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☑ INFORMATION ONLY ☐ INTERNAL REVIEW ☐ CLIENT REVIEW/COMMENT ☐ CLIENT APPROVAL ☐ QUOTATION ☐ PURCHASE ☐ CONSTRUCTION	FOR PREDL Manhole installation and testing BCG Project Number: 050590-01-001	☑ ENTIRE REPORT ATTACHED ☐ ISSUED REVISED SHEETS ONLY REVISION: 0

Field Report

PREDL Systems

11/12/2018

REV	DATE	BY	APPROVALS			REVISION DESCRIPTION
			QA/QC	PM	CLIENT	
D0						
D1						
D2						
0	11/12/18	RL	AV	AV		Issued for Information
1						
2						

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PREDL Manhole installation and testing

1.0 Introduction

This report summarizes the manhole installation and testing activities performed by B&F Construction Company on Wednesday, October 31, 2018 and Wednesday, November 7, 2018. The installation occurred at approximately 32°04'32.6"N 110°52'03.9"W. The manhole is part of a sewer pipeline for Pima County, Arizona.

2.0 Summary of Contractor Activity

2.1 Manhole Installation

On Wednesday, October 31, 2018, B&F Construction installed the PVC manhole raiser and concrete base with the PREDL Systems FRP Baseliner, concrete ring were installed after the work on this day, see Figure 1,Figure 3, and Figure 6. Personnel representing the following firms were at the site monitoring the installation:

- PREDL Systems
- Bowman Consulting Group
- Diamond Plastics
- Pima County
- B&F Construction
- Borderland Construction
- Construction Product Marketing
- Westland Resources
- Dibble Engineering

After the placement of the manhole and concrete ring, no further relevant activities took place.

2.2 Vacuum Pressure Testing

B&F performed the pressure testing of the manhole on Wednesday, November 7. Prior to the testing, B&F backfilled around the manhole, see photos under Figure 10. On site the day of the test were representatives from:

- Bowman Consulting Group
- B&F Construction

- Construction Product Marketing

The Contractor placed plugs in both ends of the sewer pipe and inflated them prior to the test. The vacuum test began at 0810 and stopped at 0812. B&F had to disassemble the pressure testing apparatus and fix it. After resolving the issue, the test began again at 8:32. The pressure reached -10 in. Hg at 8:34. B&F monitored the pressure for two minutes before the manhole was depressurized. During that time, a negligible change in pressure occurred. PREDL Manhole passed the vacuum test OK.

3.0 Recommendations

After field observations and giver our experience and knowledge with the PREDL manhole design we make the following recommendations/observations.

3.1 Pipe Boot Strap

The strap used to attach the pipe boot to the PVC sewer pipe was a steel external strap/clamp (See Figure 2 Pipe boot strap). The strap is subject to corrosion and may be difficult to access if it becomes damaged and stops working. For this reason, it is recommended to use an alternative method of connection such as a corrosion resistant, internally controlled junction (Bell) or strap/clamp. It is our understanding PREDL does produce such a product.

3.2 Buoyancy Protection

The concrete base assembly contains as build in conter way for buoyancy protection which makes for a very heavy base, see Figure 4. Reviewing the design parameters and calculations for buoyancy these show no need for any counterweight feature, please see Figure 7 for the optional non-conterweigt manhole and Figure 8 showing a comparisio on the bouyancy safety factors (per ASTM F 1759-97,2004). and as such, it is recommended that in the future, the need for additional buoyancy protection is evaluated. This would allow for a lighter, more maneuverable base to be used.

3.3 Ladder Connection

The ladder is currently secured with a 1/2” SS316 threaded hex bolted connection to the raiser, see Figure 9 for details of this connection provided by PREDL. See also Figure 3 for a photograph showing the ladder in place.

APPENDIX 1

Figure 1 Manhole base with FRP liner

Figure 2 Pipe boot strap

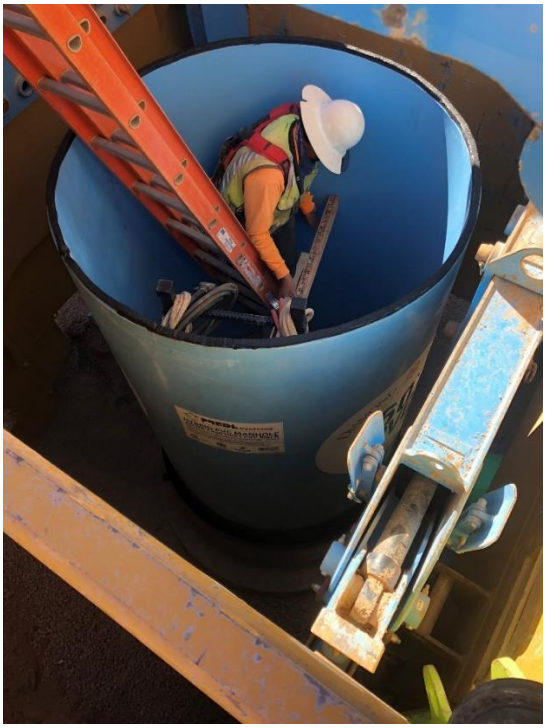


Figure 3 Manhole raiser in place (note ladder installation)

Figure 4 Manhole base (note added weigh ring to prevent buoyancy)

Figure 5 Manhole adjusting ring Installation

Figure 6 Manhole lid

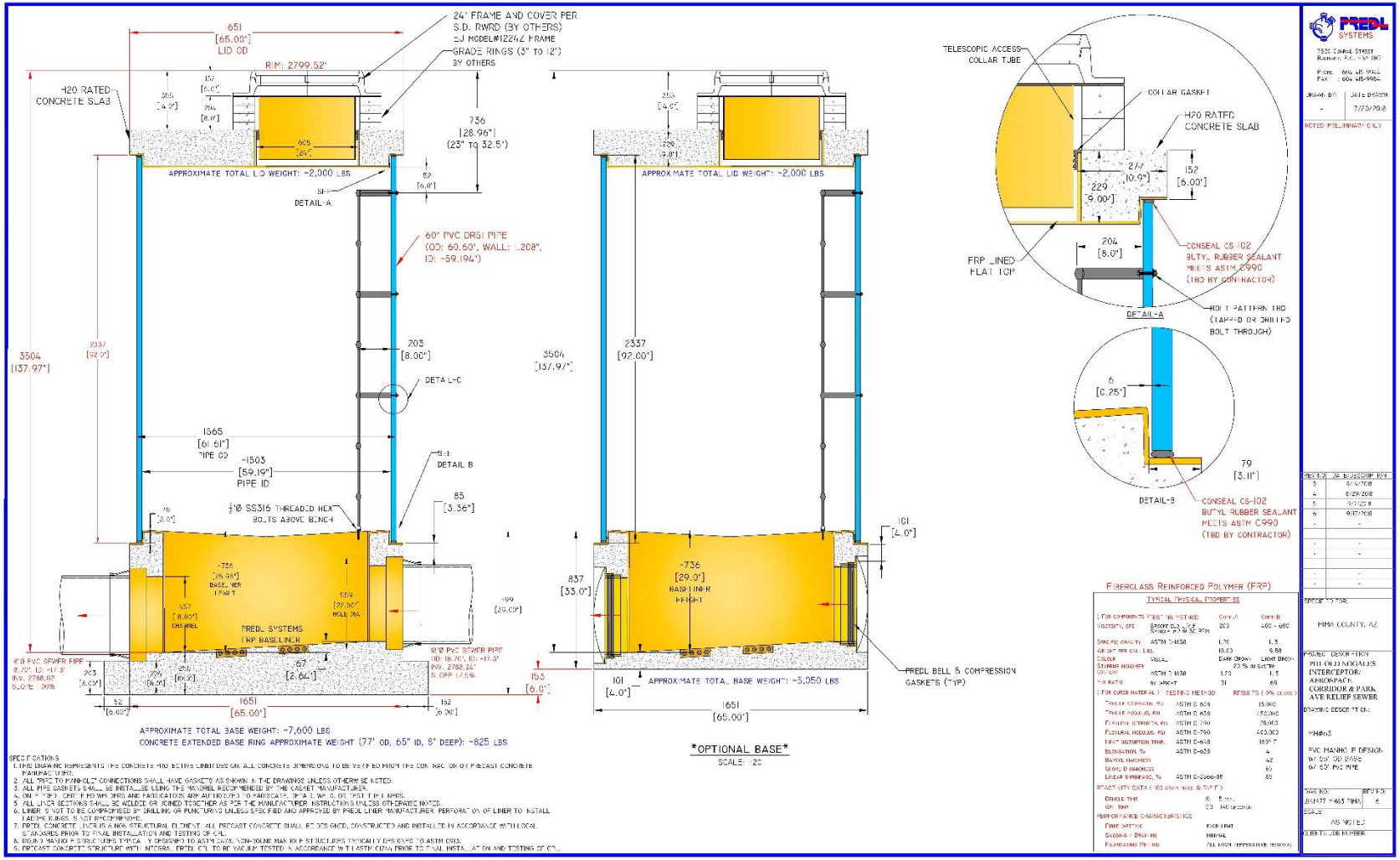


Figure 7 Manhole base options

PVC Material Information

PVC Pipe ID	60.000	inch
Wall Thickness	1.208	inch
I of Wall	0.147	Inch^4/in

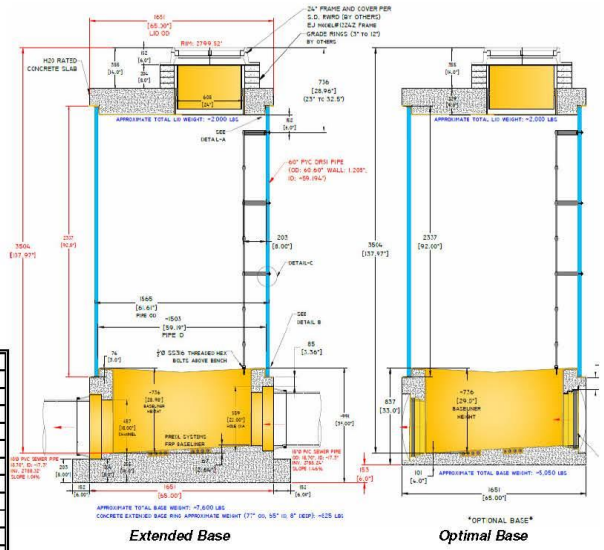
Soil Information

Water Desity	62.4	lbs/cu.f
Counter weight Soil Desity	80	lbs/cu.f
soil dry density	120.000	lbs/cu.f
soil sat. density	135.000	lbs/cu.f
soil intet.friction angle	30.000	
friction coefficient	0.400	psi,E'
Soil Modulus	1000.000	
active Earth pres. Coe.	0.333	

Buoyancy Effect Check

Counter Weights considered in the calculation:

1. Backfill soil weight on top of the lid
2. Self-weight of base and lid
3. Soil carried by the extened base or anti-floation Ring
4. PVC self-weight
5. Down Drag Force by soils



Extended Base *Optimal Base*

Calculation Sheet

Manhole Depth	PVC Length	D.D.Shear Stress	D.D. Force	Buoyancy Force	Bouyancy Effect Safety factor	
ft	ft	lbf/sf	lbs	lbs	*Extended Base*	*Optimal Base*
4.00	1.00	27.23	444.87	4900.88	2.60	2.18
5.00	2.00	38.12	1245.63	6126.11	2.25	1.90
6.00	3.00	49.01	2402.29	7351.33	2.07	1.77
7.00	4.00	59.90	3914.85	8576.55	1.99	1.71
8.00	5.00	70.79	5783.30	9801.77	1.96	1.71
9.00	6.00	81.68	8007.65	11026.99	1.97	1.74
10.00	7.00	92.57	10587.89	12252.21	2.01	1.79
11.00	8.00	103.46	13524.03	13477.43	2.06	1.86
12.00	9.00	114.35	16816.06	14702.65	2.13	1.94
13.00	10.00	125.24	20463.99	15927.87	2.22	2.03
14.00	11.00	136.13	24467.81	17153.10	2.31	2.13
15.00	12.00	147.02	28827.53	18378.32	2.41	2.23
16.00	13.00	157.91	33543.15	19603.54	2.51	2.34
17.00	14.00	168.80	38614.66	20828.76	2.62	2.46
18.00	15.00	179.69	44042.06	22053.98	2.74	2.58
19.00	16.00	190.58	49825.36	23279.20	2.85	2.70
20.00	17.00	201.47	55964.56	24504.42	2.97	2.82
21.00	18.00	212.36	62459.65	25729.64	3.09	2.94
22.00	19.00	223.25	69310.64	26954.86	3.22	3.07
23.00	20.00	234.14	76517.52	28180.09	3.34	3.20
24.00	21.00	245.03	84080.30	29405.31	3.47	3.33
25.00	22.00	255.92	91998.97	30630.53	3.60	3.46

D.D.FORCE: *Down Drag Force*

Counter weight Extened base =	7600	lbs
Counter weight Optimal base =	5650	lbs
Counter weight (lid) =	2000	lbs
PVC Riser Weight (per foot length)=	155	lbs/ft

Figure 8 Bounyancy comparision table.

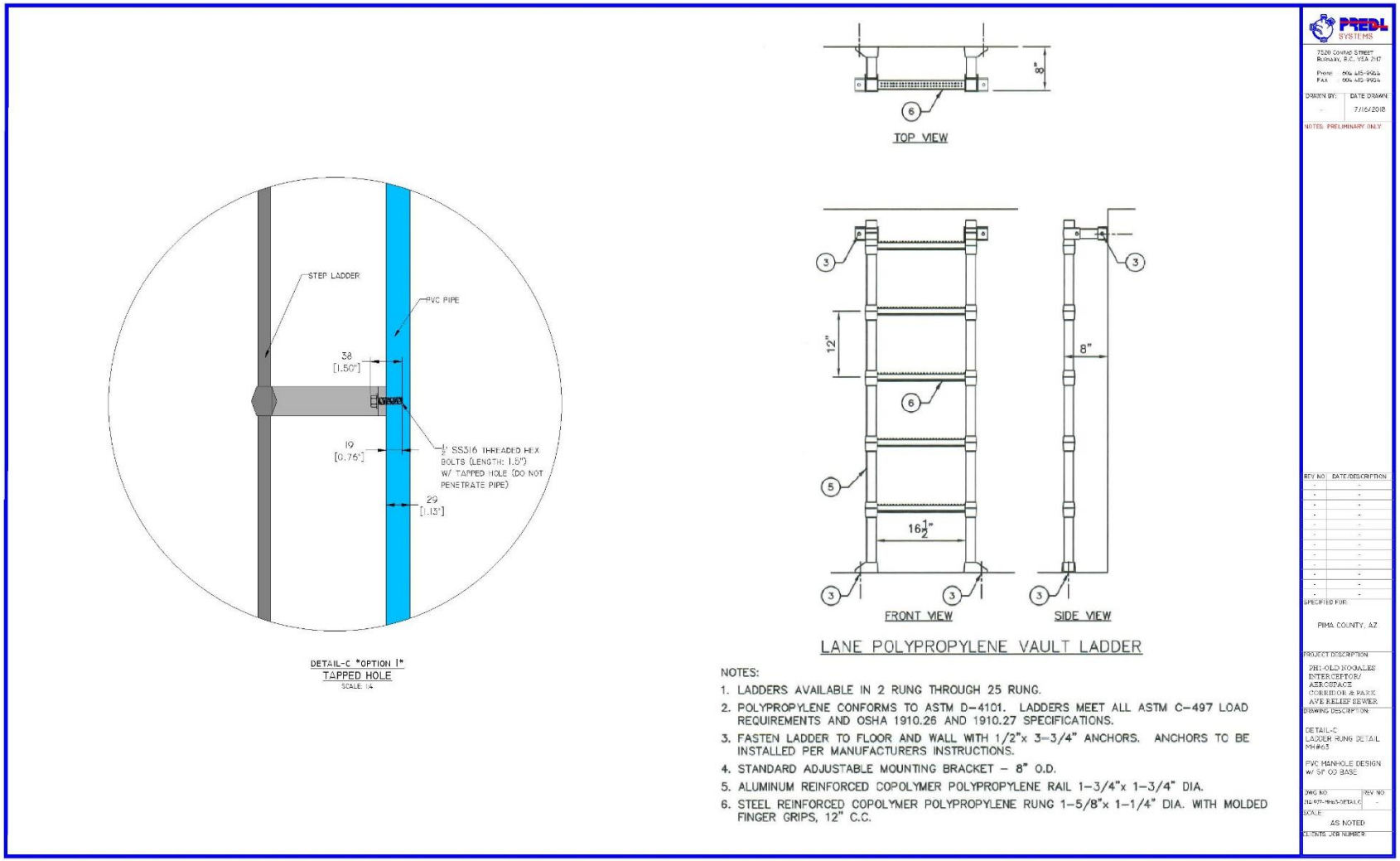


Figure 9 Ladder hung details


-15
-20
-25
-30
-40
-80
-20
0
PFQ SERIES
kPa
inHg
WINTERS
www.winters.com
P/N 110-38

Figure 10 Manhole pressure testing photos