Water and Sewer Tunnel Project Status and Conner Freud Pump Stations

Todd King, P.E.

Field Services Director

GLWA
Great Lakes Water Authority

Agenda

- DB-226 Detroit River Interceptor Project
- DB-150 Raw Water Tunnel Project
- CS-120 Conner Freud Pumping Stations

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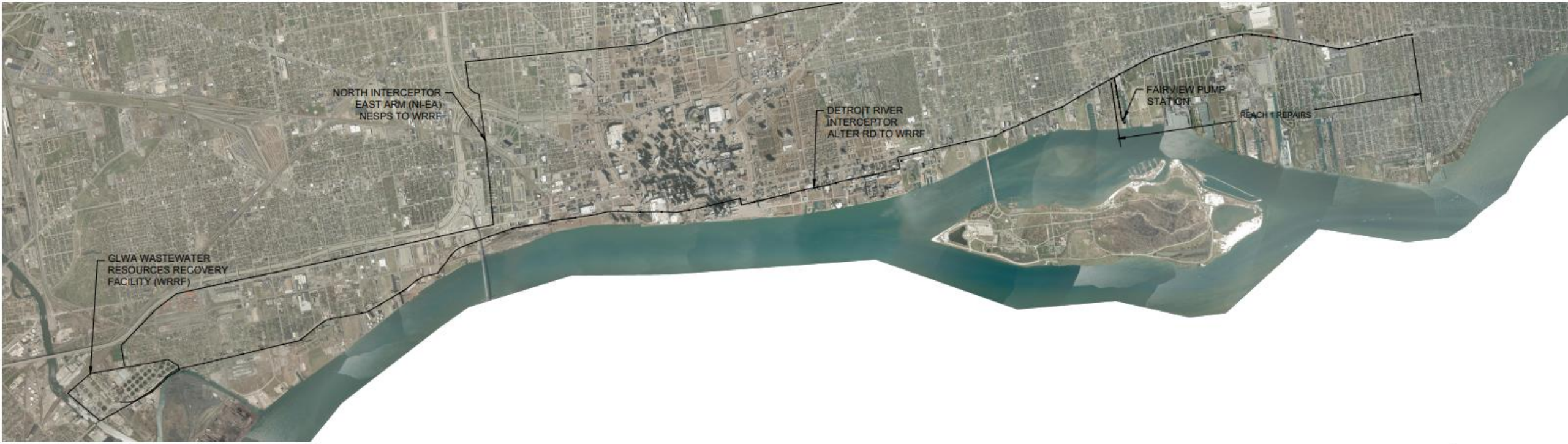
DB-226 Detroit River Interceptor Project

CIP No: 222002
Start: 5/24/2018
Duration: Five Years
Project Delivery: Design Build
Project Team: Jay Dee – Contractor and Prime; FK Engineers – Designer of Record;
Subconsultants = Applied Sciences, Inc. and Anderson, Eckstein and Westrick, Inc.
GLWA PM: Mini Panicker, P.E.
Scope: Evaluation and repair of the Detroit River Interceptor (DRI) sewer from Alter Road (City of Detroit border) to the WRRF. Approximately 12 miles of sewer with diameters from 8 to 16 feet.
Procurement Method: Quality Based Selection
Original Contract Upper Limit: $19.8 million
Original/Current Budget Estimate: $29 million / $ 50 to 60 million (20% contingency)
Current Estimated Duration: Six to Seven Years

Project Scope – Divided into 3 reaches ~ 13 miles



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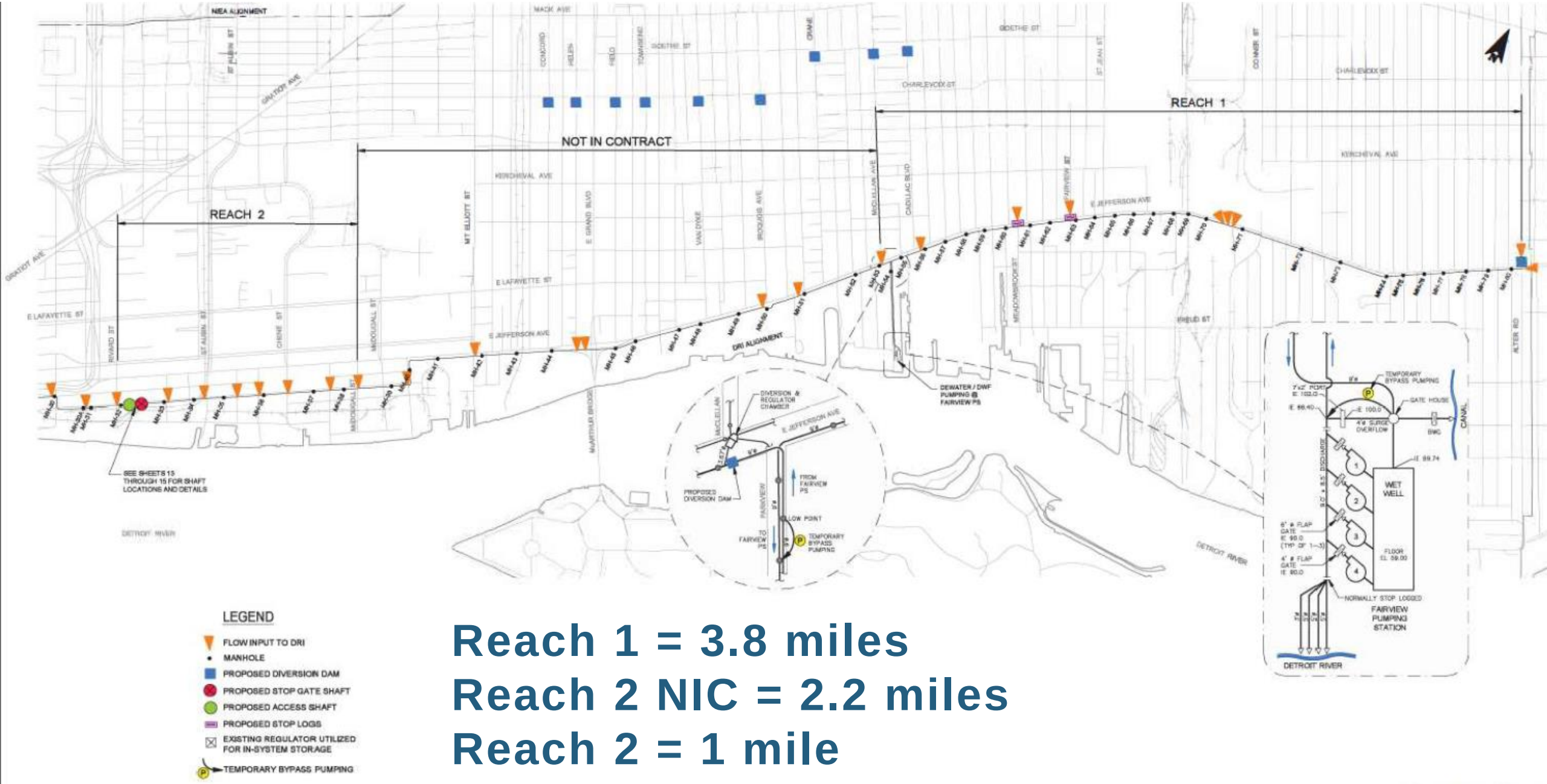


Reach 1 = 3.8 miles

Reach 2 NIC = 2.2 miles

Reach 2 = 1 mile

FIGURE NO. 1

Reach 3 = 6 miles

FIGURE NO. 2

DB-226 Detroit River Interceptor Project (cont.)

Engineering Budget:

$3.4 million as bid

Guaranteed Maximum Price (GMP) Negotiations:

Reach 1: $5.8 million – 9/5/2018
Reach 2: $4.7 million – 1/25/2019
Access Shafts: $6.0 million – 1/25/2019
NIEA-DRI Tunnel: $14 million -

Added Scope:

Reach 1: Conner Creek Access Shafts + Manhole Improvements: $1.3 million
Reach 1: Increased Repair quantities: $1.5 million
Reach 2: Increased Estimated quantities: $ 2.4 million
Reach 2: Area originally not in contract: $6 million
Reach 3: Enhanced Access Shafts/Gates: $3 million
Reach 3: Additional flows and higher than anticipated PS-1 Wet Level: $12 million
Reach 3: Contingency for additional quantities for Reach 3: $3.9 - $13.9 million

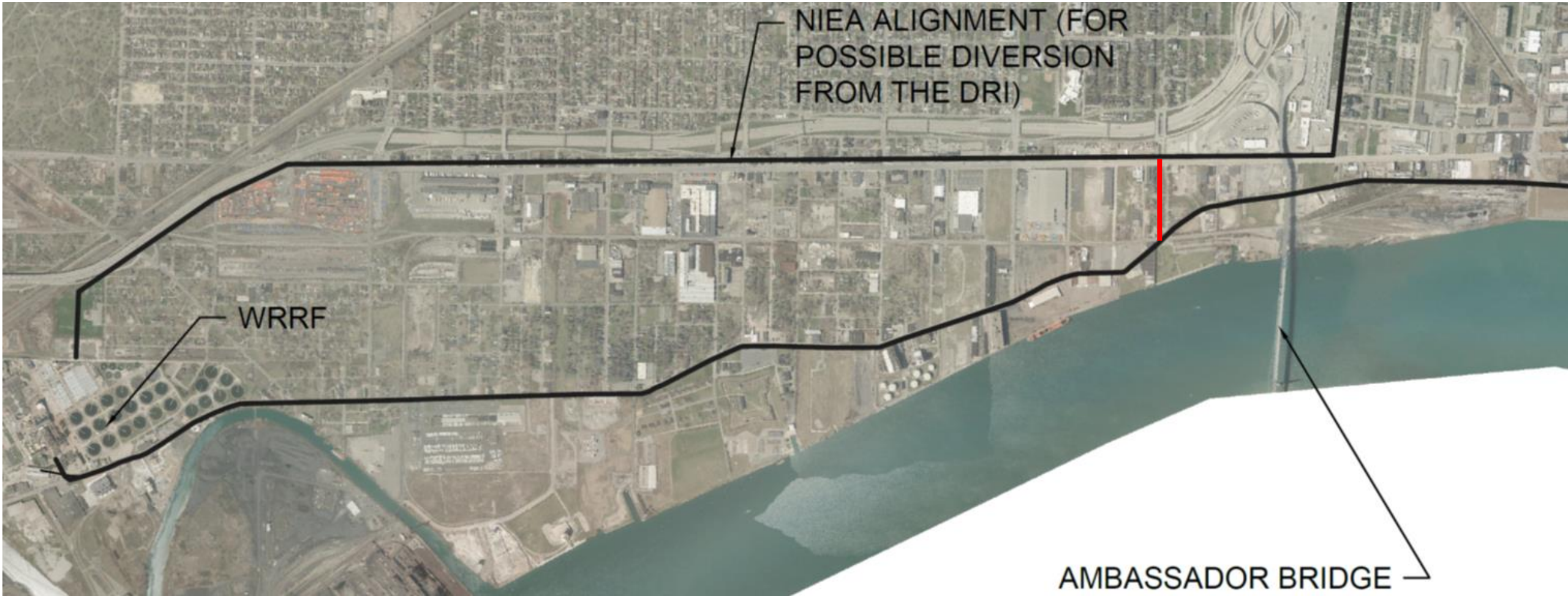
Current Estimated Budget: $50 – 60 million

Significant opportunity for cost savings

DRI to North Interceptor East Arm (NIEA) Crossover

1. Features
    - Conveys dry weather flow from DRI to NIEA
    - 84-inch tunnel to connect DRI and NIEA
    - Tunnel boring machine for 980 lineal feet
    - Connect to five DWSD lateral sewers
2. Benefits
    - Eliminates significant portions of bypass pumping and delays from Fairview project
    - Less disruption to WRRF with reduction in bypass pumping
    - Reduces Reach 3 depths and velocities

DRI-NIEA Crossover



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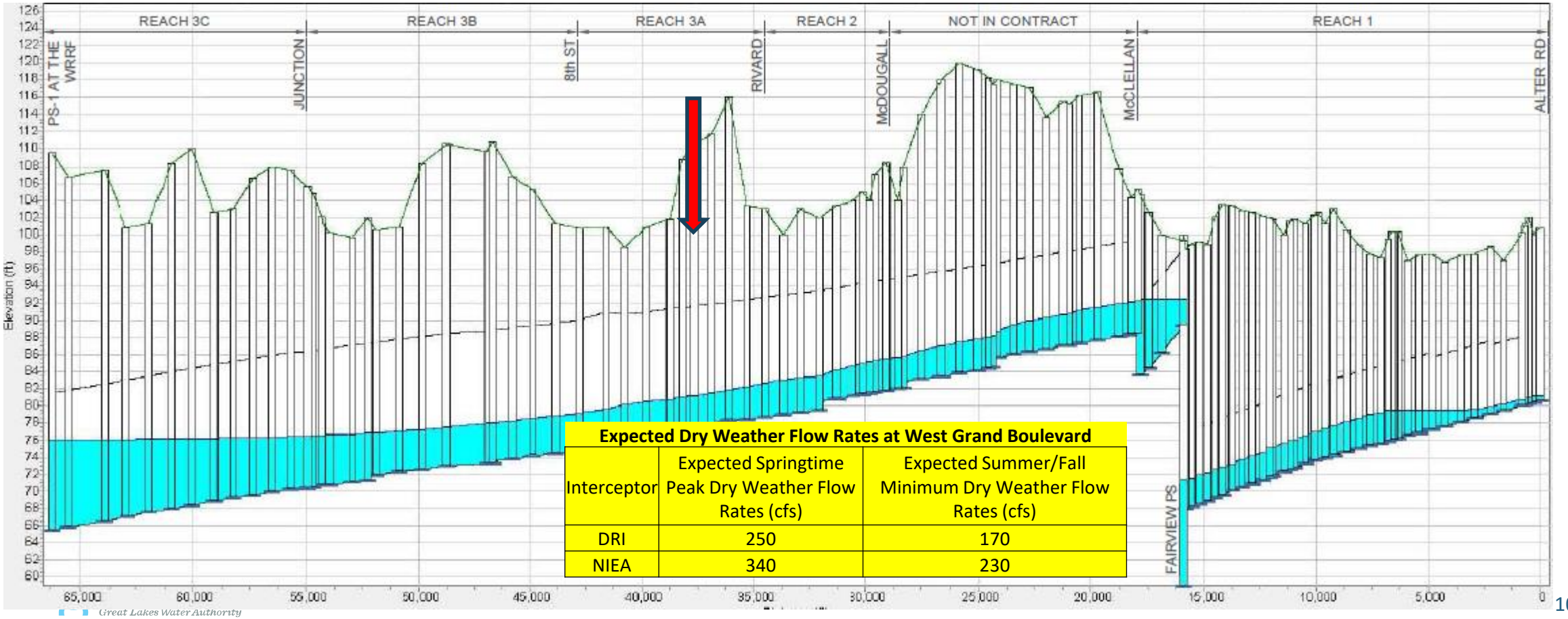
DRI and NIEA Hydraulic Capacities

DRI: 15’-6”Ø at W. Grand Blvd. in Jefferson Ave. and capacity is 952 cfs.

NIEA: 13’-6”Ø at W. Grand Blvd. along Fort St. and capacity is 1,043 cfs.



Expected Dry Weather Flow Rates at West Grand Boulevard

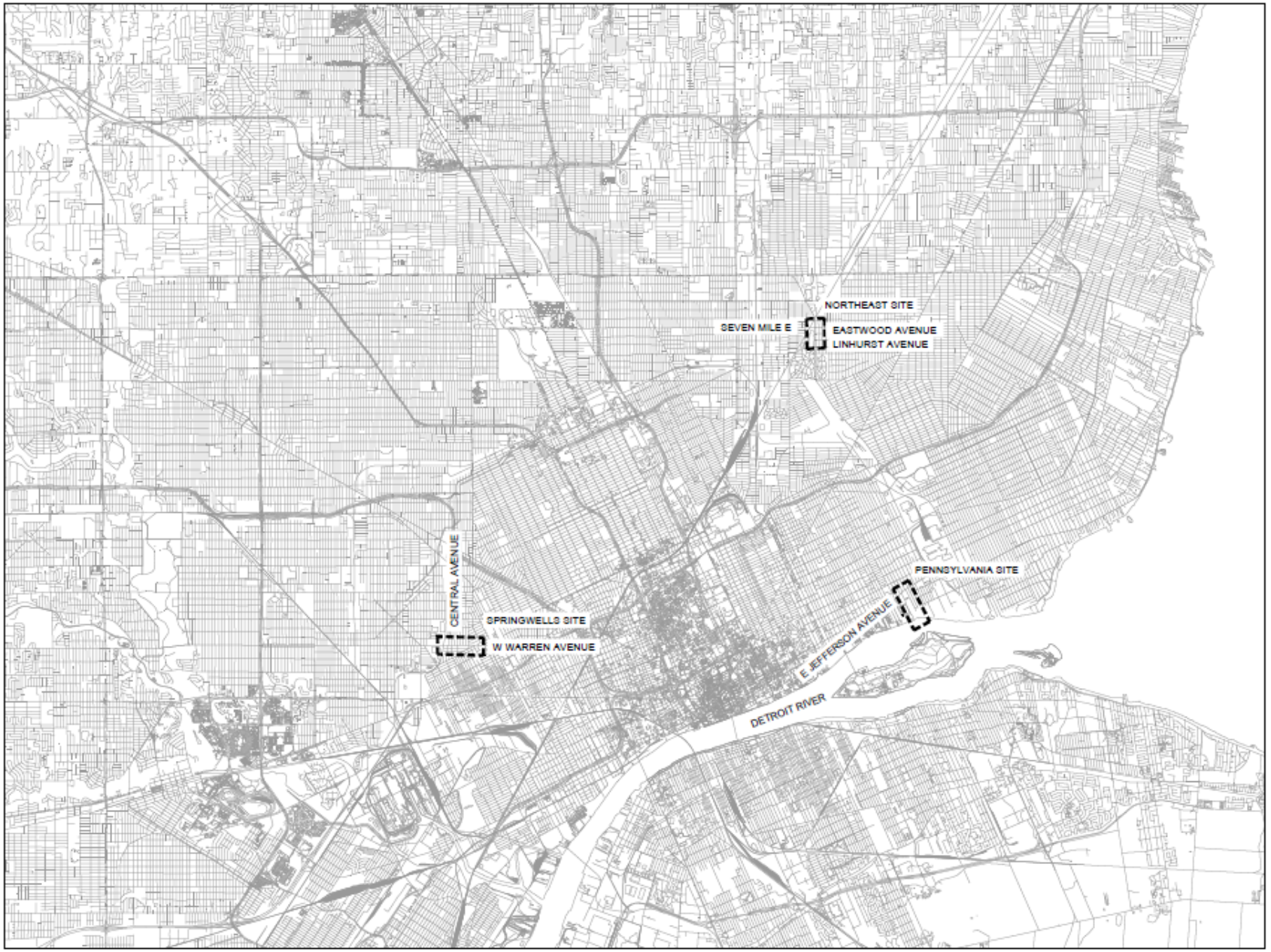
Interceptor	Expected Springtime Peak Dry Weather Flow Rates (cfs)	Expected Summer/Fall Minimum Dry Weather Flow Rates (cfs)
DRI	250	170
NIEA	340	230

DB-226 Next Steps

1) EGLE and City of Detroit have approved DRI-NIEA Crossover in Principle
2) Need to negotiate a change order and GMP for the first phase of Reach 3 work to include the DRI-NIEA Crossover
3) Will present to Board as Change Order No. 1 for DB-226 by fall

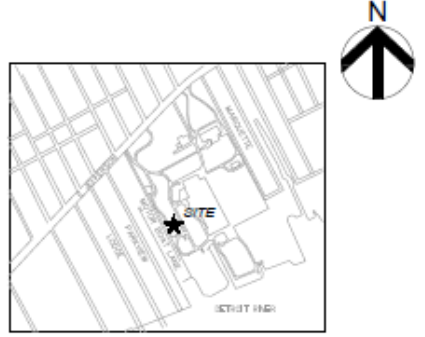
DB-150 Raw Water Tunnel Project

CIP No: 116002
Start: 1/29/2018
Duration: One Year to GMP, Construction TBD
Project Delivery: Progressive Design Build
Project Team: Ballard Marine – Contractor and Prime; Brierly and Associates – Designer of Record;
GLWA PM: Todd King, P.E.
Scope: Evaluation and repair of the raw water tunnels near Springwells WTP, Northeast WTP, and the combined Pennsylvania Tunnel that feeds same. This initial project includes supplemental investigation and production of 30-percent design to facilitate negotiation of GMP.
Procurement Method: Quality Based Selection
Original Contract Upper Limit: $10.7 million
Original/Current Budget Estimate: $30 million / $67 to 105 million (50% contingency)
Current Estimated Duration: Five Years



PROJECT KEY PLAN

SCALE: NTS



PENNSYLVANIA SITE KEY PLAN

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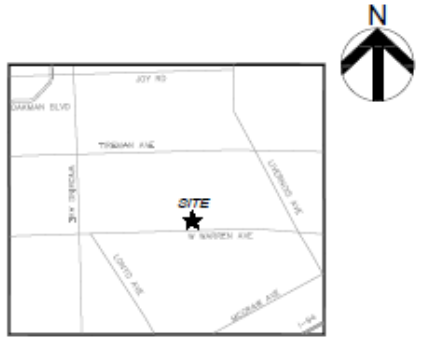


SPRINGWELLS SITE KEY PLAN

SCALE: NTS

NORTHEAST SITE KEY PLAN

SCALE: NTS

30% DRAWING SUBMITTAL- NOT FOR CONSTRUCTION

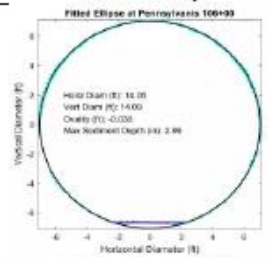
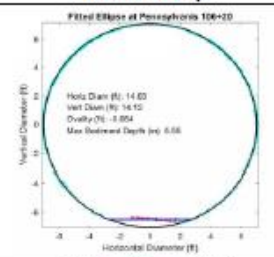
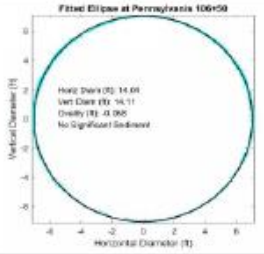
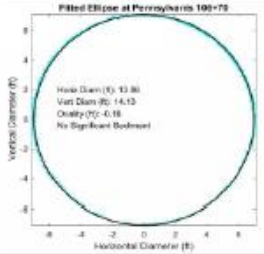
GLWA

BALLARD MARINE CONSTRUCTION | BRIERLEY ASSOCIATES

Diver Tunnel Inspection/Mapping Sheet

Tunnel: Pennsylvania **Start Station:** 105+75 (center of shaft) **End Station:** 107+00 **Inspection Date/Time:** 10/9-10/10 @ 18:00

Video File Name: _____ **Video Start Time:** _____ **Video End Time:** _____

		Anomaly Photo	Tunnel Ovality			Anomaly Photo	Tunnel Ovality
Anomaly 1				Anomaly 2			
Start Station	106+05			Start Station	106+20		
End Station	106+05			End Station	106+20		
Anomaly 3				Anomaly 4			
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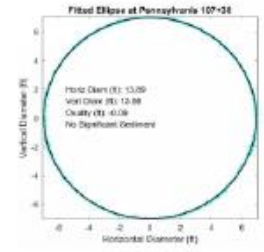
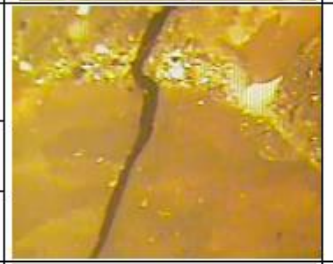
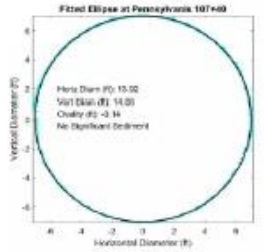
End Station	106+50			End Station	106+70		
Anomaly 5				Anomaly 6			
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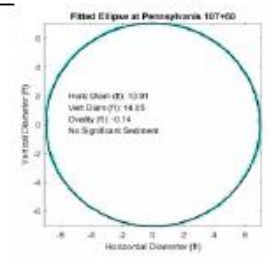
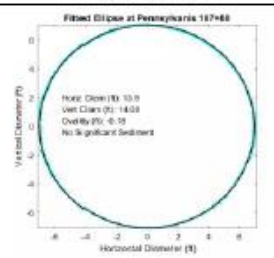
End Station	107+30			End Station	107+40		
Anomaly 7				Anomaly 8			
Start Station	107+60			Start Station	107+80		
End Station	107+60			End Station	107+80		

Form No. TME-C42
Revision No. 0
Revision Date: 11/30/2018

OBTAINING AND TESTING DRILLED CORES AND SAWED BEAMS OF CONCRETE

Quality Assurance

S&ME, Inc. - Columbus *6190 Enterprise Court, Dublin, Ohio 43016*

Project No.:	1117-18-022	Date Photos Taken:	12/3/2018
Project Name:	GLWA Detroit Raw Water Tunnels	Log No:	
Description:	Concrete Cores		

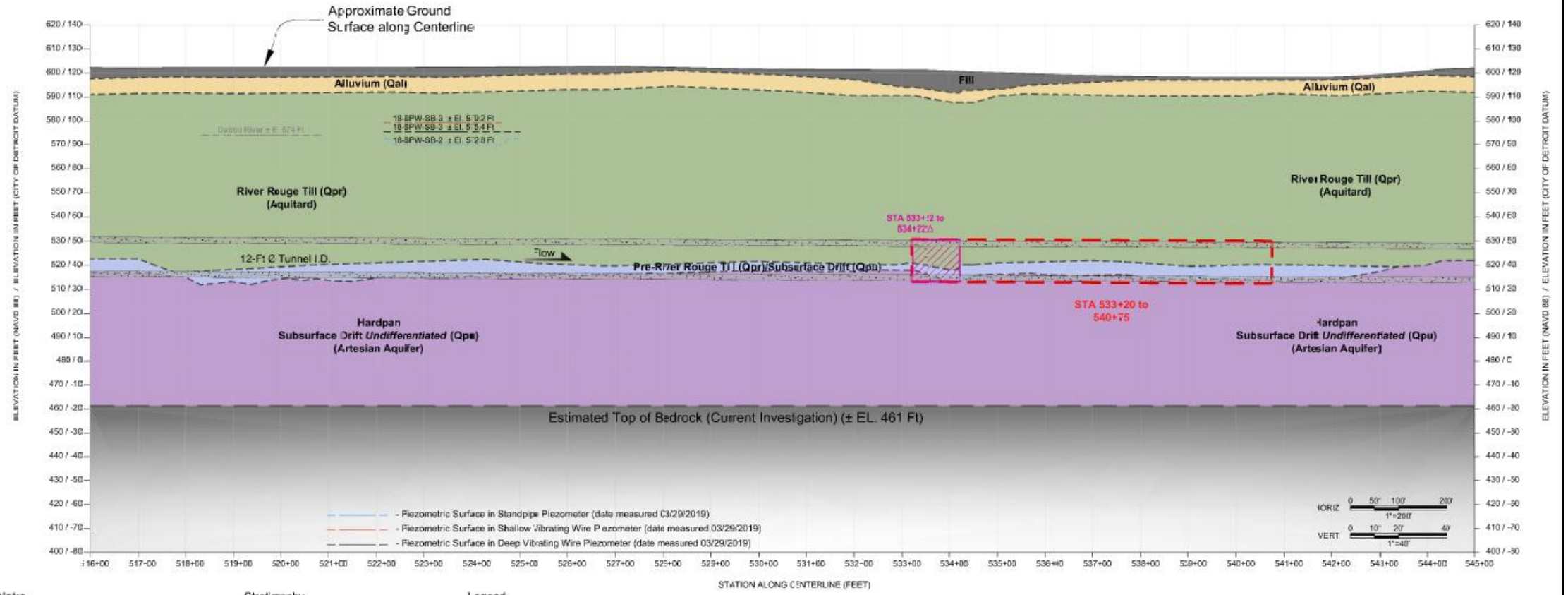
Specimen No.: 18-SPW CC-1 Sample 1

Compressive Strength: 6379 psi

Specimen No.: 18-SPW CC-1 Sample 2

Compressive Strength: 8424 psi

Paula J. Manning	11/30/2018	Erica Goodyear	12/4/2018
Performed By	*Date*	*Checked By*	*Date*



Notes

Profile represents generalized conditions based on test borings and field observations. Formation contacts and other boundaries as shown do not imply exact locations nor that the portrayed formations are necessarily continuous between borings. Borings drilled in 1928 by Ohio Drilling Company & Pennsylvania Drilling Company, borings drilled in 2016 by DLZ - American Drilling, Inc.. NAVD 88 elevation has a correction of +479.233 ft from the Detroit Datum at the Springwells WTP.

Stratigraphy

- Fill
- Alluvium (Qal)
- River Rouge Till (Qpr)
- Pre-River Rouge Till (Qpr)/Subsurface Drift *Undifferentiated* (Qpu)
- Hardpan Subsurface Drift *Undifferentiated* (Qpu)

Legend

= Area of Contracted Portion of Tunnel
= Area of Distressed Tunnel Section Identified in Video Review
Δ denotes area to be confirmed

BRIERLEY ASSOCIATES
Creating Space Underground
15808 Ranch Rd 620 N, Ste 210, Austin, TX 78717
PHONE: 512.219.1733 FAX: 512.219.1759

CLIENT: Great Lakes Water Authority
735 Randolph Street Suite 1900
Detroit, MI 48226

PROJECT NUMBER: SLWA-DB-150, Design-Build
717002-000

FIGURE/PLATE TITLE: SPRINGWELLS TUNNEL
STRATIGRAPHIC CONDITIONS

FIGURE/PLATE: TM-GEO-1.4

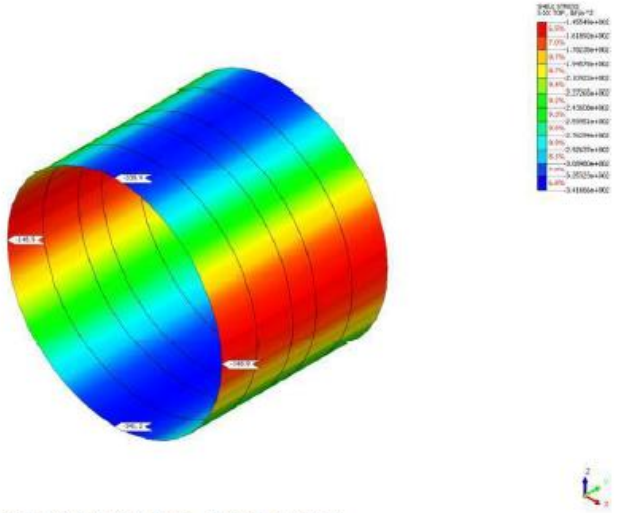


Figure 19: CIP Liner Circumferential Stress Outside Face – Tunnel Dewatered

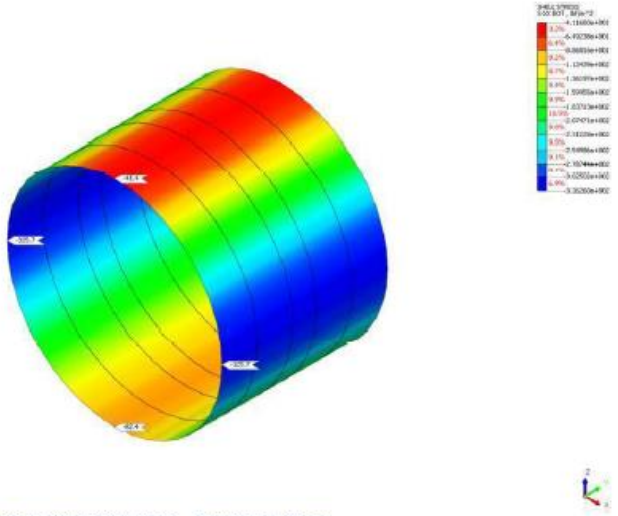


Figure 20: CIP Liner Circumferential Stress Inside Face – Tunnel Dewatered

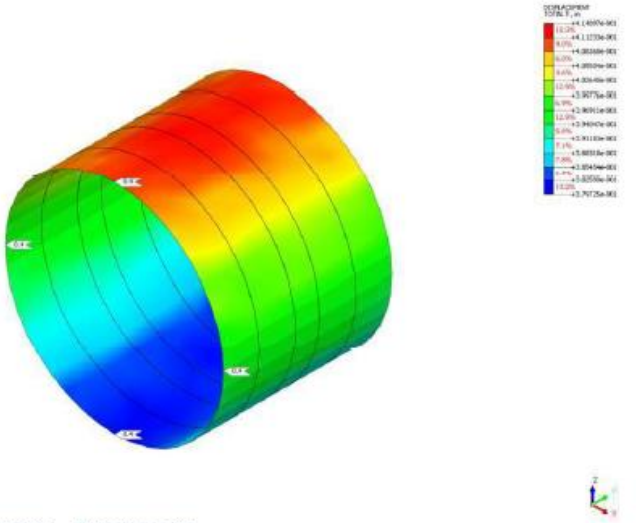


Figure 13: CIP Liner Total Deformation – Tunnel In-service

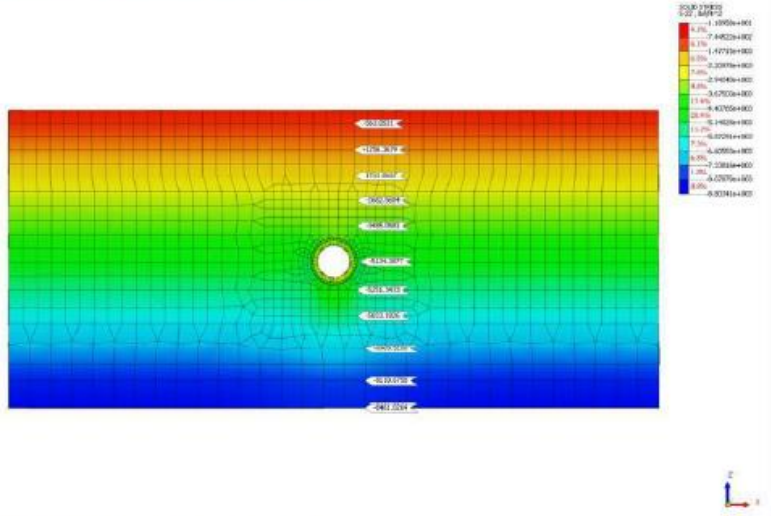


Figure 14: Vertical Effective Stress – Tunnel Dewatered

BRIERLEY ASSOCIATES
Creating Space Underground

DB-150 Significant Variations

Scope Item	Original RFP	30 % BOD	Estimated Costs
Springwells Tunnel Repairs	270 LF (in two locations)	755 LF (combined)	$40.6 to 60.9 million
Pennsylvania Tunnel Repairs	225 LF	225 LF	
Access Shafts	Temporary	Permanent	
Northeast Tunnel	400 LF	500 LF	$26.4 to 39.6 million

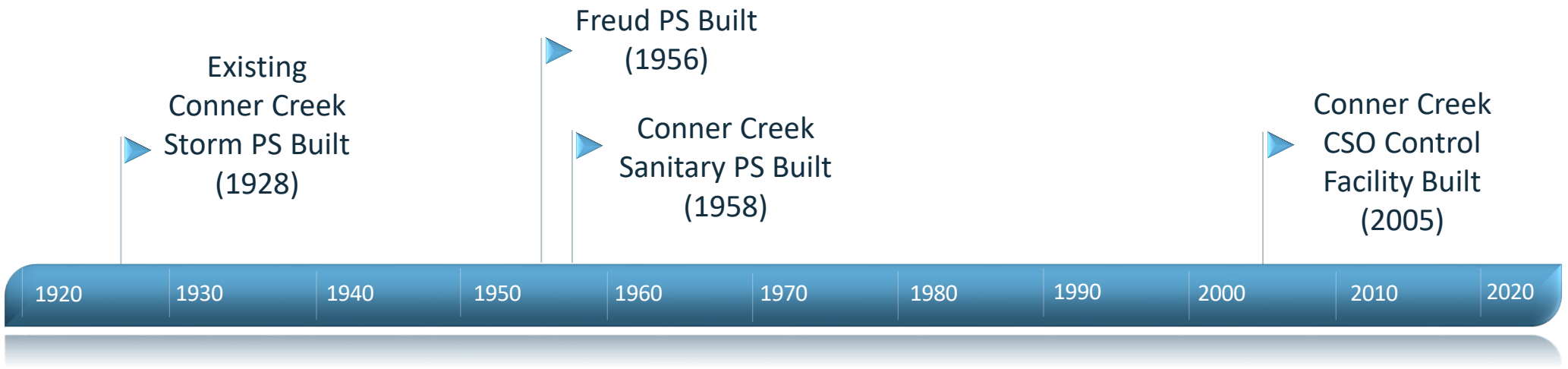
DB-150 Current GMP Status

1) Base Contract with Stainless Steel Flexible Liners at SPW and NE, Crack Repair at PENN = $80.5 million
2) GLWA Counteroffer = $66 million
3) Deduct for no action at NE tunnel = $23.9 million
4) Value of NE Tunnel as asset approximately $400 million
5) Incurred to date-additional investigation and 30-percent design = $10 million

CS-120 Conner and Freud Storm and Sanitary Pump Stations

CIP No: 232002
Start: 2016
Duration: Five Years
Project Delivery: Design Bid Build
Project Team: Arcadis, & Brown and Caldwell;
GLWA PM: Mini Panicker, P.E.
Scope: Evaluation and upgrade of Conner and Freud Sanitary and Storm Pump Stations, each with 2 BGD capacity
Procurement Method: Quality Based Selection – Design
Original Contract Upper Limit: $4.4 million
Incurred to Date: $1.2 million
Original/Current/Potential Budget Estimate: $22.5 million / $ 160 million / $218 million
Current Estimated Duration: Eight Years

Timeline – Pump Stations



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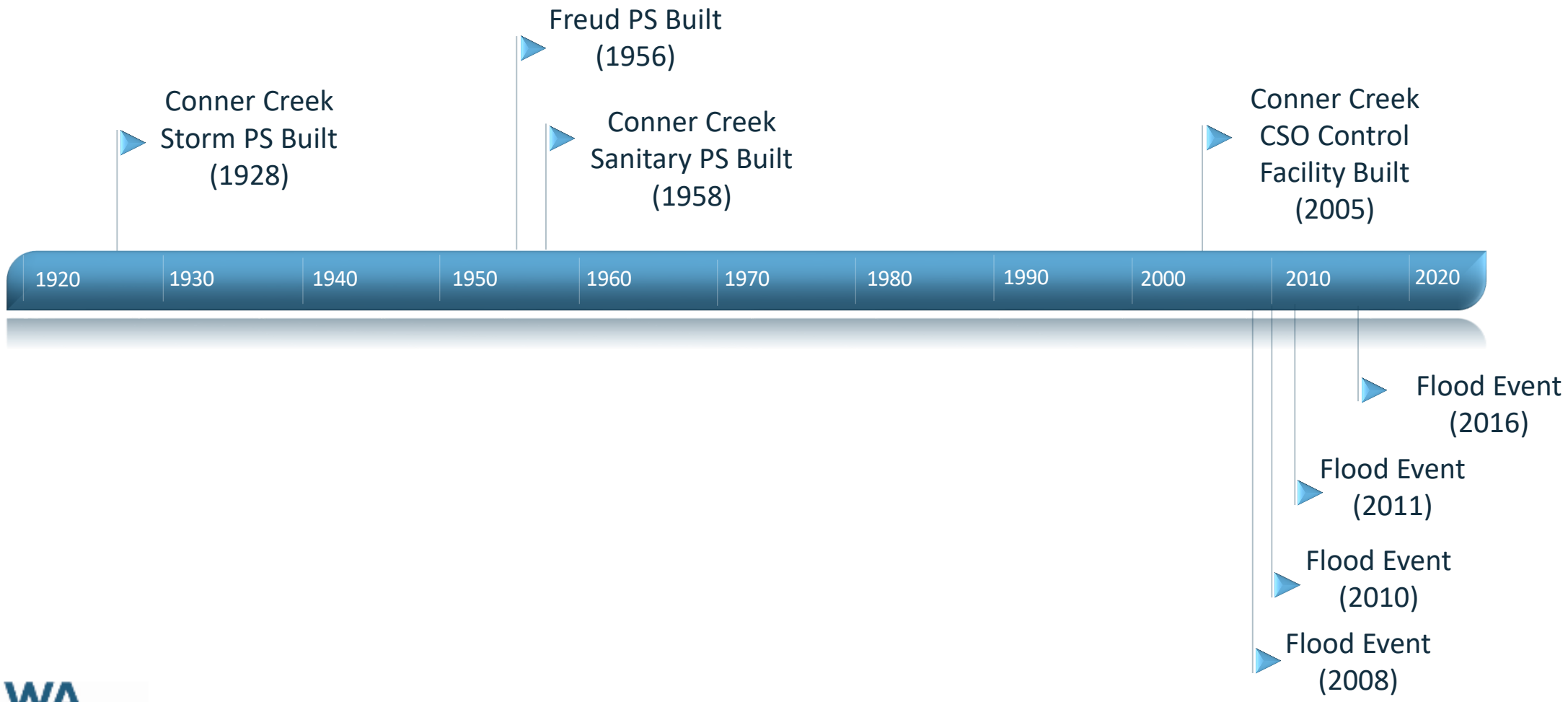
Timeline – Recent Wet Weather Events



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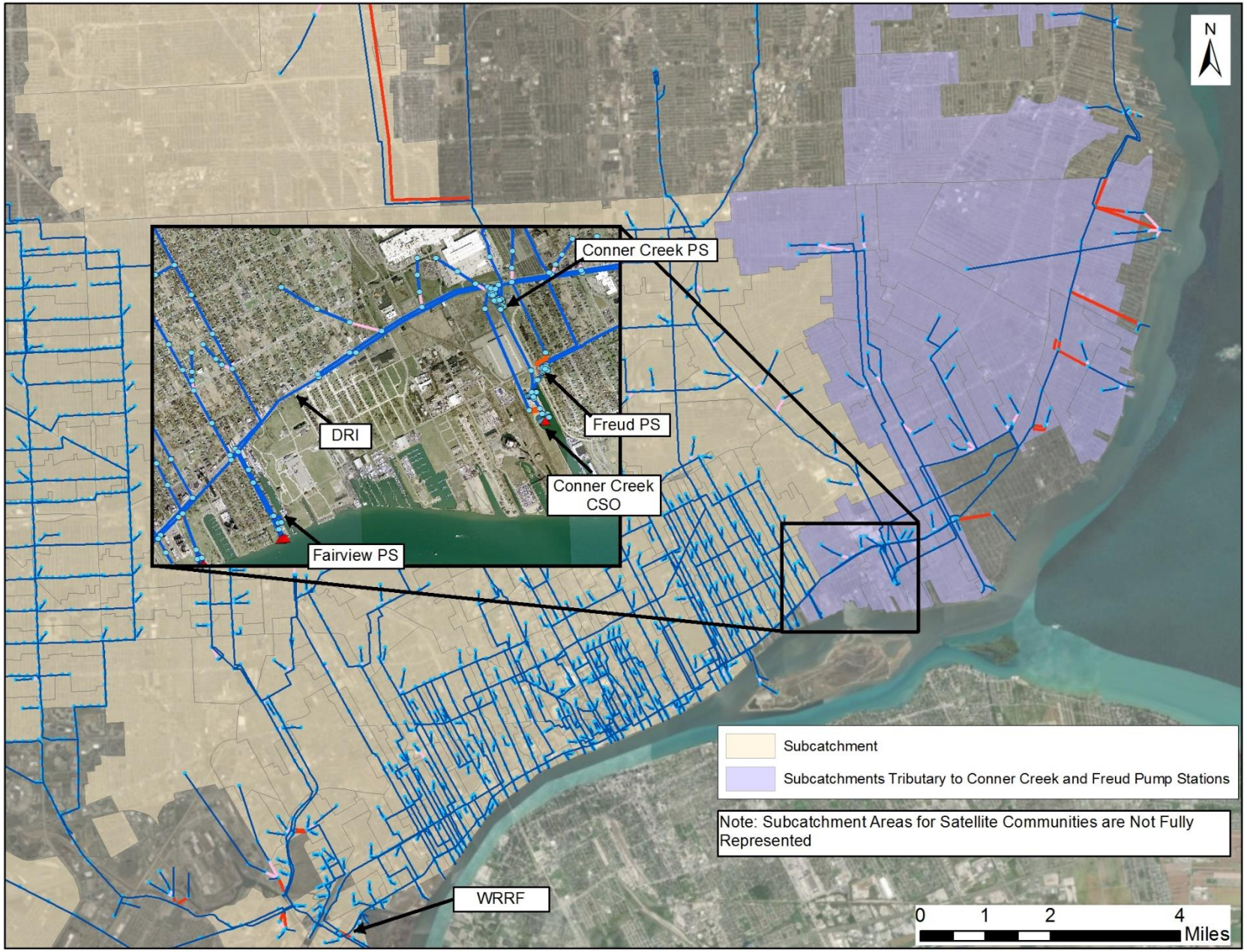
Service Area



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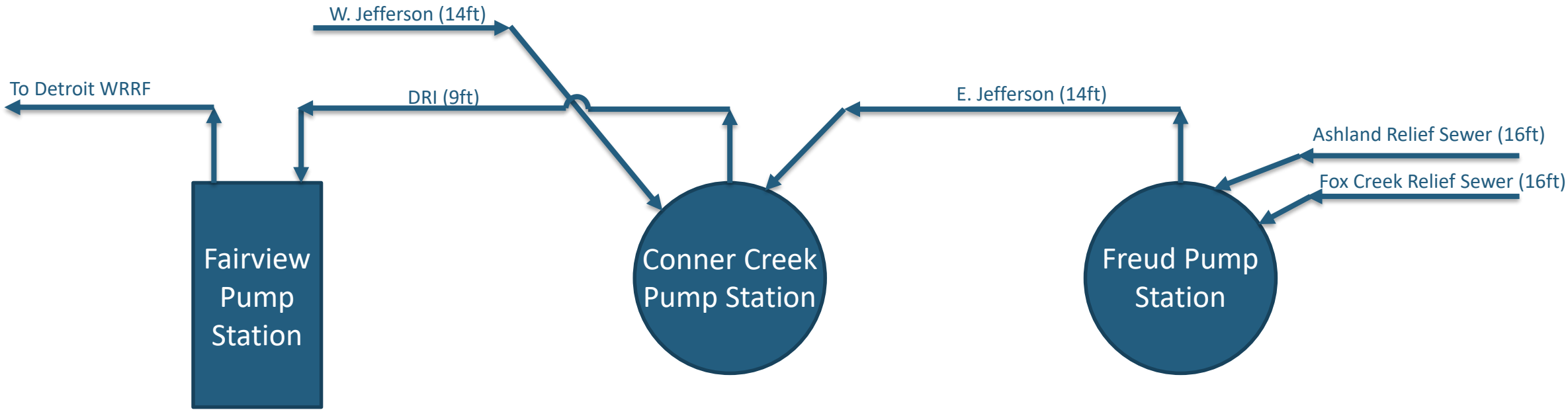
Overview – Existing Dry Weather Flow



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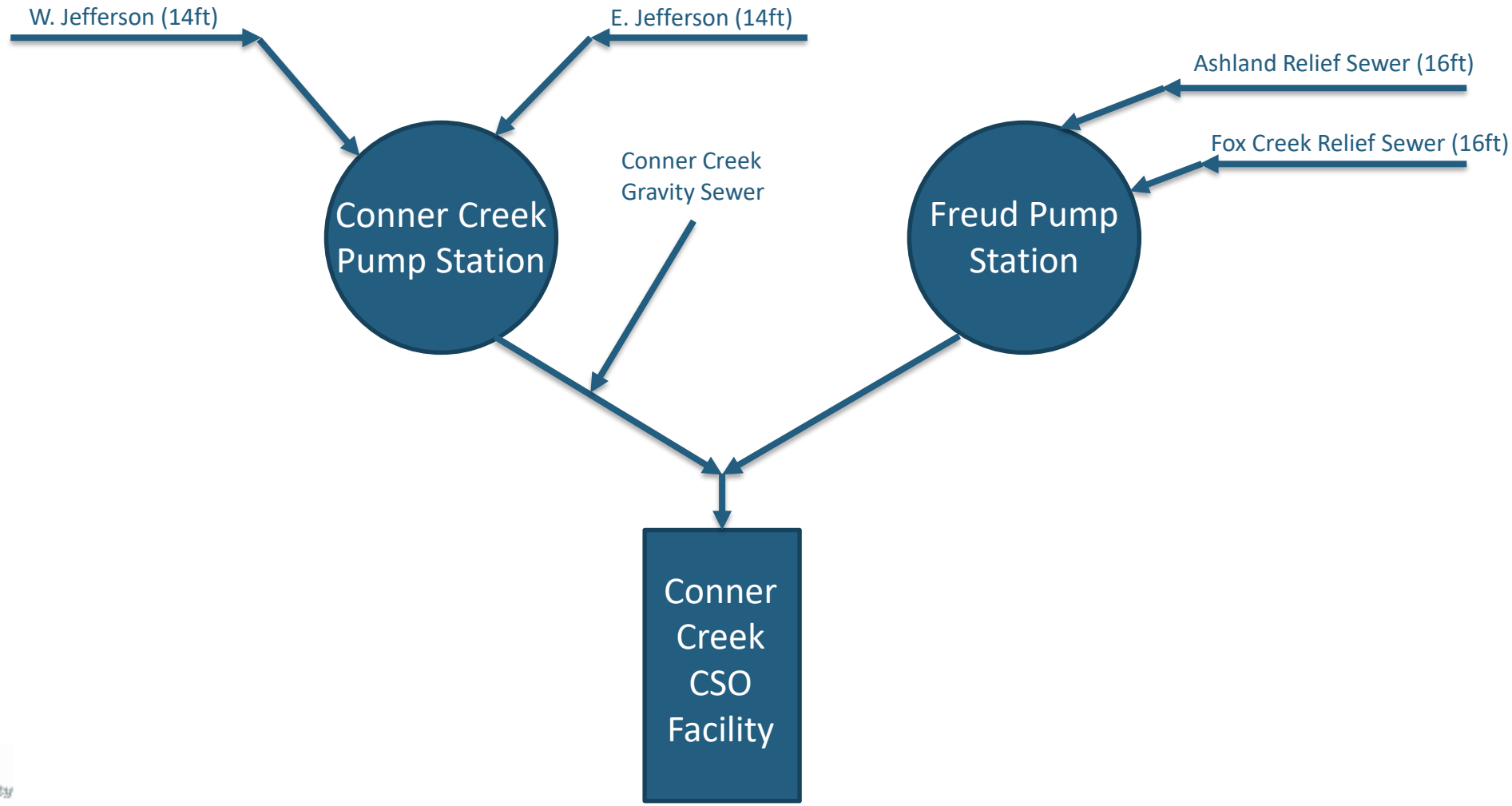
Overview – Existing Wet Weather Flow



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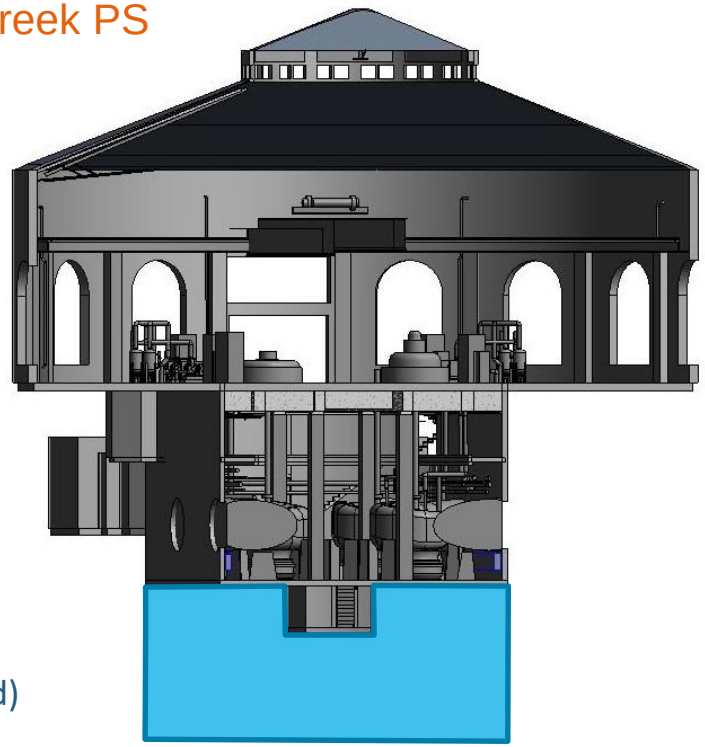
Overview – Existing Pump Stations

Conner Creek PS

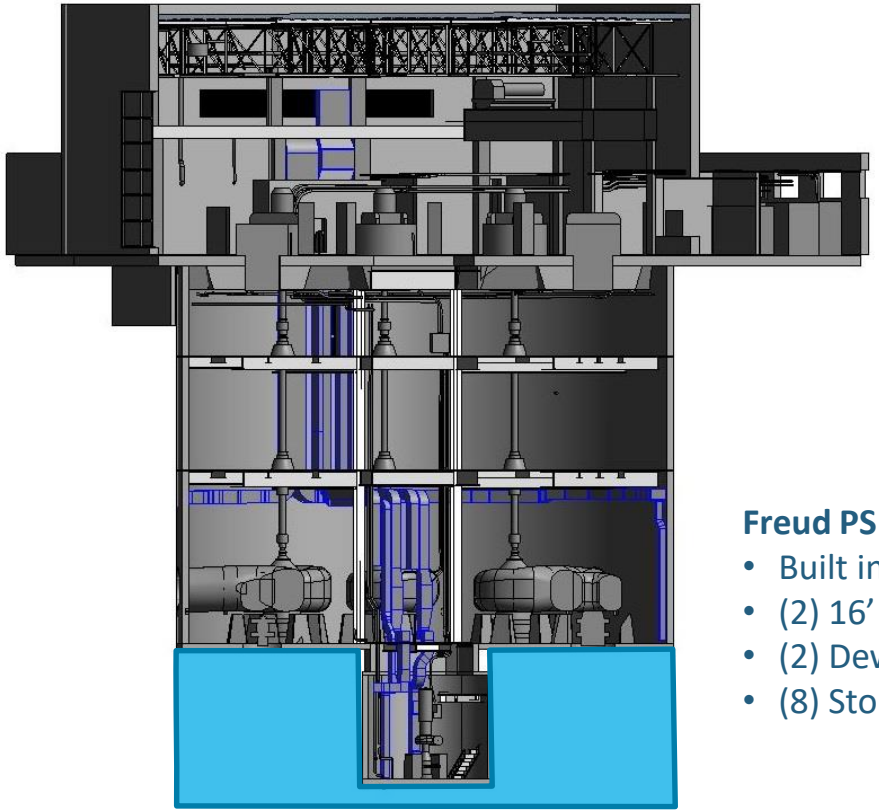


Storm Wet Well
Floor – El. 55

Conner Creek PS

- Built in 1928 (91 yrs old)
- (2) 14’ Influent Sewers
- (4) Sanitary Pumps (144 MGD)
- (8) Storm Pumps (2.23 BGD)

Freud PS



Storm Wet Well
Floor – El. 20

Freud PS

- Built in 1954 (65 yrs old)
- (2) 16’ Influent Sewers
- (2) Dewatering Pumps (13 MGD)
- (8) Storm Pumps (2.03 BGD)

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Note: Firm pump capacities listed

Project Purpose

"The primary objective of this project is to study the overall performance of both the pumping stations and develop and design an operational strategy to optimize the utilization of interconnected piping and operation between these two pumping stations and the Conner Creek Retention and Treatment Basin." (Original RFP - December 2016)

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2017 Scope of Work

Improvements for Existing Pump Stations

- Optimize Operating and Control Strategy for Freud PS, Conner Creek PS, and Conner Creek CSO Facility
- Optimize Conner Storm Pump Priming
- Incorporate means to isolate wet wells
- Evaluate hydraulic modifications to existing Storm and Sanitary Wet Wells
- Assess Physical Condition of each Pump Station
- Improve Equipment Handling

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Work Completed To-Date

Task	Conclusions
Physical Condition Assessment	Satisfactory considering age of equipment and structures; repairs and upgrades as expected
Physical Modeling – Existing System	Conner: Confirms operational challenges related to turbulence and air entrainment for both Sanitary and Storm Pump Stations Freud: Confirms Sanitary hydraulic challenges with existing design ranges
Hydraulic Modeling – Existing System	Confirms surcharging challenges in system
Pumping Hydraulics and Operation Assessment	Poor: • Conner Storm – shallow wet well and extremely tight operating range, very close to basement flooding elevations • Conner Sanitary – undersized capacity • Freud Sanitary – undersized capacity and originally intended for dewatering only

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Concept Alternatives – Initial

Alt 1 - Minimum Improvements for Conner Creek PS and Freud PS

- Conner Storm: 8 New vertical column pumps (replace existing)
- Conner Sanitary: Rehab existing 4 pumps; add 2 more pumps in new wet well
- Freud Storm: Rehab existing 8 pumps
- Freud Sanitary: Replace existing Dewatering Pumps

Alt 2 - New Conner Creek PS and Intermediate Improvements for Freud PS

- Conner Storm: New deep 2.2 BGD Pump Station
- Conner Sanitary: New deep 200 MGD Pump Station
- Freud Storm: Rehab existing 8 pumps
- Freud Sanitary: New 30 MGD Pump Station and replace existing Dewatering Pumps

Alt 3 - New Combined Pump Station

- Combined 4 BGD Pump Station with tunneling to connect 4 influent sewers

Concept Alternatives – Value Engineering Input

General Consensus with the Value Engineering Team:

- Conner Sanitary – New Pump Station (200 MGD)
- Freud Storm – Replace 2 Dewatering Pumps; Rehab 8 Storm Pumps
- Freud Sanitary – New Pump Station (30 MGD)

Estimated combined capital cost – $53 million

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Concept Alternatives – Value Engineering Input

Conner Storm – Initial Alternatives:

- Alt 1 - 8 New vertical column pumps (replace existing)
- Alt 2 - New deep 2.2 BGD Pump Station

Conner Storm – VE Team Suggested Alternatives:

- Alt 1a – Supplemental wet well with two new storm pumps
- Alt 1b – New 1 BGD capacity pump station and improve priming system on existing storm pumps
- Alt 1c – New 2.2 BGD capacity pump station as described under Alternative 2 but initially with 1 BGD of pumping capacity; utilize existing station for remaining life and add new pumps as existing pumps fail

Alternatives Comparison Summary – Conner Storm

	Alt 1 New Pumps Existing PS	Alt 1a New Pumps Existing PS + Small New PS	Alt 1b New 1 BGD PS + Existing PS	Alt 1c New 2.2 BGD PS with 1/2 Pumps + Existing PS	Alt 2 New 2.2 BGD PS
All pumps rapid start (no vacuum priming)	✓	✓			✓
Pumping Capacity (2.2 BGD)	*	✓	✓	✓	✓
Enhanced wet well operability			✓	✓	✓
Conforms to Hydraulic Institute standards**					✓
Ability to isolate wet well for maintenance			✓	✓	✓
Capital Cost ($millions)	76	104	118	135	160
Net Present Value – 40 year ($millions)	151	185	204	265	231

* TBD based on additional physical and CFD modeling

** Maximizes long term investment value, e.g. pumps and piping last longer with fewer problems

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Alternatives Comparison Summary – Conner Storm

	Alt 1 New Pumps Existing PS	Alt 1b New 1 BGD PS + Existing PS	Alt 2 New 2.2 BGD PS
No additional modeling required to prove concept		✓	✓
Construction duration – estimate	6 years	4 years	5 years
Lower constructability / regulatory risks during construction		✓	✓
Firm Pumping Capacity (2.2 BGD)	*	✓	✓
Does not require land acquisition	✓		
Provisions to facilitate equipment removal	Limited	Limited	All
Capital Cost ($millions)	76	118	160
Net Present Value – 40 year ($millions)	151	204	231

* TBD based on additional physical and CFD modeling

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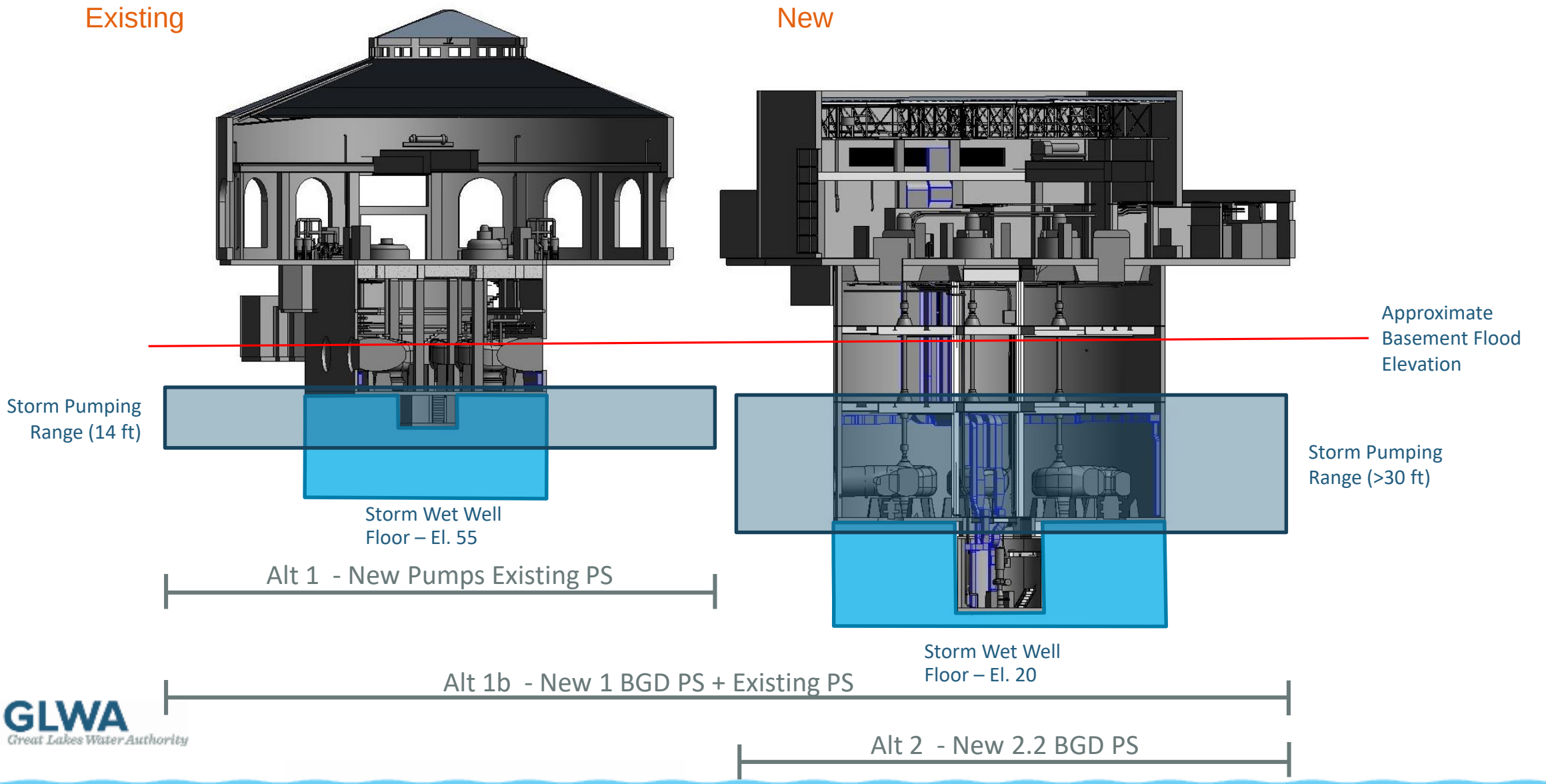
Alternatives Comparison Graphic – Conner Storm



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Pro and Con – Alternative 1 – New Pumps in Old Conner Station

Pro

- Least expensive
- Eliminates vacuum priming as potential cause of failure

Con

- Does not meet Hydraulic Institute (HI) guidelines for pumps and wet well
- Requires additional, high level modeling (computational fluid dynamics and physical model)
- Prolongs schedule and increases demands on staff to mitigate risk of potential flooding events
- Does not provide capability to isolate wet well

Pro and Con – Alternative 1b – New 1 BGD Pump Station and run existing Conner Station until failure

Pro

- Best operational solution for least cost
- New Pump Station will meet HI guidelines
- Addition of 3rd storm pump station increases flexibility

Con

- Existing pump station will not meet HI guidelines
- Retains complex vacuum priming
- Addition of 3rd storm pump station increases system complexity

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Pro and Con – Alternative 2 – New 2.2 BGD Pump Station

Pro

- Meets HI guidelines
- Eliminates vacuum priming
- Shortest schedule
- Standardized equipment (improves operability)
- Increased isolation capability (improves maintainability)

Con

- Most expensive
- Largest land acquisition footprint

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Alternatives Comparison Summary – Conner Storm

	Alt 1 New Pumps Existing PS	Alt 1b New 1 BGD PS + Existing PS	Alt 2 New 2.2 BGD PS
Least Cost	✓		
Least Time to Implement		✓	
Best Technical Solution			✓
Least Property Acquisition	✓		
Best Maintainability			✓
Lowest Operating and Maintenance Cost			✓
Capital Cost ($millions)	76	118	160
Net Present Value – 40 year ($millions)	151	204	231

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Alternatives Comparison Summary – Conner Storm –

Eliminating highest cost alternative

	Alt 1 New Pumps Existing PS	Alt 1b New 1 BGD PS + Existing PS	Alt 2 New 2.2 BGD PS
Least Cost	✓		
Least Time to Implement		✓	
Best Technical Solution		✓	✓
Least Property Acquisition	✓		
Best Maintainability		✓	✓
Lowest Operating and Maintenance Cost		✓	✓
Capital Cost ($millions)	76	118	160
Net Present Value – 40 year ($millions)	151	204	231

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Alternatives Comparison Summary – Conner Storm –

Eliminating longest time alternative

	Alt 1 New Pumps Existing PS	Alt 1b New 1 BGD PS + Existing PS	Alt 2 New 2.2 BGD PS
Least Cost	✓	✓	
Least Time to Implement		✓	
Best Technical Solution			✓
Least Property Acquisition	✓	✓	
Best Maintainability			✓
Lowest Operating and Maintenance Cost			✓
Capital Cost ($millions)	76	118	160
Net Present Value – 40 year ($millions)	151	204	231

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Best Technical Solution

Alt 2 - New Conner Creek PS and Intermediate Improvements for Freud PS

- Conner Storm: New deep 2.2 BGD Pump Station
- Conner Sanitary: New deep 200 MGD Pump Station
- Freud Storm: Rehab existing 8 pumps
- Freud Sanitary: New 30 MGD Pump Station and replace existing Dewatering Pumps
- Total Capital Cost: $220 million

Why?

- Based on criticality and consequence of failure, Alt 2 aligns with GLWA's goals:
  - Lowest risk of flooding
  - Improve reliability and operability

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Plan Forward

GLWA Selection of Alternative
Amend existing contract CS-120
Proceed with Preliminary Design based on Recommended Alternative
Initiate land acquisition
Develop Basis of Design Report for both Pump Stations
Move into Final Design for two separate construction projects

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Estimated Schedule

GLWA Selection of Alternative – Winter, 2019/20
Preliminary Design completed – Fall 2020
Final Design Freud PS completed – Summer 2021
Final Design Conner Creek PS completed – Spring 2022
Construction Freud PS completed – Spring 2024
Construction Conner Creek PS completed – Spring 2026

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Estimated Fiscal Year Spend - OUTDATED

FY Start	Total	Freud	Conner
7/1/2019	$ 3,048,000	$ 1,252,000	$ 1,796,000
7/1/2020	$ 5,996,000	$ 1,700,000	$ 4,296,000
7/1/2021	$ 45,074,000	$ 7,812,000	$ 37,262,000
7/1/2022	$ 42,170,000	$ 7,908,000	$ 34,262,000
7/1/2023	$ 42,074,000	$ 7,812,000	$ 34,262,000
7/1/2024	$ 42,170,000	$ 7,908,000	$ 34,262,000
7/1/2025	$ 34,262,000		$ 34,262,000
7/1/2026	$ 3,700,000		$ 3,700,000
Total	$ 218,494,000	$ 34,392,000	$ 184,102,000

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Note: Includes estimates for property acquisition and demolition costs

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Questions?