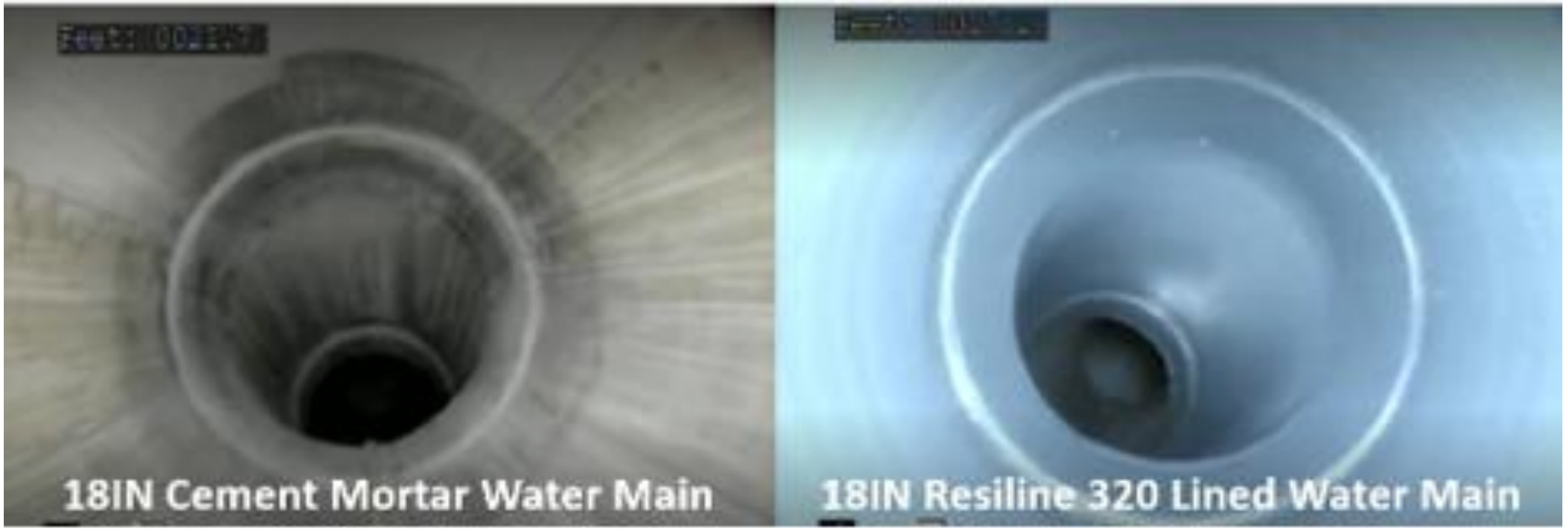
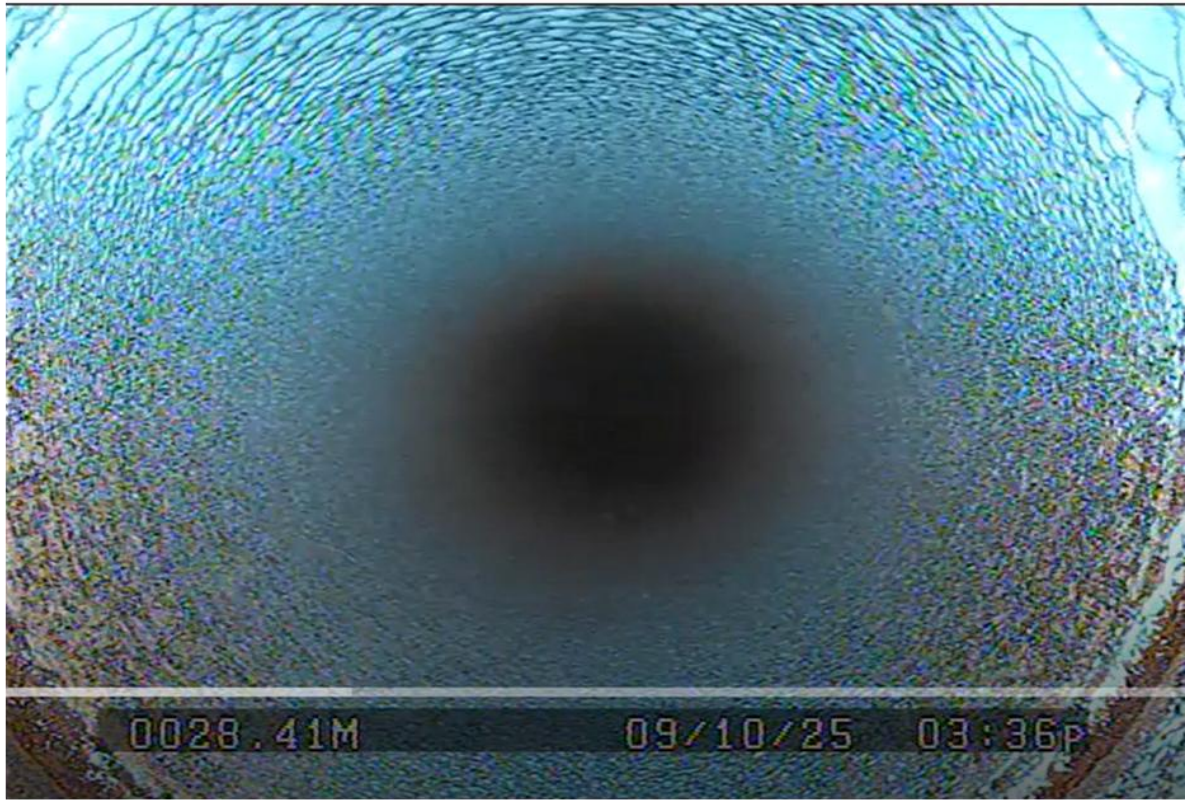
6mm liner thickness



Hydrant Leads and Tees are Not Blocked

- Often have more tuberculation than the pipe
- Hydrants can be opened and stone cleaned
- Removal of hydrant can allow for full cleaning



Stone Clean hydrant lead

Fall 2024 Deep River

7am to 8:30am open pipe

8:30am to 12:30pm – pipe cleaned

12:30 to 1:30pm - CCTV and prepare the pipe for lining

1:30 to 4:00pm – 2 x 1.5mm coating

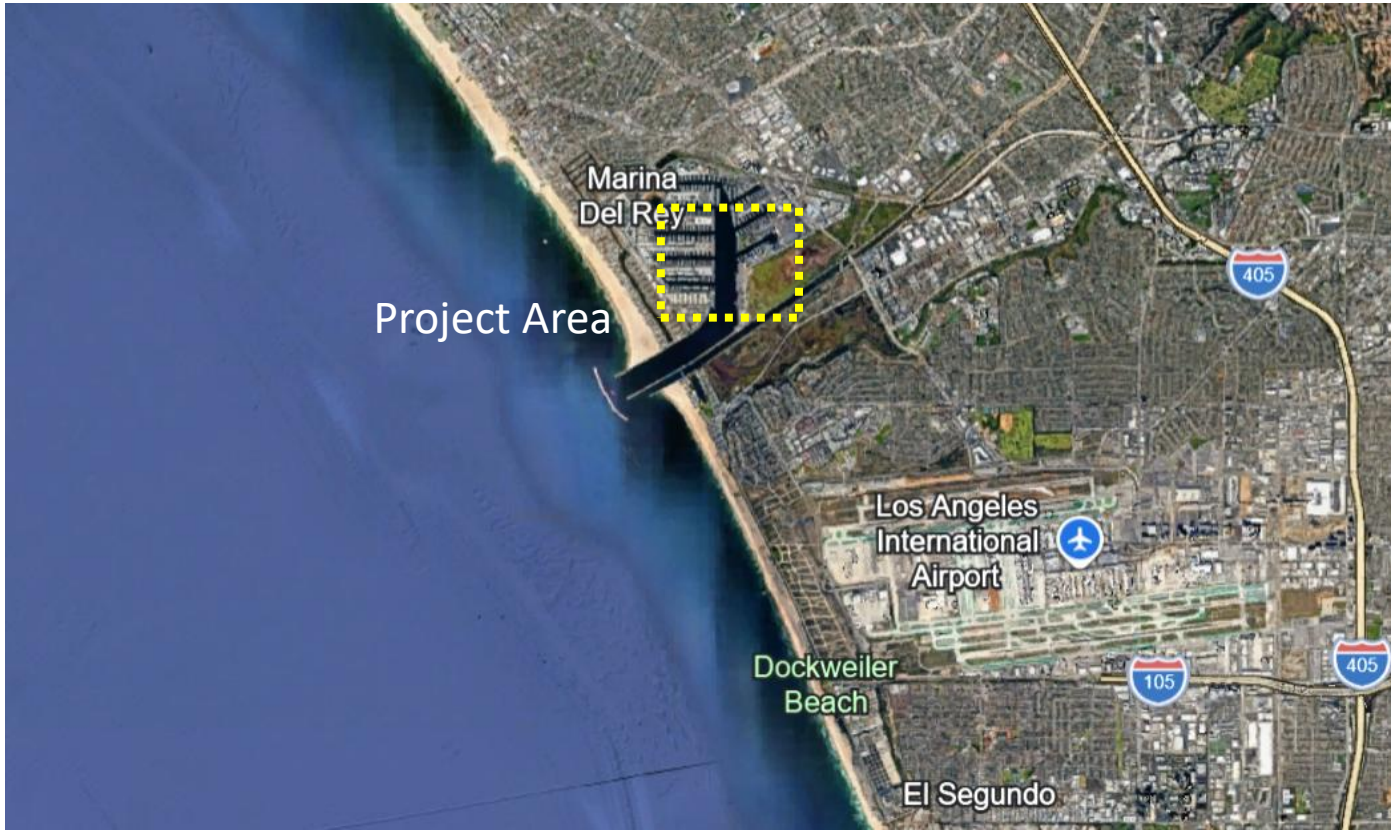
4:00 to 6pm - Disinfection and Reconnect

Same Day Return to Service is Possible

9am	10:30M Drag Scraped cleaned	12:00 Noon Abrasive Stone cleaned	4:00 pm Resiline 320 lined pipe

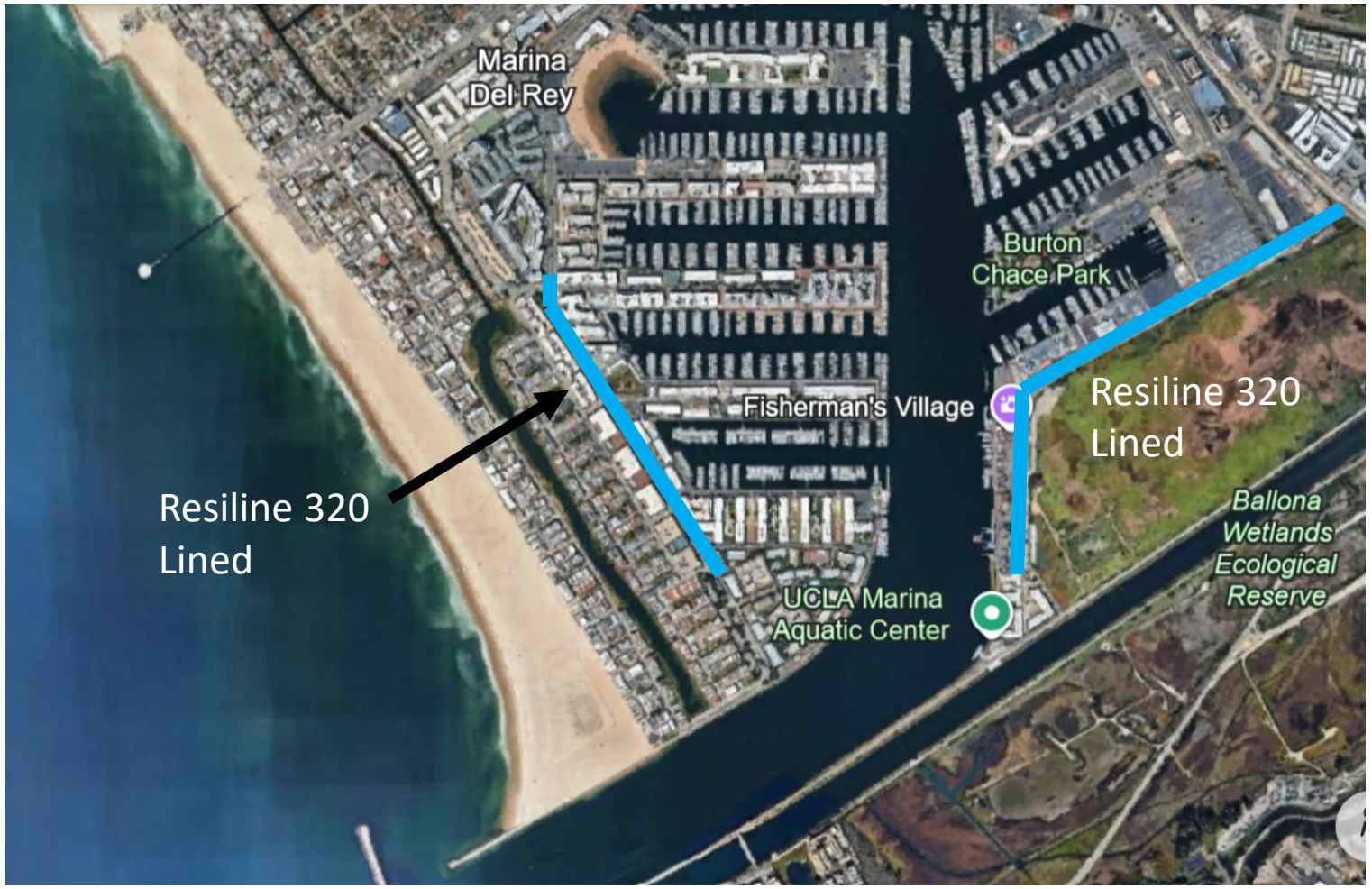
Marina Del Ray California

- 1.8 kms (5,834 feet) of 457mm (18-inch) Watermain
- 2.1 to 3m deep in high water table
- Multiple bends



Project Challenges

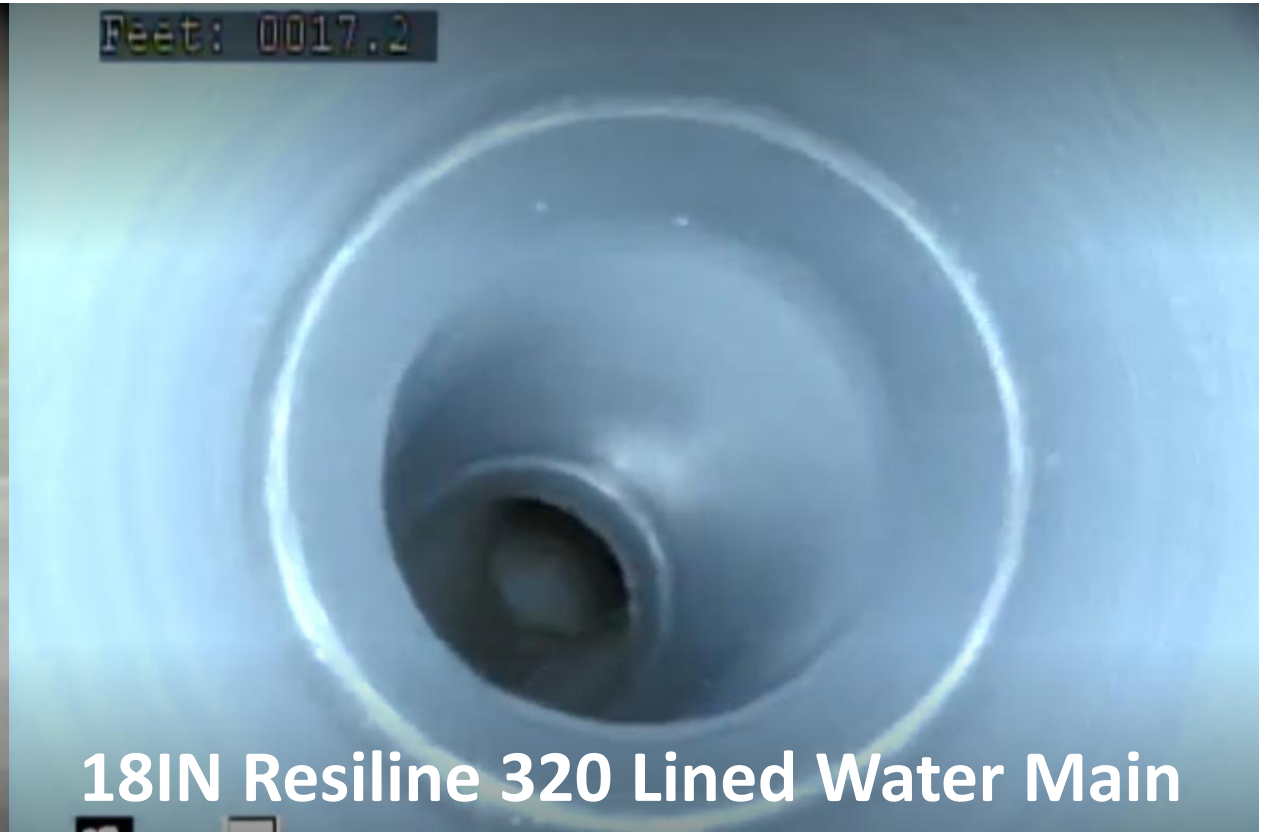
- 170m Lining lengths
- Unidentified Bends
- Single Lane crowded urban access
- Tidal water table which is near the ground surface



Flooded Pit

- Resiline 320 rapid cure resulted in the liner to be ok.
- SIPP process is contractor friendly

6mm Installation Finish



SIPP Benefits

- Quickly construct a continuous smooth watertight liner
  - at joints and service connections.
- Ability to clean and line up to 160m in one workday.
- Ability to build the liner thickness that you need.
- Reduced construction time, public disturbance, and project cost.

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