The Portland Back Cove West CSO Storage Conduit

Collaborating to Protect our Water Resources

January 2024

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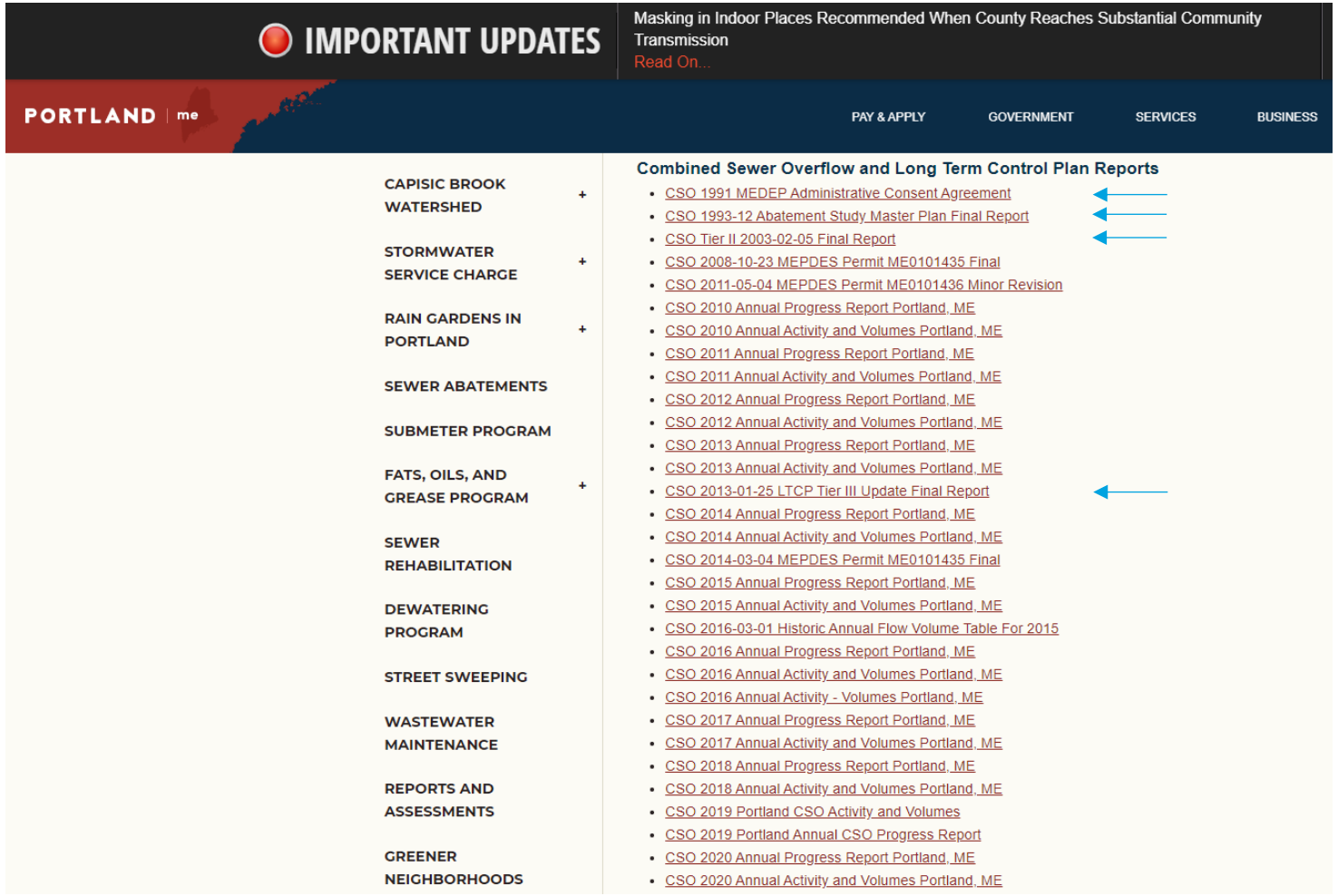
WRIGHT-PIERCE
Engineering a Better Environment

Presentation Overview

History (City's LTCPs)
Design Process
VE Process
Construction Progress
Additional Project Details
Lessons Learned
Project Performance
Thank You

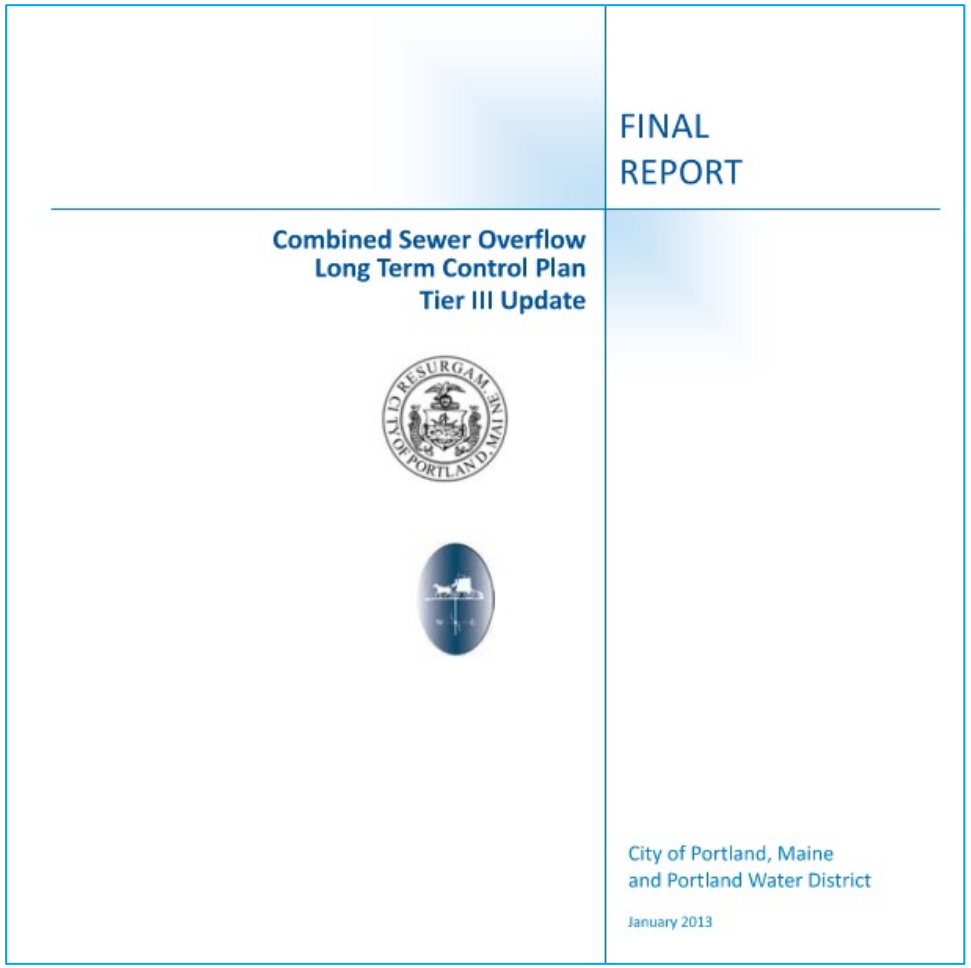
History (City's LTCPs)



- 1991 – Consent agreement
- 1993 – Master plan
- 2003 – CSO Tier II
- 2013 – CSO Tier III
- Continued annual progress reports
- Continued annual volumes report

https://www.portlandmaine.gov/1835/Reports-and-Assessments

History (City's LTCPs)



https://www.portlandmaine.gov/1835/Reports-and-Assessments

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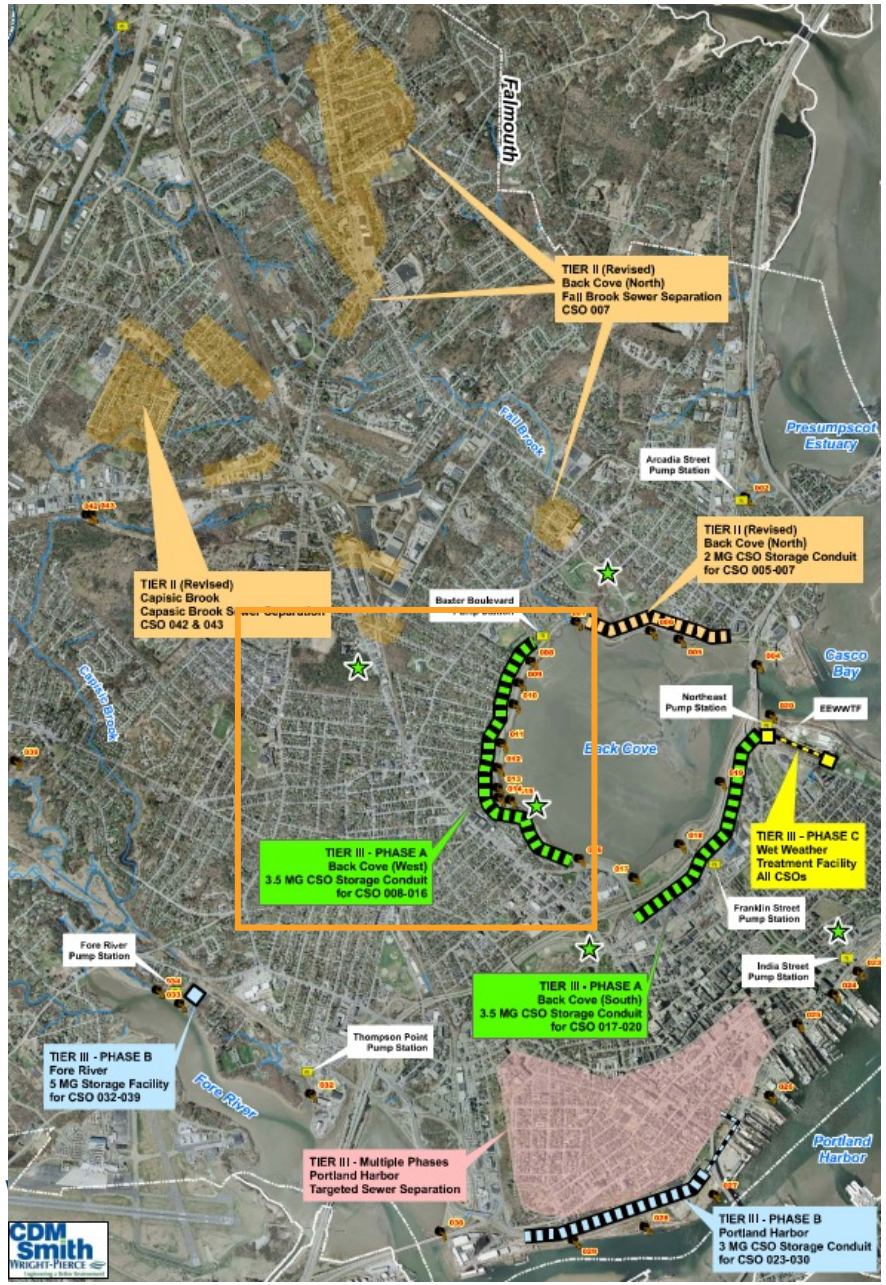
- Capture first flush – first 1" of storm
  - 80% of storm volume
  - 90% of pollutant load
- Provide flexibility
- 87% CSO volume reduction
- Storage as primary element
- Initial focus on Back Cove
- Integrate with facility upgrades
- Replace aging infrastructure

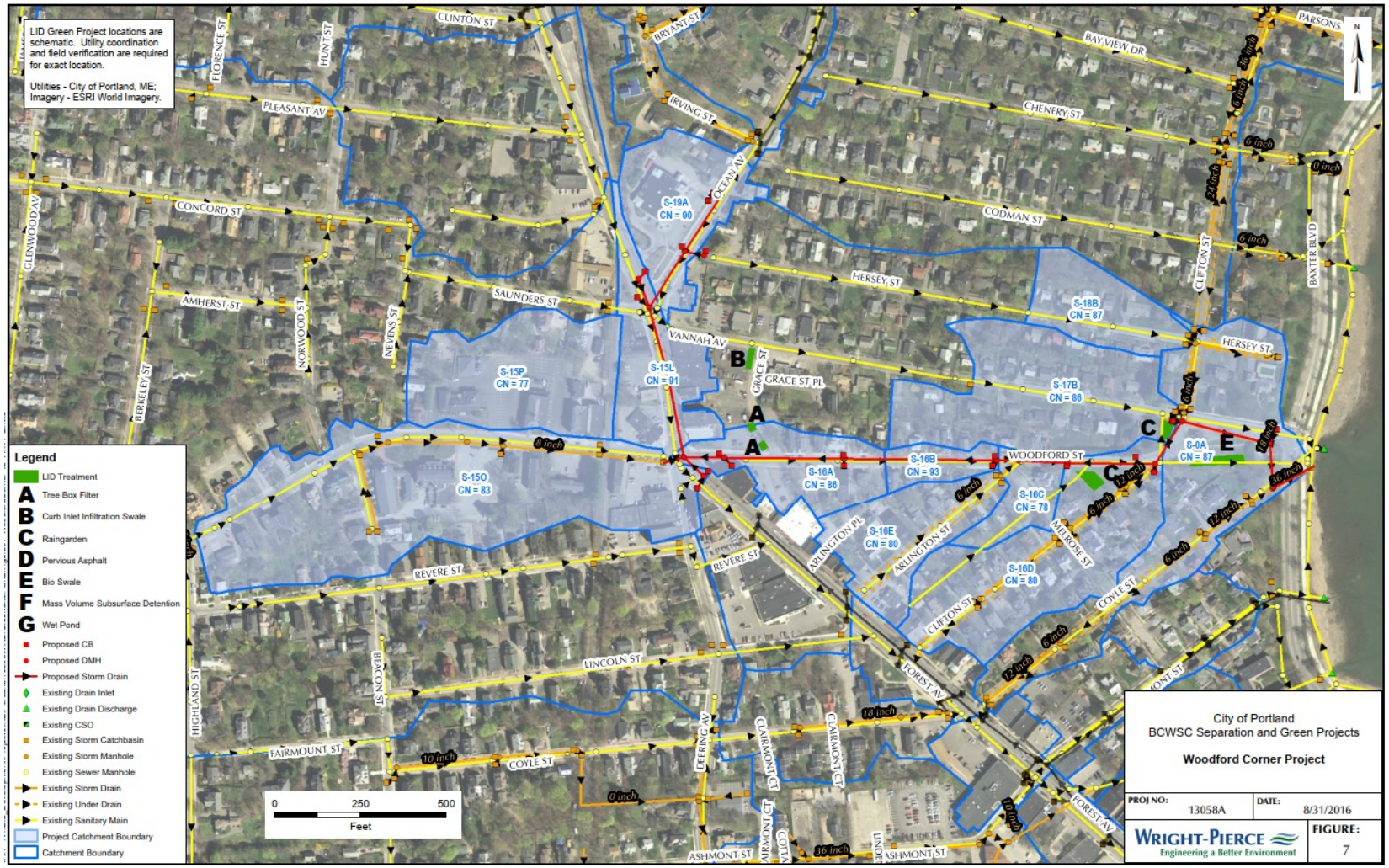
History (City's LTCPs)



- Capisic Brook Sewer Separation
- Fall Brook Sewer Separation
- Portland Harbor Sewer Separation
- Back Cove North Storage (2.0 MG)
- Back Cove South Storage (3.5 MG)
- Back Cove West Storage (3.5 MG)
- Fore River Storage (5 MG)
- Portland Harbor Storage (3 MG)
- Wet Weather Treatment Facility

https://www.portlandmaine.gov/1835/Reports-and-Assessments

Design Process

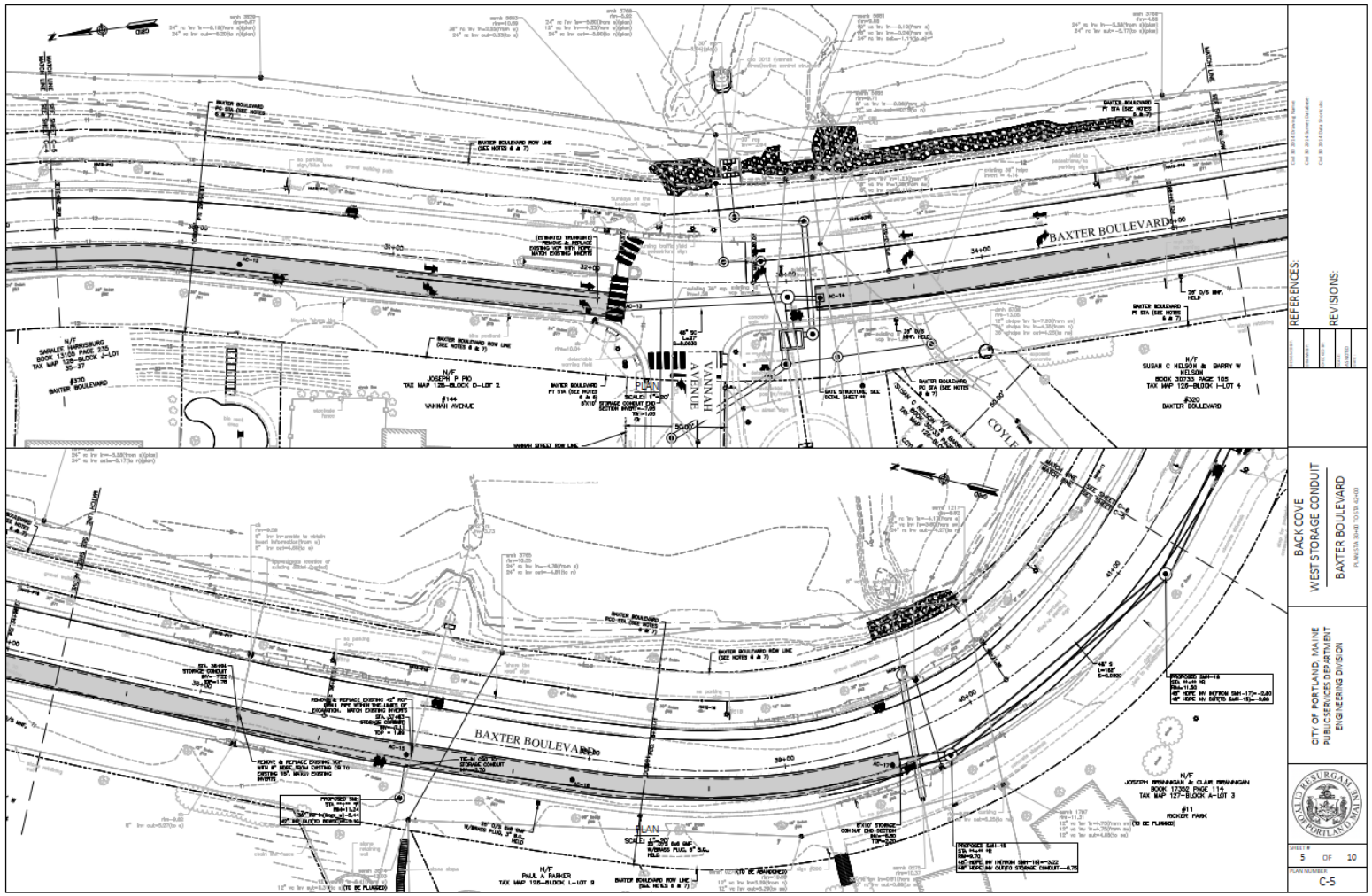


- Initial work began in late 2014
  - Field data collection
  - Flow metering
  - Preliminary InfoSWMM modeling
  - Preliminary geotechnical explorations
  - Conceptual layout
  - Green infrastructure/ separation project report
- 2016 work halted

Design Process

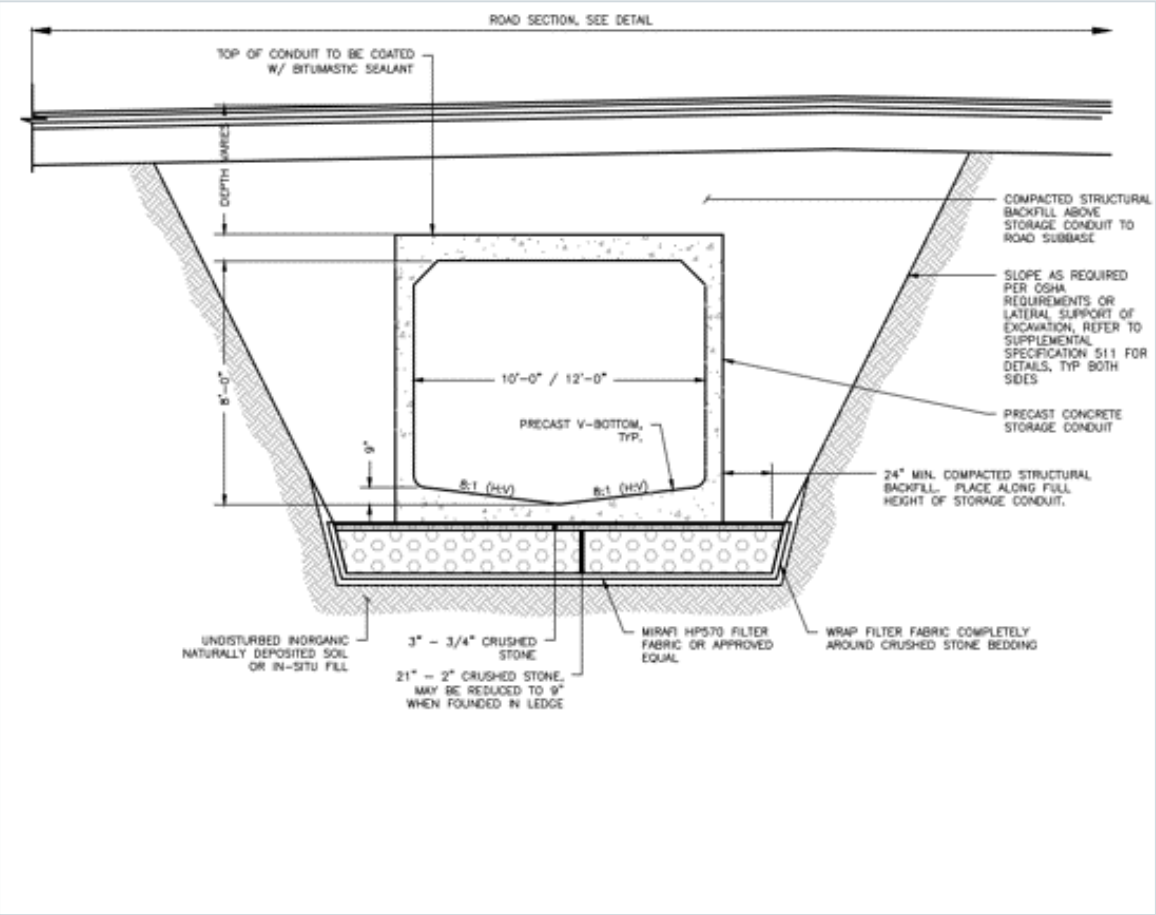
- 2016 – 2018
  - City completed separation/GI projects
  - Additional planned separation
- 2017 estimate impact of separation and LID using InfoSWMM
- Supported a reduced storage volume
  - Maine DEP approved 2.25 MG vs. 3.5 MG
- Eight CSO points down to two CSO points
- Given “go-ahead” in 2018
  - Developed preliminary design package

Design Process



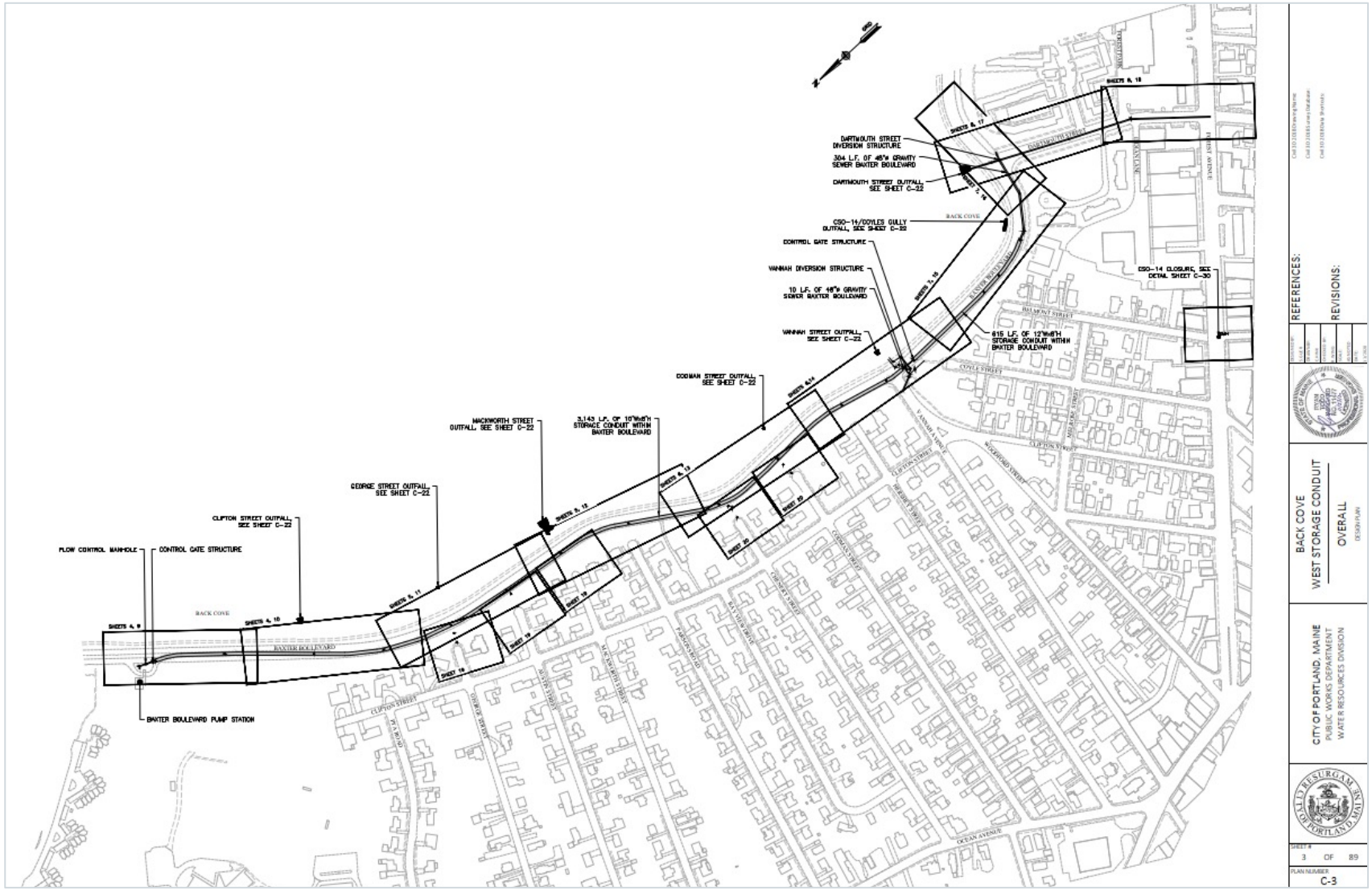
- Compile background technical documents
- Baseline project information
  - Geotech
  - Wetlands
  - Property surveys
  - Dartmouth Street
- PDR
- Preliminary specifications
- 30% layout plans
- Review sent to City

Design Process



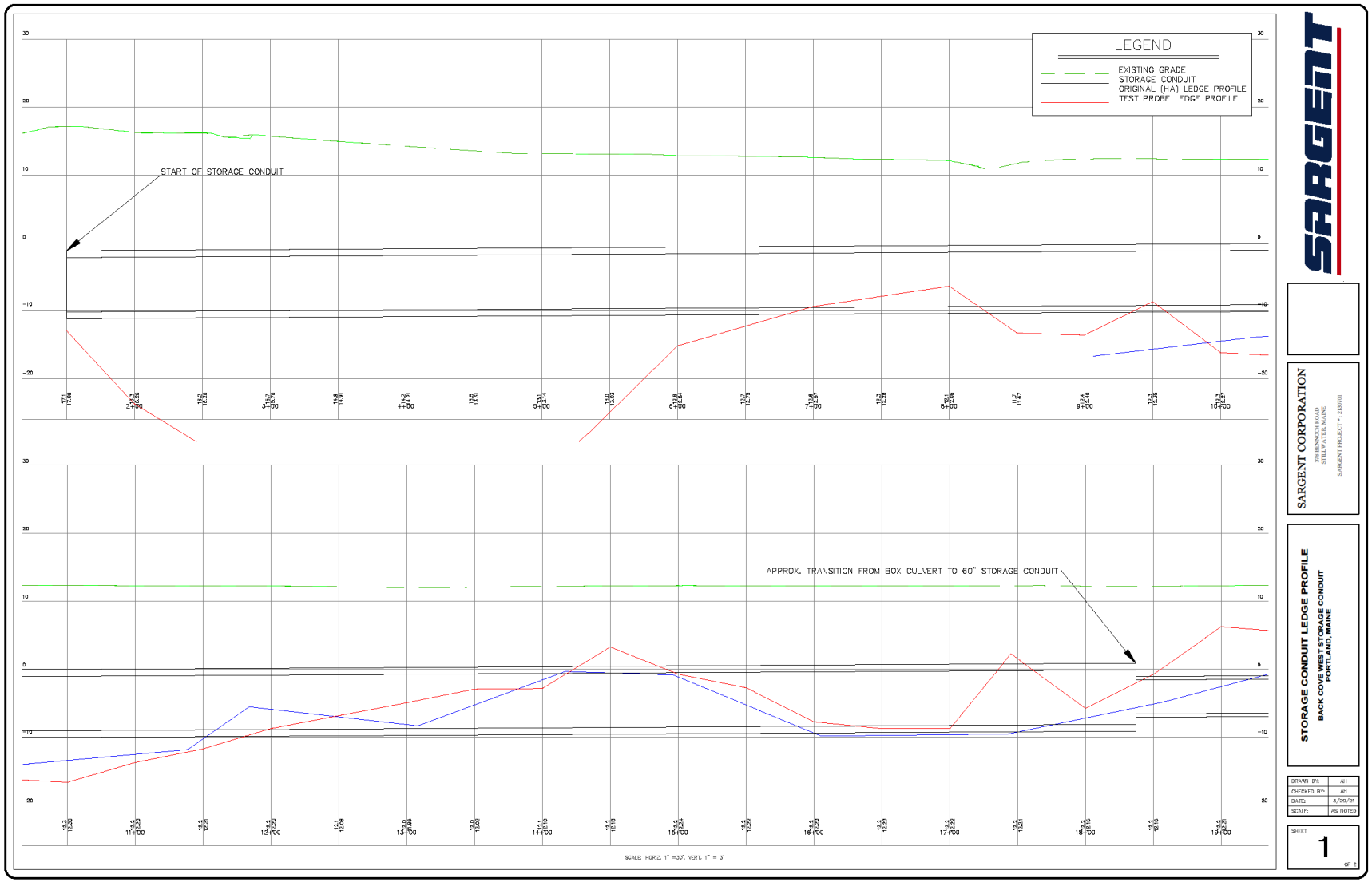
- 2019 request to develop final design and bid set
- Supplemental geotech investigations
- Geotech design memo
- Hydraulic modeling
  - InfoSWMM
  - CFD modeling (slope, F&E, venting)
- Traffic plans
- Preparation of 50%, 90%, and bidding

Design Process



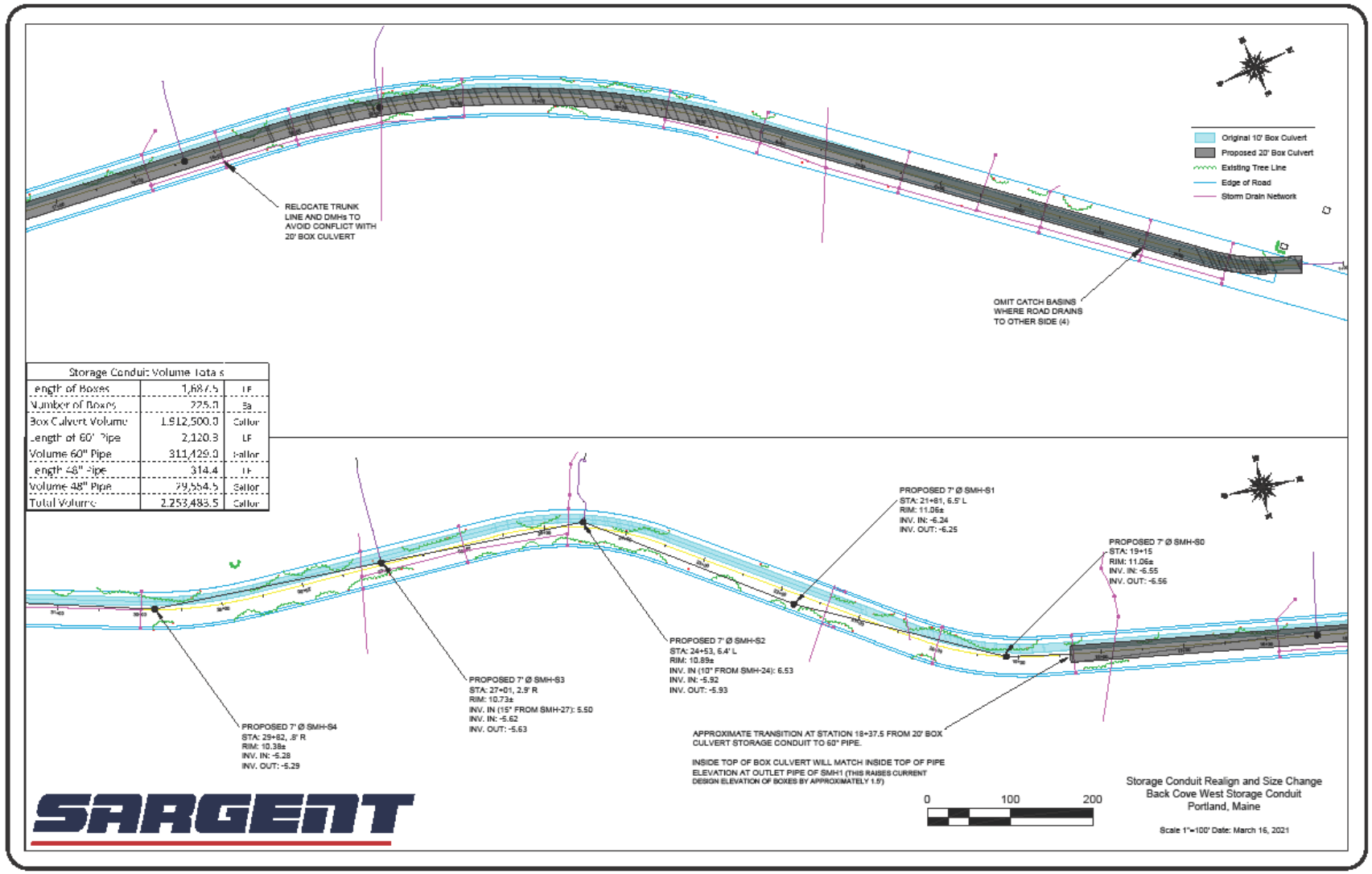
- 3,150 LF 8'x10'
- 600 LF of 8'x12'
- Drainage
- Vertical profile
- December 2020
  - Issued for bid
- Awarded to Sargent Corporation

VE Process



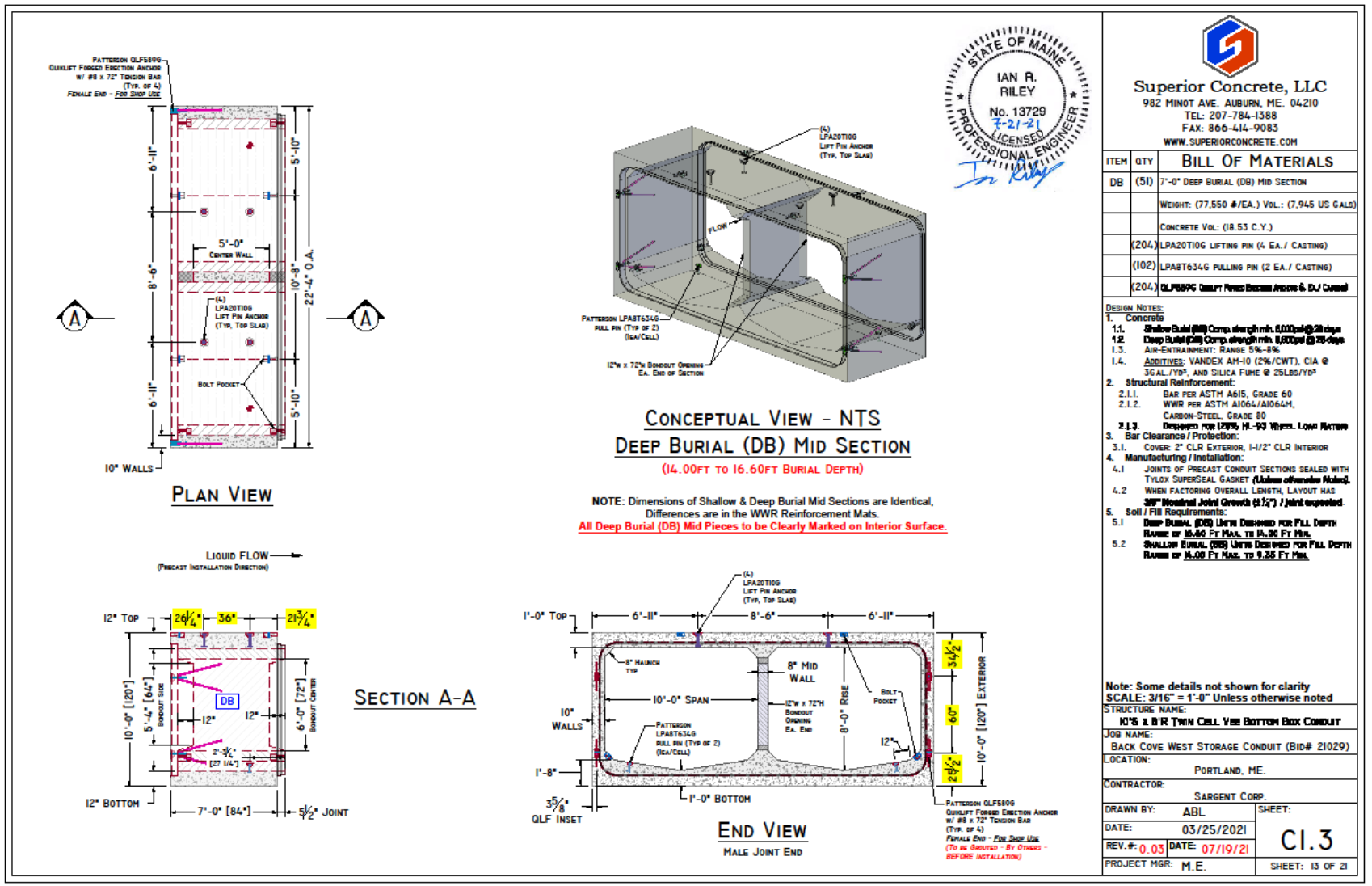
- March 2021
- Additional ledge probes and investigation by Sargent Corporation
- Higher than planned ledge
  - 12,200 CY bid
- Request for a VE option
- Bulk of storage at downstream end
  - Less ledge

VE Process

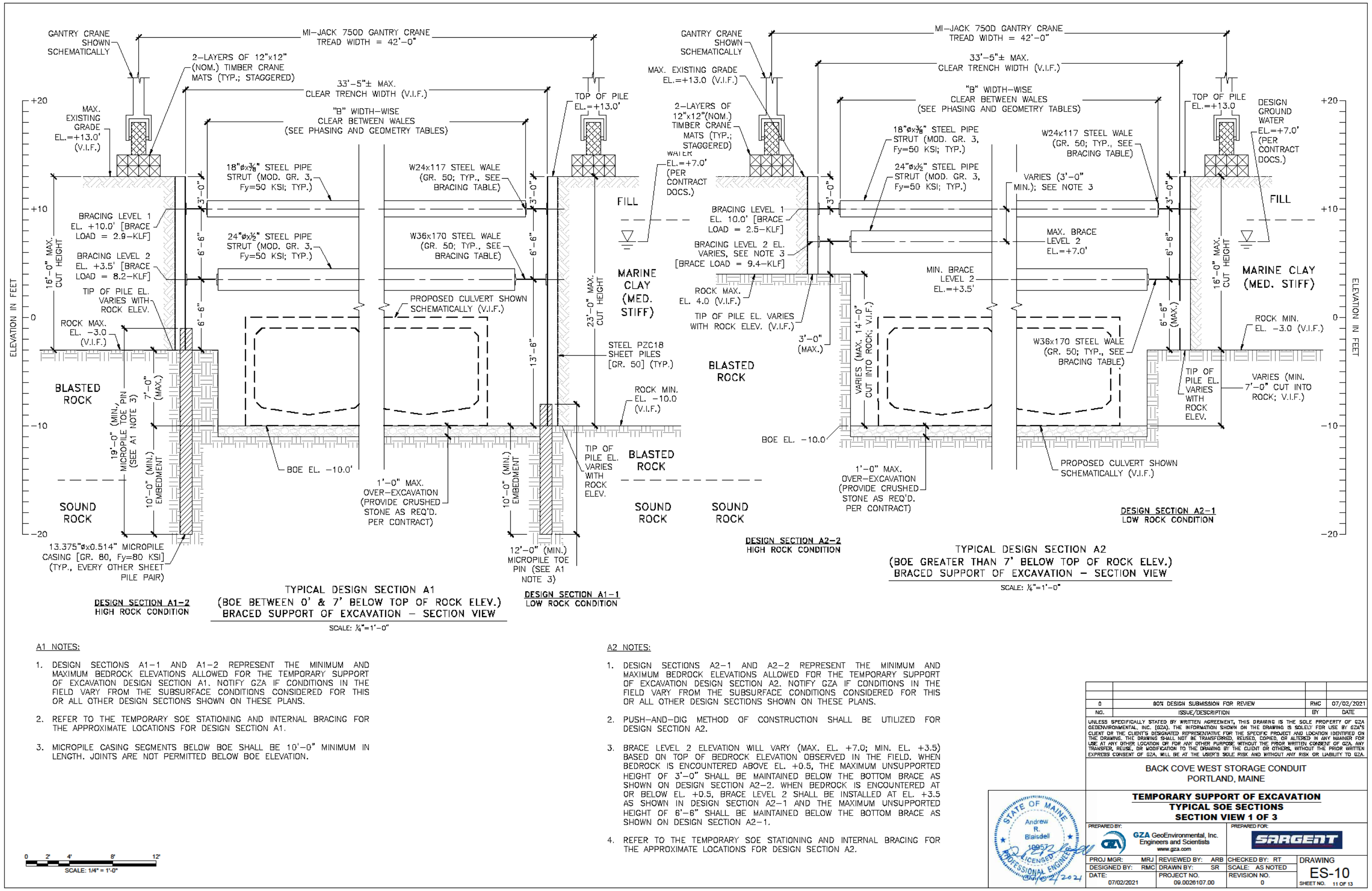


- 1,690 LF of double-barrel 8'x10' box
  - 1.93 MG
- 1,975 LF of 60"
  - 0.29 MG
- 315 LF of 48"
  - 0.03 MG
- Total Length: 3,980 LF
  - Total Storage: 2.25 MG

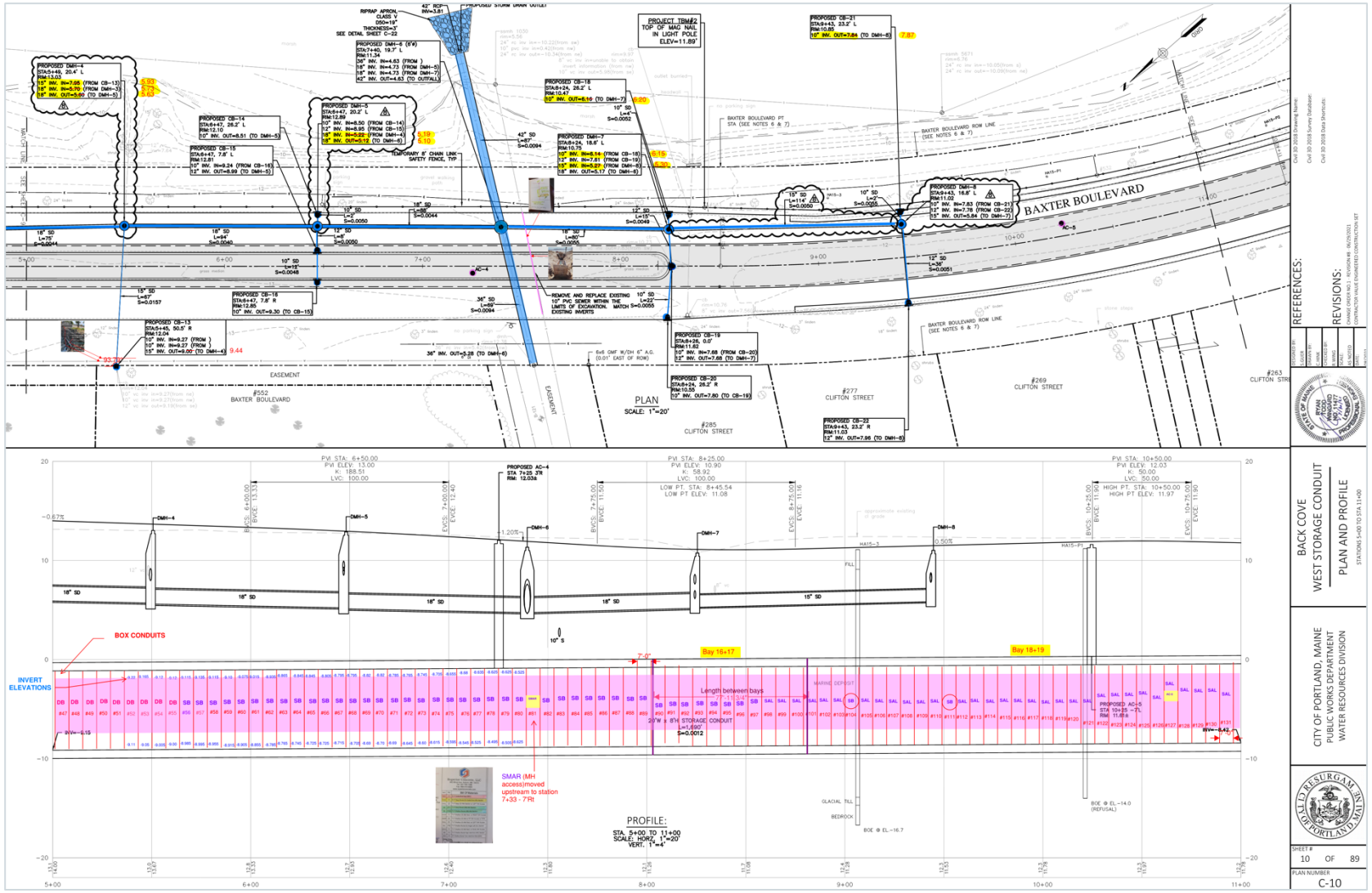
VE Process


PLAN VIEW
SECTION A-A
END VIEW
MALE JOINT END
CONCEPTUAL VIEW - NTS
DEEP BURIAL (DB) MID SECTION
(14.00FT TO 16.60FT BURIAL DEPTH)
NOTE: Dimensions of Shallow & Deep Burial Mid Sections are Identical, Differences are in the WWR Reinforcement Mats.
All Deep Burial (DB) Mid Pieces to be Clearly Marked on Interior Surface.
STATE OF MAINE
IAN R. RILEY
No. 13729
7-21-21
LICENSED
PROFESSIONAL ENGINEER
Superior Concrete, LLC
982 MINOT AVE. AUBURN, ME. 04210
TEL: 207-784-1388
FAX: 866-414-9083
WWW.SUPERIORCONCRETE.COM
BILL OF MATERIALS
DESIGN NOTES:
Note: Some details not shown for clarity
SCALE: 3/16" = 1'-0" Unless otherwise noted
STRUCTURE NAME:
10'S & 8'R TWIN CELL VEE BOTTOM BOX CONDUIT
JOB NAME:
BACK COVE WEST STORAGE CONDUIT (BID# 21029)
LOCATION:
PORTLAND, ME.
CONTRACTOR:
SARGENT CORP.
DRAWN BY: ABL
DATE: 03/25/2021
REV.#: 0.03 DATE: 07/19/21
PROJECT MGR: M.E.
SHEET: C1.3
SHEET: 13 OF 21

VE Process


MI-JACK 750D GANTRY CRANE TREAD WIDTH = 42'-0"
GANTRY CRANE SHOWN SCHEMATICALLY
2-LAYERS OF 12"x12" (NOM.) TIMBER CRANE MATS (TYP.; STAGGERED)
33'-5"± MAX. CLEAR TRENCH WIDTH (V.I.F.)
"B" WIDTH-WISE CLEAR BETWEEN WALES (SEE PHASING AND GEOMETRY TABLES)
TOP OF PILE EL.=+13.0'
MAX. EXISTING GRADE EL.=+13.0' (V.I.F.)
18"ø x 3/8" STEEL PIPE STRUT (MOD. GR. 3, Fy=50 KSI; TYP.)
W24x117 STEEL WALE (GR. 50; TYP., SEE BRACING TABLE)
24"ø x 1/2" STEEL PIPE STRUT (MOD. GR. 3, Fy=50 KSI; TYP.)
W36x170 STEEL WALE (GR. 50; TYP., SEE BRACING TABLE)
BRACING LEVEL 1 EL. +10.0' [BRACE LOAD = 2.9-KLF]
BRACING LEVEL 2 EL. +3.5' [BRACE LOAD = 8.2-KLF]
TIP OF PILE EL. VARIES WITH ROCK ELEV.
ROCK MAX. EL. -3.0 (V.I.F.)
PROPOSED CULVERT SHOWN SCHEMATICALLY (V.I.F.)
FILL
MARINE CLAY (MED. STIFF)
STEEL PZC18 SHEET PILES [GR. 50] (TYP.)
ROCK MIN. EL. -10.0 (V.I.F.)
BLASTED ROCK
SOUND ROCK
BOE EL. -10.0'
1'-0" MAX. OVER-EXCAVATION (PROVIDE CRUSHED STONE AS REQ'D. PER CONTRACT)
13.375"ø x 0.514" MICROPILE CASING [GR. 80, Fy=80 KSI] (TYP., EVERY OTHER SHEET PILE PAIR)
12'-0" (MIN.) MICROPILE TOE PIN (SEE A1 NOTE 3)
DESIGN SECTION A1-2 HIGH ROCK CONDITION
DESIGN SECTION A1-1 LOW ROCK CONDITION
TYPICAL DESIGN SECTION A1
(BOE BETWEEN 0' & 7' BELOW TOP OF ROCK ELEV.)
BRACED SUPPORT OF EXCAVATION - SECTION VIEW
SCALE: 1/4"=1'-0"
DESIGN GROUND WATER EL.=+7.0' (PER CONTRACT DOCS.)
BRACING LEVEL 1 EL. 10.0' [BRACE LOAD = 2.5-KLF]
BRACING LEVEL 2 EL. VARIES, SEE NOTE 3 [BRACE LOAD = 9.4-KLF]
MAX. BRACE LEVEL 2 EL.=+7.0'
MIN. BRACE LEVEL 2 EL.=+3.5'
VARIES (3'-0" MIN.); SEE NOTE 3
ROCK MAX. EL. 4.0 (V.I.F.)
TIP OF PILE EL. VARIES WITH ROCK ELEV. (V.I.F.)
ROCK MIN. EL. -3.0 (V.I.F.)
VARIES (MIN. 7'-0" CUT INTO ROCK; V.I.F.)
BOE EL. -10.0
DESIGN SECTION A2-2 HIGH ROCK CONDITION
DESIGN SECTION A2-1 LOW ROCK CONDITION
TYPICAL DESIGN SECTION A2
(BOE GREATER THAN 7' BELOW TOP OF ROCK ELEV.)
BRACED SUPPORT OF EXCAVATION - SECTION VIEW
SCALE: 1/4"=1'-0"
ELEVATION IN FEET
A1 NOTES:
1. DESIGN SECTIONS A1-1 AND A1-2 REPRESENT THE MINIMUM AND MAXIMUM BEDROCK ELEVATIONS ALLOWED FOR THE TEMPORARY SUPPORT OF EXCAVATION DESIGN SECTION A1. NOTIFY GZA IF CONDITIONS IN THE FIELD VARY FROM THE SUBSURFACE CONDITIONS CONSIDERED FOR THIS OR ALL OTHER DESIGN SECTIONS SHOWN ON THESE PLANS.
2. REFER TO THE TEMPORARY SOE STATIONING AND INTERNAL BRACING FOR THE APPROXIMATE LOCATIONS FOR DESIGN SECTION A1.
3. MICROPILE CASING SEGMENTS BELOW BOE SHALL BE 10'-0" MINIMUM IN LENGTH. JOINTS ARE NOT PERMITTED BELOW BOE ELEVATION.
A2 NOTES:
1. DESIGN SECTIONS A2-1 AND A2-2 REPRESENT THE MINIMUM AND MAXIMUM BEDROCK ELEVATIONS ALLOWED FOR THE TEMPORARY SUPPORT OF EXCAVATION DESIGN SECTION A2. NOTIFY GZA IF CONDITIONS IN THE FIELD VARY FROM THE SUBSURFACE CONDITIONS CONSIDERED FOR THIS OR ALL OTHER DESIGN SECTIONS SHOWN ON THESE PLANS.
2. PUSH-AND-DIG METHOD OF CONSTRUCTION SHALL BE UTILIZED FOR DESIGN SECTION A2.
3. BRACE LEVEL 2 ELEVATION WILL VARY (MAX. EL. +7.0; MIN. EL. +3.5) BASED ON TOP OF BEDROCK ELEVATION OBSERVED IN THE FIELD. WHEN BEDROCK IS ENCOUNTERED ABOVE EL. +0.5, THE MAXIMUM UNSUPPORTED HEIGHT OF 3'-0" SHALL BE MAINTAINED BELOW THE BOTTOM BRACE AS SHOWN ON DESIGN SECTION A2-2. WHEN BEDROCK IS ENCOUNTERED AT OR BELOW EL. +0.5, BRACE LEVEL 2 SHALL BE INSTALLED AT EL. +3.5 AS SHOWN IN DESIGN SECTION A2-1 AND THE MAXIMUM UNSUPPORTED HEIGHT OF 6'-6" SHALL BE MAINTAINED BELOW THE BOTTOM BRACE AS SHOWN ON DESIGN SECTION A2-1.
4. REFER TO THE TEMPORARY SOE STATIONING AND INTERNAL BRACING FOR THE APPROXIMATE LOCATIONS FOR DESIGN SECTION A2.
SCALE: 1/4" = 1'-0"
0 | 60% DESIGN SUBMISSION FOR REVIEW | RMC | 07/02/2021
BACK COVE WEST STORAGE CONDUIT
PORTLAND, MAINE
TEMPORARY SUPPORT OF EXCAVATION
TYPICAL SOE SECTIONS
SECTION VIEW 1 OF 3
GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com
SARGENT
STATE OF MAINE Andrew R. Blaisdell LICENSED PROFESSIONAL ENGINEER
DRAWING ES-10
PROJECT NO. 09.0026107.00
DATE: 07/02/2021

VE Process



- Overall, the VE was estimated to save approximately $0.75 million
- Estimated to save nearly 6,000 CY of rock excavation

Construction Progress

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Construction Progress

- Last box installed October 2022
- SAT testing completed May 3rd
- Conduit in service end of May 2023
- Baxter surface pavement completed September 2023
- Substantial completion in October 2023
- Ongoing punchlist work underway
- Final completion anticipated for summer 2024

Additional Project Details

- Environmental permitting
  - Maine DEP – permit by rule
  - ACOE – individual permit
- City historic preservation (cobbles/trees)
- Stakeholders
  - PWD – BBPS
  - Nearby homes
- Challenges
  - Shallow bedrock/ledge elevations
  - Very little elevation change
  - Conduit settling
  - Conduit waterproofing (over 200 joints)

Lessons Learned

- Pre-construction public outreach doesn't prevent public concerns during construction. Had daily/weekly updates.
- Benefited from contractor and internal constructability reviews.
- Initially scoped 2 RPRs because of project length…outside the box thinking for transportation reduced to 1 RPR.
- Expect the unexpected (i.e., police chases and attempted break-ins).
- Collaborative team effort between City, contractor, and engineer was necessary for a successful project.

Project Performance

- Performance to date (since June 1, 2023)
  - Six overflows closed, two remain
  - Between June 1st and September 20th, 14 potential CSO precipitation events with four overflow events
  - Additional weir modifications needed to help capture additional volume
  - Removing up to 2.25 MG of overflow from Back Cove for each event
- Currently operating in "manual," draining their two tanks separately
  - Goal is to have the CSO storage facilities drain via a single intervention using SCADA

Community Success

Final Striping

Baxter Boulevard Reopening Party

City of Portland: Nathaniel Smith, Bill Boornazian, Brad Roland

Sargent: Glenn Adams, Doug Morrison

Portland Water District: Adam Sellick, Charlene Poulin

THANK YOU

Contact Information

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