No Silver Bullet:

TRA's Bear Creek Large-Diameter Rehabilitation

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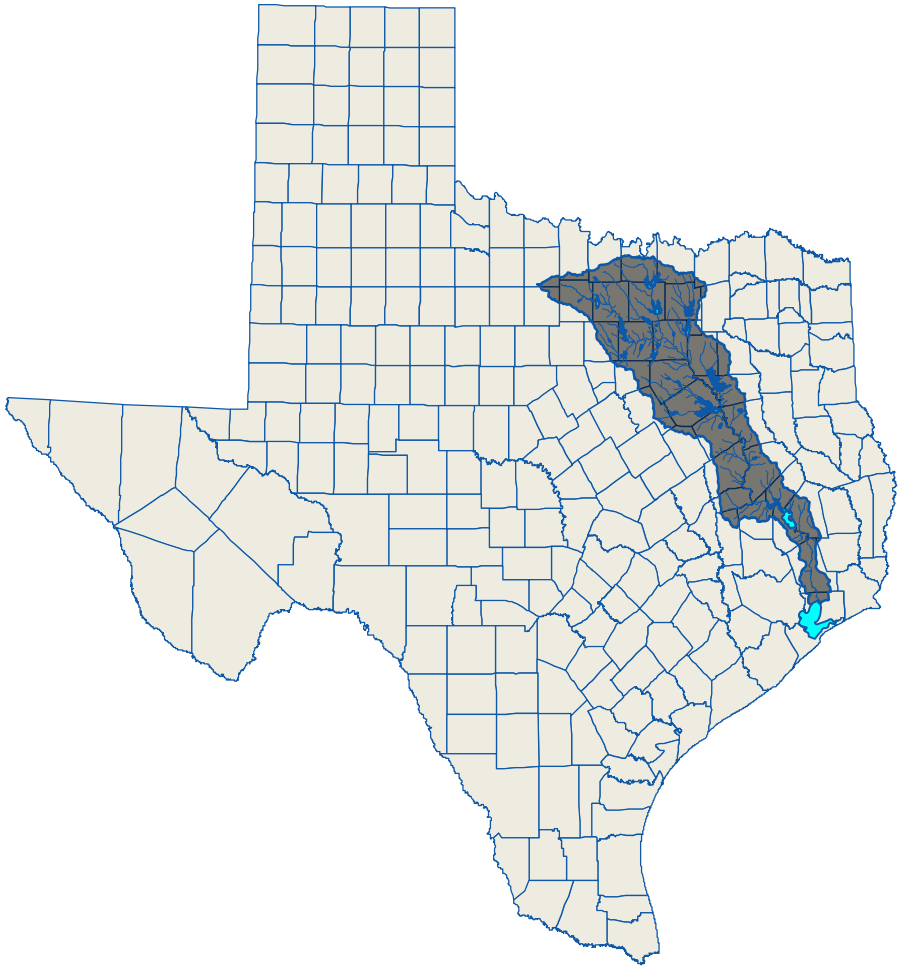
No Silver Bullet: Outline

- Trinity River Authority of Texas
- Project Overview
- Condition Assessment
- Rehab Alternatives
- OPCC Comparison
- Project Status

No Silver Bullet: Trinity River Authority of Texas

Trinity River Basin

- **Nearly 18,000 square miles**
- **Most developed large watershed in Texas with 32 water-supply reservoirs**
- **Water supply for approximately half of Texas' population.**

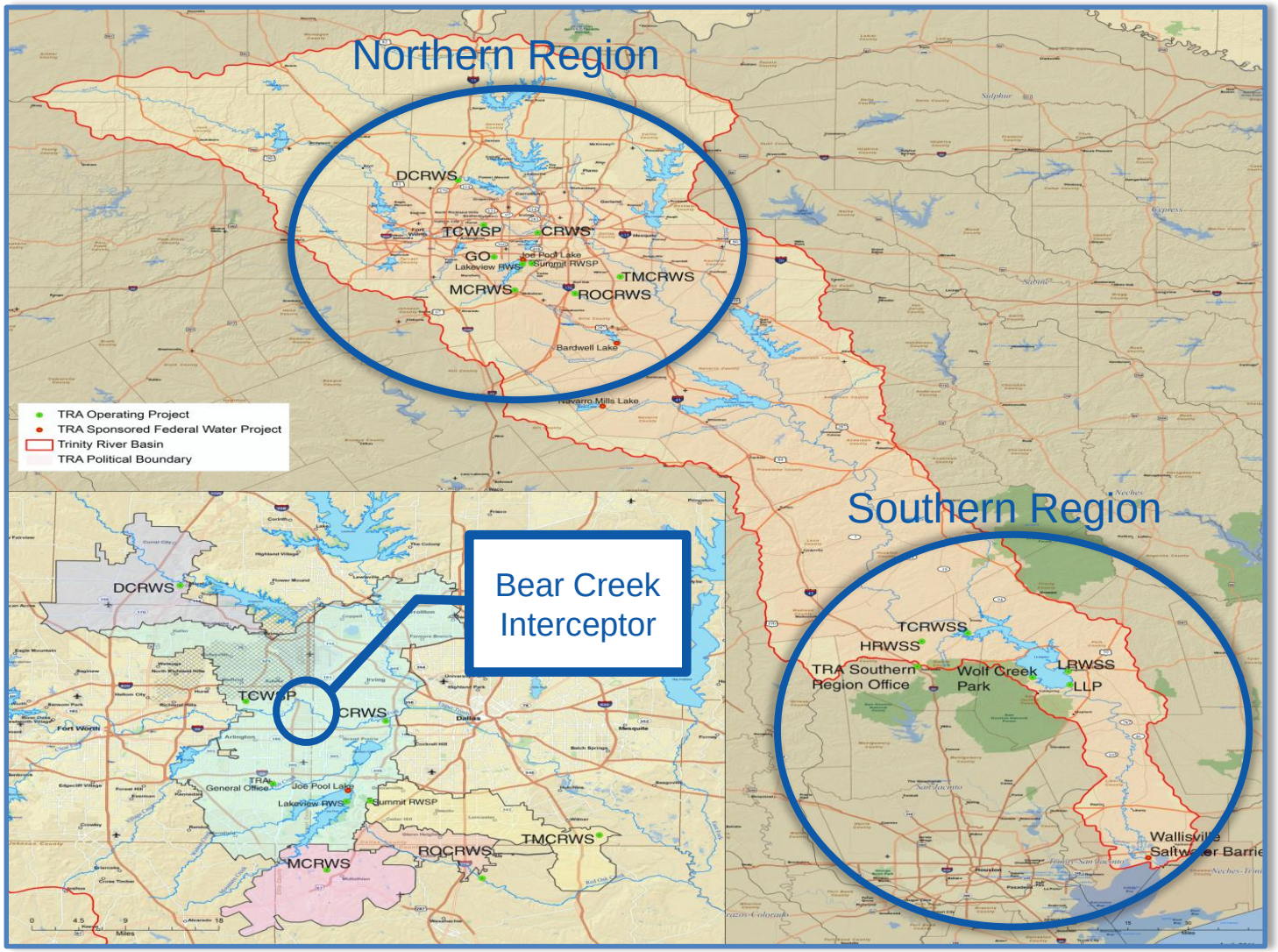


No Silver Bullet: Trinity River Authority of Texas

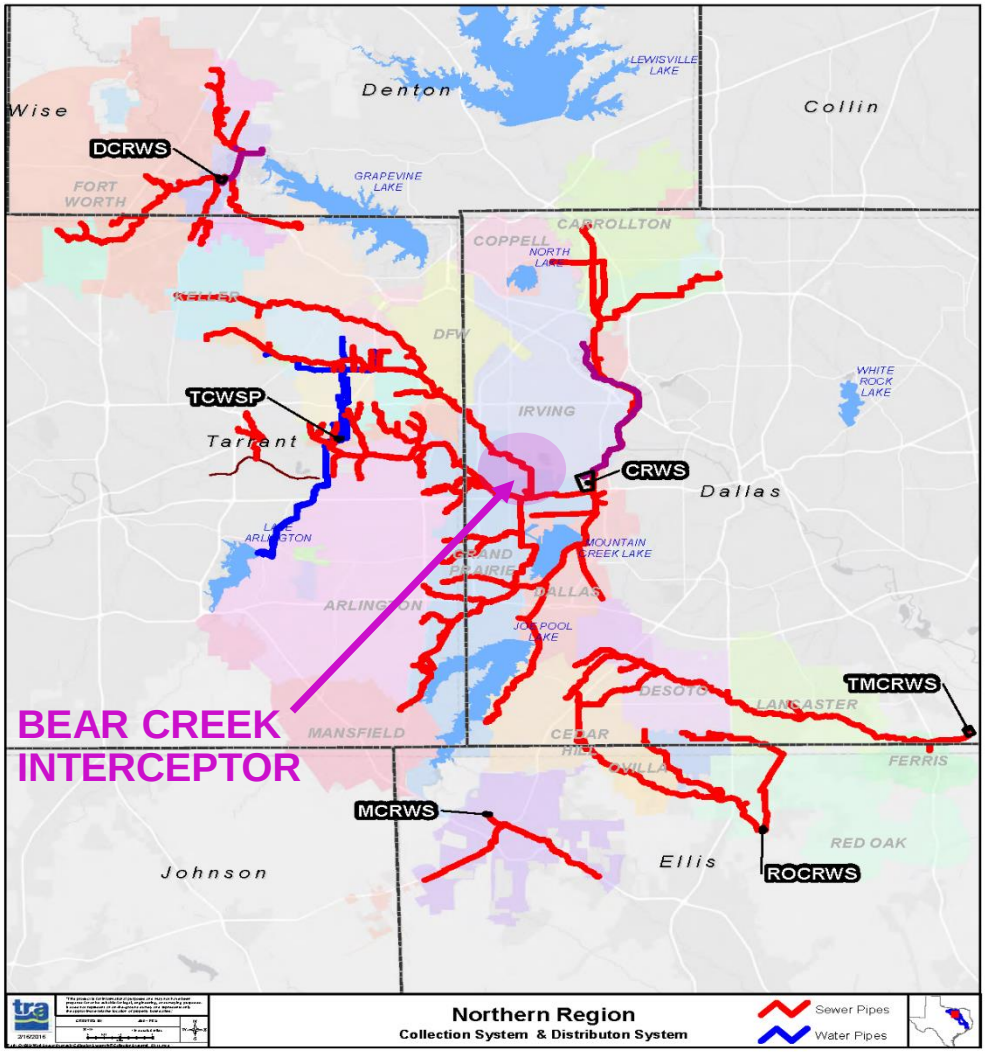
- **Established by Texas legislature in 1955**
- **Wholesale provider of water and wastewater treatment services**
- **Specialize in development and operation of multi-participant regional facilities**

Trinity River Authority of Texas

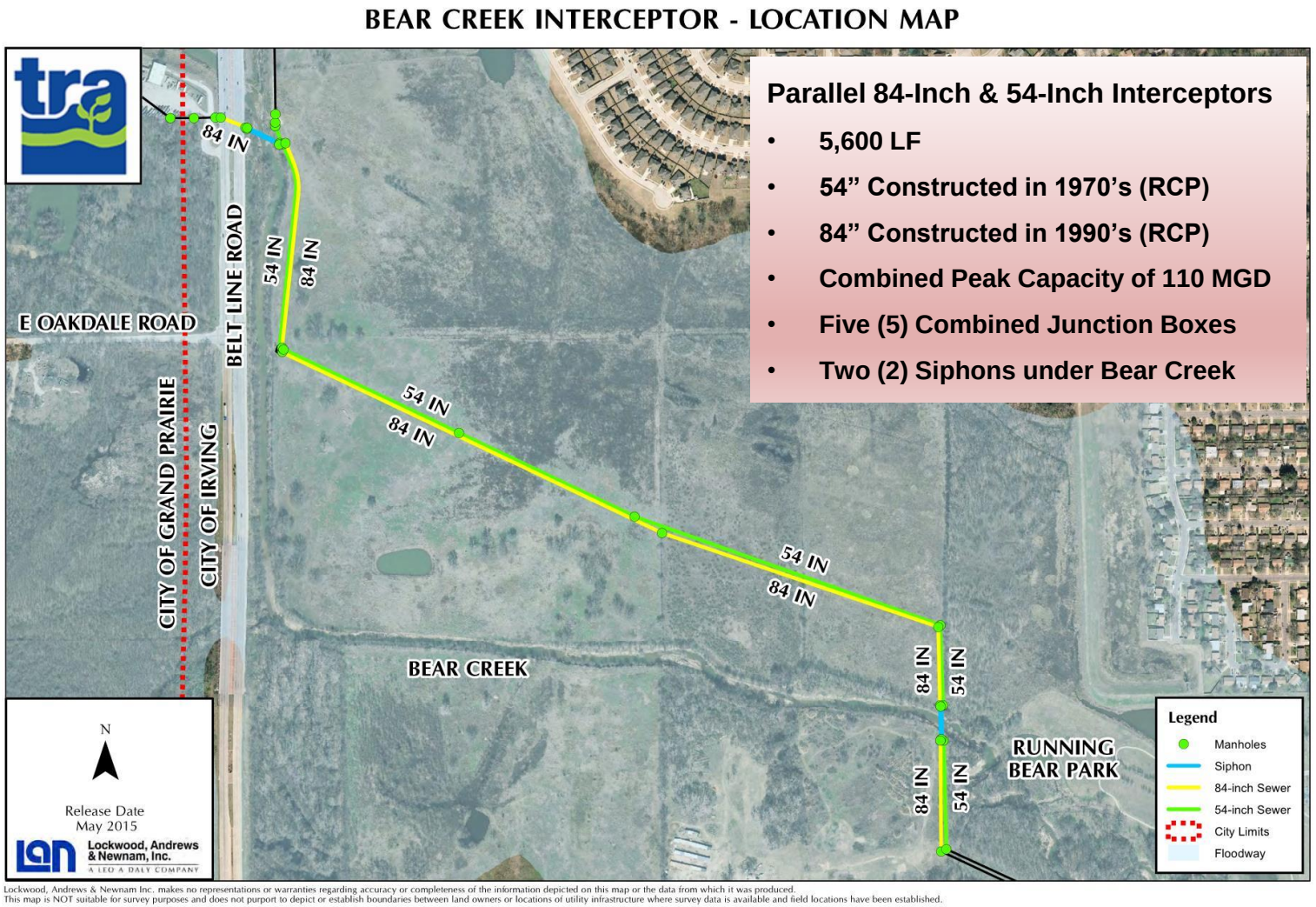
No Silver Bullet: Trinity River Authority of Texas



No Silver Bullet: Trinity River Authority of Texas



No Silver Bullet: Project Overview



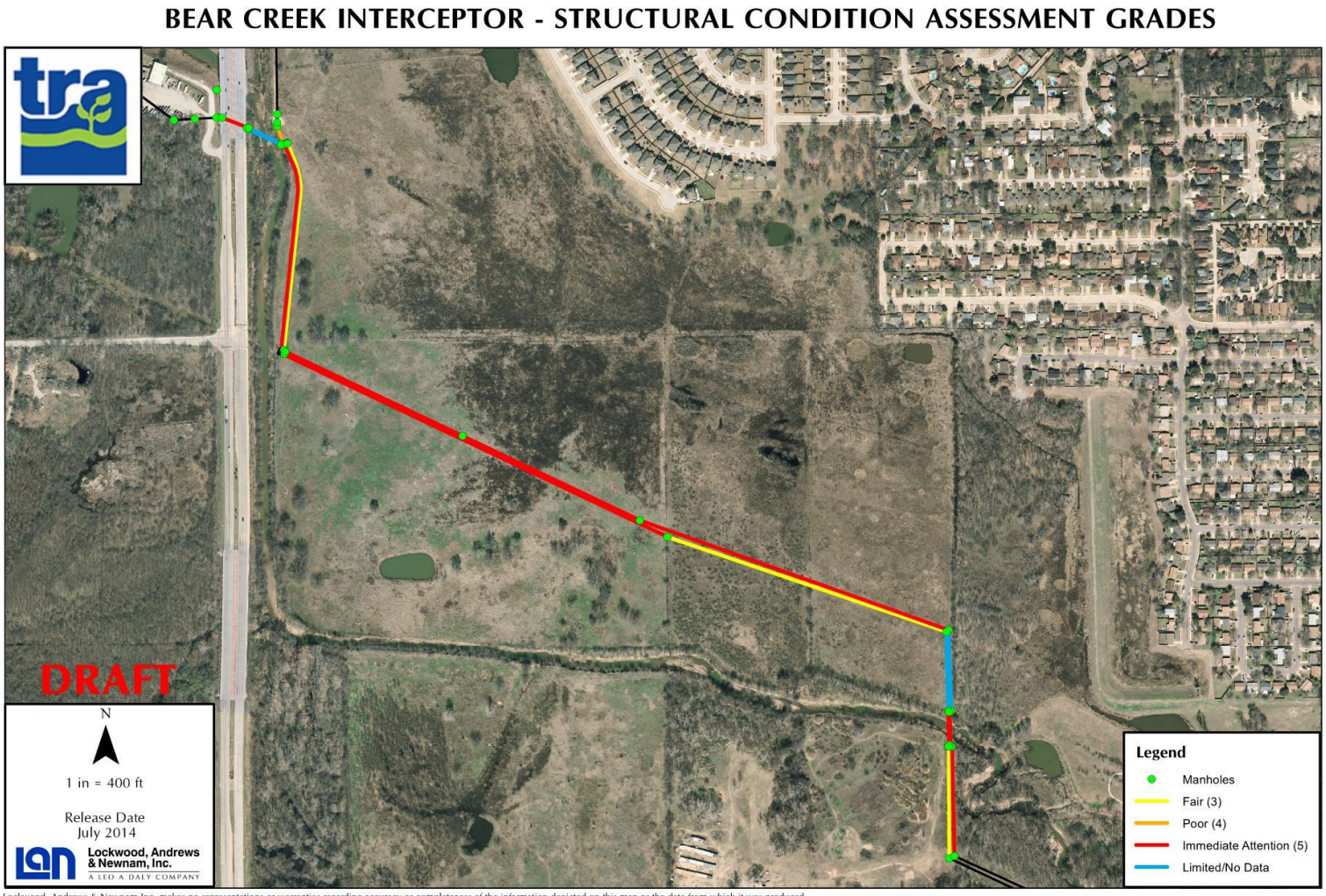
No Silver Bullet: Condition Assessment

- **Traditional CCTV used for Interceptor & MH Inspection**
  - Sonar Inspection used for Siphons
- **Condition Scoring System**

Condition Grade	Condition
1	Excellent
2	Good
3	Fair
4	Poor
5	Immediate Attention

- **10 of 16 Pipeline Sections Graded at 5**
- **17 of 23 Manholes Graded at 4**

No Silver Bullet: Condition Assessment



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No Silver Bullet: Condition Assessment

No Silver Bullet: Rehab Alternatives

- Option A: 84” Sliplining & 54” CIPP
- Option B: 90” Parallel
- Option C: 84” Sliplining & 54” Replace
- Option D: 84” CIPP & 54” CIPP
- Option E: New 84” & 90” Parallel

No Silver Bullet: Design Considerations

- Alternatives were designed for combined 2060 flow projections (97 MGD)
- Bypass Pumping
  - Manage up to 29.5 MGD daily average flow
  - Manage up to 125% peak flow (50 MGD)
- Best utilize existing assets
  - Permanent easements
  - Existing pipes

No Silver Bullet: Rehab Alternatives

Option A: 84” Sliplining & 54” CIPP

Pros:

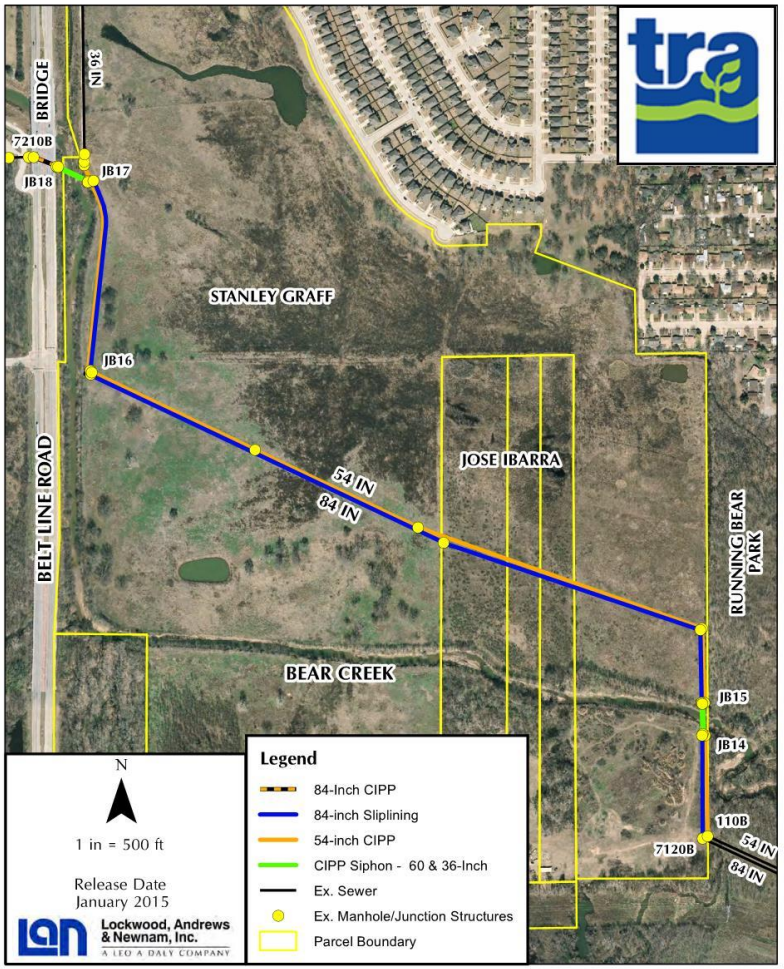
- Minimal surface impact
- Can utilize existing easements/infrastructure
- Sliplining can be completed in live flow which reduces bypass pumping

Cons:

- Potential for contractor markup on half the job
- Limited ability to fully inspect joint integrity while sliplining
- Additional insertion MHs may be needed for CIPP Install

OPCC: $9,650,000

EXHIBIT 1: REHAB OPTION A



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No Silver Bullet: Rehab Alternatives

Option B: 90” Parallel

Pros:

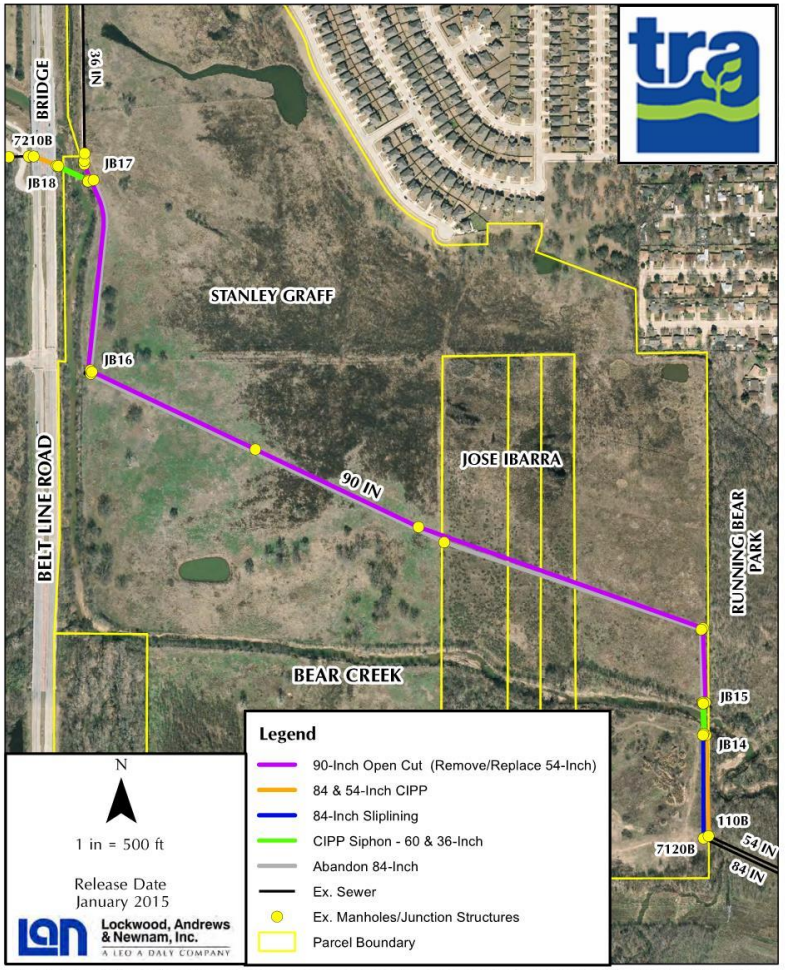
- New pipe in the ground – max design life
- Existing 84” can be used for diversion to reduce bypass pumping

Cons:

- TRA will be left with large abandoned asset in the ground – costly to fill with flowable fill.
- New permanent easements will be required

OPCC: $11,500,000

EXHIBIT 2: REHAB OPTION B



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No Silver Bullet: Rehab Alternatives

Option C: 84” Sliplining & 54” Replace

Pros:

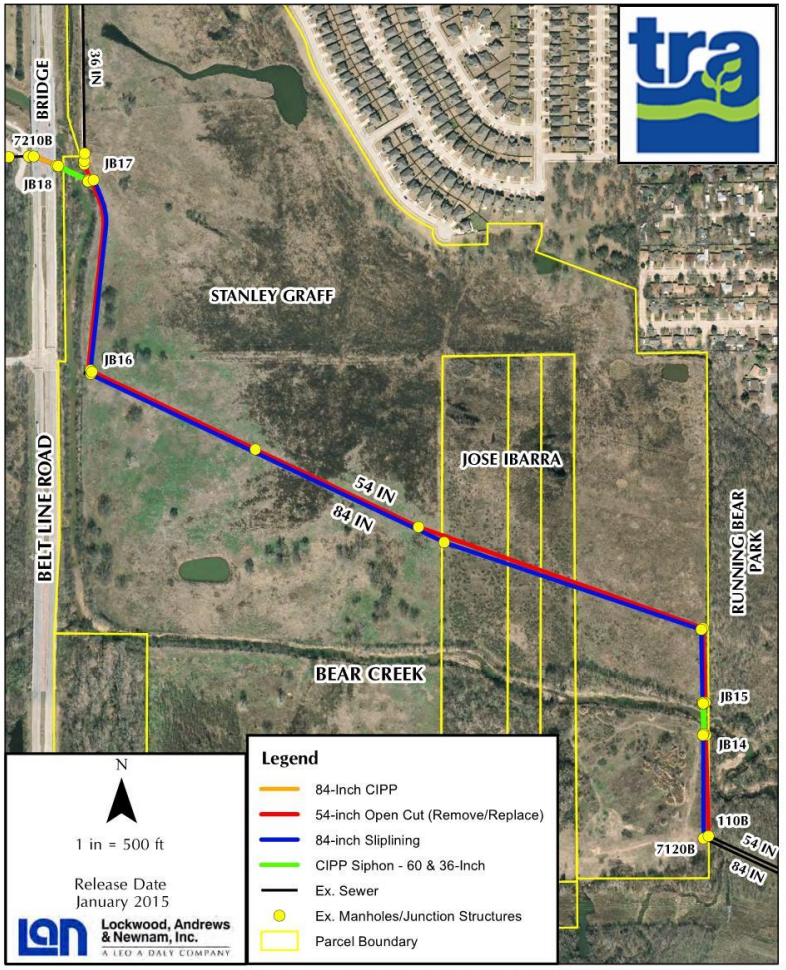
- Sliplining can be completed in live flow which reduces bypass pumping
- New 54-Inch pipe in the ground – max design life

Cons:

- New permanent easements will be required for 54” installation
- Limited ability to fully inspect joint integrity while sliplining

OPCC: $10,800,000

EXHIBIT 3: REHAB OPTION C



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No Silver Bullet: Rehab Alternatives

Option D: 84” CIPP & 54” CIPP

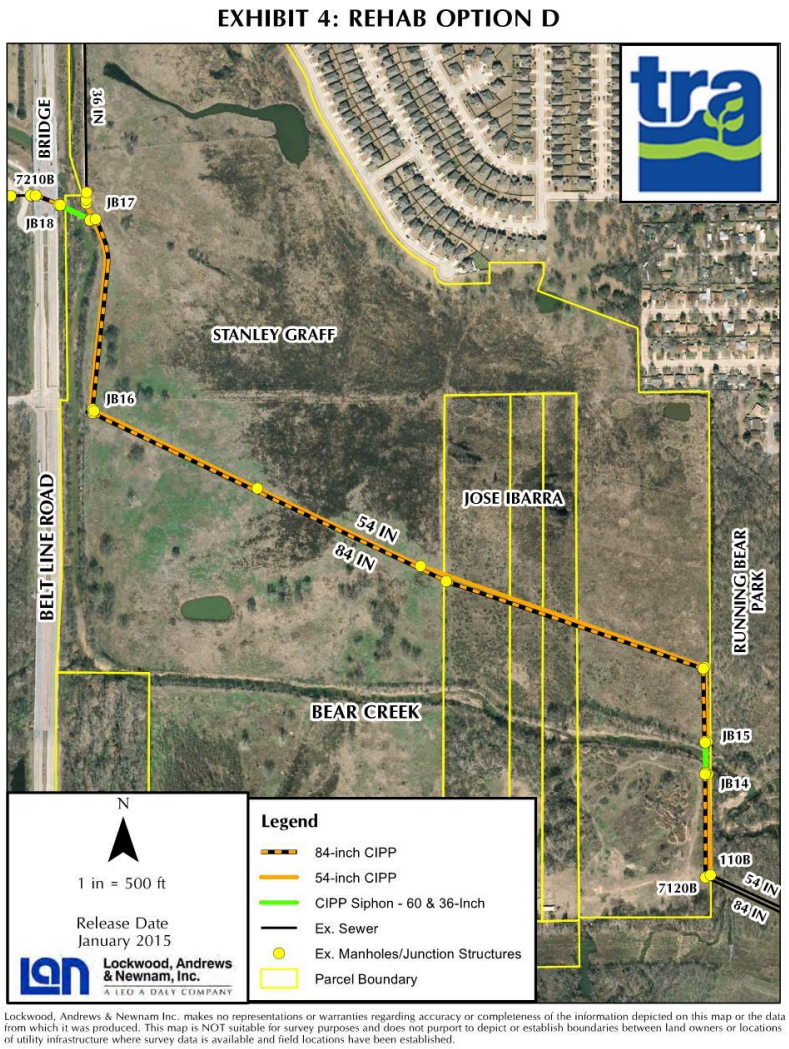
Pros:

- Minimal surface impact
- Can utilize existing easements
- One CIPP contractor can prime the job – eliminate sub markup on other technologies

Cons:

- Additional insertion MHs may be needed for CIPP Install
- Ability to make improvements to access and maintenance is minimal
- Little opportunity to use existing system for flow diversion – extensive bypass pumping

OPCC: $11,700,000



No Silver Bullet: Rehab Alternatives

Option E: New 84” & 90” Parallel

Pros:

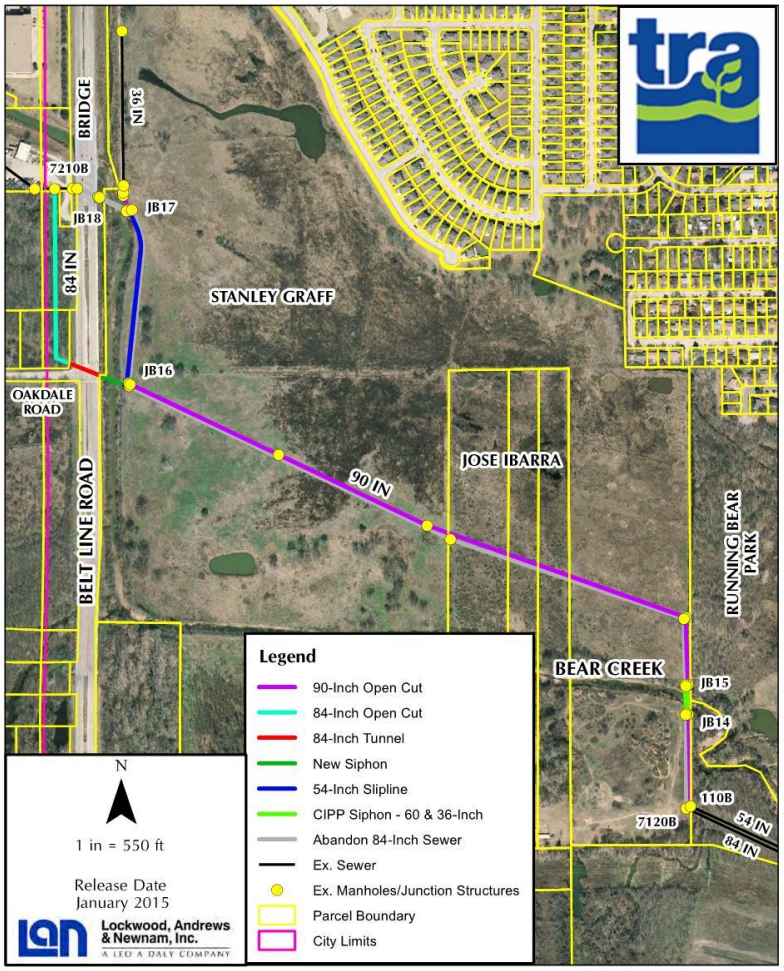
- New pipe in the ground – max design life
- Existing 84” can be used for diversion to reduce bypass pumping

Cons:

- Additional footprint of pipeline
- New temporary and permanent easements will be required
- Tunneled crossing of Belt Line Road – TxDOT permitting

OPCC: $12,150,000

EXHIBIT 5: REHAB OPTION E



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No Silver Bullet: OPCC Comparison

Rehab Option	OPCC
Option A: 84” Sliplining | 54” CIPP	$9,650,000*
Option B: 90” Parallel	$11,500,000
Option C: 84” Sliplining | 54” Replacement	$10,800,000
Option D: 84” CIPP | 54” CIPP	$11,700,000
Option E: New 84” | 90” Parallel	$12,150,000

*Could fluctuate +/- $1,000,000 depending on bypass design and contractor’s creativity.

No Silver Bullet: Project Status

- Option A Selected
  - Cost
  - Utilizes existing infrastructure
  - Sensitive land rights – minimizes need for additional permanent easements
  - Smaller construction footprint
- Currently Under Final Design
- Anticipate Bid in Mid to Late 2017

QUESTIONS

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