Helm Street Tank Replacement

Bedford Regional Water Authority

REPORTS AND DRAWINGS KNOWN TO OWNER, HELM STREET TANK SITE, BEDFORD, VA

October 2023

Whitman, Requardt & Associates, LLP
Engineers · Architects · Environmental Planners Est. 1915

REPORTS AND DRAWINGS KNOWN TO OWNER
HELM STREET TANK SITE, BEDFORD, VA

- GEOTECHNICAL ENGINEERING REPORT

Prepared for

Bedford Regional Water Authority

Bedford Regional Water Authority

Geotechnical Engineering Report For Helm Street Tank Replacement

Bedford, Virginia

July 2022 *(Revised September 2022)*

Prepared by

Whitman, Requardt & Associates, LLP

Engineers · Architects · Environmental Planners Est. 1915

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1. Introduction

A. Background

Bedford Regional Water Authority (BRWA) is proposing a full demolition and replacement of the Helm Street Round Tank. Due to space constraints on site, the old tank will be demolished, and the new tank will be constructed within approximately the same footprint. This approach is facilitated by the fact that the Round Tank is currently out of service. The Square Tank and adjacent communications facilities and structures on the site are to remain in service.

The existing round concrete tank was originally constructed as an open top concrete tank with a capacity of 1.5 million gallons. The partially buried tank is 13 feet tall, with approximately 3 feet exposed above grade. In the interior of the tank, there are a number of previously repaired cracks on the upper 4 feet of the tank wall spaced roughly 6 to 8 feet apart around the circumference of the tank. There are several pipe penetrations in the concrete wall. The overflow pipe exits the tank through the Northwest wall as well as two (2) capped pipes. Based on drawings provided by BRWA, titled "Waterworks Improvements for the City of Bedford", dated January 15, 1970, and prepared by Wiley & Wilson Consulting Engineers and Architects, the tank was retrofitted with a 149.5 foot outside diameter conical steel roof. Footings were installed to support the columns when the roof was added. There are two pipe penetrations in the tank floor. One is the influent pipe on the Northeast side of the tank near the wall and the other is the drain underneath the center column. Due to the floor drain being in the center of the floor, the center column is supported by a transfer girder spanning over the drain. The transfer girder is supported by concrete foundations on either side of the drain.

A geotechnical investigation was performed by Whitman Requardt and Associates (WRA) for the proposed tank demolition and replacement. This report presents the details of the geotechnical field investigation and soil laboratory testing results, geotechnical engineering analysis, foundation recommendations for the project.

B. Proposed Structures

1) Ground Storage Tank

A 1.0 million gallon ground storage tank will be constructed to serve as a reservoir for the water pump station. The tank shall be cylindrical, flat bottom type of all-welded steel construction approximately 16 to 20 feet tall with a diameter of 95 to 106 feet.

2) Yard Piping and Valve Vault

On-site water lines will be installed with a minimum cover of 36 inches. A valve vault will be provided for the tank control valve and the city flow meter. The valve vaults are anticipated to be install to an approximate depth of 10 feet below grade.

2. Subsurface Investigation and Laboratory Testing

A. Subsurface Investigation

A subsurface investigation was performed by WRA to provide subsurface information and laboratory test data for the proposed structures. Two (2) test borings (B-1 and B-2) were performed at the structure locations with the assistance of WRA's subcontractor SEQ Drilling, Inc. (SEQ) in May of 2022. WRA provided full-time inspection and logged the material encountered during the period of field work. A boring location plan for all the borings completed is included in Appendix A.

The borings were performed using a CME-55 all-terrain (ATV) drill rig with hollow stem auger methods. Standard penetration tests (SPT) were performed by driving a 2-inch O.D. split spoon sampler into the soil by dropping a 140-pound automatic hammer that fell freely for 30 inches. Blow counts were recorded for each 6-inch increment for a total penetration of 18 inches. In each boring, five samples were taken within the first 10 feet and one for every 5 feet thereafter. A summary of the boring locations, surface elevations and depths are listed in Table 2-1.

Table 2-1: Boring Locations

Boring	Location	Northing	Easting	Surface Elevation (ft)	Boring Depth (ft)	Bottom of Boring EL (ft)
B-1	Water Tank	3643374.6344'	11186380.9496'	1187.1 ft	25 ft	1162.1 ft
B-2	Slope	3643321.7030'	11186426.4808'	1173.2 ft	29 ft	1144.2 ft

The boring logs are included in Appendix B.

3. Subsurface Conditions

A. Geology

The project site is located the Blue Ridge Physiographic Province which is characterized by a series of northeast trending, rugged, narrow, folded and faulted ridges made primarily of Precambrian-Age igneous and metamorphic rock that separates the Piedmont Province to the east, and the Valley and Ridge Province to the west. Bedrock in this region is typically overlain by saprolite, a layer of residual soils that displays structure similar to the rock from which it was derived.

The site is underlain by the rock of the Lovingston massif, a Precambrian-age biotite granofels and gneiss. The rock is light to dark gray, greenish-gray, medium- to coarse-grained, displays a banded structure and contains garnet, hornblende and amphibole. Locally, bodies of granulite and mylonitic gneiss are present. Residual and saprolitic material overlies the rock and is likely to be up to 30 feet

in thickness. Mapped outcrops within 1 miles of the site indicate that the rock is dipping steeply to the southeast. Geologic information from the Geologic Map of the Roanoke 30 x 60 Minute Quadrangle by W. S. Henika (1997).

B. Generalized Subsurface Conditions

A review of the geology and the boring logs was performed in order to determine the general site stratigraphy. The following sections provide a description of each stratum in the order that each stratum was encountered within the completed borings.

Topsoil/rootmat: Up to 4 inches of topsoil was encountered at borings B-1 and B-2.

Fill – (Elev 1187 feet to 1169 feet): Fill soils were encountered in borings B-1 and B-2 to elevations of 1181 and 1169 feet, respectively. These soils generally consisted of a Red and brown, firm to stiff micaceous clayey silt (ML) with some gravel.

SIlty Clay – Residual (Elev 1181 feet to 1155 feet): The upper clayey soils were encountered in the borings ranging in thickness from 12 feet to 14 feet. The clayey soil generally consisted of red and brown, medium stiff to very stiff, micaceous silty clay (CL). The corrected SPT blow counts ranged from 8 to 18 bpf with an average blow count of 14 bpf.

Clayey Sand – Residual (Elev 1169 feet to 1144 feet): The sandy soils were encountered in the borings ranging in thickness from 7 feet to 11 feet. The sandy soil generally consisted of brown, orange, and tan, dense to very dense, silty sand (SM) with quartz gravel fragments. The corrected SPT blow counts ranged from 13 to 24 bpf with an average blow count of 19 bpf.

Decomposed Rock (Elev 1162 feet to boring completion): The decomposed rock was encountered in the borings below the sandy soil to the completion of the borings. The decomposed rock generally consisted of gray, tan, and white, very dense to extremely dense, sand with gravel (SP) and sandy gravel (GP). The corrected SPT blow counts ranged from 70 to 100+ bpf.

C. Groundwater

Groundwater was not encountered in the borings. The borings were filled-in after approximately 2 hours after drilling.

Although groundwater was not encountered in the borings, it is likely that after rain events, groundwater may temporarily accumulate directly above the weathered rock before dispersing down slope.

4. Evaluation and Recommendations

The ground storage tank foundation aspects were evaluated and our recommendations for each are below.

A. Seismic Design Parameters

Based on the review of the Geologic Hazards Science Center – Worldwide Seismic Design Map, the following site parameters are recommended for the proposed tank location:

- Risk Category - IV
- Site Soil Classification – Class D
- S_s – 0.19
- S_1 – 0.064

Liquefaction potential of the site was assessed and found to not be a concern based on the stiff and dense nature of the on-site soils over weathered rock and hard rock.

B. Tank Foundations

For the proposed 1 million-gallon steel ground mounted water tank, the geotechnical analyses performed were based on the following estimated loading conditions:

• Tank Capacity:	1.0 million gallons
• Tank Interior Diameter:	95 to 106 feet
• Tank Height:	16 to 20 feet
• Tank Floor Elevation:	1181 feet
• Overflow Elevation:	1197 feet
• Seismic Load:	Horizontal and vertical seismic load in accordance with ASCE 7.
• Wind Load:	In accordance with ASCE 7 for category IV (essential facility) structures
• Roof Snow Load:	20 PSF or as determined by ASCE 7.

The bottom of tank is planned to be at an elevation of 1181 feet which is approximately 3 feet higher in elevation than the existing tank. Demolition of the existing tank foundations will require overexcavation of the existing tank foundations and relocation of tank appurtenances. The subsurface conditions encountered under the proposed tank foundations are a medium stiff to stiff silty clay transitioning into a medium dense silty sand overlying weathered rock and hard rock. The silty clay and silty sand extends to a depth of approximately 25 feet with a thickness of 12 to 14 feet below the proposed tank foundation. To keep earth load off of the side of the tank the perimeter of the tank will be sloped back resulting in a 6-foot cut. The tank will be surrounded, at grade, by a gravel service driveway.

It is recommended that the tank walls be supported by a shallow ringwall foundation with the tank floor directly supported by a prepared subgrade. The ringwall foundation should be embedded a minimum depth of 18 inches below finished grade to meet frost depth requirements The allowable

soil bearing for the perimeter ring foundation should be limited to 3,000 psf with a minimum width of 3 feet.

A settlement analysis was performed to assess the use of a shallow foundation to support the proposed tank. The analysis is based on the full tank loading. The maximum settlement is estimated to be less than 1/2-inch within the center of the tank. The maximum differential settlement from the center to the edge of the tank was found to be less than 1/2-inch. These settlements are acceptable for the proposed tank type.

Multiple tank manufacturers were contacted to obtain their capability to withstand maximum and deferential settlements. The total settlement is not a restriction for the tank design. The tank and pipe connections should be designed to handle the total settlement that has been estimated for the tank. For the magnitudes predicated no special design pipe or conduit connections are anticipated to be required. The manufacturers contacted indicated their tanks could withstand differential settlement from the tank edge to the center of the tank from 1 to 2 inches and maintain the stability of the tank.

The tank is anticipated to be bearing on engineered fill after demolition of the existing tank. Due to the large diameter of the tank the design coefficient of subgrade reaction, K = 100 pci should be used when evaluating the tank bottom support.

The site grading around the proposed tank will require minor cuts and fills. The maximum angle for cut and fill slopes is 3H:1V or flatter.

C. Yard Piping and Valve Vault

The proposed valve vault will be at a depth of approximately 10 feet below existing grade. Borings indicate that the open cuts will encounter loose to medium dense sand and soft to stiff sandy clay. Excavation support may be required for the piping and valve vault. The proposed depths are not anticipated to encounter groundwater.

The valve vault is anticipated to be bearing on dense sand. A coefficient of subgrade reaction of K_1 = 400 pci should be used for the bottom slab design. Due to dimensions of the vaults and slabs the design coefficient of subgrade reaction should be correct and a K = 100 pci should be used when evaluating the tank bottom support. The vault wall design should be designed to resist lateral earth pressures generated for a soil unit weight of 125 pcf and an at-rest lateral earth pressure coefficient Ko of 0.5.

The excavated soil is anticipated to be suitable for use as backfill material for the pipe trenches. However, if the existing soil's natural moisture content exceeds the determined optimum moisture content significantly then aeration of these soils will be required prior to placement as backfill. The

soil should be thoroughly compacted to not less than 95% of maximum dry density as determined by ASTM D698, Standard Proctor.

5. Earthwork and Construction Considerations

Groundwater was not encountered within the borings at a depth of 23 to 28 feet. Based on the anticipated depth of excavation, site construction is not anticipated to encounter groundwater. The excavation should be sloped to storm water does not pond on the subgrade and flows off the pad or to a sump where it can be pumped out of the area.

After demolition of the existing tank foundation roughly 3 feet of fill will be required to raise the grade to the proposed bottom of foundation level. This fill should consist of a granular crushed aggregate material such as VDOT 21A, Crusher Run, or Recycled Concrete of similar dense gradation. Material should be placed in 8-inch loose lifts and compacted to a minimum of 95% of its maximum dry density determined by ASTM 698.

Any non-structural fill material required for the access road and other areas may utilize the rubblized existing tank. These areas must also be covered so as not to expose the lead-based paint on the concrete to the atmosphere. The access road will utilize a surface material of crushed stone for functionality and to meet the cover requirements.

6. Basis of Recommendations

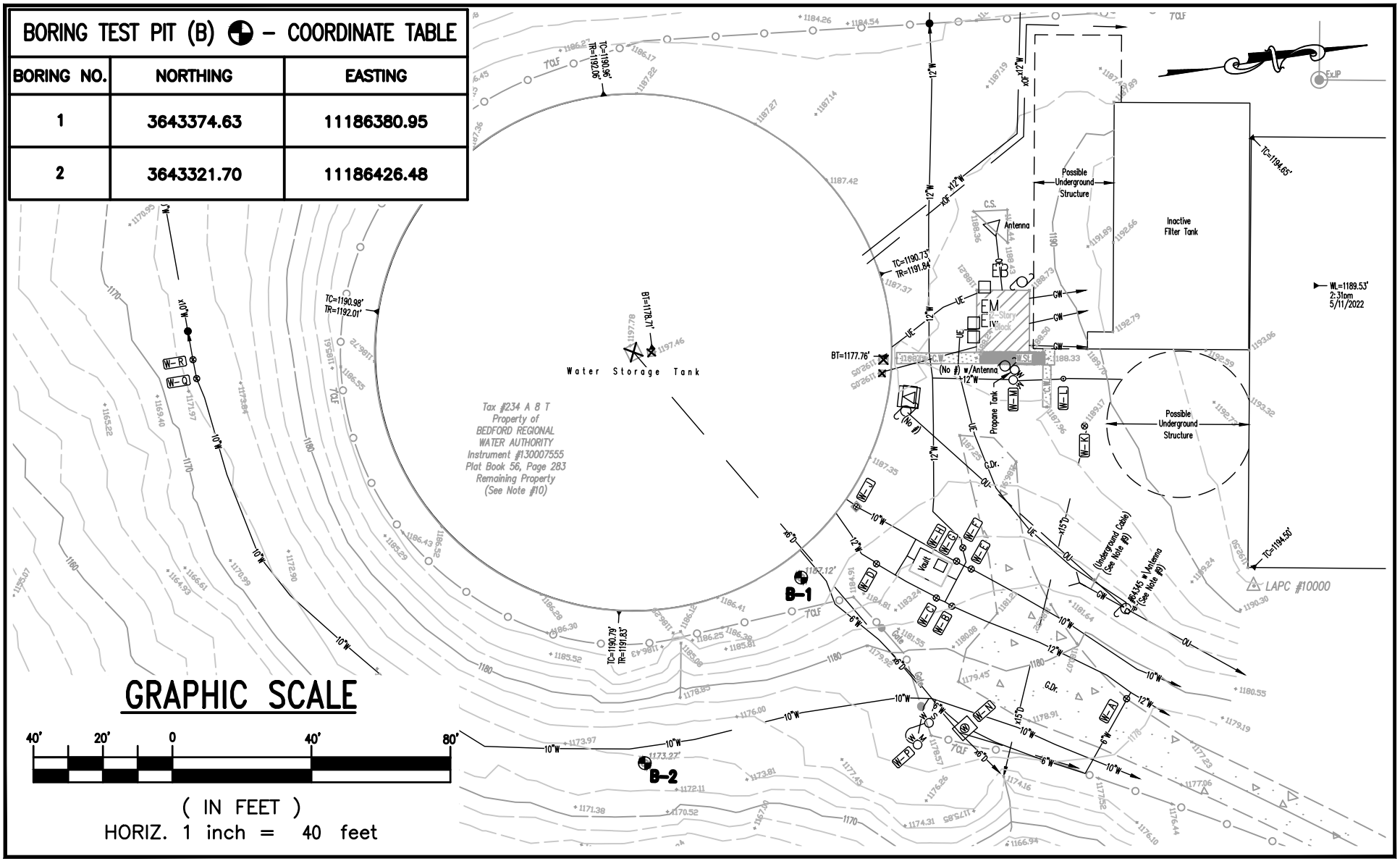
This report has been prepared to present geotechnical conditions at the project site and to provide geotechnical analyses and recommendations to serve as a basis for design and preparation of plans and specifications. The analyses and recommendations contained in the report were based upon finite data obtained from the borings which are presented in this report. The nature and extent of variations between explorations may not become evident until construction. If significant variations from the anticipated conditions are encountered in the field during construction, it may be necessary for us to reevaluate and revise the content of this report.

Our recommendations and conclusions are based upon our professional judgment and generally accepted principles of geotechnical engineering, the limited project parameters provided to us at the time of this report, and the assumption that construction will be monitored and tested by a qualified engineering technician, under the supervision of a Geotechnical Engineer who is licensed in the State of Virginia. We assume no responsibility for interpretations made by others based upon the services performed by WRA. We reserve the right to modify our recommendations and conclusions if substantial changes are incorporated into the project.

Also, this report specifically excludes exploration, sampling, testing, evaluation, and recommendations relating to the presence of hazardous materials or other environmental concerns which could affect future development of the site.

Appendix A
Site and Boring Location Plans

BORING TEST PIT (B) ⊕ – COORDINATE TABLE		
BORING NO.	NORTHING	EASTING
1	3643374.63	11186380.95
2	3643321.70	11186426.48



Whitman, Requardt & Associates, LLP 1700 Kraft Drive, Suite 1200, Blacksburg, Virginia 24060	CLIENT BEDFORD REGIONAL WATER AUTHORITY 1723 Falling Creek Road Bedford, Virginia 24523	PROJECT TITLE HELM STREET WATER TANK REPLACEMENT		DRAWING TITLE EXHIBIT DRAWING NO.	
DES: PJM	DRAWN: JES	CHECK: PJM	SCALE: AS SHOWN	DATE: 6/23/22	SHEET OF 1 OF 1

Appendix B
Boring Logs

TEST BORING LOG

Whitman, Requardt & Associates, LLP
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PROJECT: Helm Street Tank Replacement (Round Tank)
LOCATION: Bedford Regional Water Authority (BRWA), Bedford County, VA ,
DRILLING BY: SEQ Drilling, Inc. LLC **RIG:** CME 550X ATV

GROUNDWATER DATA (ft)				
Date	Time	Water	Casing	Cave-In
5/9/2022	9:42:00 AM	Dry		
5/9/2022	10:11:00 AM	Dry		

EQUIPMENT	CASING	SAMPLER	CORE
TYPE		SPT	
SIZE, ID (in)	3.25	1.5	
HAMMER WT. (lb)		140	-
HAMMER FALL (in)		30	-

WO #: 46626.003
NORTH: 3643374.6
EAST: 11186380.9
ELEVATION: 1187.1
START DATE: 5/9/2022
END DATE: 5/9/2022
DRILLER: S. Sequist (SEQ)
LOGGED BY: J. Fargher (WRA)

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% RQD)	ELEV. / DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
	S-1			2 2 2 2	EL 1187.1 0.0		Topsoil (4-inches)	
					EL 1186.8 0.3		FILL, red-brown, Clayey SILT, soft to medium stiff, moist (ML)	
	S-2			2 2 1 1				
	S-3			1 2 2 2				
5								
	S-5			5 6 8 9	EL 1181.1 6.0		Residual, Red, Silty CLAY, trace gravel, stiff to very stiff, moist (CL)	

SAMPLE IDENTIFICATION	DRILLING METHOD	BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY
- S - SPLIT SPOON	HSA - HOLLOW STEM AUGERS	0-4	VERY LOOSE	0-2	VERY SOFT
- ST - SHELBY TUBE	SSA - SOLID STEM AUGERS	5-10	LOOSE	3-4	SOFT
- RC - ROCK CORE	DC - DRIVING CASING	11-30	MEDIUM DENSE	5-8	MEDIUM STIFF
- DS -DENNISON	MD - MUD DRILLING	31-50	DENSE	9-15	STIFF
	HA - HAND AUGER	50-80	VERY DENSE	16-30	VERY STIFF
		OVER 80	EXTREMELY DENSE	OVER 30	HARD

TEST BORING LOG

PROJECT: Helm Street Tank Replacement (Round Tank)
LOCATION: Bedford Regional Water Authority (BRWA), Bedford County, VA,
DRILLING BY: S. Sequist (SEQ) **RIG:**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% RQD)	ELEV. / DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
	S-4			1 4 4 6				
10								
	S-6			6 7 7 9				
15								
	S-7			13 10	EL 1169.1		Residual, Orange, red-brown, Silty SAND, trace gravel, medium	

TEST BORING LOG

PROJECT: Helm Street Tank Replacement (Round Tank)
LOCATION: Bedford Regional Water Authority (BRWA), Bedford County, VA,
DRILLING BY: S. Sequist (SEQ) **RIG:**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% RQD)	ELEV. / DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
				11 14	18.0		dense to dense, moist (SM)	
20								
	S-8			4 29 41 50/3"				
					EL 1162.6 24.5		Weathered Rock (IGM), mottled, medium, Silty SAND, contains rock fragments, very dense, moist	
25							Boring Terminated on Auger Refusal at 25 feet. Bottom of Boring @ 25 FT	

TEST BORING LOG

Whitman, Requardt & Associates, LLP
Engineers · Architects · Environmental Planners Est. 1915

PROJECT: Helm Street Tank Replacement (Round Tank)
LOCATION: Bedford Regional Water Authority (BRWA), Bedford County, VA ,
DRILLING BY: SEQ Drilling, Inc. **RIG:** CME 550X ATV

GROUNDWATER DATA (ft)				
Date	Time	Water	Casing	Cave-In
5/9/2022	11:33:00 AM	Dry		
5/9/2022	11:42:00 AM	Dry		

EQUIPMENT	CASING	SAMPLER	CORE
TYPE		SPT	
SIZE, ID (in)	3.25	1.5	
HAMMER WT. (lb)		140	-
HAMMER FALL (in)		30	-

WO #: 46626.003
NORTH: 3643321.7
EAST: 11186426.5
ELEVATION: 1173.3
START DATE: 5/9/2022
END DATE: 5/9/2022
DRILLER: S. Sequist (SEQ)
LOGGED BY: J. Fargher (WRA)

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% RQD)	ELEV. / DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
	S-1		1.3	2 2 2 2	EL 1173.3 0.0 EL 1173.1 0.2		Topsoil (2-inches) FILL, red-brown, Clayey SILT, stiff, moist (ML)	
	S-2		1.5	2 5 4 3				
	S-3		1.17	2 5 9 12	EL 1169.3 4.0		Residual, Red-brown, Silty CLAY, stiff to very stiff, moist (CL)	
5								

SAMPLE IDENTIFICATION	DRILLING METHOD	BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY
- S - SPLIT SPOON	HSA - HOLLOW STEM AUGERS	0-4	VERY LOOSE	0-2	VERY SOFT
- ST - SHELBY TUBE	SSA - SOLID STEM AUGERS	5-10	LOOSE	3-4	SOFT
- RC - ROCK CORE	DC - DRIVING CASING	11-30	MEDIUM DENSE	5-8	MEDIUM STIFF
- DS -DENNISON	MD - MUD DRILLING	31-50	DENSE	9-15	STIFF
	HA - HAND AUGER	50-80	VERY DENSE	16-30	VERY STIFF
		OVER 80	EXTREMELY DENSE	OVER 30	HARD

Boring No. B-2

TEST BORING LOG

PROJECT: Helm Street Tank Replacement (Round Tank)
LOCATION: Bedford Regional Water Authority (BRWA), Bedford County, VA,
DRILLING BY: S. Sequist (SEQ) **RIG:**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% RQD)	ELEV. / DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
	S-4		1.25	5 8 10 12				
10								
	S-5		1.5	4 7 11 11				
15								
	S-6		1.17	5 6	EL 1155.3		Orange, brown, Silty SAND, trace gravel	

TEST BORING LOG

PROJECT: Helm Street Tank Replacement (Round Tank)
LOCATION: Bedford Regional Water Authority (BRWA), Bedford County, VA,
DRILLING BY: S. Sequist (SEQ) **RIG:**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% RQD)	ELEV. / DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
				7 7	18.0			
20								
	S-7		1.3	8 12 12 14				
25								

TEST BORING LOG

PROJECT: Helm Street Tank Replacement (Round Tank)
LOCATION: Bedford Regional Water Authority (BRWA), Bedford County, VA,
DRILLING BY: S. Sequist (SEQ) **RIG:**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE RECOVERY (in)	BLOWS/6" (% RQD)	ELEV. / DEPTH	GRAPHIC	DESCRIPTION AND CLASSIFICATION (moisture, density, color, proportions, etc.)	NOTES:
	S-8		1	12 12 50/6"				
					EL 1143.8 29.5		Weathered Rock (IGM), mottled, medium, Silty SAND, contains rock fragments, very dense, moist	
30							Boring terminated on Sampler Refusal at 30 feet. Bottom of Boring @ 30 FT	

REPORTS AND DRAWINGS KNOWN TO OWNER
HELM STREET TANK SITE, BEDFORD, VA

- LEAD PAINT ANALYSIS REPORT OF EXISTING ROUND TANK
- CONCRETE LEAD ANALYSIS REPORT OF EXISTING ROUND TANK

Environmental Hazards Services, L.L.C.
7469 Whitepine Rd
Richmond, VA 23237
Telephone: 800.347.4010

Lead Paint Chip Analysis Report

Report Number: 22-04-04809

Client: Private Company
,

Received Date: 04/22/2022
Analyzed Date: 04/27/2022
Reported Date: 04/27/2022

Project/Test Address: Whitman, Requardt and Associates; Helm Street Tank; Bedford County
Collection Date: 04/12/2022

Client Number:
00-1004

Fax Number:

Laboratory Results

Lab Sample Number	Client Sample Number	Collection Location	Pb (ug/g) ppm	% Pb by Wt.	Narrative ID
22-04-04809-001	1	TANK ROOF 1 EXTERIOR	18000	1.8	
22-04-04809-002	2	TANK ROOF 2 EXTERIOR	15000	1.5	
22-04-04809-003	3	TANK ROOF 1 INTERIOR	<49	<0.0049	
22-04-04809-004	4	TANK ROOF 2 INTERIOR	1300	0.13	
22-04-04809-005	5	TANK CONCRETE COATING 1	92	0.0092	
22-04-04809-006	6	TANK CONCRETE COATING 2	300	0.030	

Environmental Hazards Services, L.L.C

Client Number: 00-1004 Report Number: 22-04-04809

Project/Test Address: Whitman, Requardt and Associates; Helm Street Tank; Bedford County

Lab Sample Number	Client Sample Number	Collection Location	Pb (ug/g) ppm	% Pb by Wt.	Narrative ID

Preparation Method: ASTM E-1979-17
Analysis Method: EPA SW846 7000B

Reviewed By Authorized Signatory: Melissa Kanode

Melissa Kanode
QA/QC Clerk

The Reporting Limit (RL) for samples prepared by ASTM E-1979-17 is 10.0 ug Total Pb. The RL for samples prepared by EPA SW846 3050B is 25.0 ug Total Pb. Paint chip area and results are calculated based on area measurements determined by the client. All internal quality control requirements associated with this batch were met, unless otherwise noted.

The condition of the samples analyzed was acceptable upon receipt per laboratory protocol unless otherwise noted on this report. Results represent the analysis of samples submitted by the client. Sample location, description, area, etc., was provided by the client. Results reported above in mg/cm3 are calculated based on area supplied by client. This report shall not be reproduced except in full, without the written consent of Environmental Hazards Services, L.L.C.

ELLAP Accredtitation through AIHA LAP, LLC (100420), NY ELAP #11714.

LEGEND	Pb= lead	ug = microgram	ppm = parts per million
	ug/g = micrograms per gram	Wt. = weight	

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

CONCRETE TANK WALL SAMPLES ANALYSIS REPORT

June 01, 2023

Mike Harris
Whitman Requardt & Associates
1700 Kraft Drive
Suite 1200
Blacksburg, VA 24060

RE: Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

Dear Mike Harris:

Enclosed are the analytical results for sample(s) received by the laboratory on May 18, 2023. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Ormond Beach

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Jonathan W Biddix
jonathan.biddix@pacelabs.com
(704)875-9092
Project Manager

Enclosures

cc: NIch Kevey

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

CERTIFICATIONS

Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

Pace Analytical Services Ormond Beach
8 East Tower Circle, Ormond Beach, FL 32174
Alaska DEC- CS/UST/LUST
Alabama Certification #: 41320
Colorado Certification: FL NELAC Reciprocity
Connecticut Certification #: PH-0216
Delaware Certification: FL NELAC Reciprocity
DoD-ANAB #:ADE-3199
Florida Certification #: E83079
Georgia Certification #: 955
Guam Certification: FL NELAC Reciprocity
Hawaii Certification: FL NELAC Reciprocity
Illinois Certification #: 200068
Indiana Certification: FL NELAC Reciprocity
Kansas Certification #: E-10383
Kentucky Certification #: 90050
Louisiana Certification #: FL NELAC Reciprocity
Louisiana Environmental Certificate #: 05007
Maine Certification #: FL01264
Maryland Certification: #346
Massachusetts Certification #: M-FL1264
Michigan Certification #: 9911
Mississippi Certification: FL NELAC Reciprocity
Missouri Certification #: 236
Montana Certification #: Cert 0074
Nebraska Certification: NE-OS-28-14
New Hampshire Certification #: 2958
New Jersey Certification #: FL022
New York Certification #: 11608
North Carolina Environmental Certificate #: 667
North Carolina Certification #: 12710
North Dakota Certification #: R-216
Ohio DEP 87780
Oklahoma Certification #: D9947
Pennsylvania Certification #: 68-00547
Puerto Rico Certification #: FL01264
South Carolina Certification: #96042001
Tennessee Certification #: TN02974
Texas Certification: FL NELAC Reciprocity
US Virgin Islands Certification: FL NELAC Reciprocity
Virginia Environmental Certification #: 460165
West Virginia Certification #: 9962C
Wisconsin Certification #: 399079670
Wyoming (EPA Region 8): FL NELAC Reciprocity

Pace Analytical Services, LLC
9800 Kincey Ave. Suite 100
Huntersville, NC 28078
(704)875-9092

SAMPLE ANALYTE COUNT

Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
92668183001	**HELM-1**	EPA 6010	AME	1	PASI-O
		ASTM D2974-87	BMA	1	PASI-O
92668183002	**HELM-2**	EPA 6010	AME	1	PASI-O
		ASTM D2974-87	BMA	1	PASI-O

PASI-O = Pace Analytical Services - Ormond Beach

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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ANALYTICAL RESULTS

Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

Sample: HELM-1 **Lab ID: 92668183001** Collected: 05/09/23 13:00 Received: 05/18/23 12:08 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP, TCLP	Analytical Method: EPA 6010 Preparation Method: EPA 3010 Leachate Method/Date: EPA 1311; 05/26/23 13:21 Pace Analytical Services - Ormond Beach							
Lead	ND	mg/L	0.10	1	05/28/23 08:12	06/01/23 08:40	7439-92-1	
Percent Moisture	Analytical Method: ASTM D2974-87 Pace Analytical Services - Ormond Beach							
Percent Moisture	**4.0**	%	0.10	1		05/26/23 07:57		

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

Sample: HELM-2 **Lab ID: 92668183002** Collected: 05/09/23 13:36 Received: 05/18/23 12:08 Matrix: Solid

Results reported on a "dry weight" basis and are adjusted for percent moisture, sample size and any dilutions.

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
6010 MET ICP, TCLP	Analytical Method: EPA 6010 Preparation Method: EPA 3010 Leachate Method/Date: EPA 1311; 05/26/23 13:21 Pace Analytical Services - Ormond Beach							
Lead	ND	mg/L	0.10	1	05/28/23 08:12	06/01/23 09:02	7439-92-1	
Percent Moisture	Analytical Method: ASTM D2974-87 Pace Analytical Services - Ormond Beach							
Percent Moisture	**3.9**	%	0.10	1		05/26/23 07:57		

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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QUALITY CONTROL DATA

Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

QC Batch: 921544
QC Batch Method: EPA 3010
Analysis Method: EPA 6010
Analysis Description: 6010 MET TCLP
Laboratory: Pace Analytical Services - Ormond Beach
Associated Lab Samples: 92668183001, 92668183002

METHOD BLANK: 5064920 Matrix: Water
Associated Lab Samples: 92668183001, 92668183002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Lead	mg/L	ND	0.010	06/01/23 08:32	

LABORATORY CONTROL SAMPLE: 5066630

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Lead	mg/L	0.25	0.27	107	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 5066631 5066632

Parameter	Units	92668183001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Lead	mg/L	ND	2.5	2.5	2.7	2.6	107	105	75-125	2	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

QC Batch: 921152
QC Batch Method: ASTM D2974-87
Analysis Method: ASTM D2974-87
Analysis Description: Dry Weight/Percent Moisture
Laboratory: Pace Analytical Services - Ormond Beach

Associated Lab Samples: 92668183001, 92668183002

SAMPLE DUPLICATE: 5064746

Parameter	Units	35799456071 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	11.5	12.1	5	

SAMPLE DUPLICATE: 5064747

Parameter	Units	35800820003 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	17.8	17.7	1	

SAMPLE DUPLICATE: 5064748

Parameter	Units	35802027016 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	30.4	30.6	1	

SAMPLE DUPLICATE: 5064749

Parameter	Units	35802289001 Result	Dup Result	RPD	Qualifiers
Percent Moisture	%	12.8	12.1	5	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

Acid preservation may not be appropriate for 2 Chloroethylvinyl ether.

A separate vial preserved to a pH of 4-5 is recommended in SW846 Chapter 4 for the analysis of Acrolein and Acrylonitrile by EPA Method 8260.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

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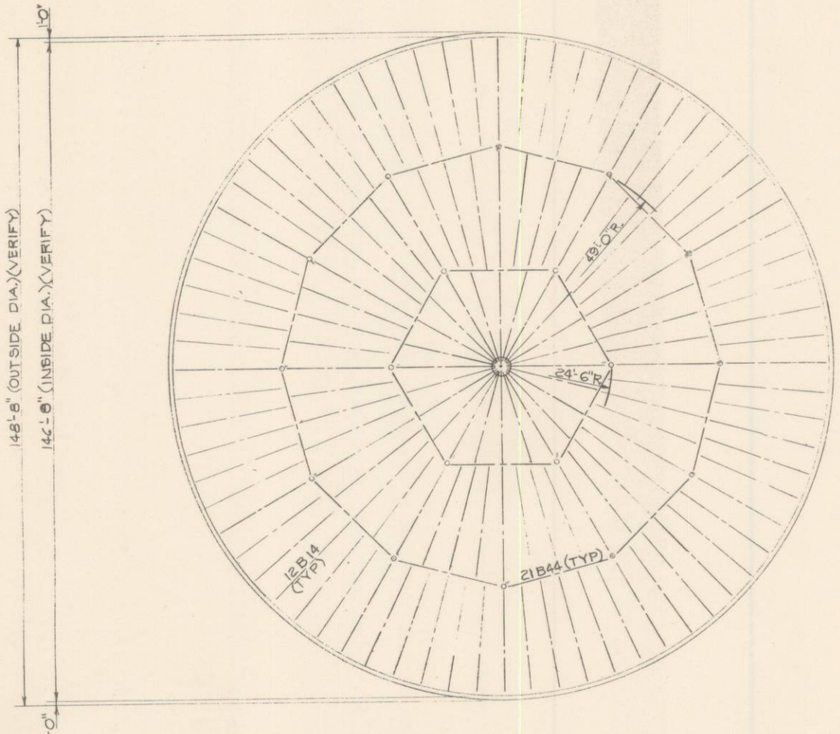
QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: HELM STREET TANK REPLACEMENT
Pace Project No.: 92668183

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
92668183001	**HELM-1**	EPA 3010	921544	EPA 6010	921601
92668183002	**HELM-2**	EPA 3010	921544	EPA 6010	921601
92668183001	**HELM-1**	ASTM D2974-87	921152		
92668183002	**HELM-2**	ASTM D2974-87	921152		

REPORTS AND DRAWINGS KNOWN TO OWNER
HELM STREET TANK SITE, BEDFORD, VA

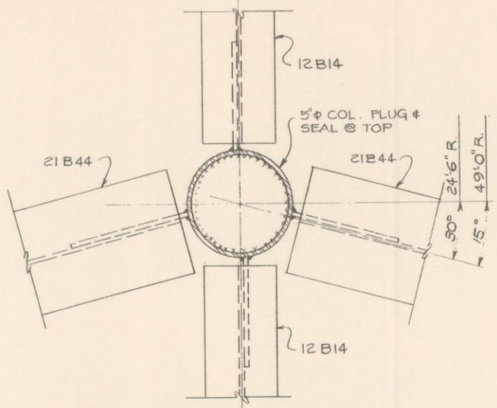
- EXISTING TANK RECORD DRAWING (AS AVAILABLE)



ROOF FRAMING PLAN

SCALE: 1/16" = 1'-0"

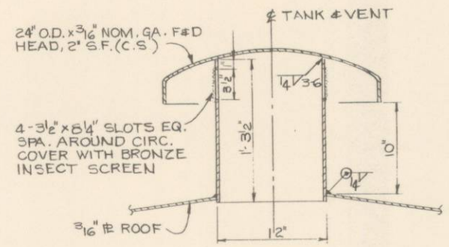
OUTSIDE DIA. 148'-8" (VERIFY)



TYPICAL COLUMN CONNECTION DETAIL

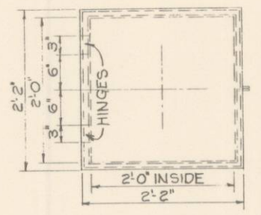
SCALE: 3" = 1'-0"

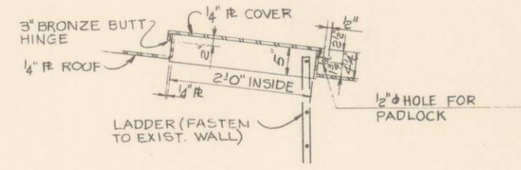
NOTE: RAFTERS ARE TO BE CONNECTED TO THE BEAMS AS REQUIRED SO THAT THE ROOF FRAMEWORK WILL FORM A TRUE CONICAL SURFACE.



ROOF VENT DETAIL

SCALE: 1 1/2" = 1'-0"

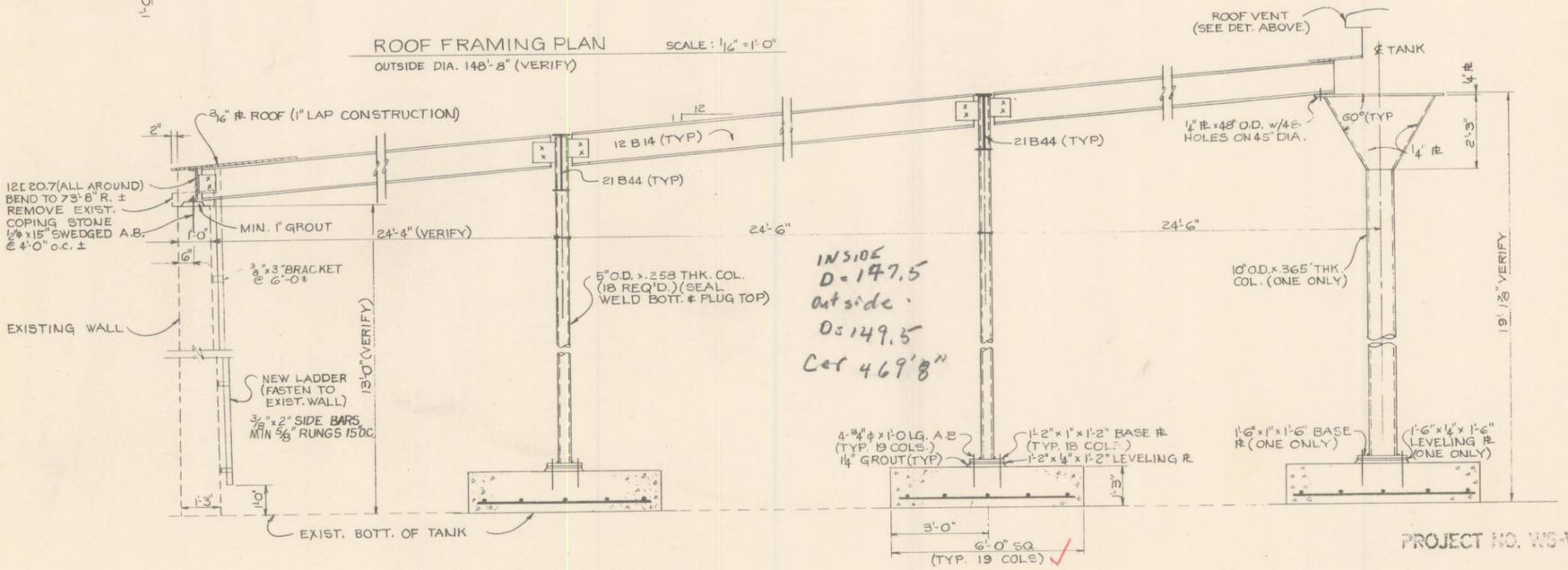




ROOF HATCH DETAIL

SCALE: 1" = 1'-0"

(LOCATE IN FIELD)



TYPICAL HALF SECTION THRU TANK

SCALE: 1/2" = 1'-0"

PROJECT NO. WS-VA-63

GRAPHIC SCALES

1/16" = 1'-0"

1/2" = 1'-0"

1" = 1'-0"

1 1/2" = 1'-0"

3" = 1'-0"

CONTRACTOR SHALL VERIFY ALL DIMENSIONS AT THE JOB AND REPORT ANY INCONSISTENCIES TO THE ENGINEERS

REVISIONS

WATERWORKS IMPROVEMENTS
FOR THE
CITY OF BEDFORD
BEDFORD, VIRGINIA

WILEY & WILSON
CONSULTING ENGINEERS AND ARCHITECTS
LYNCHBURG, VIRGINIA

COMMONWEALTH OF VIRGINIA
E. L. Robinson
NO. 3966
CERTIFIED PROFESSIONAL ENGINEER

DESIGNED	REVIEWED	SCALE	AS NOTED
DRAWN	APPROVED	DATE	JAN. 15, 1970
CHECKED		COMM. NO.	61040

REFERENCE

STRUCTURAL

SUB TITLE COVER DETAILS FOR EXISTING 148'-0" DIA. RESERVOIR

PERMANENT FILE NO.

DWG. 37

SHEET ___ OF ___