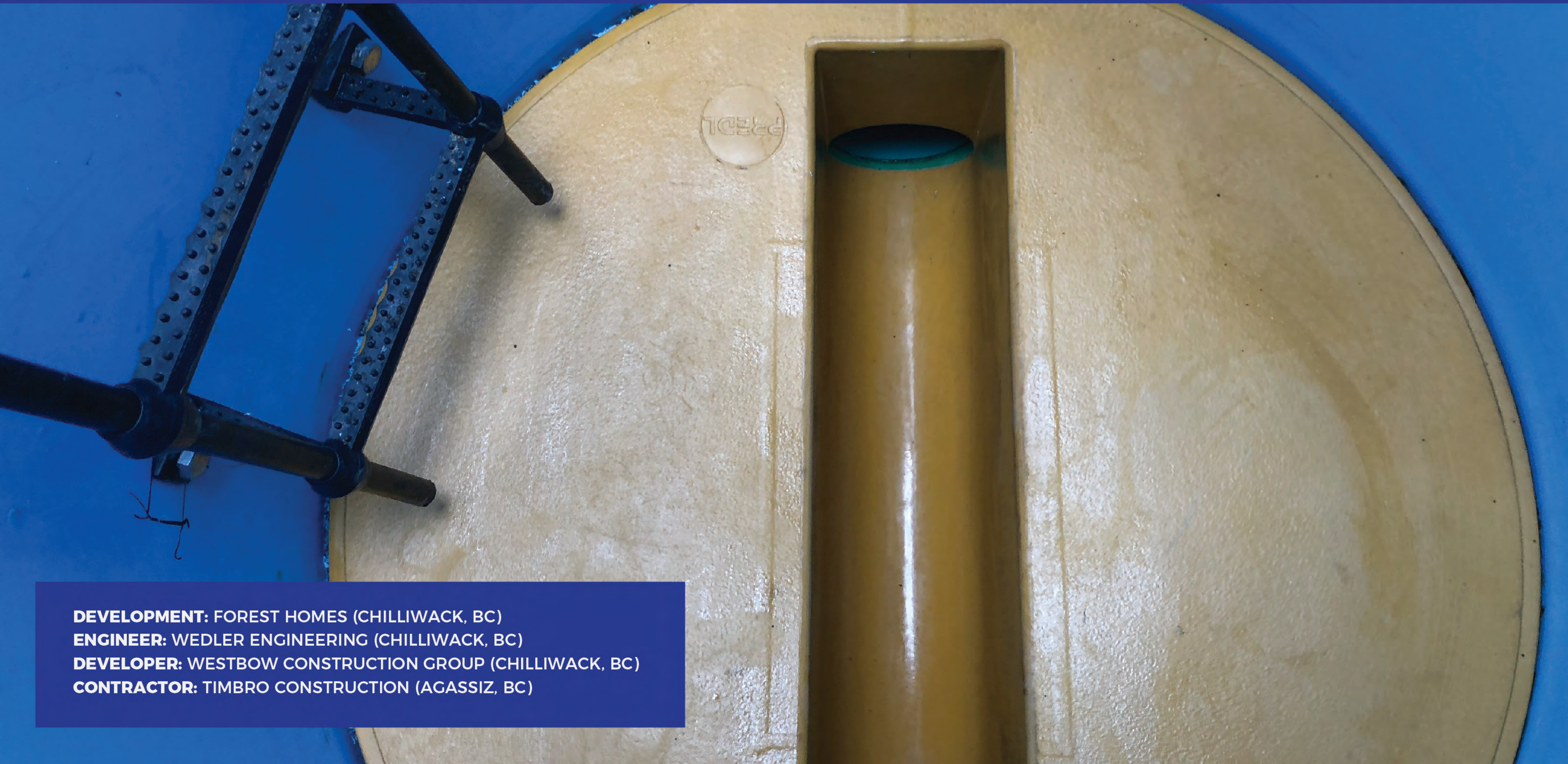


**PREDL** systems

CONCRETE PROTECTIVE LINER EXPERTS

# HYBRID PVC MANHOLE INSTALLATION & INFORMATION GUIDE

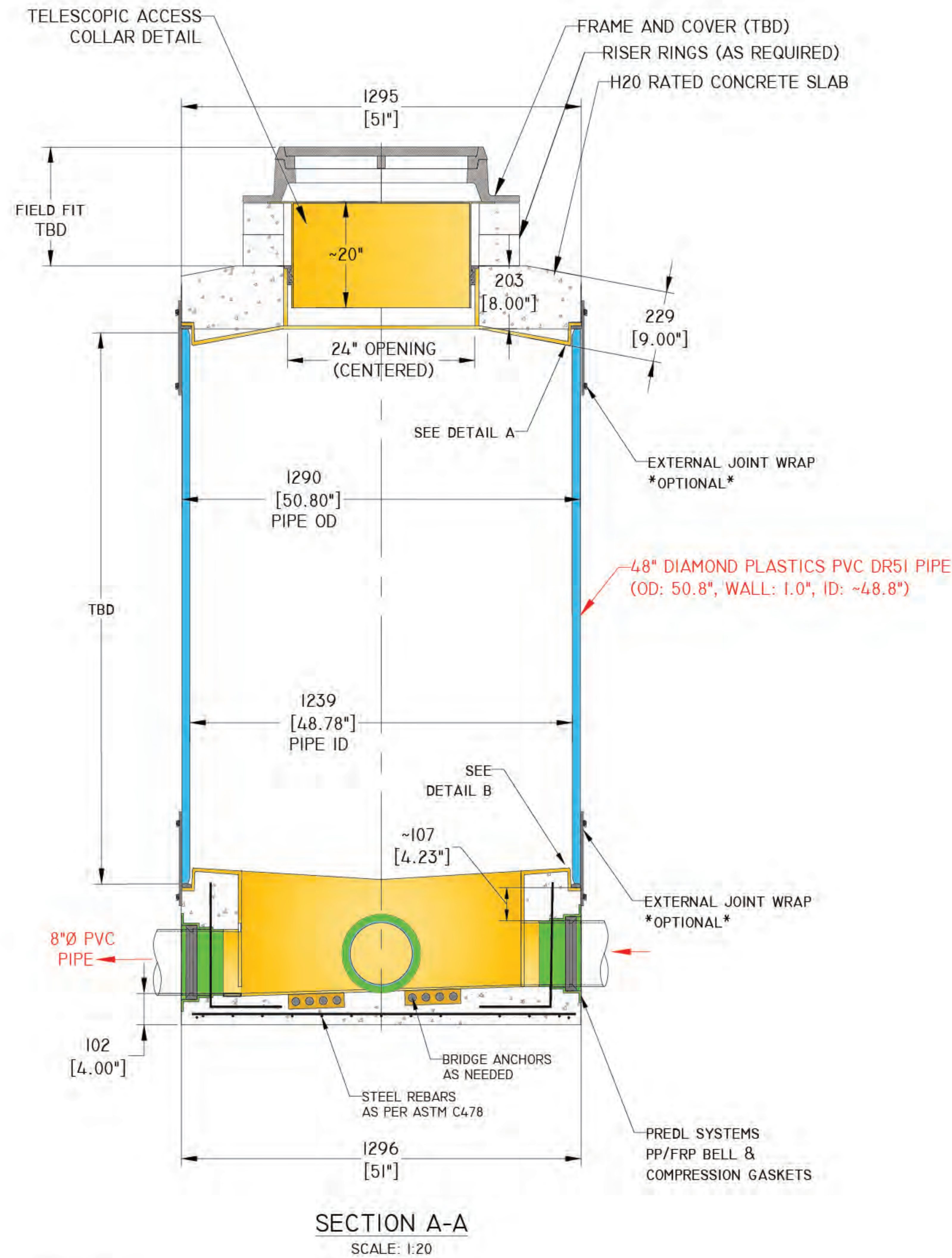


**DEVELOPMENT:** FOREST HOMES (CHILLIWACK, BC)  
**ENGINEER:** WEDLER ENGINEERING (CHILLIWACK, BC)  
**DEVELOPER:** WESTBOW CONSTRUCTION GROUP (CHILLIWACK, BC)  
**CONTRACTOR:** TIMBRO CONSTRUCTION (AGASSIZ, BC)

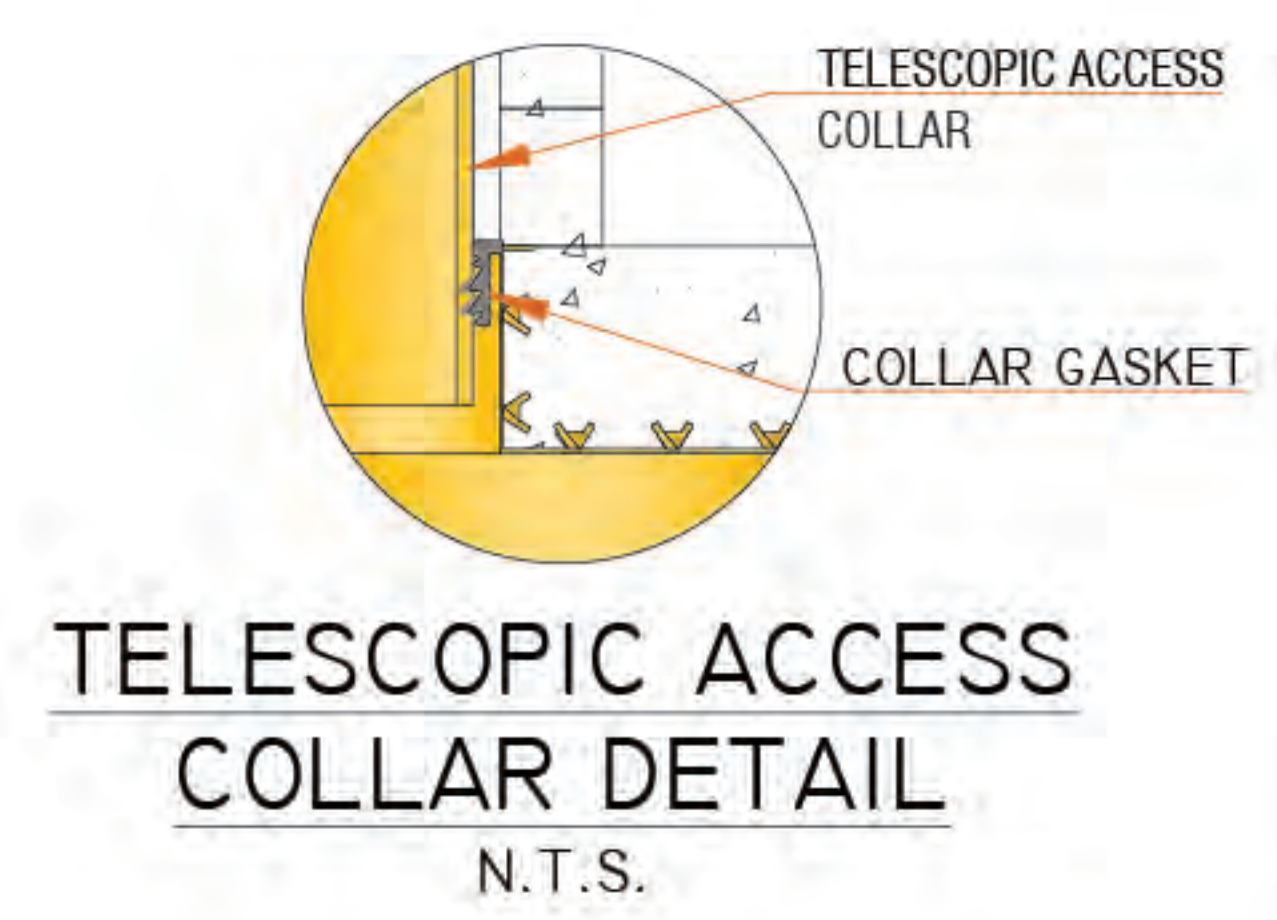
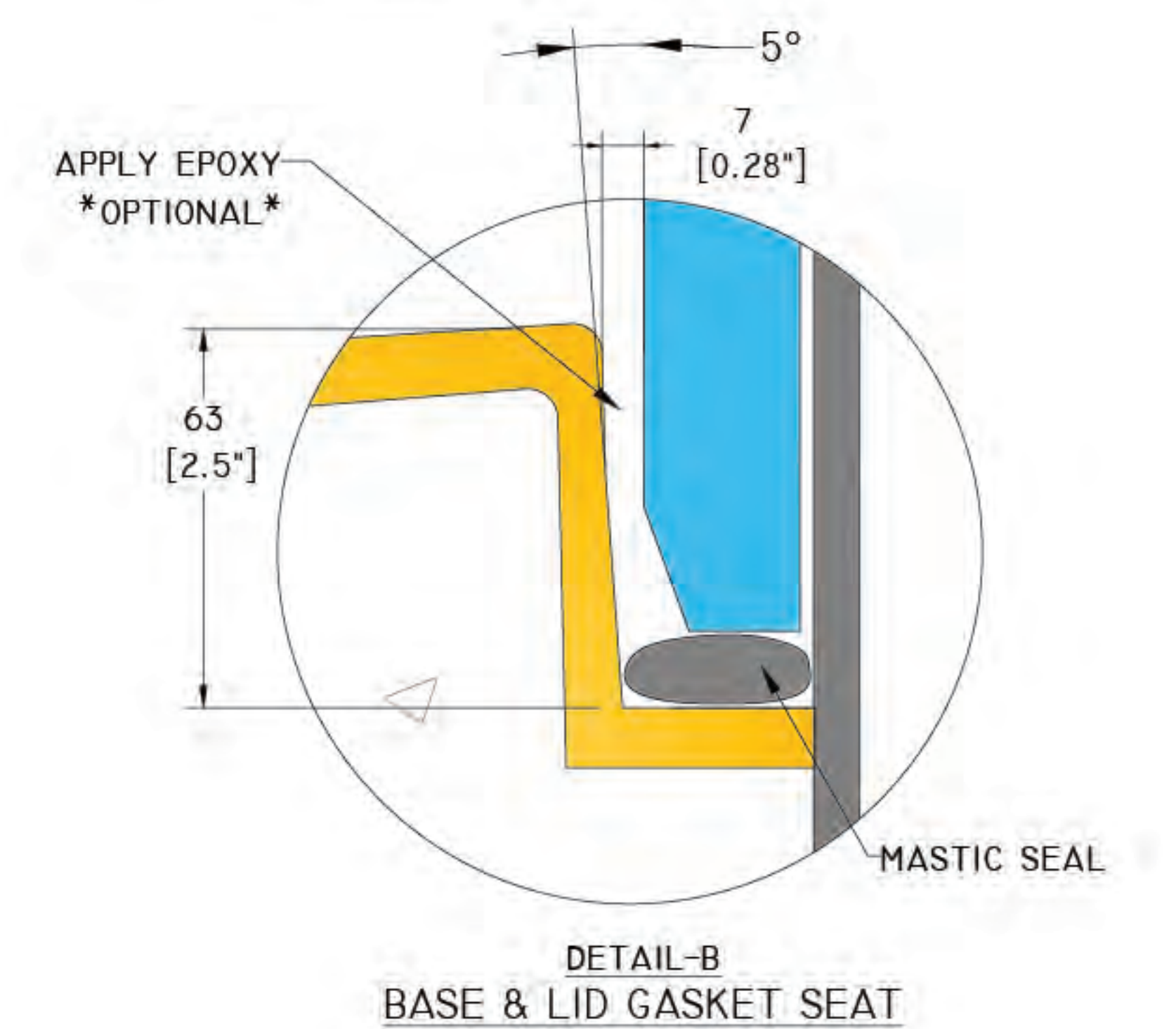
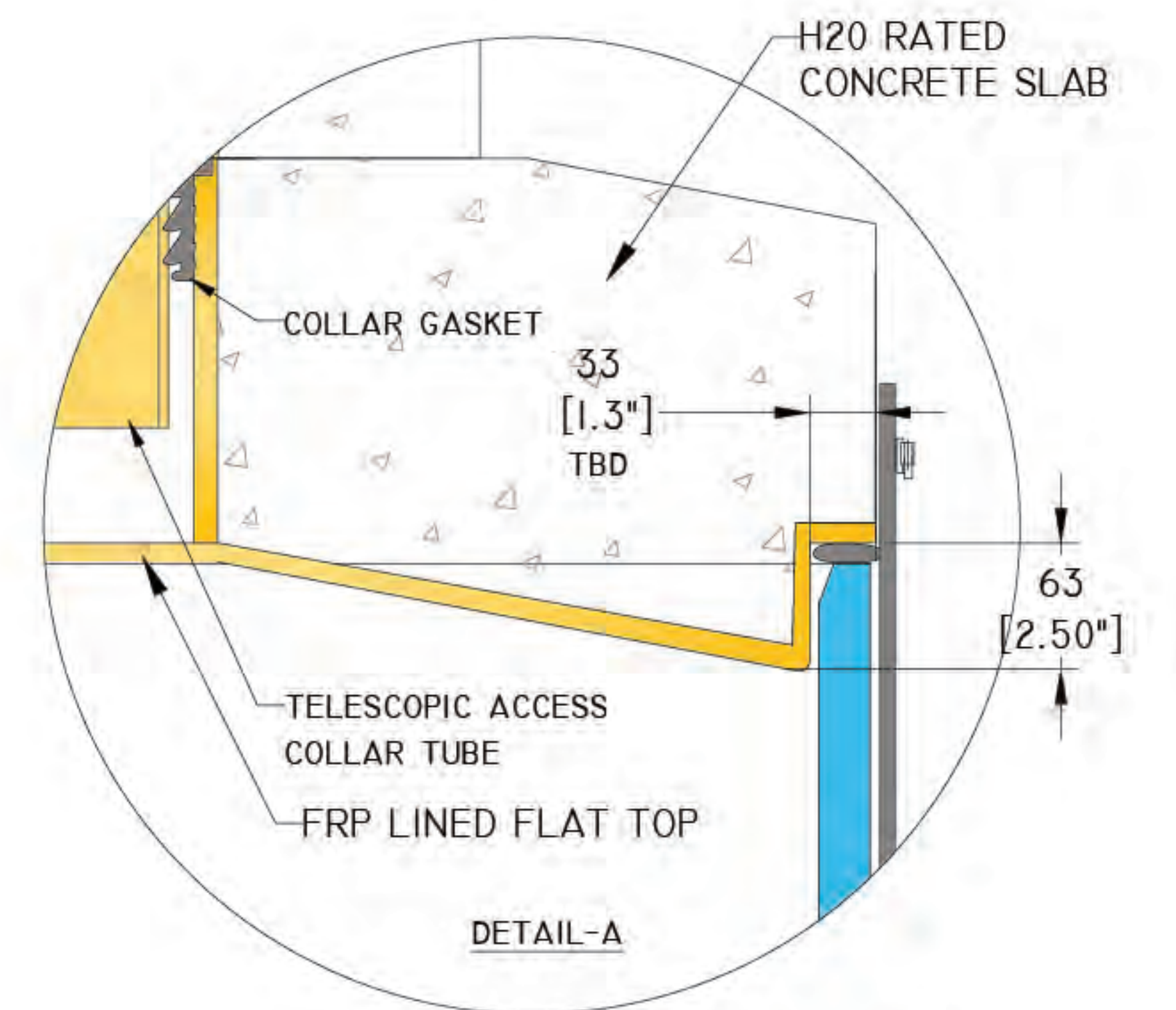
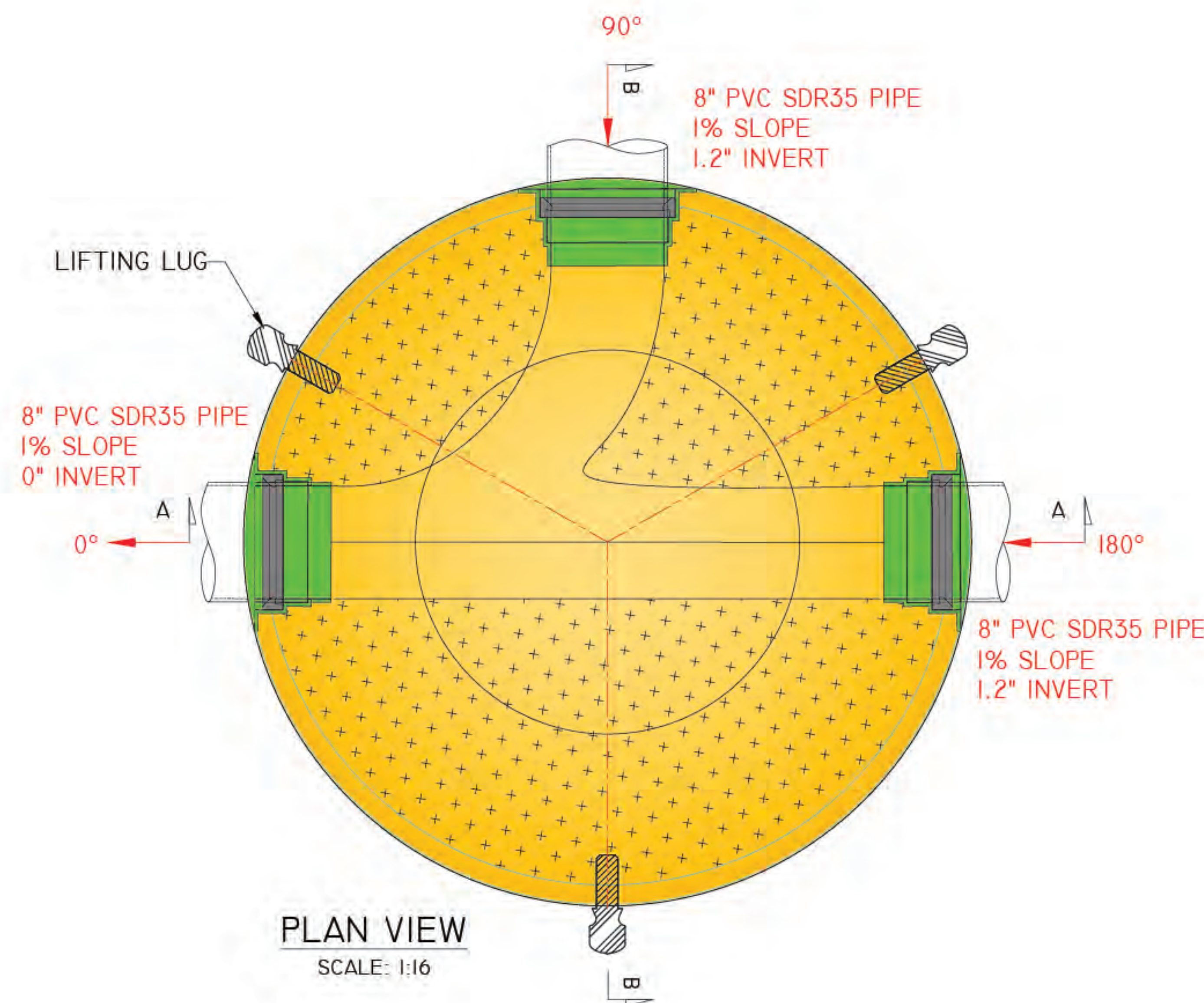


# DESIGN

## PVC MH (48in)



- SPECIFICATIONS**
- THIS DRAWING REPRESENTS THE CONCRETE PROTECTIVE LINER DESIGN. ALL CONCRETE DIMENSIONS TO BE VERIFIED FROM THE CONTRACTOR OR PRECAST CONCRETE MANUFACTURER.
  - ALL "PIPE TO MANHOLE" CONNECTIONS SHALL HAVE GASKETS AS SHOWN IN THE DRAWINGS UNLESS OTHERWISE NOTED.
  - ALL PIPE GASKETS SHALL BE INSTALLED USING THE MANDREL RECOMMENDED BY THE GASKET MANUFACTURER.
  - ONLY PREDL CERTIFIED WELDERS AND FABRICATORS ARE AUTHORIZED TO FABRICATE, REPAIR, WELD, OR TEST THE LINERS.
  - ALL LINER SECTIONS SHALL BE WELDED OR JOINED TOGETHER AS PER THE MANUFACTURER INSTRUCTIONS UNLESS OTHERWISE NOTED.
  - LINER IS NOT TO BE COMPROMISED BY DRILLING OR PUNCTURING UNLESS SPECIFIED AND APPROVED BY PREDL LINER MANUFACTURER. PERFORATION OF LINER TO INSTALL LADDER RUNGS IS NOT RECOMMENDED.
  - PREDL CONCRETE LINER IS A NON-STRUCTURAL ELEMENT. ALL PRECAST CONCRETE SHALL BE DESIGNED, CONSTRUCTED AND INSTALLED IN ACCORDANCE WITH LOCAL STANDARDS PRIOR TO FINAL INSTALLATION AND TESTING OF CPL.
  - ROUND MANHOLE STRUCTURES TYPICALLY DESIGNED TO ASTM C478. NON-ROUND MANHOLE STRUCTURES TYPICALLY DESIGNED TO ASTM C913.
  - PRECAST CONCRETE STRUCTURE WITH INTEGRAL PREDL CPL TO BE VACUUM TESTED IN ACCORDANCE WITH ASTM C1244 PRIOR TO FINAL INSTALLATION AND TESTING OF CPL.



CONCRETE BASE WEIGHT: ~2,200 LBS  
CONCRETE LID WEIGHT: ~900 LBS

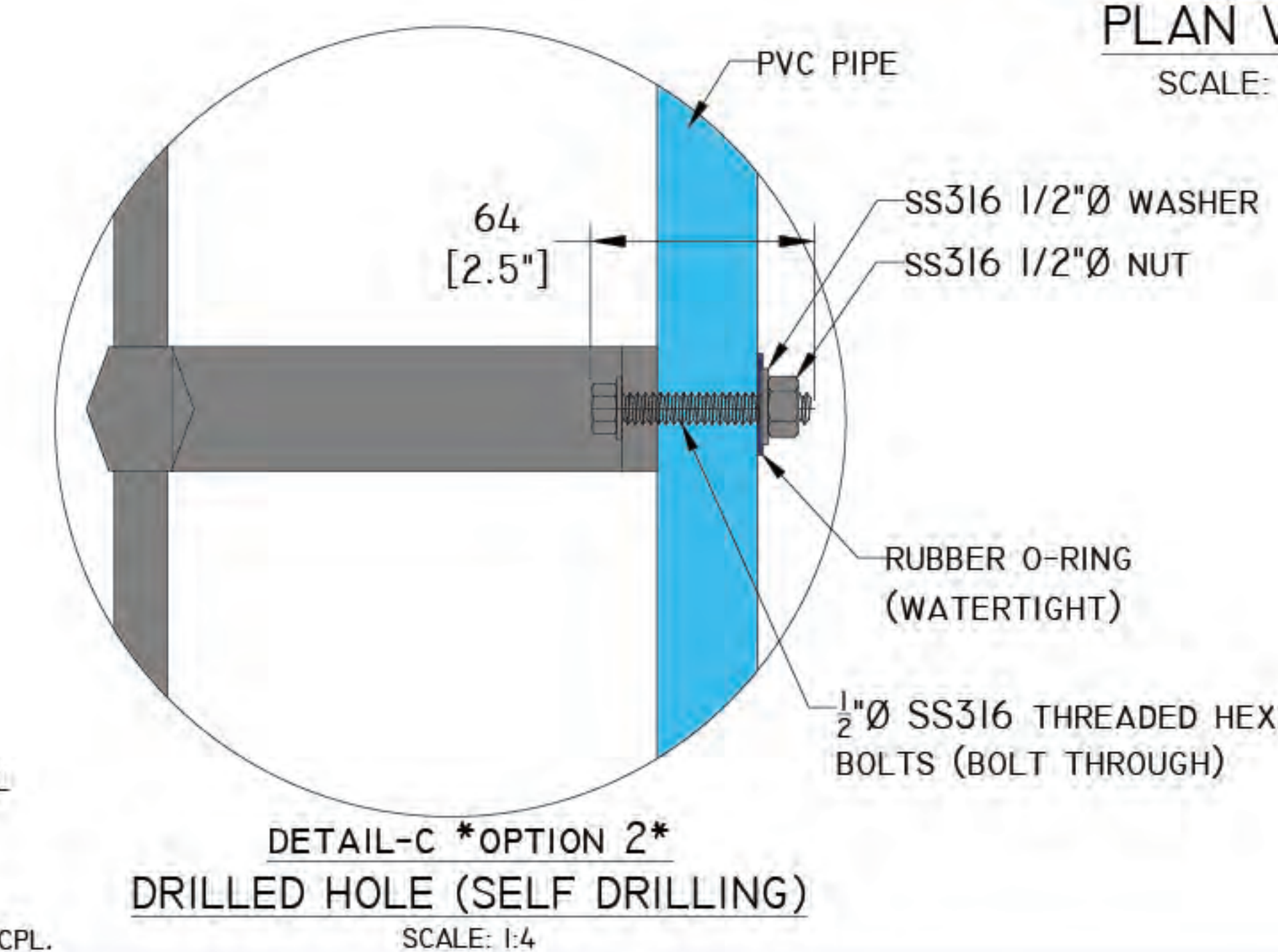
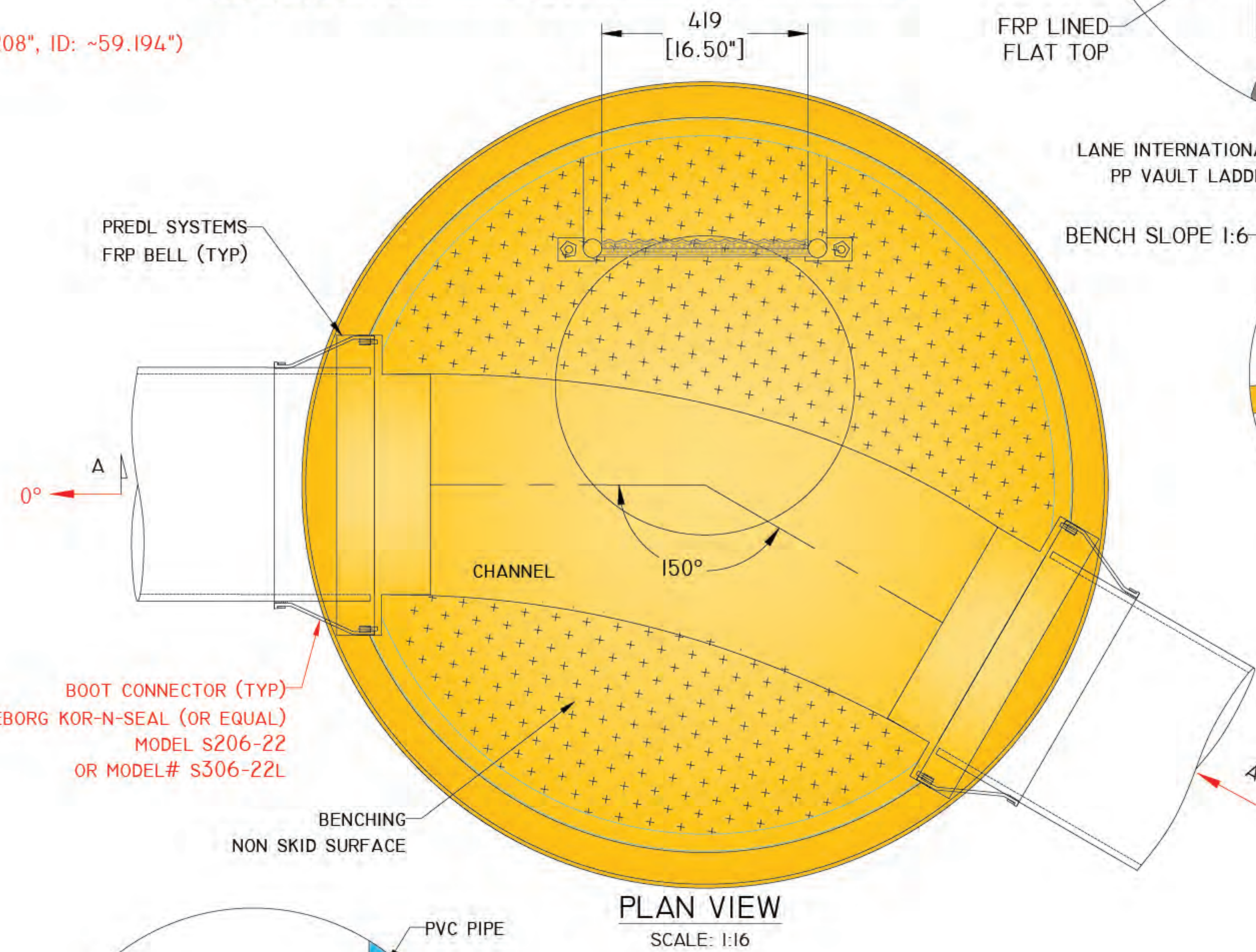
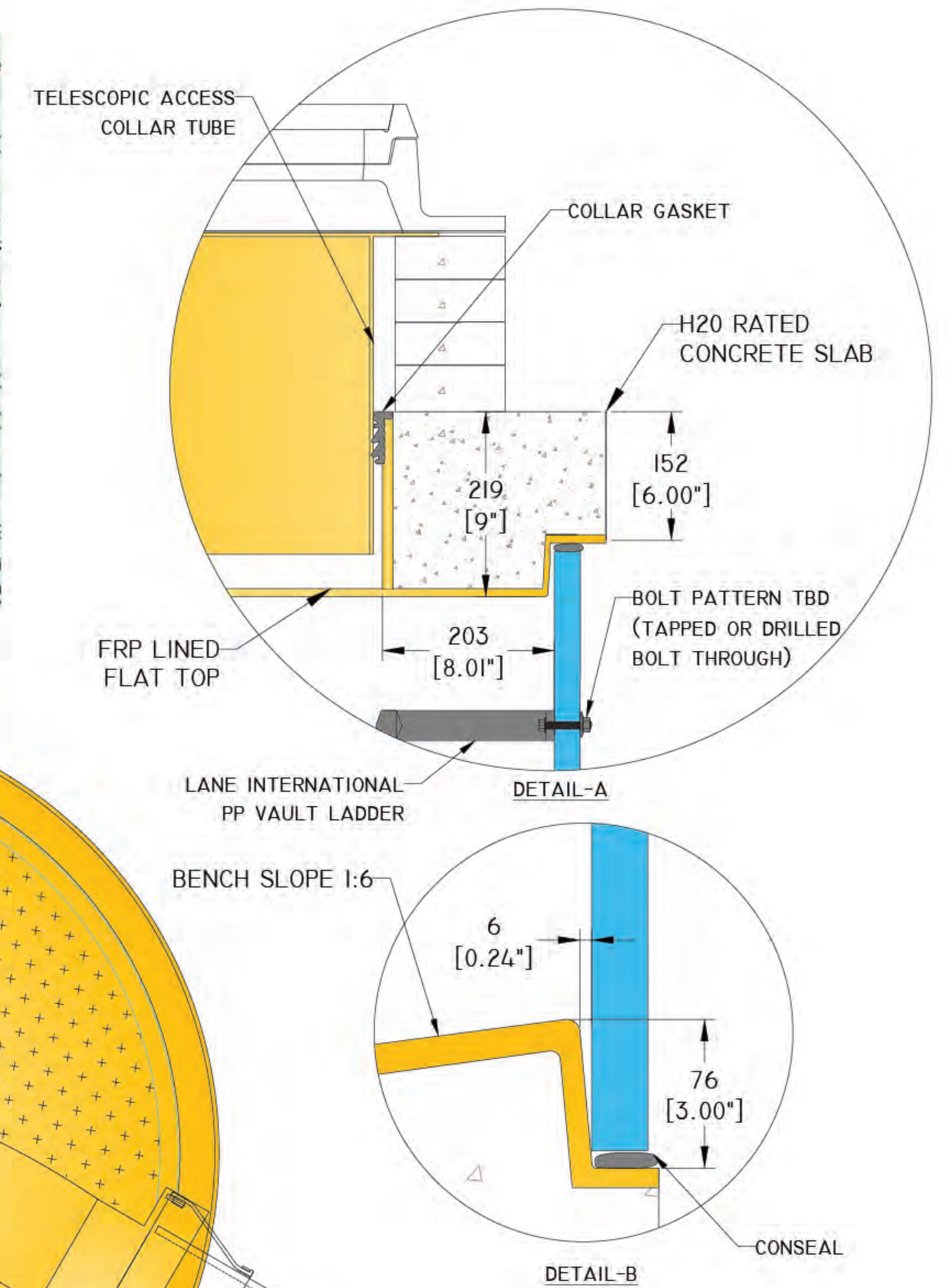
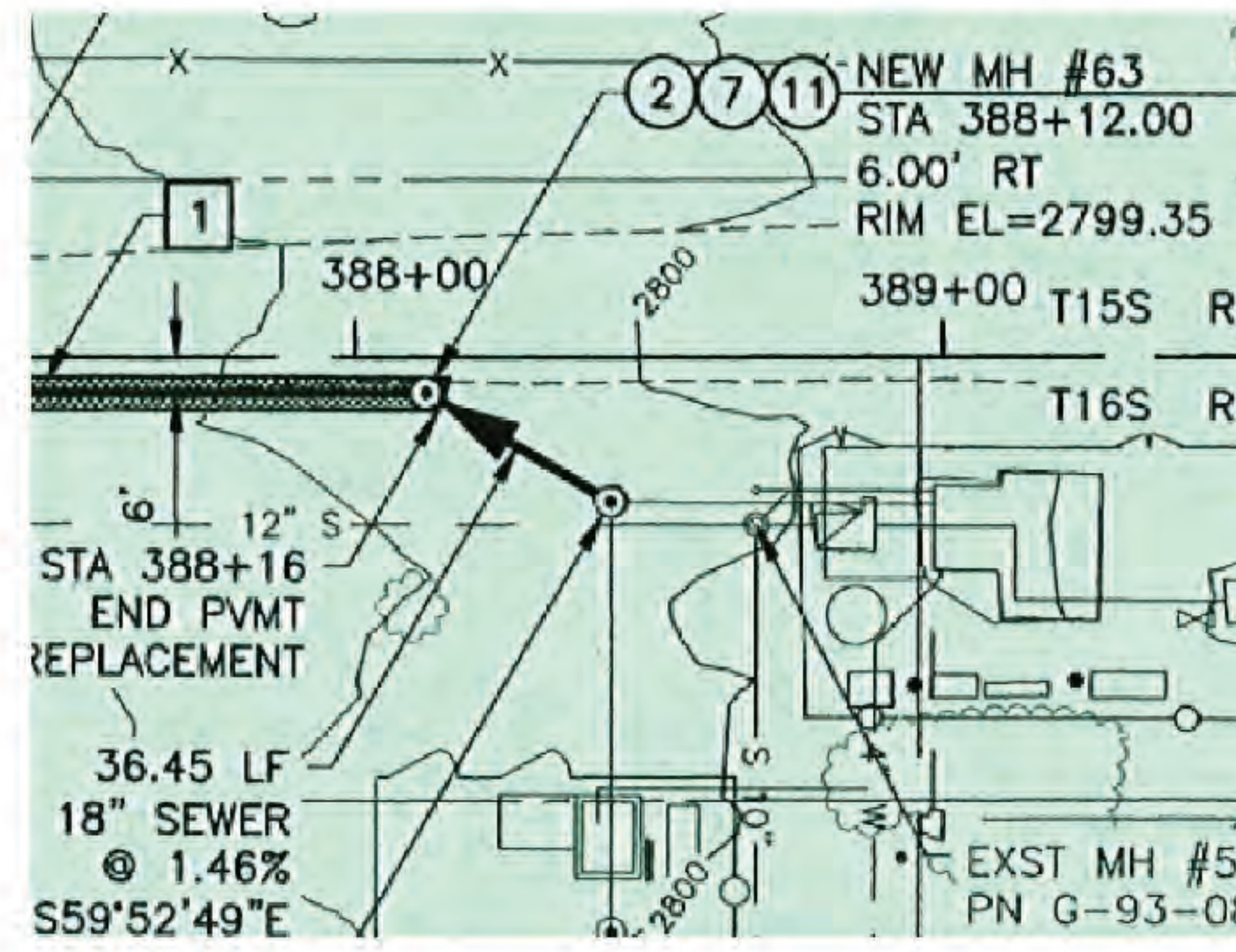
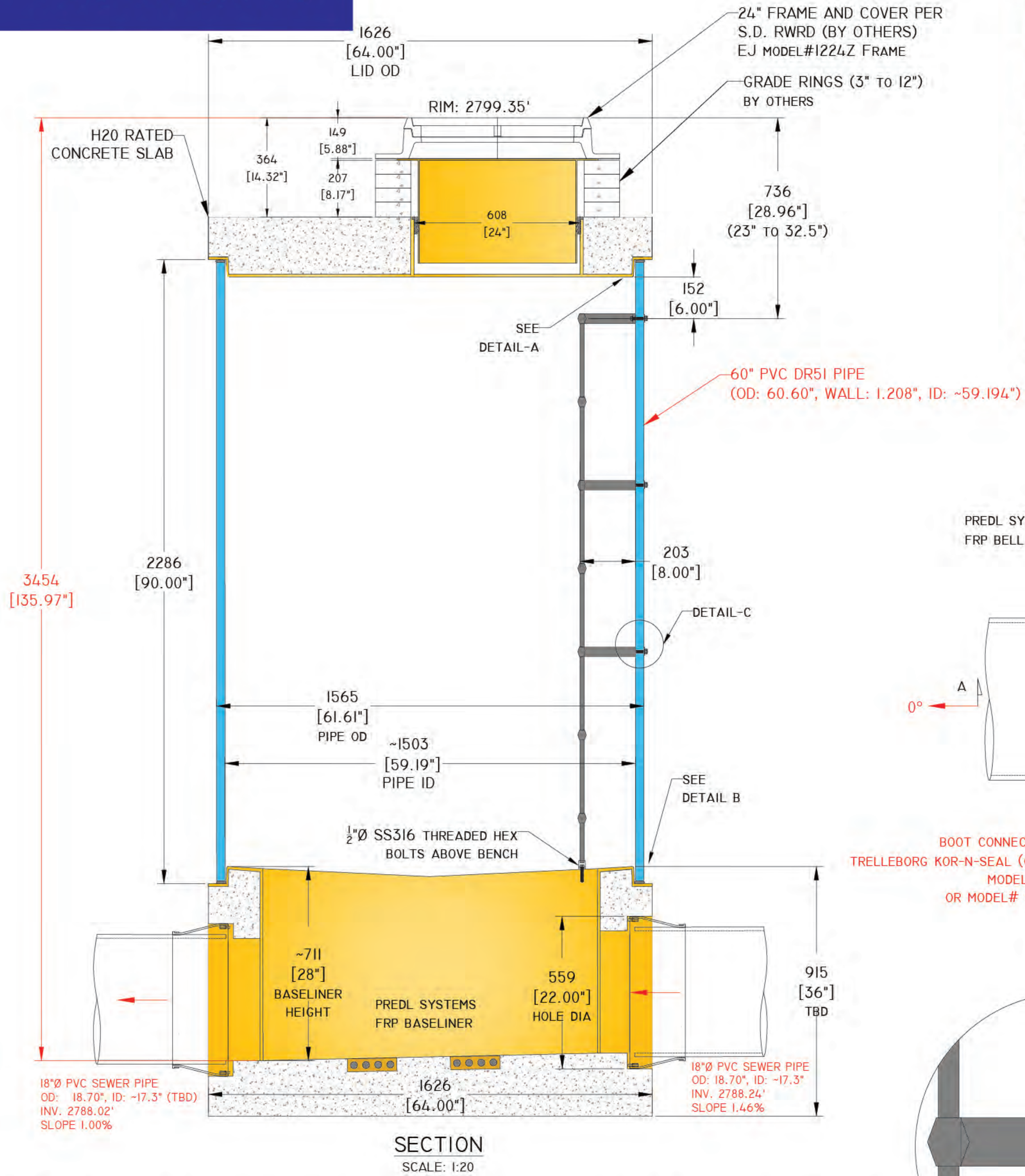
**FIBERGLASS REINFORCED POLYMER (FRP)**  
TYPICAL PHYSICAL PROPERTIES

( FOR COMPONENTS )	TESTING METHOD	COMP. A	COMP. B
VISCOSITY, CPS	BROOKFIELD L.V.F. SPINDLE #2 @ 30 RPM	200	400 - 600
SPECIFIC GRAVITY	ASTM D-1638	1.20	1.15
WEIGHT PER GAL. LBS.		10.00	9.58
COLOR	VISUAL	DARK BROWN	LIGHT BROWN
STYRENE MONOMER CONTENT	ASTM D-1638	20 % IN SYSTEM	1.15
MIX RATIO	BY WEIGHT	31	69
( FOR CURED MATERIAL )	TESTING METHOD	RESULTS ( 0% GLASS )	
TENSILE STRENGTH, PSI	ASTM D-638	13,000	
TENSILE MODULUS, PSI	ASTM D-638	450,000	
FLEXURAL STRENGTH, PSI	ASTM D-790	28,000	
FLEXURAL MODULUS, PSI	ASTM D-790	400,000	
HEAT DISTORTION TEMP.	ASTM D-648	160° F	
ELONGATION, %	ASTM D-638	4	
BARCOL HARDNESS		42	
SHORE D HARDNESS		85	
LINEAR SHRINKAGE, %	ASTM D-2566-88	85	
<b>REACTIVITY DATA ( 100 GRAM MASS @ 74° F )</b>			
DEMOLD TIME		10 - 15 MIN.	
GEL TIME		120 - 180 SECONDS	
<b>PERFORMANCE CHARACTERISTICS</b>			
FIBER WETTING		EXCELLENT	
SAGGING / DRAINING		MINIMAL	
FABRICATING METHOD		ALL ROOM TEMPERATURE METHODS	



# DESIGN

## PVC MH (60in)



**FIBERGLASS REINFORCED POLYMER (FRP)**

Typical Physical Properties

( FOR COMPONENTS ) TESTING METHOD	Comp. A	Comp. B	
VISCOUSITY, CPS	BROOKFIELD L.V.F. SPINDLE #2 @ 30 RPM	200	400 - 600
SPECIFIC GRAVITY	ASTM D-1638	1.20	1.15
WEIGHT PER GAL. LBS.		10.00	9.58
COLOR	VISUAL	DARK BROWN	LIGHT BROWN
STYRENE MONOMER CONTENT	ASTM D-1638	20 % IN SYSTEM	1.15
MIX RATIO	BY WEIGHT	3:1	6:9

( FOR CURED MATERIAL ) TESTING METHOD	RESULTS ( 0% GLASS )	
TENSILE STRENGTH, PSI	ASTM D-638	13,000
TENSILE MODULUS, PSI	ASTM D-638	450,000
FLEXURAL STRENGTH, PSI	ASTM D-790	28,000
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HEAT DISTORTION TEMP.	ASTM D-648	160° F
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SHORE D HARDNESS		85
LINEAR SHRINKAGE, %	ASTM D-2566-88	85

REACTIVITY DATA ( 100 GRAM MASS @ 74° F )

DEMOLD TIME	10 - 15 MIN.
GEL TIME	120 - 180 SECONDS

PERFORMANCE CHARACTERISTICS

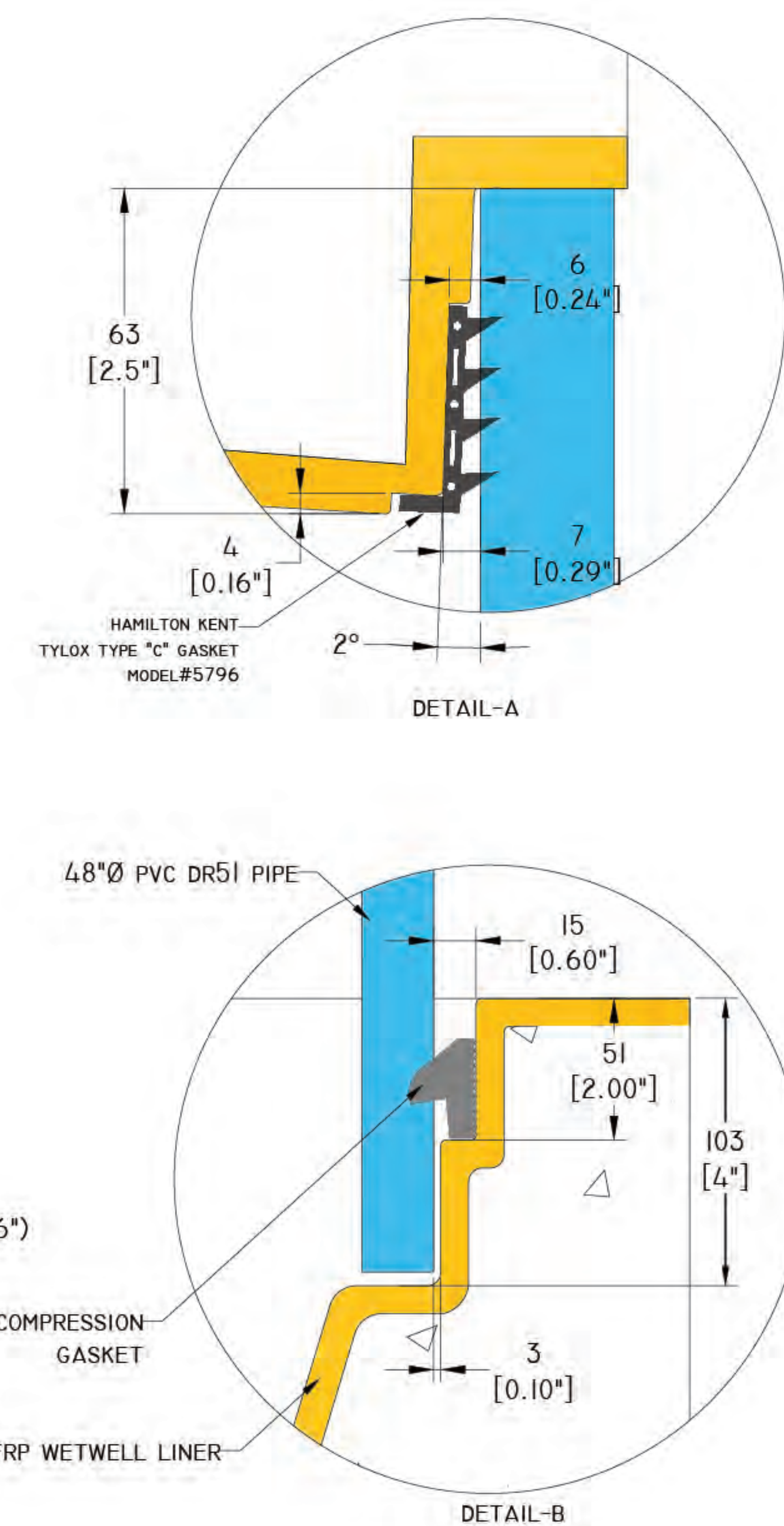
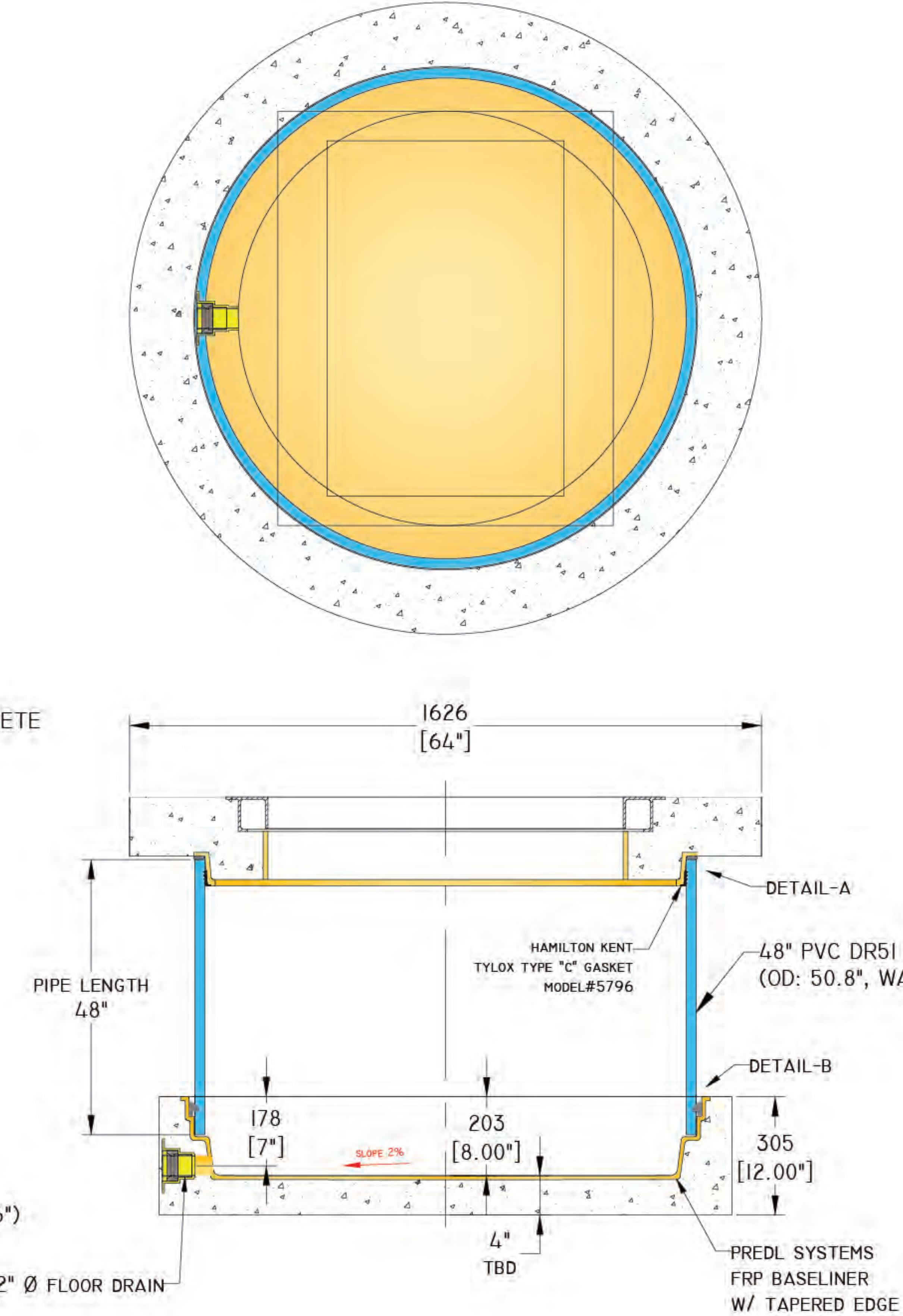
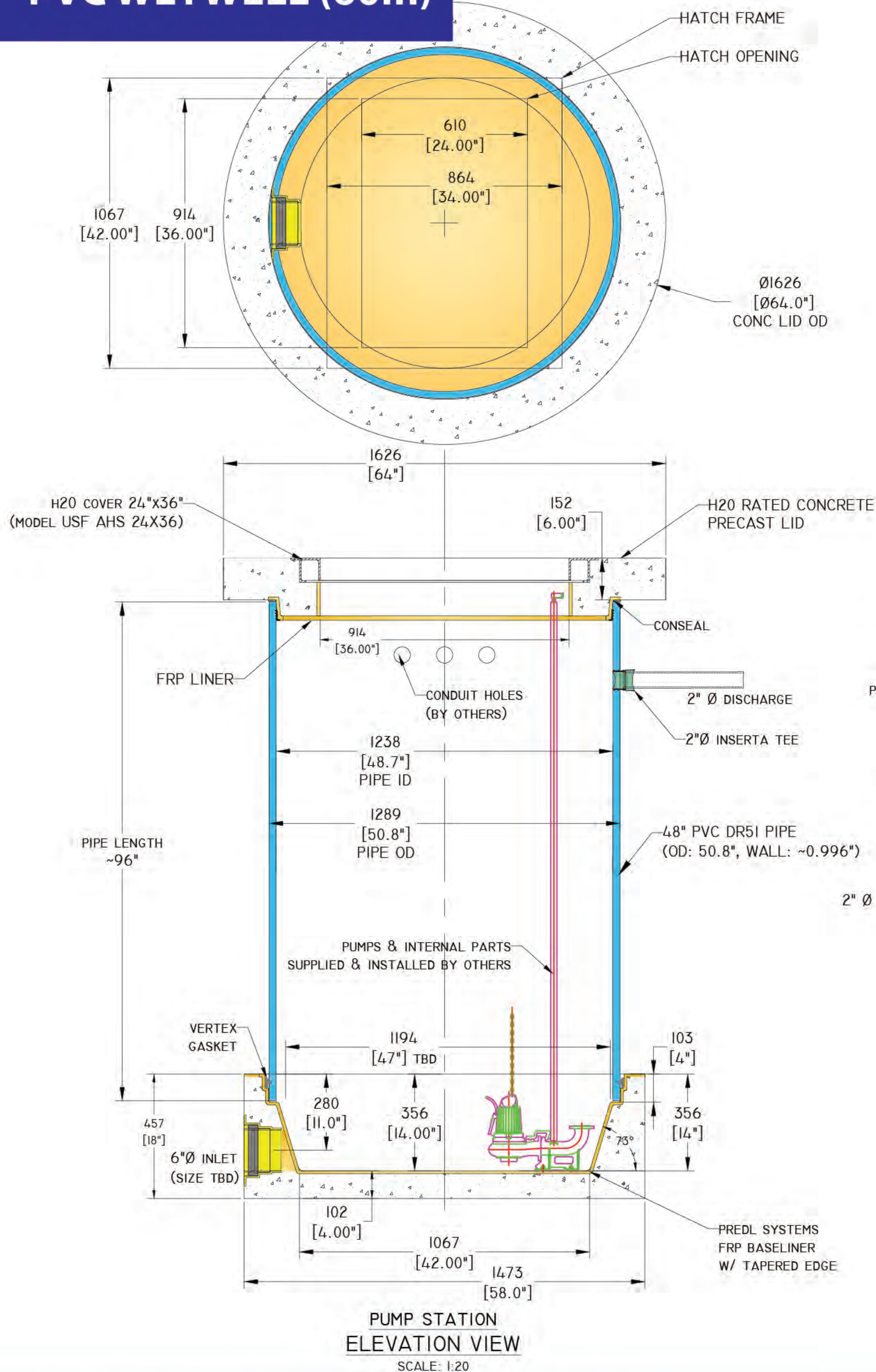
FIBER WETTING	EXCELLENT
SAGGING / DRAINING	MINIMAL
FABRICATING METHOD	ALL ROOM TEMPERATURE METHODS

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  - PRECAST CONCRETE STRUCTURE WITH INTEGRAL PREDL CPL TO BE VACUUM TESTED IN ACCORDANCE WITH ASTM C1244 PRIOR TO FINAL INSTALLATION AND TESTING OF CPL.



# DESIGN

## PVC WETWELL (60in)



**FIBERGLASS REINFORCED POLYMER (FRP)**  
TYPICAL PHYSICAL PROPERTIES

( FOR COMPONENTS )	TESTING METHOD	COMP.A	COMP.B
VISCOSITY, CPS	BROOKFIELD L.V.F. SPINDLE #2 @ 30 RPM	200	400 - 600
SPECIFIC GRAVITY	ASTM D-1638	1.20	1.15
WEIGHT PER GALL. LBS.		10.00	9.58
COLOR	VISUAL	DARK BROWN	LIGHT BROWN
STYRENE MONOMER CONTENT	ASTM D-1638	1.20	20 % IN SYSTEM
MIX RATIO	BY WEIGHT	3:1	6:1
( FOR CURED MATERIAL )	TESTING METHOD	RESULTS ( 0% GLASS )	
TENSILE STRENGTH, PSI	ASTM D-638	13,000	
TENSILE MODULUS, PSI	ASTM D-638	450,000	
FLEXURAL STRENGTH, PSI	ASTM D-790	28,000	
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HEAT DISTORTION TEMP.	ASTM D-648	160° F	
ELONGATION, %	ASTM D-638	4	
BARCOL HARDNESS		42	
SHORE D HARDNESS		85	
LINEAR SHRINKAGE, %	ASTM D-2566-88	85	
REACTIVITY DATA ( 100 GRAM MASS @ 74° F )			
DEMOLD TIME		10 - 15 MIN.	
GEL TIME		120 - 180 SECONDS	
PERFORMANCE CHARACTERISTICS			
FIBER WETTING		EXCELLENT	
SAGGING / DRAINING		MINIMAL	
FABRICATING METHOD		ALL ROOM TEMPERATURE METHODS	



# INSTALLATION GUIDE



100% SELF-PERFORM SITE LABOUR

DIAMOND PLASTICS CORPORATION  
48" PVC  
www.dpcpipe.com

PVC MH RISER

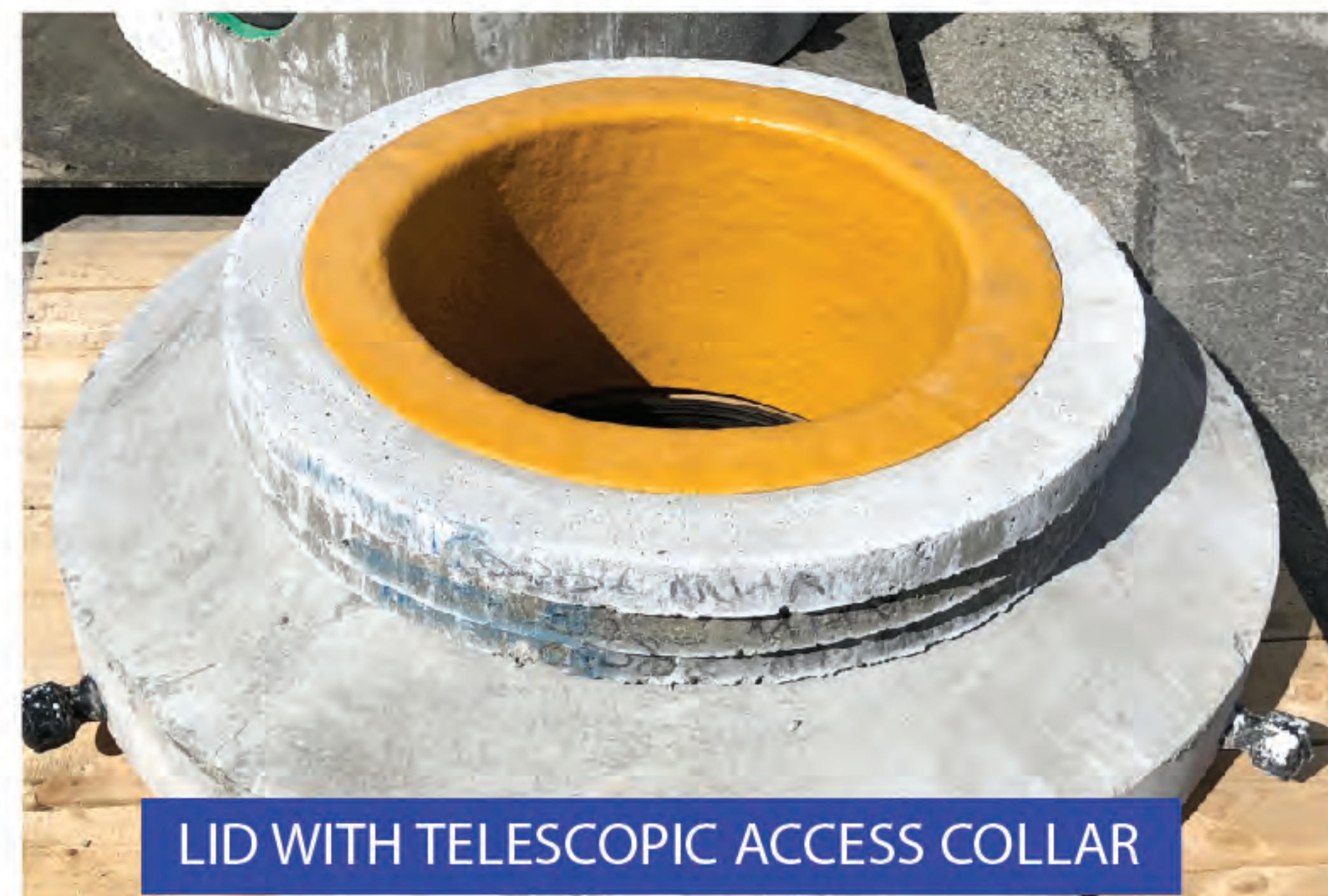
FRP-LINED PRECAST MH BASE

FRP-LINED PRECAST MH LID

3RD PARTY (CSA) CERTIFIED ASTM C478-COMPLIANT MH BASE w/ INTEGRAL PREDL FRP BASELINER w/ BELL & COMPRESSION GASKETS FOR 200mm (8") SDR35 PVC



LID UNDERSIDE



LID WITH TELESCOPIC ACCESS COLLAR



ASTM C990 BUTYL RUBBER MH JOINT SEALANT



1200mm (48") ID DIAMOND PLASTICS DR51 PVC PIPE RISER SET TO MH BASE



ASTM C877-COMPLIANT EXTERNAL MH JOINT WRAP (INCLUDES PRIMER)





# INSTALLATION GUIDE



STUB-OUT OF INLET



ASTM C990 BUTYL RUBBER MH JOINT SEALANT



PARTIAL BACKFILL



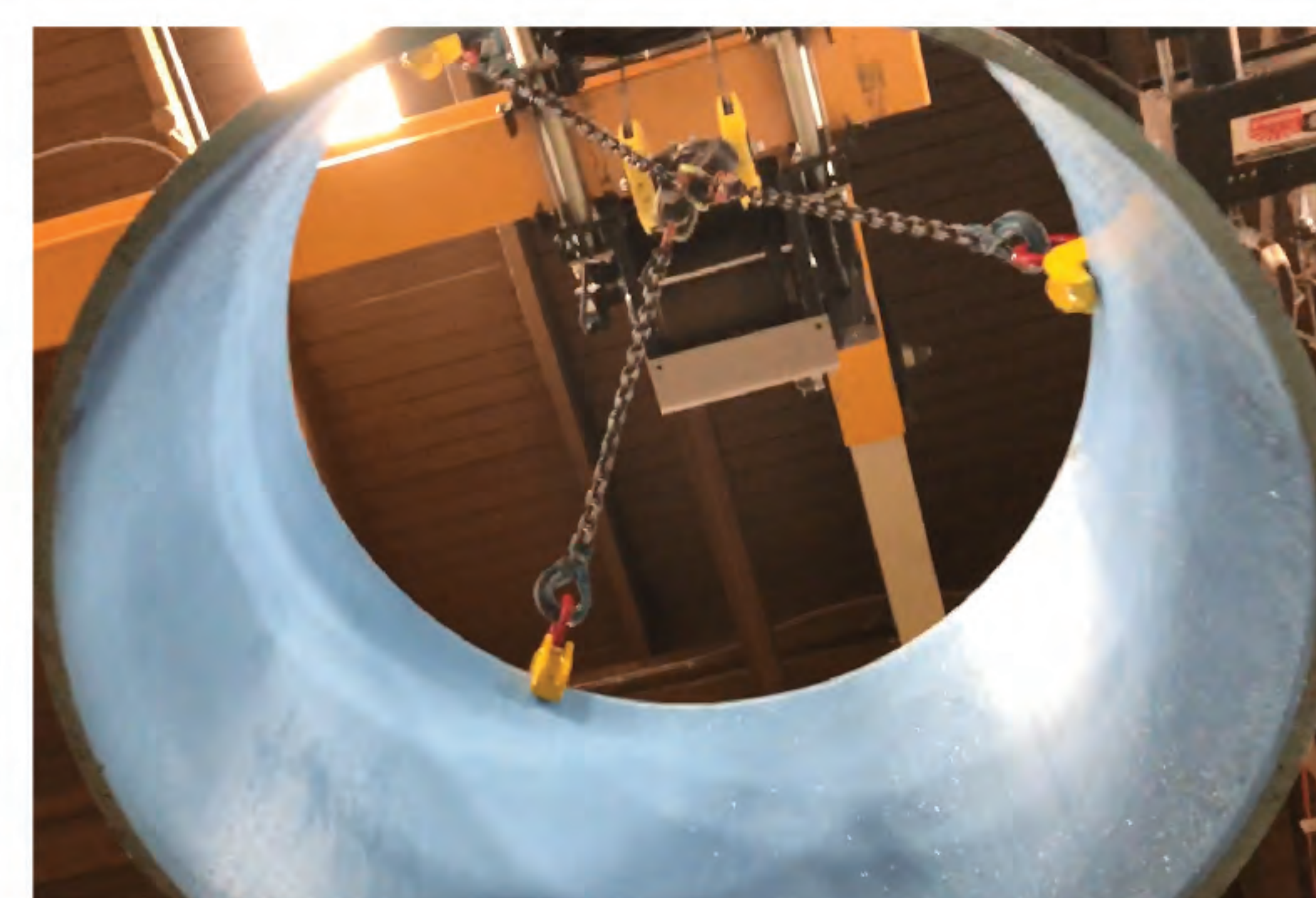
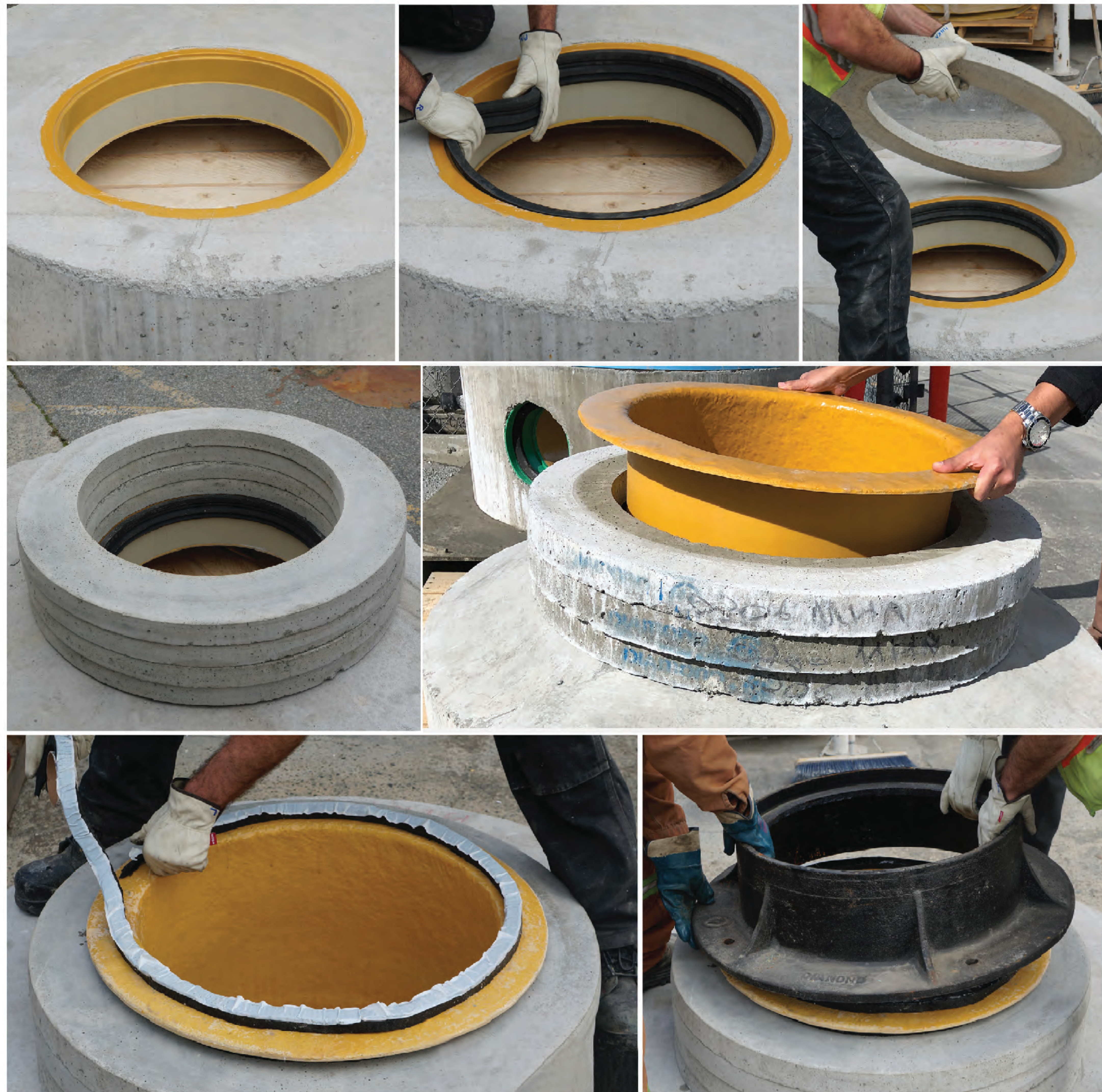
INSTALL H-20 RATED ASTM C478 PRECAST MH LID  
w/ INTEGRAL PREDL FRP LINER & TELESCOPIC ACCESS COLLAR (NOT SHOWN)



# INSTALLATION GUIDE

## TELESCOPIC ACCESS COLLAR COMPLETION DURING FINAL GRADING

## LIFTING SAFETY (3-POINT)





# INSTALLATION GUIDE

## LADDER (AS REQUIRED)



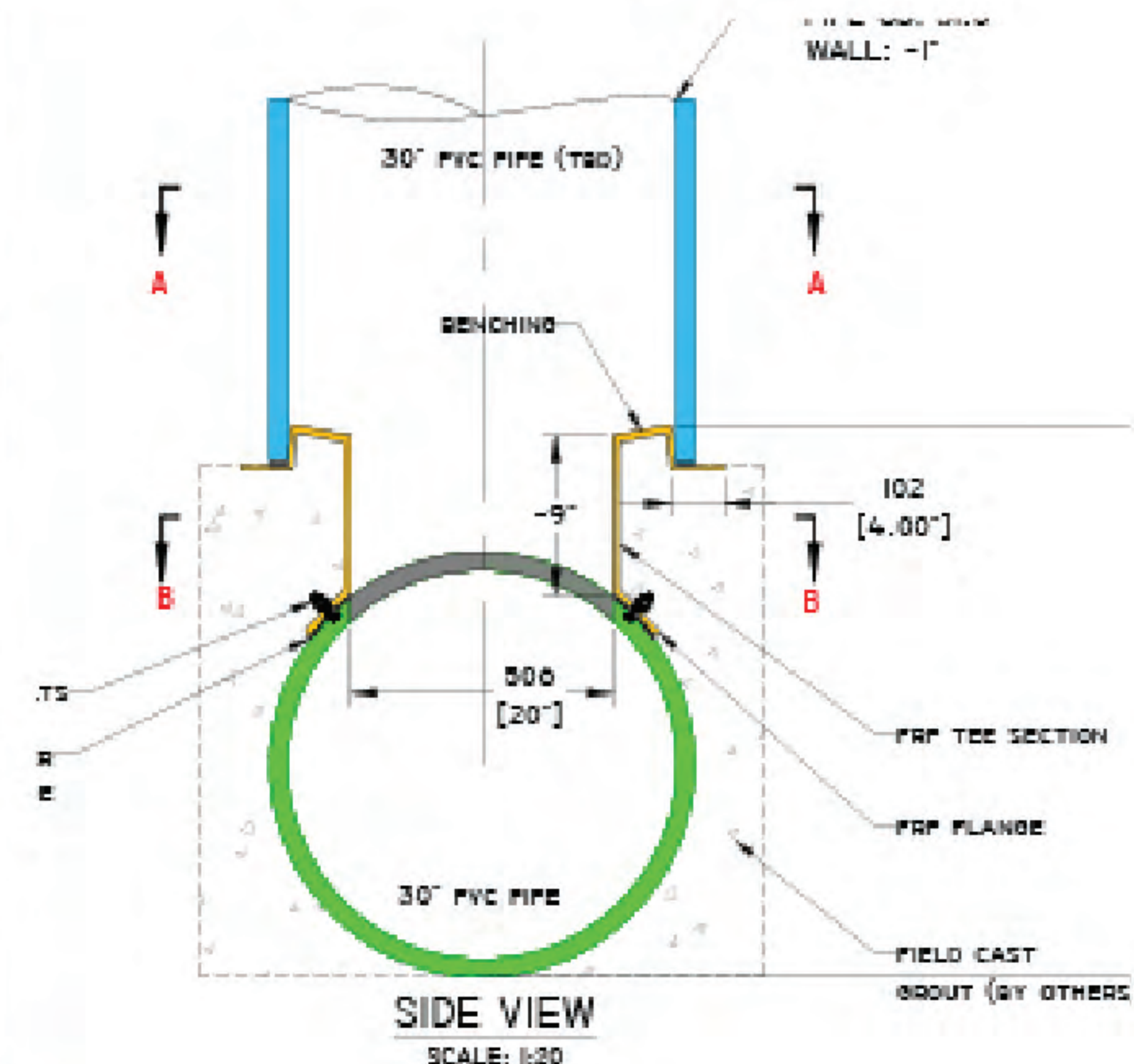
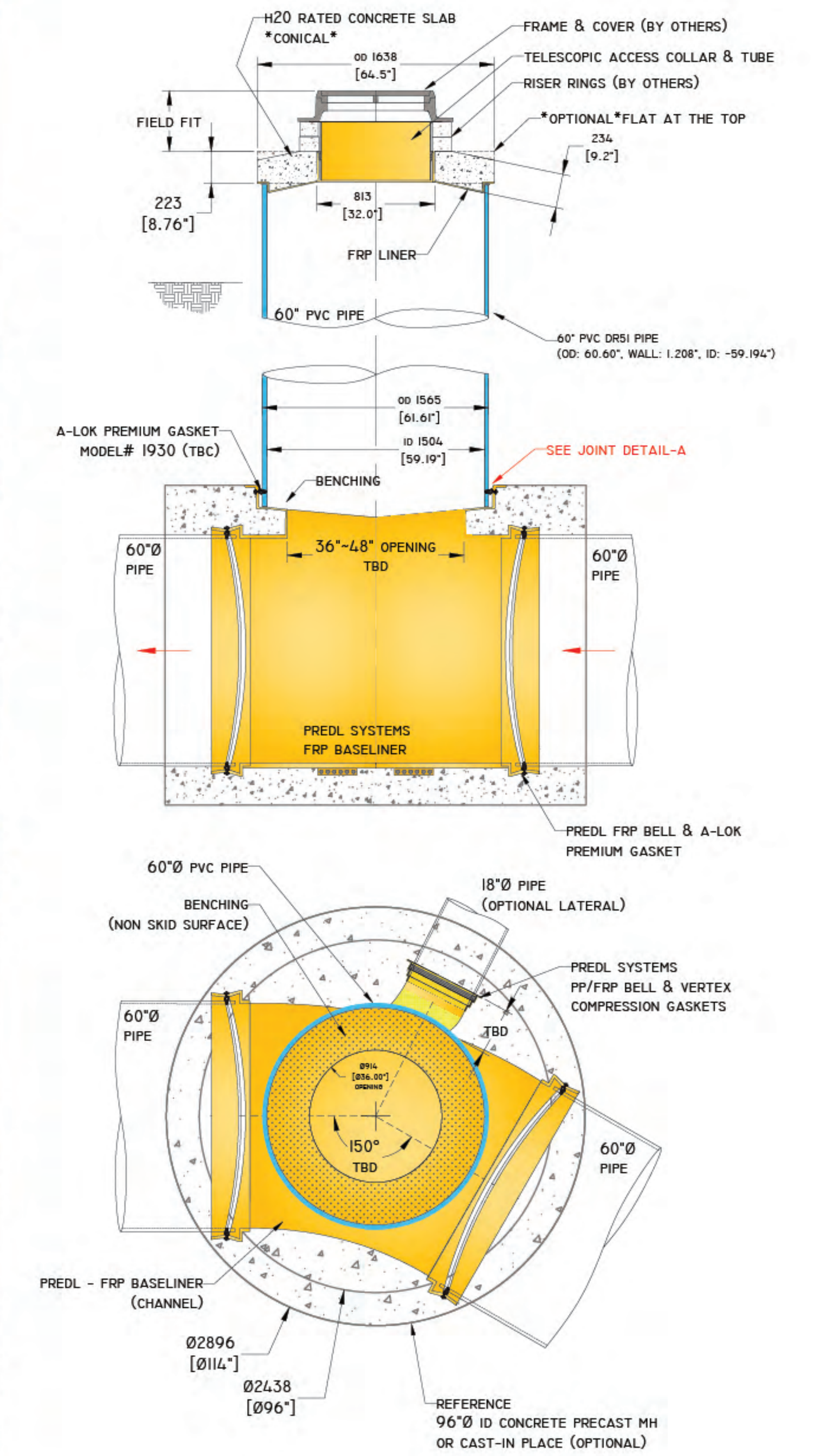
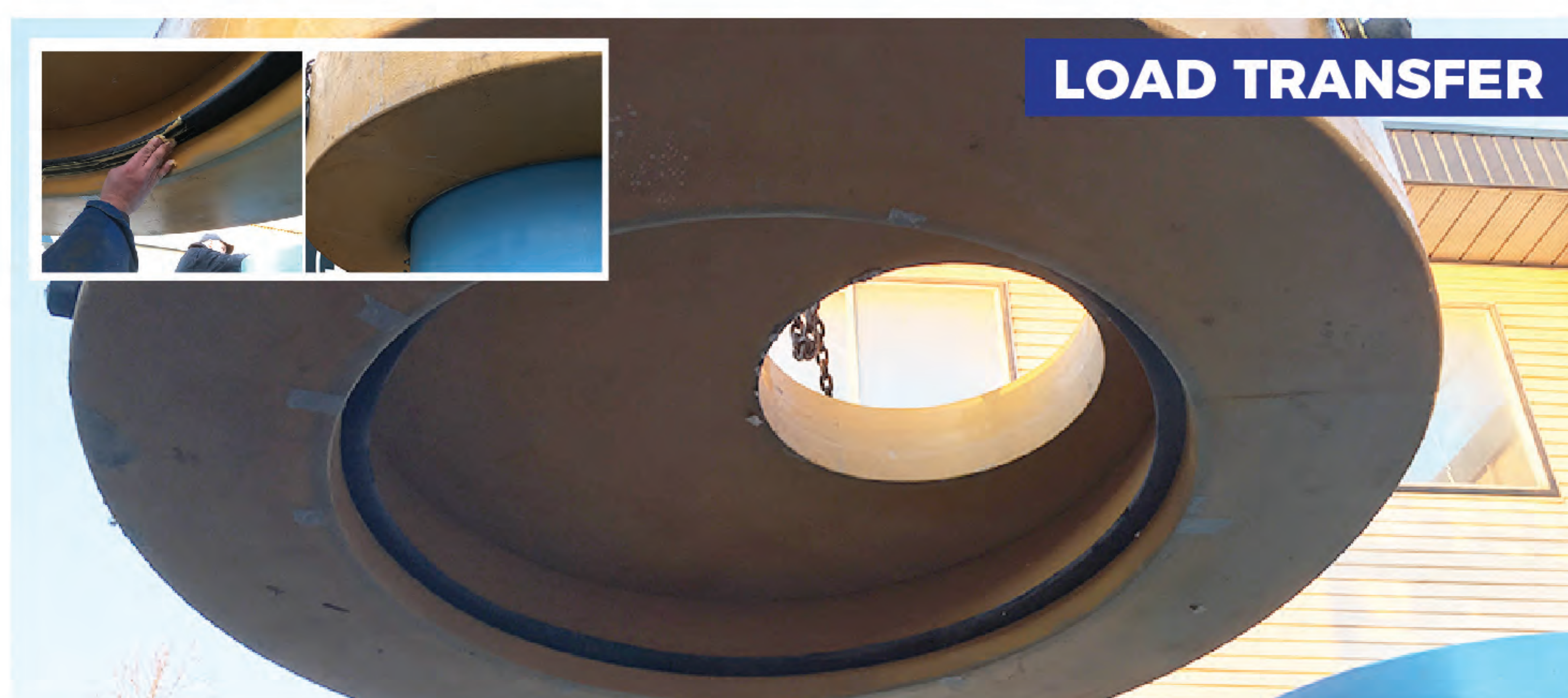
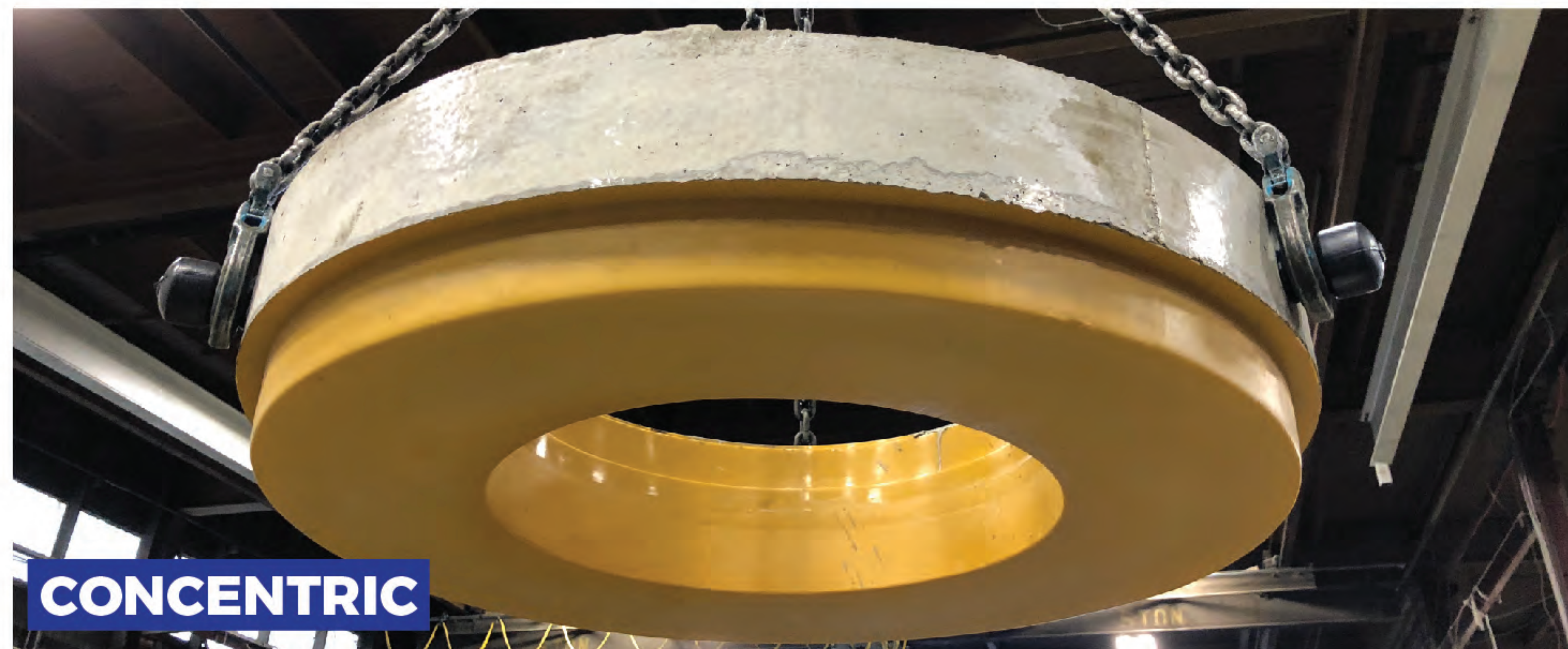
## INSIDE DROP (AS REQUIRED)



MH LADDER INSTALLATION - REQUIRES SS316 HARDWARE w/ O-RINGS



# OPTIONAL CONFIGURATIONS





# CORROSION RESISTANT PREDL FRP + DIAMOND PLASTICS PVC



Uni-Bell Handbook of PVC Pipe Design and Construction (5th Ed.)  
 Chapter 3, Resistance to Aggressive Environments 3.11

Chemical	73°F (23°C)	140°F (60°C)	Chemical	73°F (23°C)	140°F (60°C)
Disodium phosphate	R	R	Glucose	R	R
Dioxane-1,4	N	N	Glue, animal	R	R
Ether	N	N	Glycerine (glycerol)	R	R
Ethyl ether	N	N	Glycolic acid	R	R
Ethyl halides	N	N	Grape sugar	R	R
Ethylene glycol	R	R	Green liquor, paper	R	R
Ethylene halides	N	N	Heptane	R	R
Ethylene oxide	N	N	Hexane	R	N
Fatty acids	R	R	Hexanol	R	R
Ferric salts	R	R	Hydraulic oil	R	N
Fish oil	R	R	Hydrazine	N	N
Fluorine, dry gas	R	N	Hydrobromic acid, 20%	R	R
Fluorine, wet gas	R	N	Hydrochloric acid	R	R
Fluoroboric acid	R	R	Hydrocyanic acid	R	R
Fluorosilicic acid, 50%	R	R	Hydrofluoric acid, 30%	R	N
Formaldehyde	R	R	Hydrofluoric acid, 50%	R	N
Formic acid	R	N	Hydrofluoric acid, 100%	N	N
Freon—F11, F12, F113, F114	R	R	Hydrofluorosilicic acid	R	R
Freon—F21, F22	N	N	Hydrogen	R	R
Fructose	R	R	Hydrogen cyanide	R	R
Furfural	N	N	Hydrogen fluoride	N	N
Gallic acid	R	R	Hydrogen peroxide, 50%	R	R
Gas, coal, manufactured	N	N	Hydrogen peroxide, 90%	R	R
Gas, natural, methane	R	R	Hydrogen phosphide	R	R
Gasoline	R	R	Hydrogen sulfide, aq	R	R
Gelatin	R	R	Hydrogen sulfide, dry	R	R
			Hydroquinone	R	R
			Hydroxylamine sulfate	R	R



## APPROVED PRODUCTS FOR USE IN THE PUBLIC RIGHT-OF-WAY Lining and Coating

Sort by  ascending and then by  ascending Sort

Manufacturer	Model Number	Material	Product Name	Plant	Approval Expiration
Predl Systems	Predl FRP MH Lining System	Fiberglass	Type I Lining	Burnaby, British Columbia, Canada	06/04/2019

## TEST REPORT

City of Los Angeles  
 LABORATORY NUMBER:  
 3804-16-11

## RAMTECH LABORATORIES



14104 ORANGE AVENUE, PARAMOUNT, CA  
 TELEPHONE (562) 633-4924 • FAX (562) 633-4128  
 E-MAIL: [ramteclab@AOL.com](mailto:ramteclab@AOL.com)  
 Website: [www.AQLramtech.com](http://www.AQLramtech.com)

### A Chemical Resistance (Pickle Jar—Weight Change):

#### A1 Test Results:

The results of the Weight Loss Test are summarized below with graphical results presented in Appendix 3

Chemical Solution	Concentration	28-day	56-day	84-day	112-day
Sulphuric Acid (H2SO4)	20%	0.007%	0.013%	0.022%	0.030%
Sodium Hydroxide (NaOH)	5%	0.010%	0.019%	0.030%	0.040%
Ammonium Hydroxide (NH4OH)	5%	0.006%	0.012%	0.019%	0.026%
Nitric Acid (HNO3)	1%	0.005%	0.009%	0.015%	0.021%
Ferric Chloride (FeCL3)	1%	0.003%	0.008%	0.009%	0.014%
Sodium Hypochlorite (NaOCl)	1%	0.003%	0.008%	0.011%	0.016%
Soap	0.1%	0.002%	0.003%	0.005%	0.007%
Detergent (LAS)	0.1%	0.002%	0.003%	0.007%	0.011%
Bacteriological	BOD 700 ppm	0.007%	0.010%	0.020%	0.027%

#### A2 Conditions of Acceptance:

As provided in the 2012 Greenbook (Table 211-2B), the allowable weight change was 0.75% when testing a product having a nominal thickness of 0.375 inches or less.

\*R = generally resistant; C = less resistant than R but still suitable for some conditions; N = not resistant

This table is meant to aid the designer in decisions as to transporting/conveyance of undiluted chemicals. Chemical resistance data are provided as a guide only. Information is based primarily on immersion of unstressed strips in chemicals and to a lesser degree on field experience.



# VACUUM TEST REPORT



Metro Testing Laboratories (Burnaby)  
A Division of CCMET INC.  
HEAD OFFICE  
6991 Curragh Avenue  
Burnaby, BC V5J 4V6

t 604.436.9111  
tf 1.877.436.9117  
f 604.438.5317  
e info@metrotesting.ca  
w metrotesting.ca

## 2.0 TESTING PROCEDURE AND RESULTS

Metro used Karol Wagner Vacuum Gauge (Serial Number 7686) which was factory calibrated on April 4, 2018. The absolute atmosphere pressure was measured 759 mm HG at the Diamond Precast yard level (see Picture 1). Metro relatively decreased the pressure up to 254 mm HG (10 in of HG) (Absolute pressure  $759 - 254 = 505$  mm HG) and shut the valve to disconnect the manhole from the vacuum pump. Metro then measured the time for the manhole pressure to drop from 10" HG to 9" HG (Absolute pressure drop from 505 mm HG to 531 mm HG).

Metro repeated the test twice for each configuration. For the first configuration the recorded time was **30 and 35 seconds**. For the second configuration for the first round of the test, the first measured time was 195 seconds and for the second time it was more than 300 second (the test stopped at 5 minute (300 second) at 524 mm HG).

As per the ASTM Table 1 for the Manhole with a nominal 48 in of the diameter and 6 feet depth, the minimum specified time is **15 seconds**.

## 3.0 Conclusion:

As per test results, Both Manhole configurations have successfully passed the test and meet of ASTM C1244-11 specifications.

We trust that this report meets your present requirements; if you have any questions, please feel free to contact us at 604-436-9111.

**Metro Testing Laboratories (Burnaby)**  
A division of CCMET Inc.



*Abdollah (Abdi) Yadegari*

Abdollah (Abdi) Yadegari, P.Eng.  
Filed Engineer



# H-20 LOAD TEST ASTM D3753



Metro Testing Laboratories (Burnaby)  
A Division of CCMET INC.  
HEAD OFFICE  
6991 Curragh Avenue  
Burnaby, BC V5J 4V6

t 604.436.9111  
tf 1.877.436.9117  
f 604.438.5317  
e info@metrotesting.ca  
w metrotesting.ca

### 3.0 OBSERVATIONS AFTER MANHOLE DISMANTLING:

On 08 June 2018, Metro observed the following after dismantling of Manhole components:

- ☒ Gaskets were installed at the top and bottom vertical interfaces of PVC pipe and concrete pieces. One layer of the mastic was observed at the bottom horizontal interface of the PVC pipe and concrete base (pressed thickness of the mastic was 1-2 mm).

Client informed Metro that Hamilton Kent, Tylox Type "C" gasket, Model 5796 as an ASTM C443ASTM compliant Manhole Riser gasket, was used.

ConSeal, CS-102 Butyl Rubber Sealant (called mastic in this report) was used in the manhole assembly. As per the materials technical data sheet, the mastic is an ASTM C990-compliant Butyl Mastic Sealant.

### 4.0 CONCLUSION:

- ☒ The recorded vertical deflection at 24000 lbf was 0.085 in. (2.17 mm), which is below than the allowable deflection value of 0.25 in. (6.35 mm) as per clause 6.4.1 of ASTM D3753-12.
- ☒ After maintaining the 40,000 lbf load for 15 minutes as per clause 6.4.1 of ASTM D3753-12, Metro did not observe water any leakage, new cracks or damages in the manhole structure.

Metro closely reviewed different parts of the manhole such as the fiber glass collar under the concrete rings to detect any potential damage.

As per test results, Metro hereby confirms that test manhole meets the 16000lbf (~71kN) dynamic load rating as per clause 6.4.1 of ASTM D3753-12.

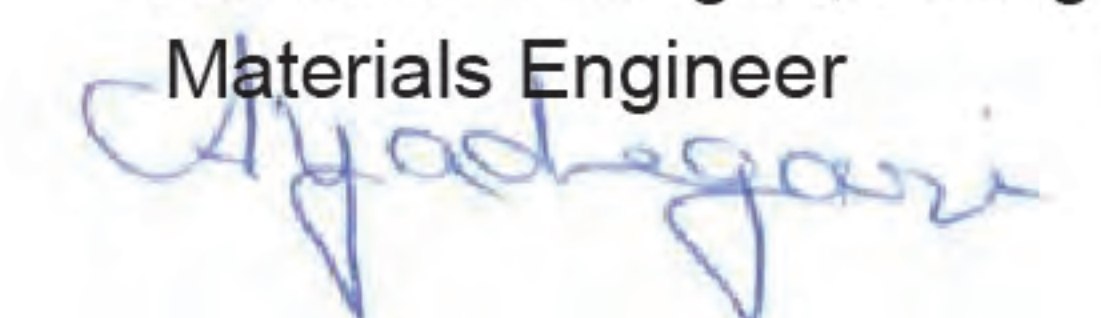
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For Metro Testing Laboratories (Burnaby)  
A division of CCMET Inc.

Reviewed by:



Abdollah Yadegari, P.Eng  
Materials Engineer





# BILL OF MATERIALS

- MANHOLE BASE: ASTM C478 PRECAST CONCRETE w/ INTEGRAL PREDL FRP LINER INCLUDING INTEGRAL BELL & GASKET PIPE CONNECTIONS
- MANHOLE RISER: DIAMOND PLASTICS TRANS-21 C900 48" DR-51 PRESSURE CLASS PVC PIPE, CUT TO HEIGHT
- MANHOLE LID: H-20 (OR H-25) RATED ASTM C478 PRECAST CONCRETE w/ INTEGRAL PREDL FRP LINER & TELESCOPIC ACCESS COLLAR
- GRADE RINGS: ASTM C478 PRECAST CONCRETE GRADE RINGS TO HEIGHT
- MANHOLE FRAME & COVER: TO LOCAL STANDARD
- JOINT SEALANT: ASTM C990 BUTYL RUBBER SEALANT
- JOINT WRAP: ASTM C877 EXTERNAL JOINT WRAP

## OPTIONAL:

- MAN ENTRY: ASTM C497 LADDER & LADDER RUNG ASSEMBLY
- INSIDE DROP: PREDL GU300 INSIDE DROP ASSEMBLY (INCLUDING ASTM F477 CONNECTION)