

STEEL-REINFORCED THERMOPLASTIC PIPE IN STATE & FEDERAL REGULATED APPLICATIONS

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Project Engineering Manager



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AGENDA

- | | | | |
|----------|-------------------------------------|----------|--|
| 1 | Reinforced Thermoplastic Pipe (RTP) | 3 | State & Federal Regulated Applications |
| 2 | Overview of FlexSteel Pipelines | 4 | Success Stories: Field Proven |



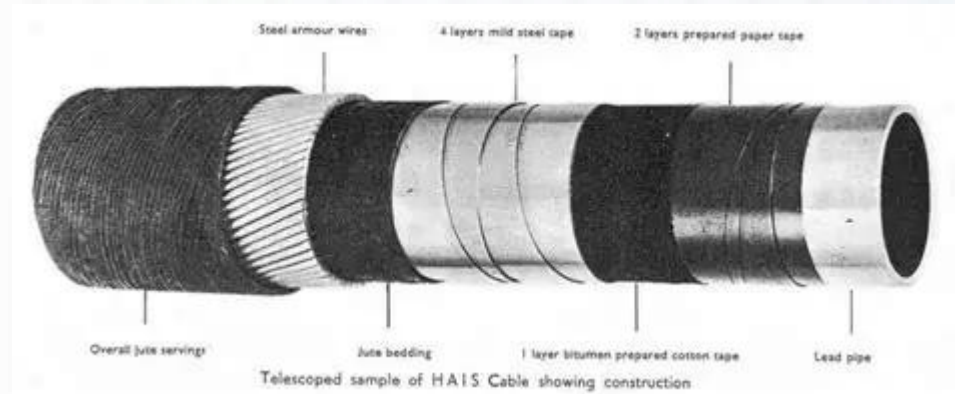
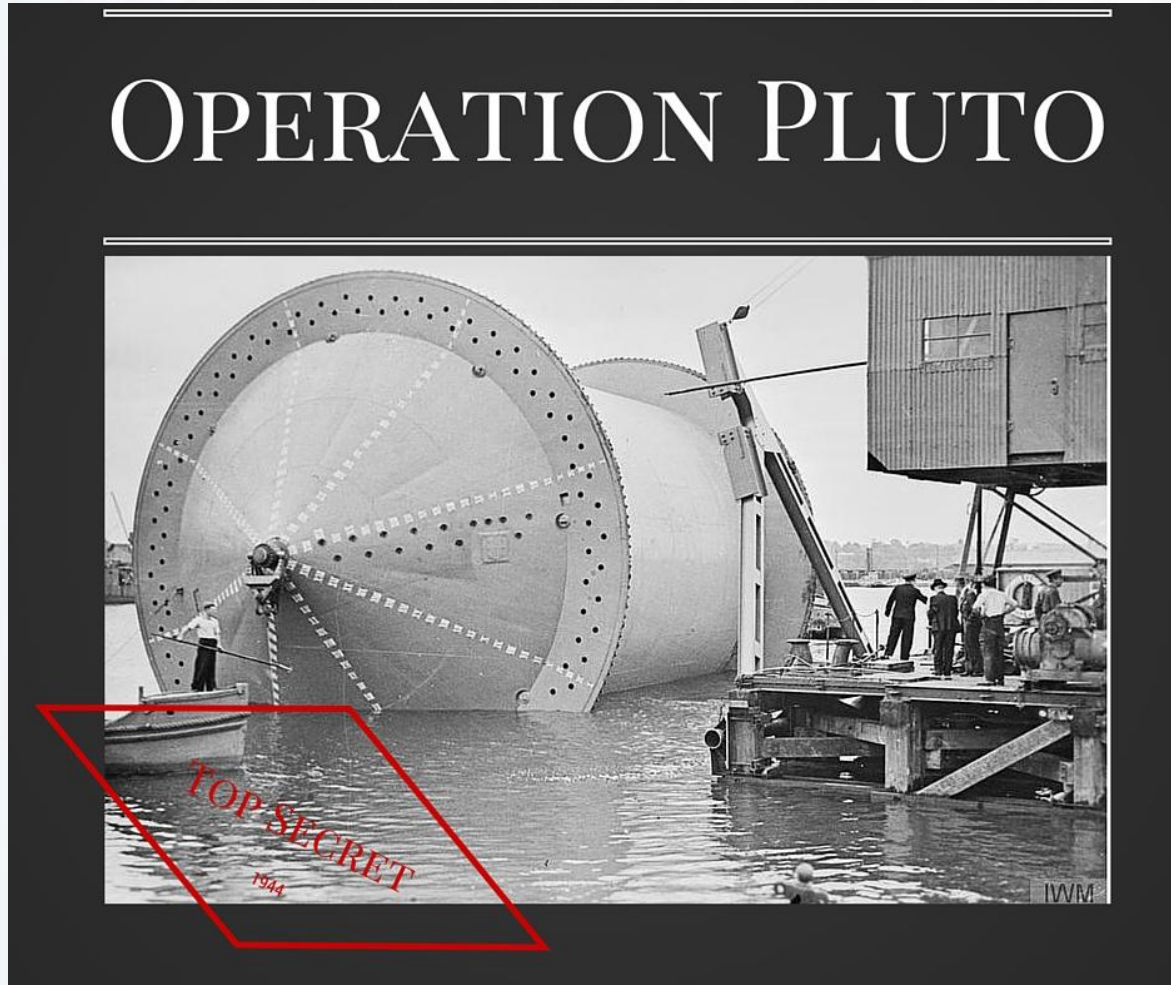
REINFORCED THERMOPLASTIC PIPE (RTP)

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WORLD'S FIRST COMPOSITE SPOOLABLE PIPELINE

REVOLUTIONIZING THE BATTLEFIELD



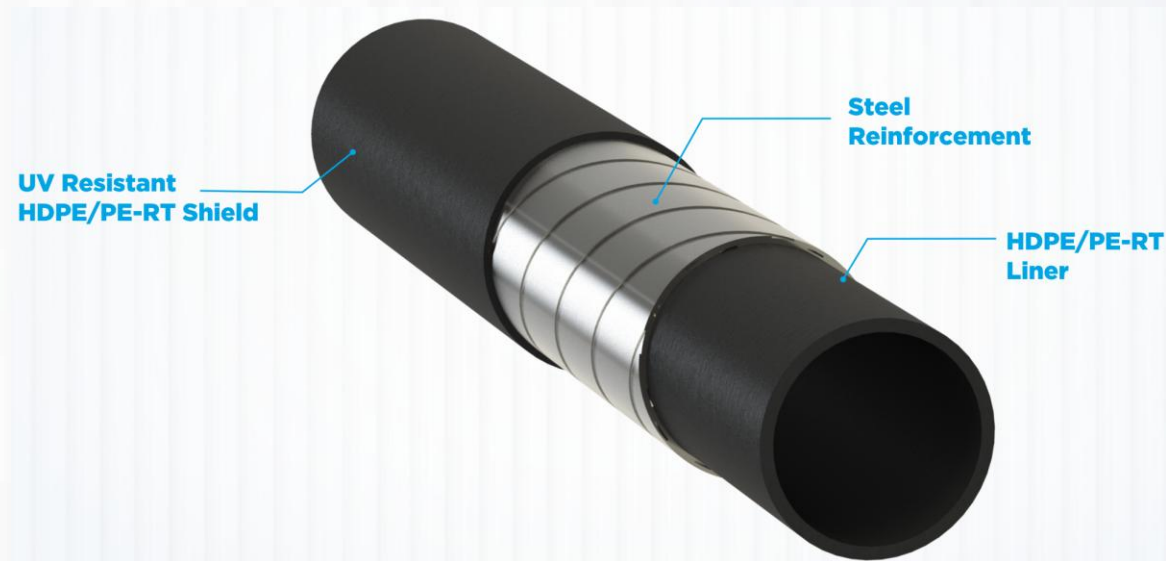
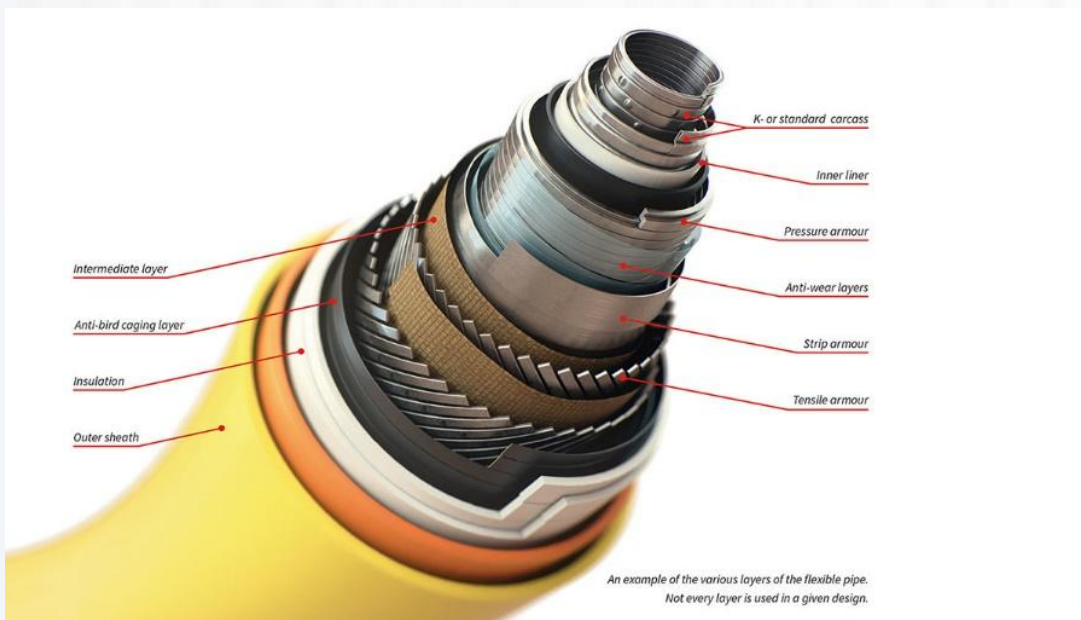
- » 70km installed in 1942 to provide fuel to allied forces
- » Transported 760 million pounds of petroleum products
- » 8% of all UK petroleum products delivered during the war

RTP ORIGIN STORY

FROM OFFSHORE TO ONSHORE

» Offshore flexible risers and flowlines were built to handle dynamic loading environments

» Onshore spoolables removed unnecessary layers and left what is needed for operation and handling loads



FLEXIBLE PIPELINE SOLUTIONS

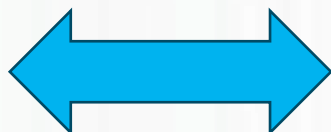
ELIMINATING CORROSION

» Inner Layers:

- HDPE
- PE-RT
- Nylon
- PPS
- PA-12
- PEX
- PVDF

» **Bonded**

» **Unbonded**

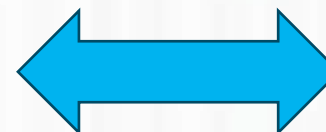


» Reinforcement Layers:

- Glass Fiber
- Aramid Fiber
- Carbon Fiber
- Kevlar
- Steel Chord
- Steel Wire
- Steel Strip

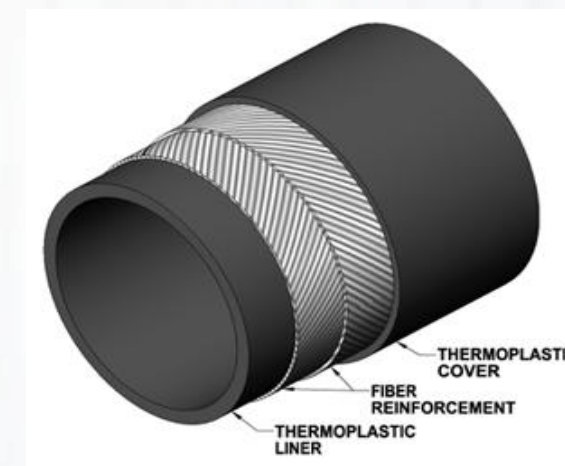
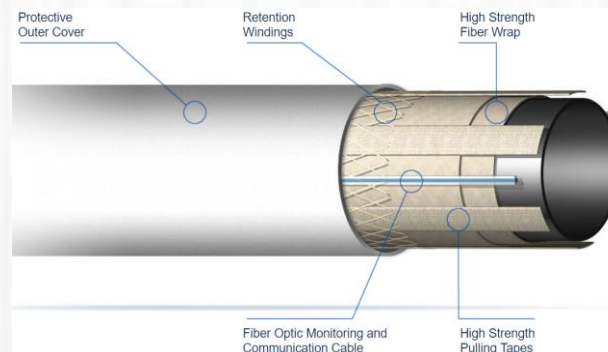
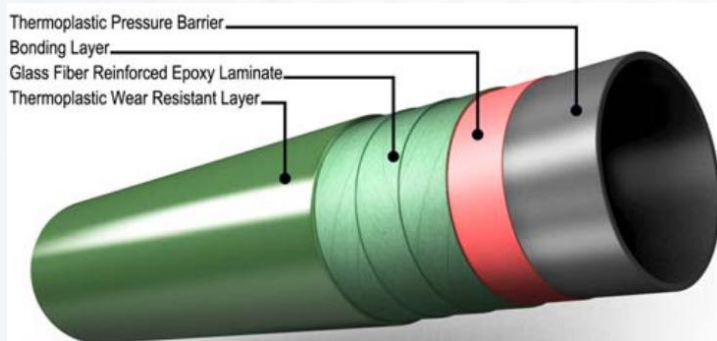
» **Bonded**

» **Unbonded**



» External Layers:

- HDPE
- PE-RT



CONNECTING FLEXIBLE PIPE

FIELD WELDLESS SYSTEMS

» Connection Type:

- Flanged
- Weld neck
- Hub and clamp
- Midline
- Tees
- Elbows
- Laterals

» Install Method:

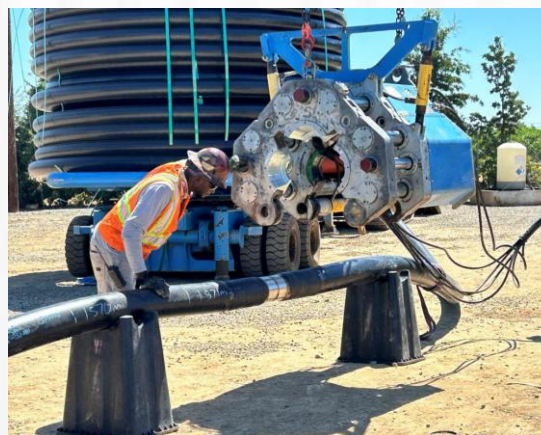
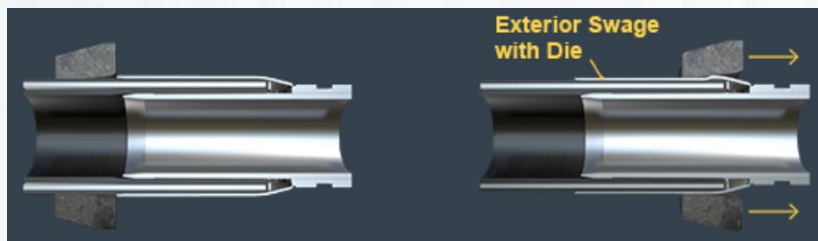
- Swaging
- Crimping
- Clamping
- Electrofusion
- Mechanical

» Fitting Alloys:

- Carbon steel
- Stainless steel
- Duplex
- Supler Duplex
- Inconel
- Hastelloy

» Fitting Coatings:

- FBE
- PEK
- PPS
- Zinc
- Nickel
- Inconel



APPLICABLE CODES & STANDARDS

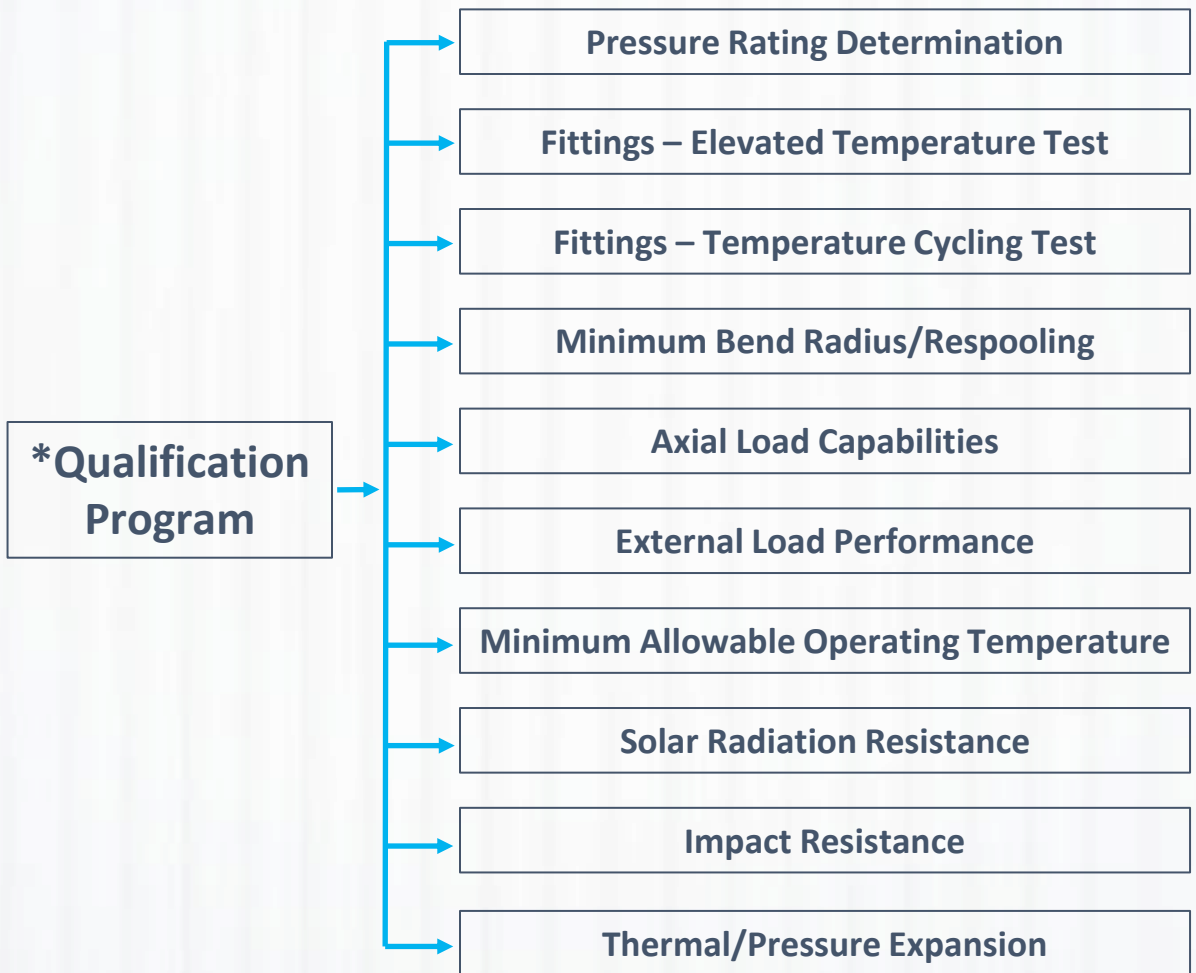
API 15S – ONSHORE APPLICATIONS (PERFORMANCE BASED)

» Steel reinforced thermoplastic pipe

- API 17J / 15S
- ASTM F2805
- CSA Z662
- ISO 18226

» Non-metallic reinforced thermoplastic pipe

- API 15S / 17B Annex H
- ASTM F2686
- CSA Z662
- ISO 18226
- DNVGL-RP-F119



CUTTING EDGE TECHNOLOGIES

DELIVERS SIGNIFICANT VALUE & SAVINGS

PRODUCT CAPABILITIES



High pressure ratings and structural durability resulting in long service life



Inner and outer layers provide protection from internal or external corrosion



Versatile capability in applications including hydrocarbons, water, CO2, hydrogen



Lightweight with high tension ratings making them ideal for pipeline rehabilitation



Minimal maintenance or repair resulting in reduced total cost of ownership

INSTALLATION ADVANTAGES



Fast deployment with smaller crews meaning reduced time to first production



Minimal ground disturbance with the ability to avoid environmentally sensitive areas



No field welding eliminates safety risks and the need for any x-ray inspections



Reduced ROW, spool packages, and weight result in smaller equipment requirements



Improved flow efficiency reduces friction, scaling, paraffins, and pressure drop

OVERVIEW OF FLEXSTEEL PIPELINES



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MADE IN THE USA

ALL PIPE AND FITTINGS START HERE

DELIVERING NEXT GENERATION LINE PIPE



Developed From
40 Years of Experience In
Offshore Environments

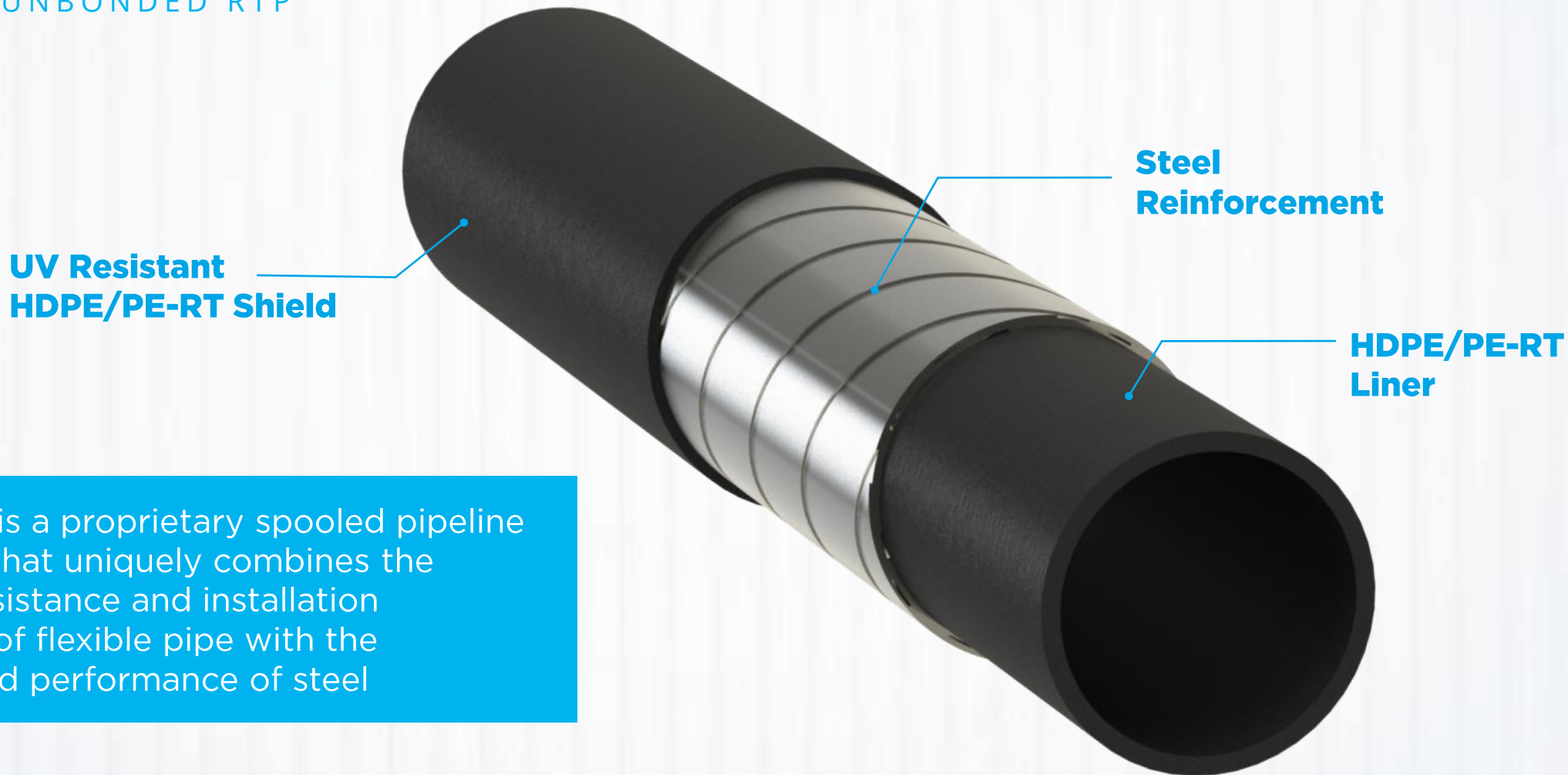
Manufacturing For
Onshore Applications
Since 2003

Opened Manufacturing
Facility in
Baytown, TX in 2012

Industry Leading
Track Record for Quality
& Performance

PRODUCT DESIGN

3-LAYER UNBONDED RTP



**UV Resistant
HDPE/PE-RT Shield**

**Steel
Reinforcement**

**HDPE/PE-RT
Liner**

FLEXSTEEL is a proprietary spooled pipeline technology that uniquely combines the corrosion resistance and installation advantages of flexible pipe with the durability and performance of steel

PRODUCT PORTFOLIO

LARGEST DIAMETERS IN THE WORLD

DESIGN PRESSURE RANGE

750, 1500, 2250, and 3000 psi

DESIGN TEMPERATURE RANGE

Standard up to **150°F**

High-temp hydrocarbons up to **185°F**

High-temp water up to **194°F**

High-temp excursions up to **220°F**

SWEET & SOUR PRODUCT LINES

15S-0001 | 17J-0018 | Q1-3633



2 in.

3 in.

4 in.

5 in.

6 in.

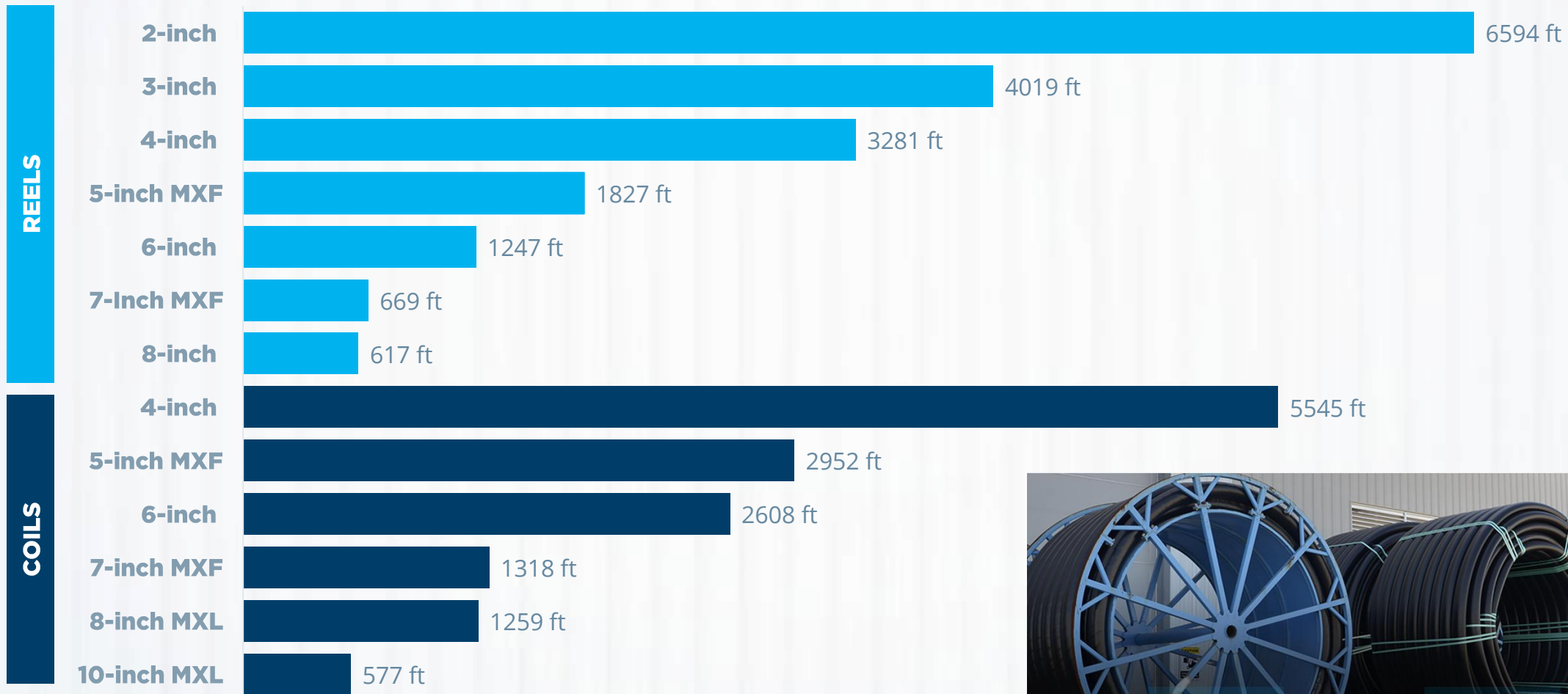
7 in.

8 in.

10 in.

PACKAGING OPTIONS

REELS VS COILS



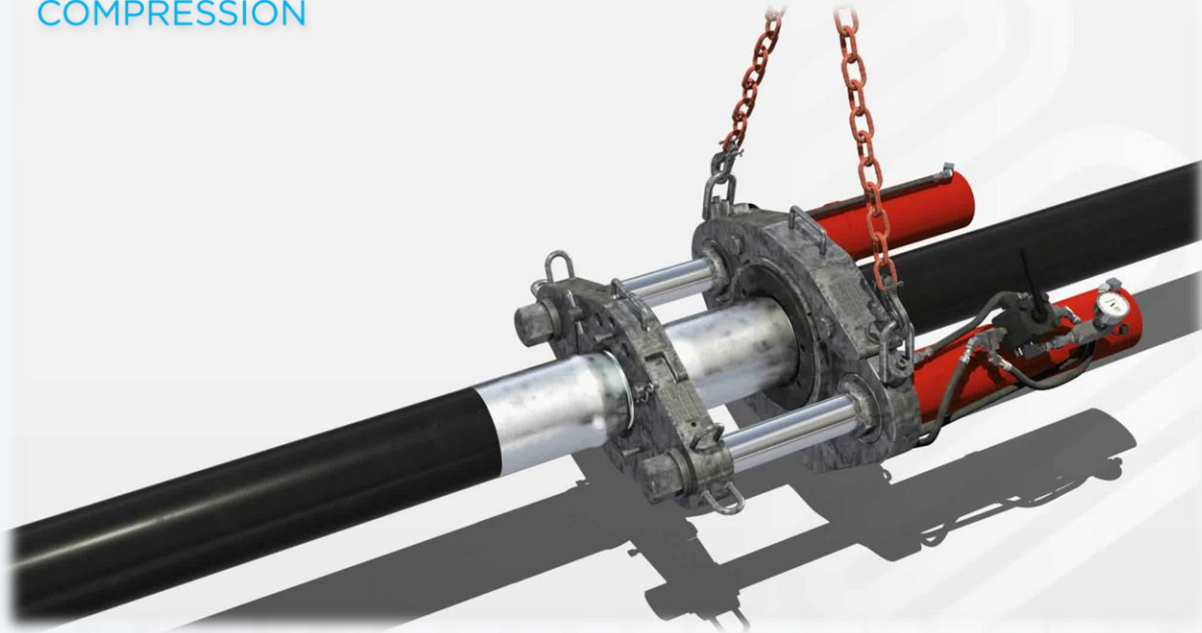
REELS

COILS

CONNECTING PIPE TO PIPE

FITTINGS & CONNECTION METHOD

360°
COMPRESSION



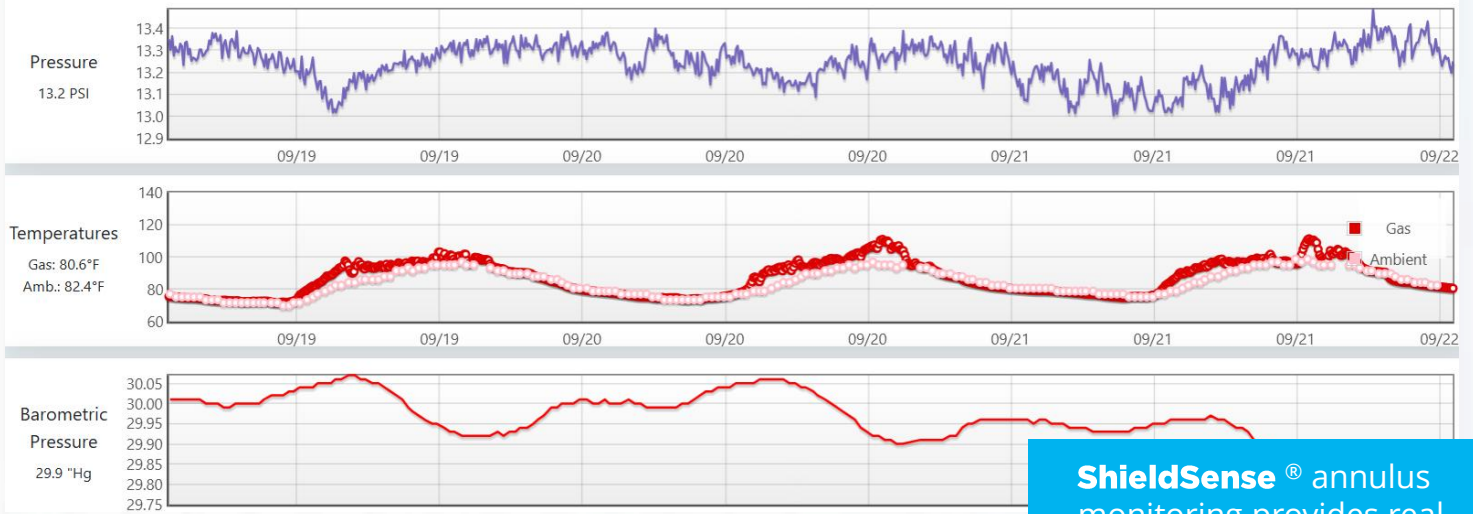
Standard Material: **316L Stainless Steel** | Other Options: Duplex, Super Duplex, Inconel, Carbon Steel, and More

INTEGRITY MANAGEMENT

PIPELINE INTEGRITY ASSURANCE POST INSTALLATION

SHIELDSURE[®]

Shield Integrity Test
Performed Post Installation



ShieldSense[®] annulus monitoring provides real-time integrity insight

World's First
Composite In-Line
Inspection Tool in
development



PIPELINE APPLICATIONS

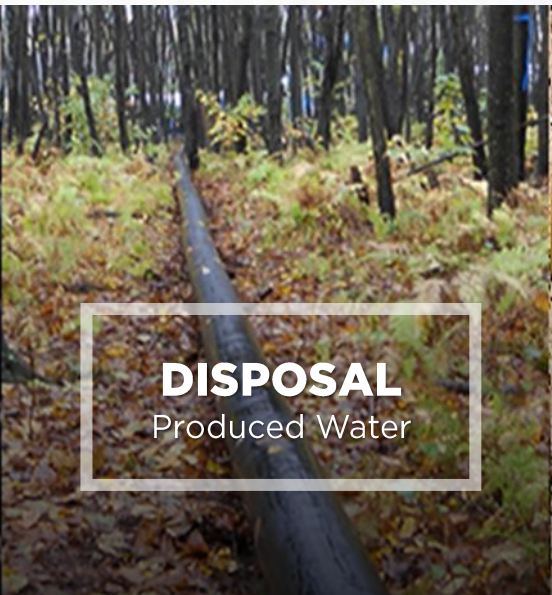
COMPATIBILITY THROUGHOUT THE INDUSTRY



PRODUCTION
Multiphase • Oil • Gas



GATHERING
Oil • Gas • CO₂ • Water



DISPOSAL
Produced Water



INJECTION
Water • CO₂ • Gas



REHABILITATION
Deteriorating Pipelines



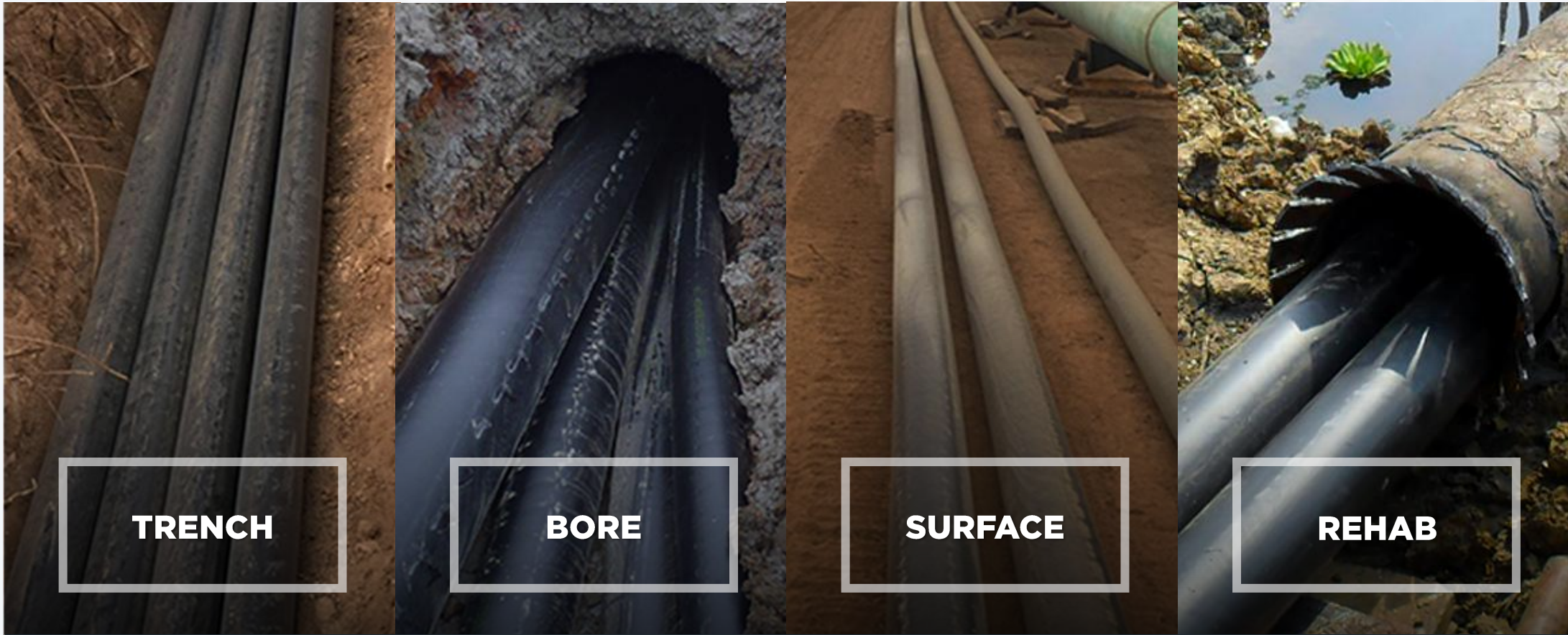
OFFSHORE
Depths up to 117m



MIDSTREAM
Transmission • Regulatory

PIPELINE INSTALLATION METHODS

DURABILITY IN ALL FORMS OF INSTALLATION



TRENCH

BORE

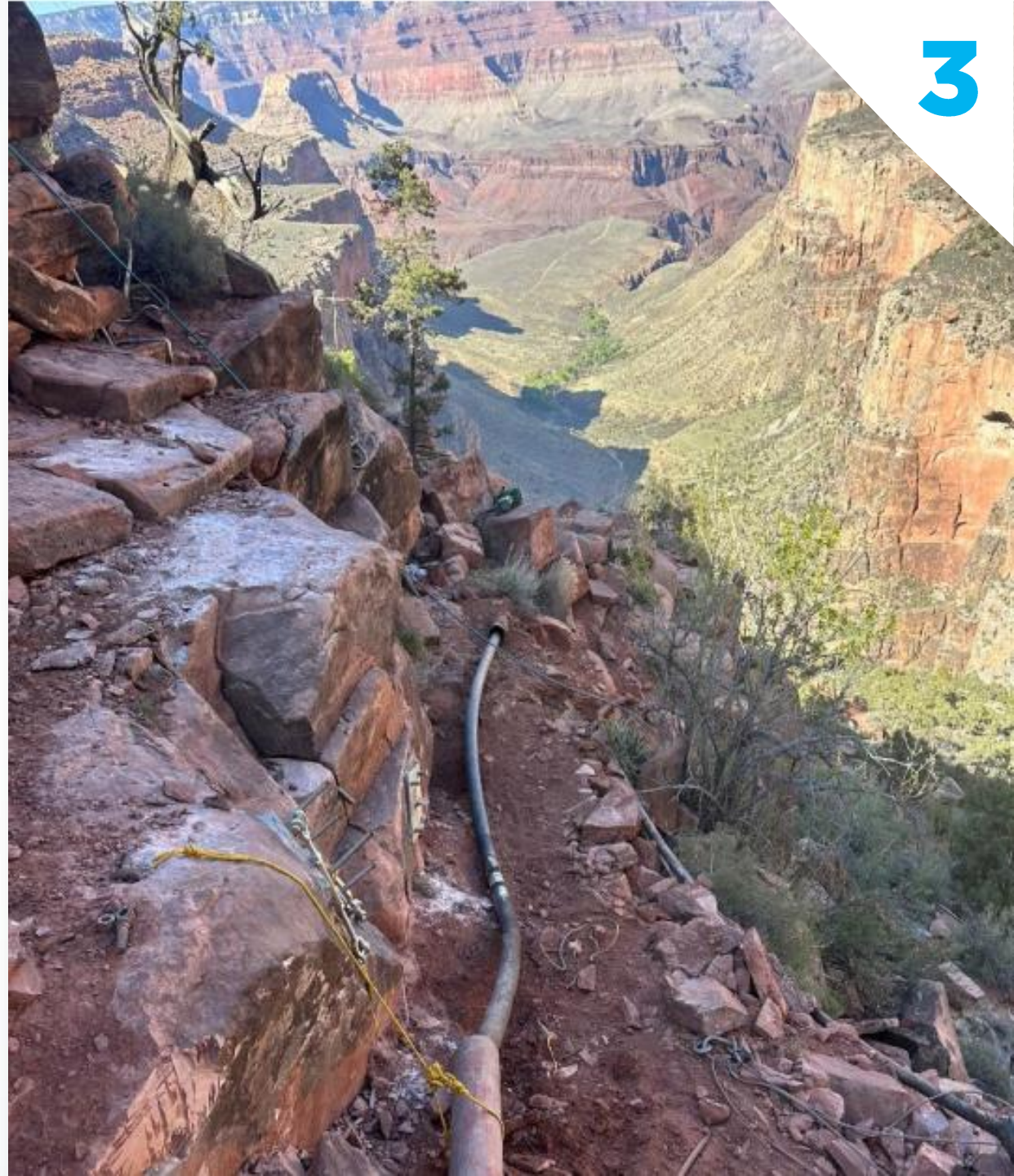
SURFACE

REHAB

FlexSteel line pipe delivers proven performance and increased safety for the most demanding applications

STATE AND FEDERAL REGULATED APPLICATIONS

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PHMSA APPROVED MATERIALS



Metallic



Non-Metallic



OR

Metallic



Non-Metallic



Composite



+

=



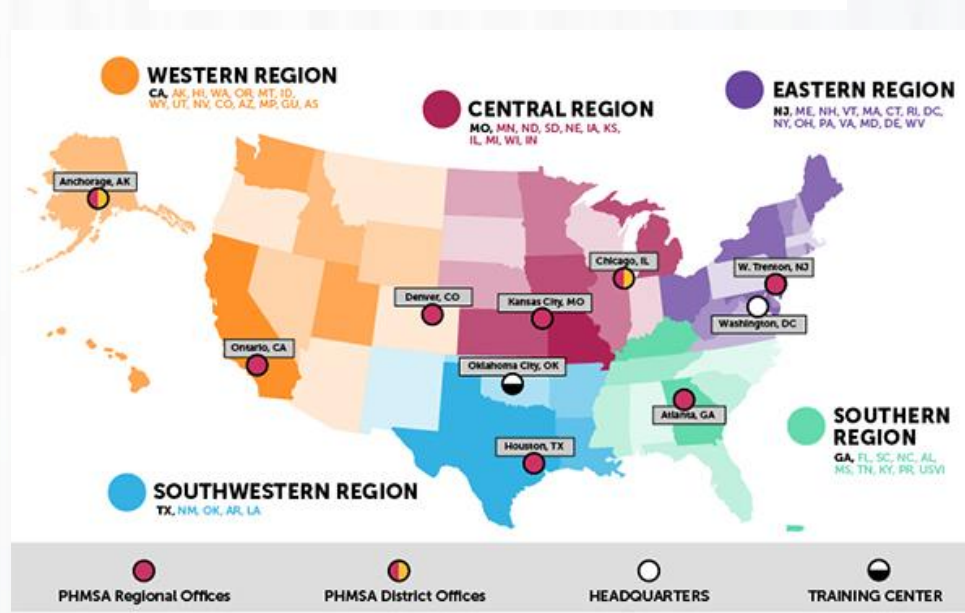
NEW ADMINISTRATION, OLD REGULATIONS

PUSHING FOR CHANGE

- » **Current cabinet emphasizing deregulation of proven technologies such as FlexSteel**
- » **Advanced Notices For Proposed Rulemaking (ANPRM)**
 - Mandatory Regulatory Reviews To Unleash American Energy and Improve Government Efficiency
 - Repair Criteria For Hazardous Liquid and Gas Transmission Pipelines
- » **Reflect a push to reduce burdens on operators**
- » **Encourage clearer standards, broader approvals, or incorporation of updated industry specs for composite pipes**
- » **Backed by the industry: API, GPA Midstream, INGAA, AGA, PPI, manufacturers, operators**



U.S. Department
of Transportation
**Pipeline and
Hazardous Materials
Safety Administration**



FLEXSTEEL REGULATORY UPDATE

FROM DEFENSE TO OFFENSE

- Visits to D.C. to meet with PHMSA administration, Engineering, Legal, Standards & Rulemaking.
- Discussed incorporation of FlexSteel into code, streamlining special permit process, reduced special conditions, decreased review and approval times, blanket application/operator approvals.
- Interpretation request submitted to make 8" MXL 750-2250psi within 8.625" diameter rule (unregulated).
- New Integrity Management Manual, Type C Gas Gathering Notification template, Special Permit templates, blanket approval templates
- Pending submissions for:
 - Blanket approval of crude gathering
 - First crude transmission rehab + first 10" regulated project



REGULATORY RESUME

23 YEARS OF EXPERIENCE

» Approvals

- 10 Special Permits
- 5+ Type C Notifications

» 192 & 195 templates

- Special Permits
- Intrastate & interstate
- Type C notification
- Blanket approval

» Projects testing & reporting to PHMSA in oil & gas service

- 1-year, 2.5-year, & 5-year intervals tested and reported in gas service
- 1-year & 2.5-year intervals tested & reported in oil service



OVER
130 MILLION FEET
of **FLEXSTEEL** pipe installed
around the world

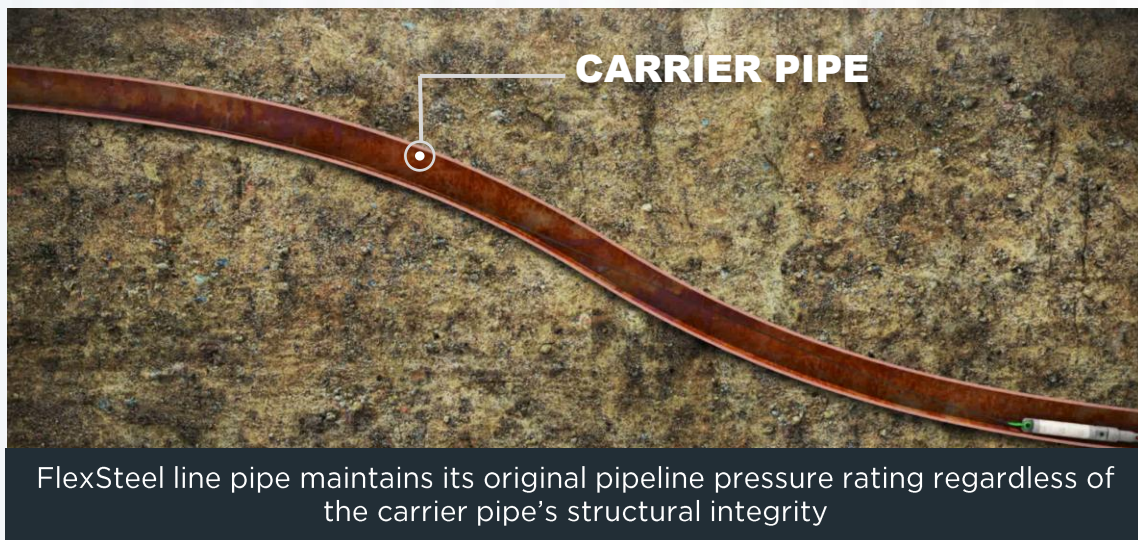
REGULATORY APPROVALS

Approved US DOT Special Permits for FlexSteel Pipe

SERVICE	APPLICATION	LOCATION	NOMINAL SIZE	INSTALLATION TYPE	APPROVAL DATE	DOCKET #
195	Gathering	Houston, TX	8-FSP	Rehab	Apr, 2020	PHMSA-2020-0042
195	Gathering	Bakersfield, CA	8-FSP	Rehab	Dec, 2019	PHMSA-2019-0101
195	Gathering	Long Beach, CA	8-FSP	Rehab	Apr, 2018	PHMSA-2018-0017
195	Gathering	St. Mary's Parish, LA	6-FSP	Rehab	Mar, 2022	PHMSA-2022-0013
192	Transmission	Elk County, PA	6-FSP	Rehab	Aug, 2017	PHMSA-2017-0090
192	Gathering	Nueces County, TX	3-FSP	Rehab	Feb, 2010	TXRRC-GSD-09903
192	Gathering	Nueces County, TX	6-FSP	Rehab	Jan, 2009	TXRRC-GSD-09813
192	Transmission	Seward County, KS	4-FSP	New Install	Oct, 2021	PHMSA-2021-0089
192/195	Gathering	Midland, TX	4-6-FSP	New Install	Apr, 2016	TXRRC-GSD-10516
192	Transmission	Lodi, CA	7-FSP	Rehab	Mar. 2025	PHMSA-2025-0009

THE COMPOSITE SOLUTION FOR REGULATED PIPELINES

THE LIST GOES ON



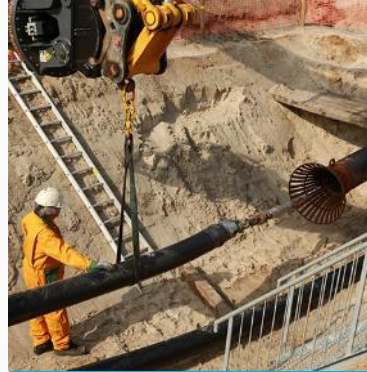
- » Level of safety equal to or greater than steel
- » No corrosion + no regression = no derating
- » 1.5x NPR hydro for 8 hours in-factory
- » Electrically continuous for cathodic protection
- » Annulus tested in field post construction
- » Real-time monitoring of annulus pressure
- » ILI tool replacing 7 year hydrotest

PIPE-IN-PIPE REHABILITATION

TRENCHLESS SOLUTION UTILIZING EXISTING INFRASTRUCTURE



A. Installation Trailer



B. Bell Hole Architecture



C. Pull Head



D. Winch

**Maintain or Increase
Pipeline Pressure Rating**

**Fraction of Cost
vs. New Pipeline
Construction**

**Minimal
Land Disturbance**

**High Tension Capability
for Longer Pulls**

REHABILITATION EQUIPMENT & TOOLING

Pull Head



Winch



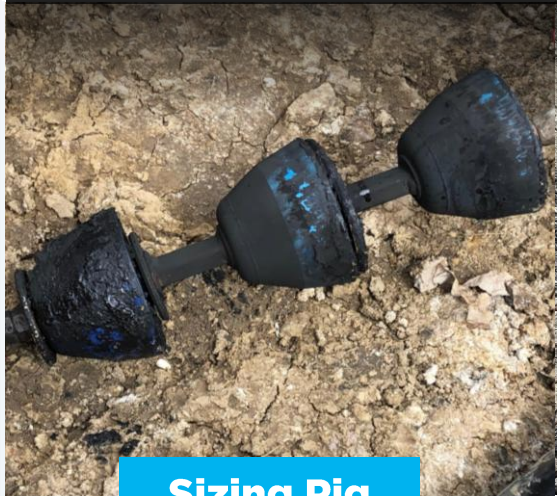
Pack off Flange



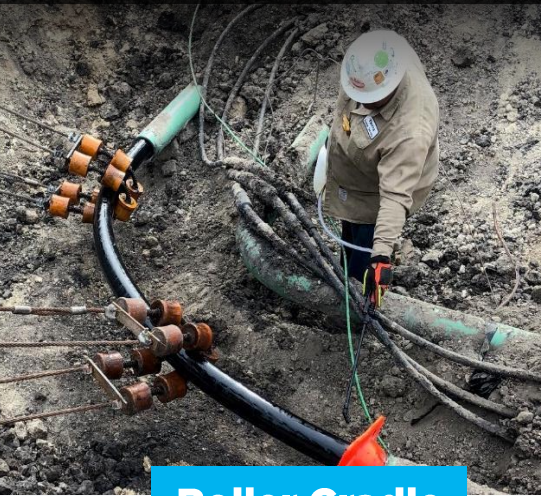
Polywater



Sizing Pig



Roller Cradle



Slimline Midline

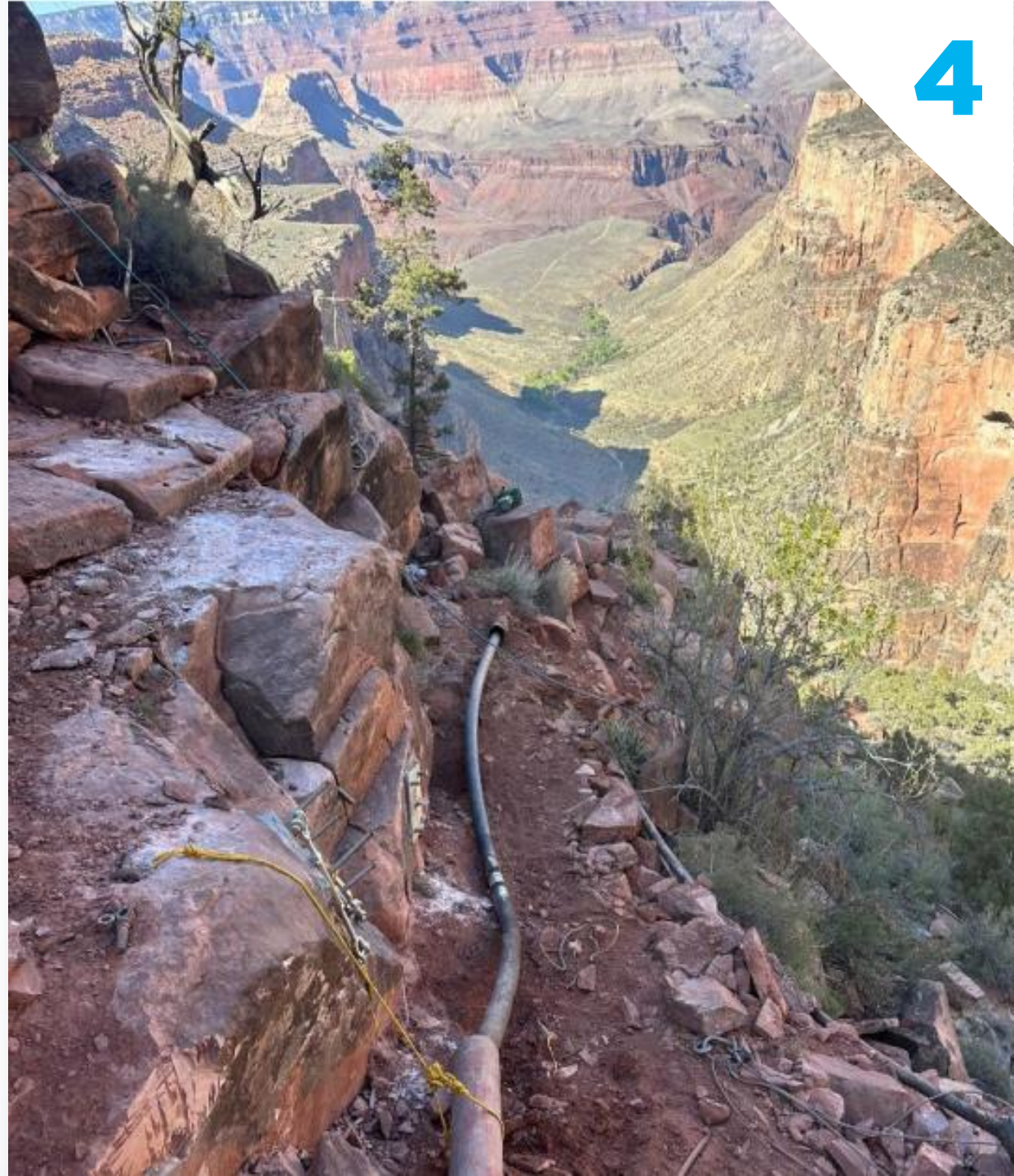


Protective Wrap



SUCCESS STORIES: FIELD PROVEN

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CALIFORNIA WINE COUNTRY PIPELINE UPGRADE

GAS STORAGE FACILITY REHAB RESULTING IN HUGE SAVINGS



Location: California

Challenge: Surrounded by wineries with minimal right of way

Service: Gas Transmission

Length: 0.78 miles of 6-3000

Host Pipe: 12-inch

Solution:

- Mix of rehabilitation, HDD, and open trench
- Slim OD Midline fitting
- Annulus Monitoring
- Cathodic Protection



MAJOR EFFICIENCIES IN CAPITAL COST & TIMING

CONVERTING A PIPELINE LIABILITY INTO A COMPANY ASSET



Location: Pennsylvania

Challenge: Mid-1950's X42 Bare Steel

Service: Natural Gas Transmission – CFR 192

Length: 5.8 miles of 6-1500

Host Pipe: 12-inch

Solution:

- 6-inch Steel-Reinforced Pipe
- Class 1 & 2 Locations
- Enters State Forest
- Continuous 3-Layer Pressure Monitoring



NEW WELLS INCREASE FLOW THROUGH SMALLER PIPE

AT CAPACITY HDPE USED AS A CARRIER PIPE IN THE MOUNTAINS



Location: West Virginia

Challenge: HDPE w/ seal beads, aggressive terrain

Service: Natural Gas Gathering – CFR 192

Length: 4.6 miles of 8-2250

Host Pipe: 16-inch DR-7

Solution:

- 8-inch Steel-Reinforced Pipe
- Type C Notification
- Flooded carrier, decreased pulling speed
- From 300psi to 1440psi



PIPELINE APPROVED FOR GASEOUS CO2 IN RECORD TIME

1,100 WELL CCUS GATHERING NETWORK



Location: Central Texas

Challenge: Texas RRC & US EPA permits,
Class II injection

Service: CO2 Injection

Length: 36 miles of 6-1500

Host Pipe: 12-Inch

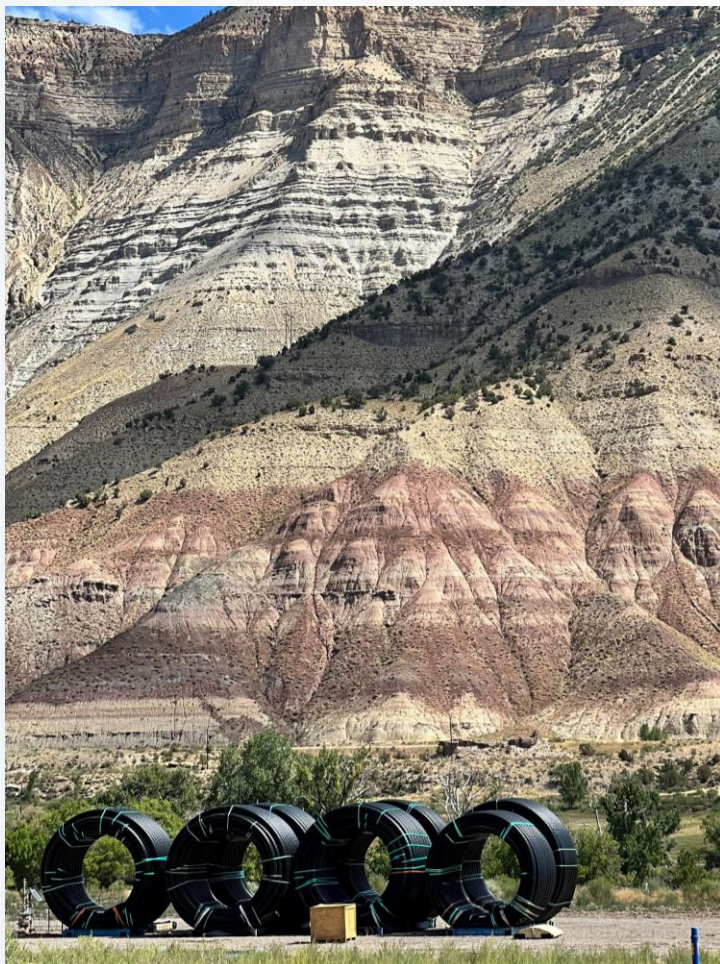
Solution:

- 6 miles of rehabilitation
- 15 pulls / 16 bell holes
- Average pull length 2,275 ft
- 30 miles installed in a trench



US NATIONAL PARK WATER DISTRIBUTION REHAB

PIPE AND EQUIPMENT PUT IN PLACE VIA HELICOPTER



Location: Grand Canyon Arizona

Challenge: Securing state waiver for potable water

Service: Water stations & treatment plant

Length: 4.5 miles of 3- & 6-1500

Host Pipe: 6-Inch

Solution:

- 4,5 miles of rehabilitation
- 1.1 of 3-inch, 3.41 of 6-inch
- Engineered an anchoring system to support the FlexSteel pipe from the cliffs.



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Questions?
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