Pipeline Rehabilitation

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Advanced Solutions

Overview

- **Introduction**
- **Pipe Rehabilitation**
  - Current Problems
  - Pipe Rehabilitation
  - 100% Solid Epoxy SIPP
  - Epoxy SIPP In Practice
  - Questions

SUEZ Advanced Solutions:

Infrastructure Rehabilitation & Maintenance

- Rehabilitate
- Maintain
- Back-up short-staffed internal teams

Extend life of asset

New Technologies

- Do more with existing assets to meet new regulations

Lower capital costs

SUEZ can provide water utilities with an integrated solution.

Smart Asset Management

- Increased efficiency
- Optimized operations

Lower operating expenses

Suez Advanced Solutions

Water Wells

- Condition assessment
- Maintenance program
- Pumps services
- Rehabilitation
- Drilling

Water Quality

- Asset chemical cleaning
- Mixers
- THM removal
- Ice Pigging
- Filter media replacement

Steel Water Tanks

- Condition assessment
- Maintenance program
- Rehabilitation
- Drone inspections

Concrete Structures

- Condition assessment
- Maintenance program
- Rehabilitation
- Water, wastewater and storm water assets

Network assets & Meters

- Maintenance program with AMI
- Advanced Network management (Aquadvanced)
- Network condition assessment and rehabilitation

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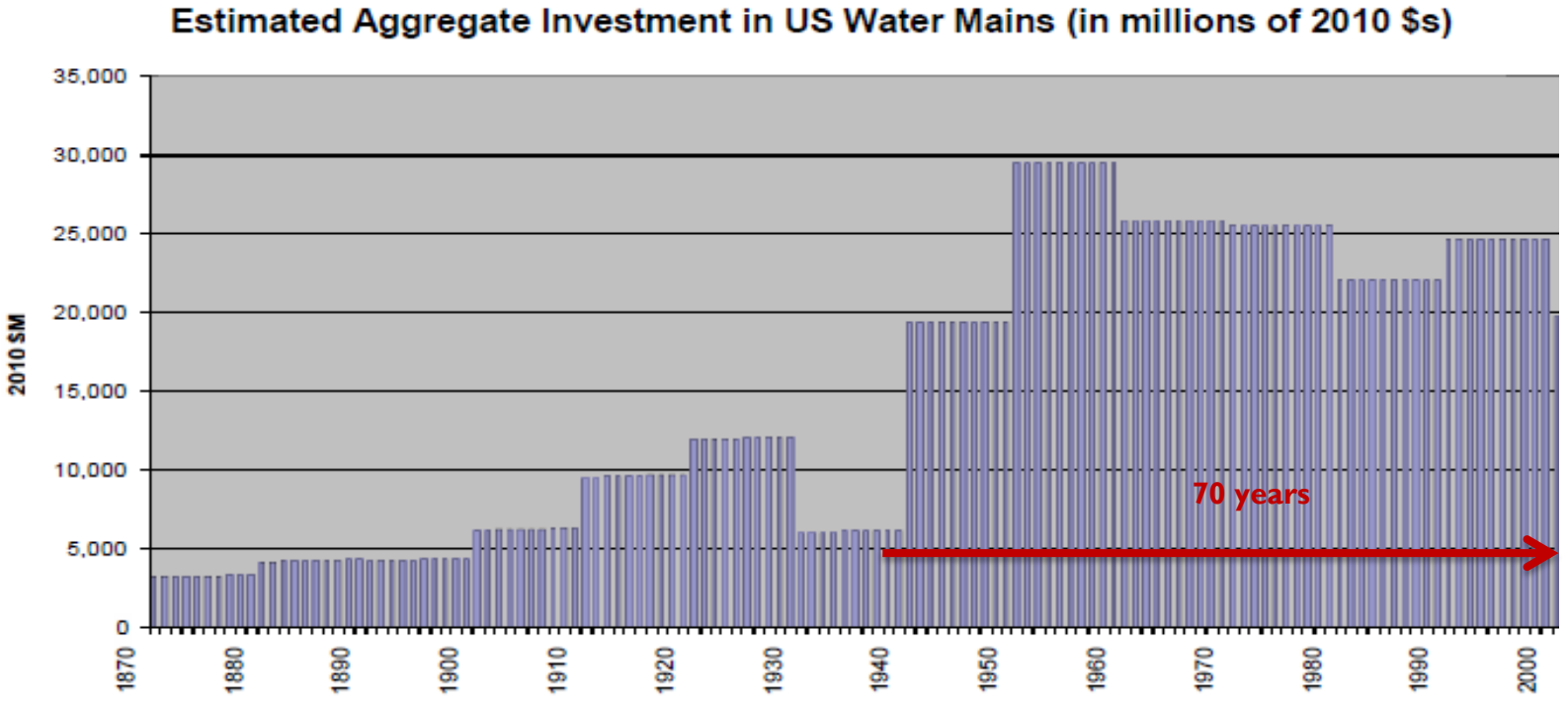
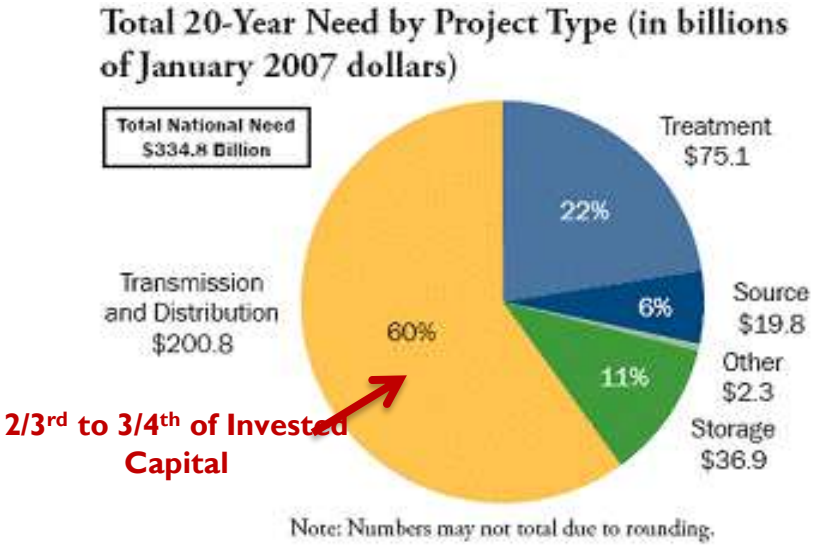
The Problem

Pipe Age:



The Investment Bubble

- AWWA Buried, No Longer Confronting Americas Infrastructure Challenge - $1Trillion Need
- American Society of Civil Engineers gives drinking water systems a D- Grade
- America's drinking water systems face an annual shortfall of at least $11 billion to replace aging facilities

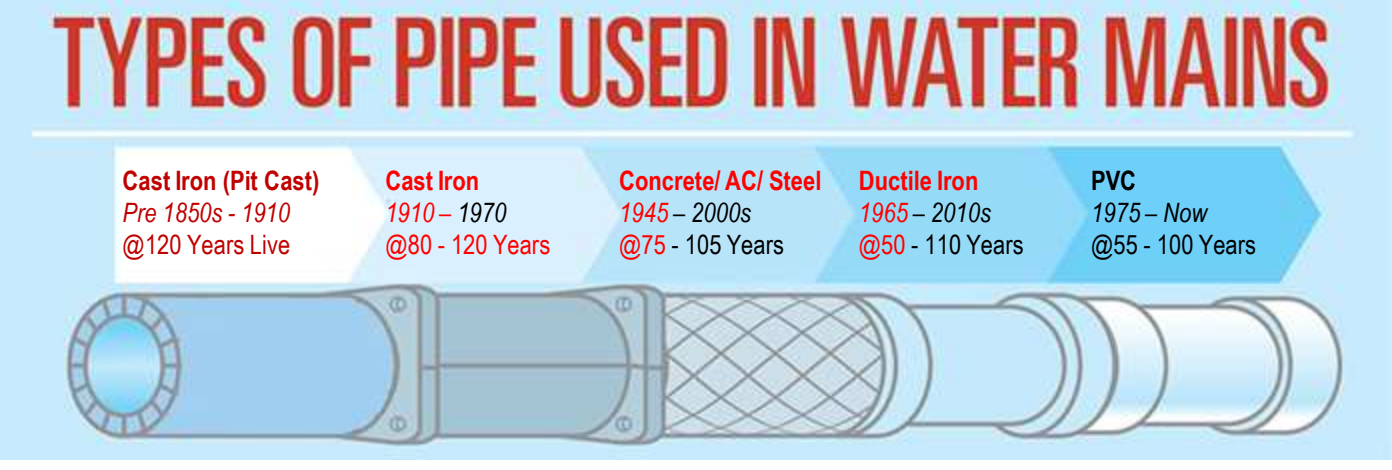


USEPA Drinking Water Needs Survey

The Problem

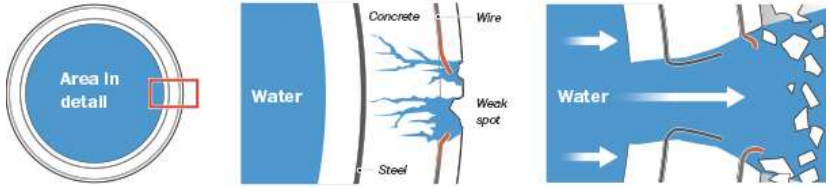
Municipal infrastructure is decaying faster than it is being renewed:

- **Pipes are surpassing useful life**

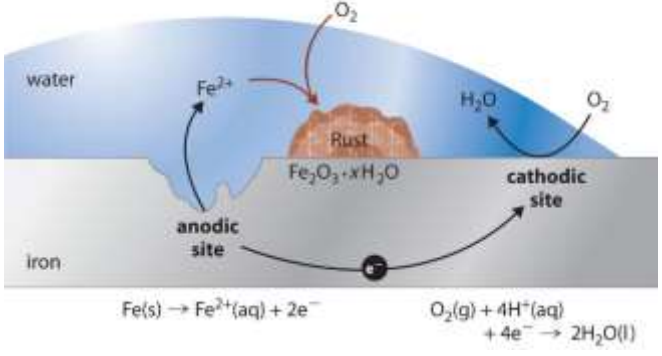


Pipes are surpassing useful life due to:

- Internal Corrosion
- Tuberculation build up
- Loosing wall thickness
- Main breaks



Example of concrete water pipe failure



Example of Cast Iron Pipe Corrosion

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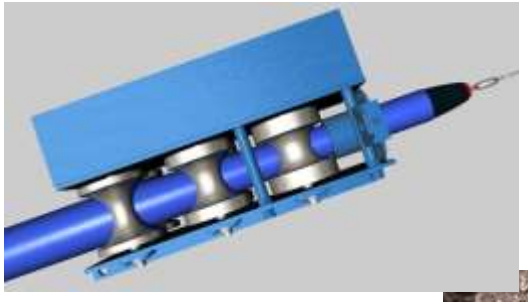
Traditional Trenchless Technologies:

Cured in Place Pipe

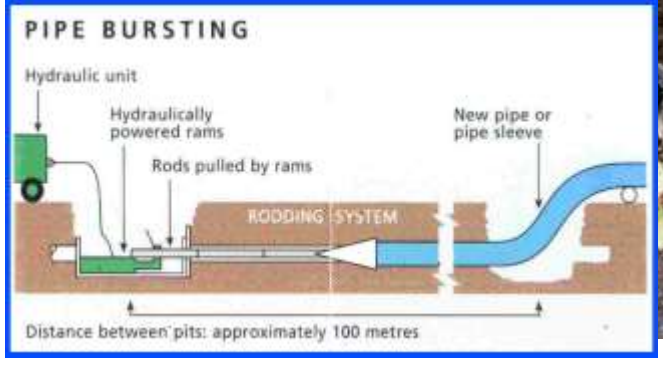
- Fabric tube impregnated with thermosetting resin



Sliplining

- HPPE pipe is pulled into host pipe
  - Diameter Reduction
  - Rolldown

Pipe Bursting/Pipe Splitting



Horizontal Directional Drilling

Spray in Place Pipe

- **Thorough cleaning of host pipe**
- **Spray host pipe with a thin lining of resin (typically 1mm thick)**

Advantages:

- Minimal excavation

Disadvantage:

- Requires a completely clean and dry host pipe
- Traditionally not providing structural rehabilitation (WQ)
- Problems with longevity

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Spray In Place - 100% Solids Epoxy

- Structural Epoxy Spray Lining
- Rapid cure (< 2 hr)
- Moisture tolerant (i.e. surfaces don’t have to be 100% dry)
- Single coat monolithic coating (i.e. no multiple coats)
- NSF approved and Bisphenol free
- Less downtime and significant savings

Coating Specification Details

- **Coatings are able to withstand prolonged exposure to heat, chemical and aggregate**
- **Other situational applicable coatings include:**
  - HVAC
  - Sewer
  - High Temperatures
  - Cooling Tower
  - Fire hydrant lines / stand pipe
  - Steam vaults
  - Steam condensate lines
  - Cogeneration
  - Domestic Water

Coating Specification Details

Coatings Specification Details

	ASTM F-1743	100% Solid Epoxy	%
Tensile Strength	3,000	7,000	233%
Flexural Strength	4,500	11,000	244%
Compressive Strength	Not Listed	12,000	--
Flexural Modulus	250,000	500,000	200%

AWWA M-28 Standards for rehabilitation of water mains. This specifies ASTM F-1743 as the class 4 Structural lining standard.

- **AWWA M-28 Standards for rehabilitation of water mains. This specifies ASTM F-1743 as the class 4 Structural lining standard.**
- **ASME PCC-2 Design considerations for buried pipe test standards were utilized and documented by Madero Engineering, Houston, TX. Certified wall thickness for our lining material for partially deteriorated pipe to resist both internal and external loads.**
- **ASTM F1216 Standard practice for rehabilitation of existing pipeline standards were utilized and documented by Madero Engineering, Houston, TX. Certified wall thickness of our material comply with this standard.**

"the ultimate capacity of all specimens exceeds 400 psi hydrostatic pressure"

– Kent Harries, Ph.D., FACI, P.Eng.

Associate Professor of Structural Engineering and Mechanics University of Pittsburgh.

SUEZ

Structurally Enhance & Reinforce

Before

Severely corroded

During

Completely cleaned

After

Epoxy lined

State of the art robotic spray application

- Computer-controlled for more refined application and curing.

Material bonds to your piping system–

- Preventing and sealing cracks
- moves with the structure, abating leaks caused by settlement.

Spray-In-Place Pipelining Process

1. System Diagnosis

- Map system
- Utilize computerized pipe video surveillance to inspect and digitally record findings
- Review findings with property management
- Diagnose and identify restoration plan

2. Repair/Replacement

- Repair or replace damaged pipe sections
- Flushing & drying
- Tuberculation removal
- Grit blasting

3. Abrasive Cleaning

- Abrasive cleaning with conical spray head to near-white metal finish *(as specified by manufacturer)*
- Pipe is now in a good state of repair

4. Epoxy Lining and Reassembly

- Pipe's state of good repair enhanced with epoxy lining
- Extends life of repaired or replaced pipe
- Prevents corrosion and biological buildup
- Enhances flow capacity
- Dampens vibration

5. Final Inspection & System Testing

- TV inspection
- Epoxy inspection of pipe lining for thickness
- and need for coating repair
- Hydrostatic pressure testing
- Leakage pressure testing
- Bacteriological disinfection
- Leaching test
- Restoration of system

SUEZ

The Process

SIPP Demo

Technology Benchmarking

No Excavation in sewer	✓
Minimal Excavation in water	✓
Structural Rehabilitation	✓
Stronger than the host pipe	✓
Not exhaust cleaning	✓
Moisture tolerant	✓
Keeps Connections	✓
Suitable for angles, turns, elbows	✓
Less downtime and significant savings	✓
No significant pipe diameter loss	✓
No depends on soil conditions	✓
NSF approved Rapid cure coating	✓
Suitable for all materials	✓
No limitations in small diameter pipes	✓

Benefits of Protective Coatings to Consumer

- Protects against future corrosion & degradation

- Extends service life of system piping & components

- Significantly enhances water and air quality

- Reduces frequency of maintenance and decreases costs and system down-time

- Eliminates the leaching of lead from the soldered joints, and the corrosion of copper and steel pipe

- Enhances flow capacity and system efficiency

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100% Solid Epoxy In Practice

Feature Project

Merrick Road – New York American Water Works

- **Restored a 100-year-old water main with a history of leaks, severe corrosion and poor water quality in Massapequa, NY**
- **Successfully lined over a 2 month period in Spring 2016**
- **Developed logistics to minimize disruption to 4-lane highway, despite multiple adverse conditions, such as multiple trapezoid sweeps, including underneath small rivers and other utility services**

Feature Project

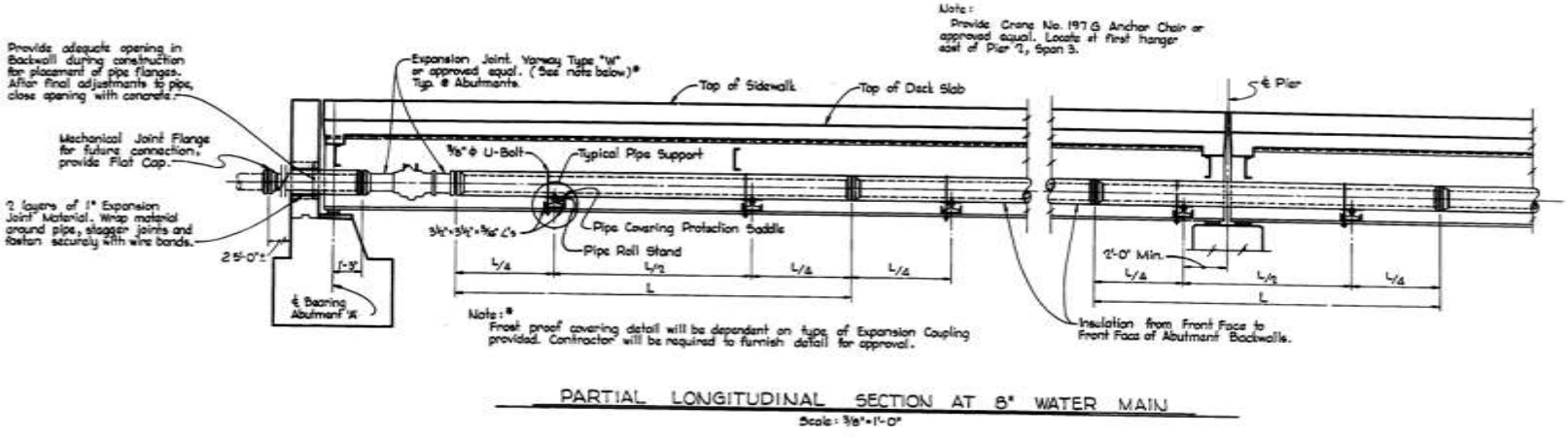
Jersey Shore Pennsylvania Domestic Water Lining Project

- **Rural town of Jersey Shore, Pennsylvania, has a gravity fed domestic water distribution system.**
- **Successfully lined two miles of pipe.**
- **Base infrastructure 16” and 12” cast iron mains originally installed in the 1890s, to supply steam locomotive station.**
- **System’s lead sealed joints had tuberculation levels as high as 50%**
- **Bypass system for approximately 150 residences installed and successfully maintained Several trapezoidal pipe layouts under streams and rivers were successfully lined in place.**
- **This was a turn key project: attended to all site safety, excavation, mechanical and road restoration.**

Marymont Drive – Piqua, Ohio

	Epoxy Cleaning and Lining	Traditional Pipe Replacement
Time Required	**3-5 days**	4-6 weeks
Access Requirements	**4 access points needing just 3 feet of pipe access**	Trench the entire street causing severe and long traffic disruptions

Rte. 42 bridge – Woodstock, Virgina



	Epoxy Cleaning and Lining	Traditional Pipe Replacement
Time Required	**2-3 days**	2-4 weeks
Access Requirements	**2 access points needing just 3 feet of pipe access**	Close half of the bridge down causing severe and long traffic disruptions

Franklin Avenue - Salem, Ohio

Time Required	**SUEZ Epoxy Cleaning and Lining**	**Traditional Pipe Replacement**
	3-5 days	4-6 weeks
Access Requirements	**4 access points needing just 3 feet of pipe access**	Trench the entire street causing severe and long traffic disruptions

Past Performance Examples

Kent County Courthouse
Dover, DE

U.S. Government GSA
Washington, D.C.

Indian Head Naval Base
Indian Head, MD

Bechtel
San Francisco, CA

DuPont Facility
Wilmington, DE

Horizon House
Naples, FL

JFK Airport
New York, NY

Saks 5th Ave
New York, NY

WTC Tower 4
New York, NY

299 Park Ave
New York, NY

Christie Street
New York, NY

The Prince
Marco Island, FL

NEW YORK AMERICAN WATER

Lehigh County Authority

GSA

PennState

pepco

suez

Spray-In-Place Pipelining Process – Summary

Benefits:

- **Extends asset life**
- **Eliminate corrosion and WQ issues**
- **Recover capacity**
- **Rapid cure and Minimal disruption**
- **Suiteable for small diameters, turns and bends (1 ¼ to 72 inches)**

Ideal Uses:

- **Steel, Cast Iron, AC**
- **Pipe Replacement is Cost Prohibitive**
  - Downtown
  - Under Rivers & Highways
- **No Upsizing Required**
  - Renovation will return pipes to original designed specs
- **Quick return to service is ideal**
- **Pipes with changes in diameter and direction**

Questions?

For Additional information:

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