

TAILORED TUNNELING SOLUTIONS: ADAPTING WATER PIPELINE CONSTRUCTION TO GEOTECHNICAL AND ENVIRONMENTAL RISKS

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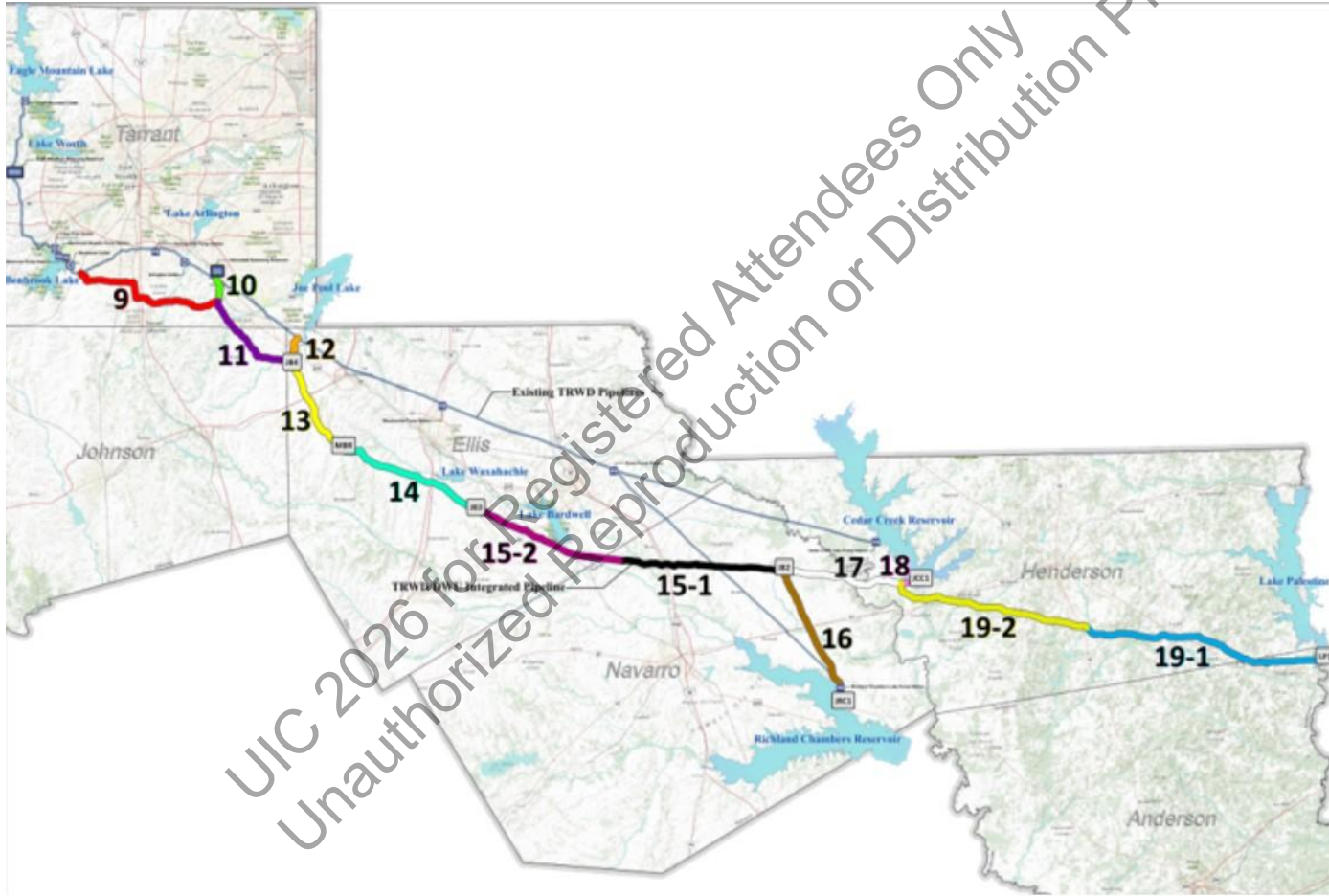
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IPL Project Overview



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Project Background/ Introduction

- IPL Section 19 Long Tunnel Crossing
- Five tunnel crossings for 84” steel carrier pipe
- Portals - 50’ x 300’ x up to 40’ deep
- Ribs/lagging and secant pile shaft up to 70’ deep
- 44,520 linear feet of open cut cross country 84” steel pipe
- 84” butterfly valve

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Why Underground Infrastructure?

- Constraints due to surface limitations / obstructions.

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Solution...? TUNNELING



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Pipeline 19 Long Tunnel

- Cedar Creek Lake Tunnel – 5,100 LF
- Stream A Tunnel – 191 LF
- Royall Boulevard (SH31 | UPRR) Tunnel – 787 LF
- Hollywood Lake Tunnel – 5,846 LF
- SH155 Tunnel – 903 LF

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One Tunneling Methodology for All ?

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Types of Tunneling Methods

- Horizontal auger boring
- Pneumatic pipe ramming
- Guided boring
- Down the hole hammer
- Slip boring
- Surface casing
- Tunnel boring

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Factors to Consider

- Cost
- Geological conditions
- Tunnel size, lengths
- Experience, expertise
- Environmental impact
- Material procurement

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Stream A Tunnel

- Stream crossing
- Mined using hand mining tools within a shield

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Stream A Tunnel



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SH31, SH155 Tunnels

- Beneath State Highways and Union Pacific Railroad
- Tight tolerances
- Mined using a Microtunneling Machine

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Cedar Creek Lake, Hollywood Lake Tunnels

- Beneath lakes and environmentally sensitive area
- Long drive lengths
- Mined using Earth Pressure Balance –Tunnel Boring Machine

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One Pipe Installation Methodology for All?

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Types of Pipe Installation Methods

- Direct lay on tunnel invert
- Pipe on supports/hangers
- Concrete-encased pipe
- Pipe inside casing/sleeve
- Jack-and-pull installation
- Sliplining inside existing tunnel pipeline
- Segmental pipe installation
- Rail/trolley-assisted transport and installation

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Factors to Consider While Selecting Pipe Installation Methodology

- Tunnel size and lengths
- Cost considerations
- Experience and expertise

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Stream A Tunnel

Cement Mortar Overcoat– Pipe Jacking

- 191 LF, 108” O.D of the casing
- Allows the pipe to skid on prepared invert rails

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Cement Mortar Overcoat– Pipe Jacking



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SH31, SH155 Tunnels

Pipe on Supports - Pipe Jacking

- 787 and 903 LF of pipe; 97.5" I.D of casing
- Approximately 452,300 and 518,300 lbs weight
- Tight tolerances

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Pipe on Supports - Pipe Jacking



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Cedar Creek Lake, Hollywood Lake Tunnels

Rail/Trolley-Assisted Transport and Installation

- 5,100 and 5,864 LF of 84-inch Steel Pipe; 120” I.D of initial support
- Curved tunnel
- Over 3,000,000 pounds

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Rail/Trolley-Assisted Transport and Installation



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Lessons Learned/ Best Practices

- Pipe rotation control



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Lessons Learned/ Best Practices

- Tunnel surface preparation



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