

# OARS – the Massive Tunnel to Protect Downtown Columbus

## PART 1



THE CITY OF  
**COLUMBUS**

ANDREW J. GINTHER, MAYOR

DEPARTMENT OF  
PUBLIC UTILITIES



# OARS Tunnel

- OARS stands for OSIS Augmentation and Relief Sewer
- OSIS stands for Olentangy Scioto Interceptor Sewer.
- The OSIS is the main sewer flowing through downtown Columbus. It was built in the 1930s and ranges in size from a 123-inch diameter pipe up to 10 ½ feet wide by 17 feet tall at Whittier Street.

# CSO Consent Order

- Eliminate 12 CSOs discharging into the Scioto River along the OSIS during the “typical year”
- Whittier Street Storm Standby Tanks (WSST) – 85% of all annual CSOs
- Required the City to prepare a LTCP in compliance with the requirements of the 1994 USEPA CSO Control Policy
- OARS is the key component of the LTCP

# OARS – Designed Level of Service

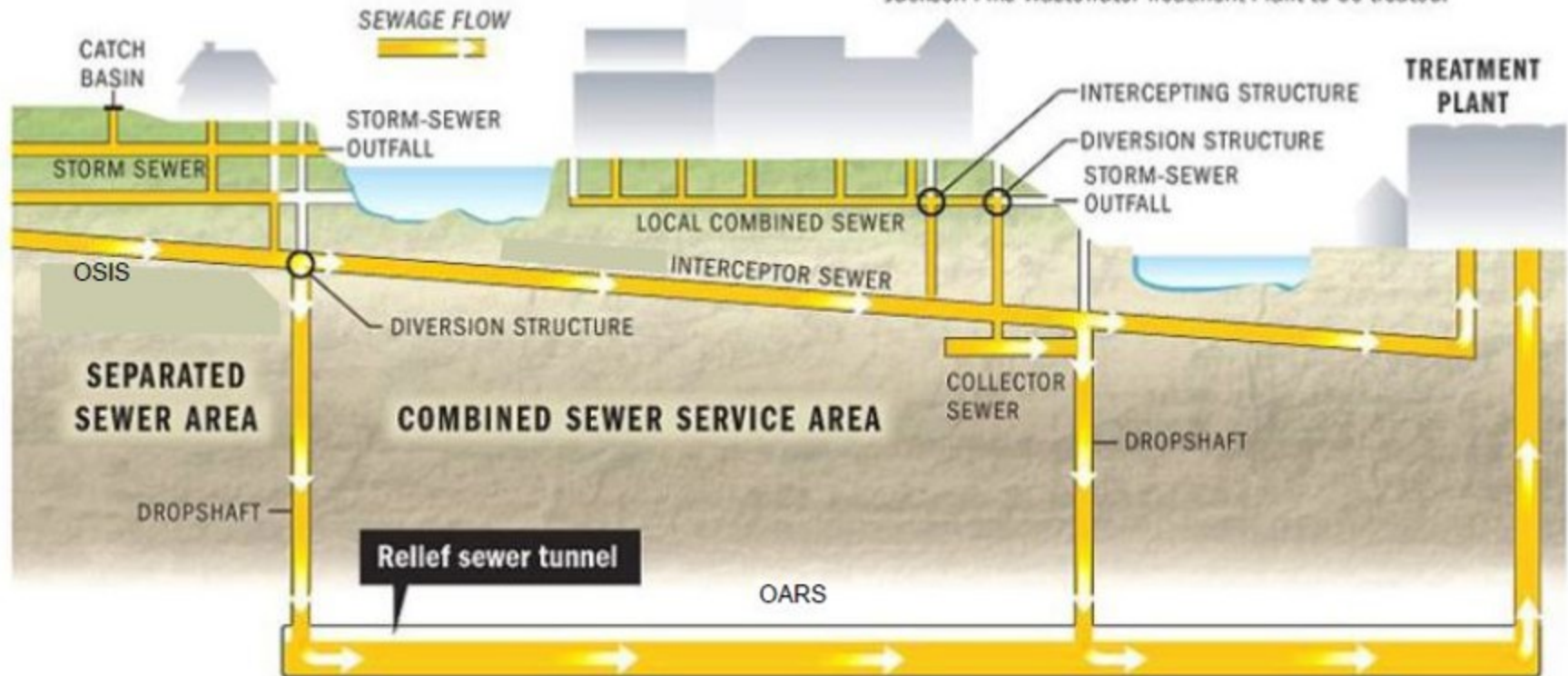
- WSST overflows will be eliminated during the “typical year”.
- Discharges from 12 CSOs along OSIS will be eliminated for up to a 10-year flow event. (exceeds Consent Order)
- Overflows at the JPWWTP from OARS will be limited to no more than 4 during the “typical year”.
- This will keep nearly 2 Billion Gallons of sewage from overflowing into the Scioto River each year!

# OARS - in Plain English

- Get all of the flow to the WWTP
- Maximize treatment
- Only discharge untreated flows after the WWTP(s) are full

# Deep Tunnel Relief Sewer System

How the relief sewer tunnel aids sewage flow

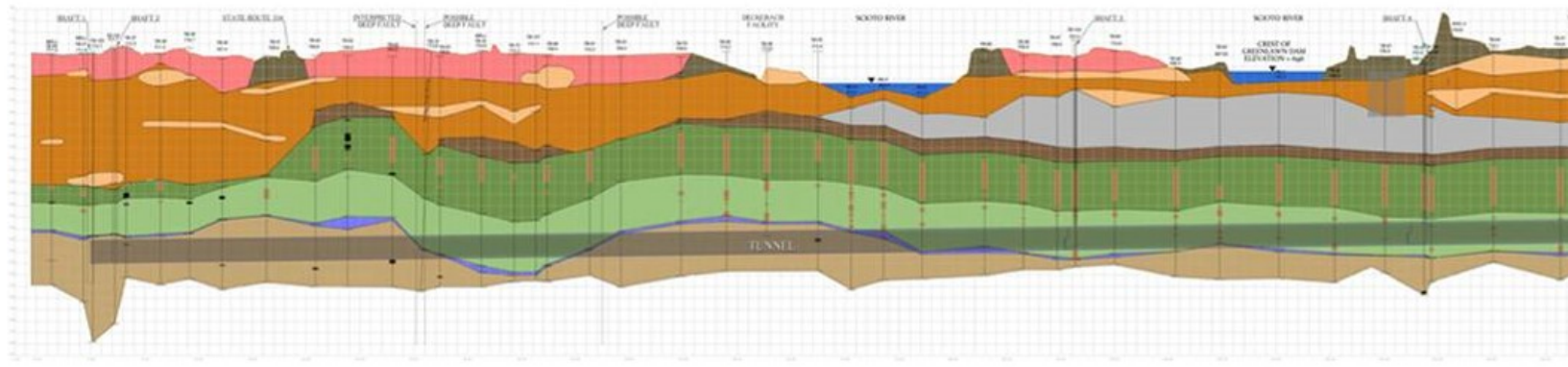


# OARS System

- 23,300 Feet of 20' Diameter Tunnel
- 6 Shafts – 4 receive flow with special drop structures
- 4 Relief Structures
- Deep Screening Structure
- Pumping System
- Treatment Plant Connection
- River Outfall Structure







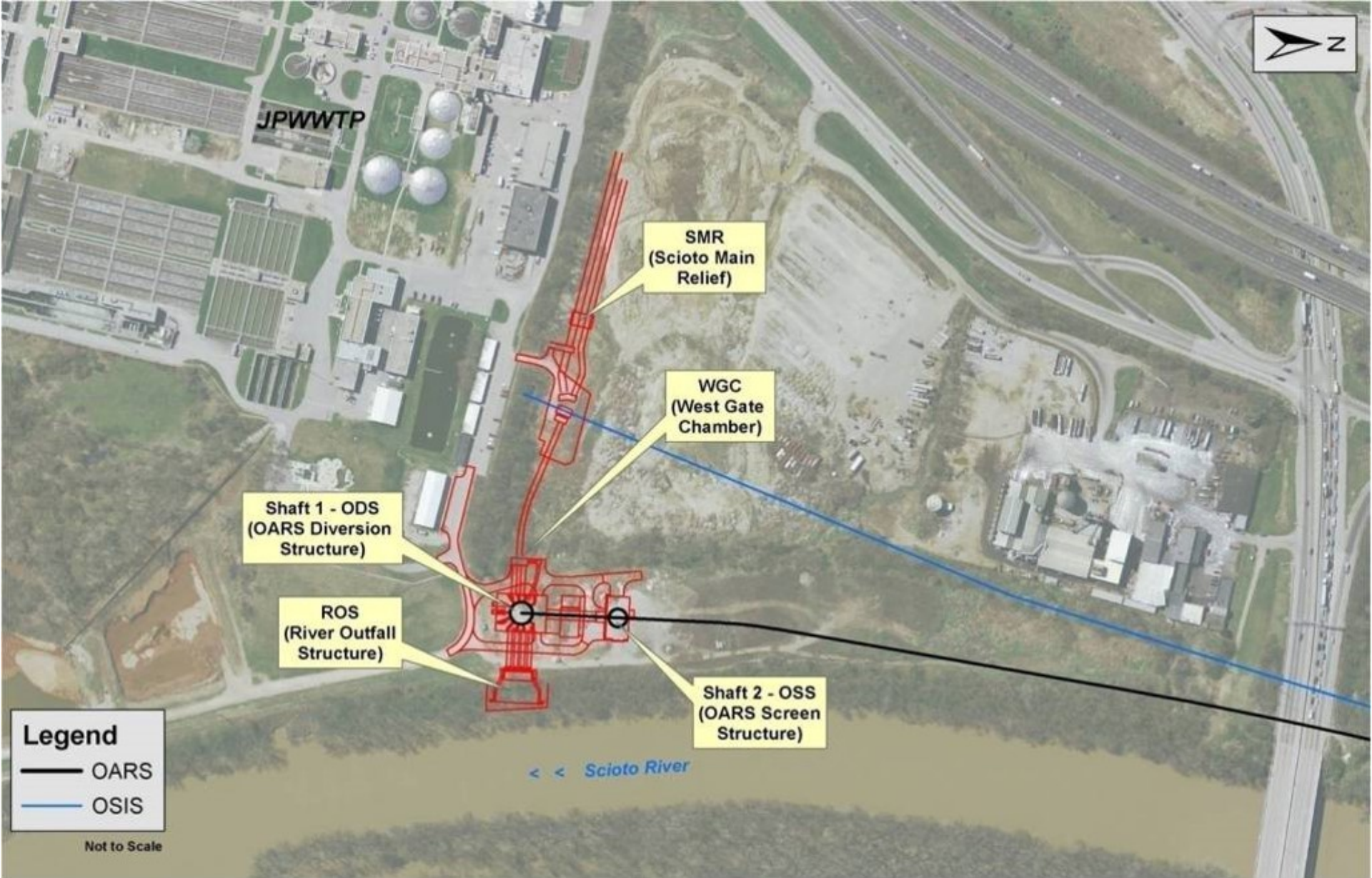
INNOVATIVE IDEAS  
EXCEPTIONAL DESIGN  
UNPARALLELED CLIENT SERVICE

OSIS AUGMENTATION AND RELIEF SEWER (OARS)



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# Shaft 1 – Stats

- Shaft 1 is the end of the line for the tunnel
- Peak flow coming in is ~ 1,700 MGD
- Shaft 1 is 215' deep and 52' in diameter
- Surface elevation is 715
- Tunnel invert is at 530
- Shaft invert elevation is 500

# Shaft 1 – OARS Diversion Structure

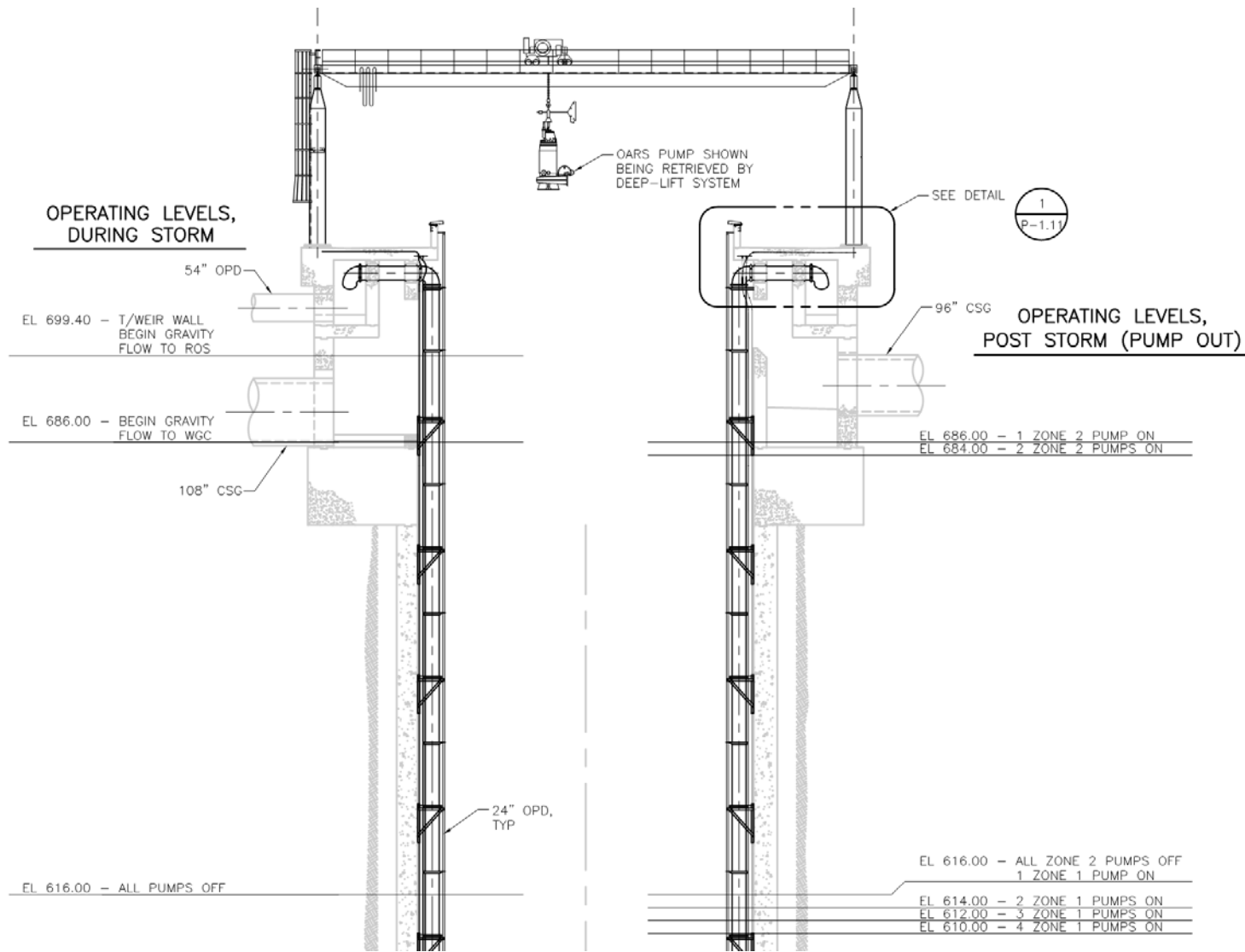
- Pump up to the WWTP(s)
- High level gravity flow to WWTP(s)
- Stubs for potential future HRT
- Final overflow weir to Scioto River
- Grit sumps and special baffling at the bottom of the wet well for pump performance

# Pumping System

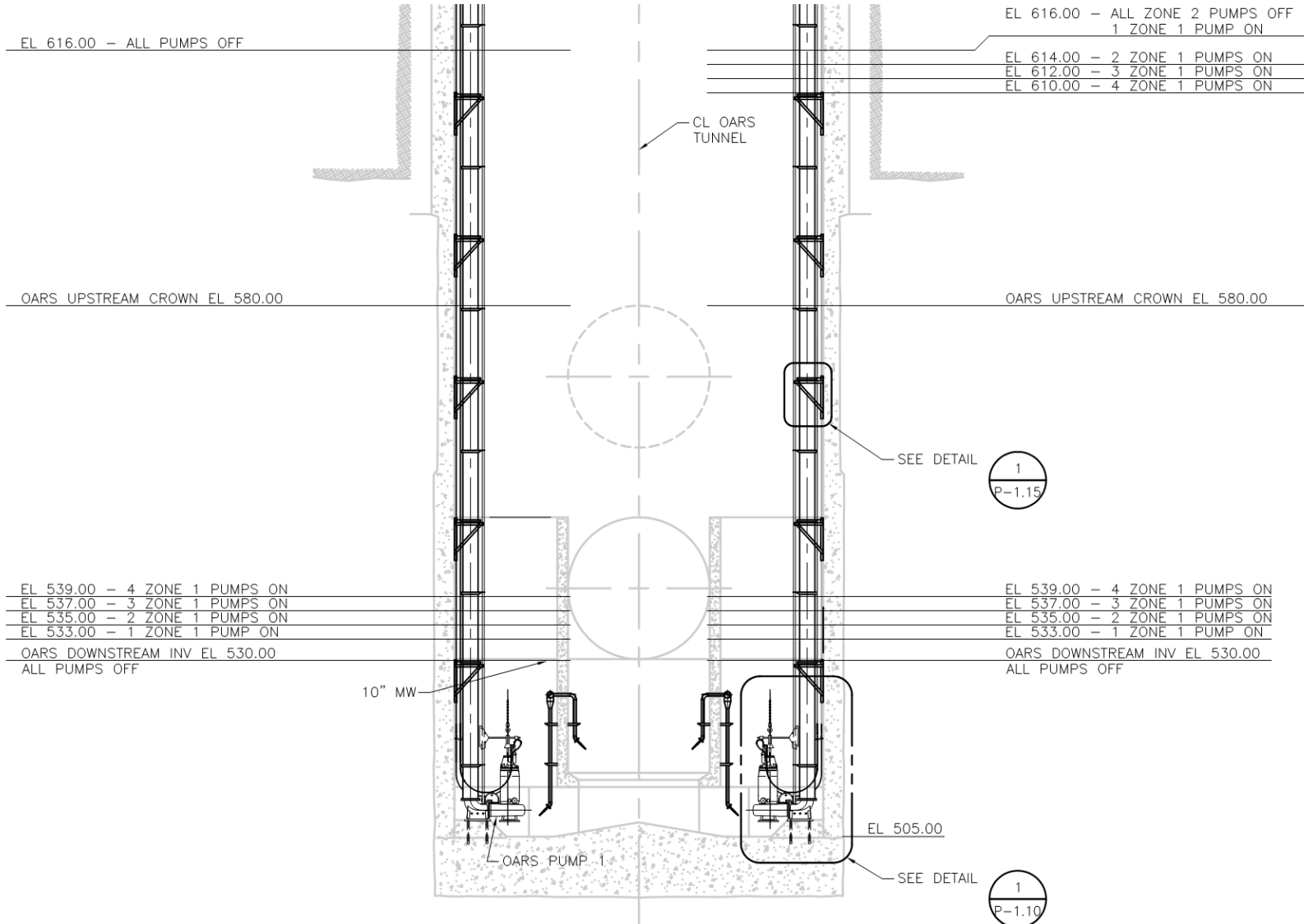
- Primary capacity requirement is to be able to dewater the OARS shafts and tunnel within 2 days
- Volume of OARS Tunnel ~ 55 MG
- Volume of Shafts ~ 5 MG
- Minimum dewatering pumping rate > 30 MGD
- Variable Gravity Head (686 – 530 = 156')

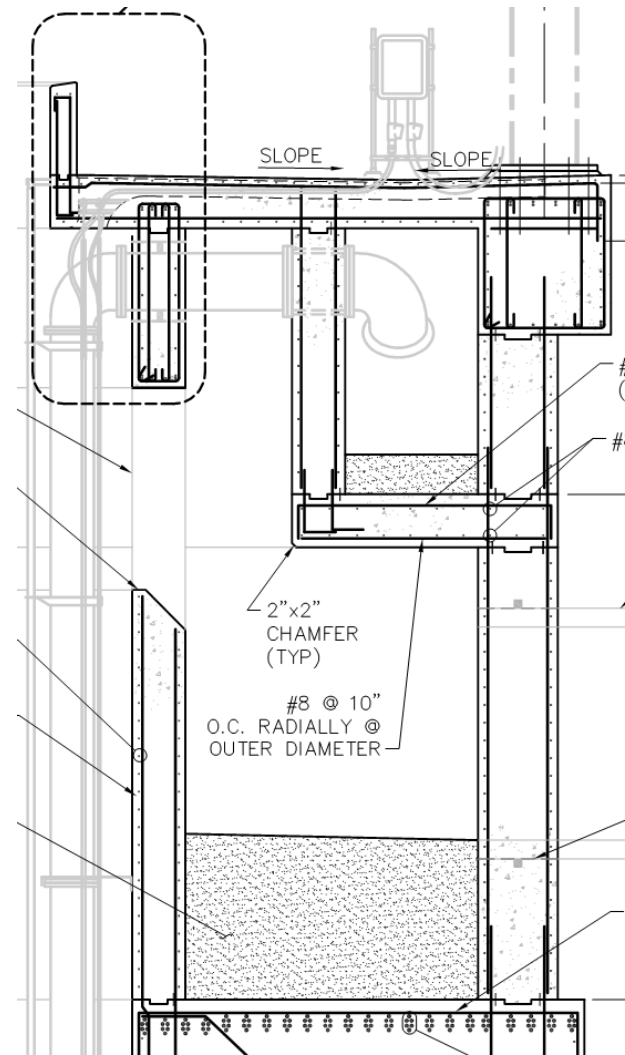
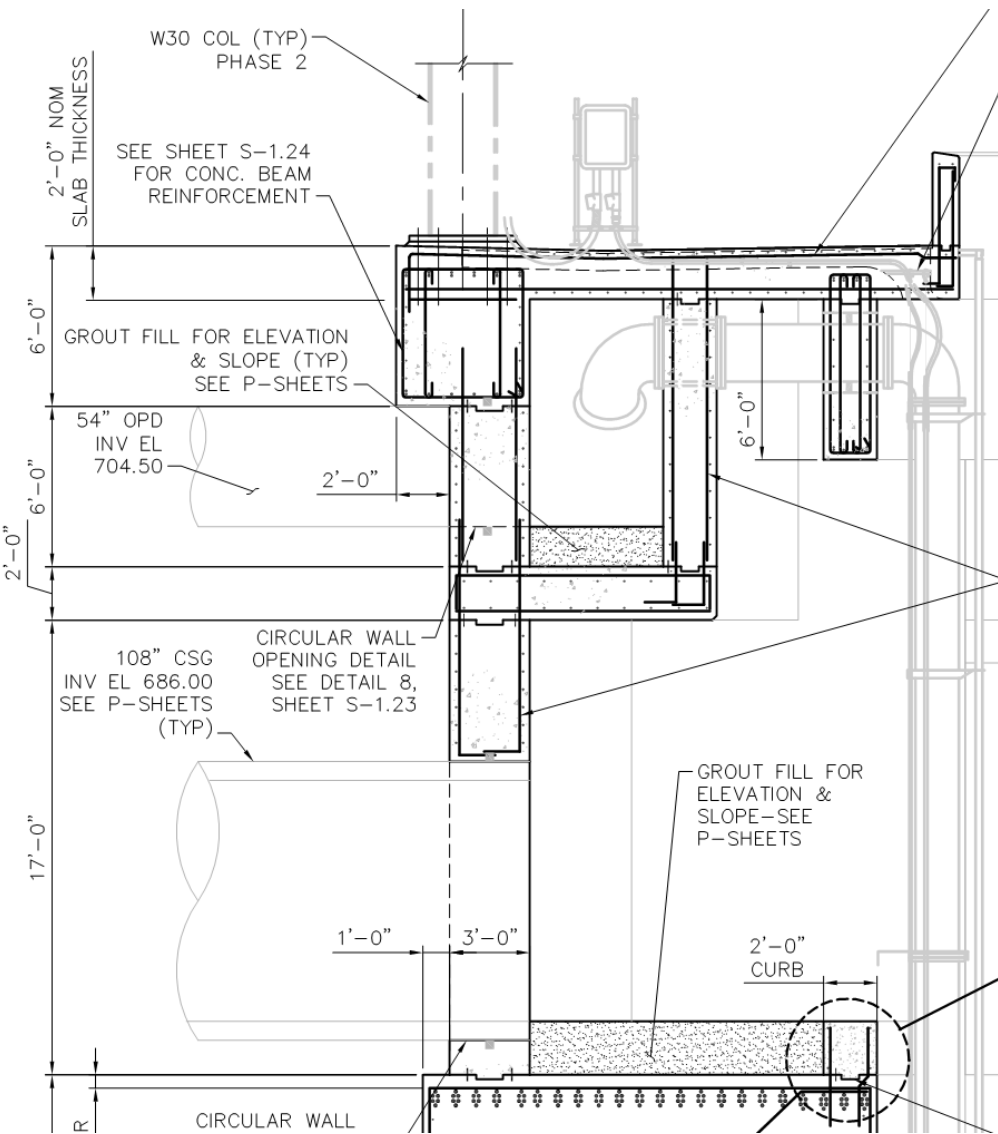
# Pumping System

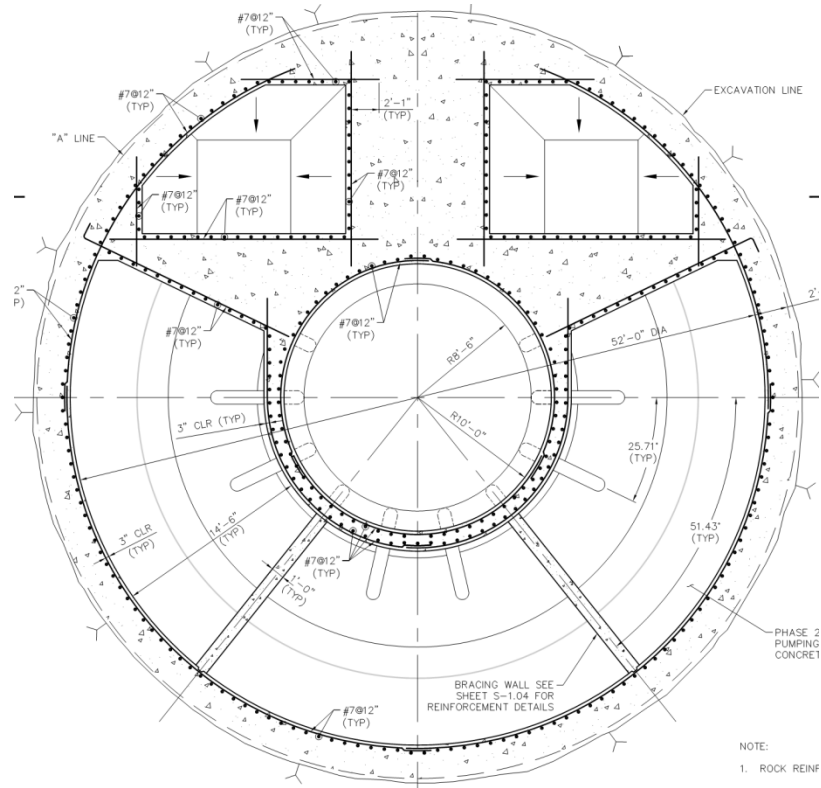
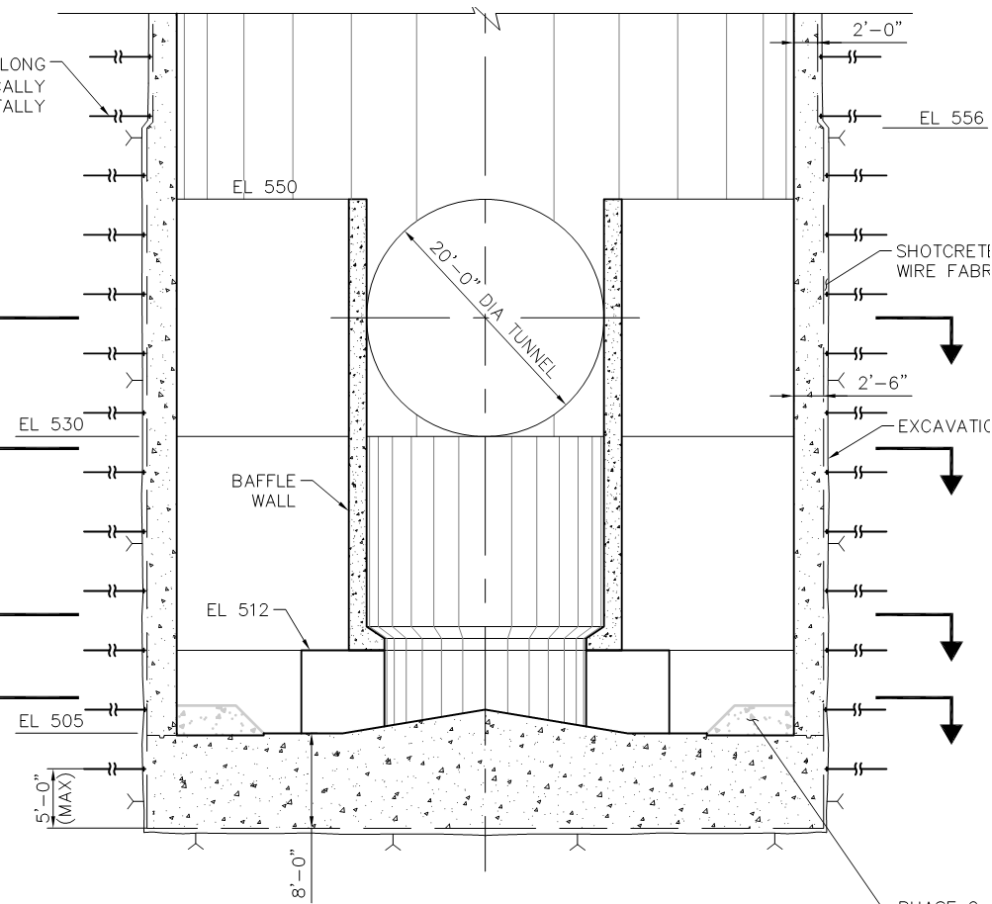
- 2 Pumps at the shaft level - 20 MGD each (450 HP); run ~ 3 hours to dewater shafts
- 4 Pumps for the level - 15 MGD each (800 HP); run ~ 22 hours
- 2 Grit Pumps - 1 MGD each (105 HP)
- All 8 Pumps discharge to an open channel; eliminated discharge valves (saved > \$2 Million)
- All 8 pumps have VFDs to operate efficiently
- 1 Shaft Mixing System

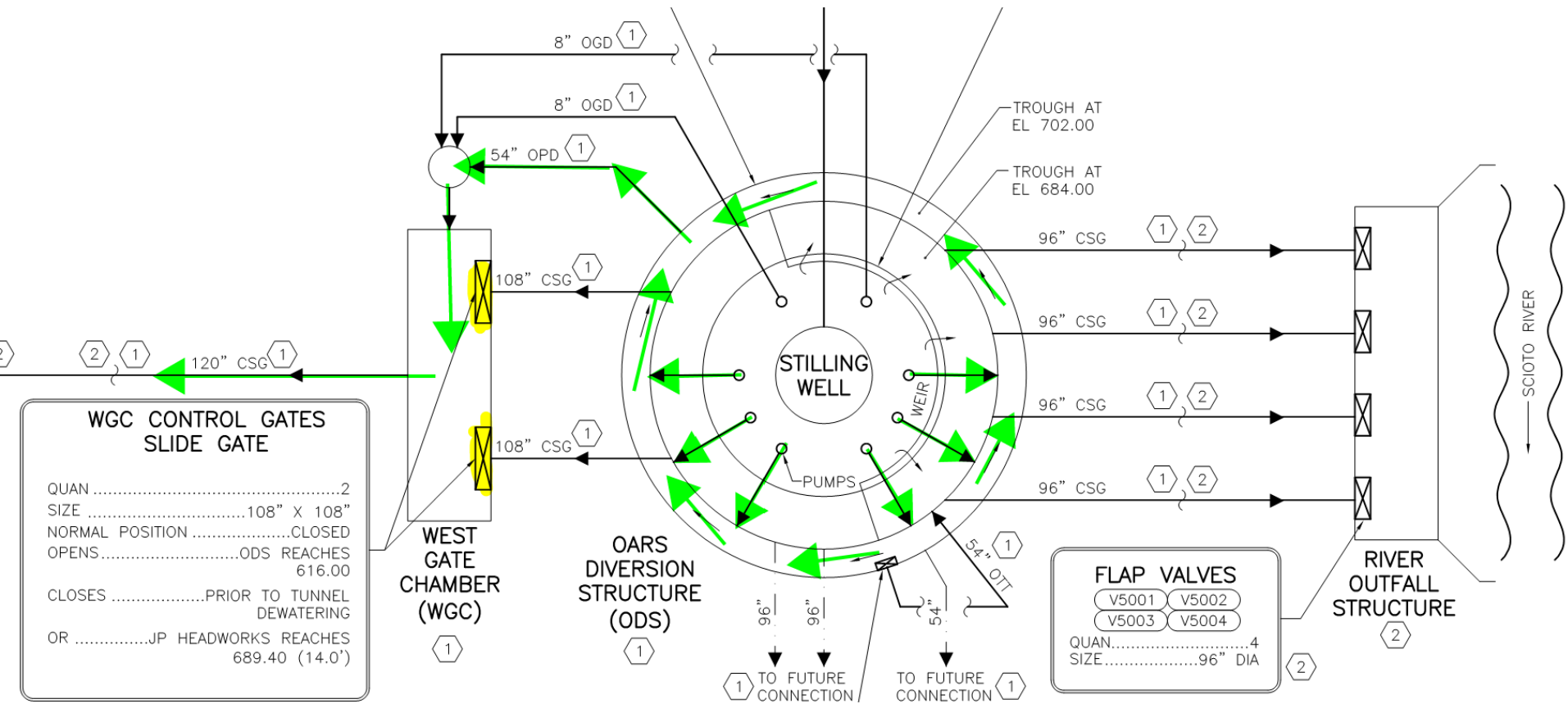




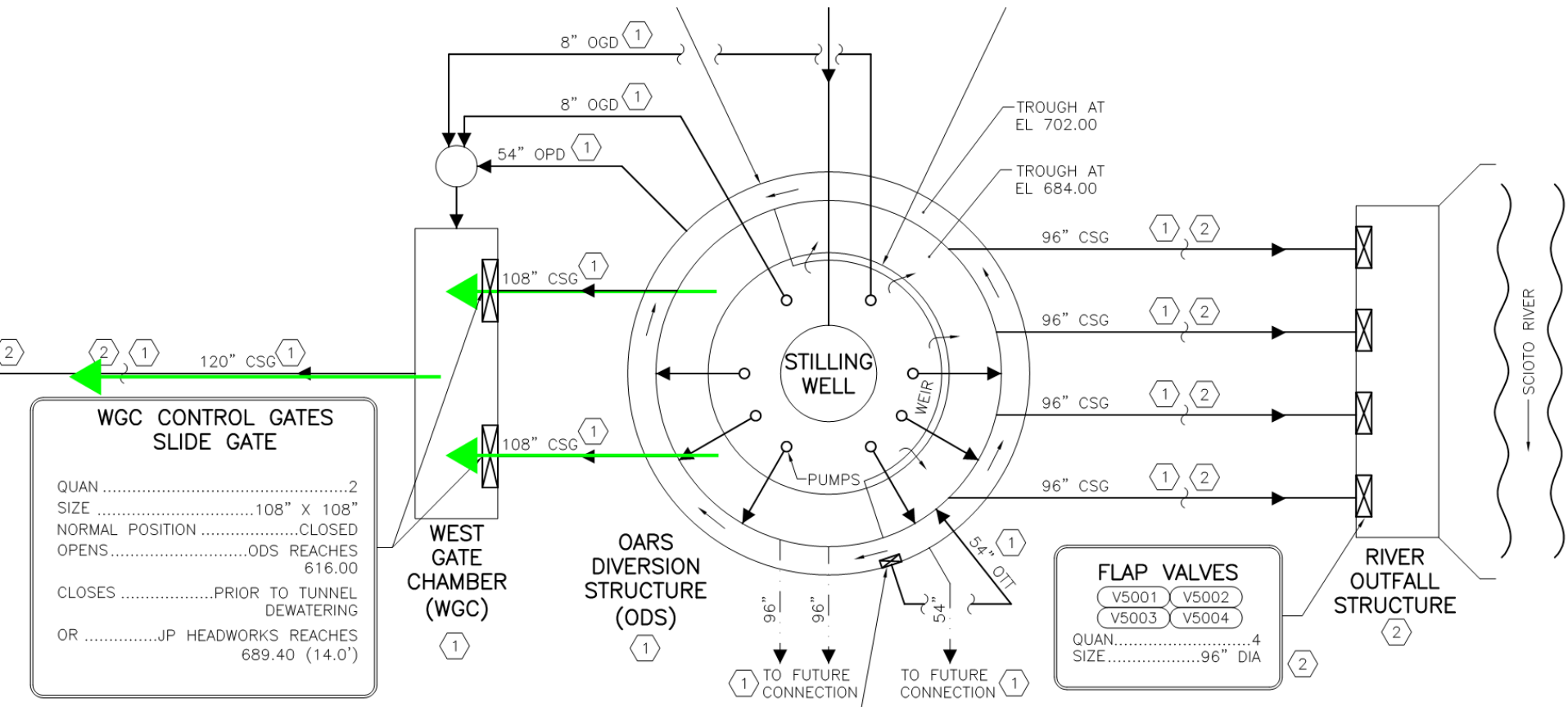








OARS starts to fill – pump to WWTP



OARS Tunnel is full & shafts are filling – gravity flow to WWTP

OARS PUMPS	
QUANTITY	6
NOMINAL FLOW	ZONE 1: 4@15 MGD EACH
	ZONE 2: 2@20 MGD EACH
TYPE	SUBMERSIBLE
PUMP CONTROLS	SEE P-1.07
	E1001
	E1002
	E1003
	E1004
	E1005
	E1006

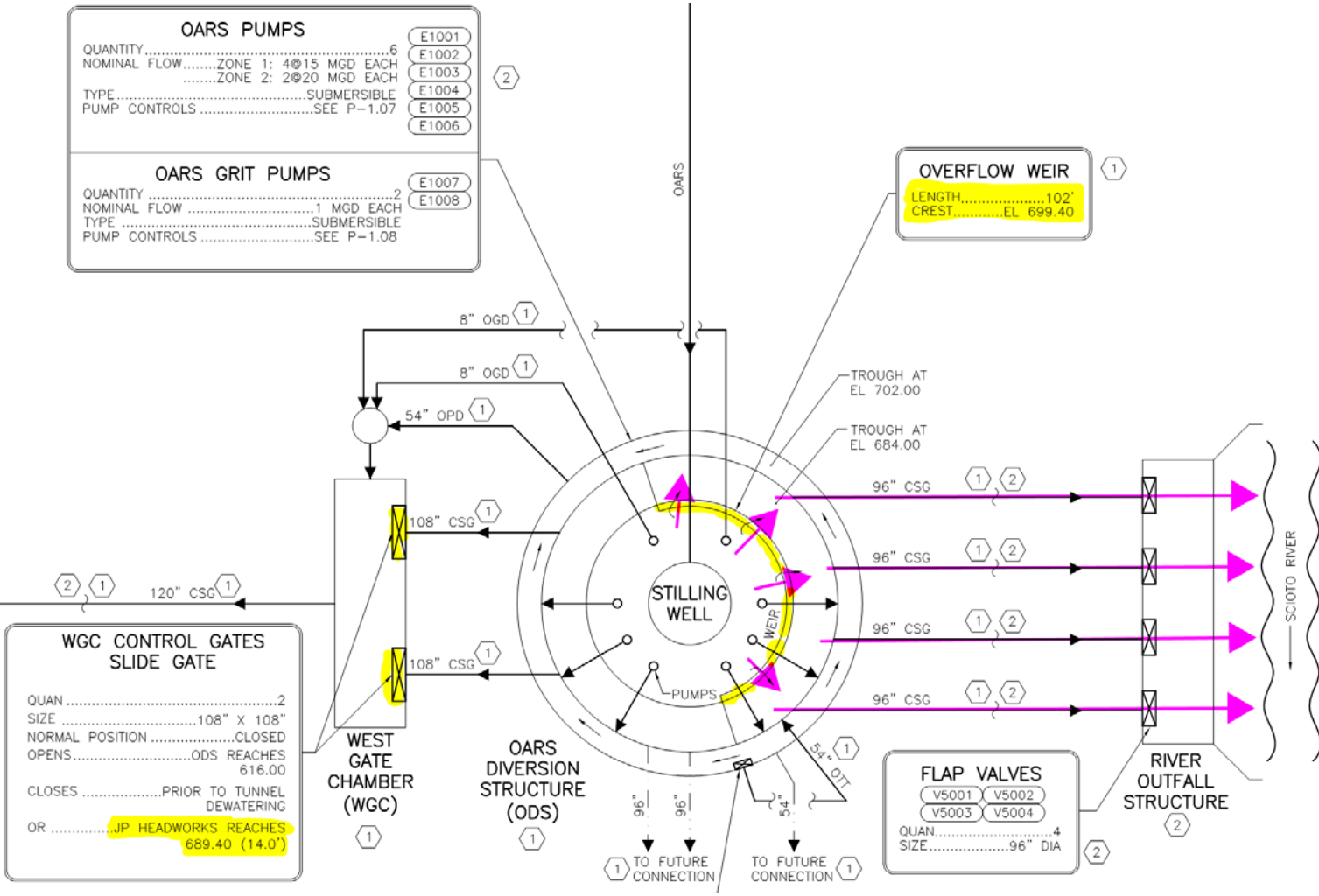
  

OARS GRIT PUMPS	
QUANTITY	2
NOMINAL FLOW	1 MGD EACH
TYPE	SUBMERSIBLE
PUMP CONTROLS	SEE P-1.08
	E1007
	E1008

OVERFLOW WEIR	
LENGTH	102'
CREST	EL 699.40

FLAP VALVES	
	V5001
	V5002
	V5003
	V5004
QUAN.	4
SIZE	96" DIA

WGC CONTROL GATES SLIDE GATE	
QUAN	2
SIZE	108" X 108"
NORMAL POSITION	CLOSED
OPENS	ODS REACHES 616.00
CLOSES	PRIOR TO TUNNEL DEWATERING
OR	JP HEADWORKS REACHES 689.40 (14.0')



OARS  
Tunnel &  
shafts are  
full and  
WWTP(s)  
are at  
capacity



## Shaft 1

Setting  
Steel for the  
Upper  
Portion of  
the Shaft

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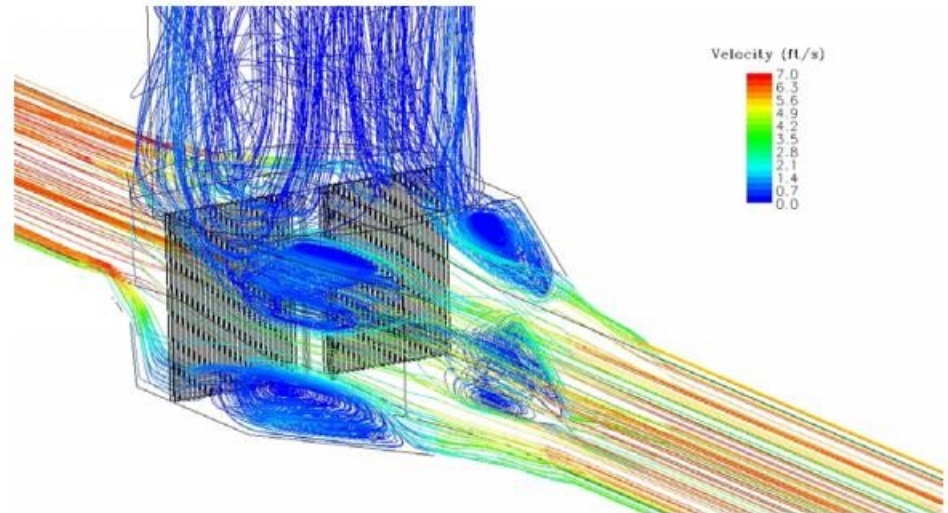
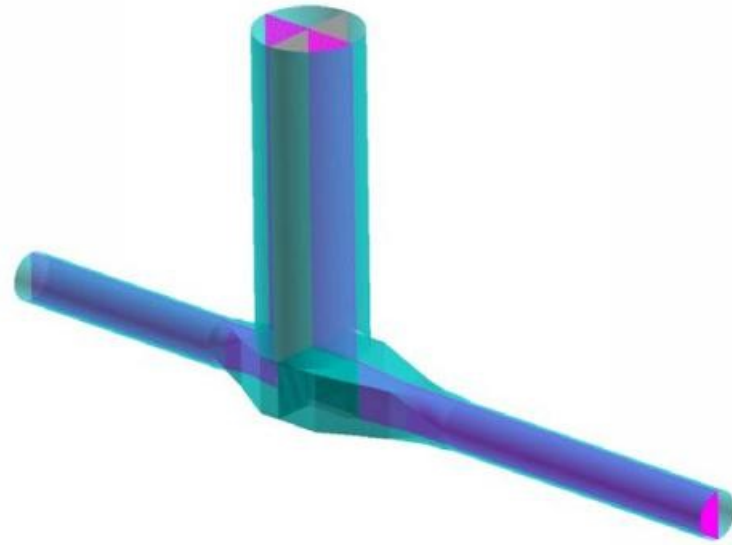
# Shaft 2 – Stats

- Shaft 2 is 185' deep and 42' in diameter
- Surface elevation is 715
- Shaft / Tunnel invert is at 530.3
- Cavern at the bottom of the shaft
- Two 16-foot wide channels
- Two 22-foot by 16-foot screens
- Screens have 2" clear openings

# Shaft 2

## CFD Model (Computational Fluid Dynamics)

Flow Velocity  
< 5 fps



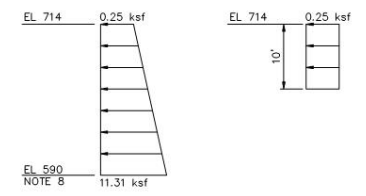
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S:\Jenny Engineering\Proj\CAD\Draw\Active Projects\2006019-OARS\Design\CAD00 - Shaft 2 Redesign\Struct\SS-EC-OSS-02.dwg 9/28/2015 2:48:03 PM Jenny Turchaso

**MINIMUM DESIGN LATERAL PRESSURE**  
(SEE NOTES 4 TO 8)

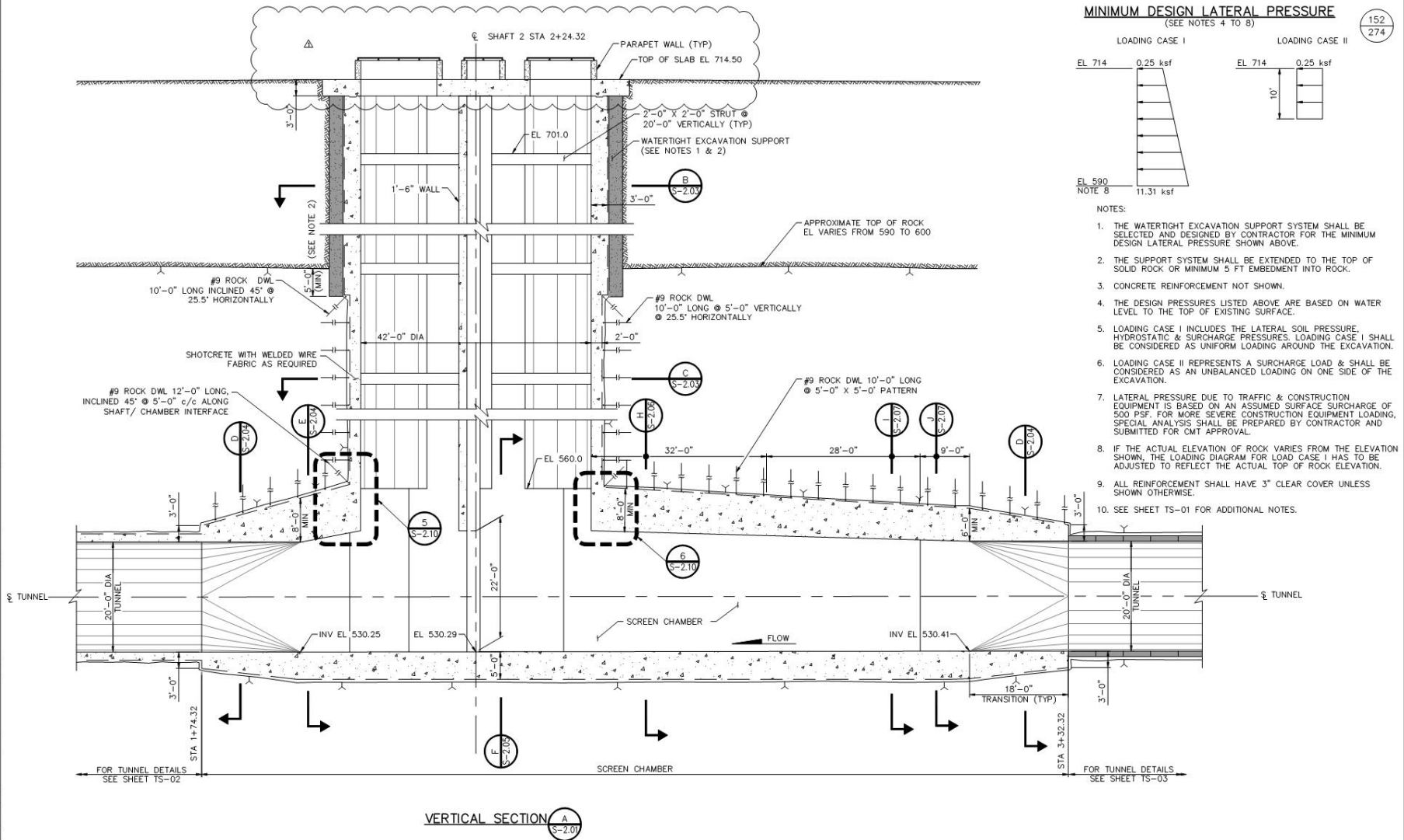
152  
274

LOADING CASE I      LOADING CASE II



NOTES:

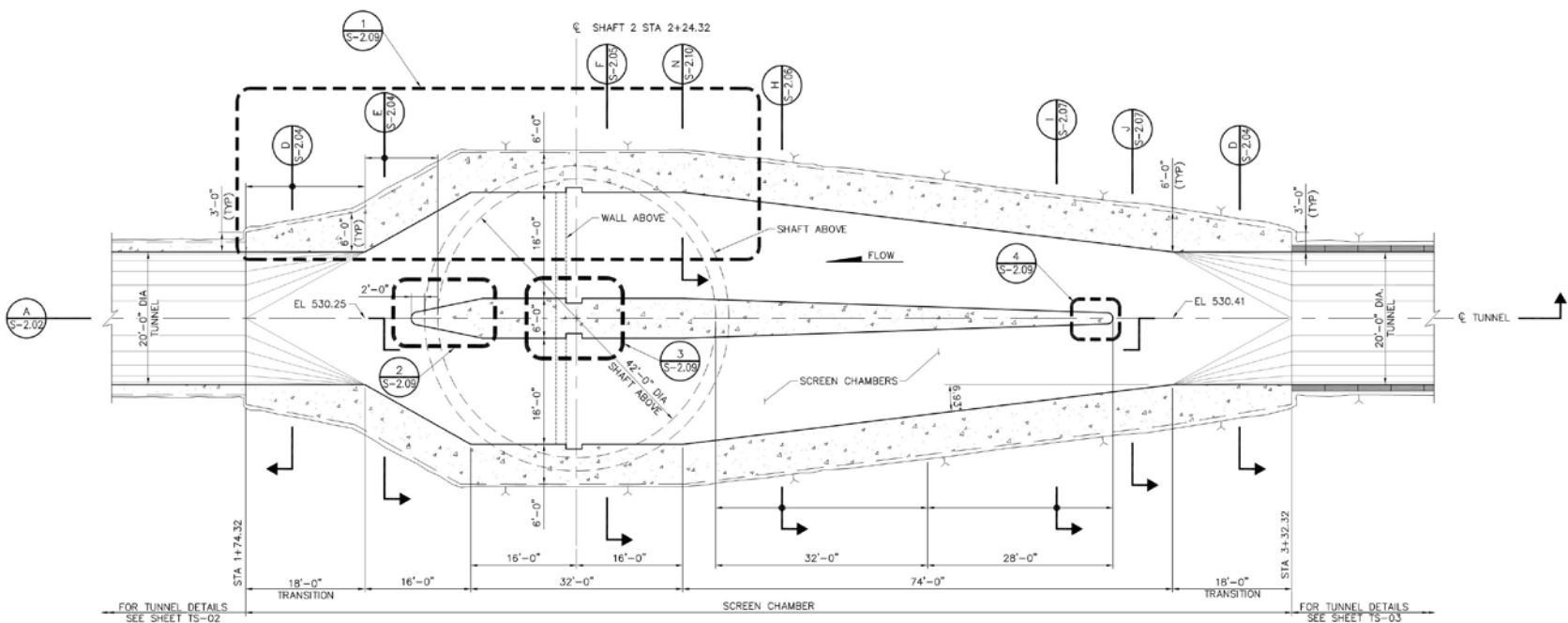
1. THE WATERTIGHT EXCAVATION SUPPORT SYSTEM SHALL BE SELECTED AND DESIGNED BY CONTRACTOR FOR THE MINIMUM DESIGN LATERAL PRESSURE SHOWN ABOVE.
2. THE SUPPORT SYSTEM SHALL BE EXTENDED TO THE TOP OF SOLID ROCK OR MINIMUM 5 FT EMBEDMENT INTO ROCK.
3. CONCRETE REINFORCEMENT NOT SHOWN.
4. THE DESIGN PRESSURES LISTED ABOVE ARE BASED ON WATER LEVEL TO THE TOP OF EXISTING SURFACE.
5. LOADING CASE I INCLUDES THE LATERAL SOIL PRESSURE, HYDROSTATIC & SURCHARGE PRESSURES. LOADING CASE II SHALL BE CONSIDERED AS UNIFORM LOADING AROUND THE EXCAVATION.
6. LOADING CASE II REPRESENTS A SURCHARGE LOAD & SHALL BE CONSIDERED AS AN UNBALANCED LOADING ON ONE SIDE OF THE EXCAVATION.
7. LATERAL PRESSURE DUE TO TRAFFIC & CONSTRUCTION EQUIPMENT IS BASED ON AN ASSUMED SURFACE SURCHARGE OF 500 PSF. FOR MORE SEVERE CONSTRUCTION EQUIPMENT LOADING, SPECIAL ANALYSIS SHALL BE PREPARED BY CONTRACTOR AND SUBMITTED FOR CMT APPROVAL.
8. IF THE ACTUAL ELEVATION OF ROCK VARIES FROM THE ELEVATION SHOWN, THE LOADING DIAGRAM FOR LOAD CASE I HAS TO BE ADJUSTED TO REFLECT THE ACTUAL TOP OF ROCK ELEVATION.
9. ALL REINFORCEMENT SHALL HAVE 3" CLEAR COVER UNLESS SHOWN OTHERWISE.
10. SEE SHEET TS-01 FOR ADDITIONAL NOTES.



VERTICAL SECTION A-A  
(S-2.10)

	No. BY DATE 11 JG 10/09/15 RFP FOR OSS REVISIONS	REVISIONS Remarks	PROJ PERSONNEL Initials DATE DES: STNC 08/14/15 DWN: DATC 08/14/15 CHD: THKA 08/14/15	CITY OF COLUMBUS, OHIO DEPARTMENT OF PUBLIC UTILITIES DIVISION OF SEWERAGE AND DRAINAGE	OSIS AUGMENTATION AND RELIEF SEWER - OARS PHASE 1 CIP 650704	SCALE 	OSS SHAFT 2 VERTICAL SECTION	ISSUED STATUS: RFP
		SHEET <b>S-2.02</b> DATE ISSUED: 10/01/15 Mo./Dy./Yr.						





GENERAL PLAN AT TUNNEL LEVEL

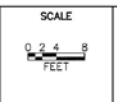
- NOTES:
1. ROCK AND CONCRETE REINFORCEMENT NOT SHOWN.
  2. FOR CONSTRUCTION JOINT AND WATERSTOP DETAILS, REFER TO SHEET TS-12.



No.	BY	DATE	REVISIONS	PREP PERSONEL	DATE
	St.	Mo./Dy./Yr.	Remarks	Initials	Mo./Dy./Yr.
				DES. SH	01/20/10
				DWN. DT	01/20/10
				CHK. EPK	01/25/10

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DEPARTMENT OF PUBLIC UTILITIES  
DIVISION OF SEWERAGE AND DRAINAGE

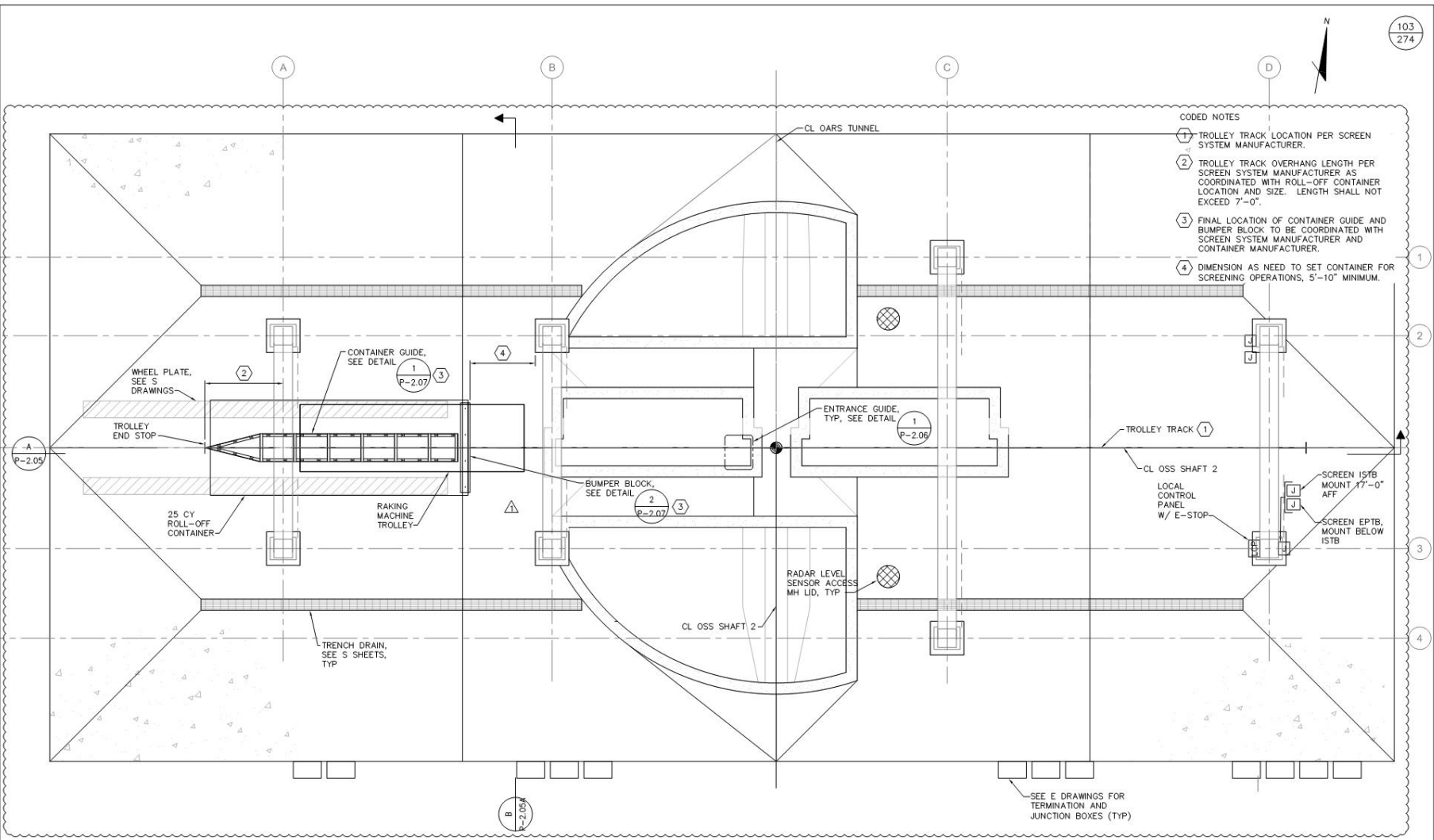
OSIS AUGMENTATION AND RELIEF SEWER - OARS  
PHASE 1  
CIP 650704



ISSUED STATUS: CTC  
SHEET S-2.01  
DATE ISSUED: 08/20/10  
Mo./Dy./Yr.

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- CODED NOTES
- ① TROLLEY TRACK LOCATION PER SCREEN SYSTEM MANUFACTURER.
  - ② TROLLEY TRACK OVERHANG LENGTH PER SCREEN SYSTEM MANUFACTURER AS COORDINATED WITH ROLL-OFF CONTAINER LOCATION AND SIZE. LENGTH SHALL NOT EXCEED 7'-0".
  - ③ FINAL LOCATION OF CONTAINER GUIDE AND BUMPER BLOCK TO BE COORDINATED WITH SCREEN SYSTEM MANUFACTURER AND CONTAINER MANUFACTURER.
  - ④ DIMENSION AS NEED TO SET CONTAINER FOR SCREENING OPERATIONS, 5'-10" MINIMUM.

<b>DLZ</b>	No.	BY	DATE	REVISIONS	PROJ. PERSONNEL	DATE
	1	M.F.	1/27/11	RFP #1	DES. M.F.	01/13/10
<b>CH2MHILL</b>	2	M.F.	10/7/15	RFP FOR OSS REVISIONS	OWN. WTM	01/13/10
					CHK. PPS	01/18/10

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DIVISION OF SEWERAGE AND DRAINAGE

OSIS AUGMENTATION AND RELIEF SEWER - OARS  
PHASE 1  
CIP 650704

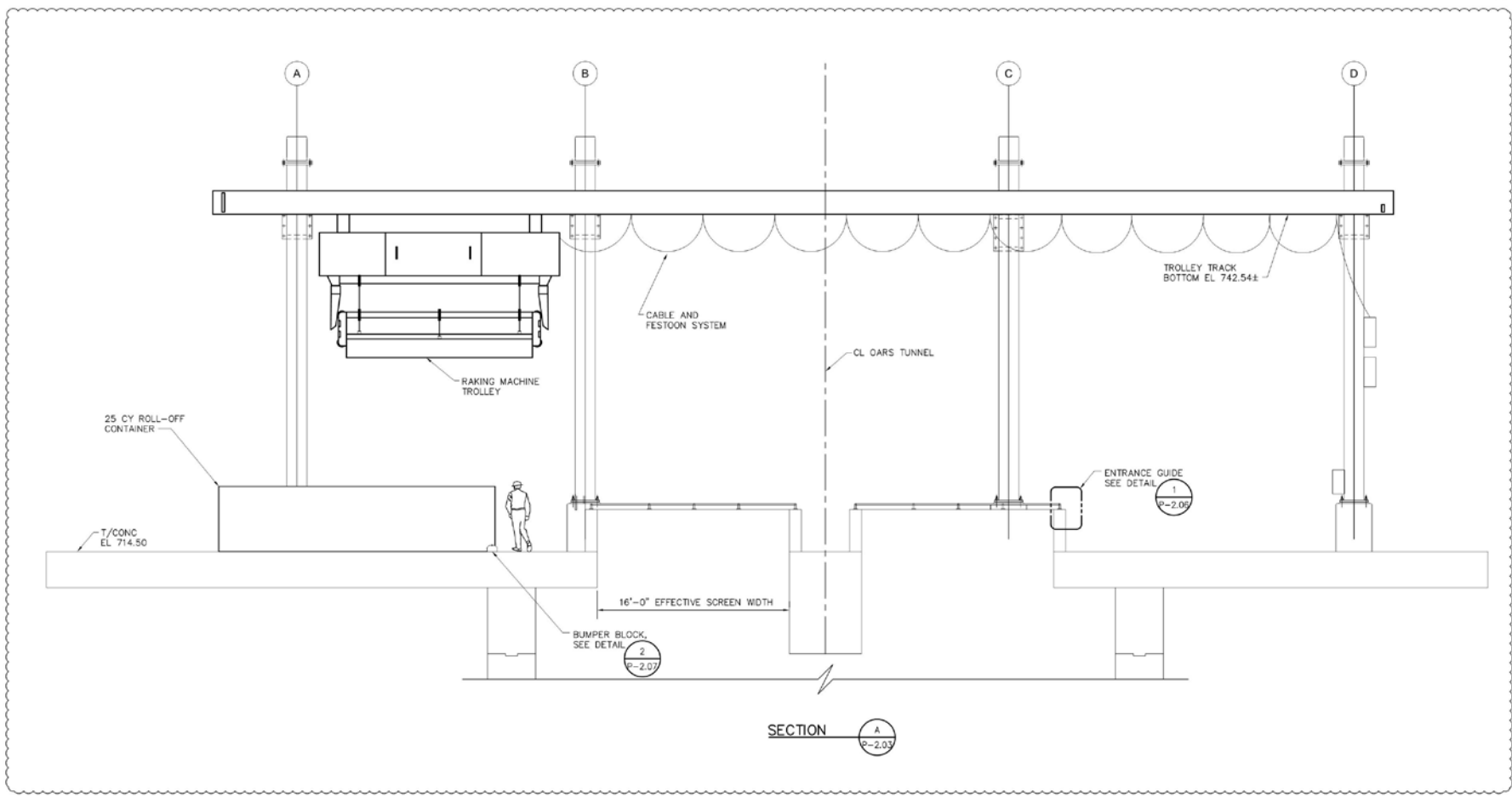
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FEET

OARS SCREEN STRUCTURE SERVICE BUILDING PLAN

ISSUED STATUS: RFP  
SHEET P-2.03  
DATE ISSUED: 10/10/1/2015  
Mo./By./Yr.

PLOTTED: 9/29/2015 2:16:04 PM

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SECTION A  
P-2.03

<b>DLZ</b>	No.	BY	DATE	REVISIONS	PREP PERSONNEL	DATE
		M.F.	1/27/11	RFP #1		01/23/10
<b>CH2MHILL</b>		M.F.	10/1/15	RFP FOR OSS REVISIONS		01/23/10

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OSIS AUGMENTATION AND RELIEF SEWER - OARS  
PHASE 1  
CIP 650704

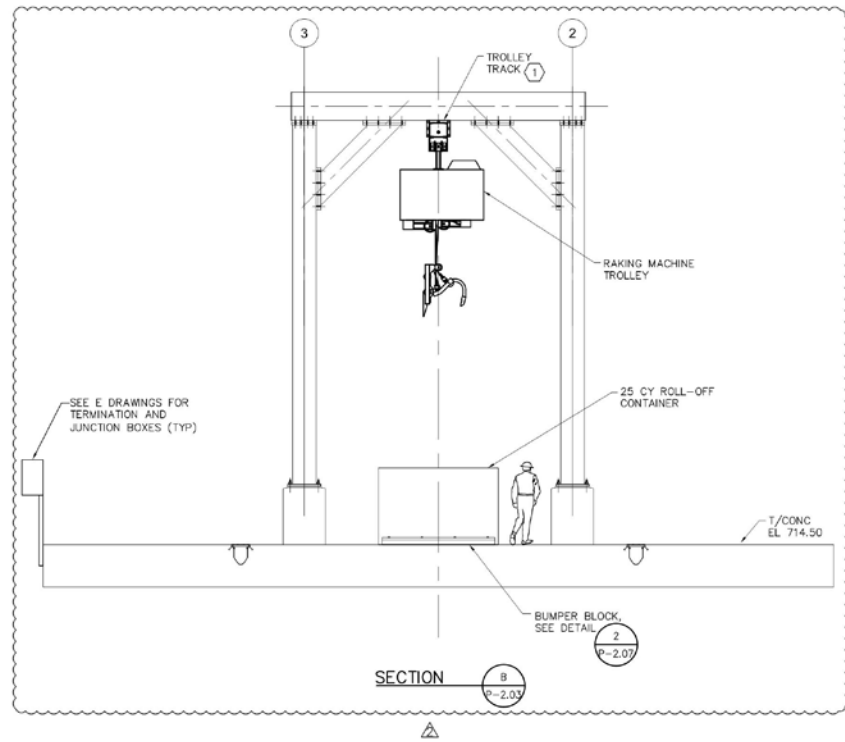
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OARS SCREEN STRUCTURE SECTIONS 2

ISSUED STATUS: RFP  
SHEET P-2.05  
DATE ISSUED: 10/10/15

CODED NOTES

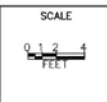
① TROLLEY TRACK LOCATION PER SCREEN SYSTEM MANUFACTURER.



No.	BY	DATE	REVISIONS	PROJ. PERSONNEL	DATE
1	M.F.	1/27/11	RFP #1		
2	M.F.	10/1/15	RFP FOR OSS REVISIONS	DES. M.F.	01/15/16
				DWN. WFM	01/13/16
				CHKD. P.B.S.	01/18/16

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DIVISION OF SEWERAGE AND DRAINAGE

OSIS AUGMENTATION AND RELIEF SEWER - OARS PHASE 1  
CIP 650704



OARS SCREEN STRUCTURE SECTIONS 3

ISSUED STATUS: RFP  
SHEET P-2.05A  
DATE ISSUED: 10/10/15

# Shaft 2

# Bosker Screen Cleaning System





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# OARS Schedule

Tunnel / Pumping Wet Testing – completed 4/2017

7/10/2017 – Shaft 4 OSIS Relief Structure Open

7/18/2017 – Shaft 5 OSIS Relief Structure Open

7/26/2017 – Shaft 6 OSIS Relief Structure Open

Screen System – Substantial Completion 8/2017

Full Startup ~ 8/2017

Final Restoration & Demobilization – 9/2017



# OARS Operations

7/10/2017 – Shaft 4 OSIS Relief Structure Open

Within a few hours of lowering the weir gates to their final working position, a large rain event occurs:

- ~ 10 year rain event
- 1.71” that afternoon

Southerly WWTP lost power during the event  
Jackson Pike WWTP maxed at 160 MGD





# OARS Operations

7/10/2017 – How did OARS work?

OARS filled (60 MG)

Overflowed to the river after treatment was at max.

No overflows at the WSST.

Net result = pretty good; OARS did its job.

OARS dewatered (60 MG) over the next couple days.

# OARS Operations

7/13/2017 – Another BIG rain event

- 2.82” of rainfall (Weather Underground Data)
- Southerly WWTP maxed at 260 MGD
- Jackson Pike WWTP maxed at 160 MGD
- OARS filled (60 MG)
- Interconnect Sewer filled
- Overflowed to the river after treatment was at max.
- WSST also overflowed.

Net result = pretty good; OARS did its job.

# OARS Project Team

- **DLZ**
- **CH2M**
- **Jenny (COWI)**
- **Prime AE**
- **EMH&T**
- **Dynotec**
- **Eagon & Associates**
- **Multivista**
- **CDM Smith**
- **Black & Veatch**
- **HR Gray**
- **Smoot**
- **Aldea Services**

**Phase 1 – Kenny / Obayashi**

**Phase 2 – Trumbull**

**Igel**

**Capital Tunneling**

**Miles McClellan**

# QUESTIONS ???

Raisa Pesina

Jeff Coffey

Coming up – OARS Part 2  
(actual operation)