

Preserving Casper's Infrastructure: Large-Diameter Pipeline Trenchless Rehabilitation Project

Mark G. Wade, P.E.
BlueWater Solutions Group, Inc

BLUEWATER
SOLUTIONS GROUP INC.



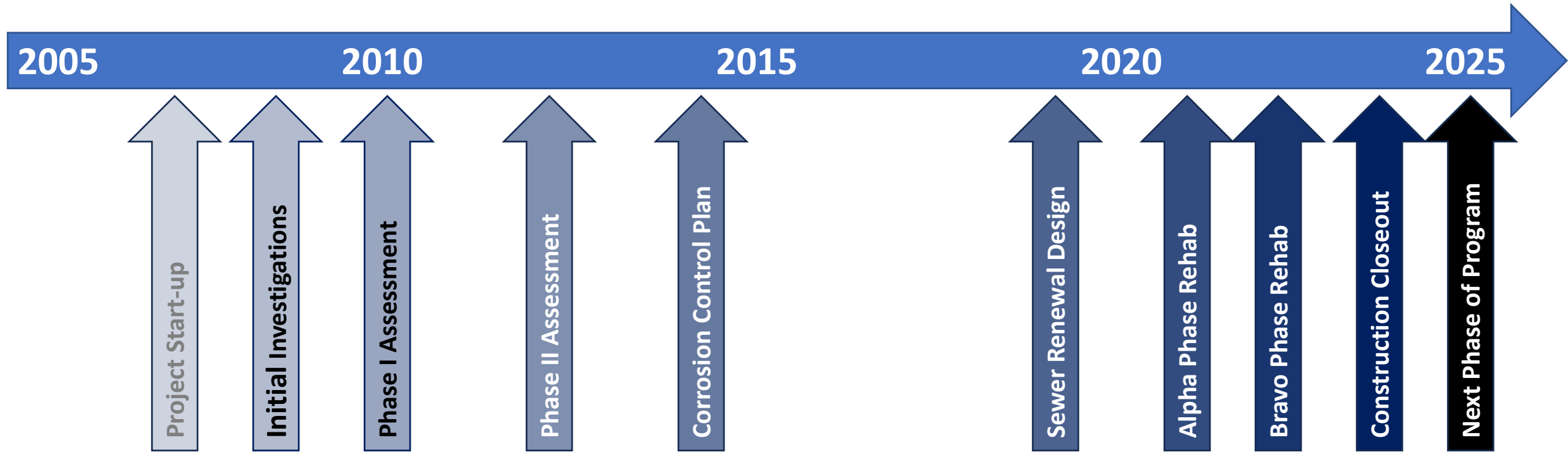
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A 17-Year Odyssey¹



1. ...and the same project team during these 17 years!



What Makes Casper Such a Great Place?

- Tate Geological Museum at Casper College
- National Historic Trails Interpretive Center
- Casper Mountain and Freemont Canyon
- Hogadon Basin Ski Area
- Casper Events Center
- Nicolaysen Art Museum
- Ford Wyoming Center Events
- Hell's Half Acre
- Fly fishing on the North Platte River



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What Makes Casper Such a Great Place?



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NPSSI and Project Location



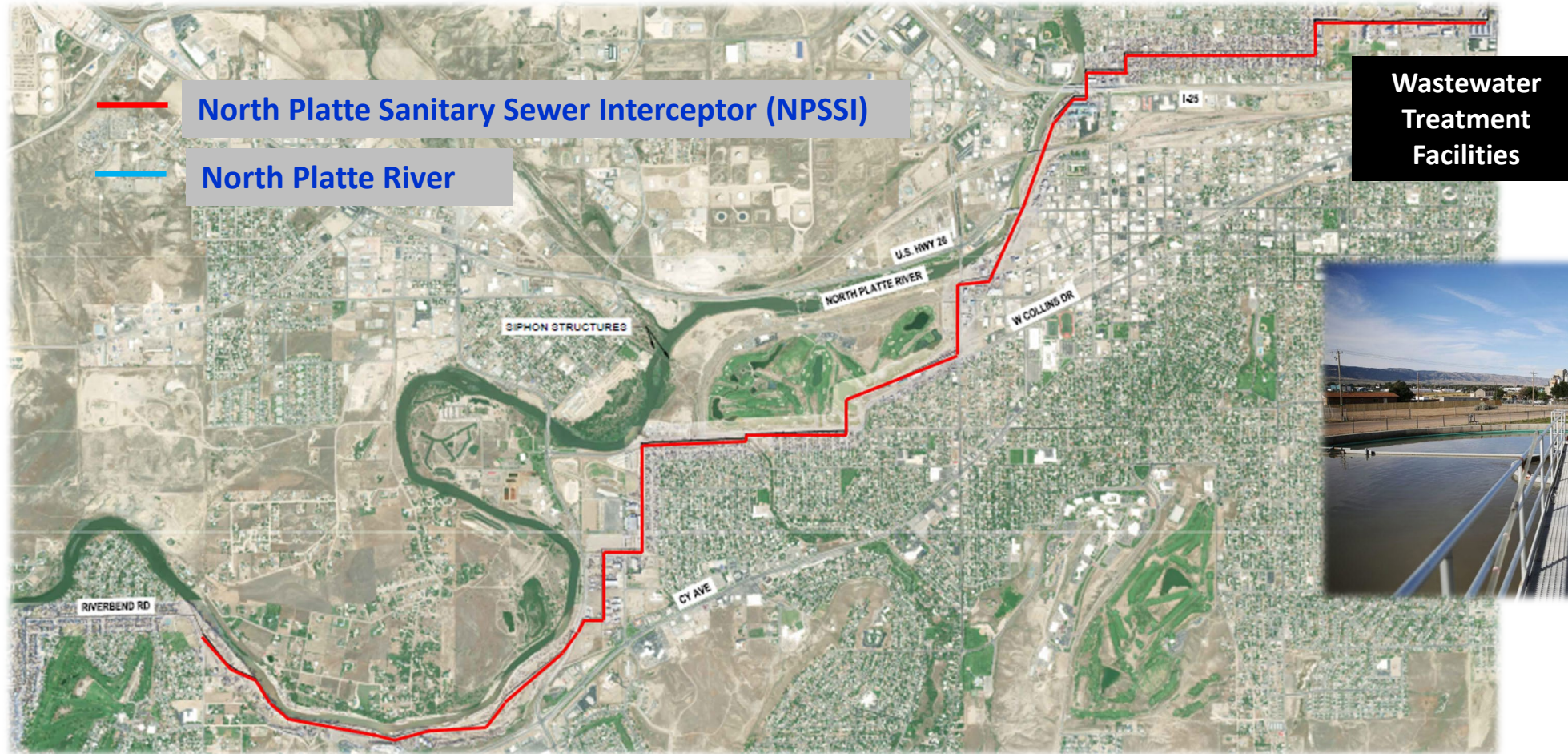
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NPSSI and Project Location



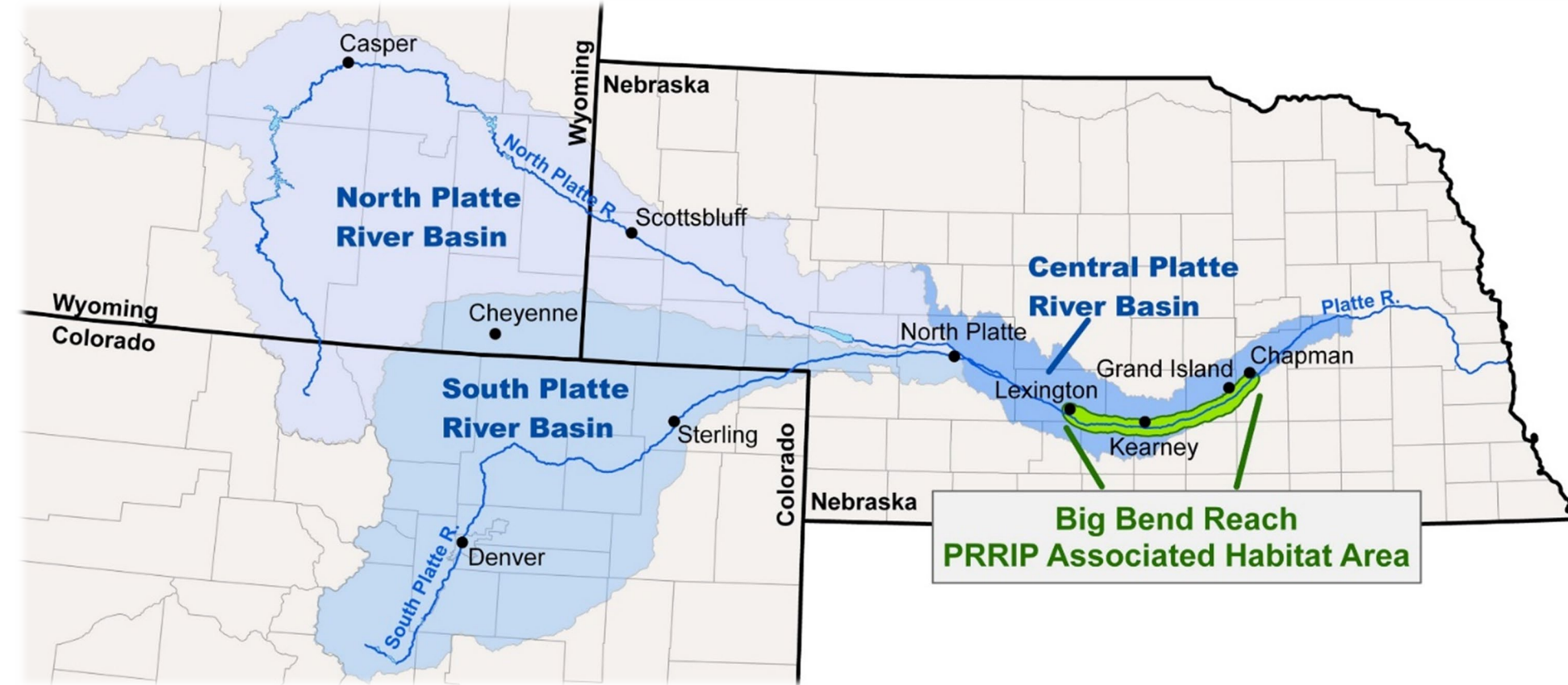
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The North Platte River Basin



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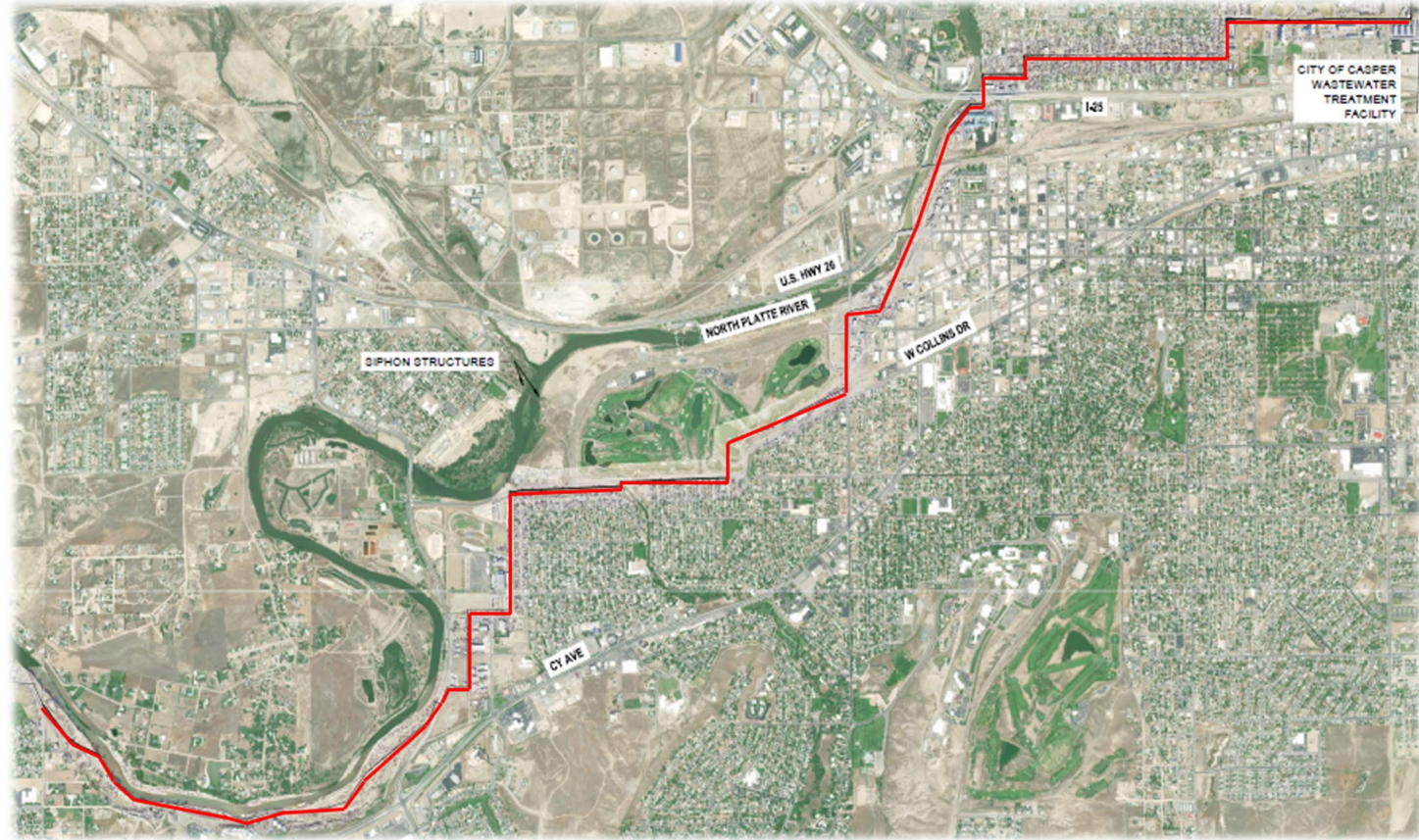
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The NPSSI and Its Challenging History

- 47,000' of unlined RCP
- Constructed: 1980-83
- Population in 1978: 74,000
- Planned growth: 250,000
- Population today: 80,000
- Aggressive corrosion
- Initial assessment: 2007



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Where it All Began in 2007-8

2005



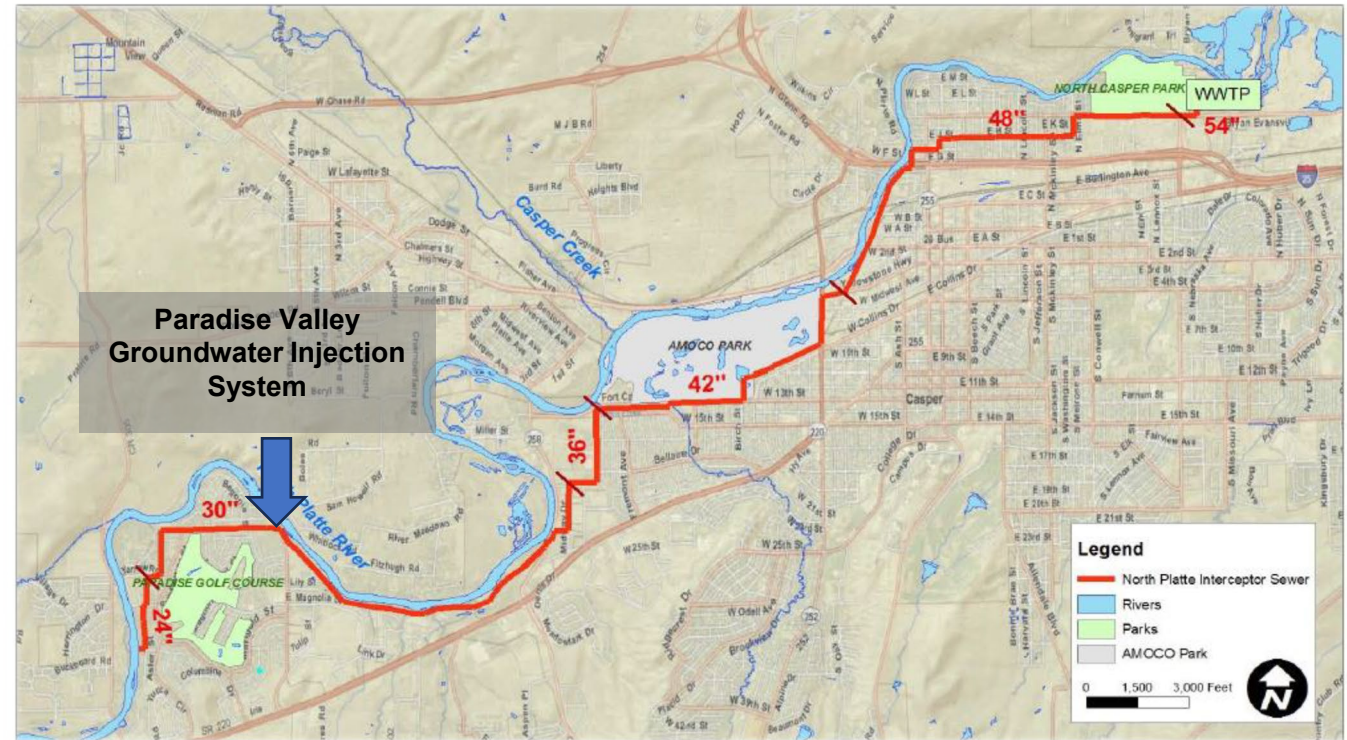
2010

2015

2020

2025

- Controlling H₂S levels (summer/fall)
- Odor control management
- Periodic visual inspection
- Testing of pipe material (coupons)



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Developing a Strategic Plan and Get Funding

2005

2010

2015

2020

2025

- Strategic planning meetings
- “Affordable” budget
- Shareholder buy-in
- Council approval
- Select project delivery team



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Phase I Inspection and Assessment

2005

2010

2015

2020

2025

- Investigate extent
- Locate all manholes
- Internally inspect
- Top-side pipe inspection
- Evaluate results
- Results & recommendations



City of Casper Manhole and Lamping Inspection Form		Basin No.	Manhole No.
Inspection Information		<input type="checkbox"/> Complete <input type="checkbox"/> Quick <input type="checkbox"/> Incomplete <input type="checkbox"/> Returned	
Data Time		Inspection Starting Information	
Date		MH Surface Type	
Permit Number		Traffic Volume	
City, State, Zip		Traffic Type	
Location Code		Weather	
Inspection Type		Ground Cond	
Why not Inspect		Corrosion deterioration widespread	
Project No.		Corrosion deterioration widespread	
Project No. 2		Corrosion deterioration widespread	
Project Name		Corrosion deterioration widespread	
Map No.		Corrosion deterioration widespread	
Use of Sewer		Corrosion deterioration widespread	
Pre-cleaning		Corrosion deterioration widespread	
Photos		Frame (cont)	
General location		Frame Condition	
Topside		Cracked, broken, deteriorated	
Other		Corroded, pitted, scaled	
Cover / Riser Ring / Cover Insert		Missing bolts or broken bolts	
<input type="checkbox"/> No Cover <input type="checkbox"/> No Cover Gasket		Missing	
<input type="checkbox"/> No Cover Insert <input type="checkbox"/> No Riser Ring		Other	
Cover Type		Missing	
Cover material		Frame Base Seal Condition	
Cover insert type		Cracked, deteriorated	
Riser ring material		Corroded, pitted, scaled	
Diameter (in)		Risks Invasive	
Width (in)		If evidence	
Thickness (in)		Grade Ring / Chimney	
No or vent holes		<input type="checkbox"/> No Grade Ring <input type="checkbox"/> No Reducer	
Avg vent hole diam (in)		Grade ring material	
Riser ring height (in)		Chimney material	
Cover base surf diam		Width (in)	
Ponding depth (in)		Depth (in)	
Tributary area (sq ft)		Reducer material	
Cover Condition		Depth (in)	
Missing		Chamber material	
Displaced		Deterioration	
Cracked, deteriorated		Cracked	
Fill in Frame		Corroded, pitted, scaled	
Corroded, pitted, scaled		Risks Invasive	
Surface wear		If evidence	
Missing bolts or broken bolts		Chimney/Shaft Seal Condition	
Collapse		Deterioration	
Cover Insert Condition		Cracked	
Missing		Corroded, pitted, scaled	
Unusable or Torn		Risks Invasive	
If evidence		If evidence	
Riser Ring Condition		Chimney/Shaft Condition	
Broken		Cracked	
Cracked or Bent		Corroded, pitted, scaled	
Corroded, pitted, scaled		Risks Invasive	
Other		If evidence	
If evidence		Reducer Condition	
Frame		Previous relin	
<input type="checkbox"/> No Frame <input type="checkbox"/> No Frame Base Seal		Cracked	
Frame material		Corroded, pitted, scaled	
Frame bearing surf diam (in)		Mortar missing	
Frame bearing surf width (in)		Bricks displaced or missing	
Frame bearing surf depth (in)		Risks Invasive	
Frame offset dist (in)		Collapse	
Frame depth (in)		seal mat	
Chamber / Wall (cont)		Bench	
Cracked		Channel Insert	
Corroded, pitted, scaled		<input type="checkbox"/> No Bench <input type="checkbox"/> No Common MH Parts	
Mortar missing		Steps material	
Bricks displaced or missing		Surcharge depth (in)	
Risks Invasive		Bench material	
Grease		Channel material	
Joint Offset or Seal		Depth (in)	
Lift hole plugs missing		Bench Condition	
If evidence		Cracked	
Bench		Corroded, pitted, scaled	
Channel Insert		Bricks displaced or missing	
<input type="checkbox"/> No Bench <input type="checkbox"/> No Common MH Parts		Risks Invasive	
Steps material		Debris/deposition	
Surcharge depth (in)		If evidence	
Bench material		Steps Condition	
Channel material		Bricks displaced or missing	
Depth (in)		Mortar missing	
Bench Condition		Risks Invasive	
Cracked		Pipe segment cracked, scaled	
Corroded, pitted, scaled		Hydraulic force	
Bricks displaced or missing		Common MH Partition Condition	
Risks Invasive		Partition Deteriorated	
Debris/deposition		Hole in common area	
If evidence		Hole in common area	



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Phase I Results and Recommendations

2005

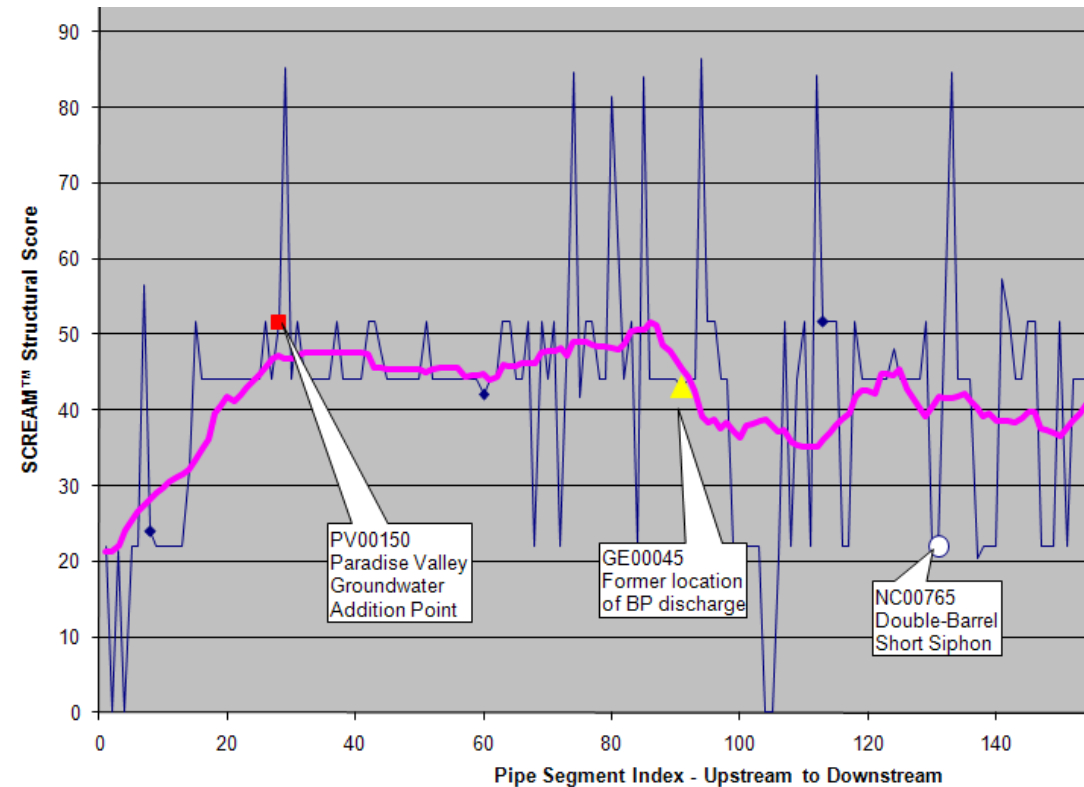
2010

2015

2020

2025

- Pipeline vs. manholes
- 1" + concrete loss
- Atmospheric H₂S levels (up to 20 ppm)
- Effect of groundwater injection evident



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Phase II Inspection and Assessment

2005

2010

2015

2020

2025

- Project kick-off and work plan
- Flow and traffic control plan
- Hydraulic cleaning



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Phase II Inspection and Assessment

2005

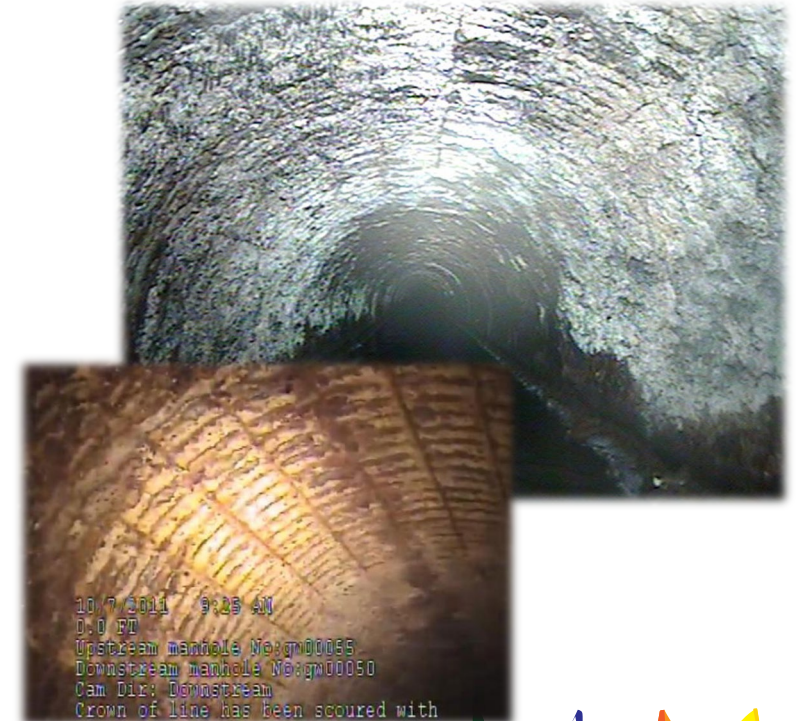
2010

2015

2020

2025

- Internal CCTV inspection
- Pipe samples and results
- Analysis of pipeline



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Bringing Risk Management to the Dinner Table

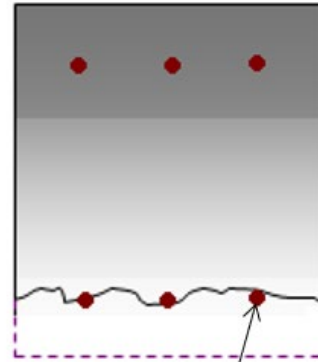
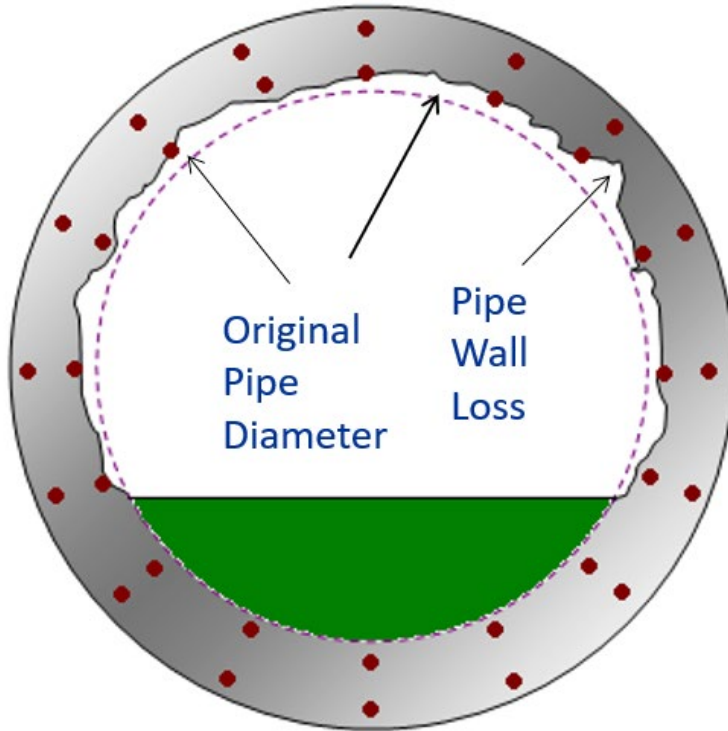
2005

2010

2015

2020

2025



Exposed rebar will corrode and provide no structural support

		Consequence of Failure (COF)				
		1	2	3	4	5
Likelihood of Failure (LOF)	1	L	L	L	M	M
	2	L	M	M	S	S
	3	L	M	S	S	S
	4	M	M	S	H	H
	5	M	S	H	H	H



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Hitting the Pause Button

2005

2010

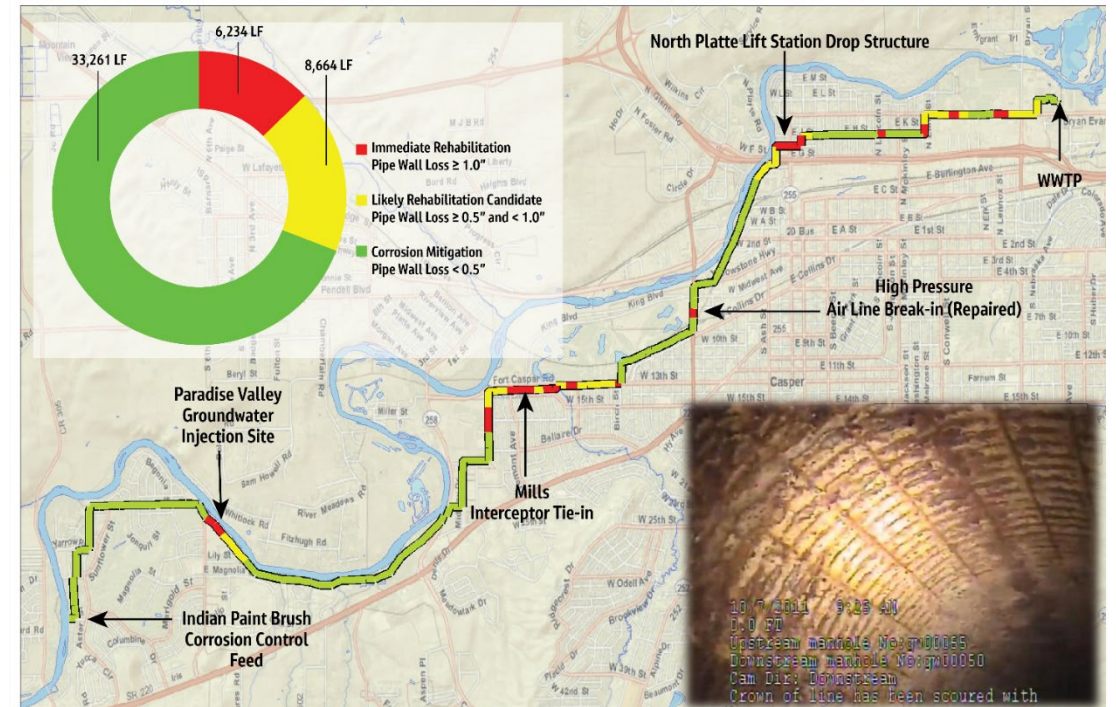
2015

2020

2025

Category	2012 Study ¹	2020 Update ²	Revised Rehab ³
Priority 1	2,000'	6,200'	7,600'
Priority 2	12,900'	8,700'	7,300'
Priority 3	33,300'	33,300'	33,300'
Total	48,200'	48,200'	48,200'

1. Based on top-side pipe inspection using pole-mounted camera;
2. Based in 8,700' of internal CCTV inspection and limited hydraulic cleaning;
3. Final recommended Rehabilitation Project.



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Hitting the Pause Button

2005

2010

2015

2020

2025

Bench-scale Corrosion Control with Chemicals Addition

1. Sodium hypochlorite, NaOCl ^a
2. Hydrogen peroxide, H_2O_2 ^a
3. Ferrous chloride, FeCl_2 ^b
4. Ferric chloride, FeCl_3 ^b

- a. Oxidant
b. Sulfur precipitant

Construction of Pilot System to Test Chemical Addition and H₂S Reduction



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Moving Forward with Rehabilitation Design

2005

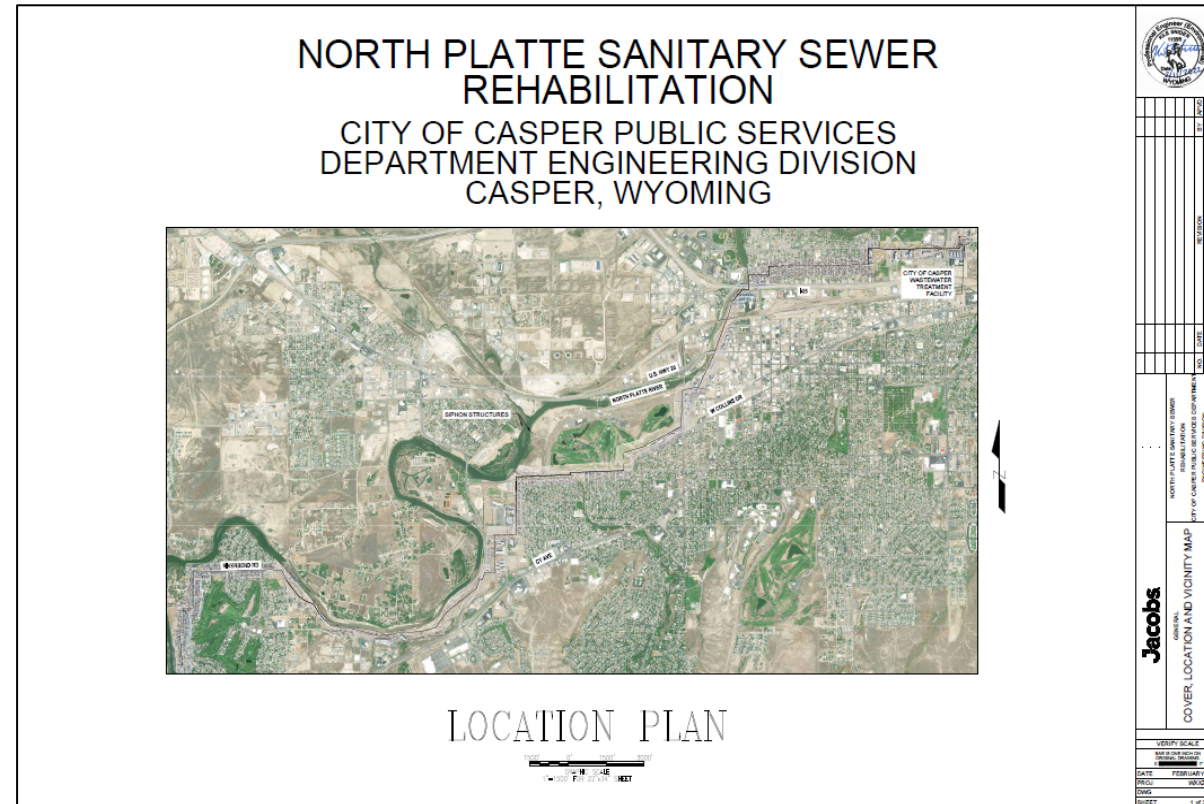
2010

2015

2020

2025

- Bid options
 - ✓ CIPP Lining
 - ✓ Sliplining
- Construction phases
 - ✓ Alpha Phase
 - ✓ Bravo Phase
- Pipe rehab – 7,600'
- Struct rehab - 14



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Bid Advertisement and Contract Award

2005

2010

2015

2020

2025

- Contract award to Insituform (\$6,635,835)
 - ✓ 71 Construction
 - ✓ ProPipe
 - ✓ Xylem
 - ✓ Advanced Lining
- Notice-to-proceed – May 2022 (completion May 2023)
- Two phases of project



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Alpha Phase of Project

2005

2010

2015

2020

2025

- 5,100'
- June – December 2022
- Last day of Alpha: -30°F



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Example Project Photos



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Pipe Rehab Sometimes “Not-So-Trenchless”



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Bravo Phase of Project

2005

2010

2015

2020

2025

- 2,500'
- March – June 2023
- Final payment - \$6,510,957
- Budget savings - \$124,878!



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Important Takeaway #1 – Establish Priorities

- Maintain interceptor operation
- Back-up mitigation plan
- Plan staging area locations
- Implement public outreach program
- Identify construction constraints
- Minimize impact to WWTP
- Refine scope and bidding strategies



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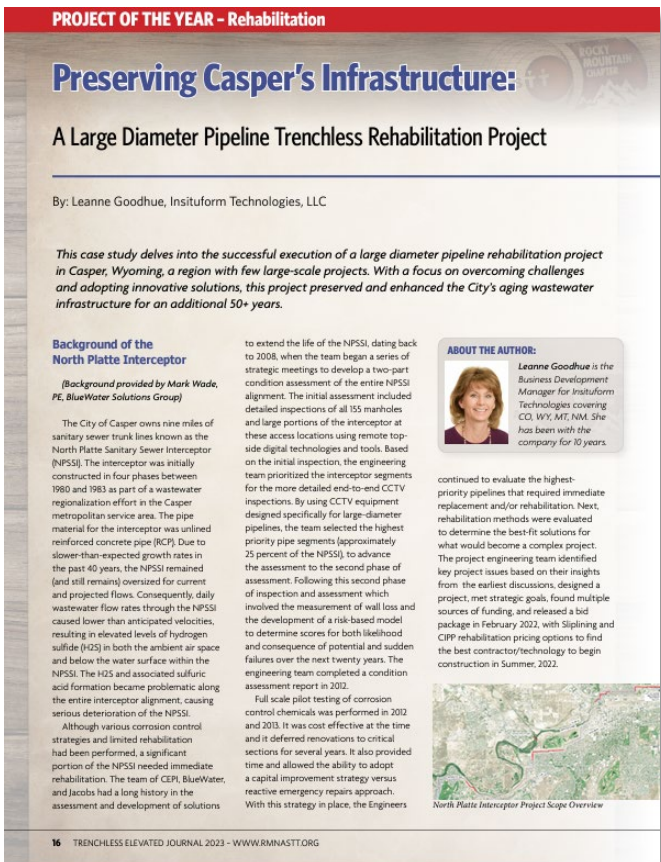
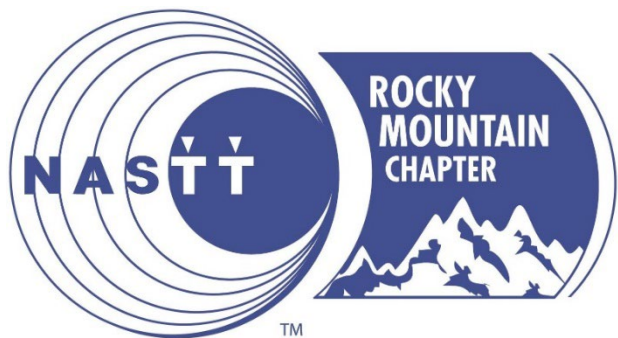
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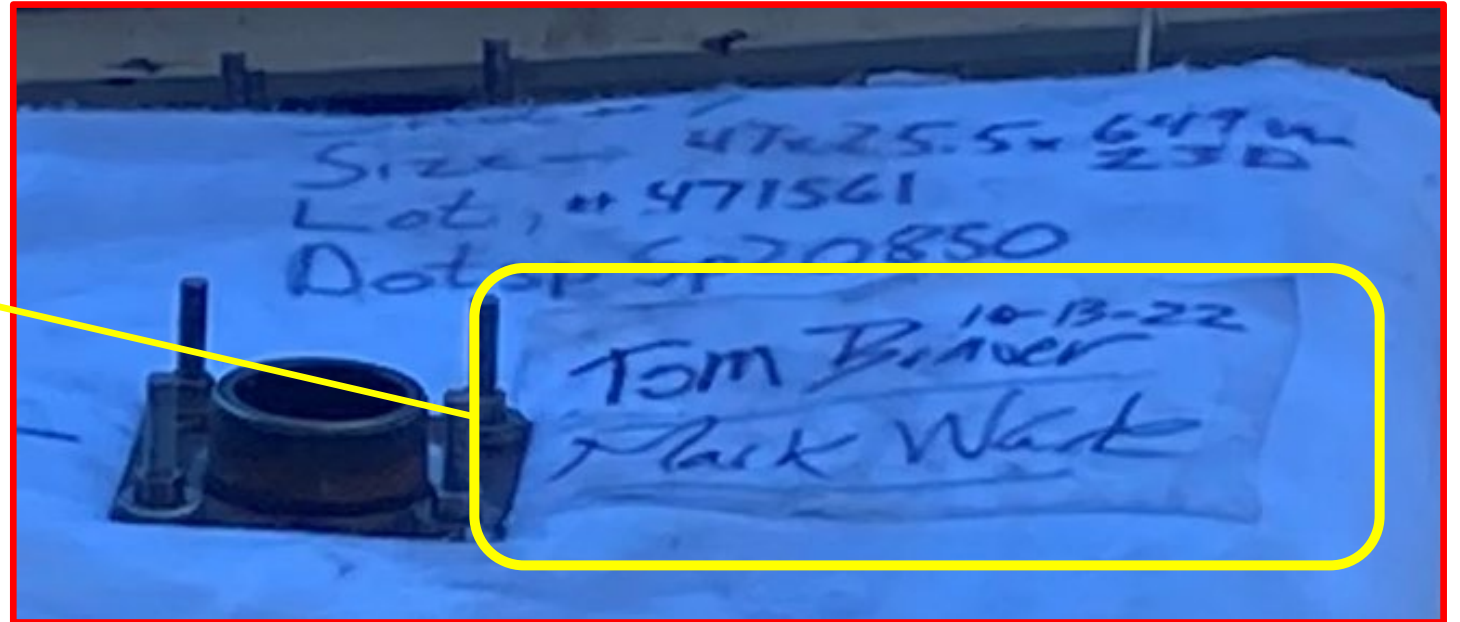
Example Bypass



Special Project Recognition



A Lasting Sign-off!



Thank You...Be Well...Safe Travels!



Tom Brauer, P.E.
tbrauer@casperwy.gov
Krista Johnston
kjohnston@casperwy.gov



Nick Larson, P.E.
nick@cepi-casper.com
Alan Corey, P.E.
alan@cepi-casper.com



Eric Huss
Todd Repstine
Joey Huber
Amanda Franklin



Mark Wade, P.E.
(785) 550-9022
mwade@bluewatersolutionsgroup.com

