



McCook 33' Diameter Steel Tunnel Liner, Chicago IL

Nash Williams-President
National Welding Corporation

NATIONAL WELDING CORP.



History of the System

- In the early 1900s Chicago lacked means to control the water ways. They were overwhelmed to the point that the Chicago River actually flowed backwards and overflows including sewage ended up in Lake Michigan. This prompted development of a large scale system to control the flows.
- In 1972, MWRDGC adopted the Tunnel and Reservoir Plan (TARP) is the largest water infrastructure undertaking in Chicago (\$3.5 billion)
- The McCook Main Tunnel System is one of the last segments to a 109 mile system of tunnels.



McCook Reservoir – Facilities Layout



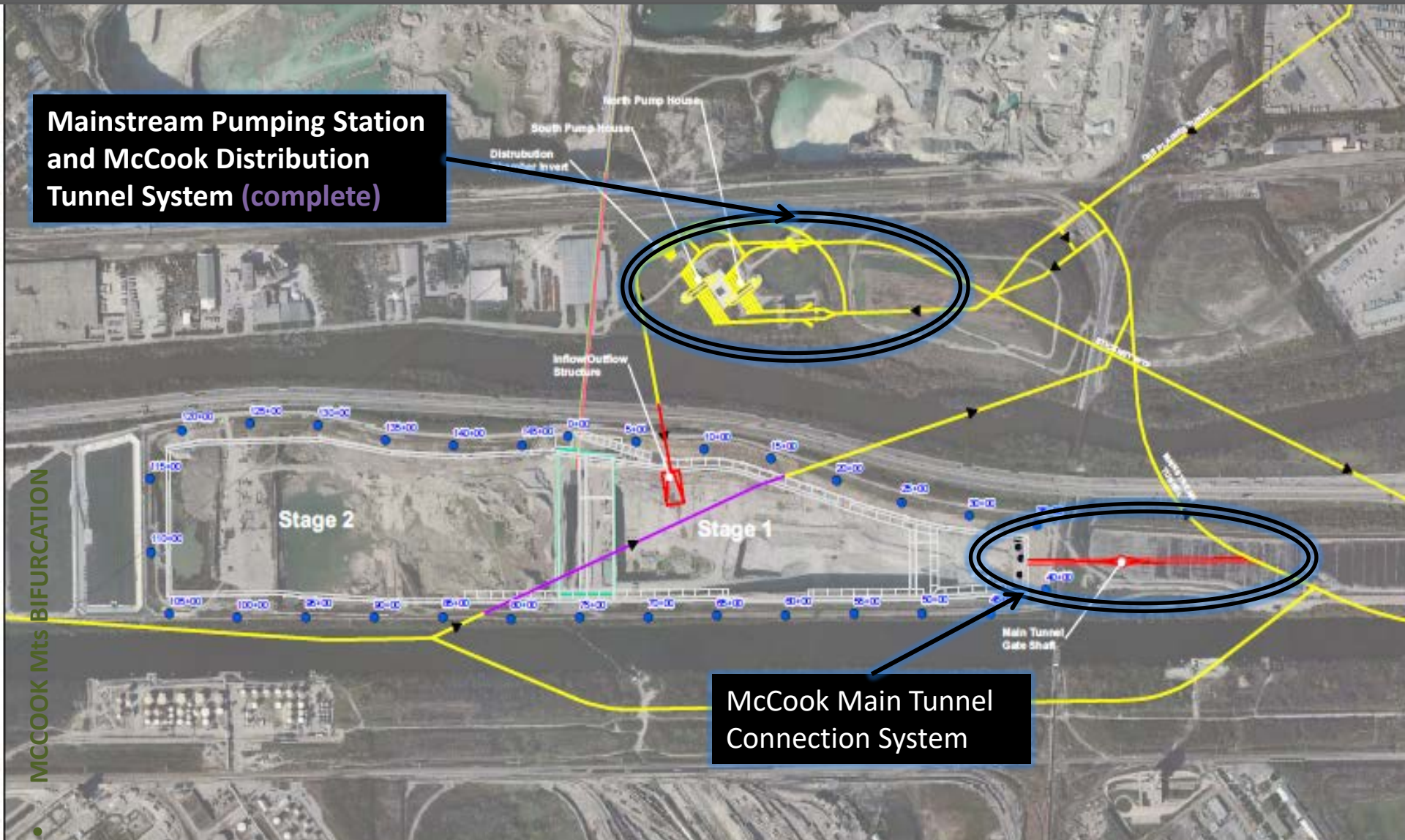
Mainstream Pumping Station and McCook Distribution Tunnel System (complete)

McCOOK Mts BIFURCATION

Stage 2

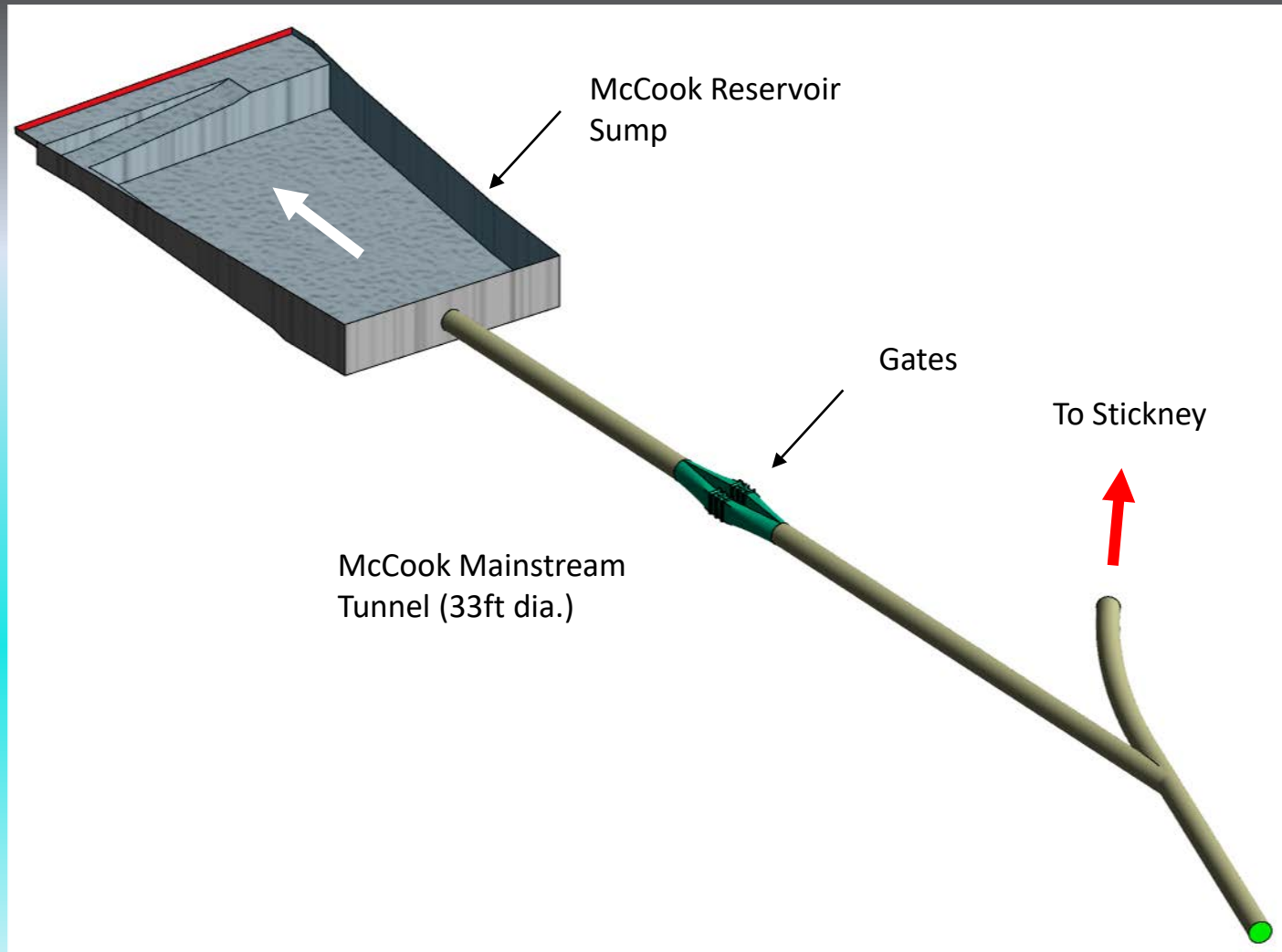
Stage 1

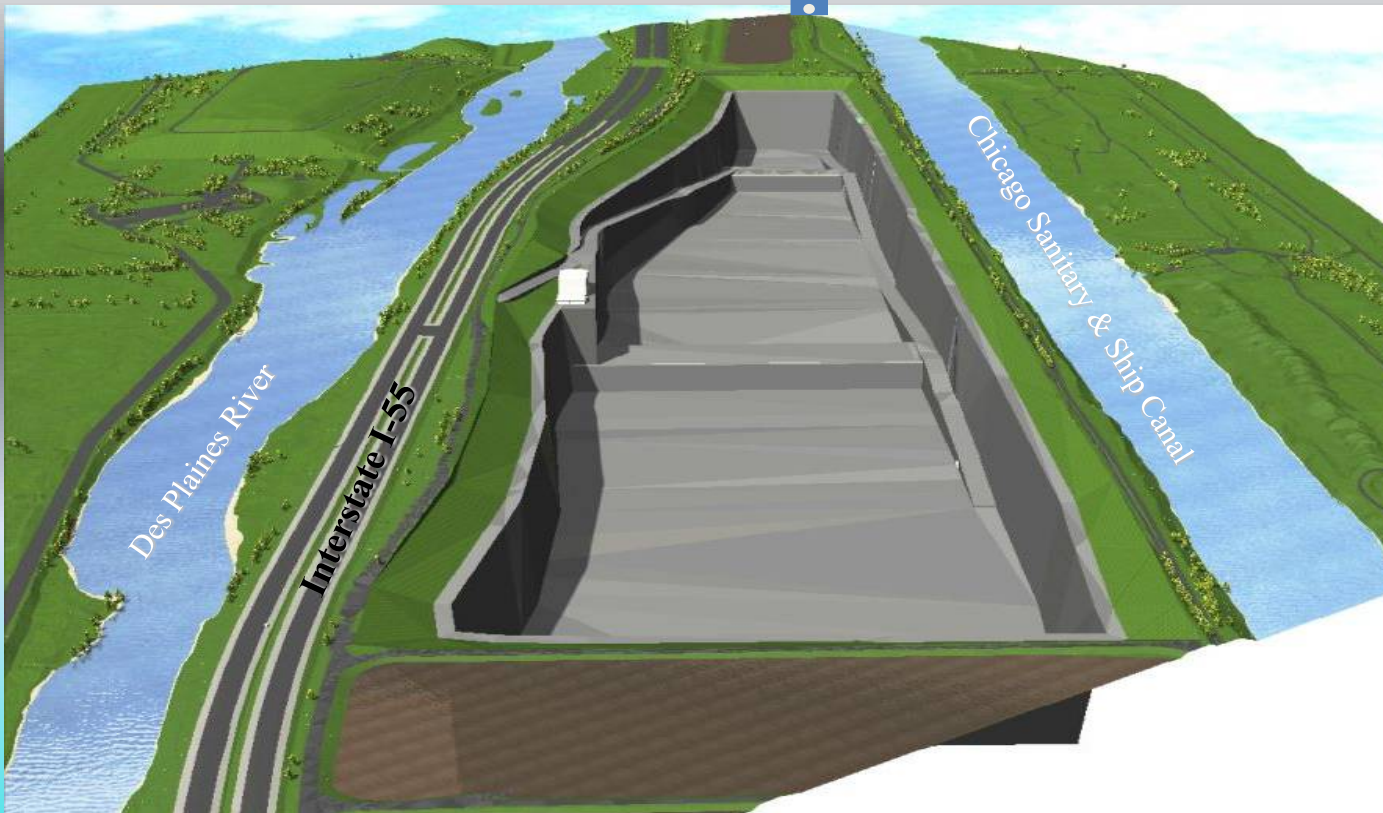
McCook Main Tunnel Connection System





McCook Tunnel System Model





- McCook Tunnel is 1600 feet long and 33' in diameter.
- When completed the system will provide 17.5 BG of CSO and flood storage for TARP with flow rates averaging 30 ft/sec
- The effluent will be pumped to the Stickney WWTP for treatment then discharged into the Des Plains River



Steel Liner Construction

National Welding Corporation – Assemble, Fit,
and Weld Steel Tunnel Liner

Kiewit Infrastructure- General Contractor,
Excavate, Concrete Lining, and oversight.

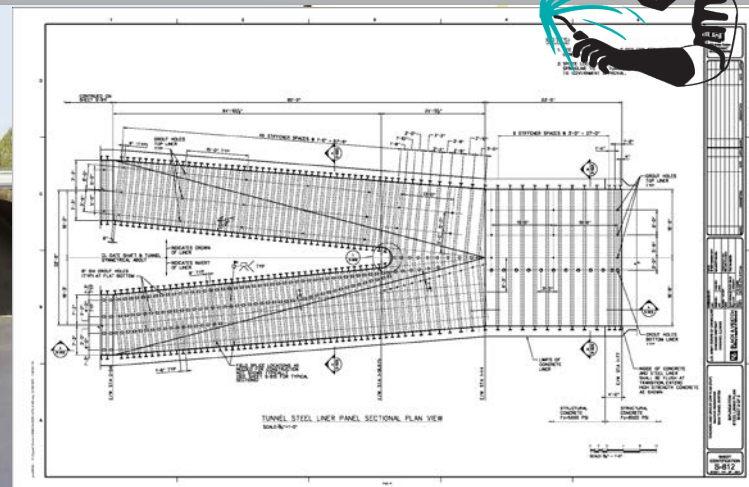
Selway Corporation- Shop Drawings and
Fabrication of Steel Liner Pieces



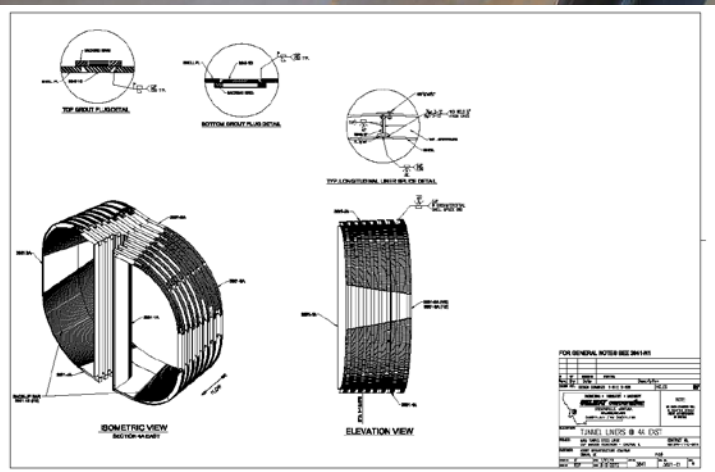
Preassembly Planning

Design

- 108 m (354 ft) of steel liner
- Bifurcation from 10 m (33 ft) to 4x9.8 m (19x32 ft)



- Designed for 6 High Wheel Gates for flow control
- Changing Geometry
- “T” Steel rings





Fabrication of Steel Liner Sections

- Tolerances
- Connections
- Preassembly



- Shipping Considerations
- 48 special loads from MT to IL





Surface Subassembly



- 10 m (33 ft) Diameter Pieces Assembled Onsite



Rigging and Connections



- Bolted Connections
- Custom Rigging for each ring of liner





Liner Support

- Cross-Bracing Installation





Environmental controls

- Surviving Chicago's Winter



- Temporary Shelter





NATIONAL WELDING CORPORATION

WELDING PROCEDURE SPECIFICATION (WPS) Revision 1

COMPANY NAME	NATIONAL WELDING CORPORATION	APPROVED BY	John Williams
WELDING PROCEDURE SPECIFICATION NO.	WPS-001	DATE	12/01/2011
SUPPORTING FOR MS	WPS-001	TIME	4:15:00 PM
WILLIAMS PROCEDURE	WPS-001		

WPS-001 (WPS-001)

Joint Design: ☐ V-Groove ☒ Bevel ☐ Square Groove ☐ J-Groove

Bevel: ☐ 1/4" ☐ 1/2" ☐ 3/4" ☐ 1" ☐ 1 1/2" ☐ 2" ☐ 3" ☐ 4" ☐ 6" ☐ 8" ☐ 10" ☐ 12" ☐ 14" ☐ 16" ☐ 18" ☐ 20" ☐ 22" ☐ 24" ☐ 26" ☐ 28" ☐ 30" ☐ 32" ☐ 34" ☐ 36" ☐ 38" ☐ 40" ☐ 42" ☐ 44" ☐ 46" ☐ 48" ☐ 50" ☐ 52" ☐ 54" ☐ 56" ☐ 58" ☐ 60" ☐ 62" ☐ 64" ☐ 66" ☐ 68" ☐ 70" ☐ 72" ☐ 74" ☐ 76" ☐ 78" ☐ 80" ☐ 82" ☐ 84" ☐ 86" ☐ 88" ☐ 90" ☐ 92" ☐ 94" ☐ 96" ☐ 98" ☐ 100"

Material: ☐ Nonferrous Metal ☐ Ferrous Metal ☐ Other ☐ 1/2" 1/4" 1/8" 1/16"

The diagram shows a cross-section of a V-groove joint. The top surface is labeled '45 Deg -10 G'. The bottom surface is labeled '1/4" (+.015" - .018" AS FIT U/P)'. The joint is shown with a 1/2" gap between the two pieces, and the bottom surface is labeled '1/2" 1/4" 1/8" 1/16'.

WPS DETAILS (WPS-001)

P-No.	Group No. 1, 6, 08 01	P-No.	Group No. 1, 6, 08 01
or			
Specification Type and Grade	A 537 CLASS B & A 508 & A 537 TYPE B & A 508, A537-50	or	
Specification Type and Grade	A 537 CLASS B & A 508 & A 537 TYPE B & A 508, A537-50	or	
Chemical Analysis and Mechanical Properties		or	
Chemical Analysis and Mechanical Properties		or	

Thickness Range	Groove 1/2" - 3"	H-Bolt	1/2" - 3"
Base Metal	Groove 2" AND OVER	or	1/2" - 3"
or			

WPS-001 (WPS-001)

Specification Type (WPS)	A 537	or	A 537
AWS No. (Class)	A537-50/508	or	
A-Abs	50	or	
Size of Filler Metals	0.010	or	
Weld Metal		or	
Thickness Range	1/2" - 1 1/2"	or	
Base Metal	1/2" - 1 1/2"	or	
Electrode Flux (Class)	7018	or	
Flux Trade Name	7018	or	
Consumable Insert	7018	or	
or	7018	or	

*Each new welding minor contribution should be recorded in addition.

NATIONAL WELDING CORPORATION

WELDING PROCEDURE SPECIFICATION NO.

NWC-6171.19

POSITION(S) (DIP-406)

Positions of Groove	AC/1	Temperature Range	70 DEG-325 DEG
Position of Groove	CP (SEE)	Time Range	NA

WELDING PROC (DIP-406)

Preheat Temperature Minimum	70 DEG	Percent Composition	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">Gas</td> <td style="width: 50%;">Metallic</td> </tr> <tr> <td>50/50</td> <td>80/20/20</td> </tr> <tr> <td>50/50</td> <td>80/20/20</td> </tr> </table>	Gas	Metallic	50/50	80/20/20	50/50	80/20/20
Gas	Metallic								
50/50	80/20/20								
50/50	80/20/20								
Interpass Temperature Maximum	325 DEG	Shielding	NA						
Preheat Temperature	70 DEG	Tailing	NA						
		Baking	NA						

ELECTRICAL CHARACTERISTICS (DIP-406)

Current (AC or DC)	DC	Polarity	EP (ELECTRODE POSITIVE)
Amper Range	30-375	Voltage Range	23.5-26.5

Tongue Electrode Size and Type	NA
Stroke of Metal Transfer	TRANSFER
Electrode Wire Feed Speed Range	333 5-451

TECHNOLOGY (DIP-406)

Storage or Release Bed	STORAGE OR BEAD
On-Pipe or Gas Cup Design	END
Initial and Intermediate Drawing	MISCELLANEOUS POWER BRUSH
Method of Back Drawing	NA
Coupling	NA
Contact Type to Work Distance	NA
Multiple or Single Hits (Per Side)	NA
Multiple or Single Electrodes	SINGLE
Travel Speed Range	7.5-12.5 IPM
Peening	NA
Other	

WELD	PROCESS	ELECTRICAL		GAS/FLUX		VOLTAGE RANGE	TRAVEL SPEED RANGE	OTHER
		CLASS	DIAMETER	POLARITY	WIRE/FLUX TYPE			
1.4	FGAR	AD-20	.082"	EP	180-357	20-29	7.5-12.5	NA



Quality Control

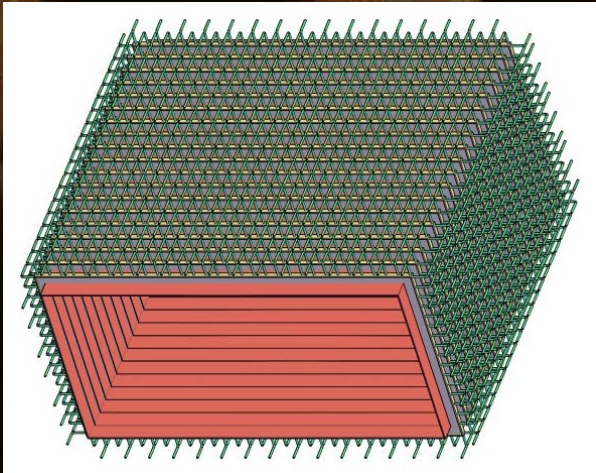
- Magnetic Particle (MT) inspection



- Ultrasonic Testing (UT) Inspection



"J" Anchor Layout and Welding



- Over 16,000 Anchors-Field Installed





Changing Geometry



• Bull Nose

Handling 33 foot diameter sections



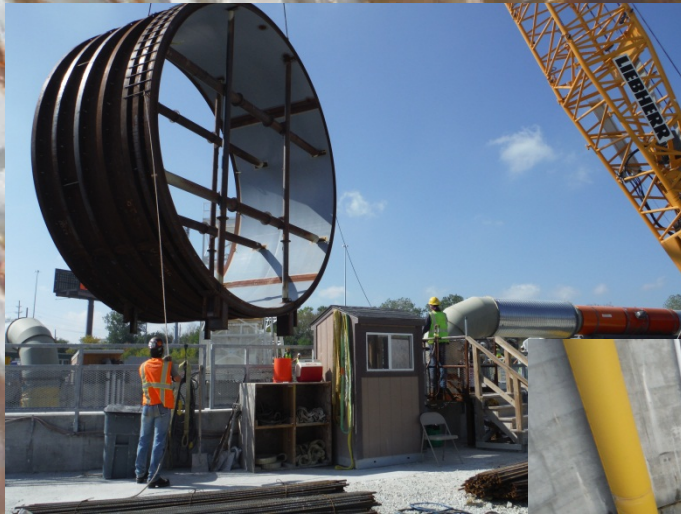
- Rotation of 164mt (180 tons)



Handling 33 Foot Diameter Sections



- Sections Lowered Down 91 m (300 ft) Shaft



• A Paradigm of



Tunnel installation



- Annular Bracing Installed



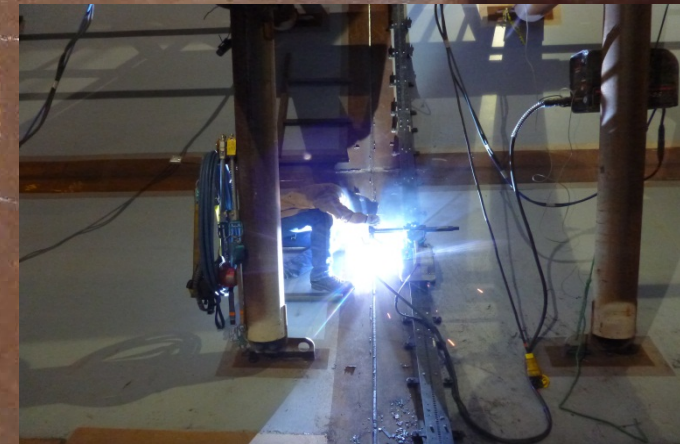
Circumferential Seams Fitting and welding



Over 937 m (3076
ft) of CJP tunnel
welds performed



Automatic and
Semi-Automatic
FCAW Welding





Finished Steel Tunnel Liner

KEY ELEMENTS OF SUCCESS

1. Team Approach
2. Capable Team Members
3. Careful Planning and Development



THANK YOU

NATIONAL WELDING CORP.

