

BEDFORD REGIONAL WATER AUTHORITY HELM STREET TANK REPLACEMENT

TOWN OF BEDFORD, VA BRWA JOB# 2021-111

GENERAL INFORMATION

OWNER/DEVELOPER: BEDFORD REGIONAL WATER AUTHORITY
CONTACT: RHONDA B. ENGLISH, PE
1723 FALLING CREEK ROAD
BEDFORD, VA 24523
PHONE: (540) 586-7679

ENGINEER: WHITMAN REQUARDT, & ASSOCIATES, LLP
CONTACT: PAULA MOORE, PE
1700 KRAFT DRIVE, SUITE 1200
BLACKSBURG, VA 24060
PHONE: (540) 328-1114
FAX: (540) 951-3741

SOURCE OF SURVEY: LUMSDEN ASSOCIATES, P.C. ENGINEERS-SURVEYORS-PLANNERS
CONTACT: LARRY THOMAS OGLE, JR. LS#2459
4664 BRAMBLETON AVENUE P.O. BOX 20669
ROANOKE, VA 24018
PHONE: (540) 774-4411
FAX: (540) 772-9445

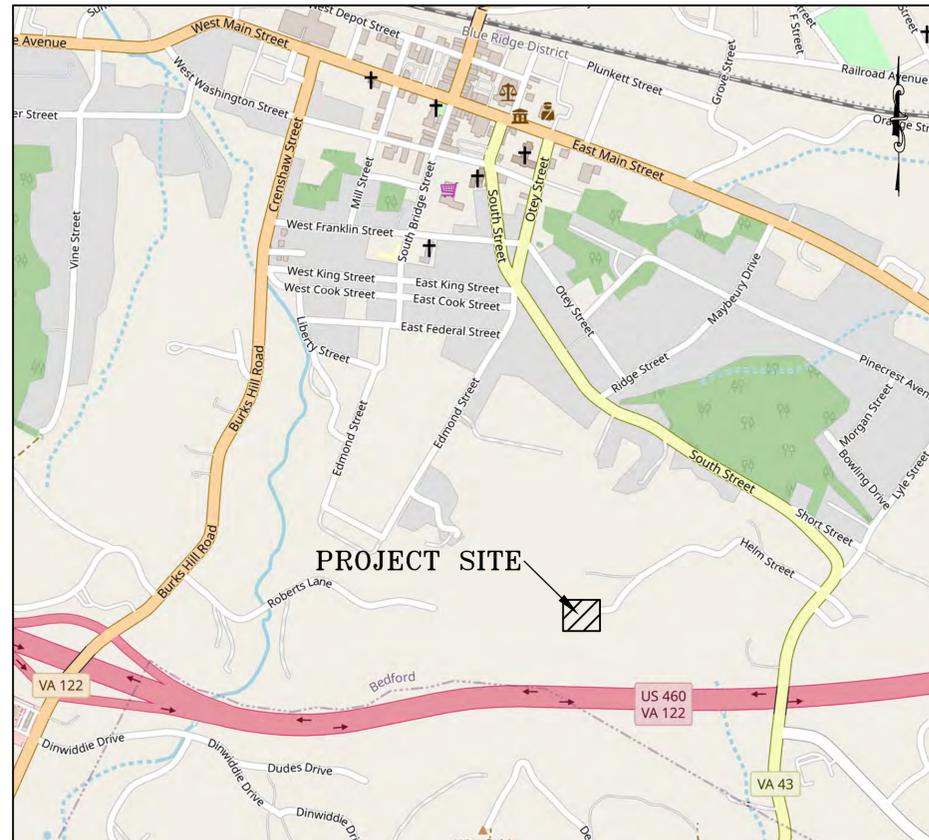
SOURCE OF TOPOGRAPHY: FIELD SURVEY BETWEEN 04/27/2022 - 05/11/2022

USGS DATUM: HORIZONTAL DATUM - VA STATE PLANE COORDINATE SYSTEM,
SOUTH ZONE NAD 83
VERTICAL CONTROL - NAVD 88

PARCEL ADDRESS: 900-902 HELM STREET, BEDFORD VA, 24523

PARCEL TAX NUMBER: 234 A 8 T

PARCEL INSTRUMENT NUMBER: 130007555 PLAT BOOK 56, PAGE 283



VICINITY MAP

SCALE - 1:12000

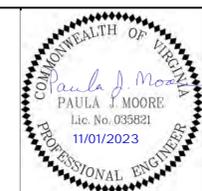
NOVEMBER 1, 2023

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NO.	DATE	BY	REVISIONS



SCALE:
HORIZ: AS SHOWN
VERT: N/A

DATE: NOVEMBER 1, 2023

DESIGNED: MSS
DRAWN: MSS
CHECKED: PJM
PROJECT NO.: 46826-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
TITLE SHEET AND VICINITY MAP

SHEET
1
OF
30
DRAWING
G-1

GENERAL NOTES

1. ALL CONSTRUCTION MATERIALS AND INSTALLATION SHALL CONFORM TO THE LATEST EDITION OF THE BEDFORD REGIONAL WATER AUTHORITY (BRWA) MASTER SPECIFICATIONS, THE VIRGINIA DEPARTMENT OF TRANSPORTATION ROAD AND BRIDGE STANDARDS, THE VIRGINIA DEPARTMENT OF HEALTH WATERWORKS REGULATIONS AND THE PROJECT MANUAL. IN CASE OF CONFLICT, THE MOST STRINGENT REQUIREMENT SHALL APPLY.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE BRWA CONSTRUCTION MANAGER AND INSPECTOR TO SCHEDULE A PRE-CONSTRUCTION MEETING AT LEAST 72 HOURS PRIOR TO STARTING ANY WORK ON THIS PROJECT. CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS.
3. EXISTING UTILITIES ARE SHOWN ONLY IN APPROXIMATE LOCATIONS ON THE PLANS BASED ON AVAILABLE RECORDS AND FIELD SURVEYS. CONTRACTOR SHALL, ON HIS OWN INITIATIVE AND AT NO ADDITIONAL COST TO THE OWNER, LOCATE ALL UNDERGROUND LINES AND STRUCTURES, BY MEANS OF TEST HOLES OR OTHER APPROPRIATE METHODS, AS NECESSARY. CONTRACTOR SHALL CALL "MISS UTILITY" @ 811 PRIOR TO CONSTRUCTION. CONTRACTOR WILL BE RESPONSIBLE FOR ANY DAMAGE AND REPAIR TO ANY UTILITY LINES OR STRUCTURES AS A RESULT OF NOT COMPLYING WITH THE VIRGINIA UNDERGROUND UTILITY DAMAGE PREVENTION ACT.
4. FINAL ACCEPTANCE BY THE BRWA SHALL NOT BE MADE UNTIL ALL WORK SHOWN ON CONTRACT DRAWINGS AND INCLUDED IN THE SPECIFICATIONS IS COMPLETED INCLUDING PAVING, GRADING, TESTING AND ALL REQUIRED ADJUSTMENTS.
5. THE OWNER WILL INSPECT ALL PIPELINES, AND APPURTENANCES THERETO, AS SHOWN ON THE APPROVED UTILITY PLANS, LOCATED WITHIN THE BRWA OWNED PARCEL.
6. CONTRACTOR SHALL RESTORE LIMITS OF WORK AND REINSTALL FENCING, LANDSCAPING, LIGHT AND POWER POLES, DITCHES, ETC. DISTURBED OR TEMPORARILY RELOCATED DURING THE WORK.
7. ALL FITTINGS AND APPURTENANCES SHALL BE RESTRAINED WITH CONCRETE THRUST BLOCKS OR MECHANICAL JOINT RESTRAINT AS INDICATED.
8. INGRESS AND EGRESS OF ACCESS ROADS SHALL BE MAINTAINED AT ALL TIMES.
9. DISTURBED DITCHES SHALL BE RESTORED TO EXISTING GRADES AND LINING EXCEPT WHERE EXISTING GRADES RESULT IN NEGATIVE GRADES. NEGATIVE GRADES SHALL BE CORRECTED TO PROVIDE POSITIVE GRADES BETWEEN CULVERTS.
10. ALL WATER MAINS SHALL BE INSTALLED WITH A MINIMUM COVER OF 3.0 FEET, 3.0 FEET BELOW EDGE OF PAVEMENT OR 3.0 FEET BELOW BOTTOM OF DITCH, WHICH EVER IS GREATER.
11. STAKE OUT OF PIPELINES AND TANK SHALL BE BY A LICENSED LAND SURVEYOR.
12. DO NOT DISCARD/DISCHARGE CHLORINATED WATER. ALL WATER SHALL BE DE-CHLORINATED PRIOR TO DISCHARGE.
13. AT TIE-INS TO EXISTING UTILITIES, CONTRACTOR SHALL FIELD VERIFY VERTICAL AND HORIZONTAL LOCATION OF EXISTING UTILITIES.
14. CONTRACTOR SHALL COORDINATE ALL SHUTDOWNS, TIE-INS AND SEQUENCING WITH THE BRWA. CONTRACTOR SHALL NOT OPERATE BRWA VALVES AT ANY TIME AND SHALL PROVIDE THREE BUSINESS DAYS ADVANCE NOTICE PRIOR TO NEEDING VALVE OPERATION BY THE BRWA.
15. LAND DISTURBANCE SHALL BE KEPT WITHIN THE LIMITS OF THE LOD INDICATED ON THE TANK SITE PLAN. THE CONTRACTOR SHALL NOT HAVE EQUIPMENT AND MATERIALS OUTSIDE OF THE LIMITS OF DISTURBANCE LAYDOWN AND STOCKPILING AREAS SHALL BE KEPT WITHIN THE AREA OF DISTURBANCE AS SHOWN ON THE PLANS.
16. ALL SPOIL AREAS SHALL BE RETURNED TO NATURAL GROUND AT THE COMPLETION OF THE PROJECT.
17. ALL BOUNDARY OR PROPERTY LINE MARKERS DISTURBED SHALL BE REPLACED AT THEIR ORIGINAL LOCATION AT NO ADDITIONAL COST BY A LICENSED LAND SURVEYOR.
18. MAINTAIN ADEQUATE CLEARANCE FROM OVERHEAD LINES AND POLES IN ORDER TO PROTECT EQUIPMENT AND WORKERS. COORDINATE WITH LOCAL UTILITY COMPANY TO TEMPORARILY LIFT, SUPPORT, PULL ASIDE, OR DEACTIVATE ANY OVERHEAD LINES WHICH MAY PRESENT DANGER TO THE CONTRACTOR, HIS WORKERS OR EQUIPMENT. CONTRACTOR SHALL PROTECT ALL UTILITY POLES ADJACENT TO THE WORK. ALL TEMPORARY BRACING TO BE PERFORMED BY OVERHEAD UTILITY COMPANY OR TO THEIR SATISFACTION. ALL COSTS SHALL BE INCLUDED IN THE CONTRACTOR'S BID.
19. COORDINATE THE REMOVAL, REPLACEMENT, OR REINSTALLATION OF ALL GUY WIRES (IF ANY) AND TEMPORARY SUPPORT OF POLES WITH OVERHEAD UTILITY COMPANY. ALL COSTS SHALL BE INCLUDED IN THE CONTRACTOR'S BID.
20. MAINTAIN DETAILED RED LINE DRAWING ON THE JOB SITE DURING CONSTRUCTION TO DOCUMENT CONSTRUCTION CHANGES AND INFORMATION AS DELINEATED IN THE SPECIFICATION. RED LINE RECORD DRAWINGS SHALL BE MADE AVAILABLE FOR PERIODIC REVIEW DURING PROGRESS MEETINGS AND TURNED OVER TO ENGINEER AT END OF PROJECT.
21. MINIMUM CLEARANCE OF WATER AND STORM DRAINS SHALL BE 18" EDGE TO EDGE.
22. WATER MAINS SHALL BE TESTED AT A PRESSURE OF 200 PSI.
23. VALVE EXTENSIONS SHALL BE USED WHEN THE DEPTH TO TOP OF VALVE NUT IS GREATER THAN 4 FEET.
24. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A BUILDING PERMIT FROM THE TOWN OF BEDFORD AND PAYING THE APPLICATION FEE PRIOR TO STARTING CONSTRUCTION. THE CONTRACTOR SHALL COMPLETE AND SUBMIT THE BUILDING PERMIT APPLICATION AND STATEMENT OF SPECIAL INSPECTIONS INCLUDED THE APPENDICES OF THE PROJECT MANUAL. THE CONTRACTOR SHALL SUBMIT THE FORMS TO THE TOWN OF BEDFORD OFFICE OF BUILDING INSPECTIONS. THE CONTRACTOR (TANK MANUFACTURER) SHALL BE THE REGISTERED DESIGN PROFESSIONAL IN CHARGE. THE SPECIAL INSPECTIONS ENGINEER IN CHARGE SHALL BE A THIRD PARTY HIRED BY THE CONTRACTOR. COPIES OF ALL TESTING REPORTS AND SUMMARIES SHALL BE SUBMITTED TO THE TOWN AND THE BRWA.

NO.	DATE	BY	REVISIONS



SCALE:
 HORIZ: N/A
 VERT: N/A
 DATE: NOVEMBER 1, 2023
 DESIGNED: MSS
 DRAWN: MSS
 CHECKED: PJM
 PROJECT NO.: 46626-003

BEDFORD REGIONAL WATER AUTHORITY
 1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
 GENERAL NOTES AND SURVEY CONTROL POINTS

SHEET
 2
 of
 30

DRAWING

 G-2

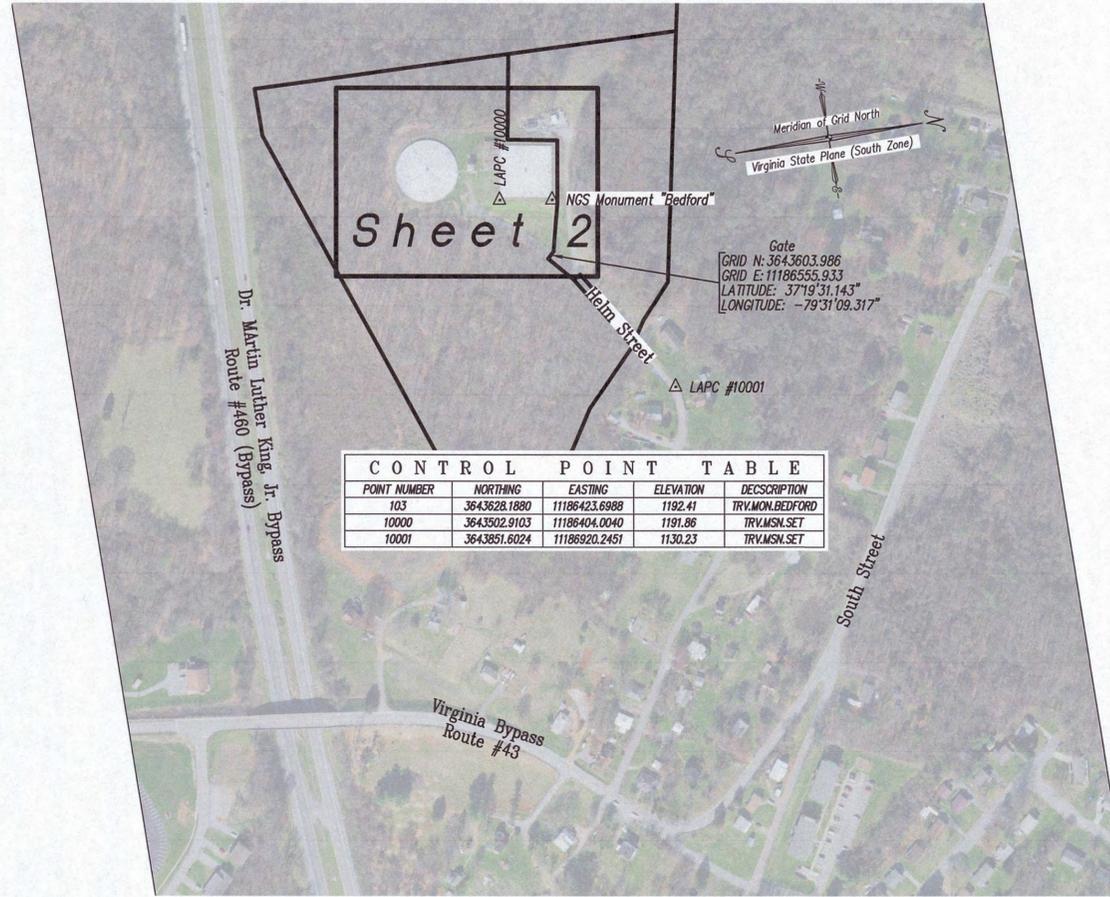
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SYMBOL LEGEND	
	Property Line
	Property Monument
	Property Corner
	Sign
	Water Manhole
	Gate Valve
	Water Spigot
	Water Meter
	Air Release Valve
	Transformer
	Utility Pole
	Guy Wire
	Electric Box
	Electric Meter
	Telephone Pedestal
	Borehole
	Flow Arrow

ABBREVIATION	DESCRIPTION
BT	Bottom of Tank
CLF	Chainlink Fence
C.S.	Concrete Slab
C.W.	Concrete Walk
D	Drain Pipe
Ex.I.P	Existing Iron Pin
G.Dr.	Gravel Drive
GW	Guy Wire
OE	Overhead Electric
OF	Over Flow Pipe
OU	Overhead Utilities
TC	Top of Concrete
TR	Top of Roof
UE	Underground Electric
W	Waterline
W.St.	Wooden Steps
x	Approximate

Pattern Legend	
	Concrete
	Metal Tank Roof
	Building
	Gravel

Linetype Legend	
	Chainlink Fence
	Ditch



CONTROL POINT TABLE				
POINT NUMBER	NORTHING	EASTING	ELEVATION	DESCRIPTION
103	3643628.1880	11186423.6988	1192.41	TRV.MON.BEDFORD
10000	3643502.9103	11186404.0040	1191.86	TRV.MSN.SET
10001	3643851.6024	11186920.2451	1130.23	TRV.MSN.SET

This Partial Topographic Survey was completed under the direct and responsible charge of, Larry Thomas Ogle, Jr., LS #2459 from an actual Ground survey made under my supervision; that the original data was obtained April 27th, 2022 through May 11th, 2022; and that this plat, including metadata meets minimum accuracy standards unless otherwise noted.

- NOTES:
- THIS PLAT IS BASED ON A CURRENT FIELD SURVEY.
 - THIS PLAT DOES NOT CONSTITUTE A BOUNDARY SURVEY.
 - THIS PLAT WAS PREPARED WITHOUT THE BENEFIT OF A CURRENT TITLE REPORT AND ENCUMBRANCES MAY EXIST THAT AFFECT THE SUBJECT PROPERTY THAT ARE NOT SHOWN HEREON.
 - THIS PROPERTY DOES NOT LIE WITHIN THE LIMITS OF A SPECIAL FLOOD HAZARD AREA AS DESIGNATED BY F.E.M.A. THIS OPINION IS BASED ON AN INSPECTION OF THE FLOOD INSURANCE RATE MAPS AND HAS BEEN VERIFIED BY ACTUAL FIELD ELEVATIONS., SEE MAP NUMBER 51019C3090, DATED SEPTEMBER 29, 2010, ZONE "X" (unSHADED).
 - THE HORIZONTAL (NAD 83) & VERTICAL CONTROL (NAVD 88) FOR THIS PROJECT WAS BASED TRIMBLE'S KEYNET VRS GPS NETWORK.
 - COORDINATE VALUES AS SHOWN HEREON ARE SURFACE COORDINATES ESTABLISHED BY SCALING THE GRID COORDINATES AT POINT #10000 (N:3643502.9103, E:11186404.0040, ELEV.:1191.86") BY A COMBINED SCALE FACTOR OF 1.00010628.
 - CONTOURS AS SHOWN ARE AT A 2-FOOT INTERVAL.
 - THIS PLAT DOES NOT GUARANTEE THE EXISTENCE OR LOCATION OF ANY UNDERGROUND UTILITIES. ALL SURFACE UTILITIES WERE FIELD LOCATED. ALL UNDERGROUND UTILITIES SHOWN WERE ESTABLISHED USING ABOVE GROUND STRUCTURES, MARKINGS, AVAILABLE UTILITY MAPS AND MARKINGS ESTABLISHED BY MISS UTILITY OF VIRGINIA, SEE MISS UTILITY TICKET #A211700135. ALL UNDERGROUND UTILITY LINES ARE APPROXIMATE AND SHOULD BE FIELD VERIFIED PRIOR TO THE START OF ANY CONSTRUCTION.
 - THERE MAY BE AN ABANDONED OR PRIVATE UNDERGROUND TELEPHONE AND/OR CABLE LOCATED NEAR ELECTRIC POLE #64345. NO MISS UTILITY MARKINGS WERE FOUND AND ALL SUCH RESPONDING UTILITY COMPANY'S STATE "NO CONFLICT".
 - TAX PARCELS #234 A B T & 8A T ARE THE PROPERTY OF THE TOWN OF BEDFORD PER DEED BOOK 161, PAGE 463, DEED BOOK 161, PAGE 64, DEED BOOK 151, PAGE 454, AND DEED BOOK 64, PAGE 138 AND INSTRUMENT #130007555.

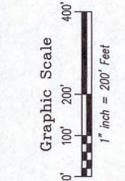
Utilities per Miss Utility Tickets #A211700135				
COMPANY	CONTACT	PHONE NUMBER	DAMAGE CONTACT PHONE NUMBER	STATUS
Town of Bedford-Electric (BDF240)	Rick Dellinger	(540)587-6071	(540)587-6071	Marked
Bedford Regional Water (BRA176)	Howard Delmarsh	(540)871-6455	(540)586-7679	Marked
Bedford Regional Sewer (BRA177)	Howard Delmarsh	(540)871-6455	(540)586-7679	No Conflict
Comcast (CMC503)	Cable Protection Services	(804)562-3861	(877)359-1821 Ext OPT 1	No Conflict
Fiberlight (FBL411)	Stake Center Office	(801)381-5064	(800)672-0181	No Conflict
Lumos DBA Segra (LMS546)	Stake Center Locating	(801)364-1063	(877)411-6930	No Conflict
Shentel Cable (STC555)	Cable Protection Services	(804)562-3861	(540)984-5531	No Conflict
Verizon (VZN804)	Utiliquest	(804)286-1721	(888)483-1233	No Conflict



LUMSDEN ASSOCIATES, P.C.
ENGINEERS-SURVEYORS-PLANNERS
ROANOKE, VIRGINIA

4664 BRAMBLETON AVENUE
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ROANOKE, VIRGINIA 24018

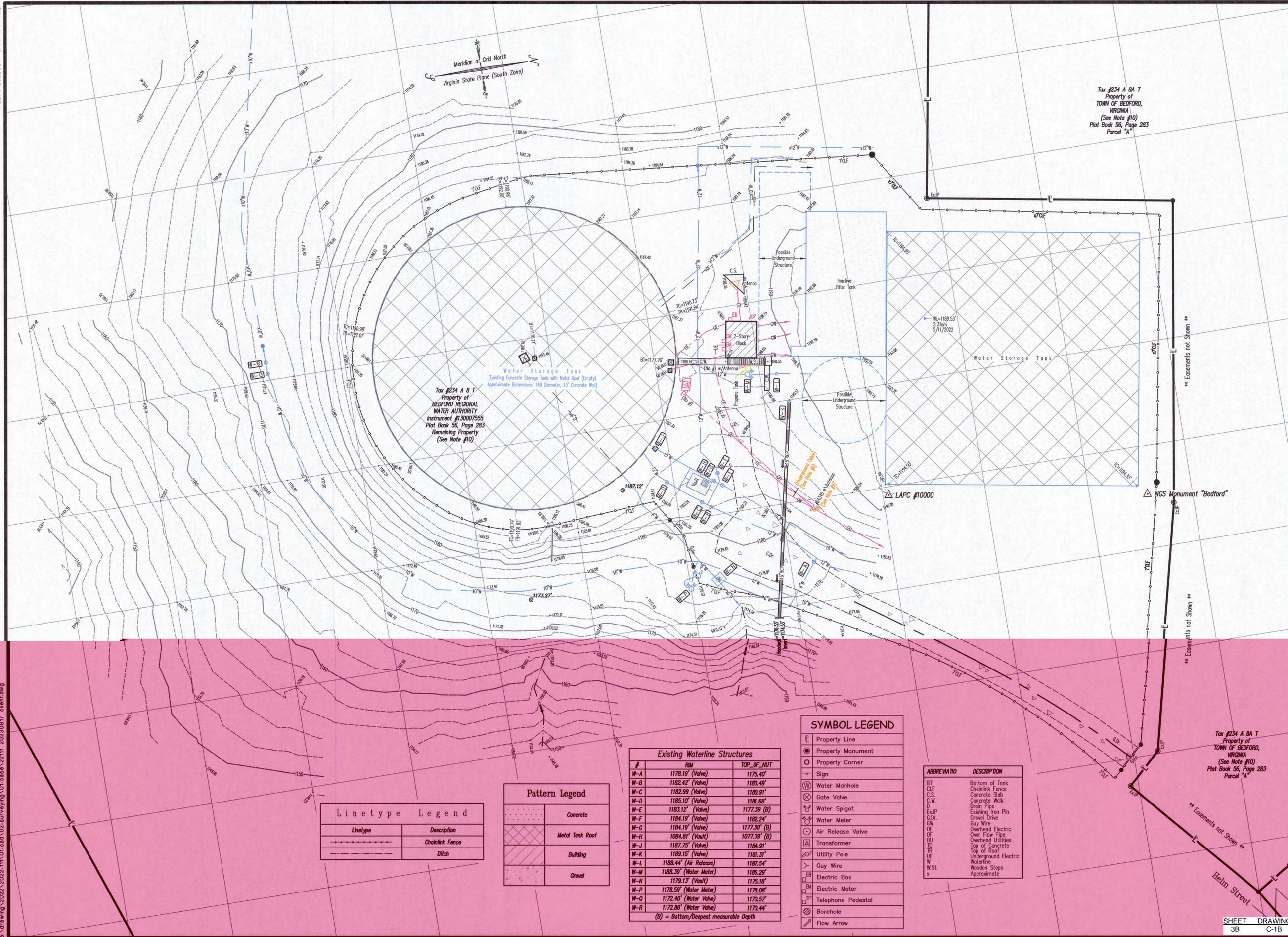
PHONE: (540) 774-4411
FAX: (540) 772-9445
E-MAIL: MAIL@LUMSDENPC.COM



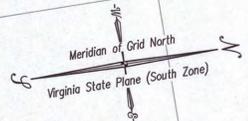
Partial Topographic Survey for
Water Tank Replacement
situated at the terminus of Helm Street
Town of Bedford, Bedford County, Virginia
prepared for the
WRA &
Bedford Regional Water Authority

NO.	DATE	DESCRIPTION
1	6/17/2022	Added Headwall and 9" RCP
2	6/17/2023	Added Tank Note & Approximate Fence
3		
4		
5		

DATE: May 20, 2022
SCALE: 1" = 200'
COMMISSION NO.: 2022-063
SHEET 1 OF 2



Tax #234 A BA T
Property of
TOWN OF BEDFORD,
VIRGINIA
(See Note #10)
Plat Book 56, Page 283
Parcel "A"



Tax #234 A B T
Property of
BEDFORD REGIONAL
WATER AUTHORITY
Instrument #130007555
Plat Book 56, Page 283
Remaining Property
(See Note #10)

LAPC #10000

NCS Monument "Bedford"

** Easements not Shown **

** Easements not Shown **

Linetype	Description
-----	Chainlink Fence
-----	Ditch

[Pattern]	Concrete
[Pattern]	Metal Tank Roof
[Pattern]	Building
[Pattern]	Gravel

#	RIM	TOP_OF_NUT
W-A	1178.19' (Valve)	1175.40'
W-B	1182.42' (Valve)	1180.49'
W-C	1182.99' (Valve)	1180.91'
W-D	1185.10' (Valve)	1181.68'
W-E	1183.12' (Valve)	1177.39' (B)
W-F	1184.19' (Valve)	1182.24'
W-G	1184.19' (Valve)	1177.30' (B)
W-H	1084.81' (Vault)	1077.09' (B)
W-J	1187.75' (Valve)	1184.91'
W-K	1189.15' (Valve)	1181.31'
W-L	1188.44' (Air Release)	1187.54'
W-M	1188.39' (Water Meter)	1186.29'
W-N	1179.13' (Vault)	1175.18'
W-P	1178.59' (Water Meter)	1178.08'
W-Q	1172.40' (Water Valve)	1170.57'
W-R	1172.86' (Water Valve)	1170.44'

(B) = Bottom/Deepest measurable Depth

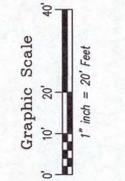
[Symbol]	Property Line
[Symbol]	Property Monument
[Symbol]	Property Corner
[Symbol]	Sign
[Symbol]	Water Manhole
[Symbol]	Gate Valve
[Symbol]	Water Spigot
[Symbol]	Water Meter
[Symbol]	Air Release Valve
[Symbol]	Transformer
[Symbol]	Utility Pole
[Symbol]	Guy Wire
[Symbol]	Electric Box
[Symbol]	Electric Meter
[Symbol]	Telephone Pedestal
[Symbol]	Borehole
[Symbol]	Flow Arrow

BT	Bottom of Tank
CLF	Chainlink Fence
C.S.	Concrete Slab
C.W.	Concrete Walk
D	Drain Pipe
Exp	Existing Iron Pin
G.D.R.	Gravel Drive
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OE	Overhead Electric
OF	Over Flow Pipe
OU	Overhead Utilities
TC	Top of Concrete
TR	Top of Roof
UE	Underground Electric
W	Waterline
W.S.L.	Wooden Steps
x	Approximate

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Topographic Survey for
Water Tank Replacement
situated at
the terminus of Helm Street
Town of Bedford, Bedford County, Virginia
prepared for the
WRRA &
Bedford Regional Water Authority

NO.	DATE	DESCRIPTION
1	6/27/2022	Issue Horizontal and 1" RCP
2	8/17/2023	Issue Tank Note & Approximate Floor

DATE: May 20, 2022
SCALE: 1" = 20'
COMMISSION NO.: 2022-063
SHEET 2 OF 2

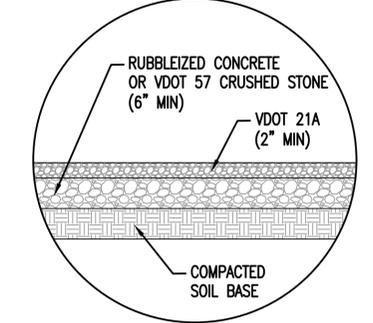
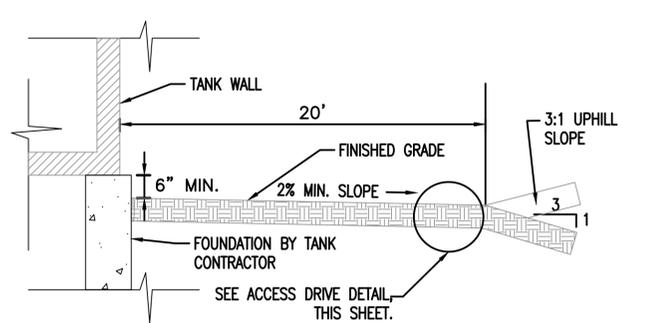
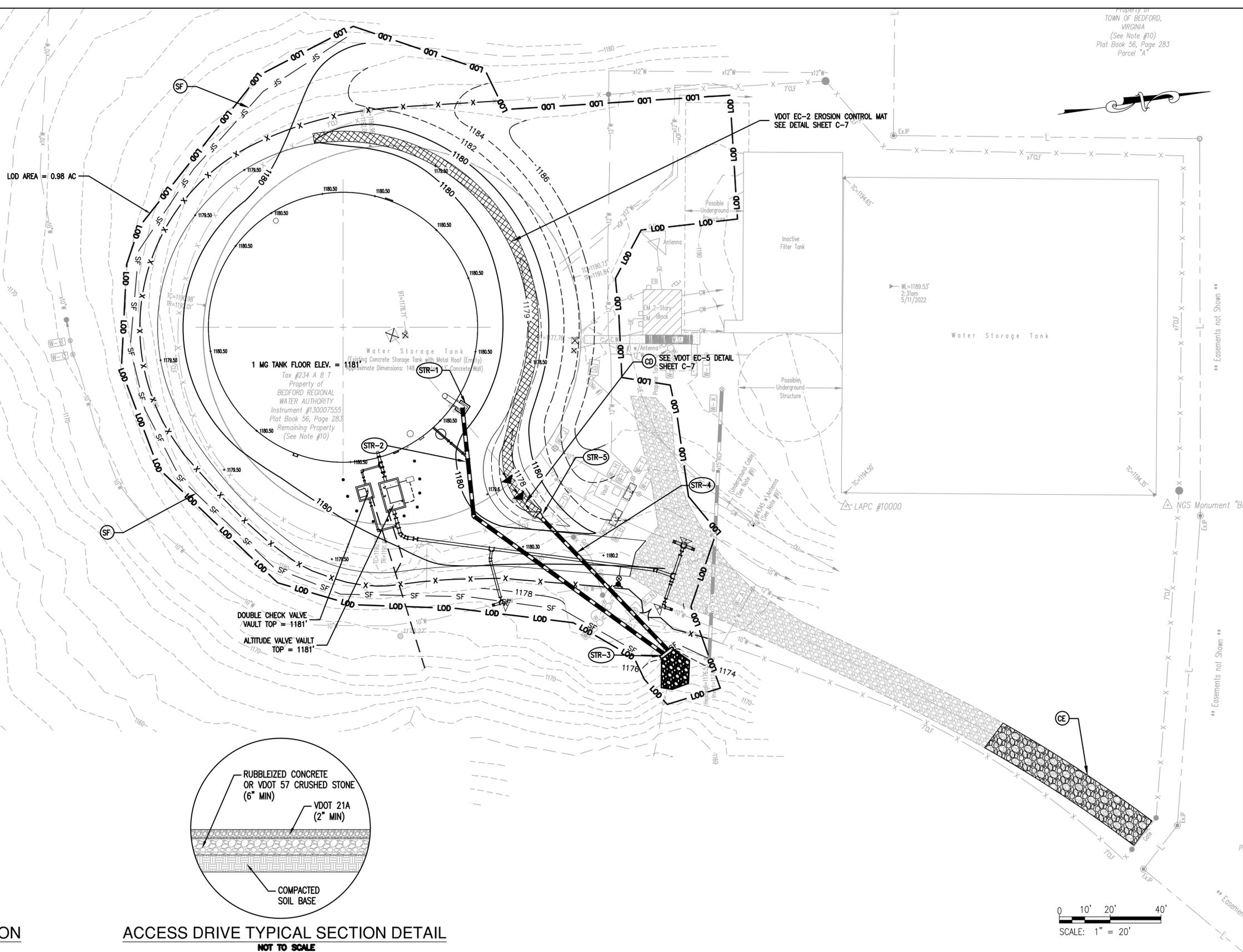
SHEET DRAWING
3B C-1B

STRUCTURE SCHEDULE

- STR-1 DI-7, TOP=1181.5, H=5.66'
SEE DETAIL, SHEET C-16
- STR-2 136 L.F. 16" D.I. PIPE AT 1.35% SLOPE
INV. IN = 1175.84 INV. OUT= 1174.0
- STR-3 VDOT EW-6 WITH OUTLET PROTECTION EC-1,
TYPE A, CLASS 1. SEE DETAIL, SHEET C-15.
- STR-4 76 L.F. 15" RCP AT 5.3% SLOPE
INV. IN = 1178.0 INV. OUT= 1174.0
- STR-5 VDOT ES-1 END SECTION
SEE DETAIL, SHEET C-15.

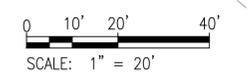
E&S SYMBOL LEGEND

- (SOME SYMBOLS SHOWN MAY NOT BE USED)
- LIMITS OF DISTURBANCE — LOD
 - TEMPORARY STONE CONSTRUCTION ENTRANCE
 - SEDIMENT BASIN
 - SILT FENCE
 - SUPER SILT FENCE
 - DIVERSION DIKE
 - TREE PROTECTION
 - STORM DRAIN INLET PROTECTION
 - CULVERT INLET PROTECTION
 - ROCK CHECK DAM



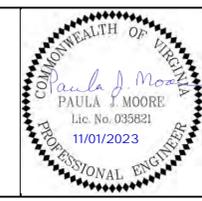
ACCESS DRIVE AROUND TANK FOUNDATION
NOT TO SCALE

ACCESS DRIVE TYPICAL SECTION DETAIL
NOT TO SCALE



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NO.	DATE	BY	REVISIONS

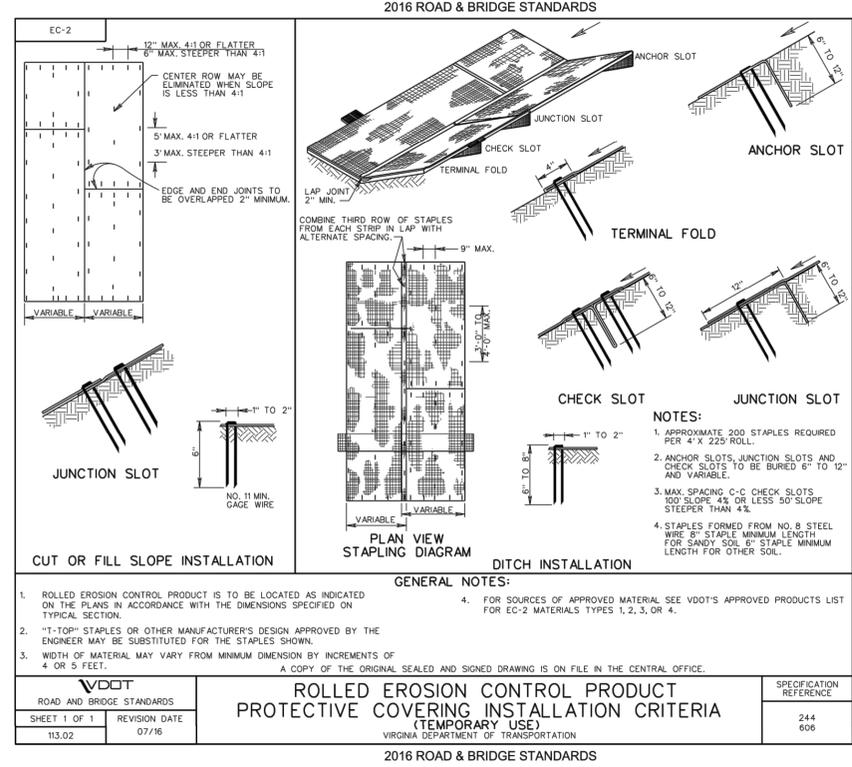
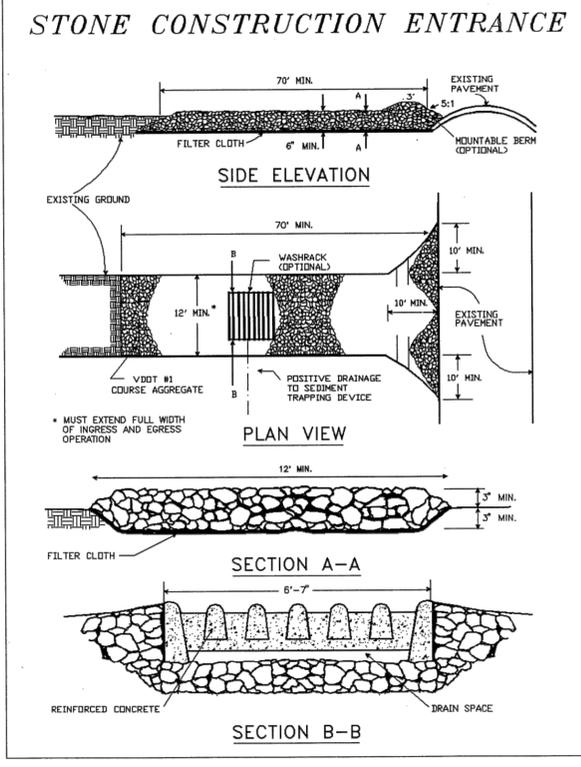
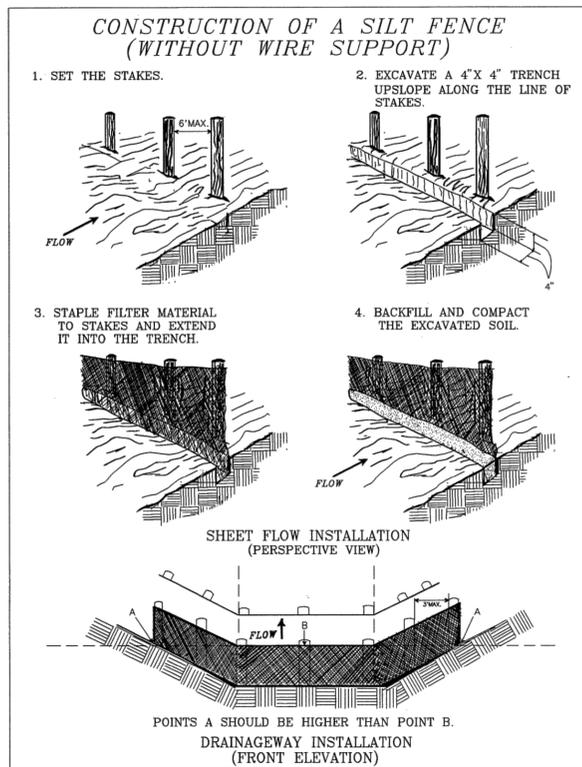


SCALE:
HORIZ: 1"=20'
VERT: N/A
DATE: NOVEMBER 1, 2023
DESIGNED: MSS
DRAWN: PJM
CHECKED: PJM
PROJECT NO.: 46626-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
GRADING AND EROSION AND SEDIMENT CONTROL PLAN

SHEET	5	DRAWING
	OF	
	30	
		C-3

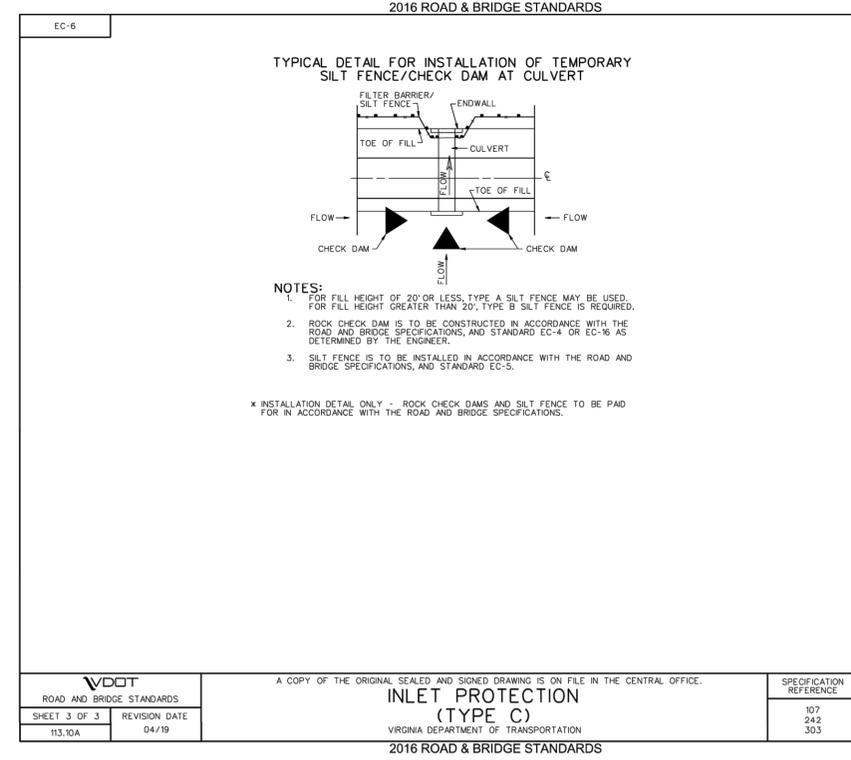
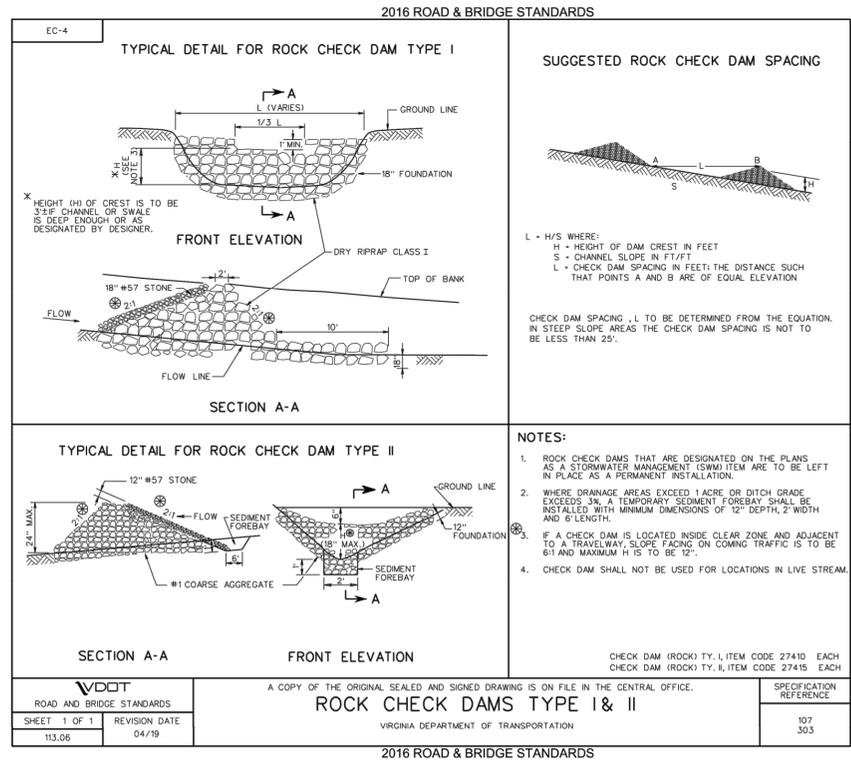
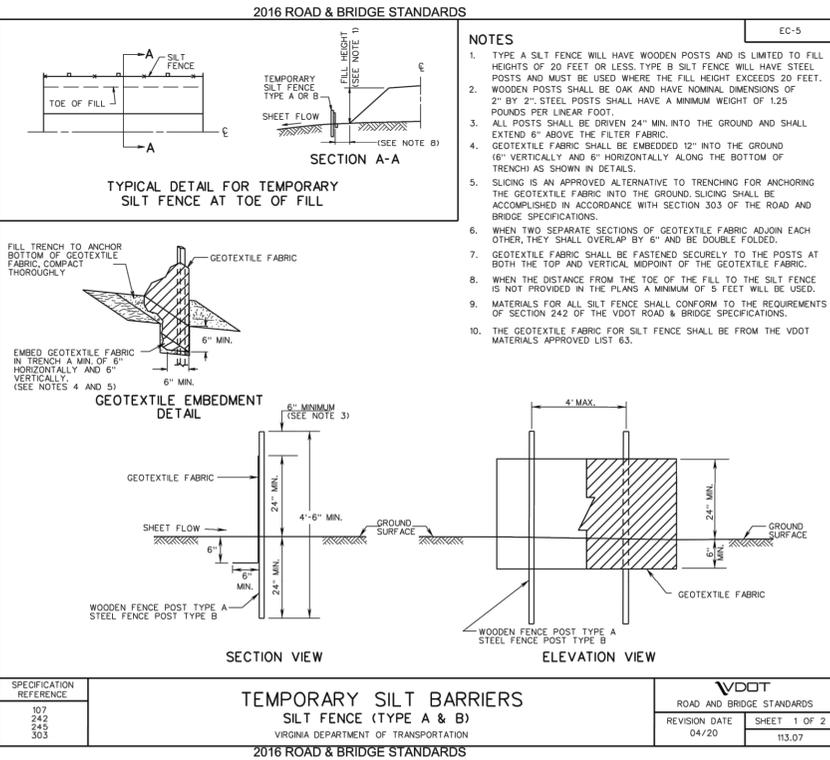


SEEDING REQUIREMENTS

Virginia Erosion and Sediment Control Regulation Minimum Standard #1

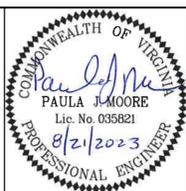
Permanent or temporary soil stabilization shall be applied to denuded areas within 7 days after final grade is reached on any portion of the site. Temporary soil stabilization shall be applied within 7 days to denuded areas that may not be at final grade but that will remain dormant (undisturbed) for longer than 30 days. Permanent stabilization shall be applied to areas that are to be left dormant for more than one year.

PERMANENT SEEDING (rates per acre):		
For lawn stabilization	February 1 to May 15	100 lbs. tall fescue 15 lbs. annual rye 2 lbs. red clover
	May 16 to July 31	120 lbs. tall fescue 10 lbs. foxtail millet 2 lbs. red clover
	August 1 to September 15	100 lbs. tall fescue 15 lbs. annual rye 2 lbs. red clover
For wildlife plantings or natural areas	September 16 to January 31	120 lbs. tall fescue 10 lbs. cereale rye 2 lbs. red clover
	Year-round broadcast rate	5 lbs. orchard grass 5 lbs. ladino clover OR 3 lbs. crown vetch OR 8 lbs. hairy vetch
	For steeply-sloped areas	40 lbs. tall fescue 10 lbs. ladino clover
TEMPORARY SEEDING (rates per acre)	Winter	40 lbs. annual rye
	Summer	40 lbs. cereale rye 40 lbs. annual rye 40 lbs. foxtail millet
FERTILIZER AND LIME (required for both temporary and permanent seeding and all seasons)	Fertilizer	1500 lbs. of 10-18-10 per acre
	Lime	2 tons per acre
MULCHING		Straw at 80 bales per acre or an approved manufactured mulch/stabilization fabric or material



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NO.	DATE	BY	REVISIONS



SCALE:
HORIZ: N/A
VERT: N/A

DATE: AUGUST 2023

DESIGNED: MSS

DRAWN: MSS

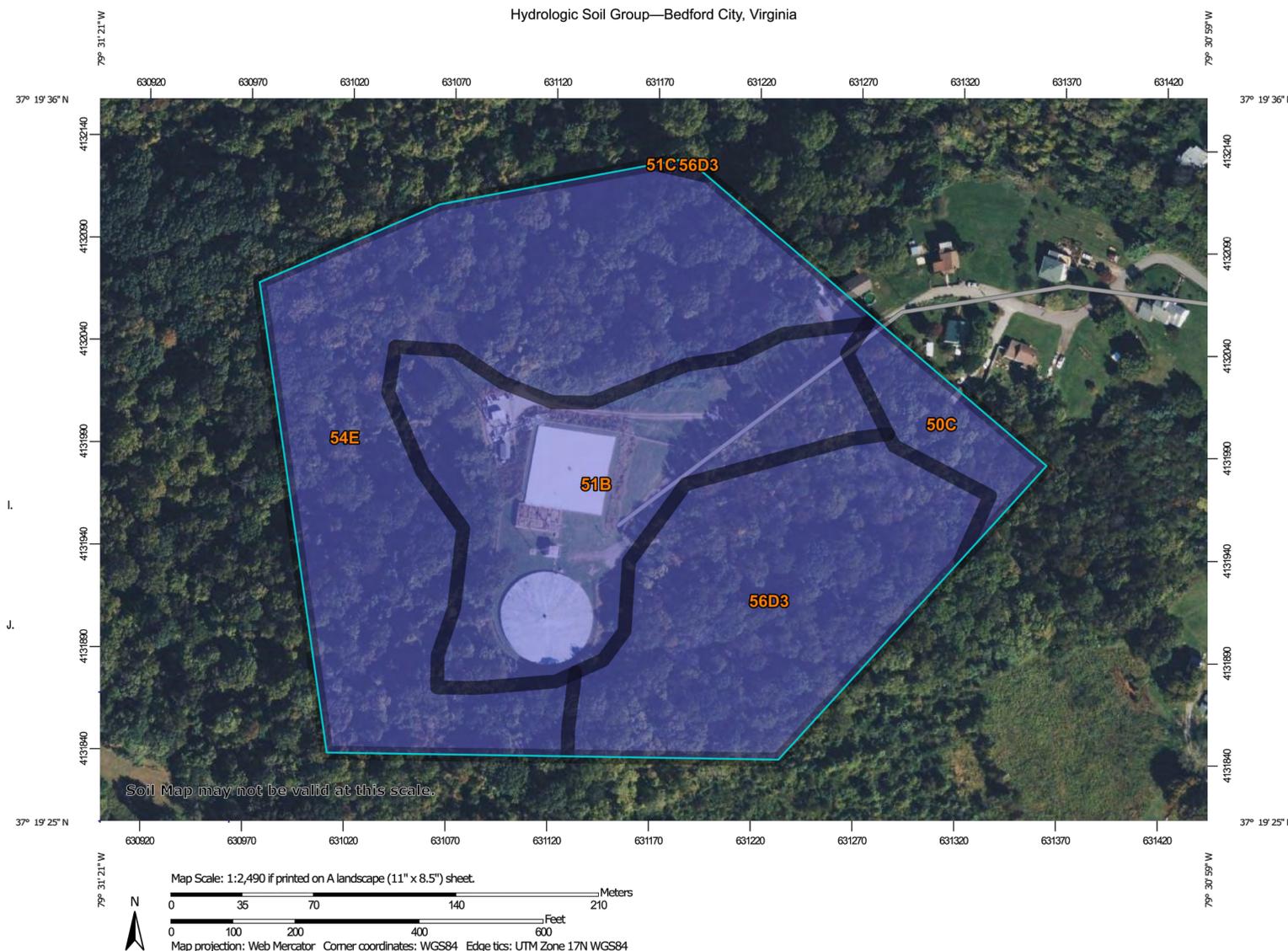
CHECKED: PJM

PROJECT NO.: 46626-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

SHEET
9
OF
30
DRAWING
C-7



Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
50C	Clifford fine sandy loam, 7 to 15 percent slopes	B	0.9	4.7%
51B	Clifford-Urban land complex, 2 to 7 percent slopes	B	5.2	25.7%
51C	Clifford-Urban land complex, 7 to 20 percent slopes	B	0.0	0.0%
54E	Rhodhiss loam, 25 to 60 percent slopes	B	9.0	44.5%
56D3	Fairview sandy clay loam, 15 to 25 percent slopes, severely eroded	B	5.1	25.2%
Totals for Area of Interest			20.2	100.0%

Map Scale: 1:2,490 if printed on A landscape (11" x 8.5") sheet.
 0 35 70 140 210 Meters
 0 100 200 400 600 Feet
 Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

USDA Natural Resources Conservation Service

Web Soil Survey National Cooperative Soil Survey

12/12/2022 Page 1 of 4

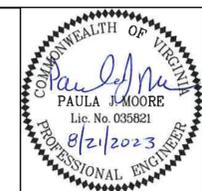
USDA Natural Resources Conservation Service

Web Soil Survey National Cooperative Soil Survey

12/12/2022 Page 3 of 4

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NO.	DATE	BY	REVISIONS



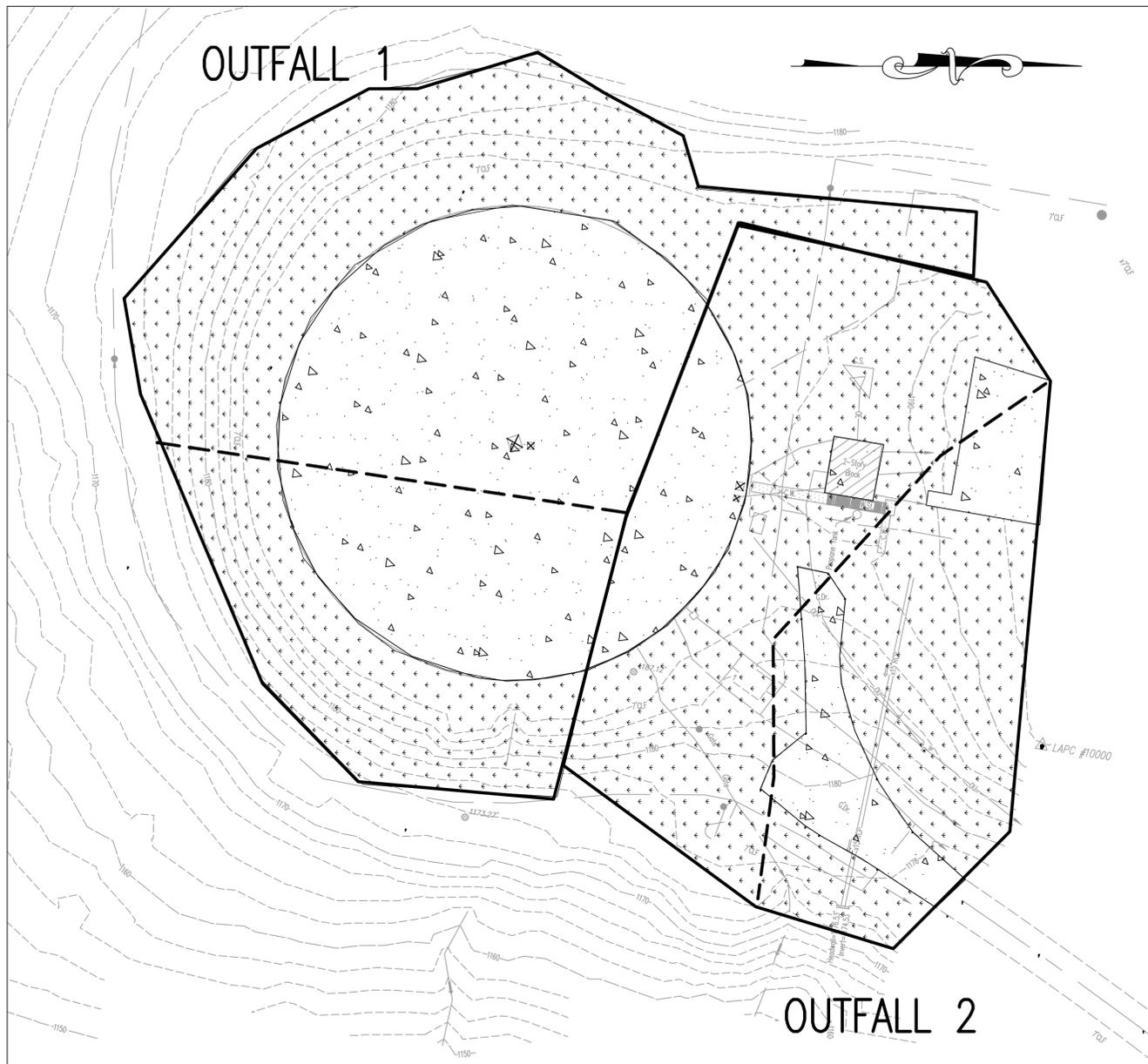
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 VERT.: N/A
 DATE: AUGUST 2023
 DESIGNED: MSS
 DRAWN: MSS
 CHECKED: PJM
 PROJECT NO.: 46626-003

BEDFORD REGIONAL WATER AUTHORITY
 1723 FALLING CREEK ROAD, BEDFORD, VA

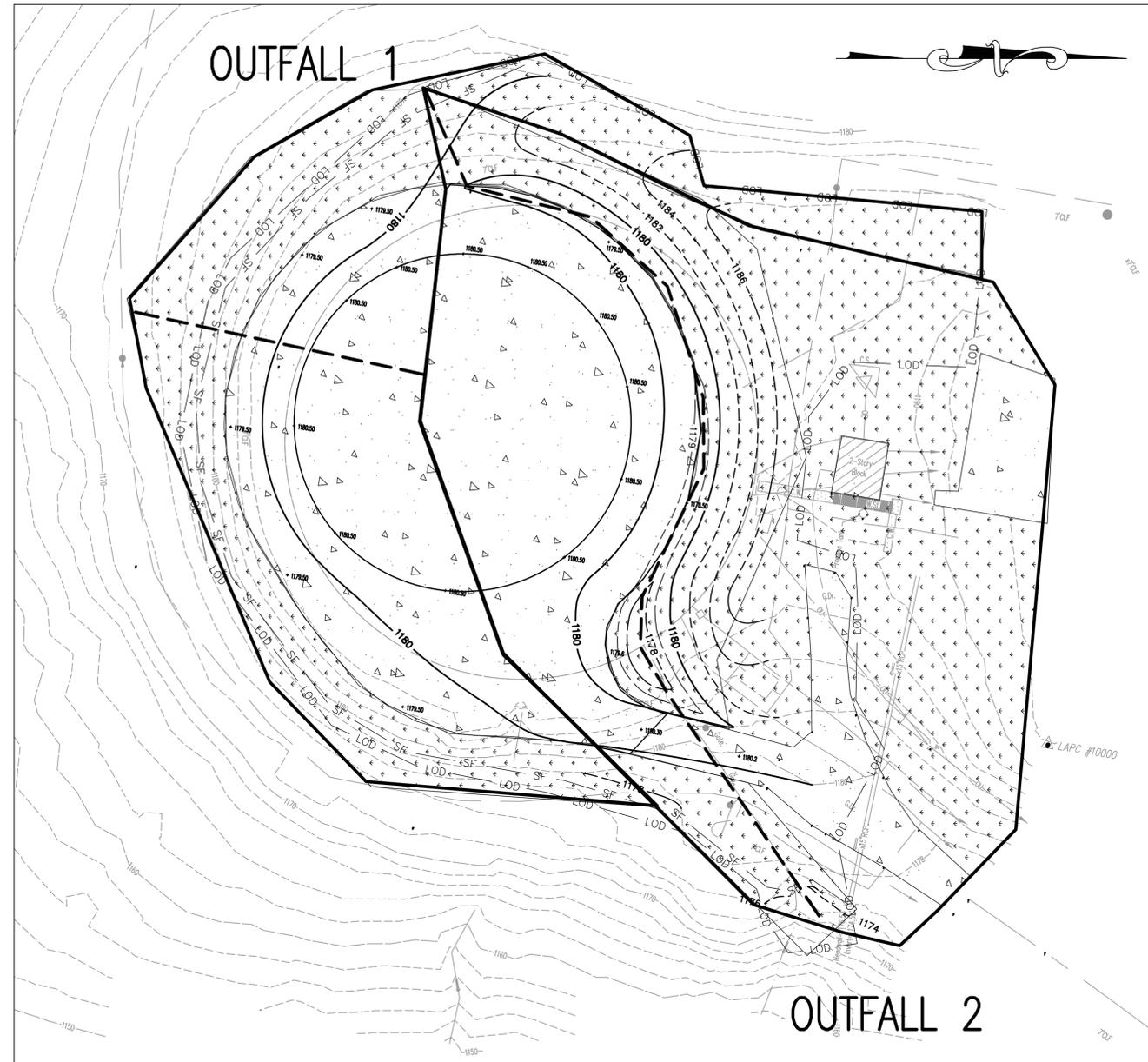
HELM STREET TANK REPLACEMENT
 EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

SHEET
10
 OF
30

DRAWING
C-8

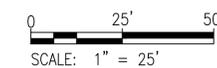


PRE-DEVELOPMENT DRAINAGE AREAS



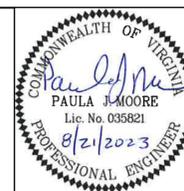
POST-DEVELOPMENT DRAINAGE AREAS

- LEGEND**
- TIME OF CONCENTRATION PATH ———
 - TURF
 - IMPERVIOUS



N:\46626-003\CADD\46626003C1-09.DWG

NO.	DATE	BY	REVISIONS



SCALE:
 HORIZ: 1" = 25'
 VERT: N/A
 DATE: AUGUST 2023
 DESIGNED: MSS
 DRAWN: MSS
 CHECKED: PJM
 PROJECT NO.: 46626-003

BEDFORD REGIONAL WATER AUTHORITY
 1723 FALLING CREEK ROAD, BEDFORD, VA
 HELM STREET TANK REPLACEMENT
 EXISTING AND PROPOSED DRAINAGE AREA PLAN

SHEET	DRAWING
11	C-9
OF	
30	

**OUTFALL 1
RATIONAL METHOD HYDROLOGY**

PRE-DEVELOPMENT VS. POST-DEVELOPMENT

LANDUSE	PRE-DEVELOPMENT			POST-DEVELOPMENT		
	AREA(AC.)	C	CA	AREA(AC.)	C	CA
GRASSED	0.42	0.50	0.21	0.18	0.50	0.09
IMPERVIOUS	0.32	0.90	0.29	0.30	0.90	0.27
TOTAL	0.74 AC	0.67AVG	0.50	0.48 AC	0.75AVG	0.36

TIME OF CONC. (Tc)	LENGTH	SLOPE	HEIGHT	AVG. VEL	TRAVEL TIME	C	PIPE DIA.
TRAVEL PATH	FT.	FT/FT	FT.	FPS	MIN.		IN.
PRE-DEVELOPMENT							
OVERLAND (SEELYE) A - B	148.0	0.020	3.0	0.3	7.70	0.50	
TOT. LENGTH =	148	2.03%	3.0		TOT Tc= 7.70 MIN.	AVG. V=0.3	

TIME OF CONC. (Tc)	LENGTH	SLOPE	HEIGHT	AVG. VEL	TRAVEL TIME	C	PIPE DIA.
TRAVEL PATH	FT.	FT/FT	FT.	FPS	MIN.		IN.
POST-DEVELOPMENT							
OVERLAND (SEELYE) A - B	93.0	0.032	3.0	0.3	5.80	0.50	
TOT. LENGTH =	93	3.23%	3.0		TOT Tc= 5.80 MIN.	AVG. V=0.3	

RAINFALL INTENSITY	COUNTY / CITY = Bedford			PRE-DEVELOPMENT		POST-DEVELOPMENT	
	FREQUENCY	B	D	E	Cf	Tc	I (IN/HR)
2-YR	45.85	10.94	0.82	1.00	7.70	4.16	5.80
5-YR	50.40	10.91	0.79	1.00	7.70	5.00	5.80
10-YR	51.89	10.64	0.77	1.00	7.70	5.52	5.80
25-YR	51.58	10.03	0.73	1.10	7.70	6.96	5.80
50-YR	50.54	9.57	0.70	1.20	7.70	8.26	5.80
100-YR	48.91	8.99	0.68	1.25	7.70	9.02	5.80

Nearest Precipitation Gage $I=Cf*B/(Tc+D)^E$

DISCHARGES (CFS)			
FREQUENCY	PRE-DEVELOPMENT		POST-DEVELOPMENT
2-YR	2.09		1.65
5-YR	2.51		1.98
10-YR	2.77		2.18
25-YR	3.49		2.74
50-YR	4.14		3.25
100-YR	4.52		3.55

**OUTFALL 2
RATIONAL METHOD HYDROLOGY**

PRE-DEVELOPMENT VS. POST-DEVELOPMENT

LANDUSE	PRE-DEVELOPMENT			POST-DEVELOPMENT		
	AREA(AC.)	C	CA	AREA(AC.)	C	CA
GRASSED	0.42	0.50	0.21	0.49	0.50	0.25
IMPERVIOUS	0.15	0.90	0.13	0.34	0.90	0.30
TOTAL	0.57 AC	0.60AVG	0.35	0.83 AC	0.66AVG	0.55

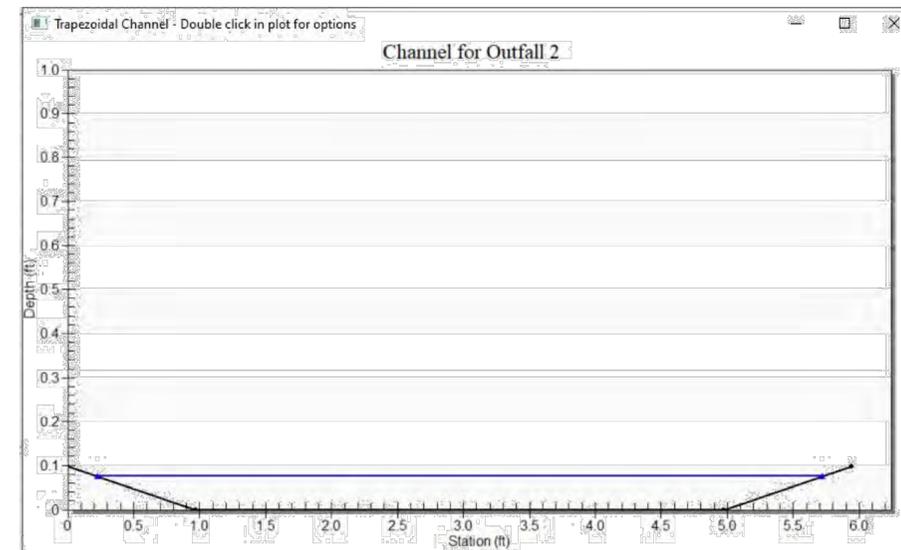
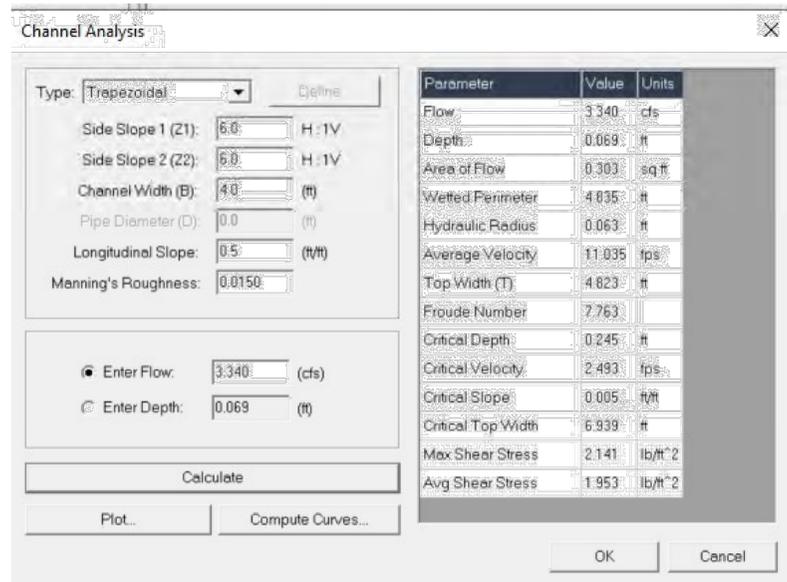
TIME OF CONC. (Tc)	LENGTH	SLOPE	HEIGHT	AVG. VEL	TRAVEL TIME	C	PIPE DIA.
TRAVEL PATH	FT.	FT/FT	FT.	FPS	MIN.		IN.
PRE-DEVELOPMENT							
OVERLAND (SEELYE) A - B	150.0	0.040	6.0	0.4	6.80	0.50	
SWALE (KIRPICH)	49.0	0.061	3.0	1.6	0.51		
TOT. LENGTH =	199	4.52%	9.0		TOT Tc= 7.31 MIN.	AVG. V=0.5	

TIME OF CONC. (Tc)	LENGTH	SLOPE	HEIGHT	AVG. VEL	TRAVEL TIME	C	PIPE DIA.
TRAVEL PATH	FT.	FT/FT	FT.	FPS	MIN.		IN.
POST-DEVELOPMENT							
OVERLAND (SEELYE) A - B	34.0	0.029	1.0	0.1	3.87	0.50	
DITCH (MANNING) B - C	201.0	0.015	3.0	2.2	1.51		
CULVERT (MANNING) C - D	92.0	0.043	4.0	11.0	0.14		15
TOT. LENGTH =	327	2.45%	8.0		TOT Tc= 5.52 MIN.	AVG. V=1.0	

RAINFALL INTENSITY	COUNTY / CITY = Bedford			PRE-DEVELOPMENT		POST-DEVELOPMENT	
	FREQUENCY	B	D	E	Cf	Tc	I (IN/HR)
2-YR	45.85	10.94	0.82	1.00	7.70	4.24	5.52
5-YR	50.40	10.91	0.79	1.00	7.70	5.09	5.52
10-YR	51.89	10.64	0.77	1.00	7.70	5.62	5.52
25-YR	51.58	10.03	0.73	1.10	7.70	7.07	5.52
50-YR	50.54	9.57	0.70	1.20	7.70	8.39	5.52
100-YR	48.91	8.99	0.68	1.25	7.70	9.16	5.52

Nearest Precipitation Gage $I=Cf*B/(Tc+D)^E$

DISCHARGES (CFS)			
FREQUENCY	PRE-DEVELOPMENT		POST-DEVELOPMENT
2-YR	1.46		2.53
5-YR	1.76		3.03
10-YR	1.94		3.34
25-YR	2.44		4.20
50-YR	2.90		4.98
100-YR	3.16		5.44

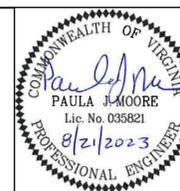


CHANNEL COMPS SHOW OUTFALL 2 CHANNEL IS NON-EROSIVE BASED ON SHEAR STRESS AND CONTAINS THE 10-YEAR FLOW. NO DOWNSTREAM FLOODING OCCURRING.

OUTFALL 1 IS SHEET FLOW. 10-YR POST IS LESS THAN 10-YR PRE.

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NO.	DATE	BY	REVISIONS

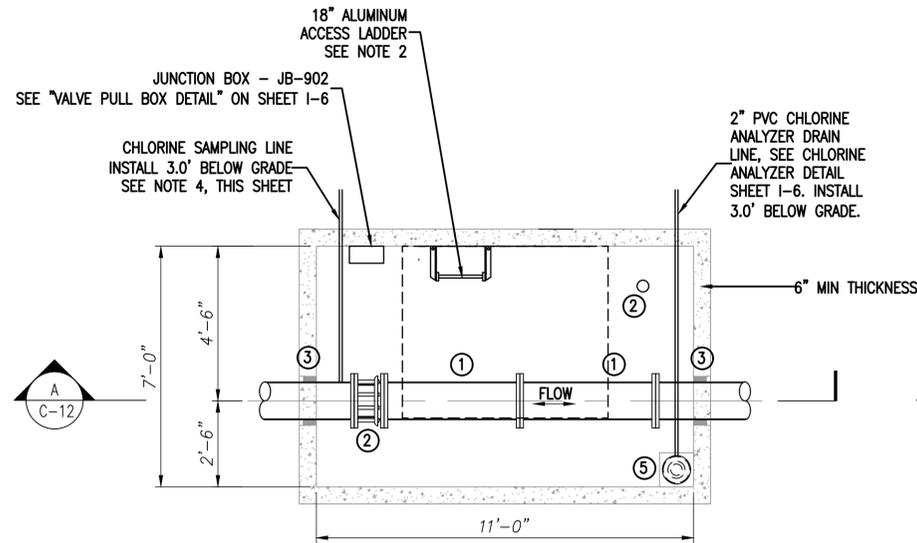


SCALE:
HORIZ.: N/A
VERT.: N/A
DATE: AUGUST 2023
DESIGNED: JBD
DRAWN: JBD
CHECKED: PJM
PROJECT NO.: 46826-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA

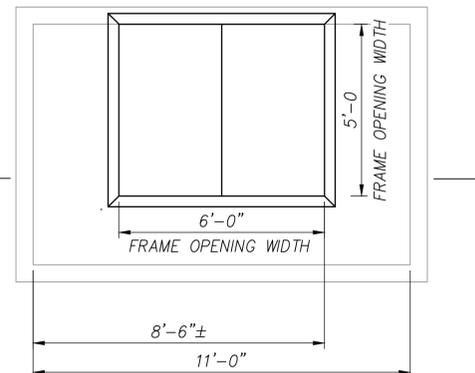
HELM STREET TANK REPLACEMENT
DRAINAGE CALCULATIONS

SHEET 12 OF 30 DRAWING C-10



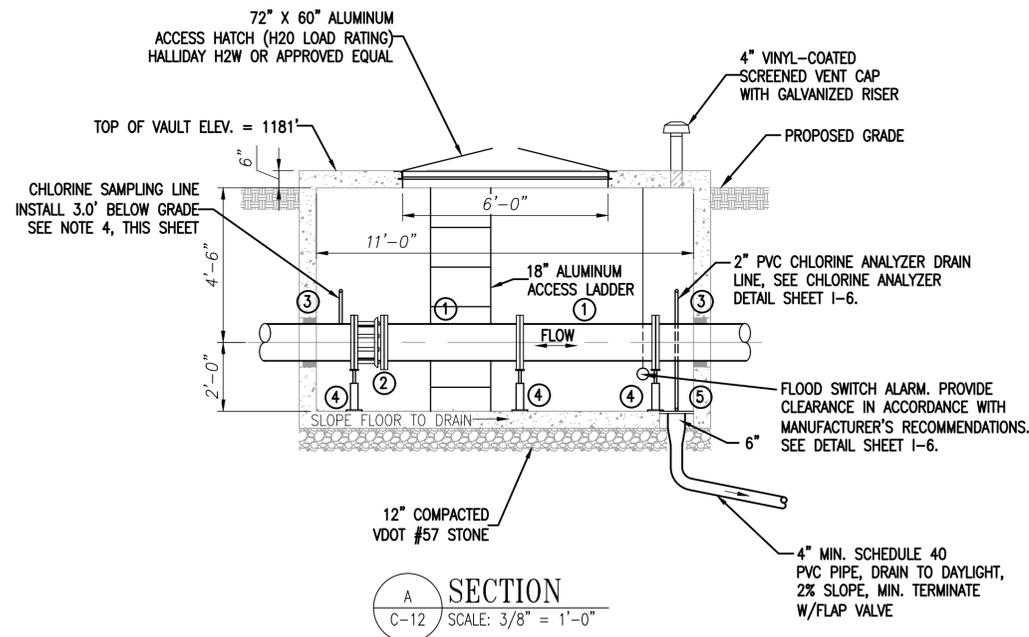
ALTITUDE VALVE VAULT PLAN

SCALE: 3/8" = 1'-0"



ROOF PLAN

SCALE: 3/8" = 1'-0"



SECTION

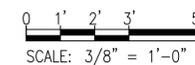
SCALE: 3/8" = 1'-0"

EQUIPMENT LIST

- ① 12" SPOOL PIECE, FLANGED
- ② 12" DISMANTLING JOINT
- ③ DOUBLE LINK-SEAL
- ④ ADJUSTABLE PIPE STAND
- ⑤ FLOOR DRAIN WITH STAINLESS STEEL GRATE
- ⑥ FLOOD SWITCH ALARM

NOTES

1. PRECAST CONCRETE UTILITY VAULT DESIGN SHALL BE DELEGATED TO A QUALIFIED PROFESSIONAL ENGINEER, SELECTED AND HIRED BY THE CONTRACTOR.
2. ALUMINUM LADDER SHALL BE BOLTED TO VAULT. PROVIDE SAFETY EXTENSION WITH LADDER.
3. ALL VAULT PENETRATIONS SHALL BE WATER TIGHT.
4. TAP PIPE WITH CORP STOP. USE STAINLESS STEEL TUBING AND PROVIDE SHUTOFF BALL VALVE. SEE SHEET I-6 FOR CONNECTION TO CHLORINE ANALYZER.
5. SLOPE VAULT FLOOR TO DRAIN. 1% SLOPE.
6. ALTITUDE VALVE AND FLOW METER TO BE PROVIDED AND INSTALLED BY OWNER IN THE FUTURE.

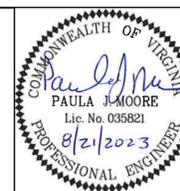


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NO.	DATE	BY	REVISIONS



Whitman, Requardt & Associates, LLP
1700 KRAFT DRIVE, SUITE 1200, BLACKSBURG, VIRGINIA 24060

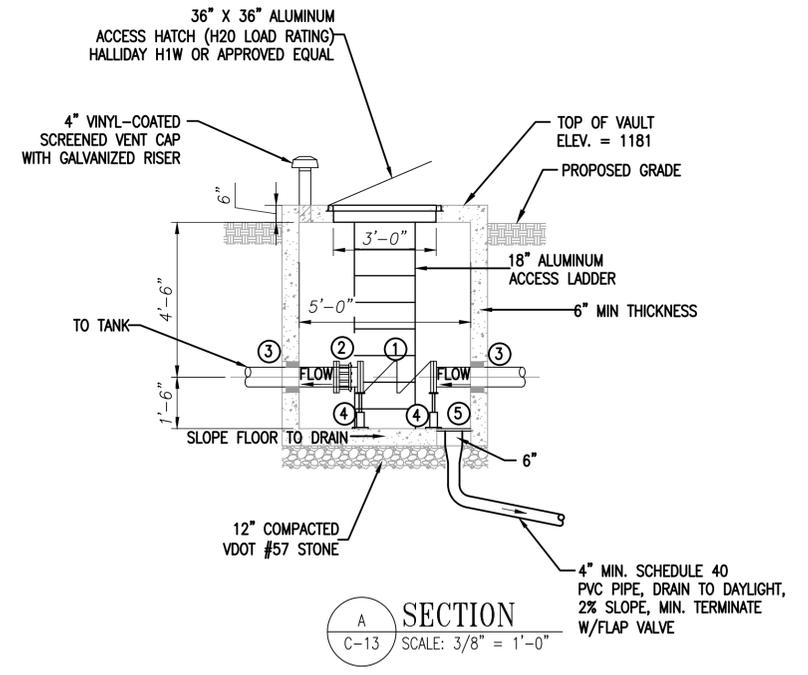
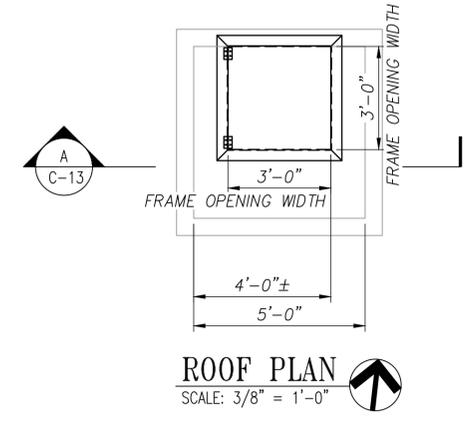
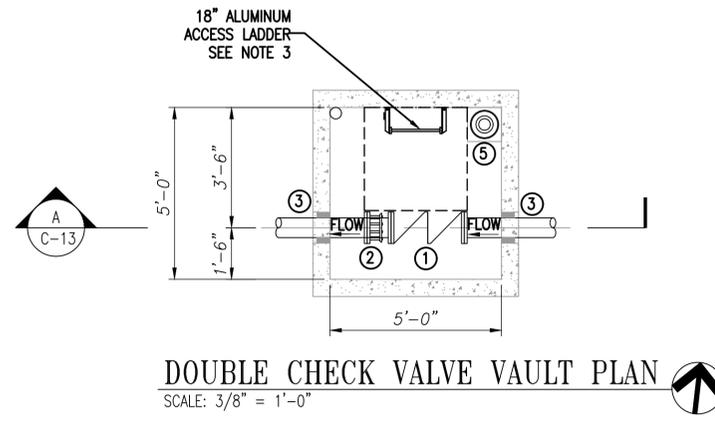


SCALE:
HORIZ: 3/8"=1'
VERT: N/A
DATE: AUGUST 2023
DESIGNED: MSS
DRAWN: MSS
CHECKED: PJM
PROJECT NO.: 46626-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA

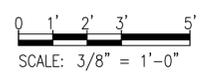
HELM STREET TANK REPLACEMENT
FLOW METER AND ALTITUDE VALVE VAULT

SHEET
14
OF
30
DRAWING
C-12



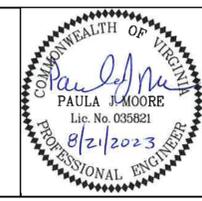
- EQUIPMENT LIST**
- ① 6" DOUBLE CHECK VALVE
 - ② 6" DISMANTLING JOINT
 - ③ DOUBLE LINK-SEAL
 - ④ ADJUSTABLE PIPE STAND
 - ⑤ FLOOR DRAIN WITH STAINLESS STEEL GRATE

- NOTES**
1. PRECAST CONCRETE UTILITY VAULT DESIGN SHALL BE DELEGATED TO A QUALIFIED PROFESSIONAL ENGINEER, SELECTED AND HIRED BY THE CONTRACTOR.
 2. ALUMINUM LADDER SHALL BE BOLTED TO VAULT. PROVIDE SAFETY EXTENSION WITH LADDER.
 3. ALL VAULT PENETRATIONS SHALL BE WATER TIGHT.
 4. SLOPE VAULT FLOOR TO DRAIN. 1% SLOPE.



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NO.	DATE	BY	REVISIONS



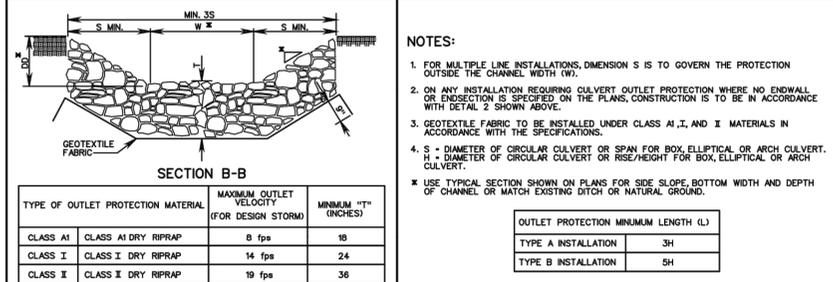
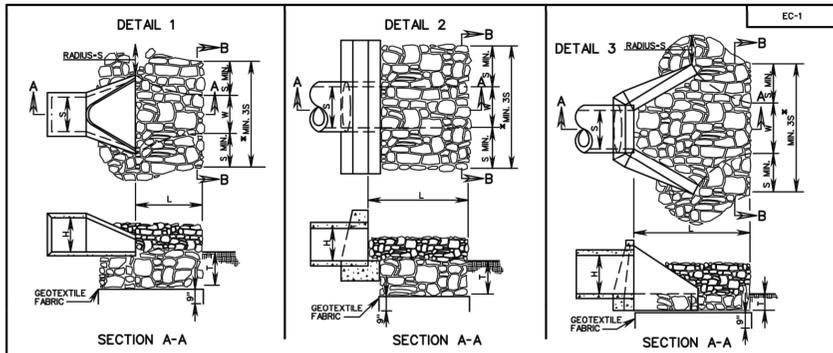
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HORIZ: 3/8"=1'
VERT: N/A
DATE: AUGUST 2023
DESIGNED: MSS
DRAWN: MSS
CHECKED: PJM
PROJECT NO.: 46826-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
DOUBLE CHECK VALVE VAULT

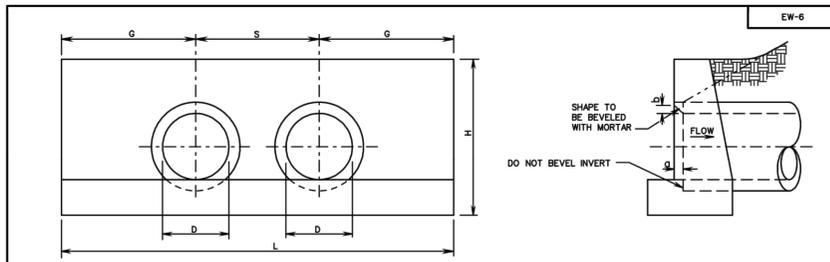
SHEET
15
OF
30

DRAWING
C-13



TYPE OF OUTLET PROTECTION MATERIAL	MAXIMUM OUTLET VELOCITY (FOR DESIGN STORM)	MINIMUM "H" (INCHES)
CLASS A1	CLASS A DRY RIPRAP	8 fpa
CLASS I	CLASS II DRY RIPRAP	14 fpa
CLASS II	CLASS II DRY RIPRAP	19 fpa

CULVERT OUTLET PROTECTION



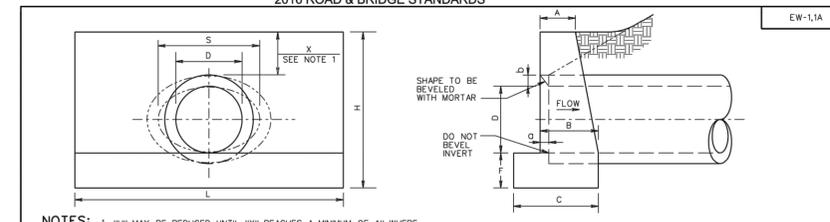
- NOTES:
- IN NO CASE SHALL TOP OF ENDWALL PROJECT ABOVE FILL SLOPE, DITCH SLOPE, DITCH SLOPE, OR SHOULDER.
 - THIS ITEM MAY BE PRECAST OR CAST IN PLACE.
 - ALL CAST IN PLACE CONCRETE TO BE CLASS A3. FOR PRECAST SEE SHEET 101.12.
 - THIS STANDARD TO BE USED WITH STRAIGHT CROSSINGS AND SKEW ANGLES TO 15°.
 - HEADWALL TO BE BEVELED IN ALL AREAS EXCEPT WHERE A CONFLICT WITH INVERT OR WINGWALLS OCCUR.
 - BEVEL EDGE IS REQUIRED ON THE HEADWALL AT THE INLET END OF THE CULVERT (WHERE THE FLOW ENTERS THE CULVERT).
 - HEADWALL AT THE OUTLET END OF THE CULVERT MAY BE EITHER SQUARE EDGE OR BEVEL EDGE.
 - ON SHALLOW FILLS, WHERE ENDWALLS ARE 1' OR LESS BELOW SHOULDER LINE, THE TOP OF THE ENDWALL SHALL BE CONSTRUCTED PARALLEL TO THE GRADE OF THE ROAD.
 - 3/4" CHAMFER MAY BE PROVIDED ON ALL EDGES AT MANUFACTURER'S OPTION.
 - QUANTITIES GIVEN ARE FOR ONE ENDWALL. PLEASE REFER TO STANDARD EW-1, SHEET 101.01 FOR ALL DIMENSIONS NOT GIVEN IN TABLES.

FOR CONCRETE PIPE						FOR CORRUGATED METAL PIPE									
D	S	G	L	CUBIC YARDS CONCRETE ONE DOUBLE ENDWALL	INCREASE FOR EACH ADDITIONAL PIPE	a	b	D	S	G	L	CUBIC YARDS CONCRETE ONE DOUBLE ENDWALL	INCREASE FOR EACH ADDITIONAL PIPE	a	b
12"	1'-10"	2'-0"	5'-10"	0.329	0.088	0'-3/4"	0'-1"	12"	1'-7"	2'-0"	5'-7"	0.344	0.087	0'-3/4"	0'-1"
15"	2'-3"	2'-6"	7'-3"	0.671	0.179	0'-1/2"	0'-1/4"	15"	1'-10"	2'-6"	8'-10"	0.696	0.178	0'-1/2"	0'-1/4"
18"	2'-8"	3'-0"	8'-8"	0.941	0.244	0'-2"	0'-1/2"	18"	2'-4"	3'-0"	8'-4"	0.950	0.241	0'-2"	0'-1/2"
21" OR 24"	3'-6"	4'-0"	11'-6"	1.763	0.444	0'-2/4"	0'-2"	24"	3'-1"	4'-0"	11'-1"	1.840	0.442	0'-2/4"	0'-2"
27" OR 30"	4'-4"	5'-0"	14'-4"	2.730	0.683	0'-3/4"	0'-2/2"	27" OR 30"	3'-10"	5'-0"	13'-10"	2.868	0.670	0'-3/4"	0'-2/2"
33" OR 36"	5'-2"	6'-0"	17'-2"	3.654	0.907	0'-3/4"	0'-3"	36"	4'-7"	6'-0"	16'-7"	4.076	0.931	0'-3/4"	0'-3"

FOR CONCRETE PIPE						FOR CORRUGATED METAL PIPE									
D	S	G	L	CUBIC YARDS CONCRETE ONE DOUBLE ENDWALL	INCREASE FOR EACH ADDITIONAL PIPE	a	b	D	S	G	L	CUBIC YARDS CONCRETE ONE DOUBLE ENDWALL	INCREASE FOR EACH ADDITIONAL PIPE	a	b
12"	1'-10"	2'-0"	5'-10"	0.329	0.088	0'-3/4"	0'-1"	12"	1'-7"	2'-0"	5'-7"	0.344	0.087	0'-3/4"	0'-1"
15"	2'-3"	2'-6"	7'-3"	0.671	0.179	0'-1/2"	0'-1/4"	15"	1'-10"	2'-6"	8'-10"	0.696	0.178	0'-1/2"	0'-1/4"
18"	2'-8"	3'-0"	8'-8"	0.941	0.244	0'-2"	0'-1/2"	18"	2'-4"	3'-0"	8'-4"	0.950	0.241	0'-2"	0'-1/2"
21" OR 24"	3'-6"	4'-0"	11'-6"	1.763	0.444	0'-2/4"	0'-2"	24"	3'-1"	4'-0"	11'-1"	1.840	0.442	0'-2/4"	0'-2"
27" OR 30"	4'-4"	5'-0"	14'-4"	2.730	0.683	0'-3/4"	0'-2/2"	27" OR 30"	3'-10"	5'-0"	13'-10"	2.868	0.670	0'-3/4"	0'-2/2"
33" OR 36"	5'-2"	6'-0"	17'-2"	3.654	0.907	0'-3/4"	0'-3"	36"	4'-7"	6'-0"	16'-7"	4.076	0.931	0'-3/4"	0'-3"

STANDARD ENDWALL FOR MULTIPLE PIPE CULVERTS

12" - 36" CIRCULAR PIPES



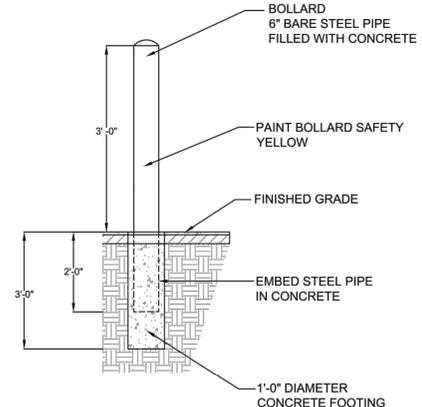
- NOTES:
- 1/4" MAY BE REDUCED UNTIL "X" REACHES A MINIMUM OF 4" WHERE ENDWALL WOULD PROVIDE ABOVE SHOULDER LINE. IN NO CASE SHALL TOP OF ENDWALL PROJECT ABOVE FILL SLOPE, DITCH SLOPE, OR SHOULDER.
 - THIS ITEM MAY BE PRECAST OR CAST IN PLACE.
 - ALL CAST IN PLACE CONCRETE TO BE CLASS A3. FOR PRECAST SEE SHEET 101.02.
 - THIS STANDARD TO BE USED WITH STRAIGHT CROSSINGS AND ALL SKEWS (TO 45°).
 - HEADWALL TO BE BEVELED IN ALL AREAS EXCEPT WHERE A CONFLICT WITH INVERT.
 - BEVEL EDGE IS REQUIRED ON THE HEADWALL AT THE INLET END OF THE CULVERT (WHERE THE FLOW ENTERS THE CULVERT).
 - HEADWALL AT THE OUTLET END OF THE CULVERT MAY BE EITHER SQUARE EDGE OR BEVEL EDGE.
 - ON SHALLOW FILLS, WHERE ENDWALLS ARE 1' OR LESS BELOW SHOULDER LINE, THE TOP OF THE ENDWALL SHALL BE CONSTRUCTED PARALLEL TO THE GRADE OF THE ROAD.
 - 3/4" CHAMFER MAY BE PROVIDED ON ALL EDGES AT MANUFACTURER'S OPTION.

ENDWALL FOR CIRCULAR PIPE										ENDWALL FOR ELLIPTICAL PIPE									
DIAMETER OF PIPE CULVERT										SIZE OF ELLIPTICAL PIPE CULVERT (SPAN x RISE)									
A	B	C	D	F	H	L	S	d	b	A	B	C	D	F	H	L	S	d	b
12"	15"	18"	21" OR 24"	27" OR 30"	33" OR 36"	0'-6"	0'-8"	0'-9"	0'-11"	1'-0"	1'-0"	23"x14"	30"x19"	34"x22"	38"x24"	42"x27"	45"x29"	49"x32"	53"x34"
0'-6"	0'-8"	0'-9"	0'-11"	1'-0"	1'-0"	0'-11"	1'-1"	1'-3"	1'-6"	1'-9"	2'-0"	0'-8"	0'-9"	0'-10"	0'-11"	1'-0"	1'-0"	1'-0"	1'-0"
1'-4"	1'-7"	1'-9"	2'-2"	2'-6"	2'-9"	1'-4"	1'-5"	1'-6"	1'-8"	1'-9"	1'-11"	1'-2"	1'-5"	1'-6"	1'-8"	1'-9"	1'-10"	1'-11"	1'-11"
1'-0"	1'-3"	1'-6"	2'-0"	2'-6"	3'-0"	1'-0"	1'-1"	1'-2"	1'-4"	1'-5"	1'-7"	1'-2"	1'-5"	1'-6"	1'-8"	1'-9"	1'-10"	1'-11"	1'-11"
0'-6"	0'-8"	0'-9"	0'-11"	1'-0"	1'-0"	0'-6"	0'-8"	0'-9"	0'-11"	1'-0"	1'-0"	0'-8"	0'-9"	0'-10"	0'-11"	1'-0"	1'-0"	1'-0"	1'-0"
2'-3"	2'-11"	3'-2"	3'-9"	4'-3"	4'-9"	2'-10"	2'-11"	3'-0"	3'-9"	4'-3"	4'-9"	2'-10"	2'-11"	3'-0"	3'-9"	4'-3"	4'-9"	4'-5"	4'-7"
4'-0"	5'-0"	5'-0"	6'-0"	10'-0"	12'-0"	5'-5"	5'-5"	7'-2"	8'-6"	9'-2"	10'-2"	10'-2"	10'-11"	12'-1"	12'-11"	12'-1"	12'-11"	12'-1"	12'-11"
S	1'-11"	2'-6"	2'-10"	3'-2"	3'-6"	1'-11"	2'-6"	2'-10"	3'-2"	3'-6"	3'-9"	4'-1"	4'-2"	4'-5"	4'-1"	4'-5"	4'-1"	4'-5"	4'-1"
d	0'-2/2"	0'-3/4"	0'-3/2"	0'-4"	0'-4/2"	0'-4/2"	0'-3/4"	0'-3/2"	0'-3/4"	0'-3/2"	0'-3/4"	0'-3/2"	0'-3/4"	0'-3/2"	0'-3/4"	0'-3/2"	0'-3/4"	0'-3/2"	0'-3/4"
b	0'-1"	0'-1/4"	0'-1/2"	0'-2/2"	0'-3/4"	0'-1"	0'-1/4"	0'-1/2"	0'-2/2"	0'-3/4"	0'-1"	0'-1/4"	0'-1/2"	0'-2/2"	0'-3/4"	0'-1"	0'-1/4"	0'-1/2"	0'-2/2"

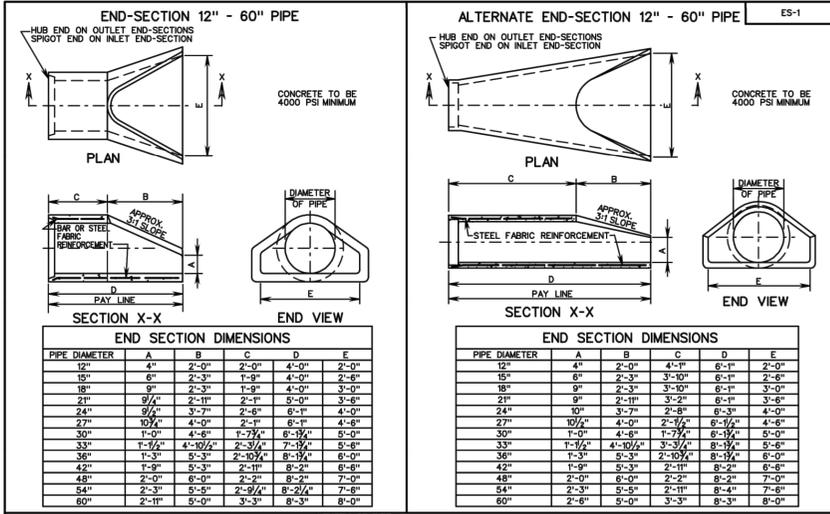
CIRCULAR PIPES						ELLIPTICAL PIPES									
CONC. PIPE	C.M. PIPE	0.241	0.492	0.637	1.319	2.067	2.947	0.502	0.855	1.236	1.500	1.811	2.101	2.512	2.801

2016 ROAD & BRIDGE STANDARDS

- NOTES:
- CONCRETE SHALL BE READY MIX VDOT CLASS A3, 3,000 PSI., AT 28 DAYS.



BOLLARD DETAIL N.T.S.

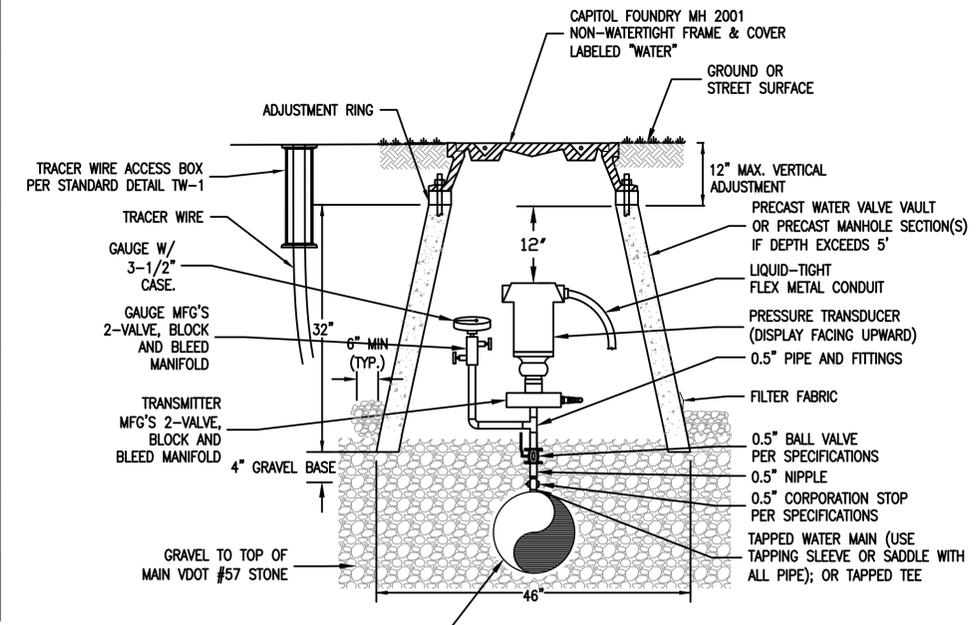


END SECTION DIMENSIONS						END SECTION DIMENSIONS					
PIPE DIAMETER	A	B	C	D	E	PIPE DIAMETER	A	B	C	D	E
12"	4"	2'-0"	2'-0"	4'-0"	2'-0"	12"	4"	2'-0"	4'-1"	6'-1"	2'-0"
15"	6"	2'-3"	1'-0"	4'-0"	2'-6"	15"	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	9"	2'-3"	1'-9"	4'-0"	3'-0"	18"	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	9 1/2"	2'-11"	2'-1"	5'-0"	3'-6"	21"	9"	2'-11"	3'-2"	6'-1"	3'-6"
24"	10 1/2"	3'-7"	2'-6"	6'-0"	4'-0"	24"	10"	3'-7"	2'-8"	6'-3"	4'-0"
27"	10 1/2"	4'-0"	2'-3"	6'-1"	4'-6"	27"	10 1/2"	4'-0"	2'-1/2"	6'-3/4"	4'-6"
30"	1'-0"	4'-6"	1'-7 1/2"	6'-1 1/2"	5'-0"	30"	1'-0"	4'-6"	1'-7 1/2"	6'-1 1/2"	5'-0"
33"	1'-1 1/4"	4'-10 1/2"	2'-3 1/4"	7'-1 1/2"	5'-6"	33"	1'-1 1/4"	4'-10 1/2"	3'-3 1/4"	6'-1 1/2"	5'-6"
36"	1'-3"	5'-3"	2'-10 1/4"	8'-1 1/4"	6'-0"	36"	1'-3"	5'-3"	2'-10 1/4"	6'-1 1/4"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-8"	42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-8"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"	48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	2'-3"	6'-6"	2'-6 1/4"	8'-2 1/4"	7'-6"	54"	2'-3"	6'-6"	2'-6 1/4"	8'-2 1/4"	7'-6"
60"	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"	60"	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"

FLARED END SECTION					
PIPE DIAMETER	A	B	C	D	E
12"	4"	2'-0"	2'-0"	4'-0"	2'-0"
15"	6"	2'-3"	1'-0"	4'-0"	2'-6"
18"	9"	2'-3"	1'-9"	4'-0"	3'-0"
21"	9 1/2"	2'-11"	2'-1"	5'-0"	3'-6"
24"	10 1/2"	3'-7"	2'-6"	6'-0"	4'-0"
27"	10 1/2"	4'-0"	2'-3"	6'-1"	4'-6"
30"	1'-0"	4'-6"	1'-7 1/2"	6'-1 1/2"	5'-0"
33"	1'-1 1/4"	4'-10 1/2"	2'-3 1/4"	7'-1 1/2"	5'-6"
36"	1'-3"	5'-3"	2'-10 1/4"	8'-1 1/4"	6'-0"
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-8"
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"
54"	2'-3"	6'-6"	2'-6 1/4"	8'-2 1/4"	7'-6"
60"	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"

2016 ROAD & BRIDGE STANDARDS

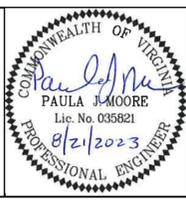
- NOTES:
- ALL PIPE AND FITTINGS SHALL BE LEAD FREE BRASS, STAINLESS STEEL, OR EPOXY COATED DUCTILE IRON. GALVANIZED, PVC, AND BLACK IRON PIPE WILL NOT BE ALLOWED.
 - FILTER FABRIC TO BE INSTALLED BETWEEN BOTTOM OF PIPE AND STONE BEDDING. FABRIC TO EXTEND VERTICALLY A MINIMUM OF 6" FROM BOTTOM OF VAULT (FULL CIRCUMFERENCE).



PRESSURE TRANSDUCER AND VAULT N.T.S.

N:\46826-003\CADD\46826003C1-15.DWG

NO.	DATE	BY	REVISIONS



SCALE:
HORIZ: N/A
VERT: N/A
DATE: AUGUST 2023
DESIGNED: MSS
DRAWN: MSS
CHECKED: PJM
PROJECT NO.: 46826-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA
HELM STREET TANK REPLACEMENT
NOTES AND DETAILS

SHEET 17 OF 30 DRAWING C-15

USE TWO LAYERS OF 15 LB. BUILDERS FELT ON FITTINGS

DIRECTION OF THRUST OR BISECTOR OF PIPE BEND

NOTES:

- FITTING FLANGE BOLTS SHALL REMAIN FREE OF CONCRETE.
- DO NOT BACKFILL UNTIL CONCRETE HAS SET FOR A MINIMUM OF 4 HOURS.

CONCRETE ANCHOR FOR HORIZONTAL AND SAG ANCHORS

PIPE DIA. (Inches)	DEAD END	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND	THRUST (lbs.)
6	7479	10,576	5724	2918	1466	200psi
	9348	13,220	7155	3647	1833	250psi
8	12,865	18,194	9847	5020	2522	200psi
	16,082	22,743	12,308	6275	3153	250psi
10	19,354	27,370	14,813	7551	3794	200psi
	24,192	34,213	18,516	9439	4743	250psi
12	27,370	38,706	20,948	10,679	5365	200psi
	34,212	48,383	28,185	13,349	6707	250psi

Bedford Regional Water Authority

CA-1

CONCRETE ANCHOR THRUST BLOCK (SEE TABLE)

VALVE

MJ CAP

PIPE DIAMETER

3/4" DIA THREADED RODS (SEE TABLE)

SOUND UNDISTURBED SOIL

BLOWOFF CHAMBER (SEE STANDARD DETAIL BC-1)

FINISHED GRADE

TRENCH

CONCRETE ANCHOR THRUST BLOCK

MJ VALVE

MJ CAP

3/4" DIA THREADED RODS

SECTION VIEW

PIPE DIAMETER (in)	B min (in)	L1 min (in)	NUMBER OF RODS PER RETAINER	L2 min (in)
4-8	12	18	4	27
10-12	27	33	4	50
14-16	44	50	6	75

NOTES:

- FOR USE WITH TEST OR WORKING PRESSURES 200 PSI OR LESS.
- RETAINER GLANDS SHALL BE IN ACCORDANCE WITH SPECIFICATIONS.

Bedford Regional Water Authority

WATERLINE BULKHEAD ANCHOR WITH GATE VALVE AND BLOW-OFF

CA-6

2016 ROAD & BRIDGE STANDARDS

DI-7, 7A, 7B

PLAN (COVER REMOVED)

SECTION A-A CAST IN PLACE FOR USE WITH 12" TO 42" PIPES

SECTION B-B PRECAST

NOTES (CONT.)

- DEPTH OF INLET (H) TO BE SHOWN ON PLANS.
- THE "H" DIMENSION SHOWN ON THE STANDARDS AND SPECIFIED ON THE PLANS WILL BE MEASURED FROM THE INVERT OF THE OUTFALL PIPE TO THE TOP OF THE STRUCTURE. PLAN "H" DIMENSIONS ARE FOR ESTIMATING PURPOSES AND THE ACTUAL DIMENSIONS SHALL BE DETERMINED BY THE CONTRACTOR FROM FIELD CONDITIONS. MAXIMUM DEPTH (H) TO BE 12'-8".
- WHEN SPECIFIED ON THE PLANS THE INVERT IS TO BE SHAPED IN ACCORDANCE WITH STANDARD 10-1. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE SHAPING IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.
- IN THE EVENT THE INVERT OF THE OUTFALL PIPE IS HIGHER THAN THE BOTTOM OF THE STRUCTURE, THE INVERT OF THE STRUCTURE SHALL BE SHAPED WITH CEMENT MORTAR TO PREVENT STANDING OR PONDING OF WATER IN THE STRUCTURE. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE SHAPING IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.
- STEPS ARE TO BE PROVIDED WHEN H IS 4'-0" OR GREATER. FOR DETAILS SEE STANDARD ST-1.
- REINFORCED CONCRETE FOOTING MAY BE PRECAST OR CAST-IN-PLACE. TWO LIFTING HOOPS OF FABRICATORS DESIGN TO BE PROVIDED IN FOOTING.
- 4" DEPTH AGGREGATE #68, #78, OR #8 X 6" WIDTH.
- 3" DIAMETER WEEP HOLE WITH 12"X12" PLASTIC HARDWARE CLOTH 1/2" MESH OR GALVANIZED STEEL WIRE MESH MINIMUM WIRE DIAMETER 0.031" NUMBER 4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO THE OUTSIDE OF THE STRUCTURE.
- THE TYPE OF INLET (PRECAST OR CAST IN PLACE), DETAILED HEREON, TO BE CONSTRUCTED, WILL BE AT THE OPTION OF THE CONTRACTOR.
- FOR DETAILS OF CONCRETE COVER, COLLAR AND GRATE AND THE METHOD OF PLACING APPROACH GUTTER SEE SHEET 2 OF 3.
- CAST-IN PLACE CONCRETE IS TO BE CLASS AS (3000 PSI). PRECAST CONCRETE IS TO BE 4000 PSI.
- CONCRETE QUANTITIES SHOWN ARE FOR INDICATED DEPTH (H) WITHOUT PIPES. THE AMOUNT DISPLACED BY PIPES MUST BE DEDUCTED TO OBTAIN TRUE QUANTITIES. FOR INLETS OF DIFFERENT DEPTHS ADD OR SUBTRACT THE APPROPRIATE CUBIC YARDS OF CONCRETE FOR EACH FOOT OF DEPTH.
- PAVED DITCHES ARE TO BE TRANSITIONED TO MEET INLET GUTTER AS SHOWN IN STANDARD PG-2A.
- PROVIDE SAFETY SLABS WHEN SPECIFIED ON THE PLANS.

PIPE SIZE	H DIMENSION CONC.	CORR. METAL
12"	2'-8"	2'-5"
15"	2'-9 1/2"	2'-8"
18"	3'-0 1/2"	2'-11"
21"	3'-3 1/4"	3'-2"
24"	3'-7"	3'-5"
27"	3'-10 1/4"	3'-8"
30"	4'-1 1/2"	3'-11"
33"	4'-4 3/4"	4'-2"
36"	4'-8"	4'-5"
42"	5'-2 1/2"	4'-11"

RECOMMENDED MINIMUM HEIGHT CHART

CONCRETE CUBIC YARDS

PIPE SIZE	MINIMUM DEPTH (ft)	CONCRETE CUBIC YARDS
12"	2'-0"	0.947
15"	2'-3 1/4"	1.045
18"	2'-6 1/2"	1.143
21"	2'-9 1/4"	1.339
24"	3'-2 1/2"	1.535
27"	3'-5 1/4"	1.731
30"	3'-8 1/4"	1.927

INCREMENT PER FOOT OF ADDITIONAL DEPTH (H) $\frac{1}{2}$ = 0.362 CU. YDS. (12" - 36" PIPE) $\frac{1}{3}$ = 0.438 CU. YDS. (42" PIPE)

STANDARD MEDIAN DROP INLET

12" TO 42" PIPE

VIRGINIA DEPARTMENT OF TRANSPORTATION

2016 ROAD & BRIDGE STANDARDS

VDOT ROAD AND BRIDGE STANDARDS

REVISION DATE SHEET 1 OF 3

104.22

2016 ROAD & BRIDGE STANDARDS

DI-7, 7A, 7B

DETAILS OF CONCRETE COVER AND GRATE

NOTES

- GRATE A IS TO BE UTILIZED IN LOCATIONS NOT NORMALLY SUBJECT TO TRAFFIC.
- GRATE B IS TO BE UTILIZED IN LOCATIONS NORMALLY SUBJECT TO TRAFFIC.
- FOR DETAILS OF LOAD CARRYING GRATE (GRATE B), SEE T-DI-7, SHEET 103.08.
- CONCRETE COVER AND GRATE ARE TO BE FURNISHED AS A SINGLE UNIT. OUTSIDE DIMENSIONS OF GRATE TO BE 3'-4" X 2'-11 1/2" (GRATE A) OR 3'-4" X 2'-11 1/2" (GRATE B).
- ALTERNATE METHODS OF ANCHORING ANGLE IRON WILL BE ACCEPTABLE IF APPROVED BY THE ENGINEER.
- GRATE AND COLLAR ARE TO BE GALVANIZED.
- CONCRETE COVER MAY BE PRECAST OR CAST IN PLACE.
- CONCRETE TO BE CLASS A3 IN PLACE. 4000 PSI IF PRECAST.
- GRATE BARS TO BE PARALLEL TO DITCH FLOW.

DETAILS OF GUTTER AND METHOD OF PLACEMENT

NOTES

- DI-7 NO GUTTERS.
- DI-7A NO GUTTER IN ONE DIRECTION.
- DI-7B GUTTER IN BOTH DIRECTIONS.
- JOINTS BETWEEN GUTTERS AND CONCRETE COVER ARE TO BE DOWELED WITH #4 X 8" SMOOTH RODS @ APPROX. 12" C-C TO PREVENT SETTLEMENT IN LEU OF DOWELS A 2" X 4" NOTCH MAY BE PROVIDED.
- SEE STANDARD T-DI-3, 4 ALTERNATE DESIGN.
- VARIABLE 2:1 OR FLATTER.
- DITCH GRADE MUST BE ADJUSTED TO MEET DIFFERENCE IN ELEVATION. SEE LONGITUDINAL SECTION.
- IF DEPTH (D) BECOMES LESS THAN 4" LENGTH OF WINGS ARE TO BE EXTENDED AS DIRECTED BY THE ENGINEER.
- CURTAIN WALL TO BE LOCATED AT THE END OF THE PAVED DITCH SECTIONS OF THE DI-7A & DI-7B THAT ARE NOT ABUTTED BY OTHER DRAINAGE.
- IF NORMAL DITCH GRADE IS TOO FLAT TO ALLOW FOR ADJUSTED GRADE TO INLET, A SPECIAL GUTTER DETAIL WILL BE REQUIRED ON PLANS.

TYPICAL ELEVATION

LONGITUDINAL SECTION (WHEN INLET IS LOCATED ABOVE NORMAL DITCH GRADE) SEE NOTE 8.

APPROXIMATE QUANTITIES

CONCRETE CLASS	DI-7	DI-7A	DI-7B
(CU. YDS.)	NONE	1.211	2.148

STANDARD MEDIAN DROP INLET

12" TO 42" PIPE

VIRGINIA DEPARTMENT OF TRANSPORTATION

2016 ROAD & BRIDGE STANDARDS

VDOT ROAD AND BRIDGE STANDARDS

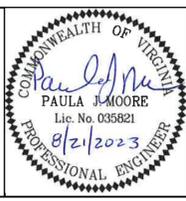
SHEET 2 OF 3 REVISION DATE

104.23

241 503

N:\46626-003\CADD\46626003C1-16.DWG

NO.	DATE	BY	REVISIONS



SCALE:

HORIZ.: N/A

VERT.: N/A

DATE: AUGUST 2023

DESIGNED: MSS

DRAWN: MSS

CHECKED: PJM

PROJECT NO.: 46626-003

BEDFORD REGIONAL WATER AUTHORITY

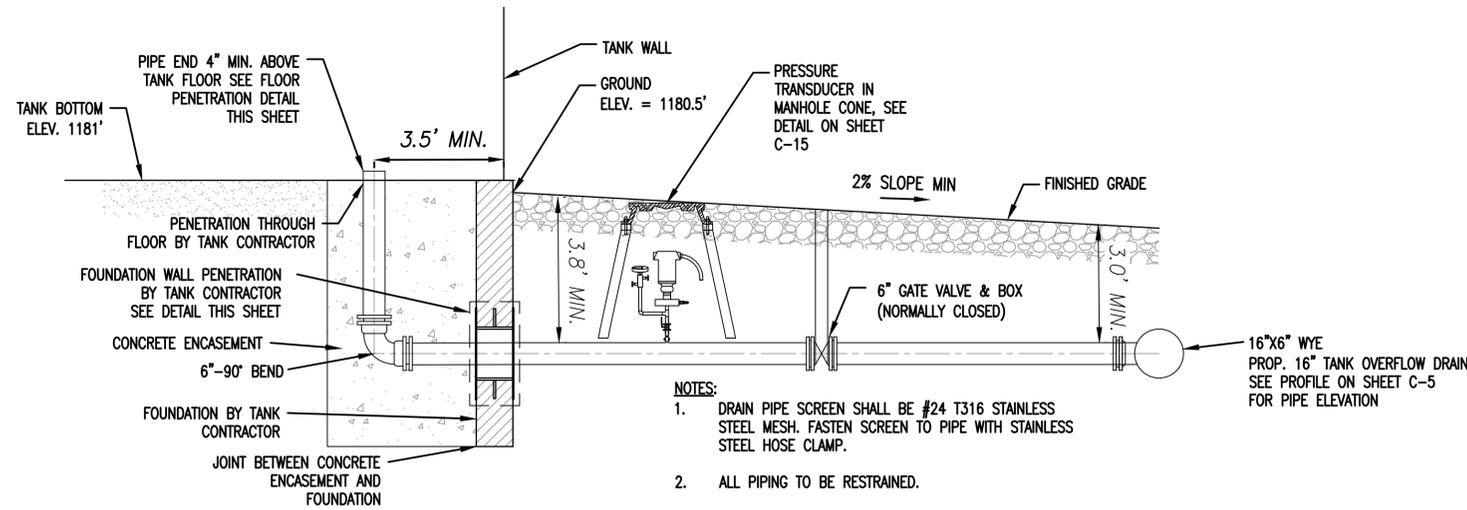
1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT

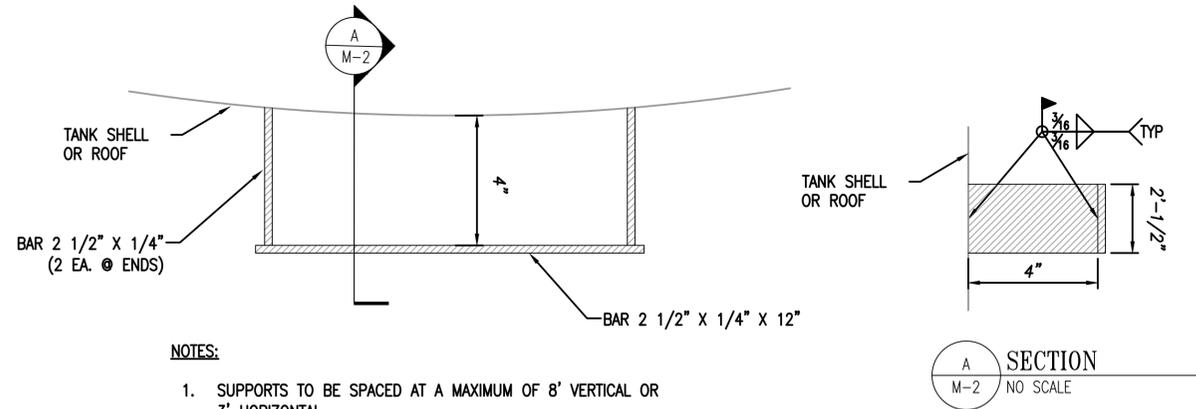
NOTES AND DETAILS

SHEET 18 OF 30

DRAWING C-16

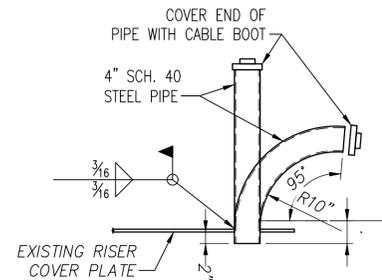


6" TANK DRAIN DETAIL
N.T.S.

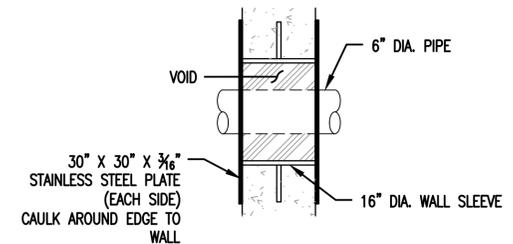


- NOTES:
- SUPPORTS TO BE SPACED AT A MAXIMUM OF 8' VERTICAL OR 3' HORIZONTAL.
 - SUPPORTS TO BE A MINIMUM OF 2' FROM THE EDGE OF THE LADDER.

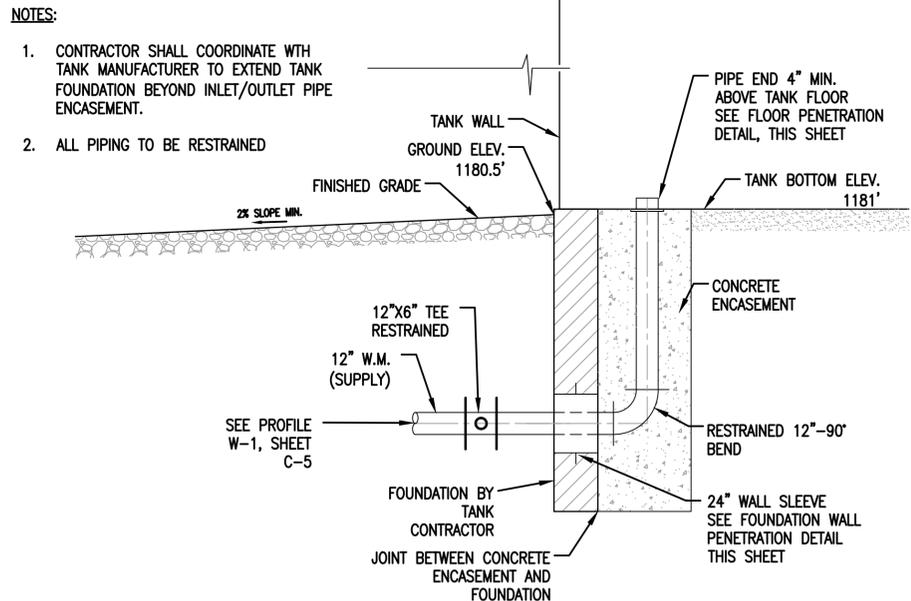
SHELL/ROOF CONDUIT AND CABLE SUPPORT DETAIL
N.T.S.



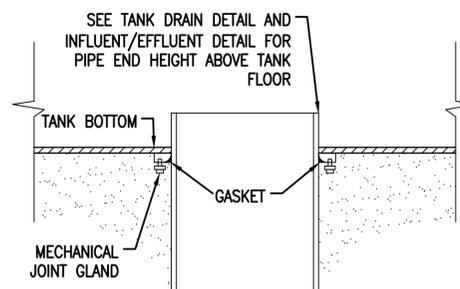
CABLE PENETRATION THROUGH ROOF
N.T.S.



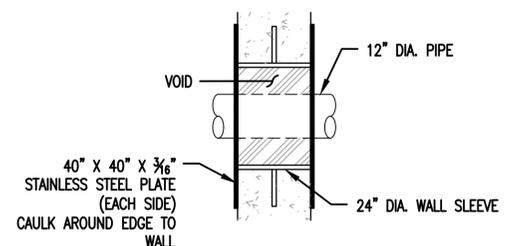
FOUNDATION WALL PENETRATION (6" DRAIN LINE)
N.T.S.



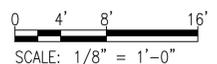
TANK INFLUENT/EFFLUENT PIPING DETAIL
N.T.S.



FLOOR PENETRATION DETAIL
N.T.S.

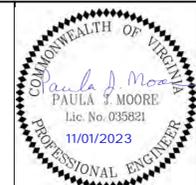


FOUNDATION WALL PENETRATION (12" INFLUENT/EFFLUENT LINE)
N.T.S.



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NO.	DATE	BY	REVISIONS



SCALE:
HORIZ: N.T.S.
VERT: N/A

DATE: NOVEMBER 1, 2023

DESIGNED: MSS

DRAWN: MSS

CHECKED: PJM

PROJECT NO.: 46826-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
GROUND STORAGE TANK DETAILS

SHEET
20
OF
30

DRAWING
M-2

GENERAL NOTES

- INSTALLATION OF ELECTRICAL WORK MUST CONFORM TO THE AHJ'S LATEST ACCEPTED EDITION OF THE NATIONAL ELECTRICAL CODE (NFPA 70) AND ALL APPLICABLE LOCAL CODES AND QUALITY WORKMANSHIP STANDARDS.
- DRAWINGS ARE DIAGRAMMATIC. FINAL EQUIPMENT LOCATIONS MUST BE COORDINATED IN THE FIELD AND FIT INTO THE AVAILABLE SPACE IN ACCORDANCE WITH GIVEN WORK SPACE REQUIRED BY CODE AND MAINTENANCE REQUIRED BY THE MANUFACTURER. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE EQUIPMENT THAT MEETS THE ABOVE REQUIREMENTS AND NOTIFY THE OWNER/ENGINEER WHEN THE REQUIREMENTS ARE NOT MET.
- PROVIDE A CONSTRUCTION SCHEDULE, SEQUENCE OF CONSTRUCTION, OUTAGE REQUESTS, AND RESTRICTED AREA ACCESS REQUESTS FOR APPROVAL BY THE OWNER. WORK IN CERTAIN AREAS IS RESTRICTED AND GOVERNED BY EXISTING SECURITY REGULATIONS. ACCESS INTO THESE AREAS REQUIRE APPROVAL. WORK MUST ALLOW FOR DAILY OPERATION OF THE FACILITY WITHOUT INTERRUPTION. WHEN TEMPORARY POWER IS REQUIRED, THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS. CONTRACTOR MUST OBTAIN WRITTEN PERMISSION FROM THE OWNER TO DE-ENERGIZE ANY BUILDING EQUIPMENT OR DISRUPT ANY COMMUNICATION LINE.
- THE ELECTRICAL CONTRACTOR MUST PROVIDE THE NECESSARY COORDINATION, INSTRUCTIONS AND SUPERVISION NEEDED WHEN WORKING WITH OTHER TRADES.
- PRIOR TO STARTING DEMOLITION AND/OR NEW WORK, COORDINATE A SITE VISIT TO EXAMINE AND EVALUATE THE EXISTING CONDITIONS AFFECTING THE EXECUTION OF THIS PROJECT. REPORT ANY CONCERNS TO THE OWNER/ENGINEER AT THAT TIME.
- THE DEMOLITION AND NEW WORK MUST BE EXECUTED IN ACCORDANCE WITH AN APPROVED WORK PLAN, SEQUENCE OF CONSTRUCTION, AND WORK SCHEDULE.
- DEMOLITION AND NEW WORK SHOWN ON THE DRAWINGS USE DARK THICK-WEIGHTED LINES. EXISTING EQUIPMENT NOT AFFECTED BY THE CONTRACT DRAWINGS ARE SHOWN USING THIN-WEIGHTED LINES.
- ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT ARE BASED ON EQUIPMENT SPECIFIED. COORDINATE EXACT REQUIREMENTS WITH MECHANICAL SHOP DRAWINGS PRIOR TO ORDERING AND INSTALLING EQUIPMENT.
- ELECTRICAL EQUIPMENT INSTALLED AGAINST CONCRETE OR MASONRY WALLS MUST BE INSTALLED WITHIN A 1/4" SPACE BETWEEN THE EQUIPMENT AND THE MOUNTING SURFACE. SPACERS MUST BE STAINLESS STEEL, PVC OR NYLON.
- PROVIDE NECESSARY COMPONENTS REQUIRED FOR MAKING FINAL CONNECTIONS OF EQUIPMENT INSTALLED AS PART OF THIS CONTRACT.
- CIRCUIT NUMBERS ARE FOR IDENTIFICATION PURPOSE ONLY. THE CONTRACTOR IS RESPONSIBLE FOR BALANCING LOADS AND CORRECTLY PHASING THE CIRCUITS IN PANELBOARDS.
- MINIMUM CONDUIT AND WIRE SIZE IS 3/4" AND #12 AWG.
- 120V CIRCUITS MUST HAVE SEPARATE NEUTRALS.
- PROVIDE #10 AWG OR LARGER WIRES TO 120 VOLT RECEPTACLE CIRCUITS WHERE THE LAST RECEPTACLE IS LOCATED 100 FEET OR MORE FROM THE PANELBOARD.
- PROVIDE PULL STRINGS IN EMPTY CONDUIT TO FACILITATE PULLING OF CABLES IN FUTURE.
- OPENINGS AND PASSAGES FOR CONDUITS OR WIREWAYS THROUGH FLOOR SLABS, FIRE-RATED WALLS, OR PARTITIONS MUST BE PROVIDED WITH UL LISTED FIRE-RATED SLEEVING SYSTEMS.
- CONDUIT ROUTING, WHEN SHOWN, IS DIAGRAMMATIC AND MUST BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT AND STRUCTURAL CONDITIONS. INTERIOR CONDUITS INCLUDING THOSE EXPOSED, ABOVE SUSPENDED CEILINGS, AND CONCEALED WITHIN FURRED WALLS MUST BE INSTALLED PARALLEL TO BEAMS AND WALLS. CONDUITS INSTALLED IN FINISHED AREAS MUST BE CONCEALED.
- PROVIDE PULL BOXES AND JUNCTION BOXES, WHEN REQUIRED, IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS THOUGH THESE BOXES MAY NOT BE SHOWN ON THE DRAWINGS. JUNCTION AND PULL BOXES, ASSOCIATED WITH FEEDERS AND BRANCH CIRCUITS, MUST BE LABELED SHOWING THE PANEL AND CIRCUIT NUMBERS ROUTED THROUGH THEM.
- PROVIDE JUNCTION BOXES WITH NUMBERED TERMINAL STRIPS AND RING TYPE COMPRESSION CONNECTORS WHEN SPLICING CONTROL AND SIGNAL WIRING.
- THE WIRING DIAGRAMS, QUANTITY AND SIZE OF WIRES AND CONDUITS ARE BASED UPON SELECTED STANDARD COMPONENTS OF ELECTRICAL EQUIPMENT. MODIFICATIONS, APPROVED BY THE ENGINEER, MAY BE MADE BY THE CONTRACTOR AT THEIR EXPENSE TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED.
- NUMBERS ADJACENT TO EQUIPMENT AND DEVICES INDICATE THE PANEL AND CIRCUIT SERVING THAT EQUIPMENT OR DEVICE. PROVIDE COMPLETE WIRING IN CONDUIT.
- ELECTRICAL EQUIPMENT LOCATED OUTDOORS MUST HAVE NEMA 4X ENCLOSURE UON.
- DIRECT-BURIED UNDERGROUND CONDUITS MUST BE SCHEDULE 40 UON.
- INTERIOR - THHN / THWN-2, UON
- EXTERIOR - XHHN / XHWN-2, UON
- PROVIDE SYSTEM GROUNDING CONDUCTORS AND EQUIPMENT GROUNDING CONDUCTORS IN ACCORDANCE WITH NEC-250, UON.

DEFINITIONS

FURNISH:	SUPPLY AND DELIVER TO PROJECT SITE, READY FOR UNLOADING UNPACKING, INSTALLATION, AND SIMILAR OPERATIONS.
INSTALL:	UNLOAD, TEMPORARILY STORE, UNPACK, ASSEMBLE, ERECT, PLACE, ANCHOR, APPLY, WORK TO DIMENSION, FINISH, CURE, PROTECT, CLEAN AND SIMILAR OPERATIONS AT PROJECT SITE.
PROVIDE:	FURNISH AND INSTALL, COMPLETE AND READY FOR INTENDED USE.
WIRING:	CONDUIT AND WIRES / CONDUCTORS.
EXISTING TO REMAIN:	LEAVE EXISTING ITEMS THAT ARE NOT TO BE REMOVED AND THAT ARE NOT OTHERWISE INDICATED TO BE SALVAGED OR REINSTALLED.
REMOVE / DEMOLISH:	DETACH ITEMS FROM EXISTING CONSTRUCTION AND DISPOSE OF THEM OFF-SITE UNLESS INDICATED TO BE SALVAGED OR REINSTALLED.
REMOVE AND SALVAGE:	DETACH ITEMS FROM EXISTING CONSTRUCTION, IN A MANNER TO PREVENT DAMAGE AND DELIVER TO OWNER FOR REUSE.
REMOVE AND REINSTALL:	DETACH ITEMS FROM EXISTING CONSTRUCTION, IN A MANNER TO PREVENT DAMAGE, PREPARE FOR REUSE, AND REINSTALL WHERE INDICATED.

ABBREVIATIONS

A	AMPERES	HID	HIGH INTENSITY DISCHARGE
AC	ALTERNATING CURRENT	HH	HANDHOLE
AFF	ABOVE FINISHED FLOOR	HOA	HAND OFF AUTOMATIC
AFG	ABOVE FINISHED GRADE	HP	HORSEPOWER
AHU	AIR HANDLING UNIT	HPS	HIGH PRESSURE SODIUM
AIC	AMPERES INTERRUPTING CAPACITY, -SYM, RMS, AMPS-	HTR	HEATER
		HV	HIGH VOLTAGE
AL	ALUMINUM	HZ	HERTZ
ANNUN	ANNUNCIATOR		
AS	AMMETER SWITCH	ICCB	INSULATED CASE CIRCUIT BREAKER
ATC	AUTOMATIC TEMPERATURE CONTROL	IDS	INTRUSION DETECTION SYSTEM
ATS	AUTOMATIC TRANSFER SWITCH	IMC	INTERMEDIATE METALLIC CONDUIT
AUTO	AUTOMATIC		
AUX	AUXILIARY	JB	JUNCTION BOX
AWG	AMERICAN WIRE GAUGE		
		KAIC	THOUSAND AMPERES INTERRUPTING CAPACITY
BCSD	BARE COPPER SOFT DRAWN	KV	KILOVOLT
BFC	BELOW FINISHED CEILING	KVA	KILOVOLT AMPERE
BFI	BLOWN FUSE INDICATOR		
BFG	BELOW FINISHED GRADE	LC	LOAD CENTER
BLDG	BUILDING	LTG	LIGHTING
BKR	BREAKER	LO	LOCKOUT
		LP	LIGHTING AND APPLIANCE PANEL
C	CONDUIT	LT/FMC	LIQUID TIGHT/FLEXIBLE METAL CONDUIT
CB	CIRCUIT BREAKER	LS	LIMIT SWITCH
CC1	POWER-CONTROL-INSTRUMENTATION CABLE RUN NUMBER AS INDICATED.	LSH	LEVEL SWITCH HIGH
CKT	CIRCUIT	MAFC	MAKE ALL FINAL CONNECTIONS
COMB	COMBINATION	M/C	MULTI/CONDUCTOR
CLG	CEILING	MCB	MAIN CIRCUIT BREAKER
CP	CONTROL PANEL	MCCB	MOLDED CASE CIRCUIT BREAKER
CPT	CONTROL POWER TRANSFORMER	MCC	MOTOR CONTROL CENTER
CT	CURRENT TRANSFORMER	MCP	MOTOR CONTROL PROTECTOR
CU	COPPER	MH	MOUNTING HEIGHT
CX	CONNECT TO EXISTING	MIN	MINIMUM
CCV	CLOSED CIRCUIT TELEVISION	MILO	MAIN LUGS ONLY
		MO	MOTOR OPERATED DAMPER
DAS	DATA ACQUISITION SYSTEM	MO	METAL OXIDE
DC	DIRECT CURRENT	MSP	MOTOR STARTER PANEL
O/D	OUT/DOOR	MTD	MOUNTED
DISC	DISCONNECT	MTG	MOUNTING
DN	DOWN		
DP	DISTRIBUTED PANEL	N	NEUTRAL
DPC	DISTRIBUTED PROCESS CONTROLLER	NEC	NATIONAL ELECTRICAL CODE
DWG	DRAWING	NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
		NFSS	NON FUSED SAFETY SWITCH
EA	EACH	NO	NORMALLY OPEN
EC	EMPTY CONDUIT	NO	NUMBER
ECD	ELEMENTARY CONTROL DIAGRAM	NC	NORMALLY CLOSED
EF	EXHAUST	NIC	NOT IN CONTRACT
EH	ELECTRIC HEATER	NL	NIGHT LIGHT
ELEV	ELEVATION	NTS	NOT TO SCALE
EMERG	EMERGENCY		
EMH	ELECTRIC MANHOLE	OL	OVERLOAD
EMT	ELECTRIC METALLIC TUBING		
ENCL	ENCLOSURE	P	POLE OR POLES
E/O	ELECTRICALLY/OPERATED	PB	PUSH BUTTON
EQUIP	EQUIPMENT	PH	PHASE
ETM	ELAPSED TIME METER	PL	PILOT LIGHT
ETR	EXISTING TO REMAIN	PLC	PROGRAMMABLE LOGIC CONTROLLER
EUH	ELECTRICAL UNIT HEATER	PNL	PANELBOARD
EWC	ELECTRICAL WATER COOLER	PS	PRESSURE SWITCH
EWH	ELECTRICAL WATER HEATER	PSH	PRESSURE SWITCH HIGH
EX	EXISTING	PT	POTENTIAL TRANSFORMER
EXP	EXPLOSION PROOF	PVC	POLYVINYL CHLORIDE
F	FUSE	RC	REMOTE CONTROL
FA	FRAM AMPS	RECEPT	RECEPTACLE
FA	FIRE ALARM	REQ'D	REQUIRED
FAP	FIRE ALARM ANNUNCIATOR PANEL	RGS	RIGID GALVANIZED STEEL
FACP	FIRE ALARM CONTROL PANEL	RM	ROOM
FBO	FURNISHED BY OTHERS UNDER SEPARATE CONTRACT	RMS	ROOT MEAN SQUARE
FC	FAN COIL UNIT	RTD	RESISTANCE TEMPERATURE DETECTOR
FDR	FEEDER	RTU	REMOTE TERMINAL UNIT
FL	FLOOR	RVAT	REDUCED VOLTAGE AUTOTRANSFORMER
FLEX	FLEXIBLE	RX	REMOVE EXISTING
FMC	FLEXIBLE METAL CONDUIT		
FS	FLOW SWITCH	SER.	SERVICE
FSS	FUSED SAFETY SWITCH	SF	SUPPLY FAN
FT	FOOT OR FEET	SG1-1A/P	SWGR POWER WIRE RUN NUMBER/ SWGR NUMBER AND UNIT NUMBER AS INDICATED
FVNR	FULL VOLTAGE NON-REVERSING		
FVR	FULL VOLTAGE REVERSING	SIC	SYMMETRICAL INTERRUPTING CURRENT
		SOPN	SPACE OR POLE NUMBER
G	GROUND	SPPS	SOUND POWERED PHONE SYSTEM
GFI	GROUND FAULT INTERRUPTER	SS	STAINLESS STEEL
GFCI	GOVERNMENT FURNISHED CONTRACTOR INSTALLED	SS	SAFETY SWITCH
GFGI	GOVERNMENT FURNISHED GOVERNMENT INSTALLED	ST	SHUNT TRIP
GFP	GROUND FAULT PROTECTION	STA	STATION
		STP	SHIELDED TWISTED PAIR
		STPS	SHIELDED TWISTED PAIR OVER ALL SHIELD

LEGEND

EQUIPMENT CONNECTION

- JUNCTION BOX
- EQUIPMENT CONNECTION AS NOTED

GROUNDING

- GROUND ROD, 3/4" DIAMETER X 10'-0" LONG UON
- AIR TERMINAL

UNDERGROUND/SITE WORK

- EXISTING HANDHOLE
- GROUND CONDUCTOR
- HANDHOLE
- UNDERGROUND DUCTBANK
- UNDERGROUND DIRECT BURIED CONDUIT

WIRING

- HPA-1,3,5 BRANCH CIRCUIT HOMERUN TO PANELBOARD. HPA DENOTES TO PANEL HPA AND NUMERALS IDENTIFY CIRCUIT NUMBERS. ARROWS DENOTE NO. OF CIRCUITS.
- CONDUIT WITH WIRES, #12 AWG IN 3/4" C. UNLESS OTHERWISE NOTED. NUMBER OF CONDUCTORS AS REQUIRED. PROVIDE SEPARATE NEUTRALS FOR ALL SINGLE PHASE CIRCUITS.
- OR
- BRANCH CIRCUIT OR FEEDER WIRING IN CONDUIT. NO TICK MARKS INDICATES 2#12 CONDUCTORS AND 1#12 GROUND IN A 1/2" (UON)
- INDICATES A CONDUIT RUN CONCEALED IN CEILING WALL, FLOOR, OR ABOVE SUSPENDED CEILING (UON)
- EXPOSED CONDUIT RUN AS INDICATED.
- CONDUIT TURNED UP
- CONDUIT TURNED DOWN
- GROUNDING CONDUCTOR (BCSD)
- RACEWAY WITH SEALING FITTING

PANELBOARDS

- ELECTRICAL PANELBOARD (240/120V, 1PH, 3W+G)

MISCELLANEOUS

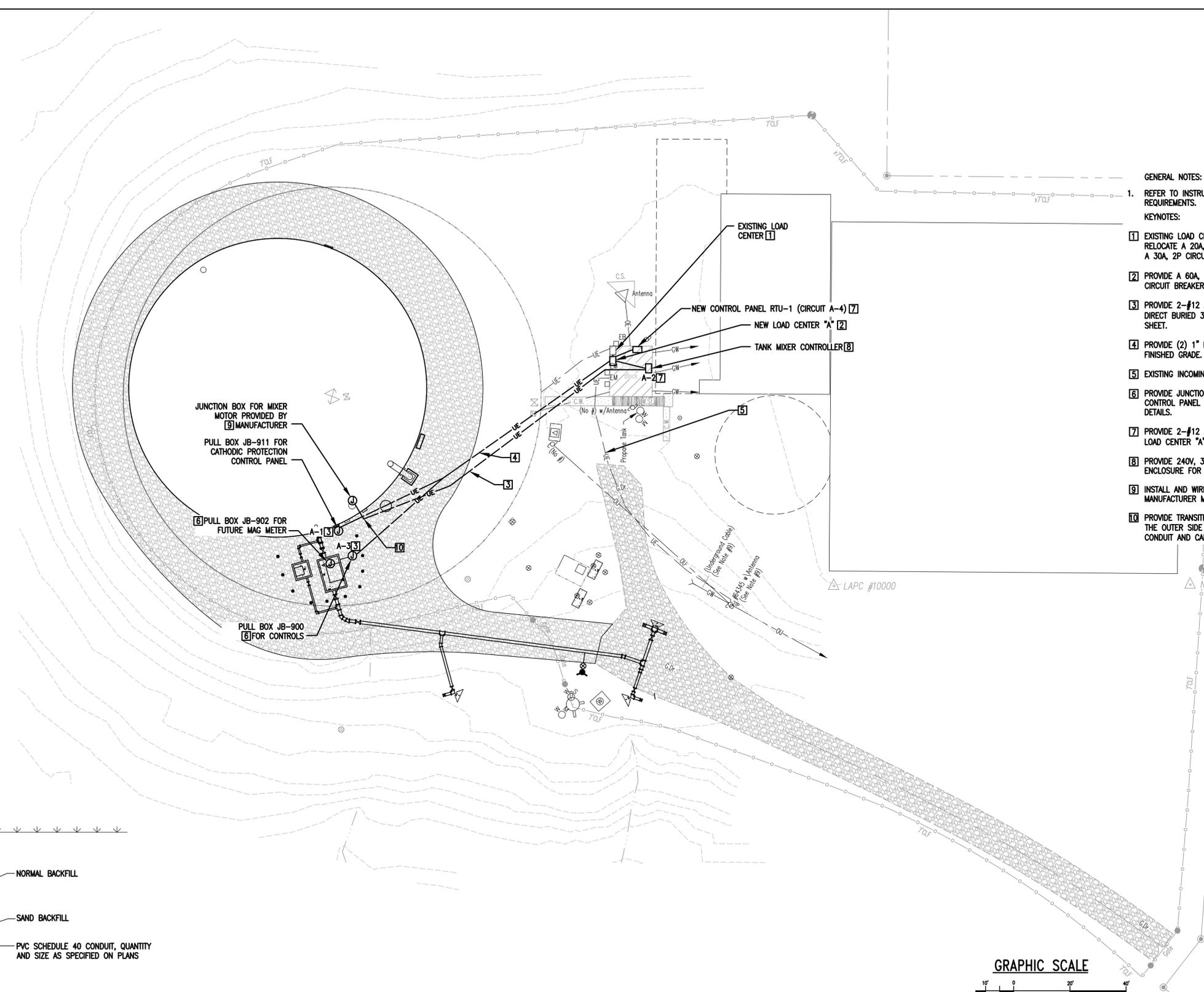
- SPECIFIC NOTE NUMBER
- FEEDER SIZE

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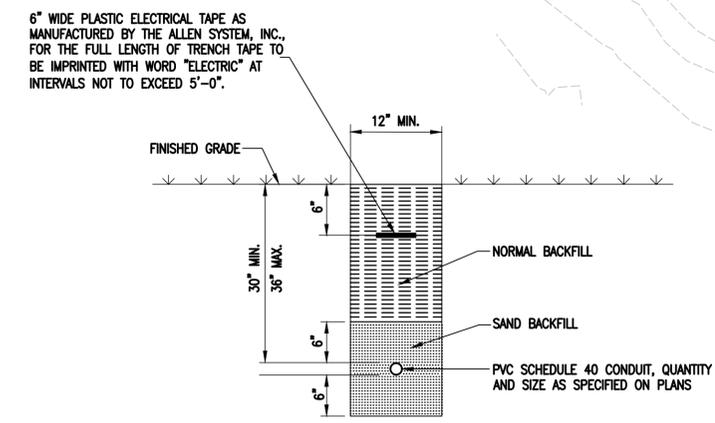
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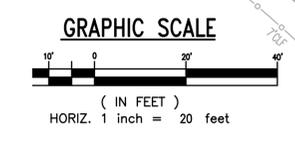
BEDFORD REGIONAL WATER AUTHORITY 1723 FALLING CREEK ROAD, BEDFORD, VA	SHEET	DRAWING
	21	
HELM STREET TANK REPLACEMENT GENERAL NOTES, DEFINITIONS, ABBREVIATIONS AND LEGEND	OF	E-1
	30	



- GENERAL NOTES:
- REFER TO INSTRUMENTATION DRAWINGS FOR ADDITIONAL CONDUIT REQUIREMENTS.
- KEYNOTES:
- EXISTING LOAD CENTER IS GE, 240/120V, 1 PH, 3W. RELOCATE A 20A, 1P CIRCUIT BREAKER TO CREATE A 2P SPACE TO PROVIDE A 30A, 2P CIRCUIT AND 3-#10 AND 1-#10G THHN IN 3/4" RGS CONDUIT.
 - PROVIDE A 60A, 240/120V, 1 PH, 3W LOAD CENTER WITH 8-20A, 1P CIRCUIT BREAKERS.
 - PROVIDE 2-#12 AND 1-#12G XHHW IN 1" PVC SCHEDULE 40 CONDUIT DIRECT BURIED 30" BELOW FINISHED GRADE. REFER TO DETAIL ON THIS SHEET.
 - PROVIDE (2) 1" PVC SCHEDULE 40 CONDUITS DIRECT BURIED 30" BELOW FINISHED GRADE. REFER TO DETAIL ON THIS SHEET.
 - EXISTING INCOMING UTILITY 240/120V, 1 PH, 3W.
 - PROVIDE JUNCTION BOX. CONTROL POWER AND SIGNALS COME FROM CONTROL PANEL RTU-1. REFER TO INSTRUMENTATION SITE PLAN FOR DETAILS.
 - PROVIDE 2-#12 AND 1-#12G THHN IN 3/4" RGS CONDUIT. REFER TO NEW LOAD CENTER "A" PANEL SCHEDULE ON SHEET E-4.
 - PROVIDE 240V, 30A, 1P NON-FUSED DISCONNECT SWITCH IN NEMA 4X ENCLOSURE FOR MIXER CONTROL PANEL.
 - INSTALL AND WIRE MIXER MOTOR AND JUNCTION BOX ACCORDING TO MANUFACTURER MANUAL.
 - PROVIDE TRANSITION FROM DIRECT BURIED CONDUIT TO RUN CONDUIT ALONG THE OUTER SIDE OF THE TANK. REFER TO SHEET M-2 FOR SHELL/ROOF CONDUIT AND CABLE SUPPORT DETAIL.



2 DIRECT BURIED CONDUIT INSTALLATION DETAIL
E-2 NOT TO SCALE

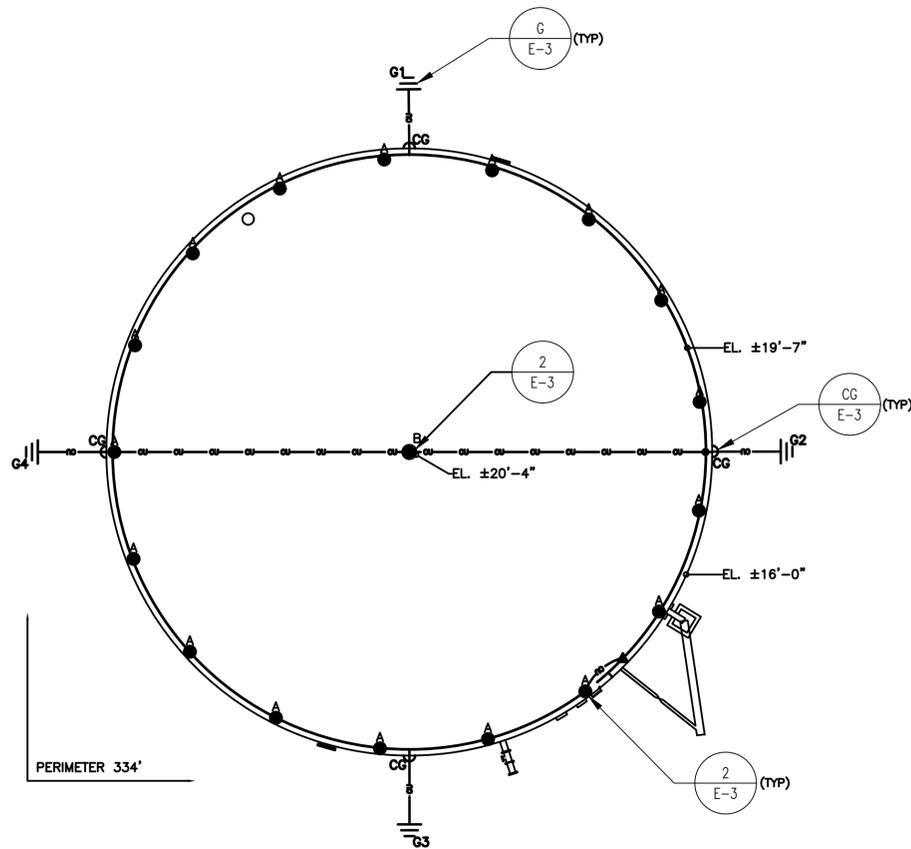


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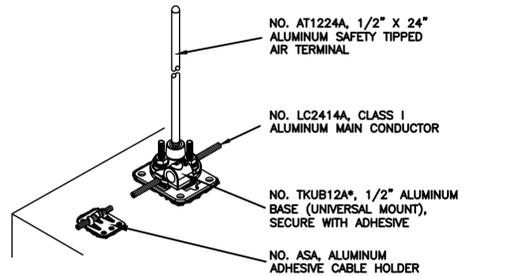
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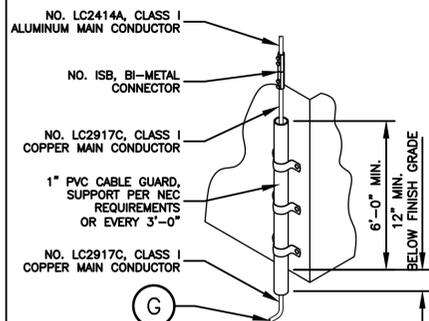
BEDFORD REGIONAL WATER AUTHORITY 1723 FALLING CREEK ROAD, BEDFORD, VA HELM STREET TANK REPLACEMENT ELECTRICAL SITE PLAN	SHEET 22 OF 30	DRAWING E-2
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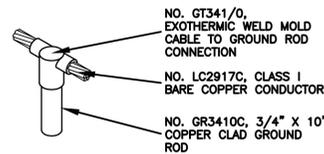
1 LIGHTNING PROTECTION PLAN
E-3 1/6" = 1'-0"



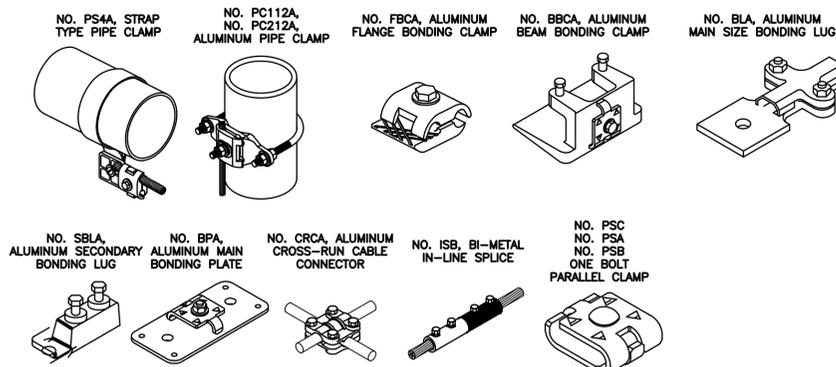
2 AIR TERMINAL A AND B DETAIL
E-3 NOT TO SCALE



CG PVC CABLE GUARD FOR DOWNLOAD CABLE
E-3 NOT TO SCALE



G VFCWELD EXOTHERMIC WELD MOLD
E-3 NOT TO SCALE



3 MISCELLANEOUS
E-3 NOT TO SCALE

GENERAL CONSTRUCTION NOTES

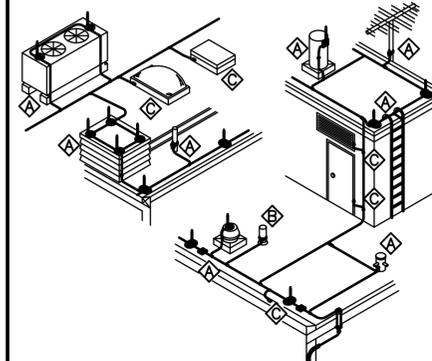
1. THIS DRAWING IS INTENDED FOR USE AS A CONSTRUCTION DOCUMENT. FIELD VERIFY ACTUAL CONDITIONS PRIOR TO CONSTRUCTION. CONTACT VFC, TO CLARIFY ANY DISCREPANCIES.

LEGEND

- AIR TERMINAL
- MECHANICAL CONNECTION
- ▲ MISC. BONDING
- CG THRU-ROOF CONNECTION
- CLASS I COPPER MAIN CONDUCTOR
- || G COPPER CLAD GROUND ROD WITH EXOTHERMIC WELD CONNECTION

GENERAL BONDING NOTES

- ◇ TYPICAL BODIES OF CONDUCTANCE AS NOTED BELOW. USE FULL SIZE CONDUCTOR AND APPROPRIATE FITTING SHOWN FOR CONNECTION.
- ◇ (PLUMBING STACK) REQUIRES BONDING WITH MAIN SIZE CABLE ONLY IF WITHIN 6'-0" (1,828mm) OF LIGHTNING PROTECTION SYSTEM.
- ◇ TYPICAL BODIES OF INDUCTANCE AS NOTED BELOW. USE SECONDARY SIZE (SMALLER) CONDUCTOR AND APPROPRIATE FITTING SHOWN FOR CONNECTION.
- ◇ BONDING CONNECTIONS AND FITTINGS SHOWN ARE TYPICAL EXAMPLES. MAKE ALL CONNECTIONS REQUIRED TO MEET CODES AS NOTED BELOW. ADJUST FITTING TYPE AS REQUIRED TO SUIT FIELD CONDITIONS.



GENERAL INSTALLATION NOTES

1. LOCATE AIR TERMINALS AS SHOWN. TAKE CARE TO ENSURE THAT ALL POINTS ARE WITHIN 2'-0" (609mm) OF OUTSIDE BUILDING EDGE, OUTSIDE CORNERS, RIDGE ENDS, AND THAT MAX SPACING DOES NOT EXCEED 20'-0" (6,096mm), AND THAT MIN PROJECTION ABOVE OBJECT PROTECTED IS 10" (254mm); POINTS PROJECTING 24" (609mm) MAY BE SPACED @ 25'-0" (7,520mm) MAX.
2. MAINTAIN HORIZONTAL OR DOWNWARD COURSE OF MAIN CONDUCTOR. ENSURE THAT ALL BENDS HAVE AT LEAST AN 8" (203mm) RADIUS AND DO NOT EXCEED 90 DEGREES.
3. ATTACH ALL EXPOSED WATER TANK, DOWN LEAD AND BONDING CABLES AT 3'-0" (914mm) ON CENTER MAX. VERIFY COMPATIBILITY OF ADHESIVE ON MEMBRANE ROOF APPLICATION PRIOR TO INSTALLATION.
4. GROUND ROD ELECTRODES SHALL BE INSTALLED AS SHOWN, BUT IN NO INSTANCE SHALL THEY BE LESS THAN 1'-0" (304mm) BELOW GRADE AND 2'-0" (609mm) FROM FOUNDATION WALL. DRIVEN RODS SHALL PENETRATE THE EARTH AT LEAST 10'-0" (3,048mm).
5. BOND TO WATER SERVICE AND OTHER PIPING SYSTEMS AS SHOWN AND AS REQUIRED BY CODE.
6. MAIN SIZE LIGHTNING CONDUCTOR BONDED TO MAIN GROUND BUS FIELD VERIFY LOCATION 1 1/4" CONDUIT FOR ACCESS, INSTALLED BY OTHERS. INTERCONNECT LIGHTNING PROTECTION GROUND TO TELEPHONE AND OTHER BUILDING SYSTEMS LOCATION FIELD DETERMINED OR AS REQUIRED BY CODE.
7. LB'S AND SIMILAR CONDUIT BODIES MAY NOT BE USED IN THE INSTALLATION OF DOWNLEAD CONDUITS, AS THEY DO NOT ADHERE TO THE REQUIRED 8" (203mm) MINIMUM BEND RADIUS.
8. SYSTEM SHALL BE INSTALLED AS SHOWN TO ENSURE PROPER CODE COMPLIANCE AND SYSTEM CERTIFICATION. ANY MAJOR VARIANCE SHALL BE RESUBMITTED FOR APPROVAL.
9. ALL MATERIALS TO BE UNDERWRITER'S LABORATORIES APPROVED WITH APPROPRIATE UL96 MARKINGS.
10. FINAL SYSTEM INSPECTION AND QUALITY CONTROL
 - A) THE CONTRACTOR SHALL FURNISH AN LPI-IP CERTIFICATE OR A UL CERTIFICATE UPON COMPLETION OF THE INSTALLATION.
 - B) LPI CERTIFICATION IF REQUIRED, REQUIRES SIGNATURE BY A REPRESENTATIVE OF THE OWNER AT MULTIPLE STAGES OF INSTALLATION & BY THEIR THIRD PARTY FIELD STAFF. UL CERTIFICATION IF REQUIRED, REQUIRES INSPECTION BY THEIR THIRD-PARTY FIELD STAFF AFTER COMPLETION OF THE INSTALLATION.
 - C) AS-BUILT DRAWINGS SHALL BE COMPLETED AND STAMPED BY AN LPI CERTIFIED MASTER DESIGNER - INSTALLER OF LIGHTNING PROTECTION SYSTEMS.
 - D) FINAL INSPECTION REPORT - A FINAL INSPECTION AND INSPECTION REPORT SHALL BE COMPLETED BASED ON ANSI/TIA/EIA 607, NEC, NFPA 780, AND UL96A INDUSTRY STANDARDS AS APPLICABLE. THE SCOPE OF THE INSPECTION AND REPORT SHALL INCLUDE:
 - a. TEST AND EVALUATION OF THE GROUNDING SYSTEM. RECORD FINAL SYSTEMS TO GROUND RESISTANCE LEVEL.
 - b. EVALUATION AND TESTING OF THE INTERNAL BONDING AND GROUNDING SYSTEMS.
 - c. EVALUATION AND TESTING OF EQUIPMENT GROUNDING.
 - d. EVALUATION OF AC SURGE SUPPRESSION INSTALLATION.
 - e. EVALUATION OF TELCO SURGE SUPPRESSION INSTALLATION.
 - f. COPY OF THE LPI-IP OR UL LIGHTNING PROTECTION CERTIFICATION.
 - g. FINAL AS-BUILT REVIEW AND SUBMISSION.
 - E) REPORT SHALL INCLUDE DETAILED REPORTING AND TEST RESULTS WITH CORRESPONDING PHOTOS OF EACH EVALUATION CATEGORY.
11. SYSTEM DESIGNED UTILIZING UL LISTED T&B/FURSE MATERIALS.

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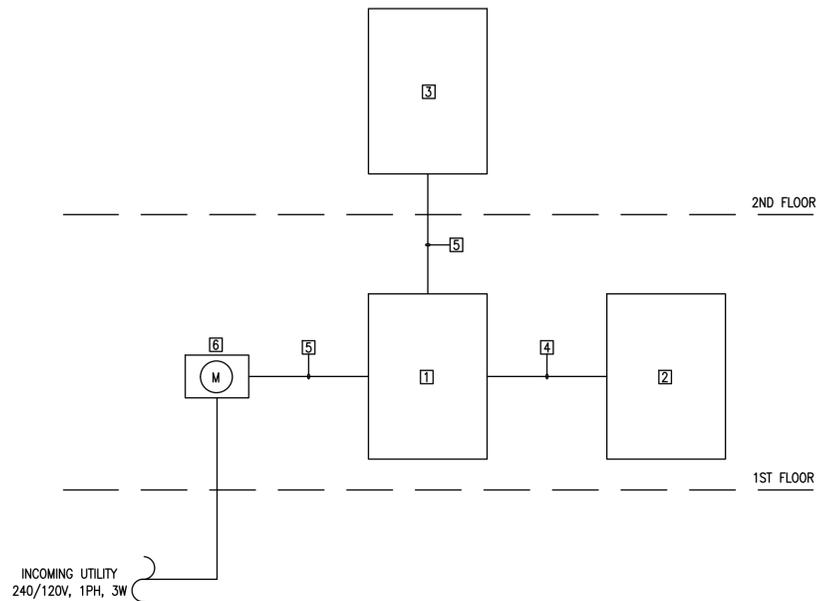
WRA
Whitman, Reardon & Associates, LLP
1700 KRAFT DRIVE, SUITE 1200, BLACKSBURG, VIRGINIA 24060



BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
LIGHTNING PROTECTION PLAN

SHEET
23
OF
30
DRAWING
E-3



1 POWER RISER DIAGRAM
E-4 NOT TO SCALE

NEW LOAD CENTER 'A'										
LOAD SERVED		CIRCUIT BRKR			CKT. NO.	CKT. NO.	CIRCUIT BRKR			LOAD SERVED
		FRAME	TRIP	P			P	TRIP	FRAME	
CATHODIC PROTECTION CONTROL PNL		100	20	1	1	2	1	20	100	TANK MIXER CONTROLLER
CHLORINE HEAT TAPE		100	20	1	3	4	1	20	100	NEW CONTROL PANEL RTU-1
SPARE		100	20	1	5	6	1	20	100	SPARE
SPARE		100	20	1	7	8	1	20	100	SPARE
SPACE		-	-	-	9	10	-	-	-	SPACE
SPACE		-	-	-	11	12	-	-	-	SPACE
SPACE		-	-	-	13	14	-	-	-	SPACE
SPACE		-	-	-	15	16	-	-	-	SPACE
SPACE		-	-	-	17	18	-	-	-	SPACE

EXISTING LOAD CENTER										
LOAD SERVED		CIRCUIT BRKR			CKT. NO.	CKT. NO.	CIRCUIT BRKR			LOAD SERVED
		FRAME	TRIP	P			P	TRIP	FRAME	
EXISTING CONTROL PANEL		100	30	1	1	2	1	20	100	EXISTING LOAD
EXISTING LOAD		100	20	1	3	4	1	20	100	EXISTING LOAD
EXISTING LOAD		100	20	1	5	6	1	20	100	EXISTING LOAD
EX. 2ND FLOOR BLOCK BUILDING LC		100	30	2	7	8	1	20	100	EXISTING LOAD
SPACE		-	-	-	9	10	1	20	100	EXISTING LOAD
SPACE		-	-	-	7	12	-	-	-	SPACE

EXISTING LOAD CENTER (PROPOSED)										
LOAD SERVED		CIRCUIT BRKR			CKT. NO.	CKT. NO.	CIRCUIT BRKR			LOAD SERVED
		FRAME	TRIP	P			P	TRIP	FRAME	
SPARE		100	30	1	1	2	1	20	100	EXISTING LOAD
EXISTING LOAD		100	20	1	3	4	1	20	100	EXISTING LOAD
EXISTING LOAD		100	20	1	5	6	1	20	100	EXISTING LOAD
EX. 2ND FLOOR BLOCK BUILDING LC		100	30	2	7	8	1	20	100	EXISTING LOAD
EXISTING LOAD		100	20	1	1	-	-	-	-	-

- KEYNOTES:
- 1 EXISTING LOAD CENTER IS GE, 240/120V, 1 PH, 3 WIRE PANEL. RELOCATE A 20A, 1P CIRCUIT BREAKER TO CREATE A 2P SPACE TO PROVIDE A 30A, 2P CIRCUIT AND 3-#10 AND 1-#10G THHN IN 3/4" RGS CONDUIT.
 - 2 NEW LOAD CENTER 'A' LOCATED ADJACENT TO EXISTING LOAD CENTER ON THE FIRST FLOOR OF THE BLOCK BUILDING.
 - 3 EXISTING LOAD CENTER TO REMAIN.
 - 4 PROVIDE 3-#10 AND 1-#10G THHN IN 3/4" RGS CONDUIT.
 - 5 EXISTING FEEDER TO REMAIN.
 - 6 EXISTING UTILITY METER.
 - 7 PROVIDE GROUND FAULT CIRCUIT BREAKER.

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NO.	DATE	BY	REVISIONS



BEDFORD REGIONAL WATER AUTHORITY 1723 FALLING CREEK ROAD, BEDFORD, VA	SHEET 24	DRAWING E-4
	HELM STREET TANK REPLACEMENT ONE LINE DIAGRAM AND SCHEDULES	

GENERAL NOTES

- SEE ELECTRICAL DRAWINGS FOR POWER DISTRIBUTION, DISCONNECT REQUIREMENTS, EQUIPMENT LOCATIONS AND FEEDER REQUIREMENTS.
- SEE MECHANICAL AND ELECTRICAL DRAWINGS FOR EQUIPMENT LOCATIONS AND POWER REQUIREMENTS. CONTRACTOR SHALL COORDINATE EQUIPMENT LOCATIONS SUCH AS NOT TO CAUSE INTERFERENCE WITH NEW AND/OR EXISTING EQUIPMENT.
- ENCLOSURE DIMENSIONS SHOWN ARE MINIMUM REQUIREMENTS. ENCLOSURES SHALL BE SIZED TO ACCOMMODATE EQUIPMENT, CONTROLS AND COMPONENTS AS SHOWN, SPECIFIED AND REQUIRED FOR AN OPERABLE SYSTEM.
- CIRCUITS SHOWN SHALL BE INSTALLED IN CONDUIT SIZES AS INDICATED IN THE GENERAL CIRCUIT/CONDUIT TAG IDENTIFICATION SCHEDULE.
- ALL PENETRATIONS THROUGH EXISTING SOLID CONCRETE STRUCTURES AND VAULT'S WALLS WHERE SLEEVES HAVE NOT BEEN PROVIDED SHALL BE CORE DRILLED AND SIZED TO ACCEPT MECHANICAL LINK SEALS.
- DISCRETE OUTPUTS SHALL BE PROVIDED WITH INTERPOSING RELAYS COMPATIBLE FOR USE WITH PLC OUTPUTS.
- CONDUIT RUNS ARE SHOWN DIAGRAMMATICALLY ONLY AND SHALL BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT AND STRUCTURAL CONDITIONS. EXPOSED CONDUITS ABOVE SUSPENDED CEILINGS AND FURRED WALLS SHALL BE INSTALLED PARALLEL TO THE BEAMS AND WALLS.
- PROVIDE ALL REQUIRED PULL BOXES AND JUNCTION BOXES FOR INSTALLATION OF THE WIRING IN ACCORDANCE WITH CONTRACT SPECIFICATIONS THROUGH THE BOXES MAY NOT BE INDICATED ON THE DRAWINGS.
- ALL INDICATION AND CONTROL WIRING IN JUNCTION BOXES SHALL BE WIRED TO NUMBERED TERMINAL STRIPS AND IDENTIFIED AS TO START AND END OF RUN.
- CABLE AND CONDUCTOR REQUIREMENTS VARY BETWEEN DIFFERENT MANUFACTURERS OF EQUIPMENT AND INSTRUMENTATION. CONTRACTOR SHALL VERIFY MANUFACTURERS REQUIREMENTS AND PROVIDE CONDUIT AND CABLES AS REQUIRED.
- EXISTING EQUIPMENT AND WIRE IS SHOWN IN A LIGHT GRAY SCALE, NEW EQUIPMENT AND WIRING IS SHOWN BOLD. ALL WORK SHALL BE ASSUMED TO BE NEW UNLESS OTHERWISE INDICATED.
- ALL CONTROL, MONITORING, INSTRUMENTATION, AND SIGNAL CONDUCTORS SHALL BE STRANDED COPPER.
- ALL CONTROL WIRING SHALL CONFORM TO THE FOLLOWING:

NO.	DESCRIPTION	COLOR	WIRE SIZE
1	LINE AND LOAD CIRCUITS (AC OR DC POWER)	BLACK	#12 AWG (MIN) STRANDED
2	NEUTRAL	WHITE	#12 AWG (MIN) STRANDED
3	AC CONTROL CIRCUITS	RED	#16 AWG (MIN) STRANDED
4	DC CONTROL CIRCUITS (+)	BLUE	#16 AWG (MIN) STRANDED
5	DC CONTROL CIRCUITS (-)	BLUE/BLACK	#16 AWG (MIN) STRANDED
6	INTERLOCK CONTROL CIRCUITS ON THE PANEL ENERGIZED FROM EXTERNAL SOURCE	YELLOW	#16 AWG (MIN) STRANDED
7	EQUIPMENT GROUNDING CONDUCTORS	GREEN	#12 AWG (MIN) STRANDED
8	ANALOG SIGNALS TWISTED SHIELDED PAIR	BLACK/RED	#18 AWG (MIN) STRANDED

NOTE: WIRE SIZES LISTED ARE MINIMUM REQUIREMENTS

ABBREVIATIONS

A/C	=	AIR CONDITIONING
AI	=	ANALOG INPUT
AMP	=	AMPERE
AO	=	ANALOG OUTPUT
AUTO	=	AUTOMATIC
AUX	=	AUXILIARY
ATS	=	AUTOMATIC TRANSFER SWITCH
BMS	=	BUILDING MANAGEMENT SYSTEM
COMM	=	COMMUNICATION
CR	=	CONTROL RELAY
DI	=	DISCRETE INPUT
DO	=	DISCRETE OUTPUT
E-NET	=	ETHERNET
E-STOP	=	EMERGENCY STOP
ETM	=	ELAPSE TIME METER
EX	=	EXISTING
F/B	=	FEEDBACK
F/C	=	FIBER/COPPER
FO	=	FIBER OPTIC
FPP	=	FIBER OPTIC PATCH PANEL
GFI	=	GROUND FAULT INTERRUPTER
GND	=	GROUND
HMI	=	HUMAN MACHINE INTERFACE
HOA	=	HAND-OFF-AUTO
HX	=	HEAT EXCHANGER
I/AW	=	IN ACCORDANCE WITH
I/O	=	INPUT/OUTPUT
ISB	=	INTRINSICALLY SAFE BARRIER
ISR	=	INTRINSICALLY SAFE RELAY
J-BOX	=	JUNCTION BOX
L	=	LINE
LLS	=	LEAD-LAG-STANDBY
LOR	=	LOCK OUT RELAY
L/R	=	LOCAL/REMOTE
LS	=	LIMIT SWITCH
MAX	=	MAXIMUM
MCC	=	MOTOR CONTROL CENTER
MFR	=	MANUFACTURER
MIN	=	MINIMUM
MMS	=	MANUAL MOTOR STARTER
MPR	=	MOTOR PROTECTION RELAY
MOD	=	MOTOR OPERATED DAMPER
MOV	=	MOTOR OPERATED VALVE
N	=	NEUTRAL
NC	=	NORMALLY CLOSED
NEMA	=	NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION
NO	=	NORMALLY OPEN
NTS	=	NOT TO SCALE
OIT	=	OPERATOR INTERFACE TERMINAL
OL	=	OVERLOAD
PC	=	PERSONAL COMPUTER
PCS	=	PLANT CONTROL SYSTEM
PIO	=	POINT I/O
PLC	=	PROGRAMMABLE LOGIC CONTROLLER
PS	=	POWER SUPPLY
PSI	=	POUNDS PER SQUARE INCH
PVCC	=	PVC COATED
QTY	=	QUANTITY
RCT	=	REPEAT CYCLE TIMER
RGS	=	RIGID GALVANIZED STEEL
RIO	=	REMOTE I/O
RTD	=	RESISTANCE TEMPERATURE DEVICE
RTU	=	REMOTE TELEMETRY UNIT
RVSS	=	REDUCED VOLTAGE SOFT STARTER
SCADA	=	SUPERVISORY CONTROL AND DATA ACQUISITION
SF	=	SUPPLY FAN
SPD	=	SURGE PROTECTIVE DEVICE
TR	=	TIMING RELAY
TSP	=	TWISTED SHIELDED PAIR
TST	=	TWISTED SHIELDED TRIAD
T-STAT	=	THERMOSTAT
TVSS	=	TRANSIENT VOLTAGE SURGE SUPPRESSOR
TYP	=	TYPICAL
UON	=	UNLESS OTHERWISE NOTED
UPS	=	UNINTERRUPTIBLE POWER SUPPLY
VAC	=	VOLTS/ALTERNATING CURRENT
VCP	=	VENTILATION CONTROL PANEL
VDC	=	VOLTS/DIRECT CURRENT
VFD	=	VARIABLE FREQUENCY DRIVE

INSTRUMENTATION IDENTIFICATION SCHEDULE

	FIRST LETTER		SUCCEEDING LETTER		
	VARIABLE	MODIFIER	PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		AUTOMATIC
B	BREAKER		USER'S CHOICE		BYPASS
C	COMMUNICATIONS		USER'S CHOICE	CONTROL	CLOSE
D	DENSITY	DIFFERENTIAL		OPEN OR START	
E	VOLTAGE (EMF)		PRIMARY ELEMENT	SENSOR	
F	FLOW RATE	RATIO	FAIL	FAIL	FAIL
G			GAUGE	GATE	LOCAL/MANUAL/HAND
H	HAND				HIGH
I	CURRENT		INDICATE		INTERMEDIATE
J	POWER	SCAN			
K	TIME	TIME RATE			
L	LEVEL		LIGHT	CONTROL STATION	LOW
M	MOTOR	MOMENTARY		MOTOR	MIDDLE
N	TORQUE		INPUT	FORWARD	ON OR OPERATE
O				OFF	OVERLOAD OR OPEN
P	PRESSURE	PNEUMATIC	POINT (TEST)	POSITION	
Q	QUANTITY OR EVENT	TOTALIZE		EMERGENCY/ABNORMAL	
R	RADIOACTIVITY		RECORD OR PRINT	REMOTE	RUN
S	SPEED OR FREQUENCY	SUM	SWITCH	SWITCH	STOP
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VARIABLE OR VISCOSITY			VALVE OR DAMPER	VFD/VALVE
W	WEIGHT OR FORCE		WELL		
X	MOD. LIGHT OR VALVE		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	INTERLOCK			RELAY OR COMPUTE	RESET
Z	POSITION			DRIVE OR ACTUATOR	

INSTRUMENT, EQUIPMENT AND CONTROL DEVICE EXAMPLES

FE	=	FLOW ELEMENT	TSH	=	TEMPERATURE SWITCH HIGH
FI	=	FLOW INDICATING TRANSMITTER	ZSC	=	POSITION SWITCH CLOSED
PE	=	PRESSURE ELEMENT	ZSO	=	POSITION SWITCH OPEN
PIT	=	PRESSURE INDICATING TRANSMITTER	FS	=	FLOW SWITCH
PI	=	PRESSURE INDICATOR	LSL	=	LEVEL SWITCH LOW
PSH	=	PRESSURE SWITCH HIGH	LSH	=	LEVEL SWITCH HIGH

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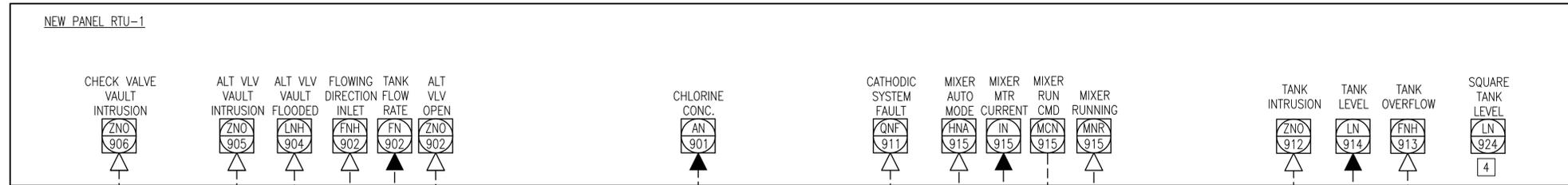


SCALE:
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 VERT: N/A
 DATE: AUGUST 2023
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 DRAWN: HDL
 CHECKED: GAH
 PROJECT NO.: 46826-003

BEDFORD REGIONAL WATER AUTHORITY
 1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
 INSTRUMENTATION ABBREVIATIONS, SCHEDULES, & GENERAL NOTES

SHEET
25
 OF
30
 DRAWING
I-1

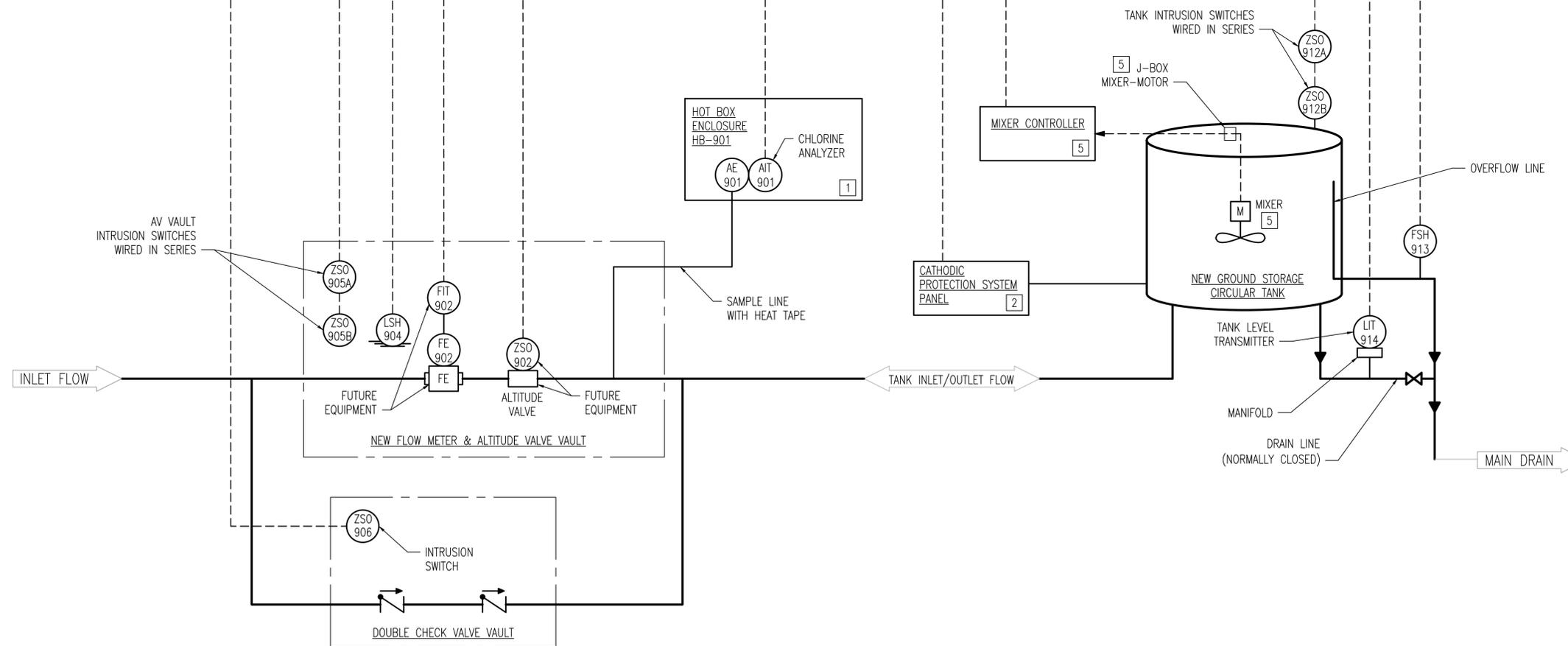


GENERAL NOTES

- SEE I&C SYMBOLS, LEGENDS AND ABBREVIATIONS SHEETS FOR DETAILS.
- P&ID SHOWN TO INDICATE CONTROL SYSTEM REQUIREMENTS AND DOES NOT REPRESENT A COMPLETE REFLECTION OF ALL PROCESS REQUIREMENTS. SEE MECHANICAL DRAWINGS FOR ADDITIONAL REQUIREMENTS.
- REFER TO ELECTRICAL & MECHANICAL DRAWINGS FOR ADDITIONAL INSTALLATION, LOCATIONS, AND EQUIPMENT REQUIREMENTS.
- NOT ALL REQUIRED I/O SHOWN FOR CLARITY.
- EXISTING-TO-REMAIN EQUIPMENT SHOWN HALF-TONE. NEW WORK SHOWN BOLD.
- NOT ALL I/O AND DEVICES SHOWN FOR INTERNAL RTU CONTROL LOGIC.
- PROCESS CONNECTION DETAILS NOT SHOWN. REFER TO MECHANICAL DRAWINGS FOR ADDITIONAL DETAILS.

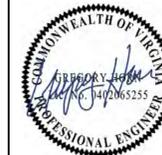
X SPECIFIC NOTES

- HOT BOX ENCLOSURE AND ACCESSORIES PROVIDED BY MANUFACTURER AND INSTALLED BY CONTRACTOR.
- CATHODIC PROTECTION SYSTEM PROVIDED BY MANUFACTURER AND INSTALLED BY CONTRACTOR.
- I/O POINTS ARE FUTURE. THE NEW RTU-1 PANEL SHALL COUNT THESE FUTURE I/O POINTS AS PART OF THE SYSTEM, NOT PART OF SPARES.
- EXISTING I/O IS FROM EX. RTU-0 PANEL. RELOCATE AND TERMINATE FIELD CONDUCTORS AND ASSOCIATED CONDUITS FROM EX. RTU-0 PANEL TO NEW RTU-1 PANEL.
- TANK MIXING SYSTEM PROVIDED BY MANUFACTURER AND INSTALLED BY CONTRACTOR.



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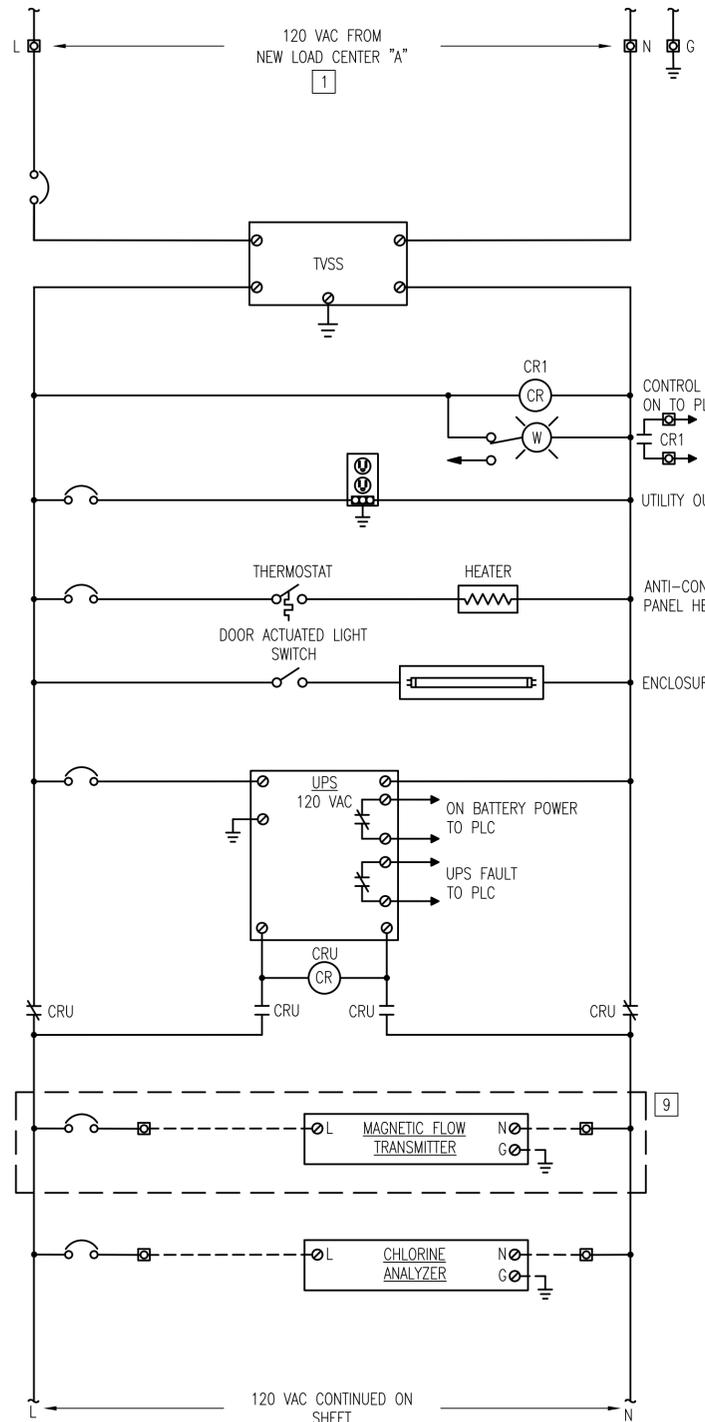


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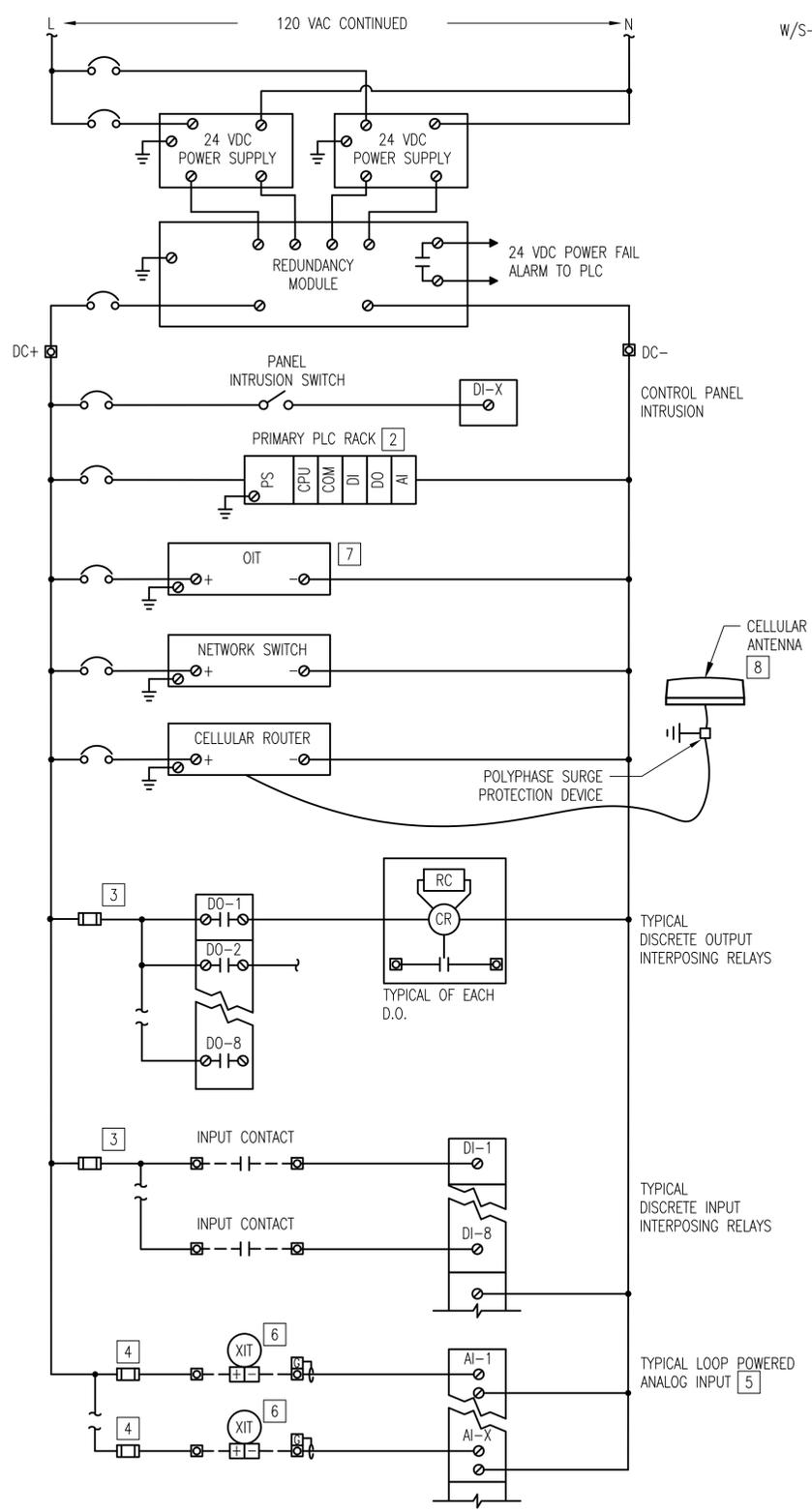
BEDFORD REGIONAL WATER AUTHORITY
 1723 FALLING CREEK ROAD, BEDFORD, VA

HELM STREET TANK REPLACEMENT
 PROCESS AND INSTRUMENTATION DIAGRAM

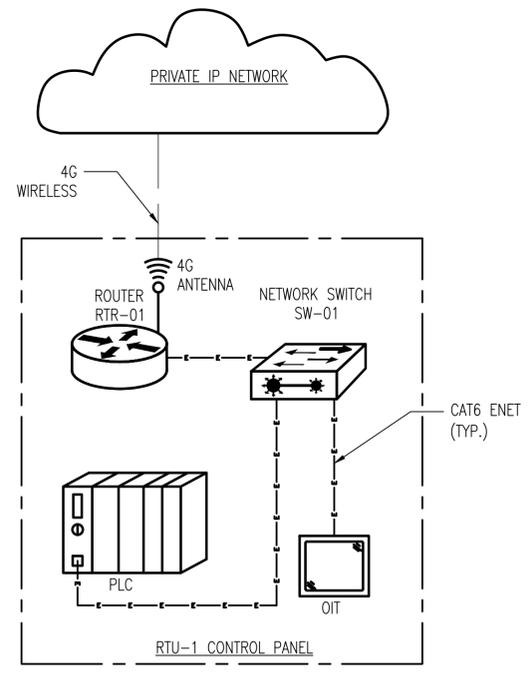
SHEET 27 OF 30 DRAWING I-3



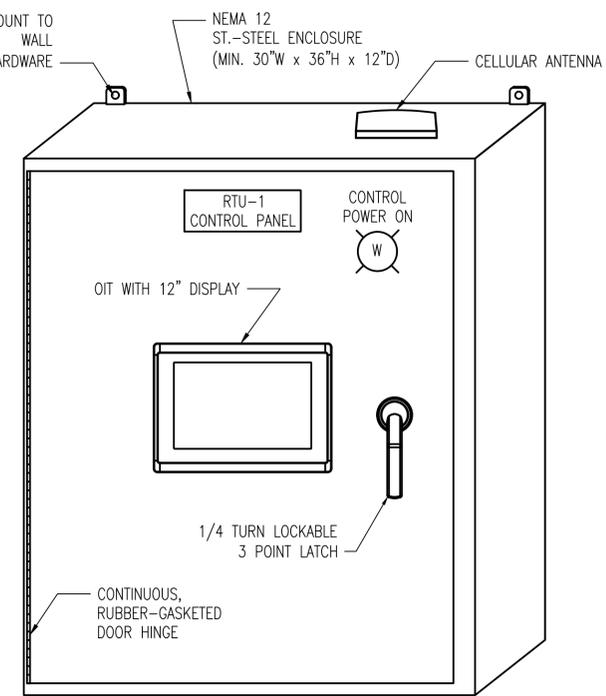
1 RTU-1 CONTROL PANEL ELEMENTARY
1-4 NTS



2 RTU-1 CONTROL PANEL ELEVATION
1-4 NTS



3 RADIO & NETWORK ARCHITECTURE
1-4 NTS



- GENERAL NOTES**
- SEE I&C SYMBOLS, LEGENDS AND ABBREVIATIONS SHEETS FOR DETAILS.
 - NOT ALL I/O WIRING AND CONNECTIONS TO I/O CARDS ARE SHOWN. PROVIDE WIRING FOR I/O AS REQUIRED FOR ACTIVE AND SPARE I/O, AS APPLICABLE. PROVIDE INTERPOSING RELAYS WITH RC OR DIODE SNUBBER CIRCUITS FOR DISCRETE OUTPUTS, BOTH ACTIVE AND SPARES. PROVIDE FUSES ON ANALOG INPUTS AND OUTPUTS, BOTH ACTIVE AND SPARES. PROVIDE WIRING OF ALL I/O INCLUDING SPARES, TO FIELD TERMINAL STRIPS.
 - LABEL ALL EQUIPMENT WITHIN THE CONTROL PANEL INCLUDING TERMINAL BLOCKS, RELAYS AND CIRCUIT BREAKERS WITH ASSOCIATED CIRCUIT OR ID NUMBER.
 - REFER TO ADDITIONAL INSTRUMENTATION DRAWINGS FOR ADDITIONAL INSTALLATION, LOCATIONS, AND EQUIPMENT REQUIREMENTS.

- SPECIFIC NOTES**
- REFER TO ELECTRICAL DRAWINGS FOR CIRCUIT LOCATION.
 - GENERAL PLC CONFIGURATION SHOWN. REFER TO I/O LIST FOR REQUIRED I/O MODULES.
 - PROVIDE FUSED POWER TO DISCRETE I/O POINTS IN GROUPS OF 8 FOR BOTH ACTIVE AND SPARE.
 - PROVIDE INDIVIDUAL 0.1A FUSED ANALOG INPUT CIRCUITS FOR EACH ANALOG SIGNAL.
 - LOOP DIAGRAMS SHOWN SIMPLIFIED FOR CLARITY. USE TWISTED SHIELDED CONDUCTORS WITH DRAIN WIRES GROUNDED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS FOR ALL ANALOG POINTS.
 - TYPICAL LOOP POWERED TRANSMITTERS. REFER TO SITE PLANS FOR ADDITIONAL INFORMATION.
 - EQUIPMENT LOCATED ON THE FACE OF THE CONTROL PANEL.
 - PROVIDE A RUGGED, LOW PROFILE, IMPACT RESISTANT (VANDAL PROOF) CELLULAR ANTENNA WITH POLYPHASE SURGE PROTECTOR.
 - FIELD DEVICE IS FUTURE. CONTROL PANEL TO ACCOUNT FOR THIS FUTURE DEVICE & ASSOCIATED I/O. REFER TO INSTRUMENTATION, SITE PLANS AND I/O LIST FOR ADDITIONAL INFORMATION.

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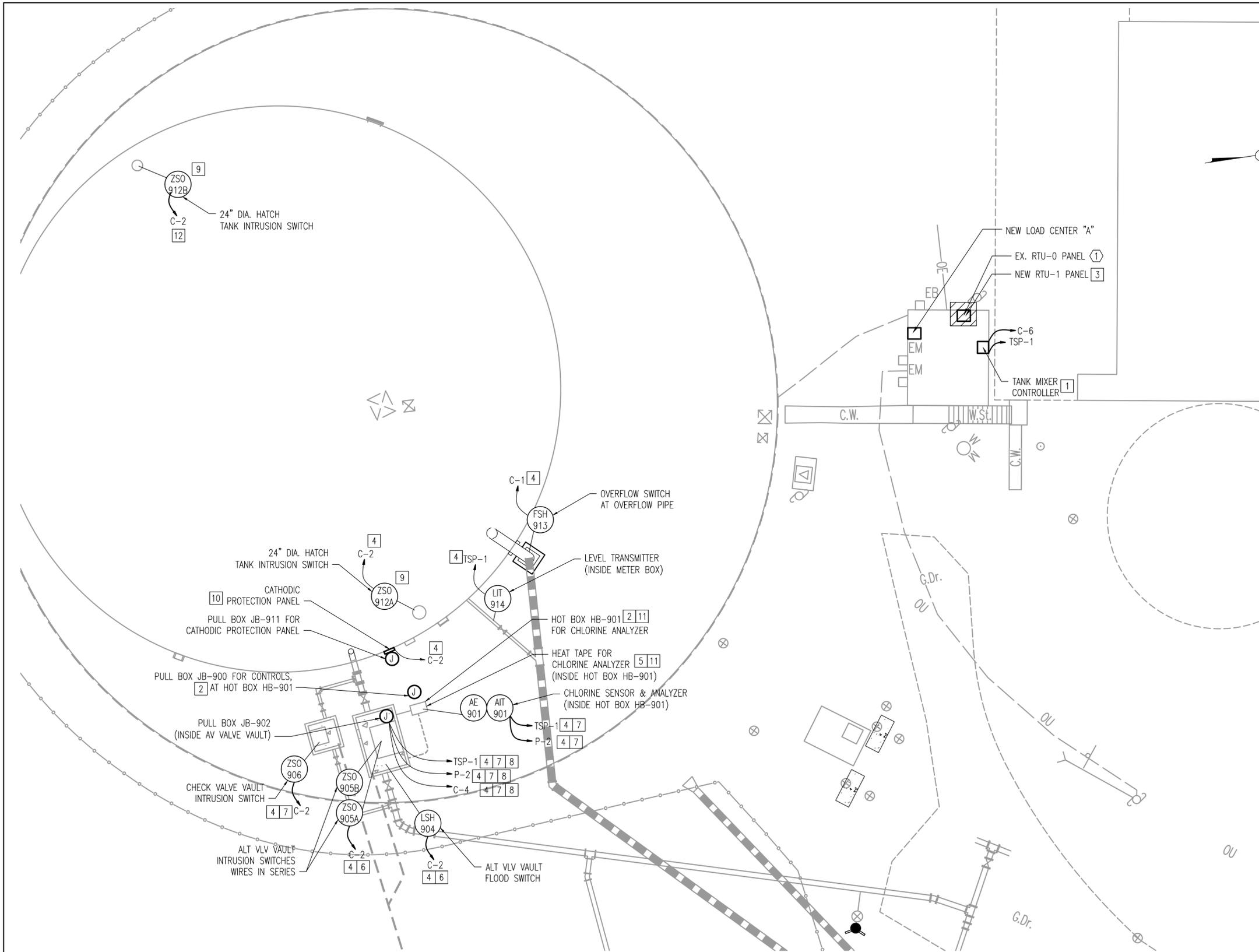
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CHECKED: GAH
PROJECT NO.: 46826-003

BEDFORD REGIONAL WATER AUTHORITY
1723 FALLING CREEK ROAD, BEDFORD, VA
HELM STREET TANK REPLACEMENT
ELECTRICAL CONTROL DIAGRAM & NETWORK DETAILS

SHEET
28
OF
30
DRAWING
I-4



GENERAL NOTES

1. SEE I&C SYMBOLS, LEGENDS AND ABBREVIATIONS SHEETS FOR DETAILS.
2. REFER TO ELECTRICAL & MECHANICAL DRAWINGS FOR ADDITIONAL INSTALLATION, LOCATIONS, AND EQUIPMENT REQUIREMENTS.
3. TERMINATE ALL CONDUIT AND CONDUCTORS AT THE NEW RTU-1 PANEL UNLESS OTHERWISE NOTED.
4. ISOLATE 120VAC AND 24VDC ANALOG CABLES. PROVIDE BARRIERS IN JUNCTION AND PULL BOXES WHERE REQUIRED TO SEPARATE WIRING. NO SPLICES OR TERMINATIONS PERMITTED IN PULL BOXES.
5. UNLESS OTHERWISE NOTED, ALL DIRECT BURIED CONDUITS SHALL BE PVC SCHEDULE 40 AND ALL OTHER CONDUITS SHALL BE RGS. PROVIDE TRANSITION AS REQUIRED.

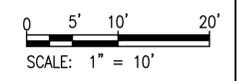
X SPECIFIC NOTES

1. TANK MIXING SYSTEM PROVIDED BY MANUFACTURER AND INSTALLED BY CONTRACTOR.
2. FOR PULL BOX JB-900 AND HOT BOX HB-901, COORDINATE FINAL ARRANGEMENT ON CONCRETE PAD TO ENABLE ACCESS AND MAINTENANCE FOR BOTH ENCLOSURES.
3. NEW RTU-1 PANEL TO BE INSTALLED IN EX. RTU-0 LOCATION.
4. DIRECT BURIED CONDUITS. REFER TO ELECTRICAL DRAWINGS FOR DIRECT BURIED CONDUIT INSTALLATION DETAIL. COORDINATE CONDUIT ROUTING WITH ELECTRICAL PLAN DRAWINGS.
5. HEAT TAPE POWER CIRCUIT IS ROUTED THRU PULL BOX JB-900 TO LOAD CENTER. SEE ELECTRICAL DRAWINGS FOR CIRCUIT DETAILS. SEE INSTRUMENTATION DETAIL DRAWING FOR LOAD TERMINATION.
6. CABLES ROUTED THRU PULL BOX JB-902 TO PULL BOX JB-900 TO RTU-1.
7. CABLES ROUTED THRU PULL BOX JB-900 TO RTU-1.
8. CABLES ARE FOR FUTURE FLOW METER AND HAVE NO TERMINATION ON BOTH ENDS. INSTALL, COVER AND MARK "SPARES FOR FUTURE".
9. TANK INTRUSION SWITCHES WIRED IN SERIES.
10. CATHODIC PROTECTION SYSTEM PROVIDED BY MANUFACTURER AND INSTALLED BY CONTRACTOR.
11. HOT BOX ENCLOSURE AND ACCESSORIES PROVIDED BY MANUFACTURER AND INSTALLED BY CONTRACTOR.
12. TO ZSO-912A. CONDUIT BETWEEN SWITCHES TO RUN ALONG TANK HANDRAIL. CONTRACTOR TO PROVIDE HARDWARE AS-REQUIRED TO SECURE TO HANDRAIL.

X DEMOLITION KEYNOTES

1. DEMO RTU-0 CONTROL PANEL BUT PRESERVE ALL EX. CONTROL CONDUCTORS AND ASSOCIATED CONDUITS. REINSTALL THE EX. CONTROL CONDUCTORS AND ASSOCIATED CONDUITS AT THE NEW RTU-1 CONTROL PANEL. TERMINATE THE EX. CONTROL CONDUCTORS PER NEW CONTROL DRAWINGS.

GRAPHIC SCALE



1 INSTRUMENTATION SITE PLAN - DEMO & NEW WORK
 I-5 SCALE: 1" = 10'

NO.	DATE	BY	REVISIONS

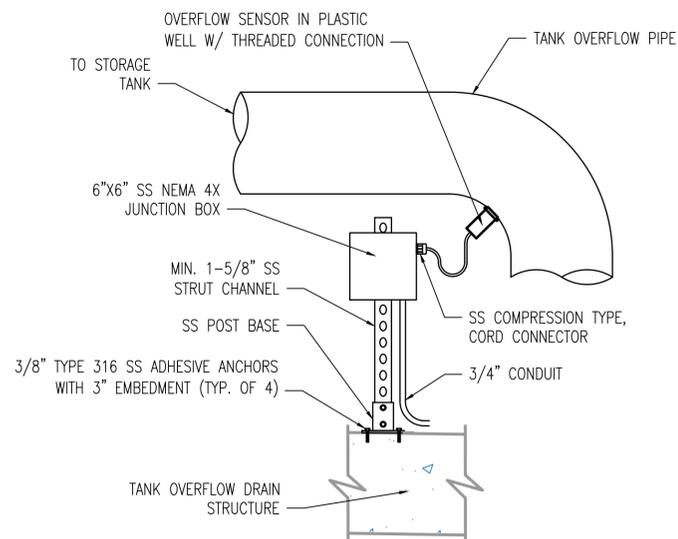


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BEDFORD REGIONAL WATER AUTHORITY
 1723 FALLING CREEK ROAD, BEDFORD, VA
 HELM STREET TANK REPLACEMENT
 INSTRUMENTATION SITE PLAN

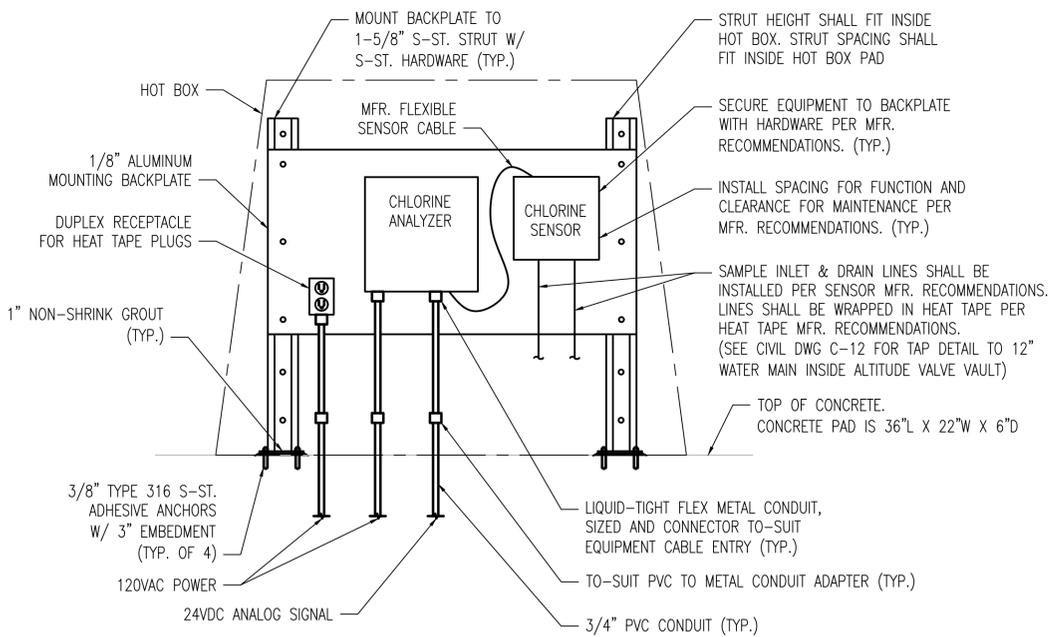
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N:\46826-003\CADD\46826003-5 SITE PLANDWG



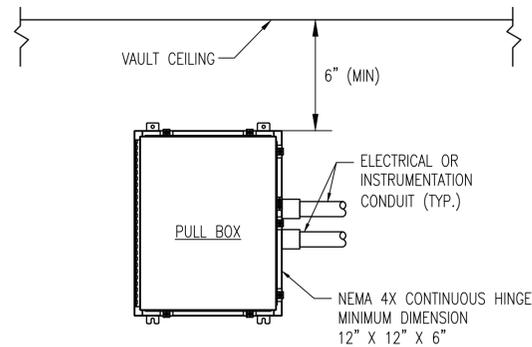
DETAIL NOTES:
 1. UNLESS OTHERWISE NOTED, ALL BOLTS, ANCHORS AND HARDWARE SHALL BE 316 STAINLESS STEEL.

1 OVERFLOW SENSOR INSTALLATION DETAIL
 1-6 NTS



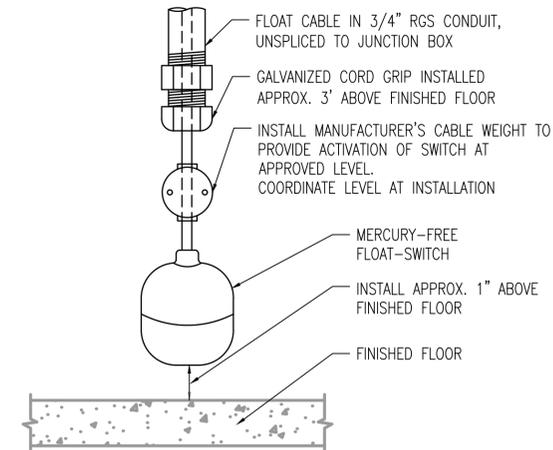
DETAIL NOTES:
 1. FOR HOT BOX AND HEAT TAPE, REFER TO MECHANICAL SPECIFICATIONS FOR ADDITIONAL DETAILS.
 2. FOR PULL BOX JB-900, REFER TO DETAIL 7, THIS DWG.

5 CHLORINE ANALYZER WITH HOT BOX DETAIL
 1-6 NTS

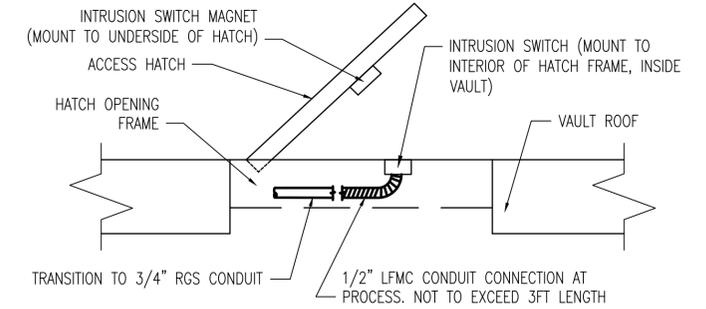


DETAIL NOTES:
 1. UNLESS OTHERWISE NOTED, ALL BOLTS, ANCHORS AND HARDWARE SHALL BE 316 STAINLESS STEEL.
 2. NO SPLICES OR TERMINATIONS PERMITTED IN PULL BOX.

2 VAULT PULL BOX DETAIL
 1-6 NTS

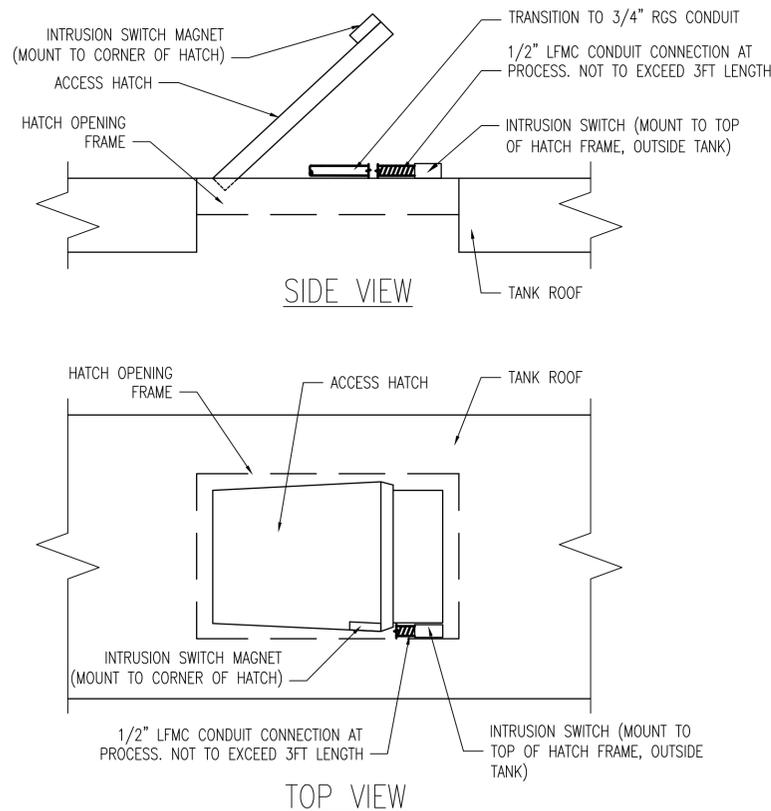


3 VALVE VAULT FLOOD SWITCH DETAIL
 1-6 NTS



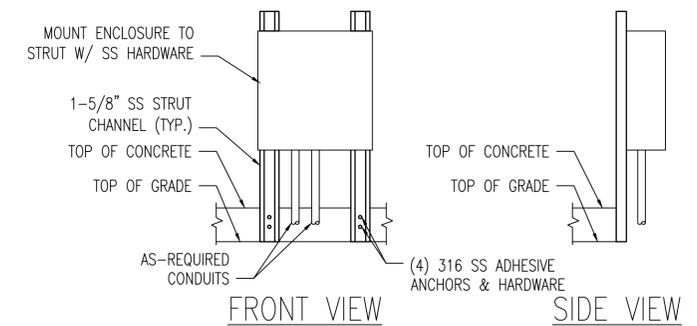
DETAIL NOTES:
 1. HATCH SWITCH LOCATION IS APPROXIMATE.
 2. INSTALL INTRUSION SWITCH LONG-WAYS, PARALLEL TO DOOR SWING DIRECTION.
 3. DRILL AND TAP HATCH AND HATCH OPENING FRAME FOR INSTALLATION OF SWITCH. ATTACH WITH STAINLESS STEEL SCREWS PER MFR INSTRUCTIONS.

4 VAULT HATCH INTRUSION SWITCH DETAIL
 1-6 NTS



DETAIL NOTES:
 1. INSTALL INTRUSION SWITCH MAGNET ON TOP OR ON SIDE OF ACCESS HATCH TO-SUIT WITH INTRUSION SWITCH TO CLOSE CONTACT WHEN ACCESS HATCH IS FULLY CLOSED.

6 TANK HATCH INTRUSION SWITCH DETAIL
 1-6 NTS



DETAIL NOTES:
 1. UNLESS OTHERWISE NOTED, ALL BOLTS, ANCHORS AND HARDWARE SHALL BE 316 STAINLESS STEEL.

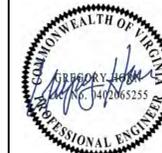
7 SIDE OF CONCRETE PAD FREE STANDING ENCLOSURE MOUNTING DETAIL
 1-6 NTS.

GENERAL NOTES

- SEE SHEETS I-1 AND I-2 FOR SYMBOLS, ABBREVIATIONS AND LEGENDS.
- SEE INSTRUMENTATION AND PLAN DRAWINGS FOR CABLE ROUTING INFORMATION.
- FOR LEVEL TRANSMITTER INSTALL DETAIL, SEE DRAWING C-15.

N:\46826-003\CADD\46826003-6 INSTALL DETAILS.DWG

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BEDFORD REGIONAL WATER AUTHORITY
 1723 FALLING CREEK ROAD, BEDFORD, VA
 HELM STREET TANK REPLACEMENT
 INSTRUMENTATION DETAILS

SHEET
 30
 OF
 30
 DRAWING
 I-6