CITY OF DOVER

DOVER PLANNING BOARD – AGENDA

Meeting Type:	Regular Meeting
Meeting Location:	Council Chambers, City Hall, 288 Central Ave, Dover NH 03820
Meeting Date:	**Tuesday, February 22, 2022**
Meeting Time:	**7:00 pm**

1. **CITIZENS' FORUM**
2. **APPROVAL OF THE PRIOR MINUTES**
   - February 8, 2022 Regular Meeting Minutes
3. **OLD BUSINESS**
4. **NEW BUSINESS**

   A. Consideration and acceptance of a Site Review for the City of Dover, Assessor's Map D, Lot 1, zoned R-40, and located at 40-42 Smith Well Road. (Proposal is for an additional water storage tank). *(P22-02)

   B. Consideration and acceptance of a Conditional Use Permit for American Durafilm Co., Inc. (Owner: AD Dover, LLC.), Assessor's Map D, Lot 11-1, zoned IT, located on Innovation Way and Venture Drive. (Proposal is to increase the amount of fill to improve the foundation support, creating an additional 553 square feet of impact to the wetland buffer increasing the previously approved impact of 7,419 square feet to 7,972 square feet). *(P22-06)

   C. Consideration and possible vote on posting the proposed Amendments to Chapter 153 (Site Review Regulations). The full text of the amendments is available in Planning Department & at www.dover.nh.gov located under meeting materials and on the Planning Department page.

   D. Consideration and possible vote on posting the proposed Amendments to Chapter 157 (Land Subdivision Regulations). The full text of the amendments is available in Planning Department & at www.dover.nh.gov located under meeting materials and on the Planning Department page.

5. **STAFF COMMENT**
6. **MEMBER COMMENTS**
7. **ADJOURNMENT**

*Indicates that if the application is accepted for discussion, the public hearing will be held the same evening. Note that some hearings will be continued from one meeting to another and some may be postponed. Since this is only a partial description of the proposal and may change, persons with questions or wishing to see the plans are invited to visit the Planning Office, Monday through Thursday from 8:30 am to 5:30 pm and Friday 8:30 am to 4:00 pm or email Dover-Planning@dover.nh.gov. You may also view materials at www.dover.nh.gov. Follow us on Twitter @DoverNHPlanning and find us on Facebook at https://www.facebook.com/DoverNHPlanning. The public is encouraged to leave comments in advance by emailing Dover-Planning@dover.nh.gov, or mailing written comments to Planning Board, Dover City Hall, 288 Central Ave., Dover, NH 03820. Messages must be received no later than 4 p.m. the day of the meeting and should identify the name and Dover address of the person leaving the message or providing the comment.

CITY OF DOVER

DOVER PLANNING BOARD – MINUTES

Meeting Type: Regular Meeting
Meeting Location: City Council Chamber's 288 Central Avenue
Meeting Date: **Tuesday, February 8, 2022**
Meeting Time: **7:00 pm**

Members Present: Gina Cruikshank (Chair), Fergus Cullen (Councilor), Tom Clark, Erinn Reville (Alternate), Dave White, Kyle Pimental, Frank Torr, Dave Landry, Mark Speidel
Members Not Present (excused): Jackie Walker (Alternate), Stephanie George (Alternate), Hayley Harmon (Vice Chair)
Members Not Present (un-excused): None
Staff Present: Donna Benton, Director of Planning and Community Development, Dave Carpenter, Community Development Planner

The Chair called the meeting to order at 7:00 p.m. and noted M. Speidel will sit as Vice Chair tonight for H. Harmon and E. Reville will sit for M. Speidel.

1. CITIZENS' FORUM

Citizens Forum Open
None
Citizens Forum Closed

2. APPROVAL OF THE PRIOR MINUTES

January 25, 2022 Regular Meeting Minutes
Motion: D. White moved to approve the minutes as amended. Seconded by D. Landry. Vote: U/A

3. OLD BUSINESS

A. Discussion and possible recommendation to the City Council of the FY23 CDBG Action Plan including proposed allocations.

D. Benton explained at the last Planning Board meeting the Board opened and closed the public hearing regarding the FY23 CDBG Action Plan. Since then staff has recommended allocating the funding according to the national objectives and prepared revised plans for the Board. The board is free to discuss the Action Plan and can decide if changes are necessary, or if it wishes to recommend the Plan as presented to the City Council. She thanked D. Carpenter for his efforts and said he was here to answer any questions.

D. Landry recused himself from the discussion and vote due to conflicts with his family members being involved with the various groups which have applied for funding.

D. Carpenter summarized the process and reviewed his recommendations for the board.

M. Speidel asked if a group asks for a certain amount, and the staff recommendation is higher, are they allowed to use the extra funds any way they wish after their proposed project is paid for, or do they need to return the extra funds to the City to be used elsewhere?
D. Carpenter noted the City only reimburses the group for funds spent on the proposed project.

K. Pimental asked why the CAP weatherization and energy efficiency program is asking for $15k less than they are receiving this year.
Also, can that money be used by landlords to improve energy efficiencies in apartment buildings?

D. Carpenter noted CAP manages the program and have to operate within the parameters of Dover's consolidated plan which has been only for single family dwellings up until the current plan. It now allows for more than single family homes, but not for 40-unit buildings. He gave a bit more detail on that. Regarding the use of the funds, it's on both CAP and Dover. He explained the past few years' worth of funding for that group since the funding was uniquely tracked through the years.

F. Cullen asked to what extent the City advertises the availability of these funds.
D. Carpenter noted the consolidated plan and a document within that lays out the rules. They issue notices in various ways when the applications are available.
F. Cullen commented he is frustrated with the minimal amount of money that these important groups receive through this process.

Motion: T. Clark moved that the Planning Board finds the proposed FY23 Dover CDBG Action Plan is consistent with the Dover CDBG Consolidated Plan and recommends to the City Council approval of the proposed FY23 Dover CDBG Action Plan. Seconded by D. White. Vote: U/A

4. NEW BUSINESS

A. Consideration and acceptance of and reapproval for a previously approved Site Plan for Gulf Landing Properties, Assessor's Map 38, Lot 9-A-2, zoned C, and located at Central Avenue. (Proposal is to still construct a three-story medical rehabilitation facility). The Site Plan was approved by the Board, with conditions, on October 27, 2020 and received an extension on June 22, 2021. *(P22-07)

D. Benton explained that this project was previously approved along with a CUP on October 17, 2020 then received an administrative extension from the Planning Board on June 22nd, 2021 but there was some staff changes at Berry Survey and Engineering and the materials were not officially submitted to the Planning Department so they need to seek a new approval. The CUP does not expire like site plan approvals so that would still be valid. No zoning or site review amendments affect the project from when it was last before the Board. It went to TRC on September 24, 2020 and is proposing 64 beds and 24/7 staff coverage for a medical withdrawal management facility. The applicant is requesting one waiver tonight which is to not provide the site specific soils map.

Joe Berry, Berry Surveying and Engineering noted the conditions have been met and revised plans have been provided for the project. There were no changes to the plans other than the conditions. He was present to answer any questions.

Motion: D. White moved to accept and declared no regional impact. Seconded by D. Landry. Vote: U/A.

Public hearing opened.
None
Public Hearing closed.

DRAFT

STAFF RECOMMENDATION-Waiver:
Chapter 153-21 states a waiver may be granted if the Board finds that
"(1) Strict conformity would pose an unnecessary hardship to the applicant and the waiver would not be contrary to the spirit and intent of the regulations; or
(2) Specific circumstances relative to the subdivision, or conditions of the land in such site plan, indicate that the waiver will properly carry out the spirit and intent of the regulations."

Staff believes that the criterion 2 has been met as the site is an urban site and heavily developed nearby.

The Planning Department recommends that the Planning Board vote to grant the waiver per the reasoning provided by the applicant with the following condition:

Condition to Be Met Prior to Signing of Plans:

1. Add a note to the plat that the Board granted waiver to Chapter 153-13.A(10) and that the Board found the criteria of Chapter 153-21.A have been met.

Motion: D. White moved to grant the waiver and found the criteria of Chapter 153-21.A have been met. Seconded by: D. Landry. Vote: U/A

STAFF RECOMMENDATION- Site Plan
Chapter 153-4 of the Site Review Regulations of the City Code provides for site review by the Planning Board of new construction of various types. This plan is consistent with those regulations.

The Planning Department recommends the Planning Board vote to approve the Site Plan with the following conditions:

Conditions to Be Met Prior to the Signing of Plans:

1. The Conditional Use Permit (P20-67) shall be approved.
2. The applicant shall provide the Planning Department a
    a. digital version of the plan
    b. CAD file to the satisfaction of the Asset Management Administrator
    c. Revised plan with owner's signatures, and LLS, PE, CWS, and LLA stamps and signatures

Condition to Be Met Prior to any Construction Activity:

3. A site construction sign with the contact information for the general contractor must be located and approved by the City Engineer or Director of Planning and Community Development.

Conditions to Be Met Prior to Issuance of a Building Permit:

4. Provide the classification of the generator, if needed
5. The wetlands buffer placards shall be installed.
6. Water and Sewer investment fees shall be paid at time of application for service.

Conditions to Be Met Prior to Occupancy:

7. Issuance of a certificate of occupancy.
8. Impact fees shall be paid per the invoice included with the Notice of Decision.
9. The applicant shall provide a letter of credit or other form of security acceptable to the City for any unfinished work.

DRAFT

Motion D. White moved to approve the site plan application with the recommended conditions. Seconded by F. Cullen. Vote: U/A

B. Consideration and acceptance of a Minor Subdivision for Michael & Colleen Foligno, Assessor's Map A, Lot 21, zoned R-40, located at 193 Blackwater Road. (1 new lot) *(P22-05)

D. Benton noted that the applicant is requesting to complete a minor subdivision and that the lot is bisected with the city boundary with Somersworth therefore a CUP and subdivision approval is also needed in Somersworth. The Board can decide if it wants to determine regional impact but staff does not feel it is required in this case. The staff memo outlines RSA 36:55 for Regional Impact and RSA 674:53 about Land Affected by Municipal Boundaries. She's spoken with the Planning Director of Somersworth and understands they are aware of this subdivision and have received the CUP and subdivision applications already. As a minor subdivision, this did not appear before the TRC.

Joe Berry, Berry Surveying and Engineering, represented the application. The minor subdivision is to create one additional single-family lot. The frontage will stay in Dover and the building area will be in Somersworth due to a wetlands pocket. They will be allowed to tie into Somersworth utilities.

Motion: F. Torr moved to accept the application and noted that this is not a development of regional impact. Seconded by T. Clark. Vote: U/A

Public Hearing Opened.
None
Public Hearing Closed.

STAFF RECOMMENDATION:
The plan is consistent with Chapter 157-15 of the City of Dover's Land Subdivision Regulations, which provides for subdivision of existing lots.

The Planning Department recommends the Planning Board vote to approve the application with the following conditions:

Conditions to Be Met Prior to Signing of Plans:

1. Provide physical and digital copies (including CAD) of complete plan set which additionally shall include:
    a. The owner's signatures for recording at Strafford County Registry of Deeds.
    b. Include Planning File Number P22-05
    c. Stamp and signature of the LLS and CWS
    d. Add NHDES subdivision permit #

Motion: F. Torr moved to approve the Minor Subdivision with conditions, as the request is consistent with the regulations. Seconded by T. Clark. Vote: U/A

C. Discussion and update from Wetlands Ordinance Subcommittee regarding potential amendments to the wetlands ordinance. *

D. Benton explained that there has been a sub-committee working for about a year now on revising the wetlands protection district ordinance using a grant with staff support from PREP, SRPC, and previously Steve Bird before his retirement in November. She said D. Landry as the Chair and K. Pimental from SRPC have prepared a short presentation to indicate the direction the committee would like to go. At a future meeting, amended language would be provided for the Board's review to post then hold public hearings.

D. Landry and K. Pimental gave their presentation to the board.

5. STAFF COMMENTS

- The only TRCs since the last meeting was January 27 for a City water tower at 40 – 42 Smith Well Road, and a second TRC for 8 townhouse units at 71 Rutland Street.

6. MEMBER COMMENTS

- The Chair signed plans for a lot line adjustment and subdivision for Settlement on Sixth.
- D. White announced his retirement at the end of the month. Members wished him well and thanked him for his time on the Board.

7. ADJOURNMENT

Motion: F. Torr moved to adjourn at 8:24pm. Seconded by D. White. Vote: U/A

DRAFT

CITY OF DOVER

PLANNING BOARD - STAFF MEMO FILE #P22-02

Application Type: Site Plan Review
Applicant(s): City of Dover
Owner(s): City of Dover
Location: 40-42 Smith Well Road (Assessor's Map D, Lot 1)
Meeting Date: February 22, 2022

INTENT: Proposal is to construct a water storage tank

LOTS/UNITS PROPOSED:
Water Storage Tank and Existing Well house

AGENDA ITEM: # 4-A

ACREAGE: 45.22 ± ac

ZONING DISTRICT: R-40

EXISTING LAND USE:
City owned property/well

PROPOSED LAND USE: Water tower and existing well house

SURROUNDING LAND USE:
Commercial and Residential

ZBA ACTION: None

ATTACHMENTS:
- Application materials including plan and TRC minutes

APPLICATION IS COMPLETE: Yes

REGIONAL IMPACT: No

SERVICED BY: Municipal water

NOTICES SENT: Abutter notices were sent by certified or first class mail to all abutters for this meeting

PERMITS REQUIRED:
-Intent to Cut
-Groundwater Discharge Registration
-NHDES Design Review

WAIVERS/CUP REQUESTED:
N/A per 674:54

Summary of Request and Background
The applicant is requesting to construct a 113' water storage tower to be used while the Garrison Hill Water Tower is renovated. The tower would be added to the city owned property at 40-42 Smith Well Road where the Smith Well Wellhouse is located. Balloon tests were done and photos simulations are provided in the packets from different viewpoints. Underground electrical line will be run down Smith Well Road as part of this project. The application appeared before the Technical Review Committee on January 27, 2022. Groundwater protection and building height relief are not needed per RSA 674:54 for governmental land uses.

Consistency with Land Use Regulations
RSA 674:54 provides for Planning Board review of governmental land uses with nonbinding written comments relative to conformity or nonconformity of the proposal with normally applicable land use regulations.

Chapter 153-4 of the Site Review Regulations of the City Code provides for site review by the Planning Board of new construction of various types. This plan is consistent with those regulations and is covered under RSA 674:54.

STAFF RECOMMENDATION:
The Planning Department recommends the Planning Board accept the application for review, open a public hearing, close the public hearing, and vote to approve the Site Plan with the following non-binding conditions:

Conditions to Be Met Prior to the Signing of Plans:

1. The applicant shall provide:
    a. a digital version of plan set
    b. a CAD to the satisfaction of the Asset Management Administrator
2. The applicant must revise final plan set to:
    a. Add the owner's signatures to the final plat.
    b. Add LLS, PE and Architect signatures/stamps to final plan.
    c. Add note that "no trespass" related signage for the water tower area will be added to the fence area and access road entrance
    d. Provide generator distance/booster and site access to the satisfaction of the Building Official.
    e. Add all applicable common site plan notes to the satisfaction of the Planning Director.

Conditions to Be Met Prior to any Construction Activity:

3. A site construction sign with the contact information for the general contractor must be located and approved by the City Engineer.
4. A pre-construction conference is held with representatives from the site excavation firm, Engineering Office, Planning Department, and Inspection Services.

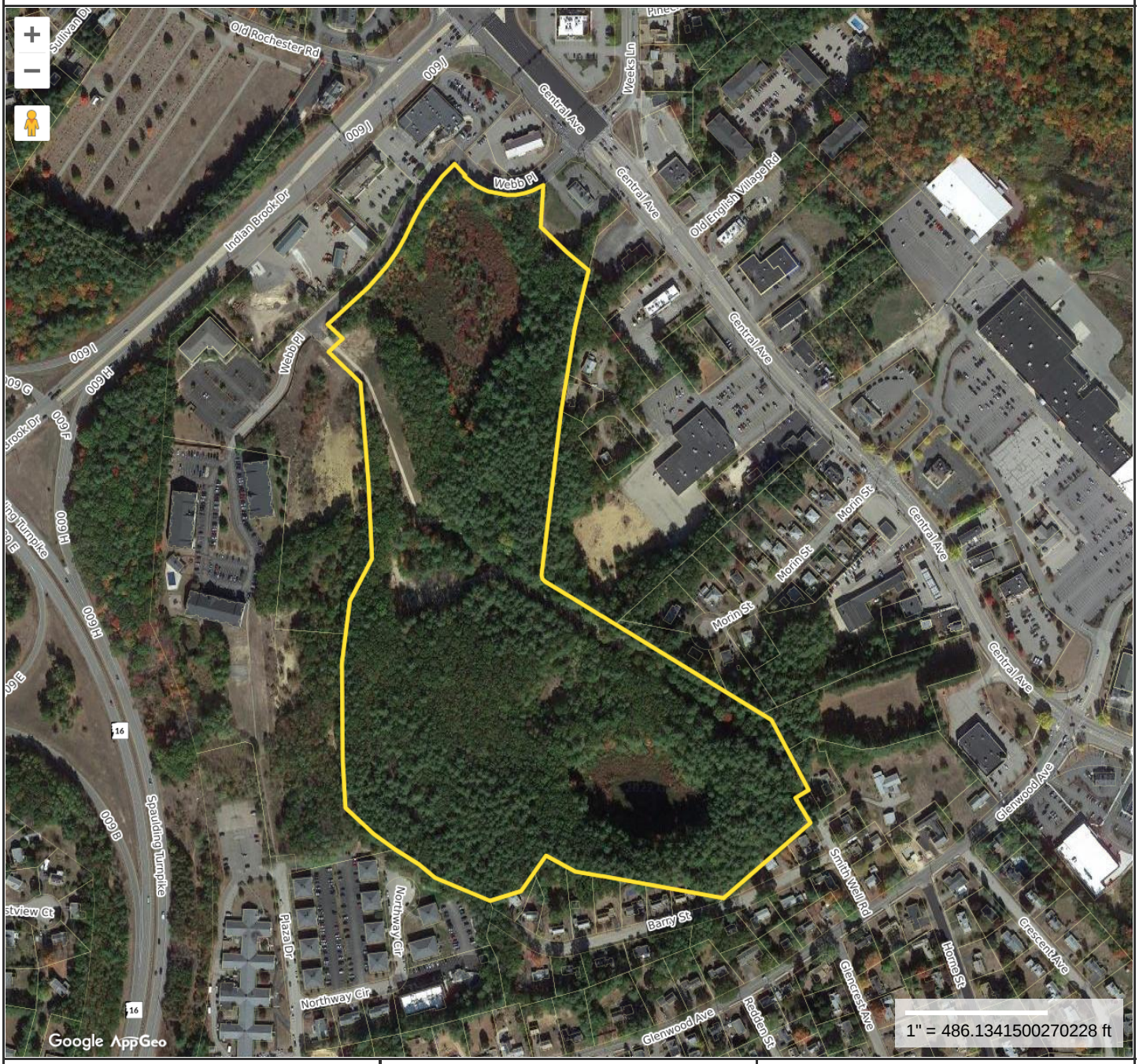
Conditions to Be Met Prior to Issuance of a Building Permit:

5. Applicant shall pay sewer investment fee at time of request for service.

Conditions to Be Met Prior to Occupancy:

6. Issuance of a certificate of occupancy.

40-42 Smith Well Road



Property Information

Property ID	D0001-000000
Location	40 42 SMITH WELL RD
Owner	CITY OF DOVER
Land Use	903

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

City of Dover, NH makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated 5/3/2021
Data updated Daily

Print map scale is approximate. Critical layout or measurement activities should not be done using this resource.

City of Dover, New Hampshire
SITE REVIEW APPLICATION

[Revision Date: June 4, 2019]

Office Use Only	Project #:		Date Received:	
	Amount Paid:		Time Received:	

APPLICANT AND OWNER INFORMATION

Name of Applicant: City of Dover Telephone # 603 516-6450

Address of Applicant: 288 Central Avenue, Dover NH 03820

E-Mail Address: j.storer@dover.nh.gov

Name of Property Owner (*if different from applicant*): (Same) Telephone #

Address of Property Owner:

PROPERTY INFORMATION

Address of Property: 40-42 Smith Well Road

Assessor's Map # D1 Lot(s) # 0

Zoning District(s) R-40 Overlay District(s) Conservation, Groundwater protection

Size of Parcel: 1,969,783 sq. ft. 45.22 ac. Property Deed: Book 599 Page: 387

Existing Use of Property: Municipal water supply aquifer

SITE PLAN INFORMATION

Describe Proposed Use: Water storage tank

Area of Parcel to be Developed: < 30% sq. ft.

If Multi-family Residential, Specify Number of Units & Buildings Proposed: N/A

Number of Parking Spaces: Existing Proposed

Highway Access (check where applicable): x City Street ____ State Highway

Number of Employees Total: 1 water operator In Maximum Shift: 1 water operator

Disposition of Parcel:

Building Footprint 1134 sq. ft.

Total Building Area 8100 sq. ft.

Paved Area 615 sq. ft.

Building Setbacks:

Front Yard 260 ft.

Rear Yard 1890 ft.

Side Yard: Right 510 ft. Left 60.5 ft.

City Water? X Yes ___ No How far is city water from the property? On property

City Sewer? ___ Yes X No How far is city sewer from the property? Abutting (Smith Well Rd)

BUILDING INFORMATION

Type of Building to be Built: Composite Elevated Water Storage Tank

Height of Building: 113 ft Finished Floor Elevation: 197.5 ft MSL

Number of Seats (where applicable) N/A

Estimated value of construction: $6.1 M Refuse removal: Public/Private (circle one)
(includes new water distribution mains on parcel)

WAIVER REQUESTS

Site Review Regulations section(s) to be waived: 170 - 28.3 Groundwater Protection

Justification for waiver request(s) (*attach additional sheets as needed*):

The City of Dover's main water pressure zone depends on a single 4.0 MG concrete water storage tank (Garrison Hill Reservoir), that is need of rehabilitation due to age. An additional water storage tank is required to maintain water service for drinking and fire suppression while the existing tank is taken offline during rehabilitation. The new tank will facilitate future maintenance and improve reliability with additional and redundant storage.

SURVEYOR INFORMATION

Name of Surveyor and Company (Licensed in N.H.) Matt Fagginger-Auer / Doucet Survey

Address 102 Kent Place, Newmarket, NH 03857 Telephone #: 603 659-6560

Professional License #: 989 E-mail address: matt@doucetsurvey.com

ENGINEER INFORMATION

Name of Engineer and Company (Licensed in N.H.) Thomas Page, Project Manager / Underwood Engineers

Address 25 Vaughan Mall, Portsmouth, NH 03801 Telephone #: 603 436-6192

Professional License #: 10959 E-mail address: tpage@underwoodengineers.com

ARCHITECT INFORMATION

Name of Architect and Company (Licensed in N.H.) N/A

Address _____ Telephone #: _____

Professional License #: _____ E-mail address: _____

LANDSCAPE ARCHITECT INFORMATION

Name of Landscape Architect and Company (Licensed in N.H.) N/A

Address _____ Telephone #: _____

Professional License #: _____ E-mail address: _____

SOIL SCIENTIST INFORMATION

Name of Soil Scientist and Company (Licensed in N.H.) Marc Grenier / R. W. Gillespie & Associates, Inc

Address 20 Pormeleau Street, Suite 100, Biddeford, ME 04005 Telephone #: 207 286-8008

Professional License #: 10615 E-mail address: mgrenier@rwg-a.com

CONSERVATION EASEMENT HOLDER

Name of Easement Holder: _____ Telephone #_____

Address Easement Holder: _____

Attachments:

- **A.** Narrative
- **B.** Aerial Figure
- **C.** Work Plan
- **D.** Visibility Check Memo
- **E.** FAA Review
- **F.** Design Drawings

SIGNATURES

I/We hereby submit this application to the City of Dover Planning Board and attest that to the best of my knowledge all of the information on this application form and in the accompanying application materials and documentation is true and accurate. Furthermore, I/we submit that the existing conditions sheet of the plan represents the lot in question, and that no alteration of the site shall take place during Planning Board review up to and including the pre-construction meeting. As applicant or as agent, I attest that I am duly authorized to act in this capacity.

Signature of Property Owner: _____ J. Michael Joyal, Jr. City Manager 2021.12.30 02:38:58 -05'00' Date: _____

Signature of Applicant (*if different from owner*): _____ Date: _____

Signature of Agent: Thomas L. Page Underwood Engineers Date: 12/20/21

AUTHORIZATION TO ENTER SUBJECT PROPERTY

I, and my successors, hereby authorize members of the Dover Planning Board, Planning Department and other pertinent City Departments and boards to enter my property for the purpose of evaluating this application, including performing inspections during the application phase, post-approval phase, construction phase and occupancy phase. It is understood that these individuals must use all reasonable care, courtesy, and diligence when on the property.

Signature of Property Owner: _____ J. Michael Joyal, Jr. City Manager 2021.12.30 02:39:39 -05'00' Date: _____

AUTHORIZATION TO COMPLETE THE PROJECT ON SUBJECT PROPERTY

I, and my successors, hereby the City of Dover or its assigns to enter my property for the purpose of completing the site work as required by the approved plan should the letter or credit or other surety be called. It is understood that these individuals must use all reasonable care, courtesy, and diligence when on the property.

Signature of Property Owner: _____ J. Michael Joyal, Jr. City Manager 2021.12.30 02:40:16 -05'00' Date: _____

Signature of Applicant (*if different from owner*): _____ Date: _____

CERTIFICATION OF FEES

I, and my successors, hereby certify that I understand that the City of Dover collects impact fees, utility investment fees and inspection fees for projects developed in Dover. Said fees must be paid before a Certificate of Occupancy can be obtained for a structure, unless a different payment schedule is agreed to by the applicant and the City prior to approvals being issued by the Dover Planning Board. Additionally, should the property be in "Current Use" it will be subject to the Land Use Change Tax.

Signature of Property Owner: _____ J. Michael Joyal, Jr City Manager 2021.12.30 02:40:46 -05'00' Date: _____

Signature of Applicant (*if different from owner*): _____ Date: _____

CITY OF DOVER SITE REVIEW
LIST OF ABUTTERS

Pursuant to RSA 676:4, the State Law of New Hampshire, the City of Dover is required to notify the applicant, abutters (including holders of conservation easements), and any professional whose seal is on the plan, of the public hearing by certified mail, return receipt requested. Staff will provide the abutter information, while the applicant must provide accurate contact information for the owner, applicant and professional agents representing the project.

Owner:

TAX MAP	LOT #	PROPERTY OWNER	MAILING ADDRESS

Applicant (if different from owner):

APPLICANT NAME	APPLICANT COMPANY	MAILING ADDRESS

Surveyor and/or Engineer/Professional Agent:

NAME	COMPANY	MAILING ADDRESS

Conservation Easement Holder:

TAX MAP	LOT #	NAME OF EASEMENT HOLDER	MAILING ADDRESS

PLANNING BOARD FEE SCHEDULE

(Revised September 17, 2020)

Below are the fees associated with plan review and are subject to a nonrefundable application fee to cover administrative expenses. Please complete the information below and provide payment with your application submittal. **Plan review fees shall be paid prior to technical review committee (TRC) being scheduled.** For plans not requiring TRC review, **fees are due 21 days prior** to the Planning Board meeting. Staff will coordinate abutter/notice fees, which will be invoiced and must be paid 28 hours before the Planning Board meeting for an application to be heard. Fees shall be paid by cash or check made payable to "City of Dover".

A. Plan Review Fees

1. Application fee for the following (SELECT ALL THAT APPLY):

- ☐ SUBDIVISION Application fee $200.00 + $150.00 x # _____ new lots created = $_____
- ☐ LOT LINE ADJUSTMENT Application fee $200.00 + $100.00 X # ___ of lots involved = $_____
- ☐ TRANSFER OF DEVELOPMENT RIGHTS Application fee $200.00 = $_____
- ☐ SITE REVIEW – RESIDENTIAL Application fee $200.00+ $100.00 x # __ per dwelling unit =$_____
- ☐ SITE REVIEW – NON-RESIDENTIAL Application fee $200.00 + (not to exceed $10,000)
  - New construction $.15 sq. ft. x # _____ sq. ft.= $_____
  - Additions (new floor space) $.10 per sq. ft. x # _____sq. ft.= $_____
- ☐ MOTEL/HOTEL $35.00 x # ___ per lodging unit= $_____
- ☐ CHANGE OF USE Application fee $200.00 + (not to exceed $5,000)
  - Existing floor spaces $.10 per sq. ft. x # _____ sq. ft. = $_____
- ☐ CONDITIONAL USE PERMIT Application fee $200.00 x # _____ per Application = $_____
- ☐ GRAVEL PIT/ EXCAVATIONS
  - Application fee $50.00= $_____
  - Permit fee $75.00= $_____
- ☐ EXTENSIONS/AMENDMENTS/WAIVERS FOR AN APPROVED PLAN Application fee $200.00 = $_____
- ☐ REQUEST FOR REZONING Application fee $200.00 = $_____
- ☐ DRIVEWAY WAIVER Application fee $200.00 = $_____

SUB TOTAL= $_____

AND

2. TOTAL IMPERVIOUS PAVED AREA (for new development, roadways or additions to existing parking lots, (not to exceed $10,000)) Application fee $200.00 + $.07 sq. ft. x # _____ = **$_____**

TOTAL PLAN REVIEW FEE= $_____

B. Abutter Notification/Mailing Labels - this office will create and print the abutter list and provide labels in triplicate for each abutter. The applicant/owner will need to review the list and provide to this office the engineer, architect, licensed land surveyor (LLS), licensed landscape architect (LLA) and/or soil scientist whose professional seal appears on the plan with names and addresses for notices.

- ☐ Applicant & Owner, engineer, architect, LLS, LLA and/or soil scientist
  - Certified letters fee # _____ of x $8.00= $_____
- ☐ Certified letters fee: # of abutters _____ X $8.00= $_____
- ☐ First Class Mail fee (for individual owner of units within a condominium or other collective form of ownership): # of abutters _____ X $1.00= $_____
- ☐ Creating/Printing Abutter Labels in triplicate per sheet _____ x $10.00= $_____

SUB TOTAL= $_____

C. Foster's newspaper public notice fee $100.00 x # _____ applications = $_____

TOTAL NOTICE FEE= $_____

The above amount must be paid 28 hours prior to the Planning Board meeting, to be heard.

City of Dover, New Hampshire
SITE PLAN REVIEW SUBMISSION CHECKLIST

[Revision Date: June 4, 2019]

This site plan review checklist, as required by Chapter 153-6-B(2), should be completed by the applicant. It is intended to assist the applicant in the planning process of preparing a Site Plan Review application for Planning Board action. The size of the project will determine the types of information required for review, therefore, a **pre-application conference** with the Planning Department to determine the list of items that must be completed is strongly encouraged.

The first step would be to appear before the Technical Review Committee, to apply, eight (8) folded copies of the site plan with scale of not less than 1"=50' or 1" =100' for larger site plans, need to be provided, along with payment of plan review fees.

Two weeks prior to Planning Board, three (3) full size and twelve (12) half size (11x17), folded, copies of the plan set and materials, including response to TRC comments, will be due. Abutter/Notice Fees will be invoiced and need to be paid 28 hours prior to the Planning Board meeting.

The applicant is cautioned that this checklist is only a guide and is not intended to be a complete list of all site plan review requirements. Please refer to the Site Plan Review Regulations for full details.

APPLICANT: City of Dover File Number: _____

PROJECT TITLE: Water Storage Improvements - Contract 1

PROPERTY LOCATION: Smith Well off Webb Place and Smith Well Road Tax Map: D01 Lot: 0

	Where/How Provided	Reviewed
1. Completed and signed Application form	By City	
2. Plan Review Fees are provided	N/A	
3. Electronic copy of the engineered/surveyed plan layout	Link provided for download	
4. Electronic copy of supplementary materials and application	Link provided for download	
5. Traffic Impact Assessment and Analysis (Standard or Advanced)	See narrative (Attachment A)	
6. Waiver requests to the Site Plan Review Regulations, with written justification	See narrative (Attachment A)	
7. Conditional Use Permit applications	N/A	
8. A colored rendering of the streetscape that will be created along the existing public right-of-way	Renderings in Visibility Check Memo (Attachment D)	
9. A colored architectural plan showing all sides of buildings	Sheet C9 (Attachment F)	
10. Folded copies of site plan w/scale of not less than 1"=50' or 1"=100' for larger site plans, for TRC. Plans shall contain the following items as appropriate:		
Location map at appropriate scale	Sheet C1 (Attachment F)	
Proposed Project name and title and Planning File #	Cover and title blocks (Attach. F)	
Date, north arrow and scale	✓	
Names of all abutting property owners	Sheets C2 to C8 (Attachment F)	
Name and address of owners and/or applicants	Cover (Attachment F)	
Signature & stamp of NH licensed land surveyor and/or engineer	Pending 100% drawings	
Zoning District boundaries, including any special or overlay districts	✓	
Location of Conservation District areas	✓	
Location, names and widths of existing and proposed streets, including pavement widths, grades, curbs and crosswalks	✓	
Location and widths of existing & proposed easements & right of ways	N/A	
Location and width of existing and proposed access/egress ways	✓	

	Explain How Provided	Reviewed
Depict pedestrian walkways and accessible access	N/A	
Existing and proposed property lines with dimensions and bearings tied into Dover's Geographic Information System coordinate system	✓	
Existing and proposed topographic information at two foot intervals	✓	
Existing and proposed buildings and structure locations	Sheets C2 to C8 (Attachment F)	
Minimum building setbacks or build to lines on all lots	✓	
Location and size of existing and proposed electric, telephone, gas cable and other underground utilities	Sheets C2 to C8 (Attachment F)	
Existing and proposed water lines and fire hydrants, including materials and capacity needed	Sheets C2 to C8 (Attachment F)	
Location and materials of sanitary sewage facilities within project site and projected additional peak hour sewer load	Sheet C8, No new load (Attachment F)	
Existing and proposed stormwater lines and facilities	Sheets C4 and C8 (Attachment F)	
Lighting plan depicting all existing and proposed exterior light fixtures and a lighting level analysis for parking lots	Electrical Drawings (Attachment F)	
Location of Flood Hazard Zone	N/A	
Location of all bodies of water and watercourses	✓	
Location of wetlands and buffers	✓	
Neighborhood plan with aerial underlay showing how project relates to abutting uses within the plan set	Attachment B	
Existing natural features and/or significant vegetation on property	✓	
Depict existing contours up to 100 ft. beyond project limits	✓	
Landscape plan depicting existing and proposed landscaping, prepared by a licensed Professional Landscape Architect	See site plan (Attachment F)	
Location of parking layout delineating spaces and arrangement; note addressing maximum required spaces	N/A	
Location, material and size of existing and proposed pavement area	Sheets C2 to C8 (Attachment F)	
Location of proposed fire lanes	Sheet C2, Access Road (Attach. F)	
Specify finished floor elevations of buildings	Sheet C2 (Attachment F)	
Location of solid waste disposal facilities (dumpster, pad and screening, etc.), including required screening	N/A	
Depict all service, storage, loading bays and utility areas	Sheet C2 (Attachment F)	
All applicable Dover Common Site Plan notes	Sheets G2 and G3 (Attachment F)	
11. Additional Information if appropriate	See Narrative (Attachment A)	
Stormwater Management Plan depicting the existing & proposed storm drainage system and engineered drainage analysis		
Stormwater Management System Operation and Maintenance Plan		
Letter to Serve from Public and Private Utilities		
Erosion and Sedimentation Control Plan		
Landscape Operation and Maintenance Plan		
Proposed restrictive covenants or homeowners association documents		
Dates and permit numbers of all required state and federal permits		
If wetland buffer, indicate placards locations, as applicable		
Depict test boring locations, groundwater elevations and soil profiles and/or soils types call-outs		
Location of proposed drive-in facilities		
Provide additional exhibits/technical data determined appropriate by the Planning Board or its staff as required		

REVIEWED BY: _____ DATE_____ TRC DATE_____

Attachment A
Narrative for Local Review

Water Storage Improvements
Dover, NH
December 16, 2021

Project Background

The City of Dover's main water pressure zone depends on a single 4.0 MG concrete water storage tank (Garrison Hill Reservoir). The existing tank was built in 1968 and is in need of rehabilitation due to age. However, the tank cannot be removed from service under current conditions. An additional water storage tank is required to maintain water service for drinking and fire suppression while the existing tank is rehabilitated. The new tank will also facilitate future maintenance, improve reliability and provide additional emergency/fire storage. The new tank provides critical redundancy in the event the Garrison Hill Tank has to be taken offline.

Per the request of the City to evaluate storage alternatives, Underwood Engineers (UE) prepared technical memorandum (February 4, 2020) to evaluate locations for a new tank and a preferred site was identified on City land currently used for water supply near the existing Smith Well (*Attachment B - Aerial Plan*).

Existing Conditions

The proposed site is located in a parcel owned by the City of Dover, near Smith Well Road. The area is already developed for water facilities (Smith and Cummings wells and well house). Existing electrical and SCADA systems at well house will be extended to the tank.

The access to the tank will be through the existing gravel road on the site. The entrance to the gravel road is located at Webb Place.

The planned construction area is partially wooded. Limited clearing is required. The proposed tank is at the highest area on the property to minimize the required tank height. The subsurface conditions consist of topsoil over naturally deposited silty sand over sand with varying amounts of silt and gravel.

Wetlands were located and delineated in the drawings during the Survey conducted by Doucet Survey in April, 2021. The proposed building and structures are located outside the 50 ft Wetland buffer.

Test boring locations, groundwater elevations and soil profiles can be found on the Geotechnical Report provided by R. W. Gillespie on May 28, 2021.

Summary of Improvements

The proposed water storage facility is a Composite Elevated Tank (CET) consisting of a concrete pedestal supporting a welded steel tank. The concrete pedestal will have a rustication pattern per the City's preference. The tank will be painted a color approved by the City. A rendering of the proposed structure is attached. The visibility of the tank was evaluated and found to be relatively insignificant except from Webb Place (*Attachment D - Visibility Check Memorandum)*.

The new tank will provide 1.0 MG of storage, including 0.5 MG for equalization and 0.5 MG for fire flows. The proposed approximate dimensions of the tank are a pedestal diameter of 38 ft, a tank diameter of ± 74 ft , a head range of ± 35 ft and a total height to the top of the tank dome of around 110 ft. The pedestal will be used as storage for City equipment and a heated control room. A future booster pump station that connects to the North End Pressure Zone (NEPZ) can be located in the heated room in the pedestal, if needed to provide additional turnover of the tank or booster pump capacity.

A waiver to the maximum height of 35 ft allowed for the Zoning Requirements for Zone R-40 is requested, due to the need to match the proposed tank height with the existing hydraulic grade line.

Two construction contracts are anticipated (*Attachment C - Work Plan*):

- Contract 1: Composite Elevated Water Storage Tank
- Contract 2: Water Distribution Main

The project includes pipe line and utility connections as follows:

- 2,500 LF of 16" DI from the Tank to Glenwood Avenue
- 1,660 LF of 12" DI Raw Water main to replace existing main (Add-Alt)
- 400 LF of 12" DI from Tank to Webb Place-High Pressure Zone (Add-Alt)
- 6 water services on Smith Well Road to be replaced
- Sewer relocation/replacement and service connections on Smith Well Road (Add-Alt)
- Electrical service from existing Well House on site
- Communications with City's existing SCADA system

Related Permits

The following permits and approvals are related to this project and are being provided under separate cover:

- Groundwater Discharge Registration: A registration for emergency discharge of the tank overflow is being prepared by UE.
- NHDES Design Approval: The design drawings and specifications will be submitted to NHDES for approval prior to bidding.
- FAA Review: The response issued on June 3, 2021, stated that no action is required regarding marking and lighting of the tank (*Attachment E - FAA Review*).

Traffic Impact Assessment

The new tank will cause no significant impact to the traffic on Webb Place. The only reoccurring access to the tank will typically be a City water operator in one vehicle. Therefore a traffic impact assessment is not necessary.

Stormwater Management Plan

Runoff from the tank will be directed to the surrounding coarse stone or paved surfaces below the tank. The tank site will be graded to direct runoff to the surrounding wooded terrain. The access road will be graded to direct runoff to the adjacent roadside soils. No new discharge off site is planned.

Erosion and Sedimentation Control Plan

The Contractor will be responsible for Erosion and Sedimentation Control as described in the Notes on Sheet G2 of the Drawings (*Attachment F - Design Drawings*).

Related Attachments:

B - Aerial Figure
C - Work Plan
D - Visibility Check
E - FAA Review
F - Design Drawings

Water Storage Improvements - Contract 1



Property Information

Property ID	D0001-000000
Location	40 42 SMITH WELL RD
Owner	CITY OF DOVER
Land Use	903

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

City of Dover, NH makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated 5/3/2021
Data updated Daily

Print map scale is approximate. Critical layout or measurement activities should not be done using this resource.

PROPOSED 400 LF
12" WATER MAIN TO
HIGH PRESSURE ZONE
(ADD-ALT)

INDIAN BROOK ROAD

WEBB PLACE

SMITH WELL

725' UNDERGROUND
UTILITY

CONNECT TO
EXISTING POWER

SMITH/CUMMINGS
WELL HOUSE

CUMMINGS
WELL

PROPOSED
TANK ACCESS
DRIVE

EXISTING 10"
WATER MAIN

PROPOSED ELEVATED TANK
(112' HIGH, 38' DIA.
PEDESTAL, 74' DIA. TANK)

BOOSTER STATION
IN PEDESTAL
(ADD-ALT)

D0001-00
CITY OF DOVER
40-42 SMITH WELLS ROAD
288 CENTRAL AVENUE
DOVER, NH 03820

PROPOSED 2500 LF
16" WATER MAIN TO
DISTRIBUTION

EXISTING 12"
RAW WATER MAIN

REPLACE 1660LF
OF RAW WATER MAIN
(ADD-ALT)

BARRY STREET

GLENNWOOD AVE.

12" MAIN

SMITH WELL ROAD

REPLACE/RELOCATE 435 LF
OF SEWER MAIN
(ADD-ALT)

MORIN STREET

CENTRAL AVE.

200 0 200

DATE DEC 2021 PROJECT 2575	UNDERWOOD engineers 25 Vaughan Mall, Portsmouth, N.H. 03801 Tel. 603-436-6192 Fax. 603-431-4733	PROPOSED WATER STORAGE TANK CITY OF DOVER DOVER, NEW HAMPSHIRE	FIG. 2

UNDERWOOD engineers

Technical Memorandum

To: John Storer, Director of Community Services

From: Thomas Page, P.E., Project Manager and Anna Alegria, E.I.T. Project Engineer

Date: 10/7/2021

Subject: Visibility Check - New Composite Elevated Tank

Introduction

The purpose of this memo is to summarize the visibility of the proposed composite elevated water storage tank based on the Balloon Test and drone flight performed by Underwood Engineers.

Drone Flight

On May 14, 2021, Underwood Engineers performed a drone flight at the new tank site located at Webb Place, Dover, NH. The drone was positioned at about 110 ft above grade, representing the overflow elevation of the tank. The flight was performed from 8 am to 9 am and a 360º video was recorded. The streets that can be seen in the video represent locations from which the tank would be visible.

The link to the video is as follows: http://gofile.me/2RfIJ/mf3zVoC5r

Balloon Test

On September 30, 2021, Underwood Engineers conducted a Balloon Test at the new tank site located at Webb Place, Dover, NH. The test was conducted from 8 am to 11 am.

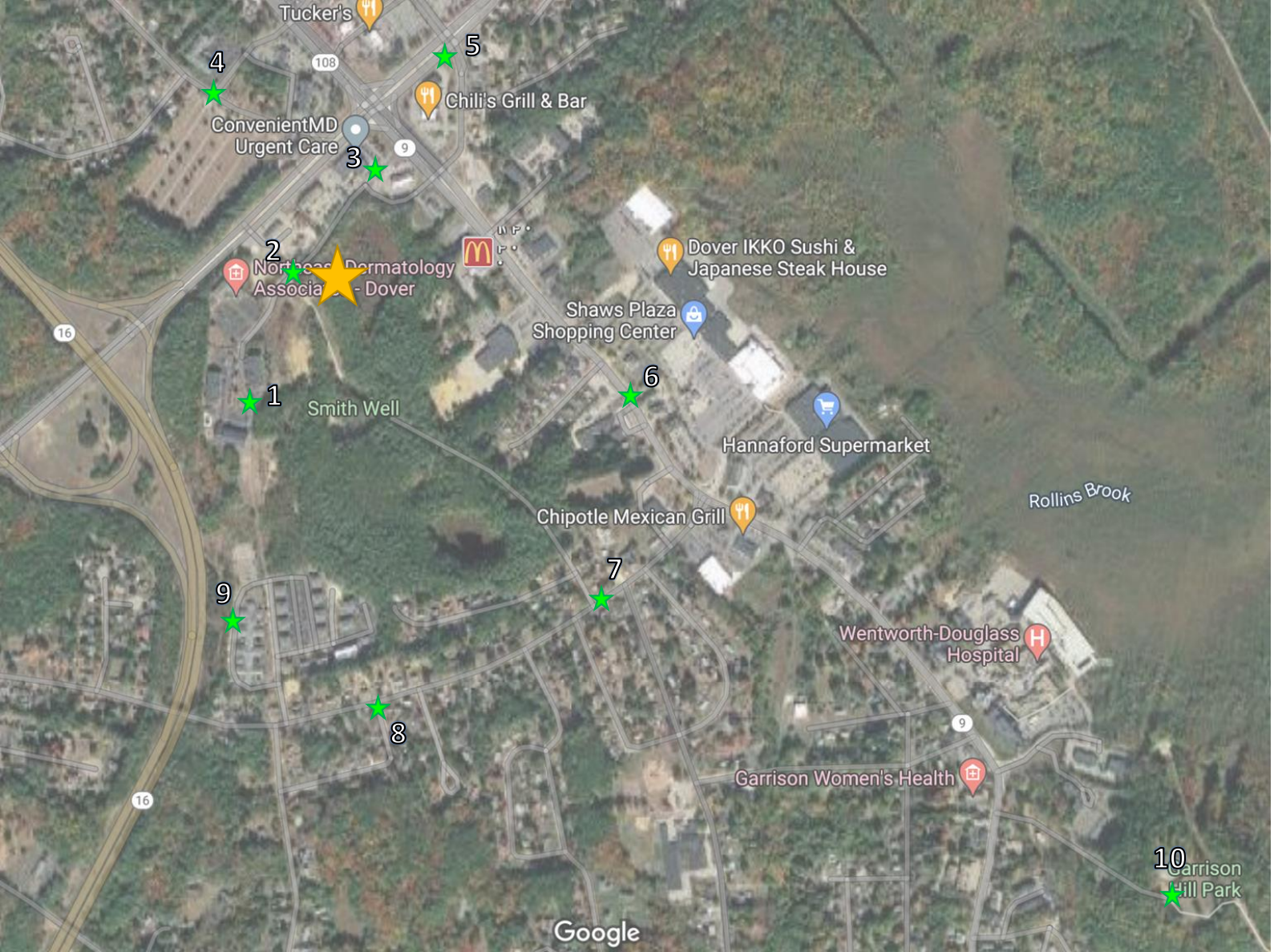
A 350g weather balloon was inflated with helium and floated to 113 ft above grade elevation of ± 197 ft. to simulate the height of the top of the proposed tank. The diameter of the inflated balloon was around 5 ft.

While the balloon was aloft, visibility was checked at the following locations and pictures were taken where visible (see attached map):

- Windshire Apartments at Webb Place
- Tank Site Access Road at Webb Place
- MD Urgent Care (not visible)
- Microtel Hotel
- St Charles Cemetery (not visible)
- Chilli's at Weeks Traffic Circle
- Shaws Plaza at Central Ave (not visible)
- Smith Well Road (not visible)
- Bartlett Street (not visible)
- Princeton Apartments at Princeton Way (not visible)
- Garrison Hill Park

Renderings of the proposed tank at selected locations based on the height of the balloon in photos taken are attached.

In summary, the results show the visibility of the proposed tank is limited depending on the location. The results of the balloon test obtained on September 30 are consistent with the 360º Drone video performed on May 14.



2575 – Dover New Water Storage Tank Balloon Test

1 – Windshire Apartments
2 – Tank Site
3 – MD Urgent Care
4 – St Charles Cemetery
5 – Weeks Traffic Circle
6 – Shaws Plaza
7 – Smith Well Road
8 – Bartlett Street
9 – Princeton Apartments
10 – Garrison Hill Park

2575 – Dover New Water Storage Tank Balloon Test



Tank Site Access Road at Webb Place

2575 – Dover New Water Storage Tank Balloon Test



Tank Site Access Road at Webb Place

2575 – Dover New Water Storage Tank Balloon Test



Webb Place – Microtel Hotel

2575 – Dover New Water Storage Tank Balloon Test



Webb Place – Microtel Hotel

2575 – Dover New Water Storage Tank Balloon Test



Windshire Apartments

2575 – Dover New Water Storage Tank Balloon Test



Windshire Apartments

2575 – Dover New Water Storage Tank Balloon Test



Garrison Hill Park

2575 – Dover New Water Storage Tank Balloon Test



Garrison Hill Park

2575 – Dover New Water Storage Tank Balloon Test



Weeks Traffic Circle – Chili’s

2575 – Dover New Water Storage Tank Balloon Test



Weeks Traffic Circle – Chili’s

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

Aeronautical Study No.
2021-ANE-2604-OE

Issued Date: 06/03/2021

Thomas Page
Underwood Engineers
25 Vaughan Mall
Portsmouth, NH 03801

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Water Tank Dover's New Water Tank
Location:	Dover, NH
Latitude:	43-13-09.80N NAD 83
Longitude:	70-53-21.80W
Heights:	195 feet site elevation (SE) 110 feet above ground level (AGL) 305 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part 1)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part 2)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking/ lighting are accomplished on a voluntary basis, we recommend it be installed in accordance with FAA Advisory circular 70/7460-1 M.

This determination expires on 12/03/2022 unless:

(a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
(b) extended, revised, or terminated by the issuing office.
(c) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power, except those frequencies specified in the Colo Void Clause Coalition; Antenna System Co-Location; Voluntary Best Practices, effective 21 Nov 2007, will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.This determination includes all previously filed frequencies and power for this structure.

If construction or alteration is dismantled or destroyed, you must submit notice to the FAA within 5 days after the construction or alteration is dismantled or destroyed.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

If we can be of further assistance, please contact our office at (718) 553-2611, or angelique.eersteling@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2021-ANE-2604-OE.

Signature Control No: 479521556-483602940 (DNE)
Angelique Eersteling
Technician

Attachment(s)
Case Description
Map(s)

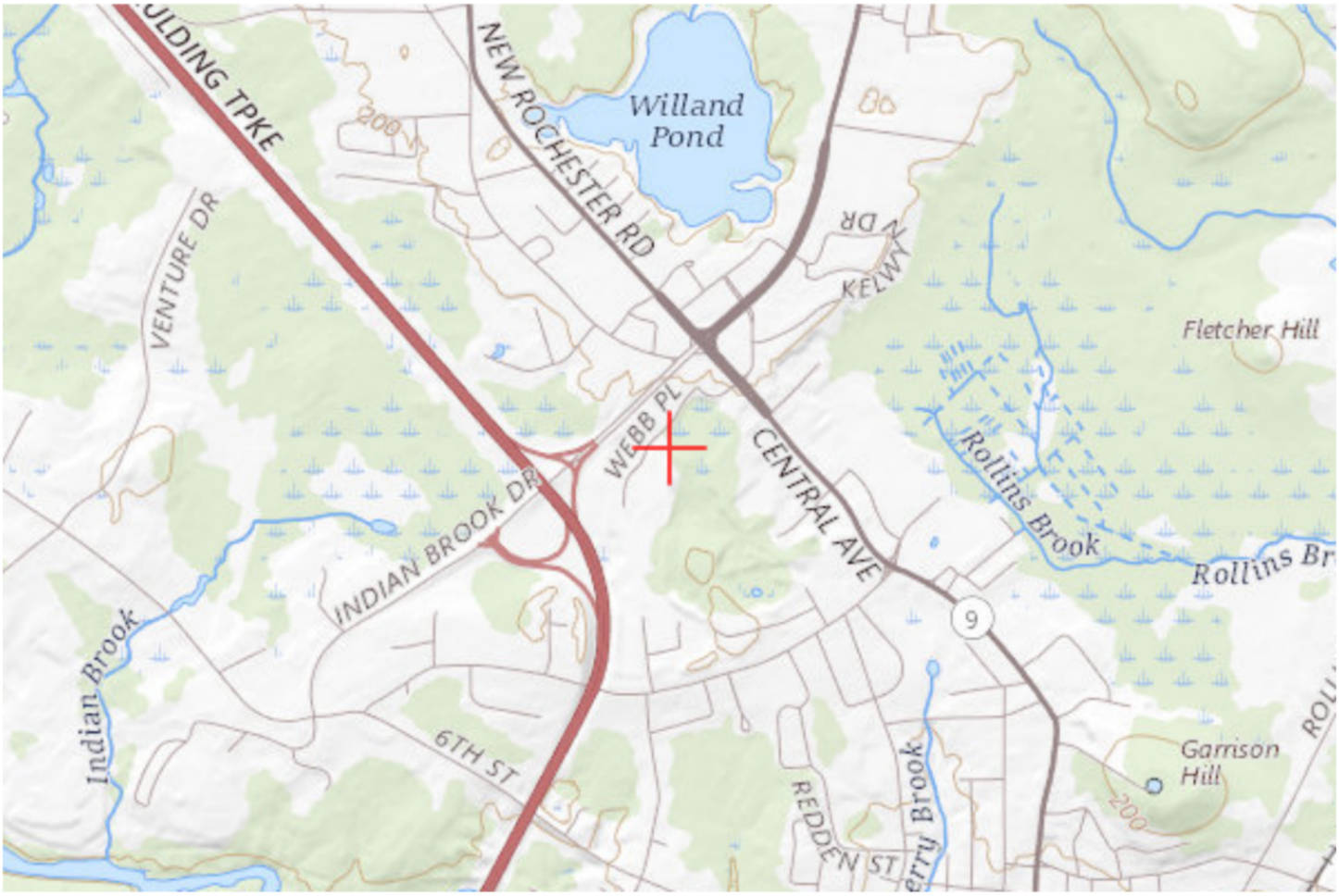
Case Description for ASN 2021-ANE-2604-OE

Construction of a new 1.0 MG water tank to increase the City of Dover water storage capacity. The tank will also help with water distribution in the City while the existing Garrison Hill Tank is under rehabilitation.

Verified Map for ASN 2021-ANE-2604-OE



TOPO Map for ASN 2021-ANE-2604-OE



Sectional Map for ASN 2021-ANE-2604-OE



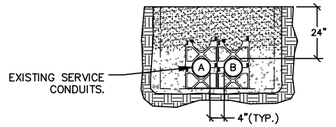
Attachment F - Foot Candle Diagram

ELECTRICAL DUCT BANK SCHEDULE

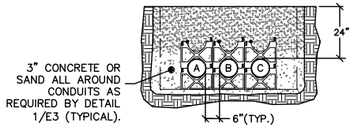
DUCT BANK SECTION NO.	CONDUIT	EQUIPMENT	WIRE	CONNECTION
A / E2	EXIST (A) 4" C	SERVICE DISCONNECT SWITCH	EXISTING 4#4/0	EXISTING SERVICE CONDUITS FROM EXISTING POLE MOUNTED TRANSFORMERS TO NEW SERVICE DISCONNECT SWITCH AND NEW UTILITY METER
	EXIST (B) 4" C	SERVICE DISCONNECT SWITCH	NEW 4#4/0	EXISTING SERVICE CONDUITS FROM EXISTING POLE MOUNTED TRANSFORMERS TO NEW SERVICE DISCONNECT SWITCH AND NEW UTILITY METER
B / E2	(A) 4" C	PANEL PPB	4#250 KCMIL, & 1#2G	FEEDER CONDUIT FROM MCC-A INSIDE SMITH/CUMMINGS WELL BUILDING TO PANEL PPB INSIDE STORAGE TANK VIA HANDHOLES.
	(B) 4" C	SPARE	PULL ROPE	SPARE CONDUIT FROM SMITH/CUMMINGS WELL BUILDING TO 12" AFF UNDET PANEL PPB INSIDE STORAGE TANK VIA HANDHOLES.
	(C) 3" C	RTU-2A	FIBER OPTIC CABLE	FIBER OPTIC CONDUIT FROM RTU-2 INSIDE SMITH/CUMMINGS WELL BUILDING TO RTU-2A PANEL INSIDE STORAGE TANK VIA HANDHOLES.

UNDERGROUND CONDUIT NOTES:

1. PROVIDE RIGID GALVANIZED SWEEPS ON ALL 90° TURNS.
2. PROVIDE RIGID GALVANIZED STEEL CONDUIT & SWEEPS AT ALL 90° TURNS AS REQUIRED.
3. COORDINATE NEW UNDERGROUND CONDUIT LOCATION WITH EXISTING UNDERGROUND ELECTRIC CONDUIT, PROCESS PIPING AND STRUCTURES PRIOR TO EXCAVATION.
4. REPAIR EXISTING PAVED AND GRASSED AREAS TO CONDITION EXISTING PRIOR TO EXCAVATION.
5. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE, MUST BE NOTIFIED, INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN, PRIOR TO DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORING OR REPAVING.
6. REFER TO DETAIL 1/E3 FOR TYPICAL TRENCHING DETAIL FOR ELECTRICAL/SIGNAL CONDUITS.
7. CONTRACTOR SHALL FURNISH AND INSTALL POLYESTER PULLING TAPE IN ALL SPARE CONDUITS RATED @ 2500 LBS, WITH FOOTAGE MARKINGS AS MANUFACTURED BY NEPT CO., MODEL# WP2500 OR APPROVED EQUAL.

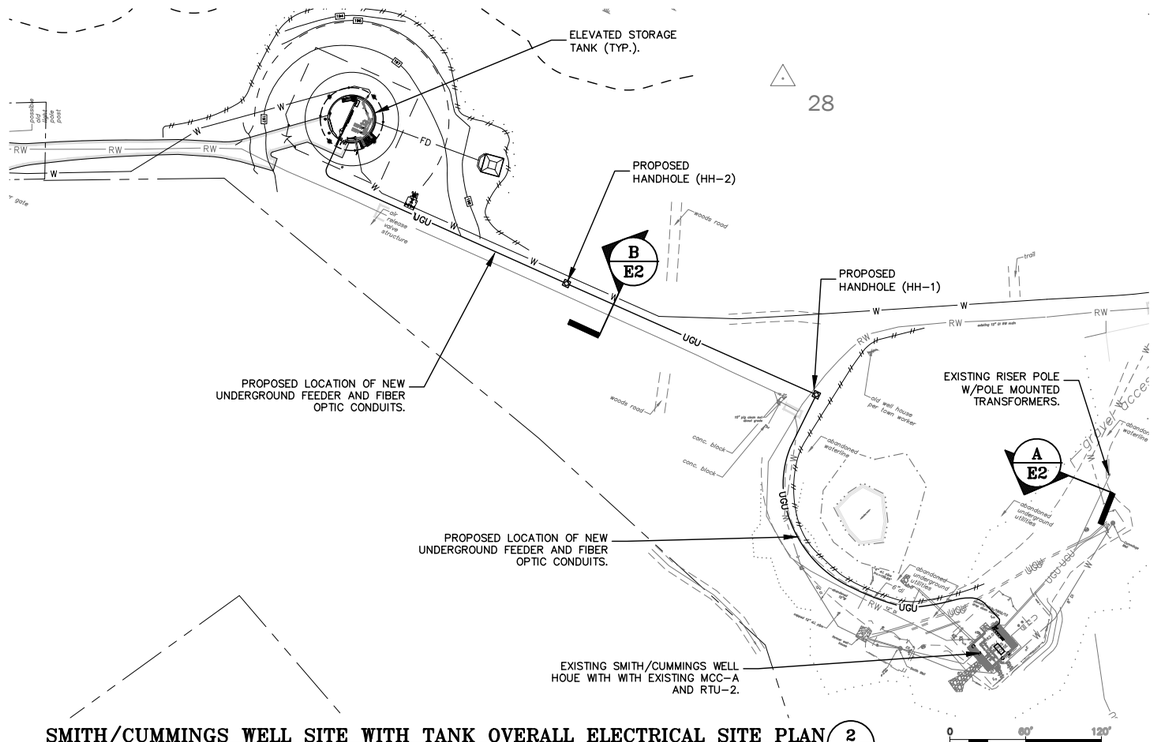


DUCT BANK SECTION A / E2
SCALE: NONE



DUCT BANK SECTION B / E2
SCALE: NONE

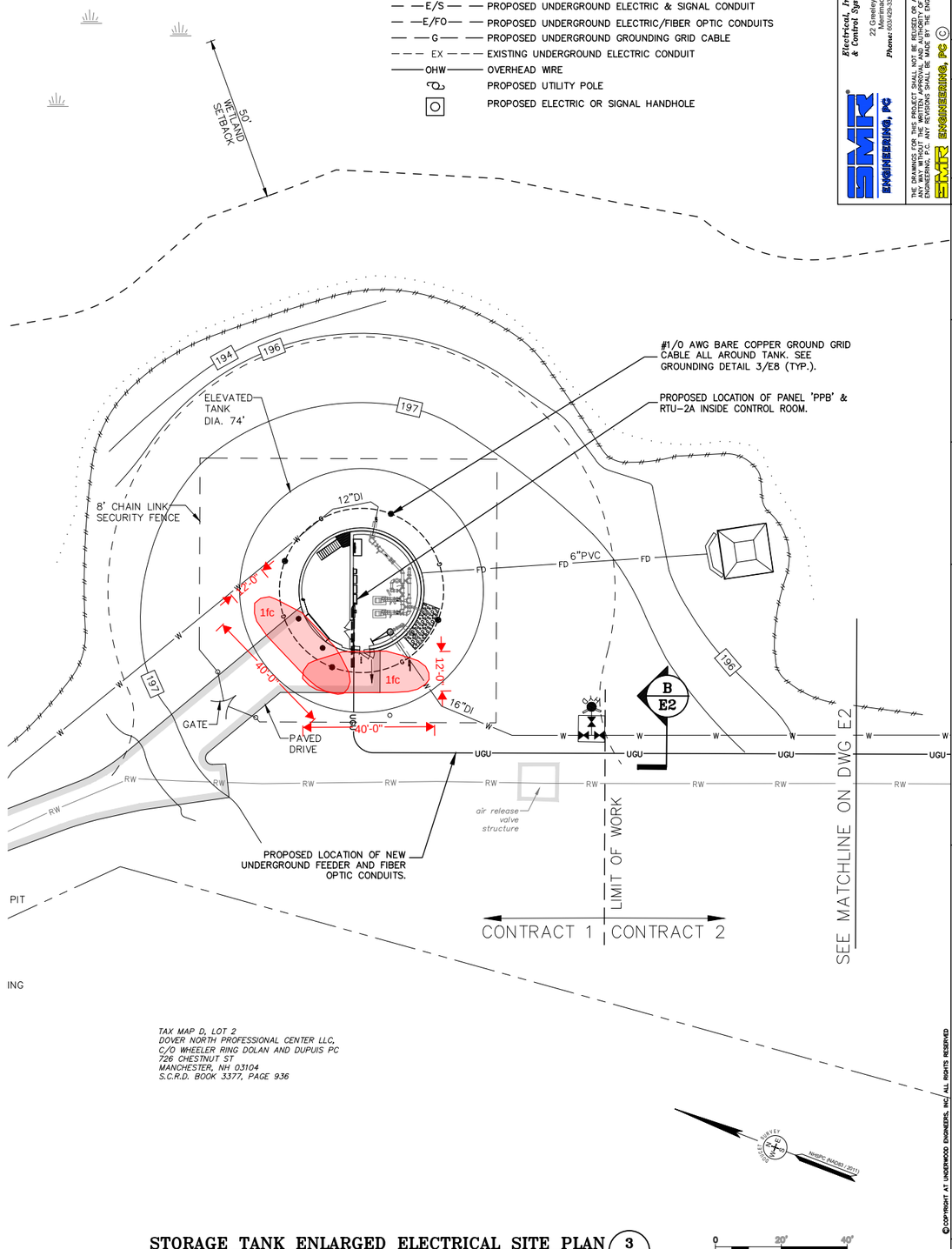
ELECTRICAL DUCT BANK SCHEDULE WITH DUCT BANK SECTIONS 1 / E3
SCALE: NONE



SMITH/CUMMINGS WELL SITE WITH TANK OVERALL ELECTRICAL SITE PLAN 2 / E8
SCALE: 1"=60'-0"

ELECTRICAL SITE LEGEND

- —ES/T— PROPOSED UNDERGROUND ELECTRICAL SERVICE & TELEPHONE CONDUIT
- —E— PROPOSED UNDERGROUND ELECTRICAL CONDUIT
- —S— PROPOSED UNDERGROUND SIGNAL CONDUIT
- —E/S— PROPOSED UNDERGROUND ELECTRIC & SIGNAL CONDUIT
- —E/FO— PROPOSED UNDERGROUND ELECTRIC/FIBER OPTIC CONDUITS
- —G— PROPOSED UNDERGROUND GROUNDING GRID CABLE
- EX EXISTING UNDERGROUND ELECTRIC CONDUIT
- OHW OVERHEAD WIRE
- PROPOSED UTILITY POLE
- PROPOSED ELECTRIC OR SIGNAL HANDHOLE



STORAGE TANK ENLARGED ELECTRICAL SITE PLAN 3 / E3
SCALE: 1"=20'-0"

Electrical, Instrumentation, & Control Systems Engineering
22 Crawley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3486
SMR ENGINEERING, PC

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY WAY BY ANYONE WITHOUT THE EXPRESSED WRITTEN CONSENT OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D	Date
	ISSUE FOR BIDDING	By	Date -
	CONSTRUCTION	By	Date -
	RECORD DRAWING	By	Date -

Drawn/Chk.
Designed
Checked
Approved TGP
Date 12/14/21
Book No. -
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

Draft
DEC. 17, 2021
"Not for Construction"

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC./ ALL RIGHTS RESERVED

STORAGE TANK ELECTRICAL SITE PLAN

COMPOSITE ELEVATED WATER STORAGE TANK

CITY OF DOVER, NEW HAMPSHIRE

DWG NO E2 | SHEET OF X

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E2-E3-Site Plans.dwg Dec 17, 2021 - 1:43pm

Composite Elevated Water Storage Tank
Dover, NH
Response to TRC Comments

January 31, 2022

In response to comments received from the Technical Review Committee on January 27, 2022 Underwood Engineers notes the following:

Planning:

1. Planning File # P22-02 added to Plans.
2. Sheets are numbered per the Index on Sheet G1.
3. Common Notes updated as follows:
    a. Note 25 has been removed (duplicate to Note 12).
    b. New note added for Contractor to file an Intent to Cut with the City Tax Assessment Office. The amount of clearing is approximately 0.37 acres.
4. Sewer details are provided for sewer improvements on Smith Well Road near the intersection with Glenwood Avenue. The existing sewer (about 500 feet) will be relocated and replaced to facilitate installation of a new 16" water main to connect the tank to the distribution system. There is no new proposed sewer for the tank facility.
5. A foot-candling plan for lighting was submitted with the application (see attachment F).

Police:

1. No Trespassing signs will be provided at the tank fence area and access road entrance.
2. Security cameras are proposed, typical for other water facilities in Dover, including four cameras around the tank pedestal.
3. The top of the new tank tower will visible above the trees from the intersection of Central and Webb, based on the Visibility Study memo previously submitted.

Fire/Inspections:

1. Site access to the tank will be from Webb Place. The gravel access road is now shown with a width of 20'. Pavement 16' wide may be added depending on bid alternates that are accepted. A gravel turn-around area is provided just outside the tank.
2. The electrical power supply to the tank will be from the existing Smith/Cummings well house, including normal utility power and backup power from the existing emergency generator, via a 700 ft +- buried conduit. Our electrical engineer has sized the wires appropriately. VFDs for the booster pumps will be installed adjacent to the pumps in the tank pedestal, so there should be no harmonic issues due to long distance. The utility service from the pole mounted transformers to the Smith/Cummings well house will be upgraded with additional wires. The existing generator should be able to power the existing well pumps plus one booster pump at a time.

P22-02 **40-42 Smith Well Road**

Property ID	Location	Owner 1	Owner 2	Owner Address 1	City	State	Zip
36001-A00000	19 GLENWOOD AV	CRUIKSHANK GINA		19 GLENWOOD AV	DOVER	NH	03820-2411
36001-B00000	17 GLENWOOD AV	GALLANT ROBERT E &	GALLANT SARIANNE L	17 GLENWOOD AV	DOVER	NH	03820
36002-000000	21 GLENWOOD AV	TAYLOR ANN I		21 GLENWOOD AVE	DOVER	NH	03820
36002-A00000	25 GLENWOOD AV	BRADY DOUGLAS B & TERESA C TRUSTEES	BRADY FAMILY REVOCABLE TRUST	25 GLENWOOD AVENUE	DOVER	NH	03820
36002-B00000	4 BARRY ST	LOWELL FAMILY REV TRUST	LOWELL ROBERT E TRUSTEE	4 BARRY STREET	DOVER	NH	03820
36002-C00000	6 BARRY ST	CLANCY MICHAEL T	CLANCY BETH	6 BARRY STREET	DOVER	NH	03820
38015-A00000	1 3 WEBB PL	ARKWELL KAREN S TRUSTEE	ARKWELL KAREN S REVOCABLE TRUST 2020	67 SENECA ST	ROCHESTER	NH	03867
38015-B00000	WEBB PL	R W REALTY INC		1 WEBB PLACE	DOVER	NH	03820
38016-000000	920 CENTRAL AV	P P D ORAZIO LLC		143 RIVER RD	WEST NEWBUR\	MA	10985
38020-000000	914 CENTRAL AV	HO LAM KITTY TRUSTEE	HO FAMILY REVOCABLE TRUST OF 2003	131 CHARLES ST	ROCHESTER	NH	03867
38021-000000	912 CENTRAL AV	MCDONALDS CORP		PO BOX 6300	AMHERST	NH	03031-6300
38023-A00000	906 CENTRAL AV	MATTHEW MICHAEL REALTY LLC		304 MAPLEWOOD AVE	PORTSMOUTH	NH	03801
38023-B00000	898 CENTRAL AV	MATTHEW MICHAEL REALTY LLC		304 MAPLEWOOD AVE	PORTSMOUTH	NH	03801
38023-C00000	902 CENTRAL AV	MATTHEW MICHAEL REALTY LLC		304 MAPLEWOOD AVE	PORTSMOUTH	NH	03801
38023-E00000	904 CENTRAL AV	NEIHART ROGER H TRUSTEE	NEIHART ROGER TRUST	904 CENTRAL AVENUE	DOVER	NH	03820
38024-000000	880 CENTRAL AV	J&N COLONY DOVER AUTOBODY REALTY LLC		880 CENTRAL AV	DOVER	NH	03820
38025-A00000	16 MORIN ST	BRIAND TYLER D		16 MORIN ST	DOVER	NH	03820
38025-B00000	18 MORIN ST	SWENSON SCOTT J &	SWENSON DEBRA M	18 MORIN ST	DOVER	NH	03820
38027-000000	13 MORIN ST	HANCOCK WILLIAM		13 MORIN ST	DOVER	NH	03820
38027-A00000	15 MORIN ST	FELD FAMILY REVOCABLE TRUST OF 2005	FELD MICHAEL A AND LYNN M TRUSTEES	15 MORIN STREET	DOVER	NH	03820
38027-B00000	20 MORIN ST	BROSNIHAN DEBORAH A		256 LONGHILL RD	DOVER	NH	03820
38030-000000	854 CENTRAL AV	FRIENDS FIDUCIARY CORPORATION		PO BOX 98	DOVER	NH	03821
38032-000000	4 A SMITH WELL RD	LITTLEFIELD ERIC P &	LITTLEFIELD DENISE A	4 A SMITH WELL RD	DOVER	NH	03820
38032-A00000	15 GLENWOOD AV	CLARK RICHARD SR & JUNE TRUSTEES	CLARK RICHARD AND JUNE TRUST OF 2001	15 GLENWOOD AVENUE	DOVER	NH	03820
38032-C00000	1 SMITH WELL RD	BRAGG MICHAEL S &	HAWKES DIANE	1 SMITH WELL RD	DOVER	NH	03820
38032-D00000	2 SMITH WELL RD	STICKLES DARLENE	STICKLES PETER L	2 SMITH WELL ROAD	DOVER	NH	03820
38032-E00000	4 SMITH WELL RD	RANDALL ROSS &	RANDALL ALEXA	4 SMITH WELL RD	DOVER	NH	03820-2410
38032-G00000	6 SMITH WELL RD	HEMPHILL JAMIE S &	HEMPHILL KILEY J	6 SMITH WELL RD	DOVER	NH	03820-2410
D0002-000000	51 WEBB PL	DOVER NORTH PROFESSIONAL CENTER LLC	C/O WHEELER RING DOLAN AND DUPUIS PC	726 CHESTNUT ST	MANCHESTER	NH	03104
D0002-001000	70 72 WEBB PL	CA INVESTMENT TRUST	CORMIER YVON AND ENXING DENISE TRUSTEES	3 CRENSHAW LN	ANDOVER	MA	01810
D0002-A00000	11 17 WEBB PL	CENTERCO DOVER LLC	C/O ANDREW SILBERFEIN	222 WEST HILLS RD	NEW CANAAN	CT	06840
D0002-A00001	31 WEBB PL	EMPIRE NORTH PROPERTIES LLC		171 GREAT RD	ACTON	MA	01720
D0002-A00LSE	WEBB PL	CENTERCO DOVER LLC	C/O ANDREW SILBERFEIN	222 WEST HILLS RD	NEW CANAAN	CT	06840
D0002-C00000	INDIAN BROOK DR	STATE OF NEW HAMPSHIRE		DEPT OF TRANSPORTATION	CONCORD	NH	03301
D0023-000000	27 GLENWOOD AV	ST CYR JOHNNA &	PICARELLA MATTHEW	27 GLENWOOD AV	DOVER	NH	03820
D0024-000000	29 GLENWOOD AV	GALLAGHER SALLY L &	GALLAGHER GLENN R	29 GLENWOOD AV	DOVER	NH	03820
D0062-000000	3 SMITH WELL RD	SNOWDON VALERIE E		3 SMITH WELL RD	DOVER	NH	03820
D0063-000000	1 BARRY ST	WOODS PHYLLIS L TRUSTEE	WOODS PHYLLIS L REV TRUST	1 BARRY STREET	DOVER	NH	03820
D0064-000000	3 BARRY ST	O DELL MARY D	O DELL TIMOTHY M	3 BARRY STREET	DOVER	NH	03820
D0065-000000	5 BARRY ST	TREADWELL CHRISTOPHER MICHAEL	TREADWELL ALEHSON MARIE	5 BARRY ST	DOVER	NH	03820
D0066-000000	7 BARRY ST	LIPINSKI ROBERT &	LIPINSKI SHANNA	7 BARRY ST	DOVER	NH	03820
D0067-000000	9 BARRY ST	HUGHES CYNTHIA L	HUGHES DANIEL P	9 BARRY STREET	DOVER	NH	03820
D0068-000000	11 BARRY ST	BEAMAN PAMELA L		855 NORTHFIELD RD	HINSDALE	NH	03451-2511
D0069-000000	13 BARRY ST	KOZLOWSKI MICHAEL F		13 BARRY ST	DOVER	NH	03820
D0070-000000	15 BARRY ST	TUTTLE PAUL E &	BUTTERFIELD MARTIN R	15 BARRY STREET	DOVER	NH	03820
D0071-000000	17 BARRY ST	MONAHAN KENNETH A		17 BARRY ST	DOVER	NH	03820
D0072-000000	14 BARRY ST	DALEY LORIS E	DALEY GERALD P	14 BARRY STREET	DOVER	NH	03820
D0074-000000	10 BARRY ST	QUINN DEBRA A TRUSTEE	QUINN DEBRA ANN REVOCABLE TRUST	10 BARRY ST	DOVER	NH	03820-2405
D0075-000000	8 BARRY ST	LANG JAMES P &	LANG GINA M	8 BARRY ST	DOVER	NH	03820
D0076-000000	2 BARRY ST	YAU JONATHAN C L		2 BARRY ST	DOVER	NH	03820
D0079-001000	306 PLAZA DR	PRINCETON DOVER LLC		1115 WESTFORD ST	LOWELL	MA	01851
D0081-000000	1 PRINCETON WY	PRINCETON DOVER LLC		5 PRINCETON WY	DOVER	NH	03820
D0001-000000	40 42 SMITH WELL RD	CITY OF DOVER	JOHN STORER	288 CENTRAL AVE	DOVER	NH	03820
		UNDERWOOD ENGINEERS	THOMAS PAGE	25 VAUGHAN MALL	PORTSMOUTH	NH	03801
		DOUCET SURVEY	MATT FAGGINGER-AUER	102 KENT PLACE	NEWMARKET	NH	03857
		R.W. GILLESPIE & ASSOCIATES INC	MARC GRENIER	20 PORMELEAU STREET, SUITE 100	BIDDEFORD	ME	04005

CITY OF DOVER

TECHNICAL REVIEW COMMITTEE MINUTES – P22-02

Application Type:	Site Review
Applicant(s):	City of Dover
Owner(s):	City of Dover
Location:	40-42 Smith Well Road (Assessor's Map D, Lot 1)
Date:	January 27, 2022

INTENT: To construct an additional water storage tank.

UNITS PROPOSED: N/A

AGENDA ITEM #: 1

ACREAGE: 45.22 ± ac

ZONING DISTRICT: R-40

EXISTING LAND USE: City owned property/well

PROPOSED LAND USE: Water tower

SURROUNDING LAND USE: Commercial and Residential

ZBA ACTION: None

PERMITS REQUIRED: N/A

RELIEF/WAIVERS REQUESTED:
Building height waiver

ATTENDANCE:
Members:
Donna Benton, Planning
Natasha Kypfer, Zoning
Dave White, Engineering
Jim Maxfield, Inspection Services
Reid Amy, Economic Development

Others:
Tom Page
Bill Boulanger
Jill Semprini
Amelia DeGrace
Mike Nadeau

Approval of Prior Meeting Minutes:
D.White moved to approve the January 20, 2022 meeting minutes. Seconded by: J. Maxfield Vote: U/A

PLAN REVIEW:
Planning Comments:
- Add Planning File # P22-02 to plans
- Include proper numbering of Sheets for PB submittal (i.e. total)
- Add or locate common notes:
- Remove not 25 on sheet 3 as it duplicates note 12
- Add owner's signatures and professional stamps on all submissions
- Groundwater Protection and height relief not needed per RSA 674:54
- How much clearing? Under intent to cut threshold?
- Sewer details?
- Lighting plan?

Engineering Comments: N/A

Police Department Comments:
- Evaluate/propose appropriate "no trespass" related signage for water tower area
- Are security cameras proposed as part of this project?
- Will new tower be visible from intersection of Central/Webb?

Fire/Inspection Services Comments:
- Clarify overall site access
- Generator distance/booster?

Economic Development Comments: N/A

Planning Board Comments:
- Very forward thinking of CS for water needs
- Commend water connection to Portsmouth

Next Steps:
Re-submit plans for Planning Board

Adjournment:
D.White moved to adjourn at 10:48am. Seconded by J.Maxfield. Vote: U/A

City of Dover, New Hampshire

City Project # B22035

FOR CONSTRUCTION

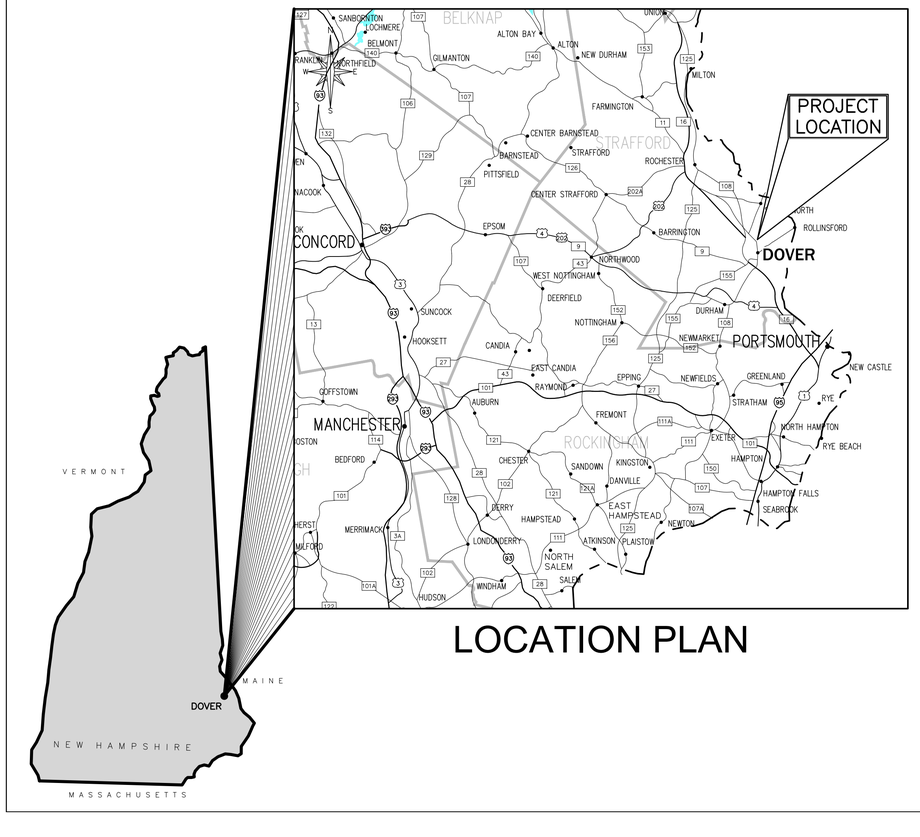
COMPOSITE ELEVATED WATER STORAGE TANK

PREPARED BY

UNDERWOOD ENGINEERS

PORTSMOUTH, NEW HAMPSHIRE

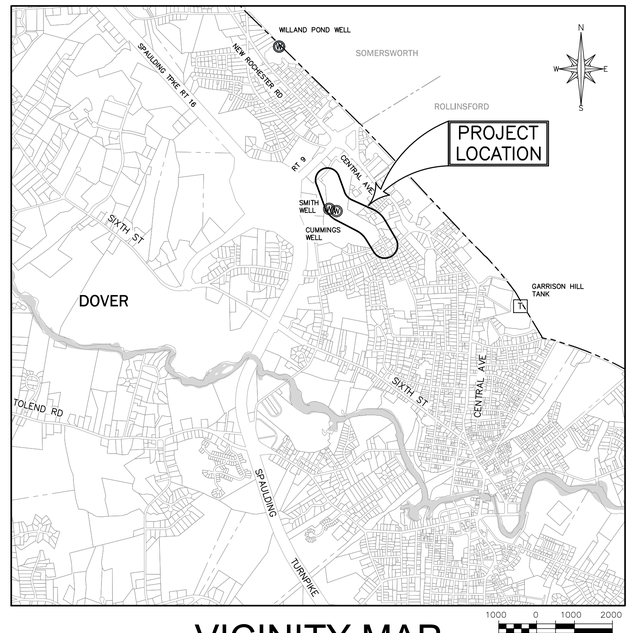
FEBRUARY 9, 2022



LOCATION PLAN







VICINITY MAP

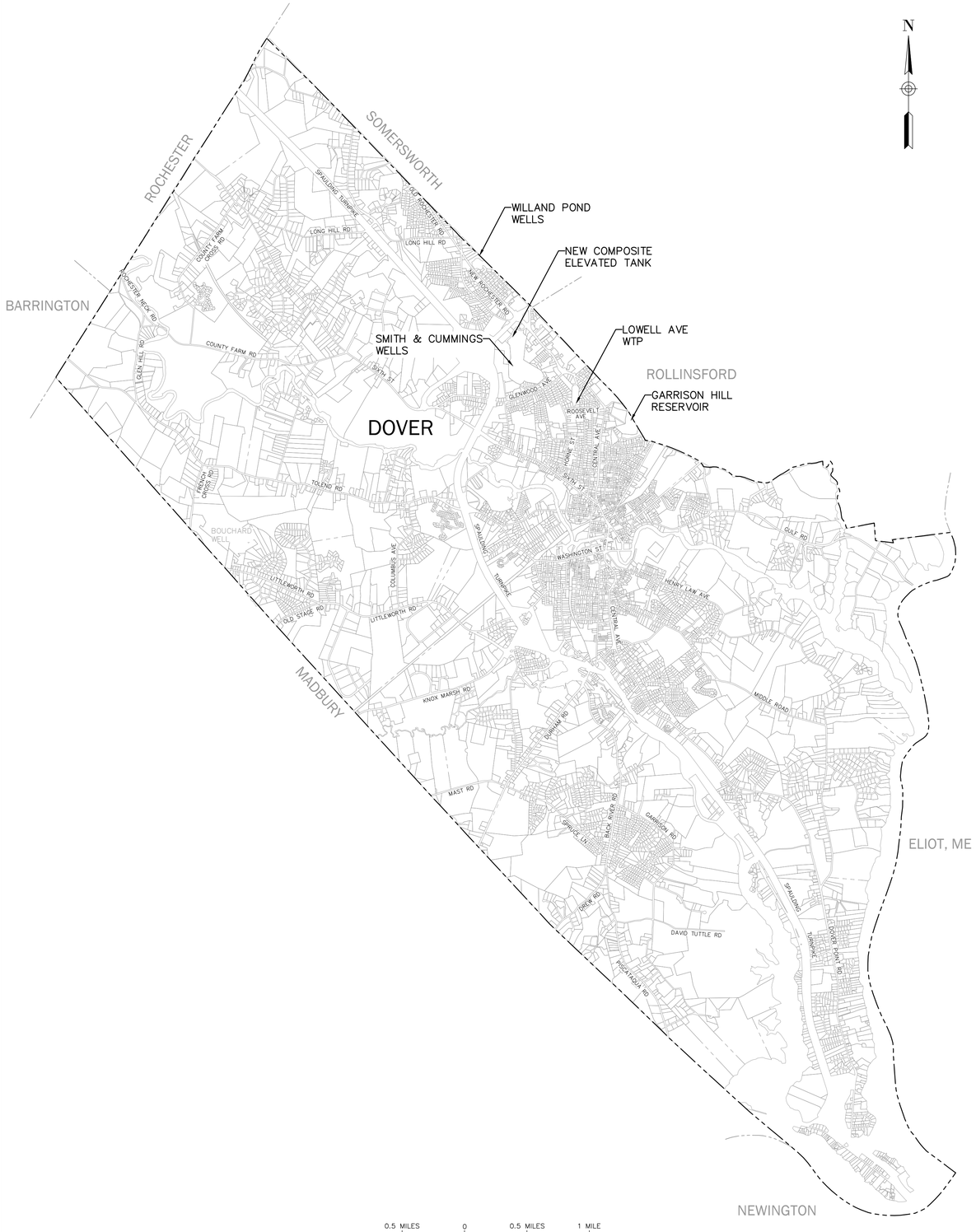
UE #2575

PLANNING FILE NO. 22-02

C:\Users\mng\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_Cover.dwg, C-R, 2/7/2022 6:09:49 PM, mng

DWG#	SHEET TITLE	SHEET
GENERAL		
–	COVER SHEET	–
G1	INDEX & LOCATION PLAN	1
G2	GENERAL NOTES I	2
G3	GENERAL NOTES II	3
G4	LEGEND & ABBREVIATIONS	4
CIVIL		
C1	INDEX SHEETS	5
C2	TANK SITE PLAN	6
C3	WELL HOUSE SITE PLAN	7
C4	PLAN & PROFILE	8
C5	PLAN & PROFILE	9
C6	PLAN & PROFILE	10
C7	PLAN & PROFILE	11
C8	PLAN & PROFILE	12
C9	TANK DETAILS I	13
C10	TANK DETAILS II	14
C11	WATER DETAILS	15
C12	EROSION CONTROL DETAILS	16
C13	DRAINAGE DETAILS	17
C14	ROADWAY AND SITE DETAILS I	18
C15	ROADWAY AND SITE DETAILS II	19
C16	SEWER DETAILS	20
CROSS SECTIONS		
X1	CROSS SECTIONS	21
X2	CROSS SECTIONS	22

DWG#	SHEET TITLE	SHEET
PROCESS		
P1	PROCESS PIPING LEGEND & NOTES	23
P2	HEATED CONTROL ROOM FLOOR PLAN	24
P3	PUMP STATION SECTION & DETAILS	25
P4	PROCESS DETAILS – II	26
MECHANICAL		
M1	HVAC BOD AND SCHEDULES	27
M2	HVAC SPECIFICATIONS	28
M3	HVAC PUMP STATION FLOOR PLAN	29
M4	PLUMBING BOD, SPECS & SCHEDULES	30
M5	PLUMBING PUMP STATION FLOOR PLAN	31
ELECTRICAL		
E1	GENERAL ELECTRICAL NOTES & LEGEND	32
E2	STORAGE TANK ELECTRICAL SITE PLAN	33
E3	STORAGE TANK WITH WELL HOUSE ELECTRICAL SITE PLAN CONTINUATION	34
E4	SMITH/CUMMINGS ONE-LINE DIAGRAM	35
E5	STORAGE TANK/BPS POWER PLAN	36
E6	STORAGE TANK/BPS LIGHTING PLAN	37
E7	SMITH/CUMMINGS WELL BUILDING MODIFIED POWER PLAN	38
E8	ELECTRIC PANEL & LIGHTING FIXTURE SCHEDULES WITH DETAILS	39
E9	LIGHTING FIXTURE MOUNTING DETAILS	40
E10	ELECTRICAL DETAILS	41
E11	ELECTRICAL DETAILS	42
E12	LOOP, WIRE, AND CONDUIT SCHEDULE	43



ISSUE FOR	By	Date
APPROVAL	TGP	12/17/21
CONSTRUCTION	TGP	2/9/22
RECORD DRAWING	–	–

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_index
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – TIMOTHY G. PRATT No. 8531 – LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE – THOMAS G. PAGE No. 10959 – LICENSED PROFESSIONAL LAND SURVEYOR

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

INDEX & LOCATION PLAN

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT BY UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO G1

SHEET 1 OF 43

C:\Users\mg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_index.dwg, G-1, 2/7/2022 6:15:54 PM, mg

GENERAL NOTES

1. THE CONTRACTOR IS RESPONSIBLE FOR THE LOCATION, PROTECTION AND REPAIR (IF DAMAGED) OF ALL EXISTING UTILITIES AND SERVICES. THE APPROXIMATE LOCATIONS OF UTILITIES AND SERVICES ARE SHOWN ON THE DRAWINGS. NOT ALL UTILITIES ARE SHOWN ON THE PLANS. NOTIFY DIG-SAFE PRIOR TO COMMENCING CONSTRUCTION (1-888-DIG-SAFE) AT THE REQUIRED FREQUENCY DICTATED BY LAW. CONTRACTOR SHALL GIVE ADEQUATE NOTICE TO THE ENGINEER OF CONFLICTS OF PROPOSED WORK WITH MARKED UTILITIES PRIOR TO CONSTRUCTING THE PROPOSED WORK.
2. THE SURFACE EVIDENCE OF THE UTILITIES SHOWN HAVE BEEN LOCATED BY FIELD SURVEY. THE LINE WORK REPRESENTING THE UNDERGROUND STRUCTURES AND PIPES SHOWN ARE BASED ON SURVEY AND PLANS AVAILABLE. THE ENGINEER/SURVEYOR MAKES NO GUARANTEE THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE ENGINEER/SURVEYOR FURTHER DOES NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED.
3. CONTRACTOR IS RESPONSIBLE FOR OBTAINING CONSTRUCTION DEWATERING PERMIT, IF NECESSARY.
4. CONTRACTOR IS RESPONSIBLE FOR OBTAINING CITY OF DOVER EXCAVATION PERMITS.
5. THIS SET OF PLANS HAS BEEN CREATED TO BE USED IN CONJUNCTION WITH A TECHNICAL SPECIFICATION ENTITLED "COMPOSITE ELEVATED WATER STORAGE TANK".
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE REMOVAL AND DISPOSAL OF ALL SURPLUS EARTH, TREES, LEDGE, PIPE AND SEWER OR DRAIN STRUCTURES EXCAVATED DURING CONSTRUCTION, UNLESS OTHERWISE INDICATED IN THE PROJECT MANUAL OR THE DRAWINGS OR UNLESS MATERIALS ARE CLAIMED BY THE OWNER.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PROPERTY RESTORATION BOTH PUBLIC AND PRIVATE. UTILITIES DAMAGED AS A RESULT OF THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
8. NOT ALL OVERHEAD WIRE DROPS TO BUILDINGS ARE SHOWN. THE CONTRACTOR SHALL ANTICIPATE THEIR EXISTENCE IN ALL OPERATIONS.
9. CONTRACTOR IS RESPONSIBLE FOR SITE SECURITY AND SAFETY.
10. CONSTRUCTION SEQUENCE (GENERAL): PERFORM WORK IN GENERAL IN THIS SEQUENCE:
    A. PRIOR TO START OF CONSTRUCTION, PROVIDE A WRITTEN NARRATIVE OF CONSTRUCTION METHODS TO BE USED AND A PRELIMINARY SCHEDULE OF KEY MILESTONES.
    B. PREPARE SITE WHERE CONSTRUCTION IS PROPOSED.
    C. CONSTRUCT TEMPORARY AND PERMANENT EROSION CONTROL FACILITIES. INSPECT AND MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES THROUGHOUT CONSTRUCTION.
    D. INSTALL PIPE IN DRY CONDITIONS TO ELEVATIONS SHOWN ON THE DRAWINGS. STABILIZE DISTURBED AREAS IMMEDIATELY AFTER PIPE INSTALLATION.
    E. BEGIN SEEDING AND MULCHING IMMEDIATELY AFTER FINAL GRADING.
    F. FINISH GRADING, SEEDING, AND MULCHING OF SHOULDERS, DITCHES, AND DISTURBED AREAS.
    G. AFTER ALL DISTURBED AREAS HAVE ESTABLISHED VEGETATIVE COVER, (APPROVED BY THE ENGINEER) REMOVE TEMPORARY EROSION CONTROL MEASURES.
11. REFER TO GEOTECHNICAL REPORT FOR SUBSURFACE AND SOIL CONDITIONS. (TECHNICAL SPECIFICATIONS, APPENDIX A).
12. ALL CONSTRUCTION SHALL CONFORM WITH THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION" AND WITH THE CITY OF DOVER COMMUNITY SERVICES REGULATIONS AND STANDARD SPECIFICATION FOR CONSTRUCTION. THE MORE STRINGENT SPECIFICATION SHALL APPLY.

WATER DISTRIBUTION SYSTEM NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LAYOUT OF ALL NEW WATER LINES. THE INTENT IS TO INSTALL THE NEW WATER LINE IN THE APPROXIMATE LOCATION AS SHOWN ON THE PLANS. EXISTING WATER LOCATIONS ARE APPROXIMATE. CONTRACTOR SHALL BE RESPONSIBLE FOR DISPOSAL OF EXISTING MAINS THAT ARE REMOVED.
2. MAINTAIN A MINIMUM 10 FEET HORIZONTAL DISTANCE BETWEEN WATER MAIN AND SEWER PIPING. MAINTAIN A MINIMUM 6 FEET HORIZONTAL DISTANCE (OUTSIDE OF PIPE TO OUTSIDE OF PIPE) BETWEEN WATER MAIN AND STORM DRAIN. NOTIFY ENGINEER OF ANY DISCREPANCIES.
3. MINIMUM DEPTH OF COVER SHALL BE 5' UNLESS SHOWN OTHERWISE ON THE DRAWINGS. THE NEW MAINS SHALL GENERALLY FOLLOW THE GROUND CONTOUR AND INSTALLED AT A CONTINUOUS RISING SLOPE TO AVOID HIGH POINTS. ABRUPT CHANGES IN GRADE SHALL BE AVOIDED.
4. ALL NEW MAINS SHALL BE POLY WRAPPED CLASS 52 DOUBLE CEMENT LINE DUCTILE IRON OR SDR HDPE, WHICH SHALL BE HDPE DR-11, AS SHOWN ON THE DRAWINGS. ALL JOINTS FOR DUCTILE IRON PIPE SHALL BE PUSH-ON JOINTS UNLESS SHOWN OTHERWISE ON THE DRAWINGS. ALL FITTINGS SHALL BE DUCTILE IRON MECHANICAL JOINT CLASS 350, UNLESS OTHERWISE SHOWN ON THE DRAWINGS. ALL HDPE PIPE TO BE FUSED.
5. ALL FITTINGS, HYDRANTS AND VALVES SHALL BE RESTRAINED BY USING PRECAST CONCRETE THRUST BLOCKS AND RETAINER GLANDS. MECHANICAL JOINT ADAPTERS SHALL BE USED TO JOIN GATE VALVES TO FITTINGS AND SHALL BE MECHANICAL JOINT FOSTER ADAPTERS, OR APPROVED EQUAL. 6" BRANCHES SHALL USE ANCHOR TEES. 8" AND 12" BRANCHES SHALL USE MECHANICAL JOINTS WITH FOSTER ADAPTERS WHERE APPLICABLE.
6. TEST PRESSURE FOR THE COMBINED PRESSURE AND LEAKAGE TEST SHALL BE 150 PSI OR 150% OF NORMAL OPERATING PRESSURE WHICHEVER IS GREATER. TEST SHALL BE PERFORMED IN ACCORDANCE WITH AWWA C-600.
7. TRENCHES SHALL NOT BE LEFT OPEN DURING NON-WORKING HOURS. ALL OPEN PIPES SHALL BE SECURED WITH A WATERTIGHT PLUG WHEN THE PIPE IS TEMPORARILY BACKFILLED AND WHEN PIPE LAYING IS NOT IN PROCESS.
8. A NEW WATER MAIN MUST CROSS ABOVE A SANITARY SEWER BUT MAY CROSS ABOVE OR BELOW A STORM SEWER. A FULL LENGTH OF WATER MAIN SHALL BE CENTERED AT THE CROSSING. MAINTAIN A MINIMUM CLEAR SEPARATION DISTANCE OF 18 INCHES.
9. NO VALVES, VALVE BOXES, FITTINGS, PIPE, ETC. SHALL BE RE-USED IN THE WORK. ALL ITEMS MEASURED FOR PAYMENT SHALL BE NEW, UNLESS SPECIFICALLY NOTED.
10. NOT ALL REQUIRED FITTINGS SUCH AS BENDS AND COUPLINGS ARE INDICATED. SOME FITTINGS MAY NOT BE REQUIRED DEPENDING ON THE FINAL LAYOUT. REQUIRED NUMBER, LOCATION, AND SIZE OF FITTINGS SHALL BE DETERMINED IN THE FIELD.
11. ALL EXISTING SYSTEM VALVES SHALL BE OPERATED ONLY BY CITY PERSONNEL. THE CONTRACTOR SHALL NOTIFY THE OWNER IF VALVE OPERATION IS REQUIRED.
12. ALL EXISTING WATER PIPE IDENTIFIED AS ABANDONED SHALL BE DEMOLISHED AS FOLLOWS: PIPE: CAP AT EACH END AND ABANDON IN PLACE UNLESS IT NEEDS TO BE REMOVED BECAUSE OF OTHER INTERFERENCES (INCIDENTAL), UNLESS NOTED OTHERWISE.
13. ALL GATE VALVES SHALL HAVE RESTRAINED MECHANICAL JOINTS AND BE JOINED DIRECTLY TO FITTINGS WITH FOSTER-ADAPTORS AND OPEN LEFT.
14. ASBESTOS CEMENT (AC) PIPE INDICATED TO BE DEMOLISHED SHALL BE REMOVED AND DISPOSED OF IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS PAID. UNDAMAGED ABANDONED AC PIPE SHALL BE LEFT IN PLACE.

SEWER AND DRAIN NOTES

1. ALL EXISTING STORM DRAINAGE SHALL BE PROTECTED BY CONTRACTOR. ANY EXISTING DRAINAGE DAMAGED WHILE COMPLETING THE WORK SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER.

REFERENCE PLANS:

1. "CITY OF DOVER, NEW HAMPSHIRE, CITY PROJECT #B14074, WATER FACILITY IMPROVEMENTS – PHASE 2, CONTRACT 1, TRANSMISSION MAIN, RECORD DRAWINGS" BY UNDERWOOD ENGINEERS, INC. PORTSMOUTH, NH, DATED APRIL, 2020.
2. "CITY OF DOVER, NEW HAMPSHIRE, CITY PROJECT #B19024, DWSRF PROJECT #0651010-04, WATER FACILITY IMPROVEMENTS – PHASE 2, CONTRACT 3, FACILITIES, RECORD DRAWINGS" BY UNDERWOOD ENGINEERS, INC. PORTSMOUTH, NH, DATED APRIL, 2020.

STORMWATER MANAGEMENT, EROSION & SEDIMENTATION CONTROL NOTES

1. A NPDES GENERAL PERMIT FOR CONSTRUCTION ACTIVITIES IS REQUIRED FOR THIS PROJECT. THE CONTRACTOR IS REQUIRED TO PREPARE AND SUBMIT BOTH A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND A NOTICE OF INTENT (NOI) TO FULFILL PROJECT REQUIREMENTS. THE SWPPP MUST BE PREPARED IN ACCORDANCE WITH THE EPA'S REQUIREMENTS. NO WORK IS TO PROCEED UNTIL THE SWPPP AND THE NOI ARE SUBMITTED AND ACCEPTED BY THE OWNER AND THE ENGINEER.
2. THE CONTRACTOR SHALL SUBMIT, FOR REVIEW AND APPROVAL, A SCHEDULE TO INCLUDE ALL EARTHWORK ACTIVITIES IN ACCORDANCE WITH SECTION 01310 OF THE PROJECT MANUAL.
3. EXCAVATION AND EARTHWORK SHALL BE CONDUCTED IN A MANNER THAT WILL MINIMIZE EFFECTS OF EROSION THROUGHOUT CONSTRUCTION.
4. THE CONTRACTOR SHALL, TO THE EXTENT POSSIBLE, PHASE EARTH WORK ACTIVITIES SO THAT THE SMALLEST PRACTICAL LAND AREA IS EXPOSED AT ANY GIVEN TIME.
5. THE CONTRACTOR SHALL LOAM, SEED AND MULCH ALL CUT SLOPES IMMEDIATELY FOLLOWING FINAL GRADING. TEMPORARY SEEDING AND MULCH SHALL BE APPLIED AT ALL UNVEGETATED AREAS THAT WILL BE EXPOSED FOR A PERIOD EXCEEDING TWENTY (20) DAYS.
6. HAYBALES, SILT FENCING AND EROSION STONE SHALL BE INSTALLED WHERE NECESSARY TO MINIMIZE THE EFFECTS OF EROSION. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE ANY ADDITIONAL MEASURES THAT MAY BE REQUIRED WHERE NECESSARY TO OBTAIN THE OBJECTIVES DESCRIBED HEREIN. ALL WORK SHALL BE COMPLETED IN CONFORMANCE WITH THE LATEST EDITION OF "STORM WATER MANAGEMENT AND EROSION AND SEDIMENT CONTROL HANDBOOK FOR URBAN AND DEVELOPING AREAS IN NEW HAMPSHIRE." PREVENT THE DEGRADATION OF DOWNSTREAM PROPERTIES AND DRAINAGE.
7. DRAINAGE SWALES SHALL BE MONITORED AND MAINTAINED THROUGHOUT CONSTRUCTION. SILT SHALL BE PERIODICALLY REMOVED FROM SWALES AS NECESSARY TO PREVENT MIGRATION.
8. HAY BALE BARRIERS SHALL BE INSTALLED ALONG SWALES AT 100 FOOT INTERVALS, AROUND CATCH BASINS AND AT ALL AREAS WHERE STORMWATER OR TRENCHWATER ARE CONCENTRATED.
9. HAY BALE BARRIERS AND SEDIMENT TRAPS ARE TO BE MAINTAINED AND KEPT CLEAN UNTIL ALL EXPOSED AREAS HAVE A HEALTHY STAND OF GROUND COVER, AT WHICH TIME TEMPORARY MEASURES ARE TO BE REMOVED. CONTRACTOR IS RESPONSIBLE FOR PROPER DISPOSAL OF SILT AND TEMPORARY MATERIALS REMOVED.
10. DISTURBED AREAS SHALL BE LOAMED AND SEEDED. MINIMUM DEPTH OF LOAM SHALL BE 4 INCHES.
11. PROVIDE SEED (PARK MIXTURE), LIME, FERTILIZER AND MULCH PER SECTION 02935 OF THE PROJECT MANUAL FOR AREAS NEAR RESIDENCES. PROVIDE CONSERVATION MIX ON CROSS-COUNTRY/CITY PROPERTY.

SURVEY NOTES

1. FIELD SURVEY PERFORMED BY DOUCET SURVEY DURING APRIL, 2021 USING A TRIMBLE S7 TOTAL STATION, A TRIMBLE R10 SURVEY GRADE GPS UNIT AND A TRIMBLE DINI DIGITAL LEVEL. TRAVERSE ADJUSTMENT BASED ON LEAST SQUARE ANALYSIS.
2. VERTICAL DATUM FOR SMITH WELL SITE IS BASED NGVD29 PER DISK 125-0800 WITH A PUBLISHED ELEVATION OF 183.84'.
3. VERTICAL DATUM FOR GARRISON TANK SITE IS BASED ON NGVD29 PER NHDOT CONTROL DISK D 50 RESET 1977 HAVING A PUBLISHED ELEVATION OF 23.33'.
4. HORIZONTAL DATUM BASED ON NEW HAMPSHIRE STATE PLANE(2800) NAD83(2011) DERIVED FROM REDUNDANT GPS OBSERVATIONS UTILIZING THE KEYNET GPS VRS NETWORK.
5. PROPER FIELD PROCEDURES WERE FOLLOWED IN ORDER TO GENERATE CONTOURS AT 2' INTERVALS. ANY MODIFICATION OF THIS INTERVAL WILL DIMINISH THE INTEGRITY OF THE DATA, AND DOUCET SURVEY, INC. WILL NOT BE RESPONSIBLE FOR ANY SUCH ALTERATION PERFORMED BY THE USER.
6. UNDERGROUND UTILITIES SHOWN HEREON ARE BASED ON A COMBINATION OF OBSERVED PHYSICAL EVIDENCE AND PAINT MARKS FOUND ON-SITE.
7. THE ACCURACY OF MEASURED UTILITY INVERTS AND PIPE SIZES/TYPES IS SUBJECT TO NUMEROUS FIELD CONDITIONS, INCLUDING; THE ABILITY TO MAKE VISUAL OBSERVATIONS, DIRECT ACCESS TO THE VARIOUS ELEMENTS, MANHOLE CONFIGURATION, ETC.
8. JURISDICTIONAL WETLANDS WITHIN THE AREA-OF-INTEREST DEPICTED WERE DELINEATED IN MARCH 2021 BY MARC JACOBS, CERTIFIED WETLAND SCIENTIST NUMBER 090, ACCORDING TO THE STANDARDS OF THE US ARMY CORPS OF ENGINEERS – WETLANDS DELINEATION MANUAL; THE 2012 REGIONAL SUPPLEMENT TO THE CORPS OF ENGINEERS WETLAND DELINEATION MANUAL: NORTHCENTRAL AND NORTHEAST REGION AND THE CODE OF ADMINISTRATIVE RULES, NH DEPARTMENT OF ENVIRONMENTAL SERVICES – WETLANDS BUREAU – ENV WT 100-900. SOILS WERE EVALUATED UTILIZING THE FIELD INDICATORS FOR IDENTIFYING HYDRIC SOILS IN NEW ENGLAND, VERSION 4, APRIL 2017 AND THE FIELD INDICATORS OF HYDRIC SOILS IN THE UNITED STATES, VERSION 8, 2016. THE INDICATOR STATUS OF VEGETATION AS HYDROPHYTIC WAS DETERMINED ACCORDING TO THE U.S. ARMY CORPS OF ENGINEERS – NORTHCENTRAL AND NORTHEAST 2016 REGIONAL WETLAND PLANT LIST. COPIES OF SITE PLANS WHICH HAVE BEEN REVIEWED BY THE WETLAND SCIENTIST ARE INDIVIDUALLY STAMPED, SIGNED AND DATED. THIS NOTE HAS BEEN CUSTOMIZED FOR THIS PROJECT.
9. NO WETLAND INVESTIGATION WAS PERFORMED ON GARRISON TANK SITE.
10. ZONING REQUIREMENTS:

REQUIRED	PROVIDED
a. DISTRICT: **R-40**	
b. MIN. LOT SIZE: 40,000 SF	> 40,000 SF
c. MIN. LOT FRONTAGE: 150 FT.	> 150 FT.
d. MIN. YARD SETBACKS: FRONT: 40 FT. SIDE: 25 FT. REAR: 30 FT. ABUT-A-STREET: 40 FT.	 > 40 FT. > 25 FT. > 30 FT. > 40 FT.
e. MAX. LOT COVERAGE: 10%	< 10%
f. MAX. BUILDING HEIGHT: 35 FT.	113 FT.

THE PROPERTY FALLS WITHIN THE CONSERVATION DISTRICT AND GROUNDWATER PROTECTION ZONE.

SETBACK REQUIREMENTS CONSIDER THE SITE FRONTAGE AS WEBB PLACE.

BUILDING HEIGHT BASED ON TOP OF TANK DOME.

ISSUE FOR			
APPROVAL	By	TDP	
Date 12/17/21			
CONSTRUCTION	By	TDP	
Date 2/9/22			
RECORD DRAWING	By	–	
Date –			

NO.	REVISIONS	APP'D

Drawn/Chk. RMG
Designed ALA
Checked TDP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_gennotes
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – ALEXANDER PRATT No. 8631 – PROFESSIONAL ENGINEER (LICENSED)

STATE OF NEW HAMPSHIRE – THOMAS G. PAGE No. 10661 – PROFESSIONAL ENGINEER (LICENSED)

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

GENERAL NOTES I

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

DWG NO G2

SHEET 2 OF 43

C:\Users\mg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_gennotes.dwg, G2, 2/7/2022 6:13:49 PM, mg

SITE PLAN NOTES

1. THE INTENT OF THIS PLAN SET IS TO OBTAIN LOCAL APPROVAL FOR THE PROPOSED COMPOSITE ELEVATED WATER STORAGE TANK.
2. THERE ARE NO ANTICIPATED SPECIAL EXCEPTIONS GRANTED BY THE ZONING BOARD OF ADJUSTMENT OR CONDITIONAL USE PERMITS GRANTED BY THE PLANNING BOARD FOR THE PROPOSED USE OR STRUCTURE.
3. PROPERTY LINE INFORMATION SHOWN HAS BEEN OBTAINED FROM THE PLAN REFERENCED IN THE SURVEY NOTES, PREPARED BY DOUCET SURVEY.
4. RECORD DRAWINGS SHALL BE SUBMITTED ON PAPER AND IN DIGITAL AUTOCAD DWG FORMAT TO THE CITY OF DOVER ENGINEER'S OFFICE UPON COMPLETION OF PROJECT. RECORD DRAWINGS WILL BE PREPARED BY A LICENSED P.E. AND WILL BE GEO-REFERENCED TO NEW HAMPSHIRE STATE PLANE COORDINATES.
5. THE INSTALLATION OF ELECTRIC POWER, CABLE TELEVISION AND TELEPHONE LINES SHALL BE UNDERGROUND THROUGHOUT THE SITE FOR WHICH DEVELOPMENT IS PROPOSED.
6. THE SUBJECT PARCEL IS SERVED BY MUNICIPAL WATER.
7. THE LIMITS OF CONSTRUCTION DISTURBANCE THAT ARE LOCATED IN OR WITHIN THE 50 FT. OF CONSERVATION AND WETLAND DISTRICTS SHALL BE STAKED, FLAGGED AND CLEARLY IDENTIFIED, IF ANY, PRIOR ANY EARTH DISTURBING ACTIVITY OCCURS.
8. ALL TREATMENT SWALES TO BE CONSTRUCTED SHALL HAVE SOD BOTTOMS.
9. RETAINAGE WITHHELD FROM THE CONTRACTOR SHALL INCLUDE THE COSTS FOR REVEGETATING ALL DISTURBED AREAS, IF REQUIRED, AND REQUIRED CONSTRUCTION SIGNS SHALL BE INSTALLED PRIOR TO EARTH DISTURBING ACTIVITIES.
10. A PRE-CONSTRUCTION CONFERENCE WILL BE HELD WITH THE CONTRACTOR, ENGINEER AND THE CITY ENGINEER PRIOR TO ANY EARTH DISTURBING ACTIVITY.
11. SITE CONSTRUCTION WORK HOURS SHALL BE AS DEFINED IN THE PROJECT MANUAL.
12. BUILDING ADDRESSES SHALL BE ASSIGNED BY THE BUILDING OFFICIAL AT THE TIME OF ISSUANCE OF A BUILDING PERMIT.
13. THE PROPOSED USE FOR THE SITE (STRUCTURE) IS A COMPOSITE ELEVATED WATER STORAGE TANK.
14. THE FOLLOWING FEDERAL AND STATE PERMITS ARE ANTICIPATED FOR THE PROJECT:
    a. GROUNDWATER DISCHARGE REGISTRATION.
    b. NHDES DESIGN REVIEW.
15. COMMERCIAL VEHICLE ROUTE DURING CONSTRUCTION SHALL CONFORM TO DOVER CITY CODE OR BE COORDINATED WITH THE COMMUNITY SERVICES DIRECTOR.
16. APPLICANT SHALL COMPLETE LAND USE DEVELOPMENT TRACKING FORM, MOST RECENTLY REVISED VERSION, UTILIZING THE ONLINE POLLUTION TRACKING AND ACCOUNTING PILOT PROJECT (PTAPP) PORTAL. HTTPS://WWW.UNH.EDU/UNHSC/PTAPP
17. FIRE DEPARTMENT ACCESS ROADS SHALL BE INSTALLED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF FIRE APPARATUS IN ALL WEATHER CONDITIONS AT ALL TIMES.
18. ADEQUATE PARKING IS PROVIDED FOR CITY STAFF, NO PUBLIC PARKING IS PROPOSED.
19. EXTERIOR LIGHTING SHALL BE CUT-OFF TYPE FIXTURES PER CHAPTER 153-14-E AND SHALL PROVIDE LIGHTING DIRECTED ON-SITE ONLY.
20. A SECURITY SYSTEM SHALL BE INSTALLED AS REQUIRED BY CHAPTER 45, ARTICLE I, SECTION 45-2 OF THE CODE OF THE CITY OF DOVER.
21. APPROVED BACKFLOW PREVENTERS SHALL BE PROVIDED FOR BOTH FIRE AND DOMESTIC WATER LINES.
22. FIRE DEPARTMENT CONNECTION(S) SHALL BE LOCATED ON THE STREET SIDE OF THE BUILDING PER NFPA 13. ACCESS TO THE FDC SHALL MAINTAIN A CLEAR AND UNOBSTRUCTED PATH AT ALL TIMES.
23. THE SITE LAYOUT SHALL COMPLY WITH APPLICABLE ACCESSIBILITY REGULATIONS. SEE ARCHITECTURAL DRAWINGS FOR ACCESSIBILITY REGULATIONS FOR THE STRUCTURE.
24. SUBJECT PARCEL IS NOT LOCATED WITHIN A FEDERALLY DESIGNATED FLOOD HAZARD AREA (COMMUNITY PANEL NMBER 33017C0310E, EFFECTIVE DATE: SEPTEMBER 30, 2015.
25. CONTRACTOR TO SUBMIT INTENT TO CUT FOR CLEARING OF TIMBER AS PROPOSED, TO CITY TAX ASSESSING OFFICE.

KEY NOTES

(TP) TP. EXPLORATORY EXCAVATION WITH ENGINEER IN ADVANCE OF WATER INSTALLATION TO IDENTIFY POTENTIAL UTILITY CROSSING CONFLICTS AND CONFIRM DESIGN ELEVATIONS. REPORT ELEVATION TO ENGINEER BEFORE PROCEEDING WITH THE WORK.

(CT) CUT TREE, ITEM 201.21.

(1) CUT-IN 12"X12" TEE & 12" GATE VALVE, CONNECT GATE VALVE TO TEE USING FOSTER ADAPTOR. CONNECT TO EXISTING 12" DI MAIN USING SOLID SLEEVE COUPLINGS. **(ADD ALT D)**

(2) CONSTRUCT HYDRANT ASSEMBLY, INCLUDING ANCHOR TEE, GATE VALVE & 6" BRANCH PIPE.

(3) UNDERGROUND UTILITIES, TELEPHONE, ELECTRIC, GAS, LIGHTING, SEWER, DRAIN, & WATER SYSTEMS EXIST THROUGHOUT THE PROJECT AREA. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE & PROTECT UTILITIES PRIOR TO AND DURING THEIR CONSTRUCTION OPERATIONS, SUBSIDIARY TO ITEM

(4) INSTALL SILT FENCE. SEE PLAN. SUBSIDIARY, SEE DETAIL 1/C12

(5) REMOVE EXISTING HYDRANT AND SALVAGE TO OWNER. SUBSIDIARY

(6) CONSTRUCT TEMPORARY WATER SYSTEM PRIOR TO CONSTRUCTION OF NEW MAIN. CAP AND ABANDON EXISTING WATER MAIN UPON COMPLETION OF NEW MAIN.

(7) INSTALL NEW 1" WATER SERVICE FROM NEW 16" DI MAIN WITH NEW CURB STOP, CONNECT TO EXISTING WATER SERVICE. LOCATE PER OWNER AND ENGINEER IN FIELD. SEE DETAIL 7/C11

(8) INSTALL RIGID INSULATION, SEE TRENCH DETAIL 2/C11

(9) CONSTRUCT NEW 4" DIA. SMH, LOCATION WILL DEPEND ON SERVICE LOCATION FOR #4. LOCATE PER OWNER AND ENGINEER IN FIELD. DETAIL 1/C16 **(ADD ALT C)**

(10) INSTALL NEW 8" SDR 35 PVC SEWER. **(ADD ALT C)**

(11) MAINTAIN EXISTING SEWER UNTIL SEWER SERVICES MOVED TO NEW SEWER. THEN CAP AND ABANDON OR REMOVE AND DISPOSE OF WHERE NECESSARY, SUBSIDIARY.

(12) REMOVE AND DISPOSE OF EXISTING SMH CONNECT EXISTING SEWER FROM BARRY STREET TO NEW SMH, SUBSIDIARY.

(13) THE COD WILL DETERMINE APPROXIMATE LOCATION OF EXISTING SEWER SERVICES. INSTALL NEW SEWER SERVICE AND MAKE CONNECTIONS AT APPROVED LOCATIONS. **(ADD ALT C)**

(14) INSTALL NEW 12" DI RAW WATER OR FINISHED WATER MAIN **(ADD-ALT D)**.

(15) INSTALL NEW 16" DI WATER MAIN.

(16) REMOVE EXISTING 6" GATE VALVE. INSTALL NEW 16"X16"X16" TEE WITH FOSTER ADAPTER. INSTALL TWO 16" HORIZONTAL BEVELED-GEARED GATE VALVES AND REDUCERS, AND 12" GATE VALVE & TWO SOLID SLEEVE COUPLINGS.

(17) INSTALL 16" X 16" X 8" TEE, FOSTER ADAPTER, 8" GATE VALVE, 8" X 6" REDUCER AND SOLID SLEEVE COUPLING.

(18) INSTALL 16" HORIZONTAL BEVELED-GEARED GATE VALVE.

(19) MAINTAIN 1 FT. MINIMUM BETWEEN TOP OF WATER MAIN AND INVERT OF DRAIN PIPE. SEE DETAIL 6/C11

(20) INSTALL NEW 12" DI RAW WATER MAIN **(ADD ALT F)**.

(21) COMMON EXCAVATION FOR SMITH WELL ROAD IS SUBSIDIARY TO FINE GRADING, ITEM 214. TURF ESTABLISHMENT WILL BE PAID FOR UNDER ITEM 912 AS A LUMP SUM UNIT AND WILL NOT BE MEASURED FOR PAYMENT. SEE DETAIL ON DRAWING C15.

(22) RESTORE DISTURBED AREAS WITH 4" LOAM AND CONSERVATION MIX SEED, SUBSIDIARY.

(23) PROTECT & RETAIN EXISTING GRAVEL ROADWAY. GRADE & SHIM WITH CRUSHED STONE (FINE GRADATION) FOLLOWING CONSTRUCTION, SUBSIDIARY.

(24) WHERE ROAD IS BEING WIDENED ADDITIONAL CRUSHED GRAVEL FOR ROAD BASE SHALL BE PAID UNDER ITEM 304.3.

(25) NOT USED

(26) ABANDON AC PIPE IN PLACE, REMOVE AND DISPOSE OF AC PIPE ONLY WHERE NECESSARY & APPROVED BY ENGINEER.

(27) FULL DEPTH RECONSTRUCTION STA. 3+00 TO 3+45 TO ACHIEVE MINIMUM GRAVEL DEPTH OF 12" & NOMINAL PAVEMENT DEPTH OF 4" BELOW FINISH GRADES SHOWN **(ADD ALT. D)**.

(28) NOT USED

(29) LIMIT OF 12" MAIN IS JUST OUTSIDE FENCE. CAP IF BID ALTERNATIVE FOR 12" CONNECTION TO WEBB PLACE IS NOT INSTALLED.

(30) RELOCATE EXISTING RW MAIN UNDER 16" MAIN, SUBSIDIARY.

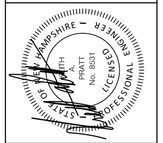
(31) 20" HDPE PIPE ADD/DEDUCT ALTERNATE A TO BE INSTALLED BETWEEN APPROX. STA 4+00 AND STA 22+38, IF ACCEPTED. RESTRAIN TO 16" DI PIPE.

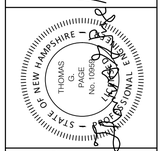
TEMPORARY WATER NOTES – SMITH WELL ROAD

1. PROVIDE 4" MINIMUM TEMPORARY WATER LINE FROM NEW HYDRANT AT GLENWOOD AVE TO BARRY STREET WATER MAIN.
2. PROVIDE TEMPORARY WATER SERVICE LINES TO CUSTOMERS ON SMITH WELL ROAD.
3. EXISTING 6" AC MAY THEN BE TAKEN OUT OF SERVICE TO INSTALL THE PROPOSED 16" MAIN.
4. TEMPORARY WATER SHALL BE INCLUDED UNDER BID ITEM FOR 16" WATER MAIN, WITH NO ADDITIONAL COST TO OWNER.

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21 By TDP	
	CONSTRUCTION Date 2/9/22 By TDP	
	RECORD DRAWING Date – By –	

Drawn/Chk. RMG
Designed ALA
Checked TDP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_gennotes
Scale AS SHOWN





UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

GENERAL NOTES II

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO G3

SHEET 3 OF 43

C:\Users\mrg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_gennotes.dwg, G3, 2/7/2022 8:13:52 PM, mrg

LEGEND:

EXISTING	PROPOSED	
		STRUCTURES/BUILDINGS
		APPROXIMATE PROPERTY LINE (PER GIS)
		PAVED ROAD/DRIVE
		EDGE OF GRAVEL
sgc		SLOPED GRANITE CURB
S		GRAVITY SEWER
W	W	WATER LINE
W		ABANDONED WATER LINE
D		DRAIN LINE
G		GAS LINE
UGU		UNDERGROUND UTILITIES
UGU		ABANDONED UNDERGROUND UTILITIES
OHW		ELECTRIC LINE
OHW		OVERHEAD WIRE
126		MINOR CONTOUR ELEVATION
130		MAJOR CONTOUR ELEVATION
126		SPOT ELECTION
		CHAIN LINK FENCE
		SPLIT RAIL FENCE
		GUARD RAIL
		RETAINING WALL
		WETLAND
		EDGE OF WETLAND
		EDGE OF VEGETATION
		DECIDUOUS TREE
		BUSH
		BUSH LINE
		STUMP
		CONCRETE
		LANDSCAPED AREA
		BRICK
		RIP-RAP/STONE
		CONCRETE/GRANITE BOUND
I.P.F. I.R.F.		IRON PIPE - IRON ROD
D.H.F.		DRILL HOLE
FP		FLAG POLE
		LIGHT POLE
		GUY WIRE
		UTILITY POLE
		UTILITY POLE W/ LIGHTS
		SIGN
W		WATER MANHOLE
		HYDRANT
WP		WATER SHUT-OFF
WV		WATER VALVE
		FITTING/BEND-THRUST RESTRAINT
S		SEWER MANHOLE
		CATCH BASIN SQUARE
MW		MONITORING WELL
B		BORING
		CONTROL POINT
		STATE FOUND WITH LABELING
W		WELL
ES		ELECTRIC SWITCH
EM		ELECTRIC METER
		ELECTRIC BOX
GR		GAS REGULATOR VALVE

LEGEND (CONT.):

EXISTING	PROPOSED	
E		ELECTRICAL HAND HOLE
		SILT FENCE

ABBREVIATIONS:

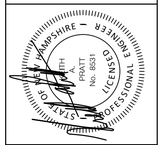
AB	ABANDONED
AER	AEROBIC (AERATION)
AVE	ABOVE FINISHED FLOOR
ALUM	ALUMINUM
AN	ANAEROBIC
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
AVG	AVERAGE
AX	ANOXIC
BFP	BACKFLOW PREVENTOR
BIT	BITUMINOUS
BL	BASELINE
BLDG	BUILDING
CB	CATCH BASIN
CCT	CHLORINE CONTACT TANK
CF	CUBIC FEET
CFS	CUBIC FEET PER SECOND
CI	CAST IRON PIPE
CL	CENTERLINE
CL2	CHLORINE LINE
CMH	CHEMICAL MANHOLE
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CONST	CONSTRUCT
CONT	CONTINUOUS, CONTINUATION
CP	POST CHLORINE PIPE
CRA	CHLORINE RESIDUAL ANALYZER
CS	CAUSTIC SODA
D	DRAIN
DI	DUCTILE IRON
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DMH	DRAIN MANHOLE
DN	DOWN
DO	DISSOLVED OXYGEN
EL	ELEVATION
ELEC	ELECTRIC
EMER	EMERGENCY
ENGR	ENGINEER
ENT	ENTRANCE
EOP	EDGE OF PAVEMENT
EXIST	EXISTING
FDN	FOUNDATION
FF	FINISHED FLOOR
FG	FINISHED GRADE
FLG	FLANGE
FM	FORCE MAIN
FT	FOOT OR FEET
FW	FINISHED WATER
GALV	GALVANIZED
GAS	PROPANE GAS
G.C.	GENERAL CONTRACTOR
GEN	GENERATOR
GHWC	GAS & HOT WATER CONDUIT
GND	GROUND
GPM	GALLONS PER MINUTE
GRD	GRIT DISCHARGE
GRO	GRIT OVERFLOW
HDPE	HIGH DENSITY POLYETHYLENE
HPS	HIGH PRESSURE SODIUM
HW	HEADWATER
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
IN	INCH
INV	INVERT ELEVATION
LB	POUND
LF	LINEAR FEET
LGT	LIGHT
LPA	LOW PRESSURE AIR
MANUF	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MJ	MECHANICAL JOINT
MON	MONUMENT
MW	MUNICIPAL WATER
NA	NOT APPLICABLE
NGVD	NATIONAL GEODETIC VERTICAL DATUM
N/F	NOW OR FORMERLY
NO.	NUMBER
N.O.	NORMALLY OPEN
N.S.	NORMALLY SHUT
OC	ODOR CONTROL
OD	OUTSIDE DIAMETER
OS	OUTLET STRUCTURE
PB	PRIMARY BYPASS
PCF	POUNDS PER CUBIC FOOT
PL	PROPERTY LINE
PLE	PLANT EFFLUENT
PO	POLYMER SOLUTION
PP	POTASSIUM PERMANGANATE
PS	PRIMARY SLUDGE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSNH	PUBLIC SERVICE OF NEW HAMPSHIRE
PT	PRESSURE TREATED
PVC	POLYVINYL CHLORIDE
PVCL	PVC CHLORINE LINE (VACUUM TUBE CASING)
PVCU	PVC UNDERDRAIN
PVDR	PVC DRAIN RETURN
PVMT	PAVEMENT
PVSA	PVC SAMPLE LINE
PVSL	PVC SUCTION LINE
PW	PLANT WATER
PYCL	POLYETHYLENE CHLORINE LINE (VACUUM TUBING CASING)
R (RAD)	RADIUS
RAS	RETURN ACTIVATED SLUDGE
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN
RD	ROAD
REM	REMOVE
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND REPLACE
R&S	REMOVE AND SALVAGE
REF	REFER OR REFERENCE
REQD	REQUIRED
RS	RAW SEWAGE
ROW	RIGHT OF WAY
RW	RAW WATER
S	MUNICIPAL SEWER
S	SLOPE
SA	SAMPLE LINE
SB	SODIUM BISULFITE
SC	SCUM
SCH	SCHEDULE
SD	SUMP DISCHARGE
SE	SECONDARY EFFLUENT
SED	SEDIMENTATION
SEP	SEPTAGE
SEW	SEWAGE
SF	SQUARE FEET
SHC	SODIUM HYPOCHLORITE
SHD	SODIUM HYDROXIDE
SHT	SHEET
SI	SECONDARY INFLUENT
SMH	SEWER MANHOLE
S.S.	STAINLESS STEEL
SQ	SQUARE
ST	STEEL
STA	STATION
STD	STANDARD
STRS	STAIRS
STRUCT	STRUCTURAL
SUP	SUPERNATANT
SW	SEAL WATER
SYMM	SYMMETRICAL
TBM	TEMPORARY BENCH MARK
TD	TANK DRAIN
TEMP	TEMPORARY
THK	THICKNESS
TOC	TOP OF CONCRETE
TOP	TOP OF PIPE
TOW	TOP OF WALL
TP	TEST PIT
TRANS	TRANSFORMER
TWAS	THICKENED WASTE ACTIVATED SLUDGE
TYP	TYPICAL
UE	UNDERGROUND ELECTRICAL
UGU	UNDERGROUND UTILITIES
UNO	UNLESS NOTED OTHERWISE
V	VOLTS
VIF	VERIFY IN FIELD
VC	VERTICAL CURVE
VCD	VC DRAIN
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
W	WATER
WAS	WASTE ACTIVATED SLUDGE
WD	WOOD
WI	WROUGHT IRON
W/	WITH
(E)	EAST
(N)	NORTH
(S)	SOUTH
(W)	WEST
@	AT (SPACING)
ø	DIAMETER
#	NUMBER
℄	CENTER LINE
&	AND

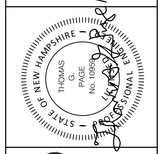
NOTE:

1. THIS IS A STANDARD LEGEND SHEET, THEREFORE SOME ABBREVIATIONS MAY APPEAR ON THIS SHEET AND NOT ON THE DRAWINGS.

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21 By TDP	
	CONSTRUCTION Date 2/9/22 By TDP	
	RECORD DRAWING Date - By -	

Drawn/Chk. RMG
Designed ALA
Checked TDP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_legend
Scale AS SHOWN





UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

LEGEND & ABBREVIATIONS

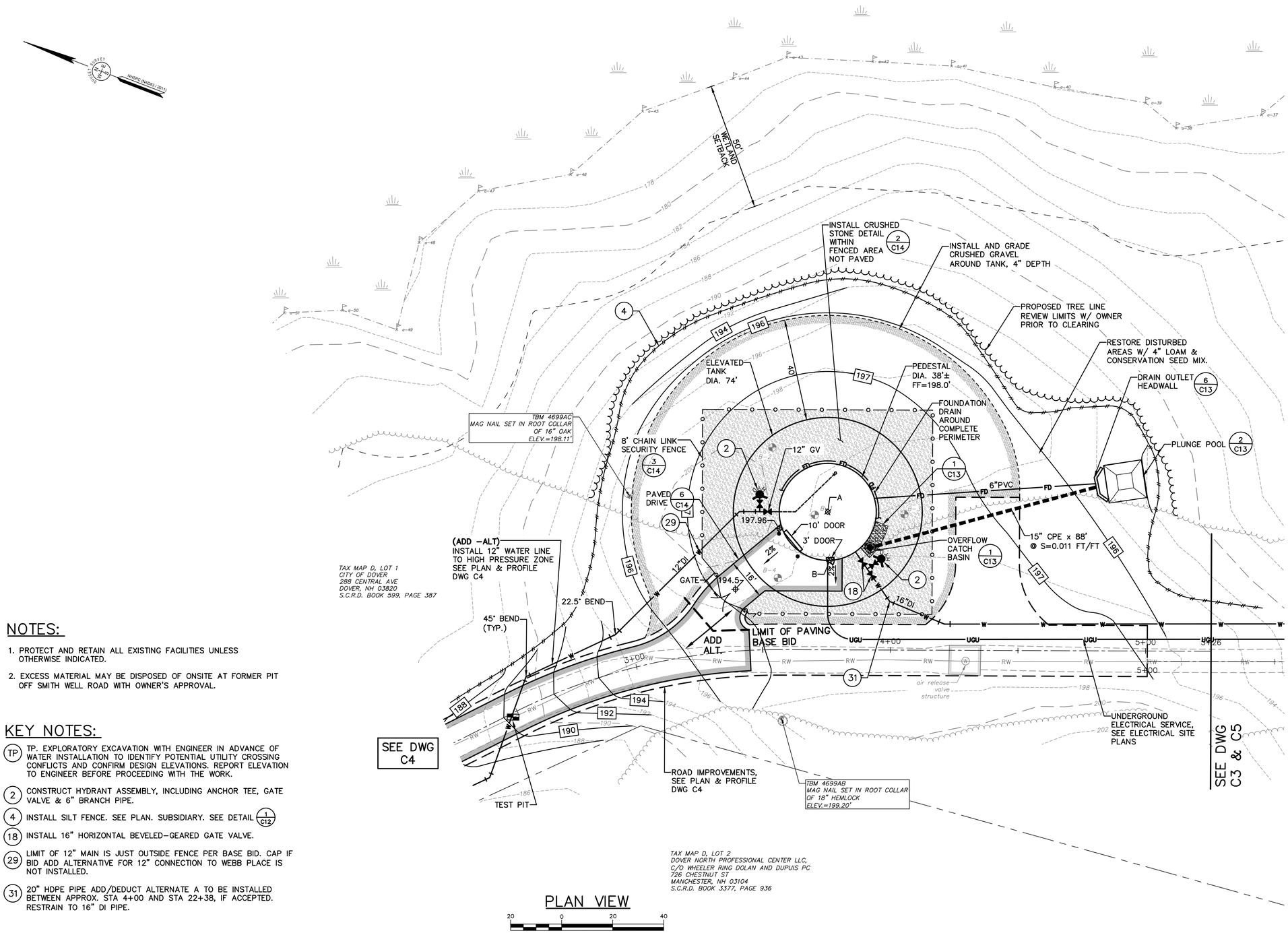
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

DWG NO	SHEET
G4	4 OF 43

C:\Users\mpg\Desktop\desktop working files\Rob Nunbert\Down\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_legend.dwg, G4, 2/7/2022 6:29:11 PM, mpg

WEBB PL.
SMITH WELL ROAD
BARRY ST.
GLENWOOD AVE
C2
C3
C4
C5
C6
C7
C8
28
32
124
126
TAX MAP D, LOT 1
CITY OF DOVER
400' WELL RADIUS
400' WELL RADIUS
W
RW
UGU
OHW
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
MW-13
MW-14
MW-15
MW-16
MW-17
MW-18
MW-19
MW-20
MW-21
MW-22
MW-23
MW-24
MW-25
MW-26
MW-27
MW-28
MW-29
MW-30
MW-31
MW-32
MW-33
MW-34
MW-35
MW-36
MW-37
MW-38
MW-39
MW-40



PLAN VIEW

SCALE: 1 INCH = 20 FT.

NOTES:

1. PROTECT AND RETAIN ALL EXISTING FACILITIES UNLESS OTHERWISE INDICATED.
2. EXCESS MATERIAL MAY BE DISPOSED OF ONSITE AT FORMER PIT OFF SMITH WELL ROAD WITH OWNER'S APPROVAL.

KEY NOTES:

- (TP) TP. EXPLORATORY EXCAVATION WITH ENGINEER IN ADVANCE OF WATER INSTALLATION TO IDENTIFY POTENTIAL UTILITY CROSSING CONFLICTS AND CONFIRM DESIGN ELEVATIONS. REPORT ELEVATION TO ENGINEER BEFORE PROCEEDING WITH THE WORK.
- (2) CONSTRUCT HYDRANT ASSEMBLY, INCLUDING ANCHOR TEE, GATE VALVE & 6" BRANCH PIPE.
- (4) INSTALL SILT FENCE. SEE PLAN. SUBSIDIARY. SEE DETAIL (1 C12)
- (18) INSTALL 16" HORIZONTAL BEVELED-GEARED GATE VALVE.
- (29) LIMIT OF 12" MAIN IS JUST OUTSIDE FENCE PER BASE BID. CAP IF BID ADD ALTERNATIVE FOR 12" CONNECTION TO WEBB PLACE IS NOT INSTALLED.
- (31) 20" HDPE PIPE ADD/DEDUCT ALTERNATE A TO BE INSTALLED BETWEEN APPROX. STA 4+00 AND STA 22+38, IF ACCEPTED. RESTRAIN TO 16" DI PIPE.

LAYOUT TABLE

ID	DESCRIPTION	NORTHERN	EASTERN
POINT A	TANK CENTER	262996.1876	1191529.1331
POINT B	TANK PEDESTAL WALL	262988.5897	1191511.7184

ISSUE FOR
APPROVAL — By TGP — Date 12/17/21
CONSTRUCTION — By TGP — Date 2/9/22
RECORD DRAWING — By – — Date –

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – LICENSED PROFESSIONAL ENGINEER – KEITH PRATT No. 8531

STATE OF NEW HAMPSHIRE – LICENSED PROFESSIONAL LAND SURVEYOR – THOMAS PAGE No. 10981

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

TANK SITE PLAN

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C2
SHEET 6 OF 43

C:\Users\mg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_prbase.dwg, C2, 2/7/2022 8:05:39 PM, mg

TAX MAP D, LOT 1
CITY OF DOVER
288 CENTRAL AVE
DOVER, NH 03820
S.C.R.D. BOOK 599, PAGE 387

RESTORE DISTURBED AREAS W/ 4" LOAM & CONSERVATION MIX.

INSTALL 16" DI WATER MAIN SEE DWG C5

SEE DWG C2 & C4

UNDERGROUND ELECTRICAL SERVICE, SEE ELECTRICAL SITE PLANS

TBM 4699AD
'X' IN BOLT OVER MAIN OUTLET ON HYDRANT
ELEV.=164.36'

TBM 4113A
MAG NAIL SET UP 6" IN UTILITY POLE PSNH64/12BFP/102/13
ELEV.=162.02'

EXISTING 12" DI RAW WATER MAIN (NOTE 1)

SEE ELECTRICAL DWGS FOR ELECTRICAL WORK

TAX MAP D, LOT 2
DOVER NORTH PROFESSIONAL CENTER LLC,
C/O WHEELER RING DOLAN AND DUPUIS PC
726 CHESTNUT ST
MANCHESTER, NH 03104
S.C.R.D. BOOK 3377, PAGE 936

NOTES:

1. PROTECT AND RETAIN ALL EXISTING FACILITIES UNLESS OTHERWISE INDICATED.

KEY NOTES:

(4) INSTALL SILT FENCE. SEE PLAN. SUBSIDIARY. SEE DETAIL 1/C12

(15) INSTALL NEW 16" DI WATER MAIN.

(23) PROTECT & RETAIN EXISTING GRAVEL ROADWAY. GRADE & SHIM WITH CRUSHED STONE (FINE GRADATION) FOLLOWING CONSTRUCTION, SUBSIDIARY.

PLAN VIEW

SCALE: 1 INCH = 20 FT.

© COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED.

ISSUE FOR
APPROVAL — Date 12/17/21 — By TGP
CONSTRUCTION — Date 2/9/22 — By TGP
RECORD DRAWING — Date – — By –

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – LICENSED PROFESSIONAL ENGINEER – TIMOTHY H. PRATT No. 8531

STATE OF NEW HAMPSHIRE – LICENSED PROFESSIONAL LAND SURVEYOR – THOMAS G. PAGE No. 10961

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

WELL HOUSE SITE PLAN

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

DWG NO C3
SHEET 7 OF 43

C:\Users\mpg\Desktop\desktop working files\Revit Numbered\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_prbase.dwg, C3, 2/7/2022 8:05:33 PM, mpg

TBM 4699AC
MAG NAIL SET IN ROOT COLLAR
OF 16" OAK
ELEV.=198.11'

SEE DWG C2

GRAVEL TURN-AROUND (1/C14)

TAX MAP D, LOT 1
CITY OF DOVER
288 CENTRAL AVE
DOVER, NH 03820
S.C.R.D. BOOK 599, PAGE 387

existing 10" DI RW main from Willand Pond

WEBB PLACE

cb #2899

cb #2898

5/8" REBAR SET FLUSH W/DIT

(pvmt. el.=183.4)
top 10" rwv=178.10
tp 15" pe = 177.1±

EXISTING 10" DI RAW WATER MAIN TRANSMISSION

possible old light pole post

existing 12" water main (high pressure zone)

6' vinyl fence

5/8" REBAR UP 2" W/CAP

tbm 4699aa
chiseled box in conc.
light pole base
elev.=184.96'

20' WIDE GRAVEL DRIVE **(BASE BID)**
16' WIDE PAVEMENT **(ADD ALT D)**

PC: 2+48.61

L=108.39
R=230.00

S47°46'08"E
223.61'

S20°46'44"E
168.74'

LIMIT OF PAVING
BASE BID

ADD ALT.

INSTALL 16" DI WATER MAIN

16"DI

air release valve structure

MEET EXISTING GRADE

SEE DWG C5

TBM 4699AB
MAG NAIL SET IN ROOT COLLAR
OF 18" HEMLOCK
ELEV.=199.20'

REMOVE/REPLACE FENCE AS REQUIRED (INCIDENTAL)

REMOVE/REPLACE GATE AS REQUIRED (INCIDENTAL)

PERMANENT ROAD REPAIRS SEE (9/C14) (ADD ALT D)

RESET GRANITE CURB & RESTORE PAVED SIDEWALK (INCIDENTAL) (5/C15) (ADD ALT D)

(ADD ALT D)

(14) (ADD ALT D)

"windshear gardens" wooden sign

bar gate

TAX MAP D, LOT 2
DOVER NORTH PROFESSIONAL CENTER LLC,
C/O WHEELER RING DOLAN AND DUPUIS PC
726 CHESTNUT ST
MANCHESTER, NH 03104
S.C.R.D. BOOK 3377, PAGE 936

PLAN VIEW

SCALE: 1 INCH = 20 FT.

PROFILE VIEW

HORIZ: 1 INCH = 20 FT.
VERT: 1 INCH = 4 FT.

PVI STA = 3+01.30
PVI ELEV = 195.59
HP: STA = 3+31.30
HP: ELEV = 196.49
A.D. = −7.00%
K = 8.57
60' VC

PVI STA = 2+30.00
PVI ELEV = 188.46
LP: STA = 1+88.70
LP: ELEV = 186.81
A.D. = 6.00%
K = 13.77
83' VC

PVI STA = 1+11
PVI ELEV = 183.70

BVCS: 2+71
BVCE: 192.59

EVCS: 3+31
EVCE: 196.49

BVCS: 1+89
BVCE: 186.81

TANK PEDESTAL
38' LEFT
FF EL. 198.0

air release manhole

3.00%

4.00%

PROPOSED 12" WATER

CONTINUES TO TANK
SEE SITE PLAN & TANK DETAILS

10" di water

16" WATER MAIN

5'-6" TYP.

5'-0" MIN.

1' MIN.

existing 12" water top=178±

drain pipe top=176.4±

0.6'

DATUM ELEV
175.00

0+25	1+00	2+00	3+00	4+00	5+00	5+25.69
183.4	185.0 / 185.26	186.5 / 187.31	189.0 / 190.62	194.4 / 194.98	196.9	197.3	197.4	196.7	194.9

KEY NOTES:

(TP) EXPLORATORY EXCAVATION WITH ENGINEER IN ADVANCE OF WATER INSTALLATION TO IDENTIFY POTENTIAL UTILITY CROSSING CONFLICTS AND CONFIRM DESIGN ELEVATIONS. REPORT ELEVATION TO ENGINEER BEFORE PROCEEDING WITH THE WORK.

(1) CUT-IN 12" X12" TEE & (3) 12" GATE VALVES, CONNECT GATE VALVE TO TEE USING FOSTER ADAPTOR. CONNECT TO EXISTING 12" DI MAIN USING SOLID SLEEVE COUPLINGS. **(ADD ALT D)**

(2) CONSTRUCT HYDRANT ASSEMBLY, INCLUDING ANCHOR TEE, GATE VALVE & 6" BRANCH PIPE.

(4) INSTALL SILT FENCE. SEE PLAN. SUBSIDIARY. SEE DETAIL (1/C12)

(8) INSTALL RIGID INSULATION, SEE TRENCH DETAIL (2/C11)

(14) INSTALL NEW 12" DI FINISHED WATER MAIN **(ADD ALT D.)**.

(22) RESTORE DISTURBED AREAS WITH 4" LOAM AND CONSERVATION MIX SEED, SUBSIDIARY.

(23) PROTECT & RETAIN EXISTING GRAVEL ROADWAY. GRADE & SHIM WITH CRUSHED STONE (FINE GRADATION) FOLLOWING CONSTRUCTION, SUBSIDIARY.

(27) FULL DEPTH RECONSTRUCTION STA. 3+00 TO 3+45 TO ACHIEVE MINIMUM GRAVEL DEPTH OF 12" & NOMINAL PAVEMENT DEPTH OF 4" BELOW FINISH GRADES SHOWN **(ADD ALT D)**.

(29) LIMIT OF 12" MAIN IS JUST OUTSIDE FENCE. CAP IF BID ALTERNATIVE FOR 12" CONNECTION TO WEBB PLACE IS NOT INSTALLED.

NO.	REVISIONS	APP'D
	RECORD DRAWING By – Date –	
	CONSTRUCTION By TGP Date 2/9/22	
	APPROVAL By TGP Date 12/17/21	
	ISSUE FOR	

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

NEW HAMPSHIRE – STATE OF – LICENSED PROFESSIONAL ENGINEER – KENNETH J. PRATT No. 8531

NEW HAMPSHIRE – STATE OF – LICENSED PROFESSIONAL ENGINEER – THOMAS PAGE No. 10961

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

PLAN & PROFILE

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C4

SHEET 8 OF 43

C:\Users\mgr\Desktop\desktop working files\Real Numbers\Down\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_prbase.dwg, C4, 2/7/2022 6:05:39 PM, mrg

INSTALL 16" DI WATER MAIN

16"DI

SEE DWG C4

RESTORE DISTURBED AREAS W/ 4" LOAM & CONSERVATION MIX. (SUBSIDIARY)

CONSTRUCT CHECK DAMS ON SLOPE AS REQUIRED

woods road

TAX MAP D, LOT 1
CITY OF DOVER
288 CENTRAL AVE
DOVER, NH 03820
S.C.R.D. BOOK 599, PAGE 387

CROSS UNDER HYDRANT CONNECTION 16" TOP ELEV. 156.0± CONFIRM IN FIELD

SEE DWG C6

SMITH WELL RD

existing 12" DI RW main

trail

6" oak

8" oak

20" oak

18" oak

psnh 64/12

old well house per town worker

abandoned waterline

conc. block

10" pig clean out about grade

10" cip inv.=162.9'

TBM 4699AD
'X' IN BOLT OVER MAIN OUTLET ON HYDRANT
ELEV.=164.36'

SEE DWG C3

SEE DWG C3

PLAN VIEW

20 0 20 40
SCALE: 1 INCH = 20 FT.

KEY NOTES:

4. INSTALL SILT FENCE. SEE PLAN. SUBSIDIARY. SEE DETAIL 1/C12
15. INSTALL NEW 16" DI WATER MAIN.
22. RESTORE DISTURBED AREAS WITH 4" LOAM AND CONSERVATION MIX.
23. PROTECT & RETAIN EXISTING GRAVEL ROADWAY. GRADE & SHIM WITH CRUSHED STONE (FINE GRADATION) FOLLOWING CONSTRUCTION, SUBSIDIARY.
TP. EXPLORATORY EXCAVATION WITH ENGINEER IN ADVANCE OF WATER INSTALLATION TO IDENTIFY POTENTIAL UTILITY CROSSING CONFLICTS AND CONFIRM DESIGN ELEVATIONS. REPORT ELEVATION TO ENGINEER BEFORE PROCEEDING WITH THE WORK.

PROFILE VIEW

20 0 20 40
4 0 4 8
HORIZ: 1 INCH = 20 FT.
VERT: 1 INCH = 4 FT.

16" WATER MAIN

CONTINUE 5'-6" COVER IN CROSS COUNTRY SECTION (TYP) WITH NO INTERMEDIATE HIGH POINTS

10" dI water

pig cleanout

MAINTAIN POSITIVE SLOPE FROM LOW POINT TO AIR RELEASE MANHOLES

5'-6"

6" hydrant pipe

12" water main

16" WATER MAIN

DATUM ELEV 150.00

5+25	6+00	7+00	8+00	9+00	10+00	11+00
195.2	192.4	185.4	178.8	171.6	163.5	161.5
					161.4	160.5
					159.8	159.7
					159.7	161.5

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21 By TGP	
	CONSTRUCTION Date 2/9/22 By TGP	
	RECORD DRAWING Date – By –	

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – TIMOTHY G. PAGE No. 10982 – LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE – KEVIN A. PRATT No. 8531 – LICENSED PROFESSIONAL ENGINEER

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

PLAN & PROFILE

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C5
SHEET 9 OF 43

C:\Users\mgr\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_prbase.dwg, C5, 2/7/2022 6:05:44 PM, mg

SEE DWG C5

CROSS 16" DI UNDER 12" RAW WATER LINE TP 16" DI ELEV. 155.0'

22.5° BEND (TYP.)

PROTECT AND MAINTAIN DITCH ALONG ACCESS ROAD

MAINTAIN MIN. 1' FT. OF VERTICAL SEPARATION BETWEEN PIPES.

PROTECT EXISTING 12" CI RW MAIN UNTIL NEW 12" RW MAIN IS IN SERVICE

TBM 4699AE
MAG NAIL SET UP 6" IN POLE PSNH 64/10
ELEV.=169.06'

12" CI WATER LINE TO BE ABANDONED. PROTECT EXISTING RW MAIN IF NEW 12" RAW WATER NOT INSTALLED PER ADD ALT. F

SEE DWG C7

TBM 4699AF
MAG NAIL SET UP 6" IN POLE PSNH 64/8
ELEV.=171.33'

TAX MAP 38, LOT 27A
FELD FAMILY REVOCABLE TRUST OF 2005,
FELD MICHAEL A AND LYNN M TRUSTEES
15 MORIN STREET
DOVER, NH 03820
S.C.R.D. BOOK 3294, PAGE 472

TAX MAP 38, LOT 27B
BROSNIHAN DEBORAH A
256 LONGHILL RD
DOVER, NH 03820
S.C.R.D. BOOK 1622, PAGE 713

SMITH WELL RD

psnh 64/11

psnh 64/9

dirt pile

12" oak

6" maple

10" maple

(3)6" maple

18" oak

20" oak

6" oak

PLAN VIEW

20 0 20 40
SCALE: 1 INCH = 20 FT.

TAX MAP D, LOT 1
CITY OF DOVER
288 CENTRAL AVE
DOVER, NH 03820
S.C.R.D. BOOK 599, PAGE 387

KEY NOTES:

(TP) TP. EXPLORATORY EXCAVATION WITH ENGINEER IN ADVANCE OF WATER INSTALLATION TO IDENTIFY POTENTIAL UTILITY CROSSING CONFLICTS AND CONFIRM DESIGN ELEVATIONS. REPORT ELEVATION TO ENGINEER BEFORE PROCEEDING WITH THE WORK.

(15) INSTALL NEW 16" DI WATER MAIN.

(20) INSTALL NEW 12" DI RAW WATER MAIN **(ADD ALT F)**.

(30) RELOCATE EXISTING RW MAIN UNDER 16" MAIN, SUBSIDIARY.

PROFILE VIEW

20 0 20 40
4 0 4 8
HORIZ: 1 INCH = 20 FT.
VERT: 1 INCH = 4 FT.

5'-6" TYP.

16" & 12" WATER MAINS TO RUN PARALLEL ON OPPOSITE SIDES OF GRAVEL ROAD MIN. 5' SEPARATION

CONSTRUCT PIPE LEVEL, WITH HIGH POINT AT AIR RELEASE MANHOLES DWG C7.

156.0± TEST PIT TO CONFIRM

12" RW MAIN

12" RAW WATER MAIN

16" WATER MAIN

155.0±

DATUM ELEV 150.00

11+00	12+00	13+00	14+00	15+00	16+00	16+75
161.5	163.2	165.2	166.9	168.7	170.2	170.9	171.4	171.7	172.2	172.2	172.1	171.9

ISSUE FOR			APP'D
APPROVAL	Date 12/17/21	By TGP	
CONSTRUCTION	Date 2/9/22	By TGP	
RECORD DRAWING	Date -	By -	

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – TIMOTHY J. PRATT No. 8531 – LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE – THOMAS PAGE No. 10961 – LICENSED PROFESSIONAL ENGINEER

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

PLAN & PROFILE

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C6

SHEET 10 OF 43

C:\Users\mrg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_prbase.dwg, C6, 2/7/2022 8:05:49 PM, mrg

TAX MAP 38, LOT 25B
SWENSON SCOTT J &, SWENSON DEBRA M
18 MORIN ST
DOVER, NH 03820
S.C.R.D. BOOK 2818, PAGE 423

TAX MAP 38, LOT 30
FRIENDS FIDUCIARY CORPORATION
PO BOX 98
DOVER, NH 03820
S.C.R.D. BOOK 2594, PAGE 359

TAX MAP 38, LOT 27B
BROSNIHAN DEBORAH A
256 LONGHILL RD
DOVER, NH 03820
S.C.R.D. BOOK 1622, PAGE 713

(INCIDENTAL TO ADD-ALT ITEM FOR 12" WATER MAIN) RELOCATE EXISTING MANHOLE STRUCTURE & AIR RELEASE VALVE TO 12" DI RW HIGH POINT

REMOVE/REINSTALL GATE AS REQUIRED (INCIDENTAL)

SMITH WELL RD

AIR RELEASE MANHOLE FOR 16" DI WATER MAIN INSTALLED AT HIGH POINT (4/C11)

STA 9+00 TO STA 22+40 (5/C14)

SEE DWG C6

SEE DWG C8

TBM 4699AG
'X' IN BOLT OVER MAIN OUTLET ON HYDRANT
ELEV.=173.82'

TAX MAP D, LOT 1
CITY OF DOVER
288 CENTRAL AVE
DOVER, NH 03820
S.C.R.D. BOOK 599, PAGE 387

area infested w/invasive japanese knotweed

PLAN VIEW

SCALE: 1 INCH = 20 FT.

KEY NOTES:

(2) CONSTRUCT HYDRANT ASSEMBLY, INCLUDING ANCHOR TEE, GATE VALVE & 6" BRANCH PIPE.

(4) INSTALL SILT FENCE. SEE PLAN. SUBSIDIARY TO ITEM . SEE DETAIL (1/C12)

(5) REMOVE EXISTING HYDRANT AND SALVAGE TO OWNER. SUBSIDIARY

(15) INSTALL NEW 16" DI WATER MAIN.

(18) INSTALL 16" HORIZONTAL BEVELED-GEARED GATE VALVE.

(20) INSTALL NEW 12" DI RAW WATER MAIN **(ADD ALT F)**.

(31) 20" HDPE PIPE ADD/DEDUCT ALTERNATE A TO BE INSTALLED BETWEEN APPROX. STA 4+00 AND STA 22+38, IF ACCEPTED. RESTRAIN TO 16" DI PIPE.

PROFILE VIEW

HORIZ: 1 INCH = 20 FT.
VERT: 1 INCH = 4 FT.

AIR RELEASE MANHOLE FOR 16" WATER MAIN (RT)

AIR RELEASE MANHOLE FOR 12" RAW WATER MAIN (LT)

16" & 12" WATER MAINS TO RUN ADJACENT TO EACH OTHER (TYP.)

GRADE WITH CR. GRAVEL OR RECLAIM 22+00 TO 22+40

END PAVEMENT
PVI STA = 22+40
PVI ELEV = 171.54

6" hydrant pipe

DATUM ELEV
155.00

16+75	17+00	18+00	19+00	20+00	21+00	22+00	22+50
171.9	172.1	172.1	172.9	173.5	174.1	173.9	172.8	171.8	171.1	171.0	170.8	171.3	171.70

ISSUE FOR
APPROVAL — By TGP — Date 12/17/21
CONSTRUCTION — By TGP — Date 2/9/22
RECORD DRAWING — By – — Date –

NO.	REVISIONS	APP'D

Drawn/Chk. RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – THOMAS PRATT No. 8531 – LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE – THOMAS PAGE No. 10982 – LICENSED PROFESSIONAL LAND SURVEYOR

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

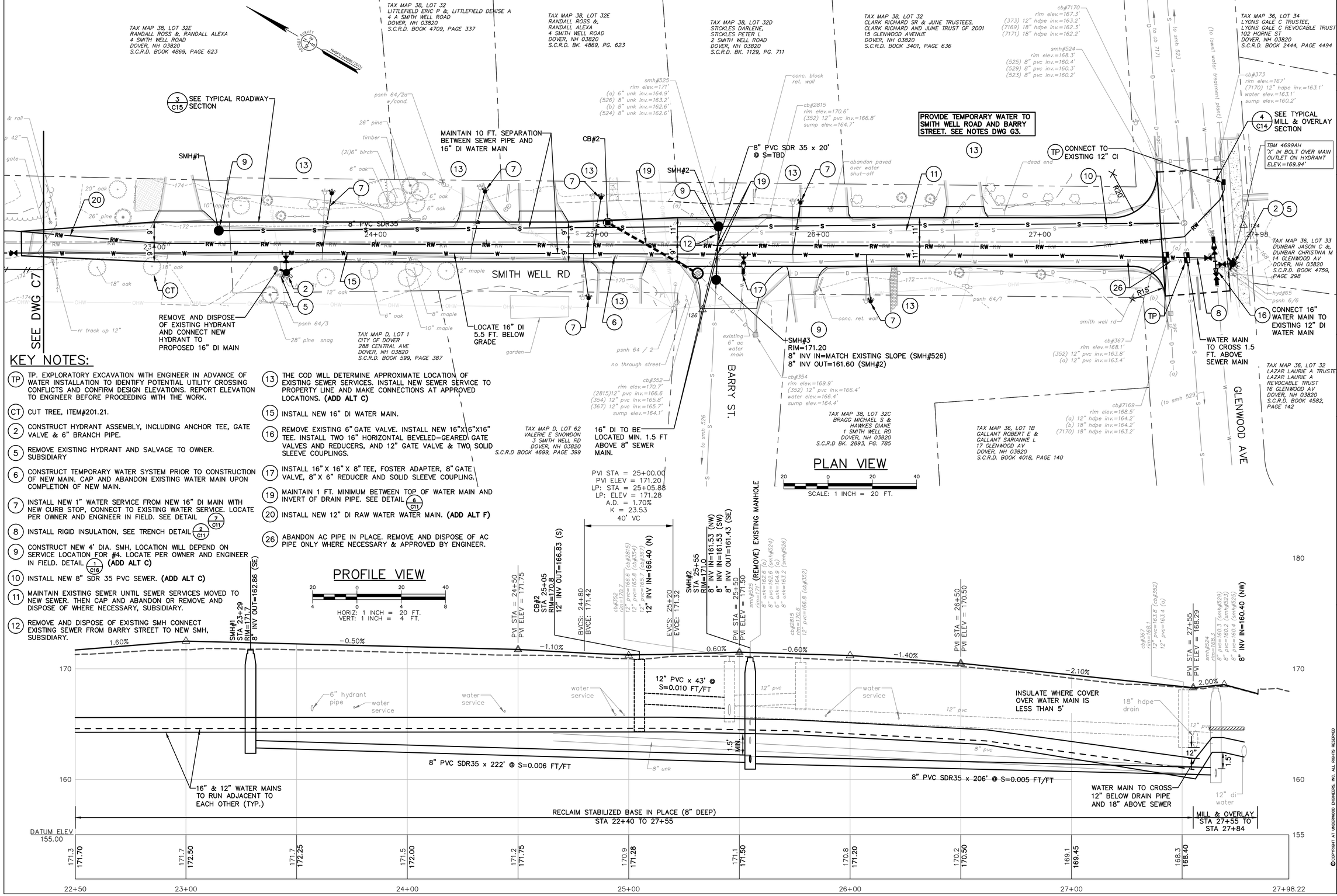
PLAN & PROFILE

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C7
SHEET 11 OF 43

C:\Users\mrg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_prbase.dwg, C7, 2/7/2022 8:05:54 PM, mrg



KEY NOTES:

(TP) TP. EXPLORATORY EXCAVATION WITH ENGINEER IN ADVANCE OF WATER INSTALLATION TO IDENTIFY POTENTIAL UTILITY CROSSING CONFLICTS AND CONFIRM DESIGN ELEVATIONS. REPORT ELEVATION TO ENGINEER BEFORE PROCEEDING WITH THE WORK.

(CT) CUT TREE, ITEM#201.21.

(2) CONSTRUCT HYDRANT ASSEMBLY, INCLUDING ANCHOR TEE, GATE VALVE & 6" BRANCH PIPE.

(5) REMOVE EXISTING HYDRANT AND SALVAGE TO OWNER. SUBSIDIARY

(6) CONSTRUCT TEMPORARY WATER SYSTEM PRIOR TO CONSTRUCTION OF NEW MAIN. CAP AND ABANDON EXISTING WATER MAIN UPON COMPLETION OF NEW MAIN.

(7) INSTALL NEW 1" WATER SERVICE FROM NEW 16" DI MAIN WITH NEW CURB STOP, CONNECT TO EXISTING WATER SERVICE. LOCATE PER OWNER AND ENGINEER IN FIELD. SEE DETAIL 7/C11

(8) INSTALL RIGID INSULATION, SEE TRENCH DETAIL 2/C11

(9) CONSTRUCT NEW 4' DIA. SMH, LOCATION WILL DEPEND ON SERVICE LOCATION FOR #4. LOCATE PER OWNER AND ENGINEER IN FIELD. DETAIL 1/C16 **(ADD ALT C)**

(10) INSTALL NEW 8" SDR 35 PVC SEWER. **(ADD ALT C)**

(11) MAINTAIN EXISTING SEWER UNTIL SEWER SERVICES MOVED TO NEW SEWER. THEN CAP AND ABANDON OR REMOVE AND DISPOSE OF WHERE NECESSARY, SUBSIDIARY.

(12) REMOVE AND DISPOSE OF EXISTING SMH CONNECT EXISTING SEWER FROM BARRY STREET TO NEW SMH, SUBSIDIARY.

(13) THE COD WILL DETERMINE APPROXIMATE LOCATION OF EXISTING SEWER SERVICES. INSTALL NEW SEWER SERVICE TO PROPERTY LINE AND MAKE CONNECTIONS AT APPROVED LOCATIONS. **(ADD ALT C)**

(15) INSTALL NEW 16" DI WATER MAIN.

(16) REMOVE EXISTING 6" GATE VALVE. INSTALL NEW 16"X16"X16" TEE. INSTALL TWO 16" HORIZONTAL BEVELED-GEARED GATE VALVES AND REDUCERS, AND 12" GATE VALVE & TWO SOLID SLEEVE COUPLINGS.

(17) INSTALL 16" X 16" X 8" TEE, FOSTER ADAPTER, 8" GATE VALVE, 8" X 6" REDUCER AND SOLID SLEEVE COUPLING.

(19) MAINTAIN 1 FT. MINIMUM BETWEEN TOP OF WATER MAIN AND INVERT OF DRAIN PIPE. SEE DETAIL 6/C11

(20) INSTALL NEW 12" DI RAW WATER MAIN. **(ADD ALT F)**

(26) ABANDON AC PIPE IN PLACE. REMOVE AND DISPOSE OF AC PIPE ONLY WHERE NECESSARY & APPROVED BY ENGINEER.

ISSUE FOR	By	Date
APPROVAL	TGP	12/17/21
CONSTRUCTION	TGP	2/9/22
RECORD DRAWING	–	–

NO.	REVISIONS	APP'D

Drawn/Chk. RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – THOMAS PRATT No. 8531 – LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE – THOMAS PAGE No. 10961 – LICENSED PROFESSIONAL LANDSCAPE ARCHITECT

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

PLAN & PROFILE

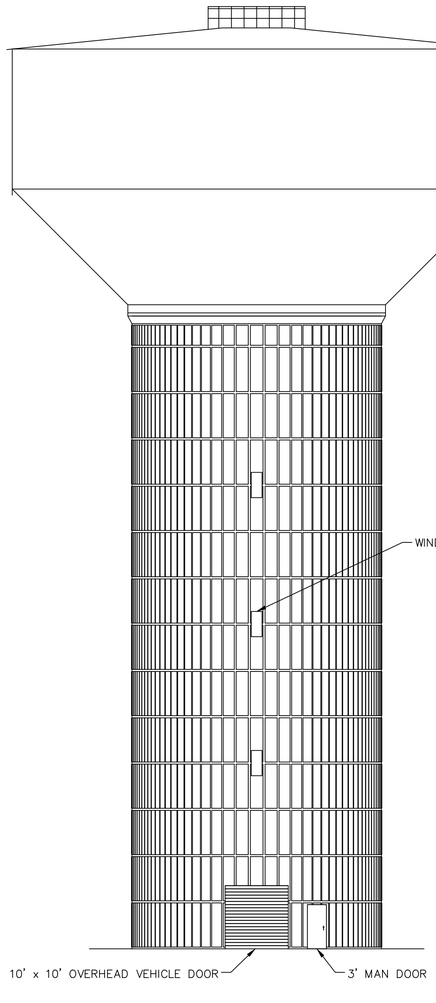
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

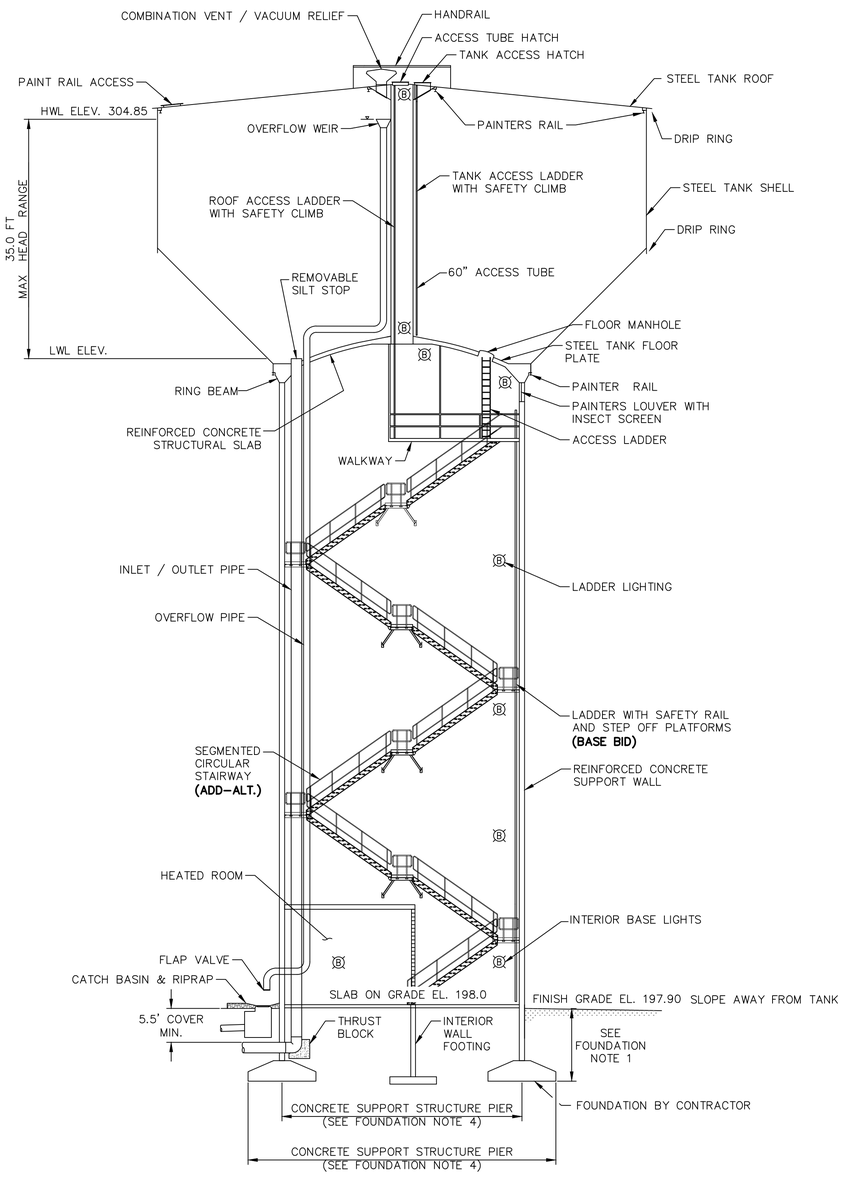
©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C8
SHEET 12 OF 43

C:\Users\mg\Desktop\desktop working files\Real Numbered\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_prbase.dwg, C8, 2/7/2022 6:05:59 PM, mg



ELEVATION
NOT TO SCALE



SECTION
NOT TO SCALE

NOTES:

GENERAL:

1. SEE CONTRACT SPECIFICATIONS FOR DESIGN CRITERIA AND DETAILS. APPLICABLE ELEVATED TANK SPECIFICATIONS ARE AWWA D107 AND ACI 318, MOST RECENT VERSION. STRUCTURAL DESIGN LOADS DEVELOPED USING AWWA D107 AND BY REFERENCE ASCE 7 SHALL CONSIDER THIS TO BE A RISK CATEGORY IV STRUCTURE.
2. STEEL TANK FLOOR WITHIN THE PERIMETER OF THE CONCRETE SUPPORT PEDESTAL SHALL BE SUPPORTED BY A STRUCTURAL CONCRETE SLAB.
3. PROVIDE ADEQUATE FREEBOARD TO ENSURE ROOF PROJECTIONS AND PAINTER RAIL REMAIN ABOVE THE HIGH WATER LEVEL AND TO MEET MINIMUM SLOSHING WAVE HEIGHT REQUIREMENTS PER AWWA D107 SECTION 4.2.8.8.
4. CONCRETE PEDESTAL EXTERIOR SHALL INCORPORATE HORIZONTAL AND VERTICAL RUSTICATIONS TO CREATE A SYMMETRICAL ARCHITECTURAL PATTERN. SEE CONTRACT SPECIFICATIONS.
5. SEE CONTRACT SPECIFICATIONS FOR STEEL TANK COATING REQUIREMENTS.
6. TANK APPURTENANCES ARE ROTATED FOR CLARITY.
7. AS-BUILT DRAWINGS TO BE PROVIDED BY TANK CONTRACTOR.

FOUNDATION:

1. REFER TO THE GEOTECHNICAL REPORT FOR RECOMMENDATIONS REGARDING ALLOWABLE BEARING CAPACITY AND MINIMUM FROST DEPTH.
2. DESIGN LOADS IN ACCORDANCE WITH AWWA D107 (LATEST VERSION).
3. DESIGN CONCRETE FOUNDATION IN ACCORDANCE WITH ACI 318 (LATEST VERSION).
4. CONCRETE SUPPORT STRUCTURE DIAMETER AND DIMENSIONS OF FOUNDATION SHALL BE DETERMINED BY THE TANK CONTRACTOR'S ENGINEER OF RECORD. BASED UPON THE SOIL BEARING SPECIFIED AND MINIMUM FROST DEPTH PER THE RECOMMENDATIONS IN THE GEOTECHNICAL REPORT.

MECHANICAL:

1. INLET / OUTLET AND OVERFLOW PIPING WITHIN THE CONCRETE PEDESTAL SHALL BE TYPE 304L STAINLESS STEEL.
2. PROVIDE HANGERS, BRACKETS, AND THRUST RESTRAINT AS REQUIRED.
3. OVERFLOW SYSTEM SHALL BE DESIGNED TO ACCOMMODATE MAXIMUM FILL RATE. SEE CONTRACT SPECIFICATION.
4. REMOVABLE SILT STOP SHALL BE 6 INCHES ABOVE TANK FLOOR.
5. HIGH PRESSURE ZONE CONNECTION/FUTURE BOOSTER PUMP SUCTION SUPPLY SHALL BE SEPARATE 8" SS PIPE FROM TANK TO PUMP SYSTEM (NOT SHOWN IN SECTION).
6. ELECTRIC TANK MIXER SHALL BE SUSPENDED FROM THE TANK ACCESS HATCH. SEE PROCESS AND ELECTRICAL DRAWINGS AND SPECIFICATIONS.

MISCELLANEOUS METAL:

1. ALL STAIRS, LADDERS AND LANDINGS SHALL BE GALVANIZED STEEL.
2. PROVIDE ALUMINUM SAFETY RAILS ON ALL STAIRS AND LADDERS.
3. ROOF ACCESS TUBE AND TANK ACCESS HATCHES SHALL BE 30" SQUARE.
4. A REMOVABLE ALUMINUM LOUVER SHALL BE INSTALLED AT THE UPPER LANDING FOR ACCESS TO THE EXTERIOR PAINTER RAIL.
5. COORDINATE LADDER OR STAIR DESIGN TO PROVIDE ACCESS TO HEATED ROOM ROOF.
6. LADDER TO UPPER WALKWAY SHALL HAVE STEP OFF PLATFORMS (30' MAX. SPACING AND SAFETY RAIL)
7. STEEL STAIRS (ADD ALT) SHALL MEET DESIGN GUIDE 34: STEEL-FRAMED STAIRWAY DESIGN USING OSHA STANDARDS. THE STAIR PLANS AND CALCULATIONS ARE TO BE SEALED BY A NH PE AND ARE TO BE SUBMITTED FOR REVIEW.

ELECTRICAL:

1. MOUNT BASE LIGHTS 10 PER ELECTRICAL DRAWINGS.
2. STAIRS AND LADDER LIGHTS SHALL BE SPACED PER ELECTRICAL DRAWINGS.
3. OBSTRUCTION LIGHT ON TOP OF TANK NOT REQUIRED PER FAA REVIEW.

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21	By TGP
	CONSTRUCTION Date 2/9/22	By TGP
	RECORD DRAWING Date -	By -

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE - LICENSED PROFESSIONAL ENGINEER - No. 8531 - KEITH PRATT

STATE OF NEW HAMPSHIRE - LICENSED PROFESSIONAL ENGINEER - No. 10982 - THOMAS PAGE

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

TANK DETAILS I

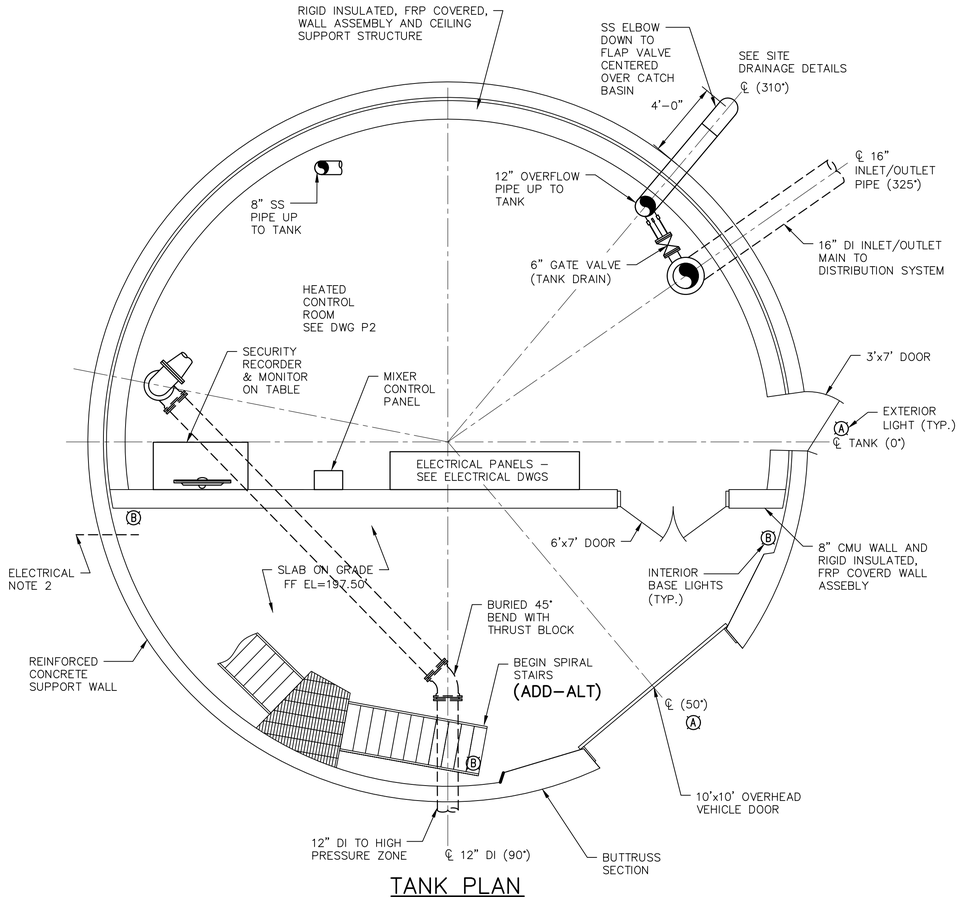
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

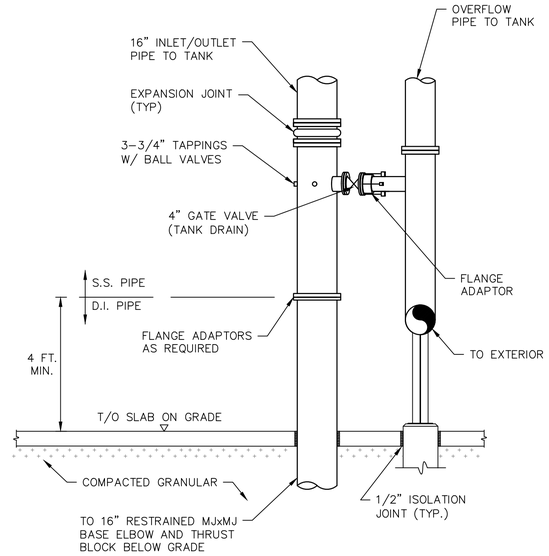
DWG NO C9
SHEET 13 OF 43

C:\Users\mg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, 03. 2/7/2022 6:18:05 PM, mg



TANK PLAN

SCALE: 1/4"=1'-0"



MECHANICAL PIPING SECTION VIEW

NOT TO SCALE

NOTES:

GENERAL:

1. MAN DOOR – 3' WIDE X 7' HIGH, INSULATED METAL DOOR WITH 16 GA. FRAME AND HEAVY DUTY CLOSURE.
2. VEHICLE DOOR – 10' WIDE X 10' HIGH ROLLING STEEL WITH INSULATED 20 GA. GALVANIZED SLATS AND MOTORIZED OPERATOR.
3. PROVIDE MONOLITHIC REINFORCED CONCRETE INTERNAL BUTTRESS SECTION ON EACH SIDE OF VEHICLE DOOR. BUTTRESS TO BE MINIMUM 3'-6" WIDE AND 6" THICKER THAN NOMINAL WALL DIMENSION.

SLAB ON GRADE:

1. PROVIDE A 6" THICK 4000 PSI CONCRETE FLOOR ON COMPACTED GRANULAR FILL REINFORCED WITH #4 BARS AT 12" CENTERS EACH WAY. PROVIDE THICKENED REINFORCED SLAB UNDER CMU WALL.
2. PROVIDE 1/2" ISOLATION JOINT BETWEEN FLOOR AND WALL AND AT ALL FLOOR PENETRATIONS. CAP WITH SELF LEVELING SEALANT.
3. SAWCUT CONTROL JOINTS 1 1/2" DEEP AT 20 FEET MAXIMUM CENTERS.
4. SLOPE SLAB MINIMUM 0.5% TO VEHICLE DOOR FOR DRAINAGE.

MECHANICAL:

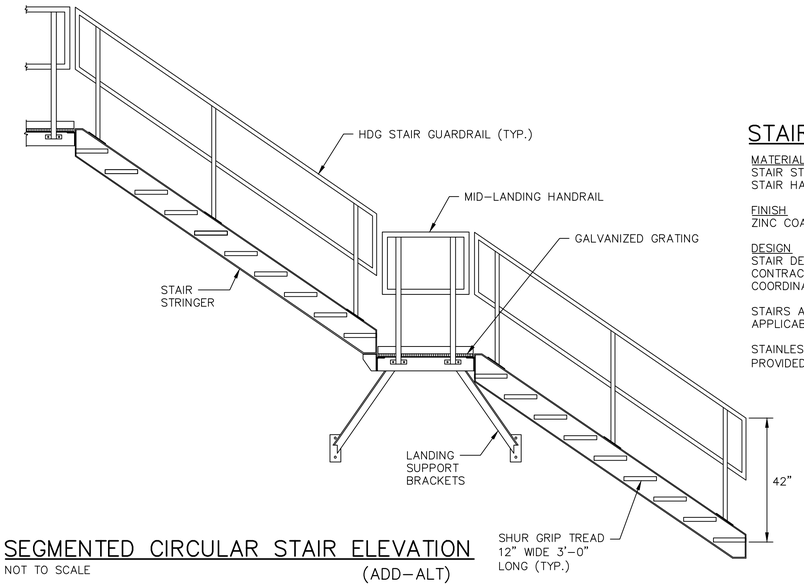
1. PROVIDE EXPANSION JOINT ON INLET/OUTLET RISER OVERFLOW, AND PUMP SUCTION RISER TO ACCOMMODATE MAXIMUM POTENTIAL DIFFERENTIAL MOVEMENT.
2. CONNECT RISER AND OVERFLOW WITH A VALVED LATERAL FOR TANK DRAINING.
3. PROVIDE THRUST RESTRAINT AND SUPPORT AS REQUIRED.
4. INSTALL 3 PC. 3/4" TAPPINGS COMPLETE WITH BRONZE BALL VALVE AND PLUG ON INLET/OUTLET PIPE.
5. ALL INLET/OUTLET PIPES TO BE INSULATED AND CLAD WITH ALUMINUM JACKET WHERE REQUIRED FOR FREEZE PROTECTION. SEE SPECIFICATION.
6. ELECTRIC TANK MIXER SHALL BE SUSPENDED FROM THE TANK ACCESS HATCH. SEE PROCESS AND ELECTRICAL DRAWINGS AND SPECIFICATIONS.

ELECTRICAL:

1. MOUNT EXTERIOR DOOR LIGHTS PER ELECTRICAL DRAWINGS.
2. PROVIDE (4) 6"C SPARE CONDUITS FOR FUTURE COMMUNICATIONS AT LOCATION APPROVED BY OWNER.
3. SEE ELECTRICAL DRAWINGS FOR ADDITIONAL REQUIREMENTS.

CONTROL ROOM:

1. SEE PROCESS DRAWINGS FOR CONTROL ROOM PLAN AND DETAILS.
2. SEE SPECIFICATIONS FOR HEATED ROOM REQUIREMENTS. TANK VENDOR TO SUBMIT DESIGN FOR HEATED ROOM WALLS & CEILING FOR APPROVAL.
3. GENERAL CONTRACTOR TO PROVIDE ALL DOORS, INSULATION, FINISHES, ELECTRICAL, MECHANICAL, PIPING ETC. NOT PROVIDED BY TANK CONTRACTOR.



SEGMENTED CIRCULAR STAIR ELEVATION (ADD-ALT)

NOT TO SCALE

STAIR NOTES:

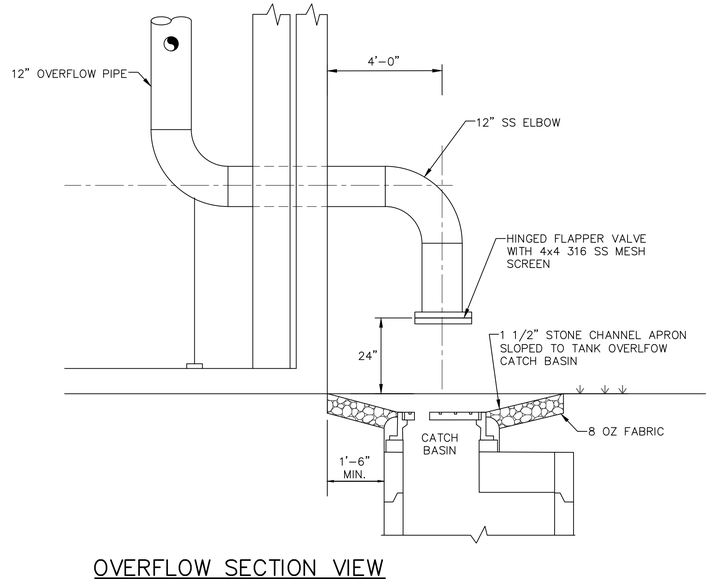
MATERIAL SPECIFICATIONS
STAIR STRINGER – ASTM A36 OR EQUAL
STAIR HANDRAIL – ASTM A53 OR A500 OR EQUAL

FINISH
ZINC COATING – ASTM A123

DESIGN
STAIR DESIGN TO BE COMPLETED BY TANK CONTRACTOR AND LOCATED AS NEEDED TO COORDINATE WITH HEATED ROOM

STAIRS AND GUARDRAILS TO COMPLY WITH APPLICABLE OSHA AND IBC REQUIREMENTS.

STAINLESS STEEL CONTINUOUS HANDRAILS TO BE PROVIDED 34" ABOVE TREND NOSING.



OVERFLOW SECTION VIEW

NOT TO SCALE

ISSUE FOR		
APPROVAL	Date 12/17/21	By TGP
CONSTRUCTION	Date 2/9/22	By TGP
RECORD DRAWING	Date -	By -

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – TIMOTHY G. PRATT No. 8531 – LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE – THOMAS A. PAGE No. 10982 – LICENSED PROFESSIONAL ENGINEER

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

TANK DETAILS II

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

DWG NO	SHEET
C10	14 OF 43

C:\Users\mgChoate\Desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, C10, 2/7/2022 6:18:08 PM, mng

NOTES:

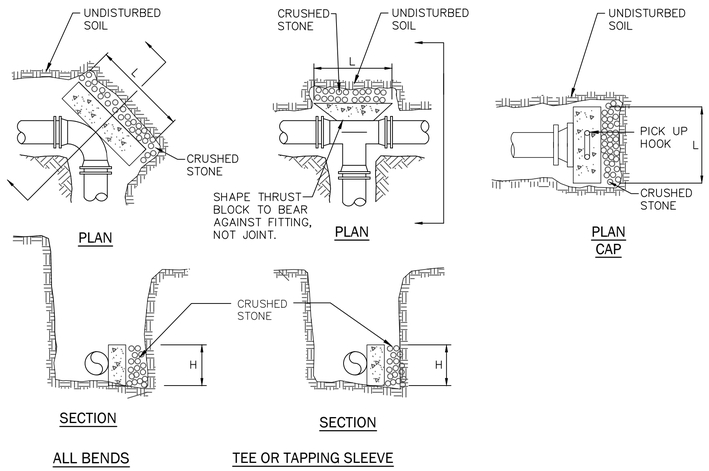
1. ALL THRUST BLOCKS SHALL BE PRE-CAST CONCRETE.
2. THE MINIMUM BEARING AREAS SHOWN IN THE THRUST BLOCK SCHEDULE ARE BASED ON A SYSTEM PRESSURE OF 100 PSI. IF THE SYSTEM PRESSURE IS ABOVE 100 PSI, INCREASE THE NOTED AREAS PROPORTIONAL TO THE ACTUAL SYSTEM PRESSURE. FOR EXAMPLE, IF THE ACTUAL SYSTEM PRESSURE IS 160 PSI, MULTIPLY THE ABOVE VALUES BY 160%.
3. SELECT THRUST BLOCKS SUCH THAT THE LENGTH (L) OF THE BLOCK IS APPROX. TWICE AS LONG AS THE DEPTH (H).
4. PLACE CRUSHED STONE BEHIND THRUST BLOCKS AGAINST UNDISTURBED SOIL.
5. PLACE THRUST BLOCKS ALONG THE FULL LENGTH OF THE FITTING TO MAXIMIZE BEARING AREA.
6. PLACE 2 LAYERS OF POLYETHYLENE OR ROOFING PAPER AROUND FITTINGS AS PROTECTION AGAINST DAMAGE FROM CONCRETE BLOCK.
7. PLACE A 12" LONG STEEL HORSESHOE-SHAPED PICKUP HOOK IN ALL PLUG AND CAP THRUST BLOCKS. DIAMETER OF HOOK SHALL BE A MINIMUM OF 5/8".
8. COAT ALL THREADED RODS, NUTS, AND BOLTS WITH BITUMINOUS PAINT.
9. PLACE ANTI-SEIZE LUBRICANT ON ALL BOLTS.
10. CONCRETE COMPRESSIVE STRENGTH: 2,000 PSI MINIMUM.
11. USE OF THRUST BLOCKS DOES NOT ELIMINATE THE REQUIREMENT OF OTHER RESTRAINTS. ALL VALVES AND FITTINGS SHALL BE RESTRAINED MJ.

THRUST BLOCK SCHEDULE

MINIMUM BEARING AREA (SQUARE FEET)

	PIPE SIZE					
Nominal Dia. (in)	4	6	8	10	12	16
Tees, Caps, Plugs, & Tapping Sleeves	1.05	2.32	4.15	6.37	9.15	16.23
90 Degree Bends	1.48	3.29	5.86	9.01	12.93	22.96
45 Degree Bends	0.80	1.78	3.17	4.88	7.00	12.42
22-1/2 Degree Bends	0.41	0.91	1.62	2.49	3.57	6.33
11-1/4 Degree Bends	0.21	0.46	0.81	1.25	1.79	3.18

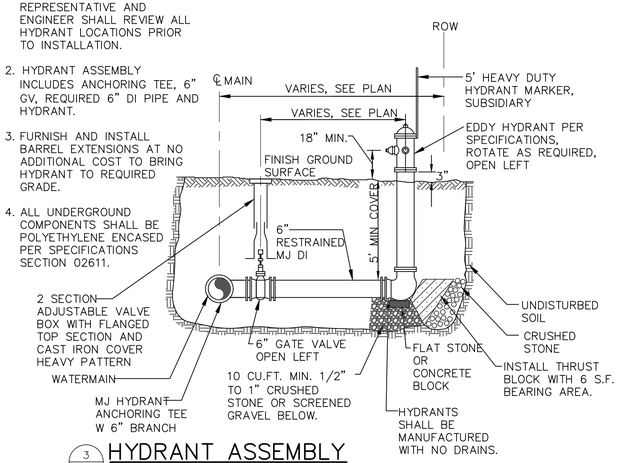
System Pressure: 100 psi
Safety Factor: 1.5
Soil Bearing Capacity: 2,000 psf



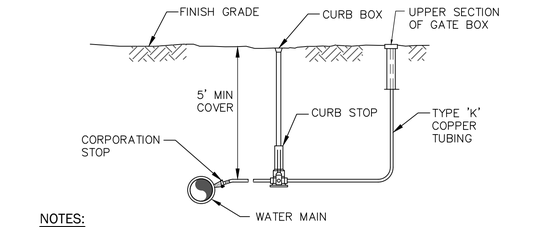
1 / C11 PRECAST CONCRETE THRUST BLOCKS AND ANCHORS
NOT TO SCALE

NOTES:

1. CONTRACTOR WITH OWNER'S REPRESENTATIVE AND ENGINEER SHALL REVIEW ALL HYDRANT LOCATIONS PRIOR TO INSTALLATION.
2. HYDRANT ASSEMBLY INCLUDES ANCHORING TEE, 6" GV, REQUIRED 6" DI PIPE AND HYDRANT.
3. FURNISH AND INSTALL BARREL EXTENSIONS AT NO ADDITIONAL COST TO BRING HYDRANT TO REQUIRED GRADE.
4. ALL UNDERGROUND COMPONENTS SHALL BE POLYETHYLENE ENCASED PER SPECIFICATIONS SECTION 02611.



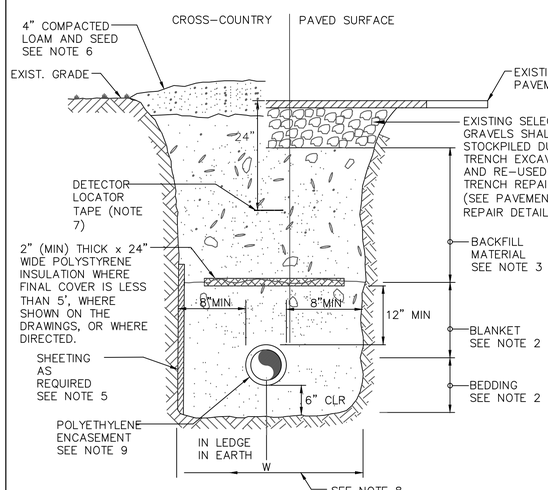
3 / C11 HYDRANT ASSEMBLY
NOT TO SCALE



NOTES:

1. DIRECT PIPING AWAY FROM ROADWAY.
2. CHLORINE INJECTION AND MANUAL AIR RELEASE ASSEMBLIES ARE TO BE REMOVED IMMEDIATELY FOLLOWING A SUCCESSFUL BACTERIA TEST. LEAVE THE CORPORATION STOP AND 12" LENGTH OF TUBING (WITH A CRIMPED END) IN PLACE.
3. SIZE AS NOTED ON PLAN OR 1" MINIMUM.
4. CHLORINE INJECTION TAPS OR MANUAL AIR RELEASE ARE SUBSIDIARY TO WATER MAIN PAY ITEM. (NOT MEASURED FOR PAYMENT)

5 / C11 TYPICAL CHLORINE INJECTION TAP AND/OR MANUAL AIR RELEASE ASSEMBLY
NOT TO SCALE

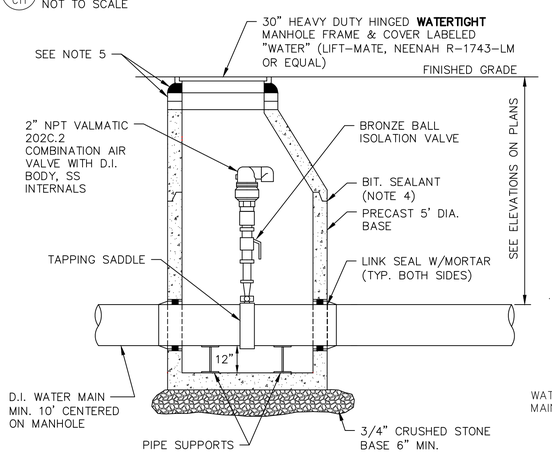


2 / C11 TRENCH - WATER
NOT TO SCALE

WATER TRENCH NOTES:

1. ORDERED EXCAVATION OF UNSUITABLE MATERIAL BELOW GRADE: BACKFILL AS STATED IN THE TECHNICAL SPECIFICATIONS OR AS SHOWN ON THE DRAWINGS.
2. BEDDING AND BLANKET: CLEAN SAND FREE FROM ORGANIC MATTER (SECTION 02200). COMPACT PER SPECIFICATIONS.
3. BACKFILL MATERIAL: IN ROADS, ROAD SHOULDERS, WALKWAYS AND TRAVELED WAYS, SUITABLE MATERIAL FOR TRENCH BACKFILL SHALL BE THE NATURAL MATERIAL EXCAVATED DURING THE COURSE OF CONSTRUCTION, BUT SHALL EXCLUDE DEBRIS; PIECES OF PAVEMENT; ORGANIC MATTER; TOP SOIL; ALL WET OR SOFT MUCK, PEAT, OR CLAY; ALL EXCAVATED LEDGE MATERIAL; ALL ROCKS OVER 6 INCHES IN LARGEST DIMENSION; AND ANY MATERIAL WHICH, AS DETERMINED BY THE ENGINEER, WILL NOT PROVIDE SUFFICIENT SUPPORT OR MAINTAIN THE COMPLETED CONSTRUCTION IN A STABLE CONDITION.

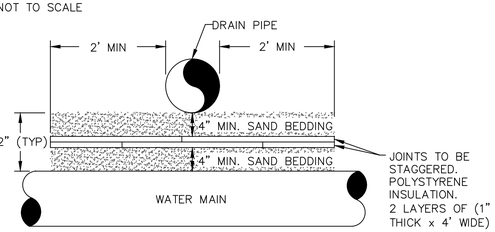
   IN CROSS-COUNTRY CONSTRUCTION, SUITABLE MATERIAL SHALL BE AS DESCRIBED ABOVE, EXCEPT THAT THE ENGINEER MAY PERMIT THE USE OF TOP SOIL, LOAM, MUCK, OR PEAT, IF ENGINEER IS SATISFIED THAT THE COMPLETED CONSTRUCTION WILL BE ENTIRELY STABLE AND PROVIDED THAT EASY ACCESS TO THE PIPE LINE, FOR MAINTENANCE AND POSSIBLY RECONSTRUCTION, WILL BE PRESERVED.
4. MINIMUM COVER NOT LESS THAN 5 FEET, AND TO AVOID EXISTING AND PROPOSED STRUCTURES. PIPE TO BE DEEPER THAN 5' IF NECESSARY TO AVOID CONFLICTS WITH EXISTING AND PROPOSED DRAINAGE OR OTHER UTILITIES.
5. SHEETING, IF REQUIRED: WHERE SHEETING IS PLACED ALONGSIDE THE PIPE AND EXTENDS BELOW MID-DIAMETER, IT SHALL BE CUT OFF AND LEFT IN PLACE TO AN ELEVATION 1 FOOT ABOVE THE TOP OF PIPE. WHERE SHEETING IS ORDERED BY THE ENGINEER TO BE LEFT IN PLACE, IT SHALL BE CUT OFF AT LEAST 3 FEET BELOW FINISHED GRADE, BUT NOT LESS THAN 1 FOOT ABOVE THE TOP OF THE PIPE.
6. FOR CROSS COUNTRY CONSTRUCTION, BACKFILL OR FILL SHALL BE MOUNDED TO A HEIGHT OF 6 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
7. LOCATOR TAPE TO BE TERRA TAPE SENTRY LINE 1350 OR EQUAL.
8. W = MAXIMUM ALLOWABLE TRENCH PAYMENT WIDTH: FOR ROCK EXCAVATION, FOR ORDERED EXCAVATION BELOW GRADE AND HANDLING OF EXCAVATED CONTAMINATED SOILS. FOR PIPES 16 INCHES NOMINAL DIAMETER OR LESS, W SHALL BE NO MORE THAN 36 INCHES. FOR PIPES GREATER THAN 16 INCHES IN NOMINAL DIAMETER, W SHALL BE 24 INCHES PLUS PIPE OUTSIDE DIAMETER (O.D.)
9. ALL DUCTILE IRON WATER MAIN, FITTINGS AND GATE VALVES SHALL BE ENCASED IN POLYETHYLENE IN ACCORDANCE WITH SPECIFICATIONS SECTION 02611. SHEETS OR TUBES SHALL BE TIGHTLY WRAPPED AROUND THE PIPE & SECURED AT 2' INTERVALS.



NOTE:

1. TAP AND ISOLATION VALVE TO BE SAME SIZE AS AIR VALVE.
2. ALL PIPE AND FITTINGS IN THE MANHOLE SHALL BE NSF 61 BRASS OR BRONZE UNLESS NOTED.
3. INSTALL WATER MAIN AT DEPTH AND LOCATION OF HIGH POINT AS SHOWN ON THE DRAWINGS UNLESS APPROVED OTHERWISE.
4. BITUMATIC SEALANT SHALL FILL 75% OF JOINT CAVITY.
5. ADJUST TO GRADE WITH A MINIMUM OF 2 COURSES OF BRICK AND FRAME SET ON A FULL BED OF MORTAR (MAX. ADJUSTMENT SHALL BE 12"). PARGE EXTERIOR OF BRICK PRIOR TO BACKFILL.

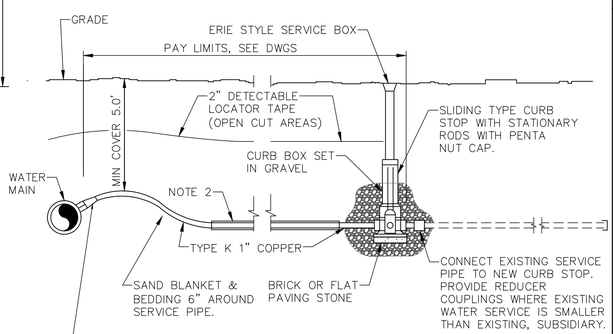
4 / C11 AIR RELEASE MANHOLE
NOT TO SCALE



NOTES:

1. INSULATION TO BE USED WHERE PIPE SEPARATION IS LESS THAN 12", SUBSIDIARY.

6 / C11 DRAIN PIPE CROSSING DETAIL
NOT TO SCALE



NEW SERVICE CONNECTION NOTES:

1. INSTALL NEW CURB STOP AT PROPERTY LINE OR AT LOCATION APPROVED BY THE ENGINEER. CONNECT TEMP. WATER SYSTEM TO NEW CURB STOP AFTER DISINFECTION. CONNECT NEW SERVICE LINE TO NEW CURB STOP AFTER PRESSURE TESTING AND DISINFECTION OF NEW MAIN.
2. PROVIDE NEW LINE USING CONTINUOUS LENGTHS OF SERVICE TUBING. COUPLINGS ARE NOT ALLOWED BETWEEN CORPORATION AND CURB STOP WITHOUT APPROVAL OF ENGINEER.
3. TAPS TO BE MADE AT APPROX. 2:00 AND 10:00.
4. PROVIDE FOR SERVICE LINE CONTRACTION AND EXPANSION BY INSTALLING "S" IN SERVICE LINE NEAR MAIN.
5. PROVIDE 5' MINIMUM COVER, UNLESS DIRECTED OTHERWISE.
6. BLANKET AROUND SERVICE PIPE TO BE SAND ONLY.
7. ALL SERVICES SHALL BE 1" MINIMUM. PROVIDE REDUCER COUPLINGS WHERE EXISTING SERVICES ARE LESS THAN SPECIFIED SIZES. CONFIRM SIZE AND LOCATION WHERE DESIGNATED.
8. PROVIDE SERVICE SADDLES FOR SERVICES EXCEEDING 1" DIA. SADDLES SHALL HAVE DOUBLE STAINLESS STEEL STRAPS.

7 / C11 NEW SERVICE CONNECTION
NOT TO SCALE

ISSUE FOR	By	Date
APPROVAL	TGP	12/17/21
CONSTRUCTION	TGP	2/9/22
RECORD DRAWING	-	-

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE - TIMOTHY J. PRATT No. 8631 - LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE - THOMAS PAGE No. 10982 - LICENSED PROFESSIONAL ENGINEER

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

WATER DETAILS
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C11
SHEET 15 OF 43

C:\Users\mpg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, C11, 2/7/2022 6:18:13 PM, mpg

EROSION & SEDIMENTATION CONTROL NOTES:

DURING CONSTRUCTION AND THEREAFTER, EROSION CONTROL MEASURES ARE TO BE IMPLEMENTED AS NOTED:

1. EXTENT OF CLEARING IS SHOWN ON THE GRADING PLANS.
2. INITIAL EROSION CONTROL MEASURES TO BE INSTALLED PRIOR TO START OF CONSTRUCTION
   - PROVIDE A STABILIZED CONSTRUCTION ENTRANCE
   - DEFINE CLEARING LIMITS IN FIELD AS SHOWN ON THE DRAWINGS.
   - INSTALL SILT FENCE IN LOCATIONS SHOWN ON THE DRAWINGS (AFTER CLEARING) OR AS DIRECTED BY THE ENGINEER.
3. THE SMALLEST PRACTICABLE AREA OF LAND SHALL BE EXPOSED FOR THE SHORTEST PRACTICAL PERIOD AT ANY GIVEN TIME DURING CONSTRUCTION. EXPOSED AREAS SHALL BE PERMANENTLY STABILIZED WITHIN 48 HOURS OF FINISH GRADING.
4. CLEAR, GRUB AND STRIP TOPSOIL. REMOVE TREES, STUMPS, VEGETATION, ROOTS, OR OTHER OBJECTIONABLE MATERIAL. TOPSOIL WILL BE STOCKPILED. USING PERIMETER SILT FENCE AND SHALL BE SEEDED AND MULCH WEEKLY AS SOIL IS ADDED TO IT. ESTABLISH A STAGING, EQUIPMENT AND STORAGE AREA WITHIN THE LIMITS OF WORK.
5. EXCAVATION AND EARTHWORK SHALL BE CONDUCTED IN A MANNER THAT WILL MINIMIZE EFFECTS OF EROSION THROUGHOUT CONSTRUCTION.
6. CONSTRUCT SITE IMPROVEMENTS AND DRAINAGE STRUCTURES AS SHOWN ON THE DRAWINGS. REFER TO DRAINAGE AND EROSION DETAILS FOR ADDITIONAL INFORMATION.
7. AS DRAINAGE ELEMENTS ARE CONSTRUCTED, INSTALL STONE CHECK DAMS IN DRAINAGE SWALES. SEED AND MULCH AREAS AS REQUIRED BELOW.
8. SEEDING AND MULCHING:
   A. TEMPORARY SEEDING AND MULCHING:
      - TEMPORARILY SEED WITCH ANNUAL RYEGRASS AND MULCH DISTURBED AREAS THAT WILL NOT BE BROUGHT TO FINAL GRADE FOR MORE THAN 21 DAYS.
      - TEMPORARILY MULCH DISTURBED AREAS, INCLUDING STOCKPILES, WHICH WILL NOT BE WORKED FOR 7 TO 21 DAYS WITH CHOPPED HAY AND NETTING
      - SLOPES STEEPER THAN 3:1 PROVIDE EROSION CONTROL BLANKET.
   B. PERMANENT SEEDING AND MULCHING:
      - ALL DISTURBED AREAS TO BE VEGETATED SHALL BE COVERED WITH A MINIMUM OF 4 INCHES OF SCREENED TOPSOIL, SEEDED, FERTILIZED AND MULCHED AS REQUIRED TO PROVIDE A PERMANENT, DENSE, HEALTHY GROWTH OF GRASS.
      - FERTILIZER IS NOT PERMITTED WITHIN 400' WELL PROTECTIVE RADIUS.
      - ALL AREAS TO BE TOP SOILED SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 4 INCHES PRIOR TO PLACEMENT OF TOPSOIL.
      - SLOPES FLATTER THAN 3:1 PROVIDE CHOPPED HAY MULCH WITH NETTING.
      - SLOPES EXCEEDING 3:1 PROVIDE EROSION CONTROL BLANKET.
9. HAY OR STRAW MULCH SHALL BE APPLIED AT A RATE OF TWO BALES PER 1,000 SQUARE FEET (OR APPROXIMATELY TWO TONS PER ACRE).
10. TEMPORARY EROSION CONTROL MEASURES ARE TO BE MAINTAINED AND KEPT CLEAN UNTIL ALL EXPOSED AREAS HAVE ESTABLISHED VEGETATION, AT WHICH TIME TEMPORARY MEASURES ARE TO BE REMOVED.
11. THE EROSION CONTROL SPECIFIED AND DETAILED ON THE PLANS SHALL BE CONSIDERED THE MINIMUM REQUIRED AND IS TO BE USED AS A GUIDELINE ONLY. ADDITIONAL MEASURES MAY BE DICTATED BY FIELD CONDITIONS. PROVIDE ADDITIONAL EROSION CONTROL AS REQUIRED BY THE TOWN, STATE OR THE ENGINEER. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING EROSION CONTROL DURING CONSTRUCTION AND UNTIL PERMANENT VEGETATION IS ESTABLISHED.
12. HAY BALES, SILT FENCING AND EROSION STONE SHALL BE INSTALLED WHERE NECESSARY TO MINIMIZE THE EFFECTS OF EROSION. ALL WORK SHALL BE COMPLETED IN CONFORMANCE WITH THE LATEST EDITION OF "STORM WATER MANAGEMENT AND EROSION AND SEDIMENT CONTROL HANDBOOK FOR URBAN AND DEVELOPING AREAS IN NEW HAMPSHIRE" TO PREVENT THE DEGRADATION OF DOWNSTREAM PROPERTIES AND DRAINAGE.
13. DRAINAGE SWALES SHALL BE MONITORED AND MAINTAINED THROUGHOUT OPERATION. SILT SHALL BE PERIODICALLY REMOVED FROM SWALES AS NECESSARY TO PREVENT SOIL MIGRATION.
14. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURRED: FINISHED COURSE GRAVELS HAVE BEEN INSTALLED; A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED; A MINIMUM OF 3" OF NON-EROSIVE MATERIALS SUCH AS STONE OR RIP RAP HAS BEEN PROPERLY INSTALLED; OR EROSION CONTROL BLANKETS HAVE BEEN PROPERLY INSTALLED.
15. WINTER CONSTRUCTION NOTES:
   A. ALL PROPOSED VEGETATED AREAS WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15TH, OR WHICH ARE DISTURBED AFTER OCTOBER 15TH, SHALL BE STABILIZED BY SEEDING AND INSTALLING EROSION CONTROL BLANKETS ON SLOPES GREATER THAN 3:1, AND PLACING 3 TO 4 TONS OF MULCH PER ACRE, SECURED WITH ANCHORED NETTING, ELSEWHERE. THE INSTALLATION OF EROSION CONTROL BLANKETS OR MULCH AND NETTING SHALL NOT OCCUR OVER ACCUMULATED SNOW OR ON FROZEN GROUND AND SHALL BE COMPLETED IN ADVANCE OF THAW OR SPRING MELT EVENTS.
   B. ALL DITCHES OR SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15TH, OR WHICH ARE DISTURBED AFTER OCTOBER 15TH, SHALL BE STABILIZED TEMPORARILY WITH STONE OR EROSION CONTROL BLANKETS APPROPRIATE FOR THE DESIGN FLOW CONDITIONS.
   C. AFTER NOVEMBER 15TH, INCOMPLETE ROAD SURFACES, WHERE WORK HAS STOPPED FOR THE WINTER SEASON, SHALL BE PROTECTED WITH A MINIMUM OF 3 INCHES OF CRUSHED GRAVEL (NHDOT ITEM 304.3).
16. THE CONTRACTOR IS RESPONSIBLE FOR STORMWATER MANAGEMENT DURING ALL PHASES OF CONSTRUCTION. NO WORK SHALL BE PERMITTED IN FLOWING WATER. DIVERSION SHALL BE ACCOMPLISHED BY THE USE OF SAND BAGS, BERMS, TEMPORARY CULVERTS, OR PUMPING. ALL DIVERTED WATER SHALL BE DISCHARGED TO DIRT BAGS, STONE FILL OR OTHER SUITABLE EROSION CONTROL STRUCTURE.
17. THE CONTRACTOR MAY NOT REMOVE EROSION CONTROL MEASURES UNTIL TURF IS VIGOROUSLY ESTABLISHED. ANY DISTURBED AREAS REMAINING AFTER OR AS A RESULT OF THE REMOVAL OF TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE LOAMED, SEEDED AND MULCHED.
18. STABILIZE ALL DITCHES AND SWALES PRIOR TO DIRECTING FLOW TO THEM.
19. PERMITS: THE PROPOSED PROJECT IS SUBJECT TO A NPDES CONSTRUCTION GENERAL PERMIT ISSUED BY EPA. NHDES PERSONNEL AND THE ENGINEER MAY MODIFY THE EROSION CONTROL PRACTICES AND THE APPROVED PLAN AT ANY TIME BASED ON SITE CONDITIONS.
20. WETLANDS: WETLANDS AREAS ARE IDENTIFIED ON THE PLANS. THE CONTRACTOR SHALL NOT IMPACT ANY WETLANDS.
21. THE CONTRACTOR IS RESPONSIBLE FOR COMPLYING WITH ALL LOCAL, STATE AND FEDERAL REGULATIONS.

EROSION CONTROL MATERIALS:

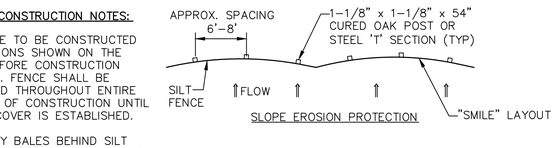
1. SILT FENCE: SILT FENCE SHALL INCLUDE PREFABRICATED 48-INCH WOOD POSTS OR APPROVED EQUIVALENT INSTALLED IN ACCORDANCE WITH THE DRAWINGS (OR AS DIRECTED BY THE ENGINEER).
2. RIP RAP: SEE DETAILS
3. MULCH: MULCH SHALL BE DRY MOWINGS OR ACCEPTABLE HERBACEOUS GROWTH, FREE OF NOXIOUS WEED OR WOODY STEMS. NO SALT HAY SHALL BE USED.
4. MULCH NETTING: NETTING USED TO HOLD MULCH IN PLACE SHALL BE AN APPROVED PAPER, TWINE, PLASTIC OR PLASTIC AND WOOD FIBER NETTING.
5. EROSION CONTROL MATTING (BLANKET): MATTING SHALL BE INSTALLED ON ANY SLOPES STEEPER THAN 3(H) TO 1(V). MATTING SHALL BE NORTH AMERICAN GREEN S75 OR APPROVED EQUIVALENT.
6. TEMPORARY SEED MIXTURE (OR EROSION CONTROL SEED MIXTURE): SEE SPECIFICATION SECTION 02935. 7. PERMANENT SEED MIXTURE: SEE SPECIFICATION SECTION 02935.

MAINTENANCE OF EROSION CONTROL STRUCTURES:

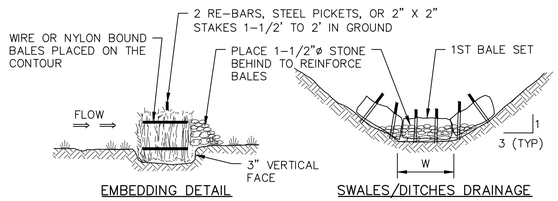
1. SILT FENCES ARE TO BE MAINTAINED AND CLEANED UNTIL SLOPES HAVE HEALTHY STAND OF GRASS. WHEN SEDIMENT ACCUMULATION REACHES A DEPTH OF 12" BEHIND THE SILT FENCE, THE SEDIMENT SHALL BE REMOVED AND DISPOSED OF PROPERLY.
2. REPAIR ALL DAMAGES CAUSED BY SOIL EROSION OR CONSTRUCTION EQUIPMENT AT OR BECOME THE END OF EACH WORKING DAY.
3. KEEP ALL DRAINAGE ENTRANCES FREE OF DEBRIS DURING CONSTRUCTION.
4. CLEAN STONE CHECK DAMS AND TEMPORARY DIVERSION DITCHES WHEN THEY BECOME FULL TO 50% OF THEIR ORIGINAL VOLUME OR AS DIRECTED BY THE ENGINEER.
5. VISUAL OBSERVATION OF ALL EROSION CONTROL MEASURES, AND ALL CLEARED AND GRADED AREAS ON THE CONSTRUCTION SITE SHOULD BE PERFORMED ONCE EVERY 14 CALENDAR DAYS AND WITHIN 24 HOURS OF THE END OF A STORM WITH RAINFALL AMOUNTS GRATER THAN 0.5 INCHES. CONTRACTOR TO USE FORMS CONTAINED IN THE STORMWATER POLLUTION PREVENTION PLAN PERMIT AS APPROPRIATE.

SILT FENCE CONSTRUCTION NOTES:

1. SILT FENCE TO BE CONSTRUCTED AT LOCATIONS SHOWN ON THE PLANS BEFORE CONSTRUCTION PROCEEDS. FENCE SHALL BE MAINTAINED THROUGHOUT ENTIRE DURATION OF CONSTRUCTION UNTIL GROUND COVER IS ESTABLISHED.
2. PLACE HAY BALES BEHIND SILT FENCE AS REQUIRED TO MAINTAIN FENCE IN AND UPRIGHT POSITION, OR AS DIRECTED BY THE ENGINEER.
3. INSTALL SILT FENCE IN "SMILE" OR "J-HOOK" LAYOUT TO REDUCE THE AREA THAT ANY ONE SEGMENT OF FENCING WILL IMPOUND.

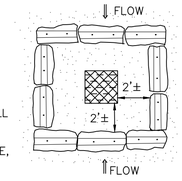


3 / C12 **SILT FENCE DETAIL**
NOT TO SCALE
UE



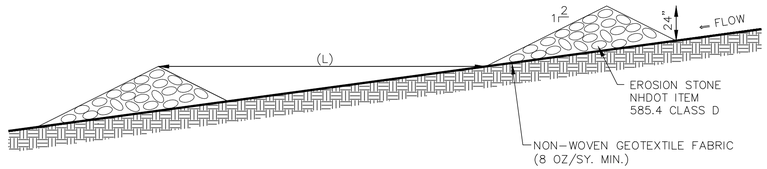
HAY BALE BARRIER CONSTRUCTION SPECIFICATIONS:

1. BALES SHALL BE PLACED IN A ROW WITH ENDS TIGHTLY BUTTED.
2. EACH BALE SHALL BE EMBEDDED IN THE SOIL A MINIMUM OF 3".
3. BALES SHALL BE SECURELY ANCHORED IN PLACE BY STAKE OR RE-BARS DRIVEN THROUGH THE BALES. THE FIRST STAKE IN EACH BALE SHALL BE ANGLED TOWARD PREVIOUSLY LAID BALE TO FORCE BALES TOGETHER.
4. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
5. BALES SHALL BE REMOVED, WHEN THEY HAVE SERVED THEIR PURPOSE, SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
6. BARRIERS SHALL BE SPACED AT 100' ALONG DRAINAGE SWALES/ DITCHES.



CATCH BASIN
EROSION PROTECTION

2 / C12 **HAY BALE DETAIL**
NOT TO SCALE
UE



NOTES:

1. INSTALL TEMPORARY STONE CHECK DAMS IN UNSTABILIZED DITCHES AND SWALES.
2. SPACE CHECK DAMS SUCH THAT LENGTH (L) SPANS THE DISTANCE FOR WHICH THE BASE (TOE) UPSTREAM DAM IS EQUAL TO THE PEAK ELEVATION OF THE DOWN STREAM DAM OR A MINIMUM OF 50'.

3 / C12 **STONE CHECK DAM (EROSION CONTROL)**
NOT TO SCALE

ISSUE FOR
APPROVAL By TGP Date 12/17/21
CONSTRUCTION By TGP Date 2/9/22
RECORD DRAWING By - Date -

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER (LICENSED) TIMOTHY G. PRATT No. 8531

STATE OF NEW HAMPSHIRE - PROFESSIONAL LANDSCAPE ARCHITECT (LICENSED) THOMAS PAGE No. 1095

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

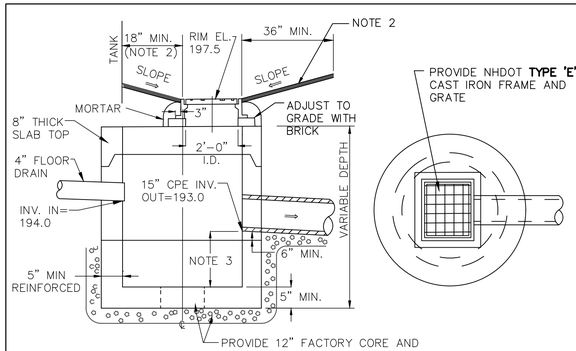
EROSION COTNROL DETAILS

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C12
SHEET 16 OF 43

C:\Users\mrg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, C12, 2/7/2022 6:18:19 PM, mrg

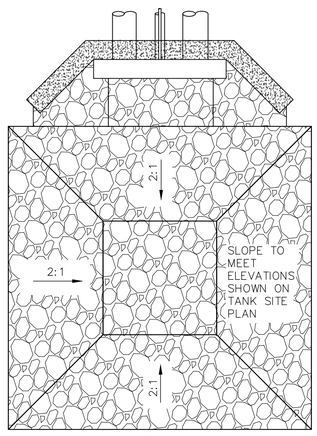


NOTES:

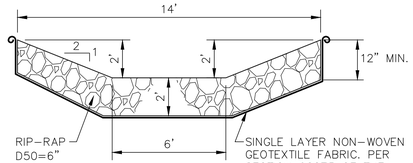
1. ENTIRE STRUCTURE SHALL BE CAPABLE OF WITHSTANDING AN H – 20 LOAD DETAILS OF REINFORCEMENT TO BE FURNISHED BY MANUFACTURER.
2. AT TANK PROVIDE 6" DEEP STONE APRON (3" STONE) 6' WIDE x 14' LONG OVER 8 OZ. NON–WOVEN GEOTEXTILE FABRIC.
3. PROVIDE 6" SUMP FOR TANK OVERFLOW CATCH BASIN. SEE OVERFLOW DETAIL C10.

1/C13 CATCH BASIN DETAIL @ TANK

NOT TO SCALE



PLAN



SECTION

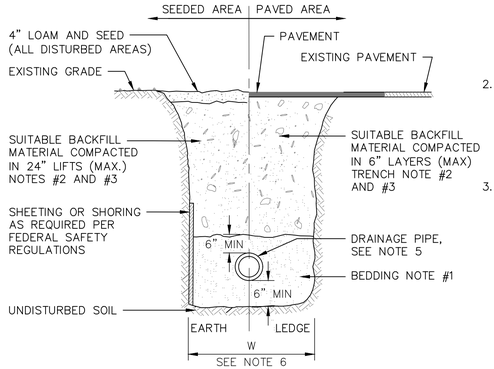
2/C13 PLUNGE POOL DETAIL

NOT TO SCALE

CONSTRUCTION SPECIFICATIONS:

1. CONSTRUCT PLUNGE POOL TO THE WIDTHS AND LENGTHS SHOWN ON THIS DETAIL AND THE PLAN.
2. THE SUBGRADE FOR THE GEOTEXTILE FABRIC AND RIPRAP SHALL BE PREPARED TO LINES AND GRADES SHOWN ON THE PLANS. NOTIFY ENGINEER OF ANY DISCREPANCIES.
3. GEOTEXTILE FABRICS SHALL BE PROTECTED FROM PUNCTURE OR TEARING DURING THE PLACEMENT OF THE EROSION STONE. DAMAGED AREAS IN THE FABRIC SHALL BE REPAIRED BY PLACING A PIECE OF FABRIC OVER THE DAMAGED AREA OR BY COMPLETE REPLACEMENT OF THE FABRIC. ALL OVERLAPS REQUIRED FOR REPAIRS OR JOINING TWO PIECES OF FABRIC SHALL BE A MINIMUM OF 18 INCHES.
4. EROSION STONE USED FOR THE STABILIZED OUTLET SHALL CONFORM TO THE FOLLOWING GRADATION:

SIZE	PERCENT PASSING BY WEIGHT
18"	100
12"	90–100
4"	0–15



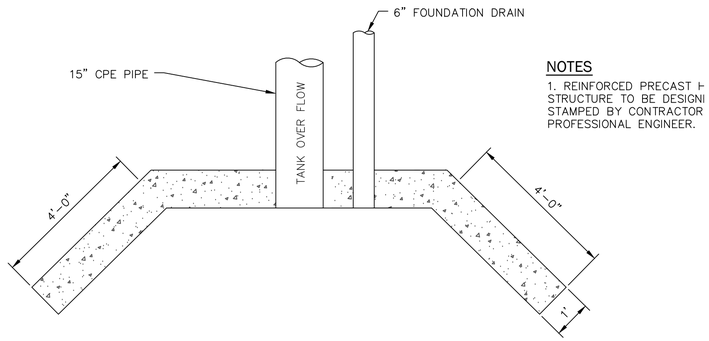
5/C13 TRENCH DETAIL – STORM DRAIN

NOT TO SCALE

UE

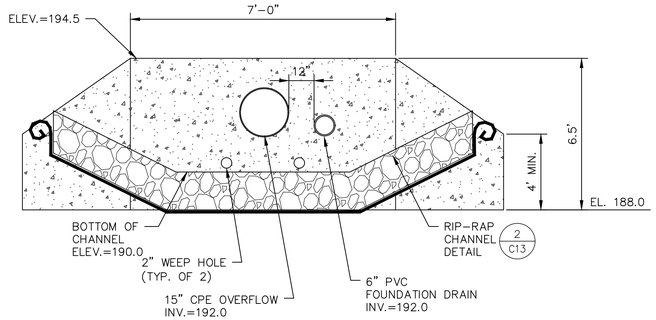
TRENCH NOTES – STORM DRAIN:

1. BEDDING: BEDDING FOR PIPES SHALL CONSIST OF PREPARING THE BOTTOM OF THE TRENCH TO SUPPORT THE ENTIRE LENGTH OF THE PIPE AT A UNIFORM SLOPE AND ALIGNMENT. CRUSHED STONE SHALL BE USED TO BED THE PIPE TO THE ELEVATION SHOWN ON THE DRAWINGS AND FOR BLANKET OVER PIPE.
2. COMPACTION: ALL BACKFILL SHALL BE COMPACTED AT OR NEAR OPTIMUM MOISTURE CONTENT BY PNEUMATIC TAMPERS, VIBRATORY COMPACTORS OR OTHER APPROVED MEANS. BACKFILL BENEATH PAVED SURFACES SHALL BE COMPACTED TO NOT LESS THAN 95 PERCENT OF AASHTO T99, METHOD C (STANDARD PROCTOR).
3. SUITABLE MATERIAL: IN ROADS, ROAD SHOULDERS, WALKWAYS AND TRAVELED WAYS, SUITABLE MATERIAL FOR TRENCH BACKFILL SHALL BE THE NATURAL MATERIAL EXCAVATED DURING THE COURSE OF CONSTRUCTION, BUT SHALL EXCLUDE DEBRIS; PIECES OF PAVEMENT; ORGANIC MATTER; TOP SOIL; ALL WET OR SOFT MUCK, PEAT, OR CLAY; ALL EXCAVATED LEDGE MATERIAL; ROCKS OVER 6 INCHES IN LARGEST DIMENSION; FROZEN EARTH AND ANY MATERIAL WHICH, AS DETERMINED BY THE ENGINEER, WILL NOT PROVIDE SUFFICIENT SUPPORT OR MAINTAIN THE COMPLETED CONSTRUCTION IN A STABLE CONDITION. IN SEEDED AREAS, SUITABLE MATERIAL SHALL BE AS DESCRIBED ABOVE, EXCEPT THAT THE ENGINEER MAY PERMIT THE USE OF TOP SOIL, LOAM, ROCKS UNDER 12", FROZEN EARTH OR CLAY, IF HE/SHE IS SATISFIED THAT THE COMPLETED CONSTRUCTION WILL BE ENTIRELY STABLE AND PROVIDED THAT EASY ACCESS TO THE PIPE WILL BE PRESERVED.
4. BASE COURSE AND PAVEMENT: SHALL MEET THE REQUIREMENTS OF THE NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION'S LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES – DIVISIONS 300 AND 400 RESPECTIVELY.
5. DRAINAGE PIPE: PIPE MATERIALS SHALL BE EITHER POLYVINYL CHLORIDE (PVC) REINFORCED CONCRETE (RC) OR CORRUGATED POLYETHYLENE (CPE). THE OWNER RESERVES THE RIGHT TO DETERMINE WHICH PIPE MATERIALS ARE USED FOR THE PROJECT.
6. W=MAXIMUM ALLOWABLE TRENCH WIDTH: FOR ROCK EXCAVATION, FOR ORDERED EXCAVATION BELOW GRADE AND HANDLING OF EXCAVATED CONTAMINATED SOILS. FOR PIPES 15 INCHES NOMINAL DIAMETER OR LESS, W SHALL BE NO MORE THAN 36 INCHES. FOR PIPES GREATER THAN 15 INCHES IN NOMINAL DIAMETER, W SHALL BE 24 INCHES PLUS PIPE OUTSIDE DIAMETER (O.D.)



NOTES

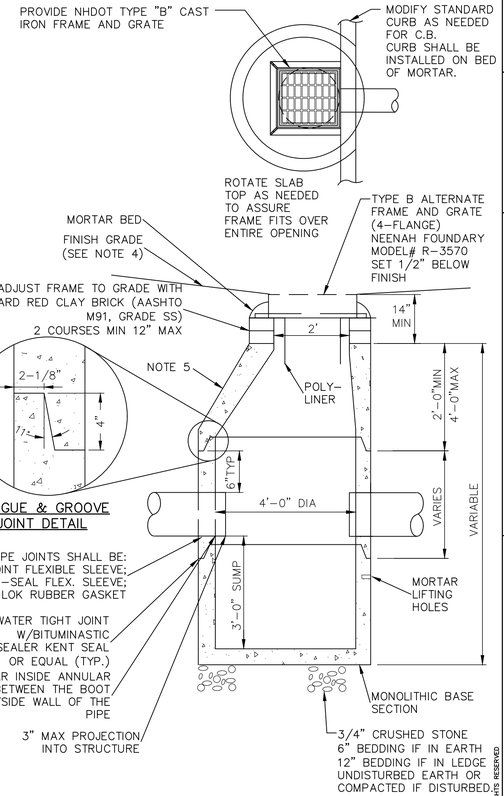
1. REINFORCED PRECAST F STRUCTURE TO BE DESIGNI STAMPED BY CONTRACTOR PROFESSIONAL ENGINEER.



PROVIDE S.S. RODENT SCREENS ON EACH PIPE

6/C13 TANK OVERFLOW & DRAIN OUTLET HEAD WALL

NOT TO SCALE



TONGUE & GROOVE JOINT DETAIL

NOTES:

1. REFERENCE GENERAL DRAIN STRUCTURE NOTES, NHDOT SECTION 604, AND SUPPLEMENTAL SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
2. PROVIDE NHDOT TYPE "B" CAST IRON FRAME AND GRATE.
3. SEPARATE CONSTRUCTION SPECIFICATIONS ARE ATTACHED OR INCLUDED IN THE CONTRACT DOCUMENTS. THESE STANDARD DRAWINGS ARE NOT COMPLETE WITHOUT SPECIFICATIONS.
4. PROVIDE 18" WIDE (ALL AROUND) BITUMINOUS PAVED APRON (TYP.).
5. PROVIDE SLAB TOP STRUCTURE WHERE APPROPRIATE FOR DEPTH OF STRUCTURE.

PRE–CAST REINFORCED CATCH BASIN @ SMITH WELL ROAD

7/C13 NOT TO SCALE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL By TGP Date 12/17/21
CONSTRUCTION By TGP Date 2/9/22
RECORD DRAWING By - Date -

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – TIMOTHY J. PIATT No. 8631 – LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE – THOMAS PAGE No. 10961 – LICENSED PROFESSIONAL ENGINEER

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603–436–6192 Fax. 603–431–4733

DRAINAGE DETAILS

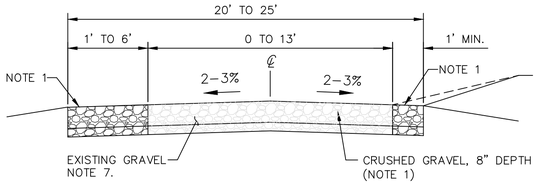
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22–02

CITY OF DOVER, NEW HAMPSHIRE

DWG NO C13

SHEET 17 OF 43

C:\Users\mpg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, C13, 2/7/2022 6:19:23 PM, mpg

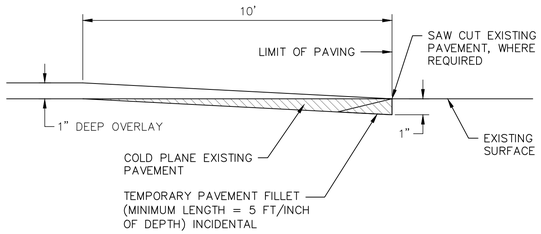


NOTES:

1. INSTALL CRUSHED GRAVEL ADJACENT TO EXISTING GRAVEL ROAD AS SHOWN AND WHERE DIRECTED, GRADE & COMPACT, PAY AS ITEM 304.3.
2. INTENT IS WIDEN EXISTING GRAVEL ROAD TO 20' AND CONSTRUCT TURN AROUND 25' WIDE.
3. GRADE EXISTING GRAVEL ROAD BASE AND INSTALL ITEM 304.3 8" TOTAL DEPTH.

TANK ACCESS ROAD FROM STA 3+35 TO 5+00 AND TURN-AROUND

1 / C14 NOT TO SCALE

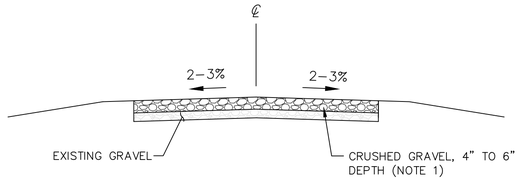


NOTES:

THE LENGTH OF THE TAPER MAY BE ADJUSTED AS ORDERED TO PROVIDE FOR VARYING FIELD CONDITIONS OR CHANGES IN SINGLE COURSE DEPTH.

OVERLAY PAVEMENT MATCH @ GLENWOOD AVE.

4 / C14 NOT TO SCALE



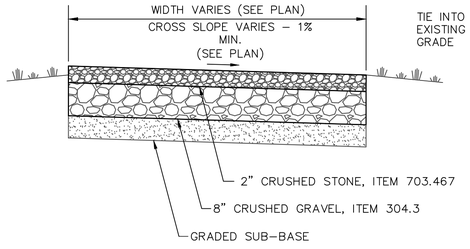
NOTES:

1. INSTALL CRUSHED GRAVEL OVER EXISTING GRAVEL BASE AS SHOWN AND WHERE DIRECTED, GRADE & COMPACT, PAY AS ITEM 304.3.
2. INTENT IS TO RESTORE SMITH WELL ROAD FROM STA 9+00 TO STA 22+40.
3. CONTAMINATED GRAVEL SHALL BE REPLACED AT CONTRACTORS OWN EXPENSE.

SMITH WELL GRAVEL ROAD RESTORATION

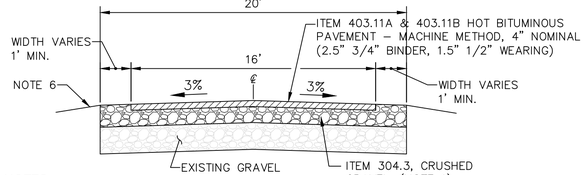
5 / C14 NOT TO SCALE

(ONLY WHERE DIRECTED)



TYPICAL GRAVEL AREA SECTION AROUND THE TANK PEDESTAL

2 / C14 NOT TO SCALE

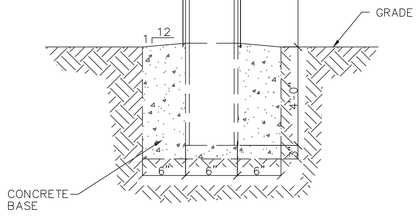


NOTES:

1. INSTALL 4" MIN. CRUSHED GRAVEL OVER EXISTING 8" GRAVEL BASE, STA. 1+10 TO STA 3+00, GRADE & COMPACT, PAY AS ITEM 304.3.
2. INTENT IS TO PAVE TANK ACCESS ROAD FROM STA 1+11 TO STA 3+34 (ADD-ALT) AND PARKING AREA/GATE ENTRANCE AT TANK PEDESTAL (BASE BID).
3. UNIFORMLY GRADE ROADWAY AS SHOWN ON PLANS UNLESS DIRECTED OTHERWISE. PROVIDE A POSITIVE GRADIENT AWAY FROM THE PAVEMENT SO THAT THE PAVED SURFACE IS FREE DRAINING. TYPICAL ROAD CROSS SLOPE=3% UNLESS OTHERWISE DIRECTED.
4. LOAM, SEED & MULCH ROADSIDE SLOPES. TURF ESTABLISHMENT IS SUBSIDIARY AND WILL NOT BE MEASURED FOR PAYMENT. THE CONTRACTOR SHALL LIMIT DISTURBANCE TO THE EXTENT POSSIBLE. ADDITIONAL DISTURBANCE MUST FIRST BE COORDINATED WITH THE ENGINEER FOR APPROVAL.
5. ALL SEAMS AND JOINTS SHALL BE RAKED AND LUTED PRIOR TO COMPACTION AND ROLLING.
6. FINE GRADE, LOAM, SEED & MULCH SHOULDERS TO BLEND WITH EXISTING TERRAIN (BOTH SIDES), SUBSIDIARY.
7. GRADE EXISTING GRAVEL ROAD BASE AND INSTALL ITEM 304.3 12" TOTAL GRAVEL DEPTH.

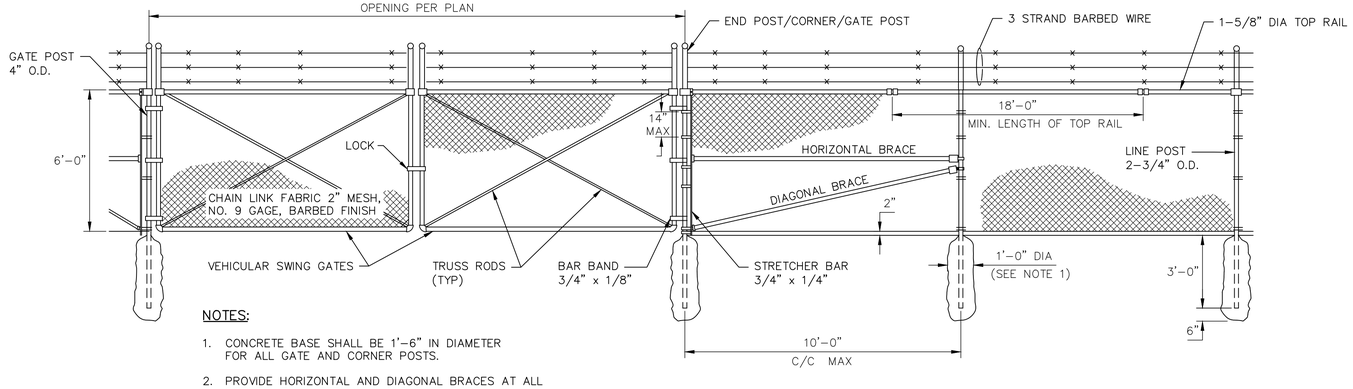
TANK ACCESS ROAD PAVEMENT AND PAVED AREA AT TANK PEDESTAL

6 / C14 NOT TO SCALE



STEEL BOLLARD DETAIL

7 / C14 NOT TO SCALE

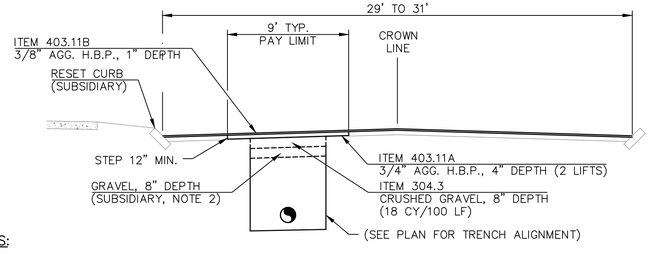


NOTES:

1. CONCRETE BASE SHALL BE 1'-6" IN DIAMETER FOR ALL GATE AND CORNER POSTS.
2. PROVIDE HORIZONTAL AND DIAGONAL BRACES AT ALL CORNER, PULL, TERMINAL, AND GATE POST.
3. POSTS SHALL BE SPACED AT A MAXIMUM OF 10'-0".

CHAIN LINK FENCE & GATE DETAIL

3 / C14 NOT TO SCALE



NOTES:

1. TEMPORARY PAVEMENT SHALL BE INSTALLED WITHIN 24 HOURS FOLLOWING PIPE INSTALLATIONS. PERMANENT ROAD REPAIRS WILL PROCEED FOLLOWING EXPOSURE TO TRAFFIC LOADING AND COMPLETION OF PIPE INSTALLATION.
2. CONTRACTOR MAY SALVAGE & INCORPORATE GRAVEL EXCAVATED BENEATH THE PAVEMENT FOR BACKFILL COMPACT IN 8" LIFTS.
3. INTENT IS TO RESTORE EXISTING CROSS SLOPE.
4. FOLLOWING ONE FREEZE-THAW CYCLE. REVIEW MILLING LIMITS AND CROSS SLOPES WITH ENGINEER AND OWNER'S REPRESENTATIVE PRIOR TO THE TRENCH REPAIR.

PERMANENT ROAD REPAIRS WEBB PLACE FROM STA 0+39 TO 1+11 AND GLENWOOD AVE

9 / C14 NOT TO SCALE

ISSUE FOR	By	Date
APPROVAL	TGP	12/17/21
CONSTRUCTION	TGP	2/9/22
RECORD DRAWING	-	-

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER - LICENSED - No. 8531 - KEITH PRATT

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER - LICENSED - No. 10982 - THOMAS PAGE

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

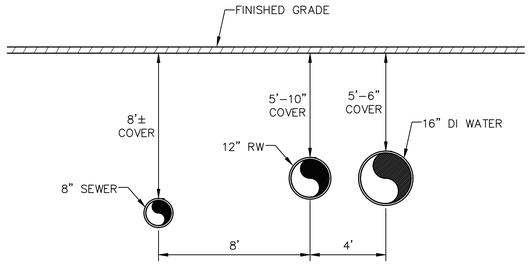
ROADWAY AND SITE DETAILS I

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO C14
SHEET 18 OF 43

C:\Users\mgDesktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, C14, 2/7/2022 6:18:28 PM, mpg



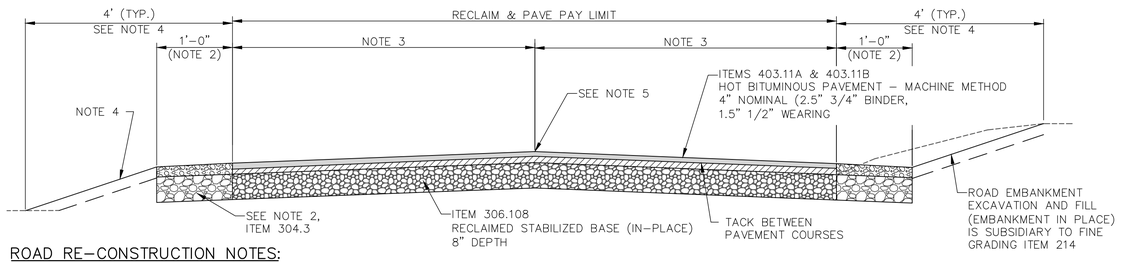
NOTES:

1. SEWER AND WATER MAIN DEPTH PER PROFILE.
2. CONTRACTOR MAY INSTALL 12" & 16" WATER MAINS IN SAME TRENCH.
3. 16" FINISH WATER MAIN & 8" SEWER MAIN SHALL MAINTAIN 10' SEPARATION MIN.
4. REVIEW FINAL ALIGNMENT WITH OWNER & ENGINEER IN THE FIELD.

TYPICAL ALIGNMENT OF WATER & SEWER ON SMITH WELL ROAD

1 / C15

NOT TO SCALE



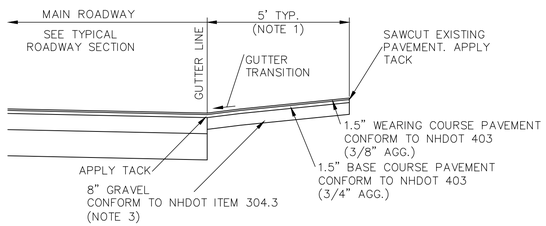
ROAD RE-CONSTRUCTION NOTES:

1. SAWCUT DRIVEWAYS AND CONSTRUCT DRIVEWAY APRON FOLLOWING CONSTRUCTION OF PAVEMENT BINDER COURSE (SEE DRIVEWAY APRON DETAILS, THIS DRAWING).
2. SPREAD RECLAIMED ASPHALT PRODUCT 1 FOOT BEYOND EDGE OF PAVEMENT & GRADE FLUSH WITH PAVEMENT, SUBSIDIARY. RECLAIM MAY BE USED FOR SHOULDER MATERIAL (SUBSIDIARY) WHERE ROAD IS BEING WIDENED (STA. 22+50 TO STA 25+66) ADDITIONAL CRUSHED GRAVEL FOR ROAD BASE OR SHOULDER LEVELING SHALL BE PAID UNDER ITEM 304.3.
3. UNIFORMLY GRADE ROADWAY AS SHOWN ON PLANS UNLESS DIRECTED OTHERWISE. PROVIDE A POSITIVE GRADIENT AWAY FROM THE PAVEMENT SO THAT THE PAVED SURFACE IS FREE DRAINING. TYPICAL ROAD CROSS SLOPE=3% UNLESS OTHERWISE DIRECTED.
   9 FT LANES FROM STA 22+50 TO STA 25+37.
   11 FT LANES FROM STA 25+37 TO GLENWOOD DRIVE
4. LOAM, SEED & MULCH ROADSIDE SLOPES. TURF ESTABLISHMENT IS SUBSIDIARY TO ITEM 912 AND WILL NOT BE MEASURED FOR PAYMENT. THE CONTRACTOR SHALL LIMIT DISTURBANCE TO THE GRADING LIMITS SHOWN ON THE DRAWINGS. ADDITIONAL DISTURBANCE MUST FIRST BE COORDINATED WITH THE ENGINEER FOR APPROVAL. CONFIRM SEED MIX W/ OWNER & ENGINEER.
5. ALL SEAMS AND JOINTS SHALL BE RAKED AND LUTED PRIOR TO COMPACTION AND ROLLING.

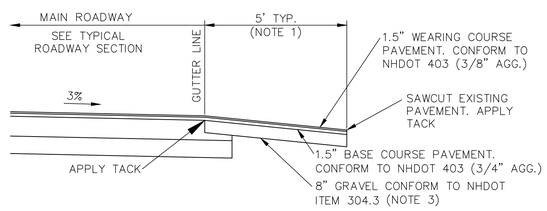
TYPICAL ROADWAY SECTION - SMITH WELL ROAD

3 / C15

NOT TO SCALE



DRIVEWAY APRON ABOVE ROAD GRADE



DRIVEWAY APRON BELOW ROAD GRADE

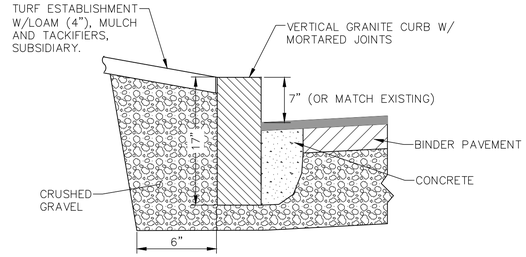
NOTES:

1. UNLESS OTHERWISE DIRECTED BY THE ENGINEER, PAVED APRONS SHALL EXTEND 5' BEYOND THE ROADWAY. ANY DIMENSION GREATER THAN 5 FEET SHALL FIRST BE COORDINATED WITH THE OWNERS REPRESENTATIVE.
2. TACK COAT SHALL BE APPLIED TO THE JOINTS AND BETWEEN PAVEMENT COURSES AND SHALL BE SUBSIDIARY TO UNIT ITEM COST.
3. REMOVAL OF PAVEMENT AND UNDERLYING MATERIAL FOR CONSTRUCTION OF DRIVEWAY APRONS SHALL BE SUBSIDIARY. WHERE EXISTING DRIVEWAY GRAVELS EXIST, GRAVEL REPLACEMENT WILL NOT BE REQUIRED.
4. ALL PAVEMENT MATCHES AT DRIVEWAY SHALL BE SAWCUT & KEYED FOR SMOOTH TRANSITION (SUBSIDIARY).

TYPICAL DRIVEWAY APRON PROFILE DETAILS

4 / C15

NOT TO SCALE

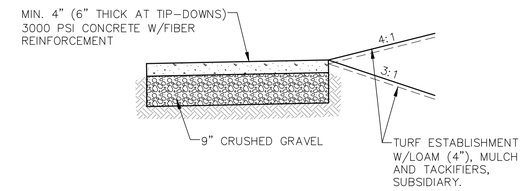


RADUIS	MAX LENGTH
<21'	USE CURVED CURB
12'	3'
22'-28'	4'
29'-35'	5'
36'-42'	6'
43'-49'	7'
50'-56'	8'
57'-60'	9'
OVER 60'	10'

CITY OF DOVER-STANDARD CURBING DETAILS VERTICAL GRANITE CURB

5 / C15

NOT TO SCALE



NOTES:

1. MATERIALS SHALL BE IN ACCORDANCE WITH THE CITY OF DOVER STANDARDS SPECIFICATIONS
2. SIDEWALK AND DRIVEWAY WIDTHS SHALL BE EQUAL TO EXISTING WIDTHS OR AS APPROVED AND SHALL MATCH EXISTING ELEVATIONS.
3. BASE FOR THE SIDEWALKS AND DRIVEWAYS SHALL BE 9 INCHES OF CRUSHED GRAVEL.
4. DETECTABLE WARNING STRIPS SHALL BE CAST IRON.

CITY OF DOVER-STANDARD SIDEWALK DETAIL

6 / C15

NOT TO SCALE

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL By TGP Date 12/17/21
CONSTRUCTION By TGP Date 2/9/22
RECORD DRAWING By - Date -

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER - LICENSED - JOSEPH PRATT No. 8531

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER - LICENSED - THOMAS PAGE No. 10982

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

ROADWAY AND SITE DETAILS II

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

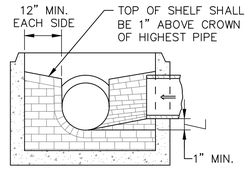
CITY OF DOVER, NEW HAMPSHIRE

© COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

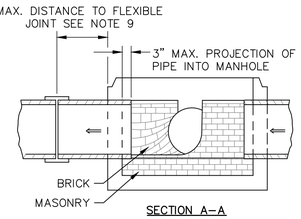
DWG NO C15

SHEET 19 OF 43

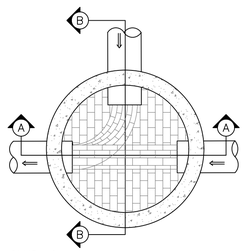
C:\Users\mpg\Desktop\desktop working files\Real Numbered\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, C15, 2/7/2022 6:16:33 PM, mpg



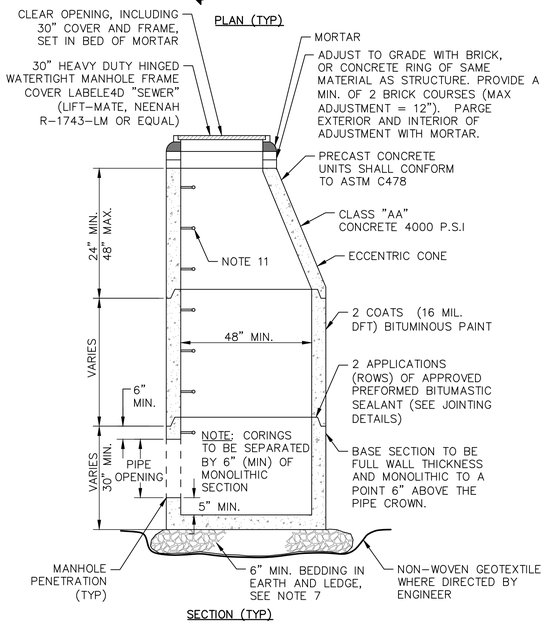
SECTION B–B



SECTION A–A



PLAN (TYP)



SECTION (TYP)

1 C16 SEWER MANHOLE DETAILS
NOT TO SCALE

STANDARD MANHOLE NOTES:

1. IT IS THE INTENTION: THAT THE MANHOLE, INCLUDING ALL COMPONENT PARTS, HAVE ADEQUATE SPACE, STRENGTH, AND LEAKPROOF QUALITIES CONSIDERED NECESSARY BY THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES (NHDES) FOR THE INTENDED SERVICE. SPACE REQUIREMENTS AND CONFIGURATIONS SHALL BE AS SHOWN ON THE DRAWING. MANHOLES MAY BE AN ASSEMBLY OF PRECAST SECTIONS, WITH STEEL REINFORCEMENT, IN ANY APPROVED MANHOLE, THE COMPLETE STRUCTURE SHALL BE OF SUCH MATERIAL AND QUALITY AS TO WITHSTAND LOADS OF 8 TONS (H–20 LOADING) WITHOUT FAILURE, AND TO PROVIDE A WATER TIGHT SEAL CONTINUOUSLY FOR THE LIFE OF THE STRUCTURE.
2. BARRELS AND CONE SECTIONS: SHALL BE PRECAST REINFORCED CONCRETE.
3. PRECAST CONCRETE: BARREL SECTIONS, CONES, GRADE ADJUSTMENT RING AND BASES SHALL CONFORM TO ASTM C478.
4. VACUUM TEST: SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS. INVERT AND SHELF TO BE PLACED AFTER LEAKAGE TEST. REPAIRS SHALL BE MADE TO THE OUTSIDE OF THE STRUCTURE.
5. INVERTS AND SHELVES: MANHOLES SHALL HAVE A BRICK PAVED SHELF AND INVERT, CONSTRUCTED TO CONFORM TO THE SIZE OF PIPE AND FLOW. CARE SHALL BE TAKEN TO INSURE THAT THE BRICK INVERT IS A SMOOTH CONTINUATION OF THE SEWER INVERT. INVERT BRICKS SHALL BE LAID ON EDGE. AT CHANGES IN DIRECTION, THE INVERTS SHALL BE LAID OUT IN CURVES OF THE LONGEST POSSIBLE TANGENT TO THE CENTER LINE OF THE SEWER PIPES. SHELVES SHALL BE CONSTRUCTED TO AN ELEVATION OF 1" ABOVE THE HIGHEST PIPE CROWN AND SLOPE TO DRAIN TOWARD THE FLOWING THROUGH CHANNEL. UNDERLAYMENT OF INVERT AND SHELF SHALL CONSIST OF BRICK MASONRY.
6. FRAMES AND COVERS: PROVIDE HINGED MANHOLE COVERS, SEE SPECIFICATIONS. MANHOLE FRAMES AND COVERS SHALL BE OF HEAVY DUTY DESIGN, MANUFACTURED IN USA, AND PROVIDE A 30–INCH CLEAR OPENING. A 3–INCH LETTER "S" FOR SEWERS SHALL BE PLAINLY CAST INTO THE CENTER OF EACH COVER.
7. BEDDING: SCREENED GRAVEL AND/OR CRUSHED STONE FREE FROM CLAY, LOAM, ORGANIC MATTER AND MEETING ASTM C33. STONE SIZE NO. 67.

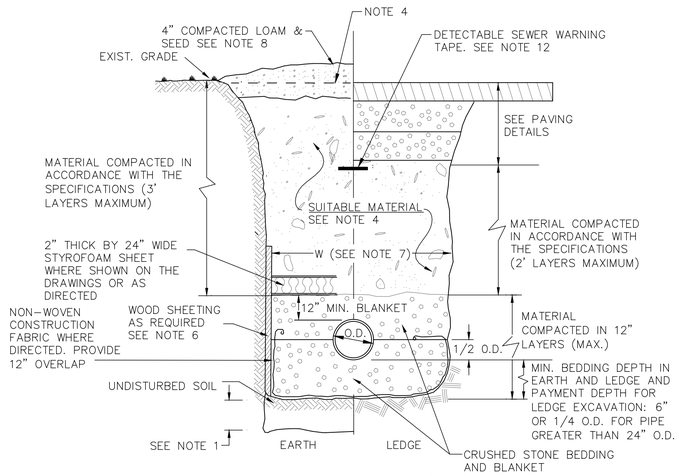
PERCENT PASSING	SCREEN SIZE
100%	1 INCH
90 –100%	3/4 INCH
20 – 55%	3/8 INCH
0 – 10%	#4 SIEVE
0 – 5%	#8 SIEVE

WHERE ORDERED BY THE ENGINEER, FOR STRUCTURES UNDER 6' OR TO STABILIZE THE BASE, SCREENED GRAVEL OR 1–1/2 INCH CRUSHED STONE MAY BE USED.

8. SHALLOW MANHOLE: IN LIEU OF A CONE SECTION, WHEN MANHOLE IS LESS THAN 6 FEET, A REINFORCED CONCRETE SLAB COVER HAVING AN ECCENTRIC ENTRANCE AND CAPABLE OF SUPPORTING H–20 LOADS MAY BE USED.
9. FLEXIBLE JOINT: A FLEXIBLE JOINT SHALL BE PROVIDED WITHIN THE FOLLOWING DISTANCES:

   DI PIPE – NONE REQUIRED
   PVC (ASTM 3034) – UP THROUGH 15" DIA. – NONE REQUIRED
   PVC (ASTM F679) – LARGER THAN 15" DIA. – 48" TO 60"
   RCP PIPE – 48"
10. SPECIFICATIONS: ADDITIONAL CONSTRUCTION SPECIFICATIONS ARE INCLUDED IN THE CONTRACT DOCUMENTS. THESE STANDARD MANHOLE DRAWINGS ARE NOT COMPLETE WITHOUT THESE SPECIFICATIONS.
11. MANHOLE LADDER:

    ALIGN LADDER RUNGS ALONG VERTICAL/PLUM WALL OF MANHOLE, SEE SPECIFICATIONS.



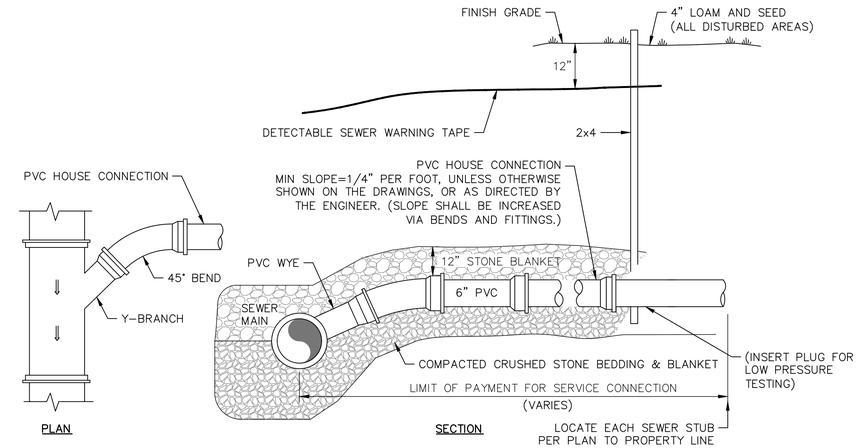
TRENCH SECTION (TYP)

TRENCH SECTION WITH CONCRETE ENCASEMENT

2 C16 TRENCH – GRAVITY SEWER
NOT TO SCALE

GRAVITY SEWER TRENCH NOTES:

1. ORDERED EXCAVATION OF UNSUITABLE MATERIAL BELOW GRADE: BACKFILL AS STATED IN THE TECHNICAL SPECIFICATIONS OR AS SHOWN ON THE DRAWINGS.
2. BEDDING AND BLANKET: SEE NOTE 7 OF STANDARD MANHOLE NOTES. WHERE ORDERED BY THE ENGINEER TO STABILIZE THE TRENCH BASE, GRADED SCREENED GRAVEL OR CRUSHED STONE 1/2 INCH TO 1–1/2 INCH SHALL BE USED.
3. NOT USED
4. SUITABLE MATERIAL: IN ROADS, ROAD SHOULDERS, WALKWAYS AND TRAVELED WAYS, SUITABLE MATERIAL FOR TRENCH BACKFILL SHALL BE THE NATURAL MATERIAL EXCAVATED DURING THE COURSE OF CONSTRUCTION, BUT SHALL EXCLUDE DEBRIS; PIECES OF PAVEMENT; ORGANIC MATTER; TOP SOIL; ALL WET OR SOFT MUCK, PEAT, OR CLAY; ALL EXCAVATED LEDGE MATERIAL; ALL ROCKS OVER 6 INCHES IN LARGEST DIMENSION; AND ANY MATERIAL WHICH, AS DETERMINED BY THE ENGINEER, WILL NOT PROVIDE SUFFICIENT SUPPORT OR MAINTAIN THE COMPLETED CONSTRUCTION IN A STABLE CONDITION. IN CROSS–COUNTRY CONSTRUCTION, SUITABLE MATERIAL SHALL BE AS DESCRIBED ABOVE, EXCEPT THAT THE ENGINEER MAY PERMIT THE USE OF TOP SOIL, LOAM, MUCK, OR PEAT, IF HE IS SATISFIED THAT THE COMPLETED CONSTRUCTION WILL BE ENTIRELY STABLE AND PROVIDED THAT EASY ACCESS TO THE SEWER, FOR MAINTENANCE AND POSSIBLY RECONSTRUCTION, WILL BE PRESERVED.
5. BASE COURSE AND PAVEMENT SHALL MEET THE REQUIREMENTS OF THE NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION'S LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES – DIVISIONS 300 AND 400 RESPECTIVELY.
6. WOOD SHEETING, IF REQUIRED: WHERE SHEETING IS PLACED ALONGSIDE THE PIPE AND EXTENDS BELOW MID–DIAMETER, IT SHALL BE CUT OFF AND LEFT IN PLACE TO AN ELEVATION 1 FOOT ABOVE THE TOP OF PIPE. WHERE SHEETING IS ORDERED BY THE ENGINEER TO BE LEFT IN PLACE, IT SHALL BE CUT OFF AT LEAST 3 FEET BELOW FINISHED GRADE, BUT NOT LESS THAN 1 FOOT ABOVE THE TOP OF THE PIPE.
7. W = MAXIMUM ALLOWABLE TRENCH PAYMENT WIDTH FOR ROCK EXCAVATION, FOR ORDERED EXCAVATION BELOW GRADE AND HANDLING OF EXCAVATED COMTAMINATED SOILS. FOR PIPES 15 INCHES NOMINAL DIAMETER OR LESS, W SHALL BE NO MORE THAN 36 INCHES. FOR PIPES GREATER THAN 15 INCHES IN NOMINAL DIAMETER, W SHALL BE 24 INCHES PLUS PIPE OUTSIDE DIAMETER (O.D.)
8. FOR CROSS COUNTRY CONSTRUCTION, BACKFILL OR FILL SHALL BE MOUNDED TO A HEIGHT OF 6 INCHES ABOVE THE ORIGINAL GROUND SURFACE.
9. CONCRETE FOR ENCASEMENT SHALL CONFORM TO THE REQUIREMENTS OF SECTION 520, NHDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, LATEST EDITION.
10. CONCRETE FULL ENCASEMENT: IF FULL ENCASEMENT IS UTILIZED, DEPTH OF CONCRETE BELOW PIPE SHALL BE 1/4 I.D. (4" MINIMUM). BLOCK SUPPORT SHALL BE SOLID CONCRETE BLOCKS.
11. GRAVEL DRIVEWAY AND SHOULDER RESTORATION: CRUSHED GRAVEL IN DRIVEWAYS AND ROAD SHOULDERS SHALL MATCH EXISTING WITH A MINIMUM OF 12". GRAVEL REPLACEMENT SHALL BE INCIDENTAL TO SEWER CONSTRUCTION AND WILL NOT BE MEASURED FOR PAYMENT.
12. LOCATOR TAPE SHALL BE TERRA TAPE SENTRY LINE 1350, OR EQUAL.



4 C16 SEWER SERVICE REPAIR, RE–ALIGNMENT & RE–CONNECTION
NOT TO SCALE

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL
Date 12/17/21 By TGP
CONSTRUCTION
Date 2/9/22 By TGP
RECORD DRAWING
Date – By –

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – TIMOTHY J. PAPIT No. 8631 – LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE – THOMAS PAGE No. 10951 – LICENSED PROFESSIONAL ENGINEER

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603–436–6192 Fax. 603–431–4733

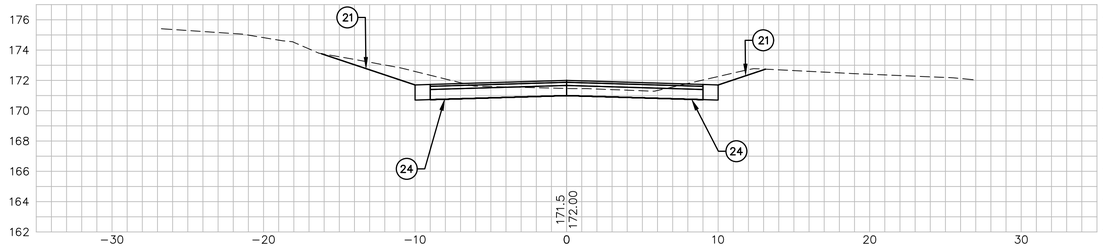
SEWER DETAILS
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22–02
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

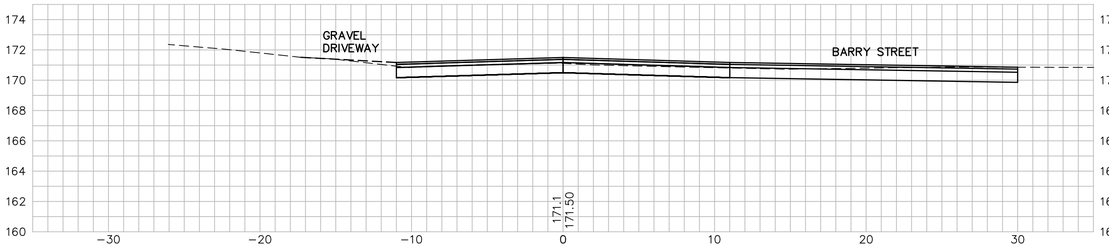
DWG NO C16
SHEET 20 OF 43

C:\Users\mvg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, C16, 2/7/2022 6:18:38 PM, mvg

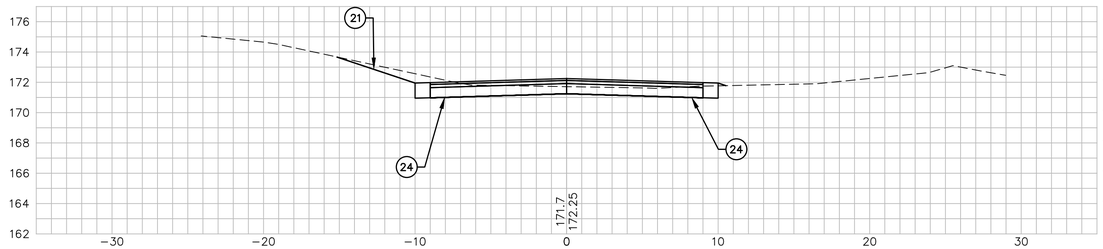
24+00



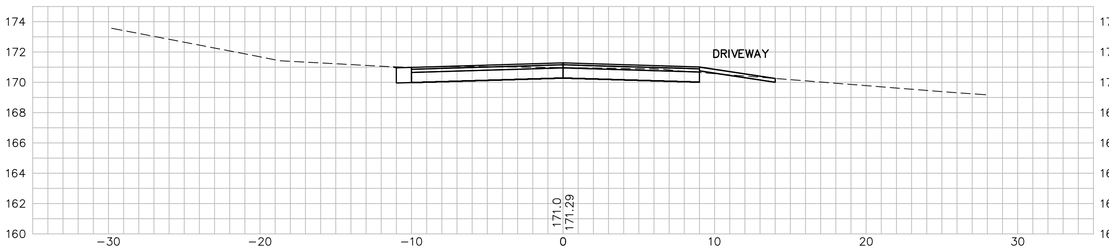
25+50



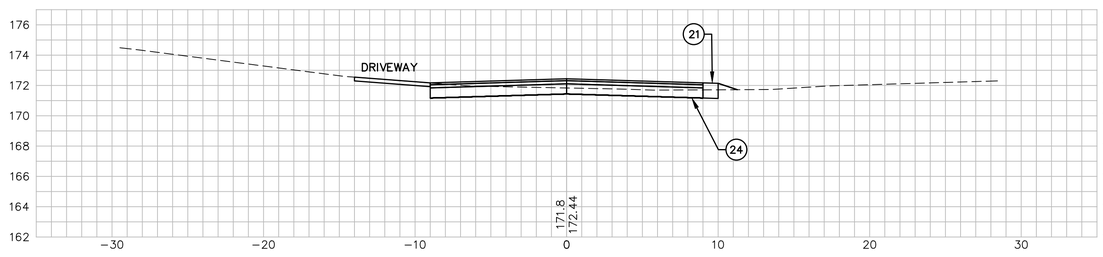
23+50



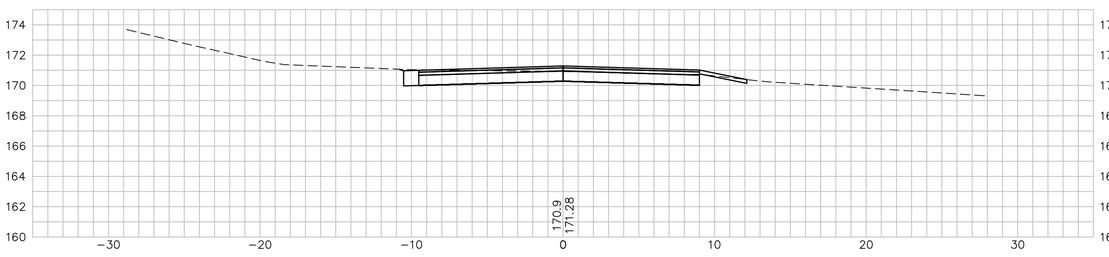
25+12



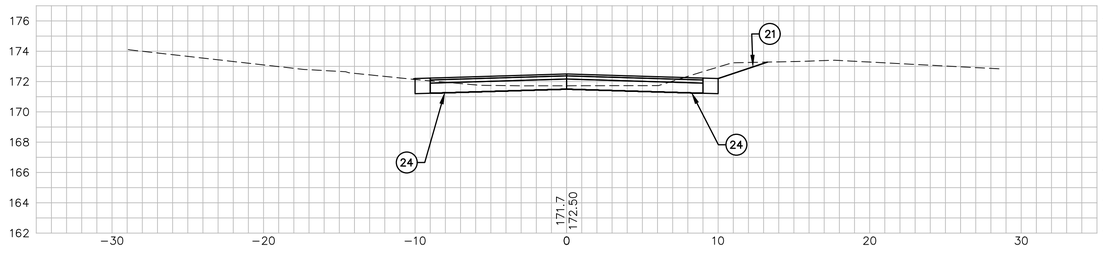
23+12



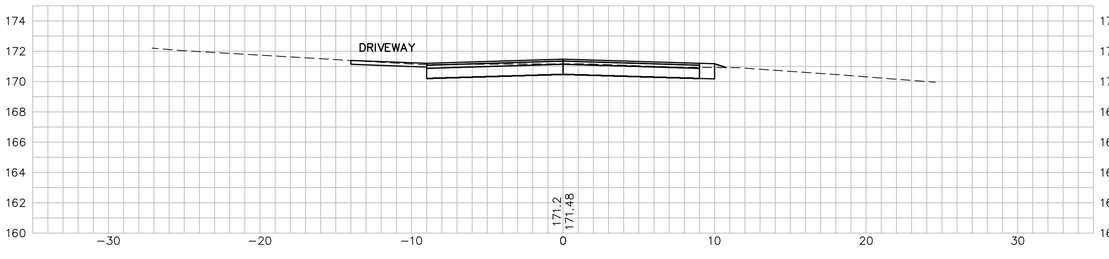
25+00



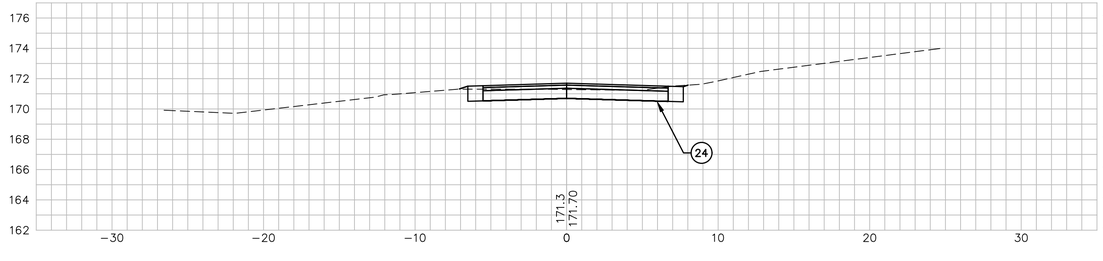
23+00



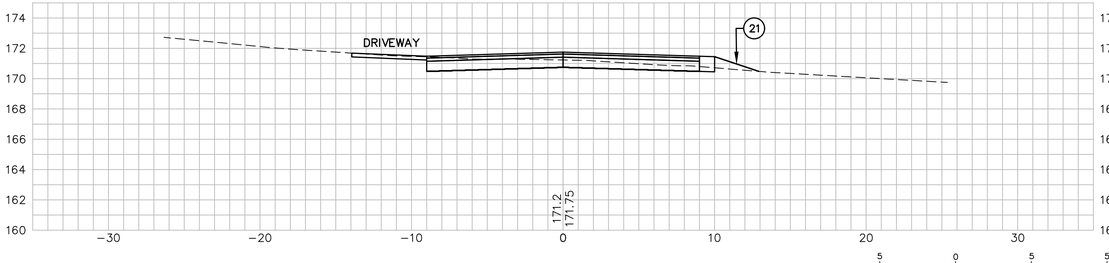
24+75



22+50



24+50



SCALE: 1 INCH = 5 FT.

ISSUE FOR			NO.
APPROVAL	By TGP	Date 12/17/21	
CONSTRUCTION	By TGP	Date 2/9/22	
RECORD DRAWING	By –	Date –	

APP'D

REVISIONS

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – PROFESSIONAL ENGINEER – LICENSED – No. 8531 – PRATT – FH

STATE OF NEW HAMPSHIRE – PROFESSIONAL LANDSCAPE ARCHITECT – No. 1095 – THOMAS PAGE

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

CROSS SECTIONS

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

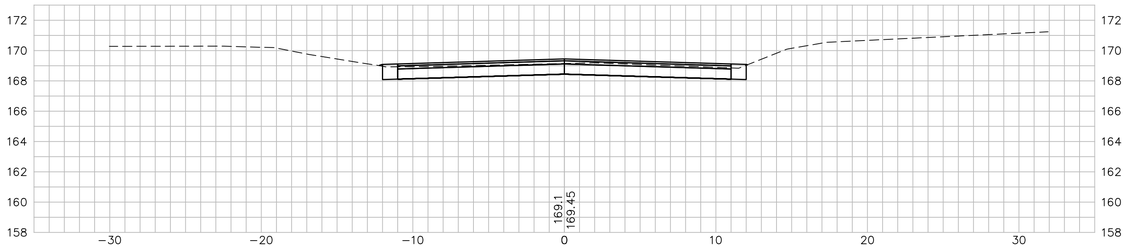
©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO X1

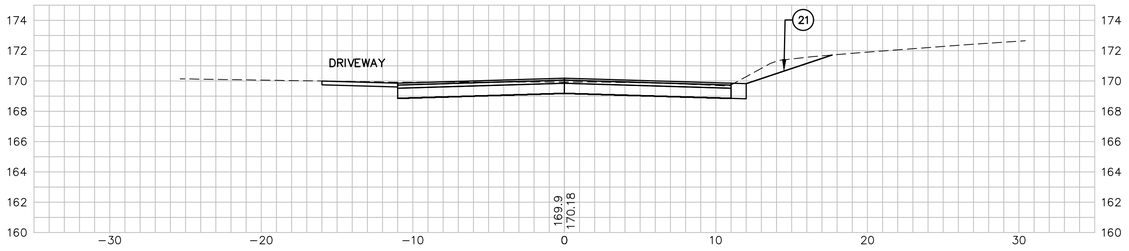
SHEET 21 OF 43

C:\Users\mrg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_prbase.dwg, X1, 2/7/2022 6:02:25 PM, mrg

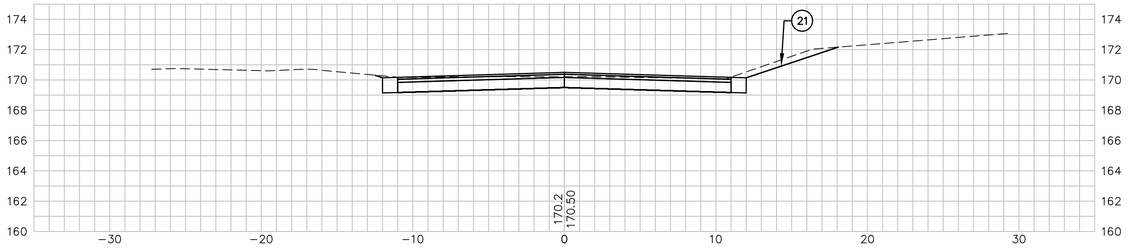
27+00



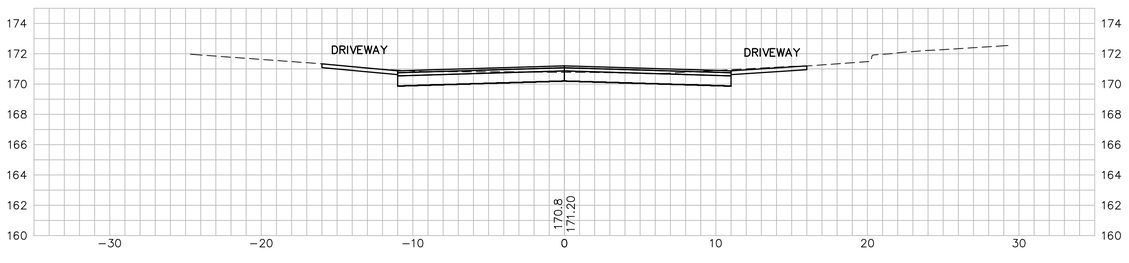
26+65



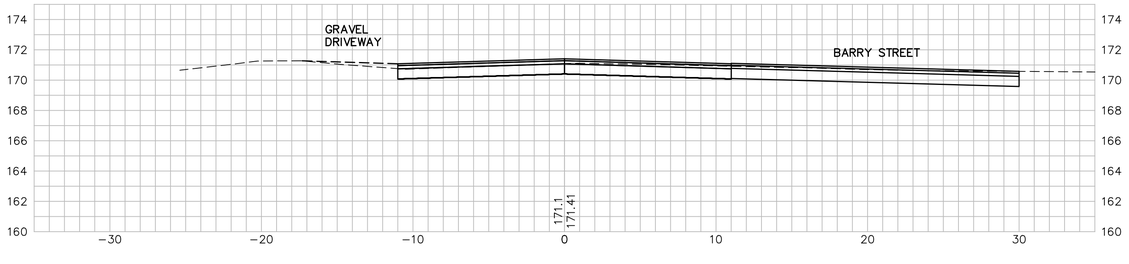
26+50



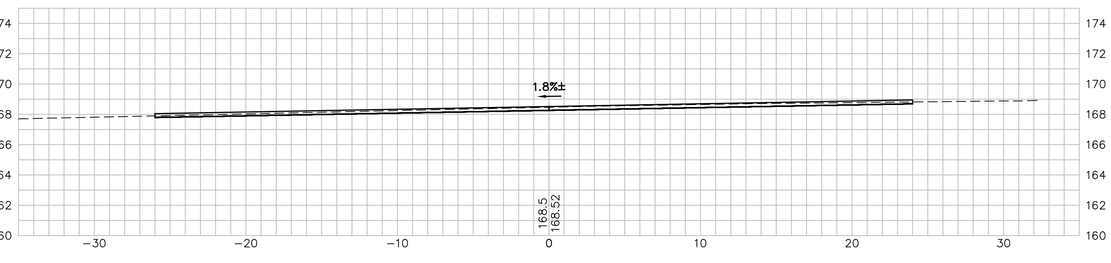
26+00



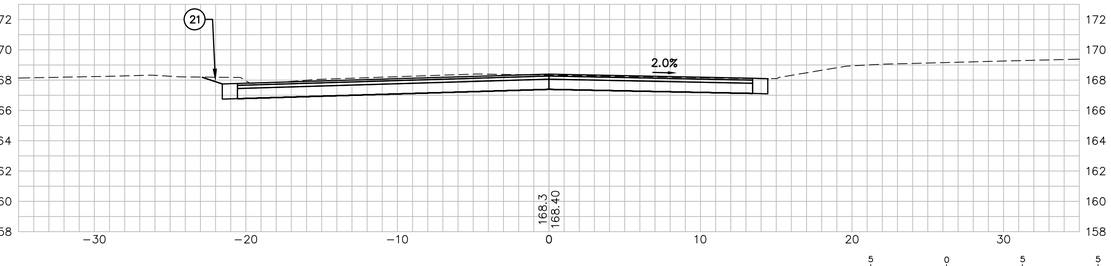
25+65



27+70



27+50



5 0 5 5

SCALE: 1 INCH = 5 FT.

NO.	REVISIONS	APP'D

PIPE AND FITTING SYMBOLS

(SEE GENERAL ABBREVIATIONS FOR PIPE MATERIAL IDENTIFICATION)

1. ALL PIPE SIZES ARE SHOWN AS NOMINAL SIZES
2. PIPE SIZES 2 1/2" AND LESS ARE SHOWN AS SINGLE LINES
3. PIPE SIZES 3" AND ABOVE ARE ARE SHOWN AS DOUBLE LINES

DOUBLE LINE	SINGLE LINE	
		EXISTING PIPE
		NEW PIPE
		FLANGED JOINT
		MECHANICAL JOINT
		SOLVENT WELDED JOINT
		PUSH-ON JOINT
		FLANGED COUPLING ADAPTER
		ELBOW 90
		ELBOW 90 UP
		ELBOW 90 DOWN
		ELBOW 45
		ELBOW 45 UP
		ELBOW 45 DOWN
		TEE
		TEE UP
		TEE DOWN
		WYE
		WYE UP
		WYE DOWN
		CROSS
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER
		UNION
		CAP (BLIND FLANGE)
		ANCHOR

ABBREVIATIONS

AL	ALUMINUM
AR	AIR RELEASE
BV	BUTTERFLY VALVE
CI	CAST IRON
CU	COPPER
CV	CONTROL VALVE
DI	DUCTILE IRON
EQ	EQUAL
FD	FLOOR DRAIN
FEXT	FIRE EXTINGUISHER
FL	FLANGED
FRP	FIBERGLASS REINFORCED PLASTIC
GV	GATE VALVE
H	HIGH
HDPE	HIGH DENSITY POLYETHYLENE
HP	HIGH POINT
LG	LONG
LP	LOW POINT
MJ	MECHANICAL JOINT
MPZ	MAIN PRESSURE ZONE
NEPZ	NORTH END PRESSURE ZONE
O.C.	ON CENTER
PE	PLAIN END
PVC	POLYVINYL CHLORIDE
R	RISER
R&D	REMOVE & DISPOSE
R&R	REMOVE & RELOCATE
RES	RESERVED
R.O.	ROUGH OPENING
SCH	SCHEDULE
SP	SPACE
SQ	SQUARE
SS	STAINLESS STEEL
STL	STEEL
T	TREAD

FLOW STREAM IDENTIFICATION

BW	BACKWASH
CHEM	CHEMICAL FEED SYSTEMS YARD PIPING CONDUIT/SLEEVES
CLS	CHLORINE SOLUTION LINE
CS	CAUSTIC SODA (SODIUM HYDROXIDE)
CW	POTABLE COLD WATER (INTERIOR ONLY)
D	DRAIN
F	FILTRATE
FB	FILTER BACKWASH
FC	FLUSHING CONNECTIONS
FTW	FILTER TO WASTE
FW	FINISHED WATER
HW	POTABLE HOT WATER (INTERIOR ONLY)
INF	INFLUENT
LPA	LOW PRESSURE AIR
LPD	LOWER PRESSURE DIFFUSER LINES
PE	PLANT EFFLUENT
PF	PRE-FILTER (AFTER CHLORINE ADDITION)
PP	BLENDED PHOSPHATE
PW	PROCESS WASTE (FILTRATE)
RW	RAW WATER
S	SANITARY SEWER
SA	SAMPLE LINE
SD	SUMP PUMP DISCHARGE
SH	SODIUM HYPOCHLORITE
SW	SEAL WATER
SWS	SERVICE WATER SUPPLY
TD	TANK DRAIN
V	VENT (INTERIOR VENTS ONLY)

VALVE SYMBOLS

(SEE GENERAL ABBREVIATIONS FOR PIPE MATERIAL IDENTIFICATION)

DOUBLE LINE	SINGLE LINE	
		AIR/VACUUM RELEASE
		BALL
	V	(VEE) BALL
		BUTTERFLY
		(BALL) CHECK
(FLANGED - TOP&SIDE)		(SWING) CHECK
		DIAPHRAGM
		FLUSHING CONNECTION
(FLANGED - SIDE) (FLANGED - TOP)		GATE
	M	MOTOR OPERATED VALVE
	HO	(HAND OPERATED) GATE
	K	(KNIFE) GATE
		GLOBE
		HOSE BIBB
		MULTI-PORT
		NEEDLE
		PINCH
		PINCH TYPE CHECK VALVE
(FLANGED - TOP&SIDE)		(ECCENTRIC) PLUG
		PRESSURE CONTROL
PRV		PRESSURE RELIEF
		QUICK CONNECTION
	S	SAMPLE
	S	SOLENOID OPERATED VALVE
	V_{104}	VALVE TYPE DESIGNATION (SEE SPECIFICATION 15100)
(FLANGED - SIDE) (FLANGED - TOP)		WATER OPERATED CONTROL VALVE

GATE SYMBOLS

ELEV	PLAN	
		FLAP
		SLIDE
		SLUICE

PUMP SYMBOLS

CENTRIFUGAL PUMP	
CHEMICAL FEED PUMP	
COMPRESSOR	
DIAPHRAGM PUMP	
PISTON PUMP	
PROGRESSING CAVITY PUMP	
SUBMERSIBLE SUMP PUMP	
SAMPLE PUMP	
POSITIVE DISPLACEMENT BLOWERS	
TRANSFER PUMP	

GENERAL NOTES

1. LAY PIPE TO UNIFORM GRADE BETWEEN INDICATED ELEVATION POINTS.
2. SIZE OF FITTINGS SHOWN ON PLANS SHALL CORRESPOND TO ADJACENT STRAIGHT RUN OF PIPE, UNLESS OTHERWISE INDICATED. TYPE OF JOINT AND FITTING MATERIAL SHALL BE THE SAME AS SHOWN FOR ADJACENT STRAIGHT RUN OF PIPE.
3. FINAL PIPE SUPPORT REQUIREMENTS SHALL BE DETERMINED IN THE FIELD AND REVIEWED BY THE ENGINEER PRIOR TO INSTALLATION. MAXIMUM SPACING SHALL BE 10' AND AT ALL BENDS AND TEES. PIPE ANCHORS TRUSS RODS AND SUPPORTS TO BE INSTALLED PER SPECIFICATION 15094.
4. ALL JOINTS SHALL BE WATERTIGHT. WALL PIPES OR SLEEVES SHALL BE USED WHEREVER PIPING PASSES FROM A STRUCTURE TO EARTH. SMALL (LESS THAN 3") WALL PENETRATIONS ARE NOT SHOWN.
5. SYMBOLS, LEGENDS, AND PIPE IDENTIFICATION SHOWN UNDER THE PROCESS DISCIPLINE SHALL ALSO BE FOLLOWED THROUGHOUT OTHER DISCIPLINES IN THE PROJECT PLANS. NOT ALL OF THE VARIOUS PIPING COMPONENTS SHOWN IN THE LEGEND ARE NECESSARILY USED IN THIS PROJECT.
6. PROVIDE UNIONS TO FACILITATE CONVENIENT REMOVAL OF VALVES, PIPING, AND MECHANICAL EQUIPMENT FOR SMALL DIAMETER CHEMICAL FEED AND WATER PIPING SYSTEMS.
7. SIZES OF EQUIPMENT FOUNDATIONS INDICATED ON THE DRAWINGS ARE APPROXIMATE. EXACT DIMENSIONS SHALL BE DETERMINED BY THE CONTRACTOR FOR THE EQUIPMENT FURNISHED. ALL FLOOR MOUNTED EQUIPMENT SHALL BE SET ON CONCRETE PADS CONFORMING TO DETAILS SHOWN ON THE STRUCTURAL AND/OR PROCESS DRAWINGS.
8. ALL MATERIALS USED IN THE PROJECT SHALL BE NEW. ALL EXISTING VALVES, PIPE, AND EQUIPMENT SHOWN TO BE DEMO'D SHALL BE DISPOSED OF BY THE CONTRACTOR OR SALVAGED TO DOVER COMMUNITY SERVICES PER THE DEMOLITION DRAWINGS.
9. CONTRACTOR TO USE SHOP DRAWINGS FOR ACTUAL DIMENSIONS OF EQUIPMENT AND ADJUST LAYOUT ACCORDINGLY.
10. CONTRACTOR SHALL FURNISH SHOP DRAWINGS OF PIPE LAYOUTS PRIOR TO INSTALLATION.
11. ALL PVC PIPE SHALL BE SCHEDULE 80 WITH 316 S.S. BOLTS WHERE SHOWN AS FLANGED.
12. ALL PIPE PENETRATIONS THROUGH WALLS SHALL BE SEALED WITH MECHANICAL RUBBER TYPE WALL SEALS.
13. ALL CONNECTIONS BETWEEN DISSIMILAR METALS SHALL BE GASKETED WITH NEOPRENE OR OTHER APPROVED METHOD.
14. DUCTILE IRON PIPE TO HAVE DUCTILE IRON FITTINGS.
15. ALL INTERIOR PIPING SHALL BE FLANGED DUCTILE IRON UNLESS NOTED OTHERWISE, WITH 316 S.S. BOLTS.

ANNOTATION SYMBOLS

A / P-7	SECTION CUT NUMBER ID
	SHEET UPON WHICH SECTION APPEARS
1 / P-8	DETAIL NUMBER ID
	SHEET UPON WHICH DETAIL APPEARS
8	KEY NOTE

LEGEND

	DEMOLITION
	STATIC MIXER
	PRESSURE TRANSDUCER
M	MAGNETIC FLOW METER
	PRESSURE GAUGE

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21 By TGP	
	CONSTRUCTION Date 2/9/22 By TGP	
	RECORD DRAWING Date - By -	

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2116_P-MTP
Scale AS SHOWN

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER - LICENSED - No. 8531 - KEITH PRATT

STATE OF NEW HAMPSHIRE - PROFESSIONAL ENGINEER - LICENSED - No. 10961 - THOMAS PAGE

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

PROCESS PIPING LEGEND & NOTES

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

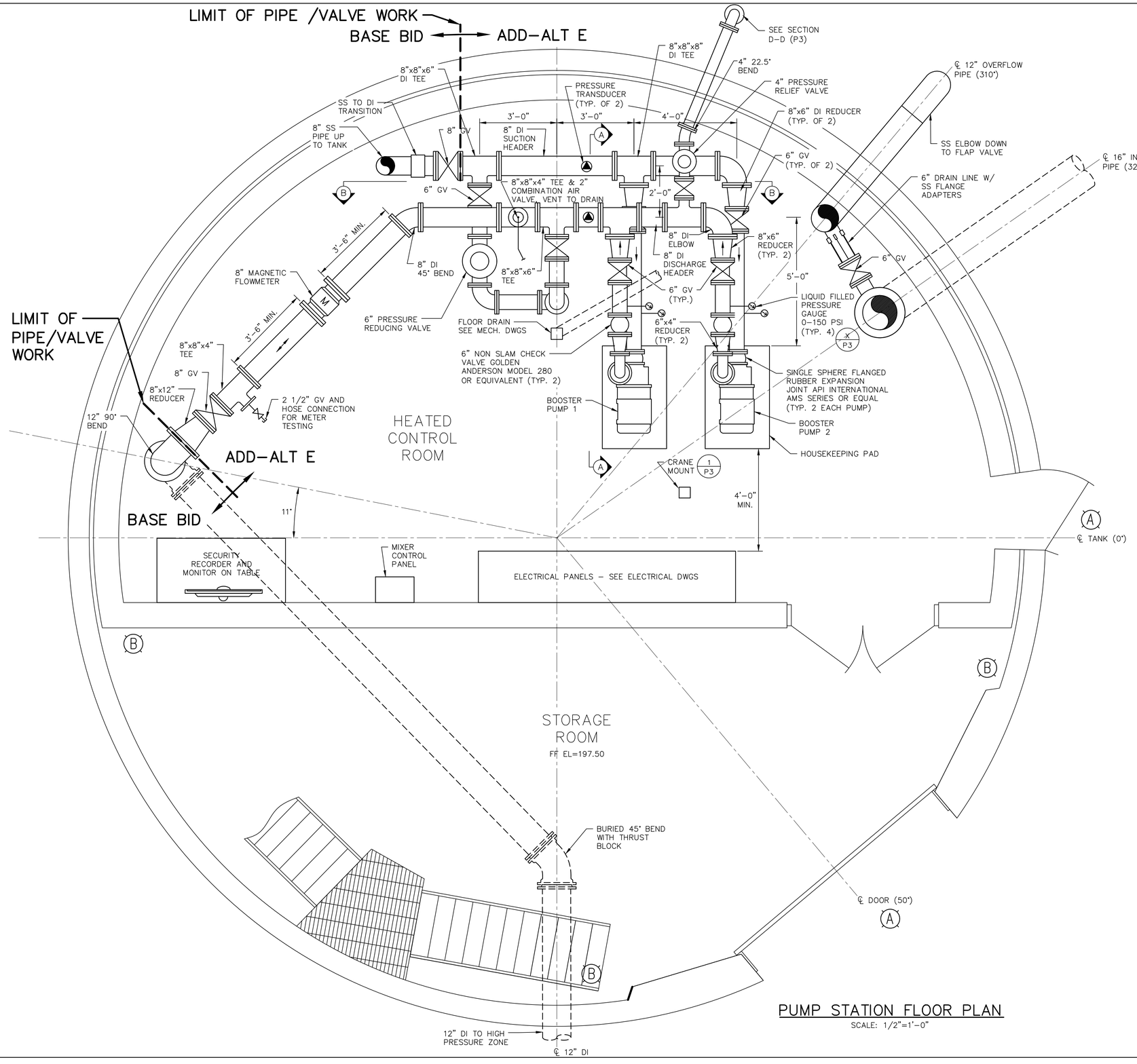
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO P1

SHEET 23 OF 43

C:\Users\mng\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_plngnmt.dwg, P1, 2/7/2022 6:31:23 PM, mng



PUMP STATION FLOOR PLAN

SCALE: 1/2"=1'–0"

NOTES:

1. THREADED FLANGE ADAPTER, BALL VALVE, AND 2 1/2" HOSE COUPLING. ORIENT IN FIELD PER OWNER FOR ACCESS FOR FLOWMETER TESTING.
2. 1/2" TAP, BALL VALVE AND 0–150 PSI PRESSURE GAUGE. ORIENT IN FIELD PER ENGINEER.
3. INSTALL MAGNETIC FLOW METERS W/MIN. 5 PIPE DIAMETERS STRAIGHT RUN UPSTREAM AND DOWNSTREAM, OR AS RECOMMENDED BY MANUFACTURER, FOR FLOW BOTH DIRECTIONS.
4. CONTRACTOR RESPONSIBLE TO VERIFY DIMENSIONS AND ELEVATIONS IN FIELD. EQUIPMENT AND PIPING LAYOUTS SHALL BE COORDINATED WITH EQUIPMENT SUPPLIED AND/OR EXISTING CONDITIONS.
5. ALL BURIED PIPE CONNECTIONS TO STRUCTURES SHALL HAVE FLEXIBLE MJ CONNECTIONS APPROX. 4 FEET OUTSIDE THE STRUCTURE. COUPLINGS SHALL BE RESTRAINED ON PRESSURE PIPES.
6. PROVIDE PIPE SUPPORTS FOR ALL PIPE PER SPECIFICATIONS.
7. WORK UNDER ADD–ALT E BOOSTER PUMP STATION INCLUDES FLOWMETER, PRESSURE REDUCING VALVE, BOOSTER PUMPS, VFD'S, PRESSURE TRANSDUCERS, PRESSURE GAUGES AND ASSOCIATED PIPING AND VALVES. INSTALL BLIND FLANGES UNDER BASE BID IF BOOSTER PUMP STATION NOT INSTALLED UNDER THIS PROJECT.

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21 By TGP	
	CONSTRUCTION Date 2/9/22 By TGP	
	RECORD DRAWING Date – By –	

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – PROFESSIONAL ENGINEER – KEITH PRATT No. 8531 (LICENSED)

STATE OF NEW HAMPSHIRE – PROFESSIONAL ENGINEER – THOMAS GAGE PAGE No. 10961 (LICENSED)

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603–436–6192 Fax. 603–431–4733

HEATED CONTROL ROOM FLOOR PLAN

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22–02

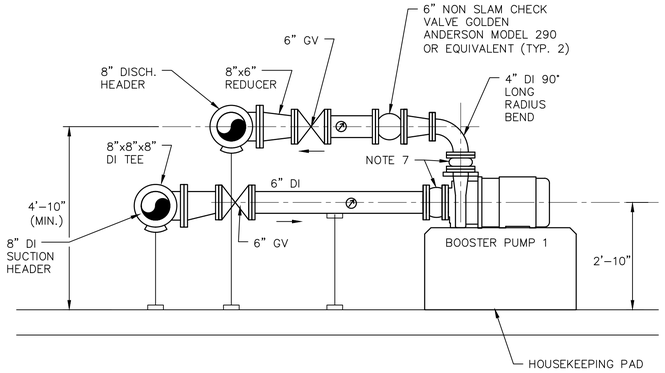
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO P2

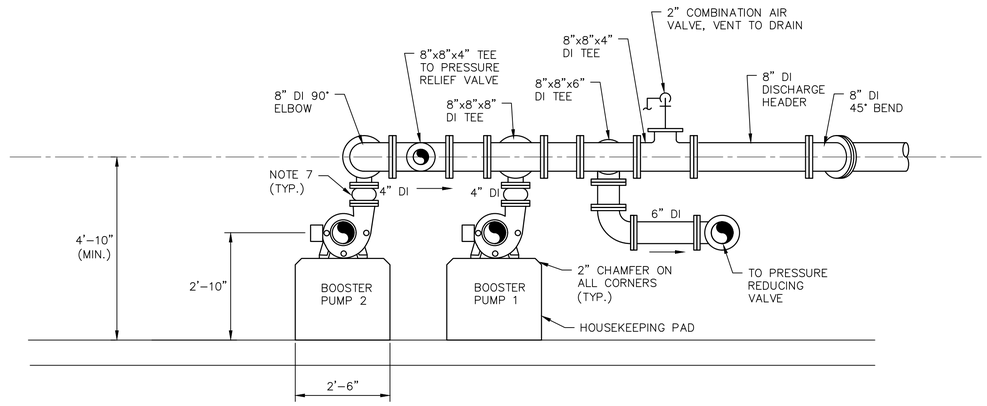
SHEET 24 OF 43

C:\Users\mg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, P2, 2/7/2022 2:26:05 PM, mg



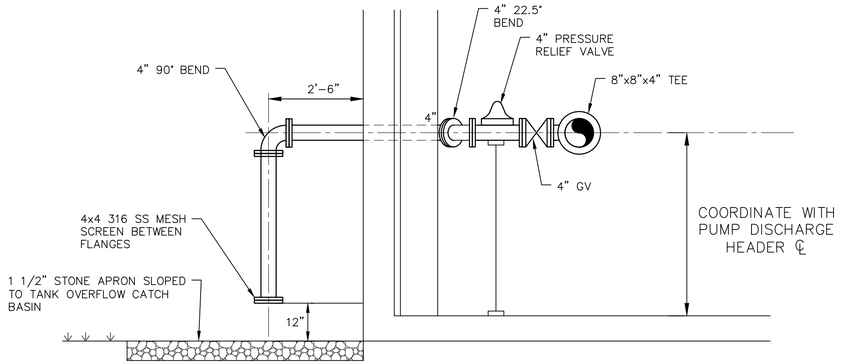
SECTION A–A

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



SECTION B–B

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



SECTION D–D

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

BOOSTER PUMPING STATION NOTES:

1. NORMAL OPERATION: RAISE WATER PRESSURE FROM EXISTING MAIN PRESSURE ZONE HGL TO THE DOVER NORTH END PRESSURE ZONE, MAINTAINED BY THE EXISTING NORTH END STORAGE TANK.

2. ALT. OPERATION: FLOW FROM THE NORTH END PRESSURE ZONE TO THE MAIN PRESSURE ZONE.

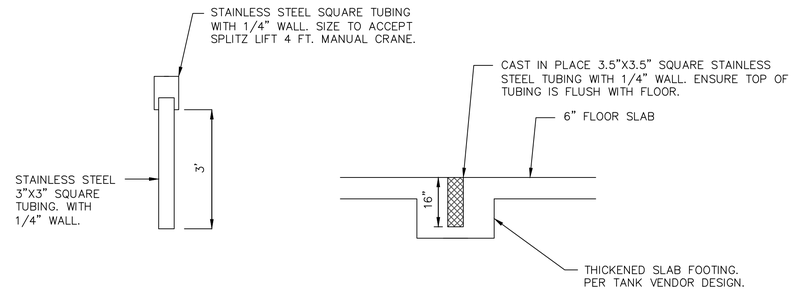
3. SLOPE FLOOR TO DRAIN. SLOPE 4" PVC OUTLET 1/2" PER FOOT (MIN.) TO CATCH BASIN. SEE MECHANICAL DRAWINGS FOR FLOOR DRAIN SPECIFICATIONS.

4. THE FOLLOWING SURFACES SHALL BE PAINTED: TRIM, CEILING, PIPING, PIPE SUPPORTS, DOORS & FRAMES. SEE SECTION 09912 OF PROJECT MANUAL.

5. PIPE SUPPORTS MUST BE INSTALLED ON SUCTION AND DISCHARGE HEADERS SUCH THAT THE WEIGHT OF THE PIPES DOES NOT BEAR ON THE PUMPS.

6. CITY TO PROVIDE SPITZ LIFT 4 FT. PORTABLE MANUAL CRANE WITH BOLT ON/WELD ON KIT, TO BE USED AS PUMP HOIST.

7. FLANGED SINGLE SPHERE RUBBER EXPANSION JOINT, API INTERNATIONAL AMS SERIES OR EQUAL.



1/P3 STEEL & CONCRETE FLOOR SLEEVE SUPPORT FOR PUMP HOIST

SCALE: NOT TO SCALE

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21 By TGP	
	CONSTRUCTION Date 2/9/22 By TGP	
	RECORD DRAWING Date – By –	

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – LICENSED PROFESSIONAL ENGINEER – KEITH PRATT No. 8631

STATE OF NEW HAMPSHIRE – LICENSED PROFESSIONAL ENGINEER – THOMAS PAGIE No. 10982

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

PUMP STATION SECTION & DETAILS

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

DWG NO P3

SHEET 25 OF 43

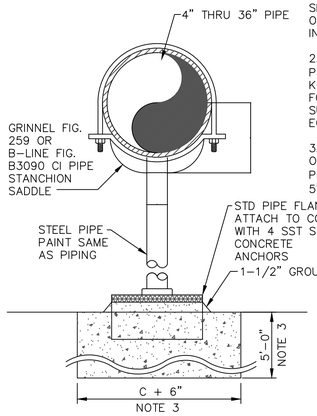
C:\Users\mrg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, P3, 2/7/2022 6:26:07 PM, mrg

NOTES:

1. PROVIDE HALF ROUND RIGID INSULATION AND INSULATION PROTECTION SHIELD, SIMILAR TO GRINNELL FIGURE 167 OR ELCEN FIGURE 219, WHERE PIPING IS INSULATED.

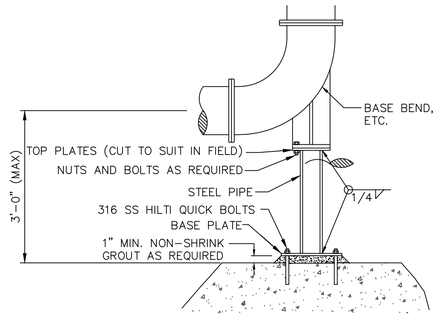
2. PROVIDE NEOPRENE WAFFLE ISOLATION PAD, SIMILAR TO MASON TYPE 'W' OR KORFUND KORPAD 40, UNDER SUPPORT FOOT WHEN PIPING IS ISOLATED OR SUPPORT IS ADJACENT TO MECHANICAL EQUIPMENT.

3. WHERE PIPE HAS TO BE SUPPORTED OVER EARTH, A TYPE A CONCRETE PEDESTAL EQUAL IN WIDTH TO C+6" AND 5' DEEP SHALL BE USED.

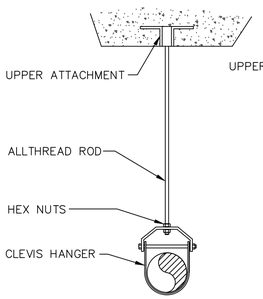


DIMENSION TABLE			
PIPE SIZE	A	B	C
3"	3"	3-9/16"	9"
4"	3"	4-3/16"	9"
5"	3"	4-13/16"	9"
6"	3"	5-7/16"	9"
8"	3"	6-15/16"	9"
10"	3"	8-7/16"	9"
12"	3"	9-15/16"	9"
14"	4"	10-15/16"	11"
16"	4"	12-3/8"	11"
18"	4"	13-7/8"	11"
20"	6"	15-3/8"	13-1/2"
22"	6"	16-5/8"	13-1/2"
24"	6"	17-15/16"	13-1/2"
28"	6"	19-1/8"	13-1/2"
30"	6"	21-5/16"	13-1/2"
32"	6"	22-1/2"	13-1/2"
36"	8"	24-1/2"	16"

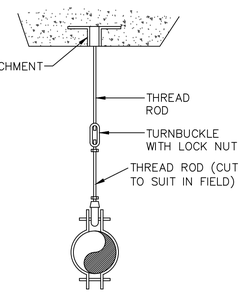
PIPE SUPPORT
N.T.S.



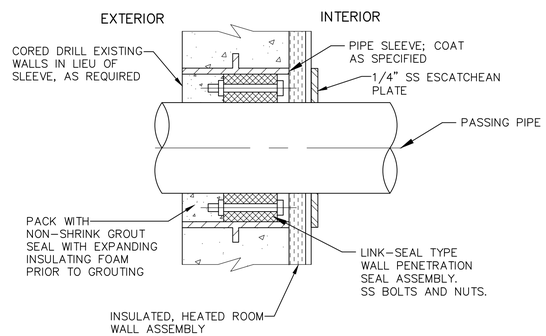
BASE ANCHOR PIPE SUPPORT
N.T.S.



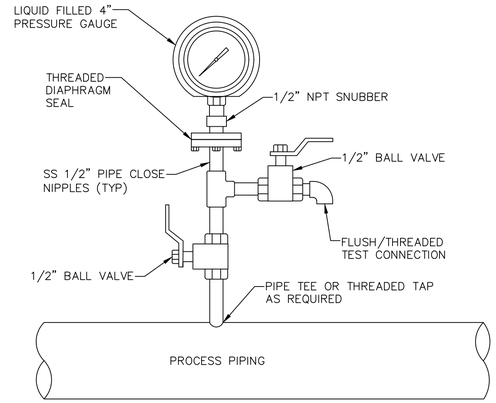
PIPE SUPPORT
N.T.S.



PIPE SUPPORT
N.T.S.



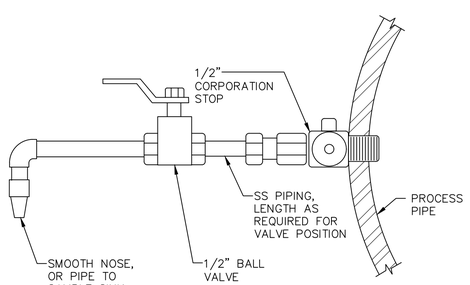
TYPICAL CONCRETE WALL PENETRATION
N.T.S.



GAUGE ASSEMBLY
N.T.S.

NOTES:

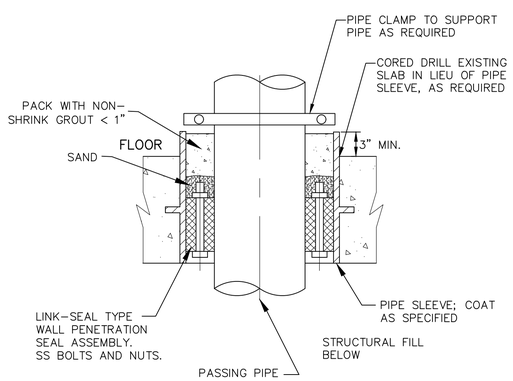
1. SEE DIV. 15 FOR ADDITIONAL SPECIFICATIONS.
2. MINIMIZE HEIGHT OF ASSEMBLY.
3. DIAPHRAGM SEAL NOT REQUIRED FOR FINISHED WATER.



NOTES:

1. LOCATE IN FIELD PER ENGINEER.

SAMPLE PORT DETAIL
N.T.S.



TYPICAL CONCRETE FLOOR PENETRATION
N.T.S.

C:\Users\mrg\Desktop\desktop working files\Real Numbers\Dover\2575 - Garrison Hill Water Storage Facilities\Drawings\2575_details.dwg, Fri, 2/7/2022 6:06:12 PM, mrg

ISSUE FOR		
APPROVAL	By	TGP
Date 12/17/21		
CONSTRUCTION	By	TGP
Date 2/9/22		
RECORD DRAWING	By	-
Date -		

NO.	REVISIONS	APP'D

Drawn/Chk RMG
Designed ALA
Checked TGP
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_details
Scale AS SHOWN

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT BY UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

PROCESS DETAILS - II

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

DWG NO	SHEET
P4	26 OF 43

HVAC LEGEND

CIRCULATOR PUMP	SUPPLY AIR	LAT	LEAVING AIR TEMPERATURE	COP	COEFFICIENT OF PERFORMANCE
BALL VALVE	RETURN OR EXHAUST AIR	LF	LINEAL FOOT	EER	ENERGY EFFICIENCY RATIO
PRESSURE GAUGE	SUPPLY & RETURN AIR TURN DOWN	LWT	LEAVING WATER TEMPERATURE	FLA	FULL LOAD AMPS
CHECK VALVE	MANUAL BALANCING DAMPER	MCA	MINIMUM CIRCUIT AMPACITY	FO	FLAT OVAL DUCT
PRV SAFETY RELIEF VALVE	SUPPLY AIR FLOW	RA	RETURN AIR	CFF	CAPPED FOR FUTURE
THERMOMETER	RETURN/EXHAUST AIR FLOW	SA	SUPPLY AIR	AWT	AVERAGE WATER TEMPERATURE
THERMOSTAT / AQUASTAT	CONNECT TO EXISTING	EA	EXHAUST AIR	VFD	VARIABLE FREQUENCY DRIVE
OCCUPANCY SENSOR	POINT OF DEMOLITION	OA	OUTDOOR AIR	CAR	CONSTANT AIRFLOW REGULATOR
TEMPERATURE SENSOR	FLEX CONNECTOR	SC	SENSIBLE COOLING CAPACITY	AD	ACCESS DOOR
DIFFERENTIAL PRESSURE SENSOR	PIPE TEE AND 90 ELBOW	TC	TOTAL COOLING CAPACITY	C.M.	CONSTRUCTION MANAGER
WALL SWITCH	MECHANICAL EQUIPMENT	WPD	WATER PRESSURE DROP	A.H.J.	AUTHORITY HAVING JURISDICTION
METHANE SENSOR	MANUAL BALANCING VALVE	BDD	BACKDRAFT DAMPER	FPF	FINS PER FOOT
HYDROGEN SULFIDE SENSOR	2-WAY CONTROL VALVE	A.F.F.	ABOVE FINISHED FLOOR	G.C.	GENERAL CONTRACTOR
OXYGEN SENSOR	3-WAY CONTROL VALVE	APD	AIR PRESSURE DROP	M.C.	MECHANICAL CONTRACTOR
PIPE RISE & PIPE DROP	PRESSURE RELIEF VALVE	S.L.	SKYLIGHT	P.C.	PLUMBING CONTRACTOR
PIPE OR DUCT REDUCER	THERMOSTATIC MIXING/ DIVERTING VALVE	SD	SMOKE DAMPER	(E)	EXISTING
FD FIRE DAMPER	BUTTERFLY VALVE	ACV	AUTOMATIC CONTROL VALVE	UH	UNIT HEATER
SD SMOKE DAMPER	CIRCUT SENSOR	SCV	SELF CONTAINED CONTROL VALVE	CUH	CABINET UNIT HEATER
MD MOTORIZED CONTROL DAMPER	FLOW SENSOR	HWS/R	HOT WATER SUPPLY & RETURN	NTS	NOT TO SCALE
BDD BACK DRAFT DAMPER	AUTOMATIC BALANCING VALVE	ACD	AUTOMATIC CONTROL DAMPER		
RETURN UNDER ENCLOSURE	XX-1 EQUIPMENT TAG	B.F.C.	BELOW FINISHED CEILING		
REMOVE/DEMOLISH EQUIPMENT/PIPING SHOWN HATCHED ON DEMO PLANS	A 48x12 1000 RGD TAG, NECK SIZE, CFM	BHP	BRAKE HORSE POWER		
	FTR-1 14'-0" 0.5 FINNED TUBE RADIATOR TAG, LENGTH, GPM	CD	CONDENSATE DRAIN		
		EAT	ENTERING AIR TEMPERATURE		
		ESP	EXTERNAL STATIC PRESSURE		
		EWT	ENTERING WATER TEMPERATURE		

CODES & STANDARDS

THE FOLLOWING CODES APPLY TO THE DESIGN OF THE MECHANICAL SYSTEM:

BUILDING CODE:	2015 INTERNATIONAL BUILDING CODE (IBC)
MECHANICAL CODE:	2015 INTERNATIONAL MECHANICAL CODE (IMC)
PLUMBING CODE:	2015 INTERNATIONAL PLUMBING CODE (IPC)
VENTILATION:	2015 INTERNATIONAL MECHANICAL CODE (IMC)
ENERGY CODE:	2015 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

CLIMATE

HEATING AND COOLING LOADS HAVE BEEN PERFORMED USING THE FOLLOWING CURRENT CLIMATE DATA FROM THE 2013 ASHRAE HANDBOOK FOR PORTSMOUTH, NH:

WINTER DESIGN CONDITIONS:	OUTDOOR AIR DB:	2.2°F (99.6% VALUE)
	INDOOR AIR DB:	70°F
SUMMER DESIGN CONDITIONS:	OUTDOOR AIR DB:	89.6°F (0.4% VALUE)
	OUTDOOR AIR MCWB:	72.8°F (0.4% VALUE)
	INDOOR AIR DB:	75°F
	INDOOR DEW POINT:	50°F

SPACE & SYSTEMS DESCRIPTION

HEATING/COOLING:

- HEATING AND COOLING IS PROVIDED BY A NON-DUCTED AIR-SOURCE HEAT PUMP (ASHP) SYSTEM CONSISTING OF (1) INDOOR WALL HUNG UNIT CONNECTED TO (1) OUTDOOR UNIT. REFRIGERANT PIPING CONNECTS INDOOR AND OUTDOOR UNITS. A THERMOSTAT IS PROVIDED FOR THE INDOOR UNIT.

DEHUMIDIFICATION:

- DEHUMIDIFICATION IS PROVIDED BY PORTABLE PLUG-IN TYPE DEHUMIDIFICATION UNITS.

PORTABLE DEHUMIDIFIER SCHEDULE

TAG	MAKE	MODEL	BLOWER CFM	WATER REMOVAL (GALLON)	VOLTAGE/ PHASE	FLA (AMPS)	POWER (KW)	DIMENSIONS WxDxH (IN.)	UNIT WEIGHT (LB.)	NOTES
DH-1	QUEST	HI-E DRY 195	540	24 @ 80°F, 60% RH	115/1	12	1.25 @ 80°F, 60% RH	37x19x40	180	1, 2

1. POWERED BY A FACTORY INSTALLED POWER CORD.
2. PROVIDE WITH PLEATED MEDIA MERV-8 FILTERS (AND THREE ADDITIONAL SETS OF SPARE FILTERS) FOR EACH UNIT AND INTEGRAL CONDENSATE PUMP.

AIR SOURCE HEAT PUMP - OUTDOOR UNIT SCHEDULE

TAG	MAKE	MODEL	COOLING CAP. (BTU/H)	HEATING CAP. (MBH) 47F/5F	REF. TYPE	VOLT/PH/CY	MCA (AMPS)	MAX FUSE SIZE (AMPS)	WEIGHT (LBS)	DIMENSIONS (HxWxD)	REFRIG. LINE CONN.	NOTES
HPCU-1	MITSUBISHI	PUZ-HA24NHA1	24,000	26,000/26,000	R410A	208/1/60	17	27	190	38x14x37	¼" RL & ⅜" RS	1-3

1. PROVIDE 18" HIGH STEEL STAND ON 4" CONCRETE HOUSEKEEPING PAD.
2. PROVIDE HYPER HEAT MODEL.
3. PROVIDE WIND BAFFLE FOR LOW-AMBIENT COOLING OPERATION.

AIR SOURCE HEAT PUMP - INDOOR UNIT SCHEDULE

TAG	MAKE	MODEL	COOLING CAP. (BTU/H)	HEATING CAP. (MBH) 47F/5F	REF. TYPE	TOTAL AIR FLOW (CFM)	VOLT/PH/CY	MCA (AMPS)	WEIGHT (LBS)	TYPE	REFRIG. LINE CONN.	NOTES
HP-1	MITSUBISHI	PKA-A24KA7	24,000	26,000/26,000	R410A	635	208/1/60	1.0	46	WALL CASSETTE	¼" RL & ⅜" RS	1-3

1. INCLUDE WALL MOUNTED, HARD WIRED PROGRAMMABLE THERMOSTAT, MITSUBISHI MODEL PAC-YT53CRAU.
2. INCLUDE DRAIN LEVEL PAN SENSOR (DLPS).
3. INDOOR UNIT IS POWERED DIRECTLY FROM OUTDOOR UNIT.

Petersen Engineering

ISSUE FOR			NO.
APPROVAL	Date 12/17/21	By TGP	
CONSTRUCTION	Date 1/31/22	By TGP	
RECORD DRAWING	Date -	By -	

REVISIONS	APP'D

Drawn/Chk. AH/EA
Designed JMI
Checked SC
Approved JFP
Date 2/4/22
Book No. -
Project No. 22/2
Dwg. ID -
Scale AS SHOWN

STATE OF NEW HAMPSHIRE - JAMES F. PETERSEN No. 8129 - LICENSED PROFESSIONAL ENGINEER

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

HVAC BOD AND SCHEDULES

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

© COPYRIGHT BY UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO M-1

SHEET 27 OF 43

DIVISION 15500 HVAC SPECIFICATIONS

1. SUMMARY OF WORK:

THESE DRAWINGS DEPICT THE INSTALLATION OF MECHANICAL SYSTEMS TO SERVE PROJECT NAME. IT IS THE INTENT OF THESE DRAWINGS TO IDENTIFY THE MAIN SYSTEM COMPONENTS AND REQUIREMENTS.

2. COMPLETE SYSTEMS:

IT IS NOT THE INTENT OF THESE DRAWINGS AND SPECIFICATIONS THAT EVERY ITEM NECESSARY FOR COMPLETE SYSTEMS BE SHOWN. THE CONTRACTOR'S WORK SHALL INCLUDE LABOR, MATERIALS AND EQUIPMENT REQUIRED FOR A HIGH QUALITY, COMPLETE INSTALLATION. OFFSETS AND/OR CHANGES IN ELEVATION OF PIPES AND DUCTWORK DUE TO UNFORESEEN INTERFERENCES SHALL BE PROVIDED AT NO ADDITIONAL COST.

3. SUBMITTALS:

SHOP DRAWINGS SHALL BE SUBMITTED IN PDF FORMAT FOR APPROVAL FOR ALL EQUIPMENT AND MATERIALS, REFER TO DIVISION 1 SPECIFICATION FOR ADDITIONAL SUBMITTAL REQUIREMENTS.

PIPING, DUCTWORK, AND EQUIPMENT LAYOUT SHALL BE SUBMITTED ON 1/4" OR 1/8" SCALE DRAWINGS (AS REQUIRED TO MATCH SCALE ON DESIGN DRAWINGS) AND SHALL BE COORDINATED AND STAMPED BY ALL TRADES. SHOP DRAWINGS SHALL SHOW LOCATION OF ALL NEW EQUIPMENT AND WORK.

SUBMIT COORDINATED SHOP DRAWINGS FOR AUTOMATIC CONTROL DIAGRAMS.

SUBMIT SHEET METAL AND PIPING CONSTRUCTION STANDARDS.

4. PERMITS, FEES AND REGULATIONS:

THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL REQUIRED PERMITS, LICENSES, CERTIFICATES, FEES AND CHARGES FOR WORK INSTALLED CERTIFYING COMPLIANCE WITH LOCAL CODES AND GOVERNING AUTHORITIES.

5. OPERATION AND MAINTENANCE (O&M) MANUALS:

OPERATION AND MAINTENANCE MANUALS AND INSTRUCTIONS
PRIOR TO SUBSTANTIAL COMPLETION, THE CONTRACTOR SHALL PROVIDE THREE (3) BOUND COPIES OF PRINTED OPERATIONS INSTRUCTIONS AND MAINTENANCE INFORMATION FOR EQUIPMENT AND SYSTEMS PROVIDED UNDER THIS CONTRACT, INCLUDING PREVENTATIVE MAINTENANCE PROCEDURES.

6. MAINTENANCE CONTRACT:

THIS CONTRACTOR SHALL PROVIDE AND ASSUME COMPLETE RESPONSIBILITY FOR START-UP AND 24 HOUR/DAY SERVICE WITH A RESPONSE TIME NOT TO EXCEED 6 HOURS.

INCLUDE IN THIS CONTRACT A PRICE TO PROVIDE MAINTENANCE ON A QUARTERLY BASIS (4 MAINTENANCE INSPECTIONS A YEAR) FOR A PERIOD OF ONE YEAR FOR ALL NEW HVAC EQUIPMENT.

THIS ONE YEAR MAINTENANCE CONTRACT SHALL INCLUDE, BUT IS NOT LIMITED TO THE FOLLOWING WORK:

CHECK LINES FOR LEAKAGE OF REFRIGERANT/WATER
REFILL LINES IF NECESSARY
LUBRICATE MOTORS
REPLACE AIR FILTERS
CHECK AND TIGHTEN ELECTRICAL CONNECTIONS
CHECK CONTROLS AND MAKE CORRECTIONS IF NECESSARY
CHECK FOR NOISE AND VIBRATION
CHECK REFRIGERANT PRESSURE DURING OPERATION
CHECK CURRENT (AMPERAGE) DRAW OF ALL MOTORS
CHECK OPERATION OF CONDENSATE DRAIN SYSTEM
CHECK AIR TEMPERATURE ACROSS EVAPORATOR

7. GUARANTEE:

THE CONTRACTOR SHALL GUARANTEE ALL WORK FOR A PERIOD OF ONE (1) YEAR AFTER SUBSTANTIAL COMPLETION. THE CONTRACTOR SHALL REPAIR OR CORRECT THE WORK WITHIN TEN (10) DAYS OF WRITTEN NOTIFICATION. IF THE CONTRACTOR DOES NOT COMPLY, THE OWNER MAY HAVE THE WORK CORRECTED AND CHARGE ALL SUCH TO THE CONTRACTOR.

8. STORAGE OF MATERIALS:

THE CONTRACTOR SHALL COORDINATE STORAGE OF HIS MATERIALS AND EQUIPMENT WITH THE GENERAL CONTRACTOR AND SHALL BE RESPONSIBLE FOR ALL LOSS AND DAMAGE.

9. REFERENCE STANDARDS AND INDUSTRY SPECIFICATIONS:

ANY MATERIAL OR OPERATION SPECIFIED BY REFERENCE TO PUBLISHED SPECIFICATIONS OF A MANUFACTURER, SOCIETY, ASSOCIATION, CODE OR OTHER PUBLISHED STANDARD, SHALL COMPLY WITH REQUIREMENTS OF THE LISTED DOCUMENT. ALL WORK SHALL COMPLY WITH THE LATEST EDITION OF STATE, LOCAL AND OTHER CODES WHICH APPLY TO THIS PROJECT OR HAVE JURISDICTION.

INTERNATIONAL BUILDING CODE 2015
NFPA 13 STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME).
UNDERWRITERS LABORATORY (UL).
AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI).
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA).
AMERICAN SOCIETY OF TESTING MATERIALS (ASTM).
NATIONAL ELECTRICAL CODE (NEC).
ASSOCIATED AIR BALANCE COUNCIL (AABC).
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA).
SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA).
AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS (ASHRAE).

10. WORKMANSHIP:

ALL WORK SHALL BE EXECUTED IN A WORKMANLIKE MANNER, BY EXPERIENCED MECHANICS OF THE TRADE IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS AND THE MOST MODERN TRADE PRACTICE AND SHALL PRESENT A NEAT APPEARANCE.

11. SITE INSPECTION:

BEFORE BEGINNING WORK, THE CONTRACTOR SHALL INSPECT THE SITE AND SURVEY THE CONDITIONS TO BE ENCOUNTERED IN THE PERFORMANCE OF THE WORK. FAILURE TO FAMILIARIZE HIMSELF WITH THE CONDITIONS SHALL NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY FOR FULL COMPLETION OF THE WORK IN ACCORDANCE WITH THESE DOCUMENTS.

12. COORDINATION:

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE HIS WORK WITH ALL OTHER TRADES SUCH THAT ALL BUILDING SYSTEMS AND COMPONENTS CAN BE ASSEMBLED WITHOUT CONFLICT AND IN CONFORMANCE WITH ALL CONSTRUCTION DOCUMENTATION, INCLUDING THOSE OF OTHER TRADES.

13. DRAWINGS:

THE DRAWINGS SHOW APPROXIMATE LOCATION OF EQUIPMENT, DUCTWORK AND PIPING. THE EXACT LOCATION SHALL BE DETERMINED BASED ON FIELD CONDITIONS. EQUIPMENT, DUCT WORK AND PIPING SHALL FIT INTO THE SPACES SHOWN ON THE DRAWINGS ALLOWING FOR ACCEPTABLE CLEARANCES FOR INSTALLATION, REPLACEMENT AND MAINTENANCE.

IT IS NOT INTENDED THAT THE DRAWINGS SHOW IN DETAIL EVERY FITTING, DEVICE, ETC. ALL MATERIAL NECESSARY TO SATISFY THE GOVERNING REGULATIONS. THE CURRENT BEST PRACTICES OF THE TRADE SHALL BE IMPLEMENTED TO MEET THE DESIGN INTENT DEPICTED ON THE DRAWINGS AND TO SATISFY ALL APPLICABLE CODE REQUIREMENTS. ALL REQUIRED WORK SHALL BE FURNISHED WITHOUT ADDITIONAL RECOMPENSE.

AUTOCAD RECORD DRAWINGS SHALL BE PREPARED BY THE CONTRACTOR AT THE COMPLETION OF THE PROJECT SHOWING THE AS-BUILT ARRANGEMENT OF THE SYSTEMS. THE ENGINEER'S AUTOCAD FILES WILL BE PROVIDED AT NO COST TO THE CONTRACTOR.

14. DISCREPANCIES AND CLARIFICATIONS:

IN THE EVENT OF A DISCOVERED DISCREPANCY OR AMBIGUITY, IT SHALL BE BROUGHT TO THE ARCHITECT'S ATTENTION IN WRITING AND IN A TIMELY FASHION. THE CONTRACTOR SHALL NOT PROCEED WITH RELATED WORK WITHOUT A WRITTEN RESOLUTION CLARIFICATION FROM THE ARCHITECT.

15. ON-SITE SUPERVISION:

THE CONTRACTOR SHALL MAINTAIN ON-SITE SUPERVISION OF HIS OWN WORK FORCE AND HIS SUB-SUBCONTRACTORS.

16. HVAC MATERIALS:

CONDENSATE DRAIN PIPING SHALL BE TYPE L COPPER.

REFRIGERANT PIPING SHALL BE ASTM B 280 TYPE ACR COPPER TUBE. PIPE SIZES, MANIFOLD ARRANGEMENTS AND MISCELLANEOUS MEANS AND METHODS SHALL MEET THE VRV EQUIPMENT MANUFACTURER'S REQUIREMENTS.

TRAP SEAL IN CONDENSATE DRAIN PIPING SHALL BE MINIMUM 1" GREATER THAN THE STATIC PRESSURE IN SYSTEM.

17. PIPING SUPPORTS:

HORIZONTAL PIPING SHALL BE SUPPORTED BY FORGED STEEL ADJUSTABLE CLEVIS BY ANVIL INTERNATIONAL, INC. OR EQUAL. PROVIDE PROTECTION SHIELDS ON INSULATED PIPING, HANGERS, AND SUPPORTS.

HANGER RODS AND MAXIMUM SPACING SHALL BE AS FOLLOWS:

PIPE SIZE	ROD DIAMETER	MAX SPACING
1-1/4 IN. & BELOW	3/8 IN.	6 FT.
1-1/2 IN. & 2 IN.	3/8 IN.	8 FT.
2-1/2 IN. TO 4 IN.	1/2 IN.	10 FT.

PROVIDE ADDITIONAL SUPPORTS AT CHANGE OF DIRECTION, RUNOUTS, AND CONCENTRATED LOADS DUE TO VALVES, ETC.

18. PIPING SYSTEM TESTING:

ALL PIPING SYSTEM'S SHALL BE PRESSURE TESTED PER MANUFACTURER'S REQUIREMENTS AND PER APPLICABLE CURRENT INDUSTRY STANDARDS.

19. REFRIGERANT PIPING INSTALLATION:

PROVIDE OPERATING CHARGE OF REFRIGERANT AND OIL PER EQUIPMENT MANUFACTURER'S REQUIREMENTS.

INSTALL ALL COMPONENTS (PIPE, VALVES, SIGHTGLASS, RECEIVER'S, ETC.) PER EQUIPMENT MANUFACTURER'S INSTALLATION REQUIREMENTS.

PROVIDE ADEQUATE SUPPORT WITH NO SAGS.

20. EQUIPMENT:

REFER TO EQUIPMENT SCHEDULES. SCHEDULED EQUIPMENT IS THE BASIS OF DESIGN. ALTERNATE MANUFACTURERS WILL BE CONSIDERED, BUT MUST BE EQUAL IN PERFORMANCE AND IN QUALITY (AS DETERMINED BY PETERSEN ENGINEERING).

21. EQUIPMENT SUPPORT:

PROVIDE 4" CONCRETE HOUSEKEEPING PADS FOR ALL FLOOR MOUNTED EQUIPMENT. HOUSEKEEPING PADS SHALL EXTEND A MINIMUM OF 4" BEYOND THE FOOTPRINT OF EQUIPMENT BASES.

22. SEISMIC PROTECTION:

THE MECHANICAL SYSTEMS SHALL BE SEISMICALLY PROTECTED. THE MECHANICAL CONTRACTOR SHALL SUBMIT SEISMIC DESIGN AND CALCULATIONS FOR ALL SYSTEMS SUPPORTED BY THE STRUCTURE. SEISMIC DESIGN AND CALCULATIONS SHALL BE PREPARED AND STAMPED BY A PROFESSIONAL ENGINEER WHO IS LICENSED IN THE STATE OF NEW HAMPSHIRE.

23. EQUIPMENT ACCESS:

MAKE PROVISIONS FOR ACCESS TO ALL CONCEALED VALVES, EQUIPMENT AND ANCILIARY COMPONENTS THAT REQUIRE ACCESS FOR MAINTENANCE OR ADJUSTMENT. PROVIDE WALL OR CEILING ACCESS PANELS AS REQUIRED.

24. IDENTIFICATION:

PROVIDE PERMANENT NAMEPLATES ON ALL EQUIPMENT, INDICATING EQUIPMENT DESIGNATION AS SHOWN ON THE DRAWINGS. PROVIDE TAGS ON ALL VALVES AND PIPE MARKERS WITH FLOW DIRECTION ARROWS ON ALL PIPING.

25. FIRESTOPPING:

PROVIDE FIRESTOPPING AT ALL PENETRATIONS THROUGH FIRE RATED PARTITIONS AND FIRE BARRIERS.

26. HVAC INDOOR AIR QUALITY PLAN DURING CONSTRUCTION:

FOLLOW SMACNA'S STANDARD "IAQ GUIDELINES FOR OCCUPIED BUILDINGS UNDER CONSTRUCTION".
DO NOT OPERATE FAN SYSTEMS UNTIL TIME OF AIR BALANCING NEAR THE END OF SUBSTANTIAL PROJECT COMPLETION. COVER AND SEAL ALL GRILLES, DUCT OPENINGS AND EQUIPMENT INLET AND OUTLETS WITH PLASTIC OR OTHER SUITABLE MATERIAL DURING CONSTRUCTION. USE PORTABLE UNIT HEATERS AND EXHAUST FAN SYSTEMS AS REQUIRED FOR VENTILATION AND HEATING DURING CONSTRUCTION.

CONTROL SEQUENCES

1. DUCTLESS SPLIT SYSTEM (HPCU-1, HP-1):

ON A CALL FOR HEATING/COOLING FROM THE MANUFACTURER'S PROGRAMMABLE THERMOSTAT, THE DUCTLESS SPLIT SYSTEM SHALL OPERATE.
(1) HEATING SETPOINT IS 60°F.
(2) COOLING SETPOINT IS 80°F.

2. PORTABLE DEHUMIDIFIER (PH-1):

ON A CALL FOR DEHUMIDIFICATION FROM INTEGRAL DEHUMIDISTAT, THE UNIT SHALL BE POWERED ON.
SETPOINT: 40% RH (ADJUSTABLE)

Petersen Engineering

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21 By TGP	
	CONSTRUCTION Date 1/31/22 By TGP	
	RECORD DRAWING Date - By -	

Drawn/Chk. AH/EA
Designed JMI
Checked SC
Approved JFP
Date 2/4/22
Book No. -
Project No. 2275
Dwg. ID -
Scale AS SHOWN

JAMES F. PETERSEN No. 8129 LICENSED PROFESSIONAL ENGINEER STATE OF NEW HAMPSHIRE

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

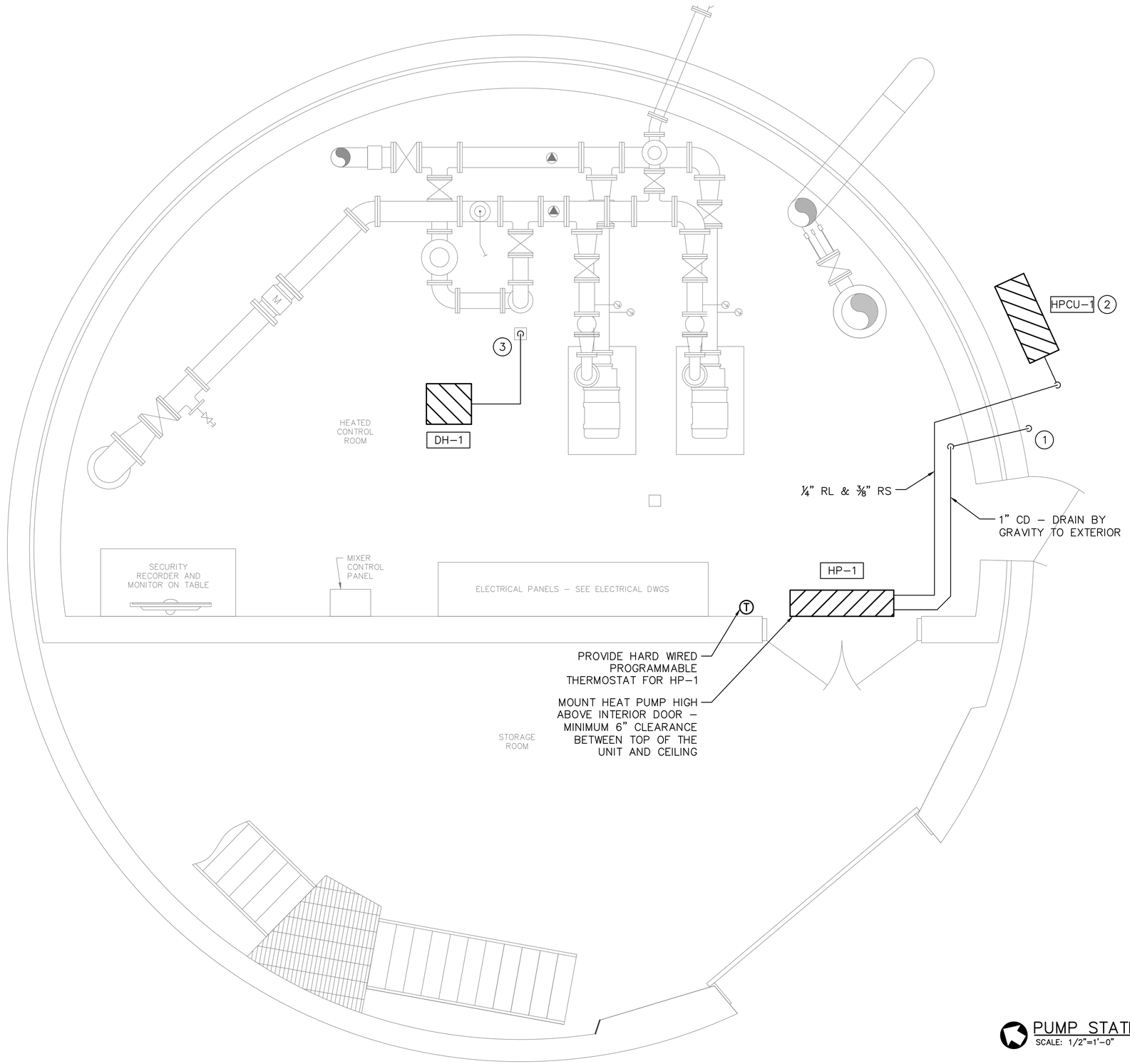
HVAC SPECIFICATIONS

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

DWG NO M-2

SHEET 28 OF 43



PUMP STATION FLOOR PLAN
SCALE: 1/2"=1'–0"

GENERAL NOTES:

1. –

SHEET NOTES:

1. ROUTE CONDENSATE DRAIN PIPING FROM HEAT PUMP TO EXTERIOR WITH A 1" ELBOW DOWN TERMINATION WITH INSECT SCREEN LOCATED 24" ABOVE GRADE.
2. PROVIDE 18" STAND ON 4" CONCRETE PAD FOR HEAT PUMP CONDENSING UNIT
3. DRAIN BY GRAVITY TO FLOOR DRAIN

Petersen Engineering

NO.	REVISIONS	APP'D
	ISSUE FOR APPROVAL Date 12/17/21 By TGP	
	CONSTRUCTION Date 1/31/22 By TGP	
	RECORD DRAWING Date – By –	

Drawn/Chk. AH/EA
Designed JMI
Checked SC
Approved JFP
Date 2/11/22
Book No. –
Project No. 252/5
Dwg. ID –
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – JAMES F. PETERSEN No. 8182 – LICENSED PROFESSIONAL ENGINEER

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603–436–6192 Fax. 603–431–4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

HVAC PUMP STATION FLOOR PLAN

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22–02
CITY OF DOVER, NEW HAMPSHIRE

DWG NO M–3
SHEET 29 OF 43

DIVISION 15400 PLUMBING SPECIFICATIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. GENERAL AND SPECIAL CONDITIONS OF DIVISION 1 OF THESE SPECIFICATIONS ARE HEREBY MADE A PART OF THIS SECTION.

B. INCLUDE ALL LABOR, MATERIALS, EQUIPMENT, APPLIANCES AND SERVICES NECESSARY TO FURNISH, FABRICATE AND INSTALL ALL WORK SPECIFIED HEREIN. REFER TO THE DRAWINGS OR FURTHER DEFINITION OF LOCATION, EXTENT AND DETAILS OF THE WORK. DRAWINGS ARE GENERALLY DIAGRAMMATIC AND ARE INTENDED TO CONVEY THE SCOPE OF WORK AND ARE TO INDICATE THE GENERAL ARRANGEMENT OF EQUIPMENT, DUCTS, PIPING, CONDUITS AND FIXTURES. THE DRAWINGS ARE NOT LIMITED TO THE WORK TO BE DONE UNDER THIS SECTION AND ALSO ALL OTHER DRAWINGS RELATED TO THE WORK TO BE DONE UNDER THIS CONTRACT SO THAT THE CONTRACTOR HAS FULL COMPREHENSION OF THE SCOPE OF HIS WORK AND ITS RELATIONSHIP TO THE OTHER PORTIONS OF THE WORK.

C. THE ARCHITECT RESERVES THE RIGHT TO MAKE REASONABLE MODIFICATION TO THE ARRANGEMENT OF OUTLETS, APPARATUS AND EQUIPMENT UP TO THE TIME OF ROUGHING PIPING WITHOUT INCURRING EXTRA COST TO THE OWNER.

D. THE INTENTION OF THE SPECIFICATIONS AND PLANS IS TO PROVIDE FOR FINISHED SYSTEMS, THAT ARE PROPERLY TESTED AND READY FOR OPERATION, INCLUDING DETAILS AND ACESSORIES REQUIRED TO MAKE THE WORK COMPLETE, EVEN THOUGH SUCH ITEMS MAY NOT BE EXPRESSLY SHOWN OR SPECIFIED FOR ALL SYSTEMS HEREIN SPECIFIED AND SHOWN ON THE DRAWINGS.

E. SPECIFICATIONS ARE INTENDED TO COMPLEMENT THE DRAWINGS; HOWEVER, WORK DETAILED AND/OR NOTED ONLY ON THE DRAWINGS OR WORK DESCRIBED ONLY IN THE SPECIFICATIONS SHALL ALSO BE CONSIDERED AS PART OF THE SCOPE OF WORK. WORK SHALL BE PERFORMED AS DESCRIBED IN THE SPECIFICATIONS EXCEPT WHERE DEVIATIONS ARE INDICATED AND/OR NOTED ON DRAWINGS.

F. BIDDERS ARE ADVISED TO VISIT THE SITE AND INFORM THEMSELVES AS TO CONDITIONS UNDER WHICH THIS WORK WILL BE PERFORMED. FAILURE TO DO SO WILL, IN NO WAY, RELIEVE THE SUCCESSFUL BIDDER FROM THE RESPONSIBILITY OF FURNISHING ANY MATERIALS OR PERFORMING ANY WORK IN ACCORDANCE WITH THE TRUE INTENT AND MEANING OF THE DRAWINGS AND SPECIFICATIONS. NO CLAIM FOR EXTRA COMPENSATION WILL BE RECOGNIZED IF DIFFICULTIES ARE ENCOUNTERED WHICH AN EXAMINATION OF THE SITE CONDITIONS AND CONTRACT DOCUYMENTS PRIOR TO EXECUTING THE CONTRACT WOULD HAVE REVEALED.

1.2 GENERAL CONTRACTOR AND TRADE CONTRACTOR

A. THE PLUMBING CONTRACTOR SHALL BE A DIRECT SUB-CONTRACTOR TO THE PROJECT GENERAL CONTRACTOR.

1.3 PROJECT WORK SCOPE

A. PERFORM WORK AND PROVIDE MATERIAL AND REQUIPMENT FOR SYSTEMS SHOWN ON DRAWINGS AND AS SPECIFIED IN THIS SECTION.

B. GIVE NOTICES, FILE PLANS, OBTAIN PERMITS AND LICENSES, PAY FEES AND BACK CHARGES, AND OBTAIN NECESSARY APPROVALS FROM AUTHORITIES THAT HAVE JURISDICTION AS REQUIRED TO PERFORM WORK IN ACCORDANCE WITH ALL LEGAL REQUIREMENTS AND WITH SPECIFICATIONS, DRAWINGS, ADDENDA AND CHANGE ORDERS, ALL OF WHICH ARE PART OF CONTRACT DOCUMENTS.

1. IN GENERAL, PROJECT WORK SCOPE SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING:
   1. PREPARE ALL SHOP DRAWINGS AND MATERIAL/PRODUCT SUBMITTALS FOR REVIEW AND APPROVAL.
   2. PROVIDE FULLY COORDINATED RELOCATION AND/OR RE-INSTALLATION OF EXISTING PLUMBING SERVICED TO ACCOMODATE INSTALLATION OF NEW EQUIPMENT, PIPING, AND WIRING REQUIRED FOR NEW WORK.
   3. PROVIDE NEW PLUMBING FIXTURES AND EQUIPMENT AS SPECIFIED AND AS SCHEDULED ON PROJECT DRAWINGS.
   4. PROVIDE ALL SPECIFIED PIPING SYSTEMS, INCLUDING ALL REQUIRED MATERIAL TO ENSURE COMPLETE, SOUND SYSTEMS; FITTINGS, SUPPORTS AND HANGERS, ANCHORS, GUIDES, SLEEVES, INSERTS, VALVES, STRAINERS, SYSTEM SPECIALTIES, AND ALL OTHER REQUIRED ACCESSORIES.
   5. PROVIDE SEISMIC RESTRAINT DESIGN AND INSTALLATION AS SPECIFIED IN THESE SPECIFICATIONS.
   6. PROVIDE INSULATION FOR PIPE AS SPECIFIED .
   7. PROVIDE LABELS AND TAGS FOR ALL NEW PIPING, VALVES, AND EQUIPMENT.
   8. PROVIDE SYSTEM FLUSHING/CLEANING AND SYSTEM LEAK/PRESSURE TESTING, OR NEW PIPING INSTALLED AS PART OF THIS PROJECT.
   9. PROVIDE CORE DRILLING FOR PIPING.
   10. PROVIDE OPERATING AND MAINTENANCE MANUALS, AND START-UP INSTRUCTIONS BY MANUFACTURER'S TECHNICAL REPRESENTATIVE, AND OPERATING AND MAINTENANCE INSTRUCTIONS TO OWNER'S PERSONNEL.
   11. PROVIDE EQUIPMENT AND SYSTEM MAINTENANCE DURING CONSTRUCTION AND THROUGH WARRANTY PERIOD.
   12. PROVIDE FIRE WATCH AND REQUIRED BY THE LOCAL FIRE DEPARTMENT FOR ALL CUTTING, SOLDERING, BRAZING AND WELDING PROCEDURES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PAYING ALL ASSOCIATED COSTS.
   13. PROVIDE FINAL AS-BUILT DRAWINGS (BOTH ELECTRONIC AND HARD COPIES) INDICATING AS-BUILT DEVIATIONS FROM DESIGN DRAWINGS FOR RECORD PURPOSES.
2. THE WORK COVERED BY THIS SECTION OF THE SPECIFICATIONS INCLUDES THE FURNISHING OF ALL LABOR AND MATERIALS AND IN PERFORMING ALL OPERATIONS IN CONNECTION WITH THE INSTALLATION OF THE PLUMBING WORK SHOWN ON THE DRAWINGS AND AS DESCRIBED HEREIN AND SHALL BE INTERPRETED AS WORK TO BE DONE BY THE PLUMBING CONTRACTOR. WORK TO BE PERFORMED BY OTHER TRADES WILL ALWAYS BE SPECIFICALLY REFERENCED TO A PARTICULAR CONTRACTOR AND/OR SECTION.

1.4 COORDINATION ITEMS WITH GENERAL CONTRACTOR:

A. LISTED BELOW ARE THE ITEMS THAT REQUIRE CLOSE COORDINATION BETWEEN THE PLUMBING CONTRACTOR AND GENERAL CONTRACTOR:
   1. GENERAL CONTRACTOR SHALL REMOVE AND RE-INSTALL ANY EXISTING CEILINGS THAT ARE REQUIRED TO BE TEMPORARILY REMOVED TO FACILITATE WORK BY THE PLUMBING CONTRACTOR. PLUMBING CONTRACTOR SHALL COORDINATE WITH GENERAL CONTRACTOR THE LOCATIONS AND EXTENT OF THIS WORK. GENERAL CONTRACTOR SHALL BE REQUIRED TO MATCH EXISTING.
   2. GENERAL CONTRACTOR SHALL PROVIDE TEMPORARY WALL SYSTEMS AND EXHAUST SYSTEMS AS REQUIRED OVER THE COURSE OF CONSTRUCTION TO CONTAIN CONSTRUCTION DEBRIS/DUST WITHIN CONSTRUCTION WORK AREA AND TO NOT ALLOW CONSTRUCTION DEBRIS/DUST TO AFFECT OCCUPIED SPACES.
   3. ANY REQUIRED CUTTING, CORING, AND PATCHING OF MASONRY, CONCRETE, AND OTHER PARTS OF STRUCTURE THAT IS LESS THAN 6" DIAMETER TO ACCOMODATE REMOVAL/INSTALLATION OF EQUIPMENT, DUCTWORK, AND/OR PIPE SHALL BE PERFORMED BY THIS TRADE CONTRACTOR. THE TRADE CONTRACTOR IS RESPONSIBLE FOR ALL REQUIRED X-RAY OF BUILDING ELEMENT TO ENSURE THAT ALL REINFORCED STEEL IS AVOIDED WITH ANY NEW CORING/CUTTING OF BUILDING ELEMENT.
   4. ANY CUTTING, CORING THAT IS LARGER THAN 6" DIAMETER REQUIRED BY THIS TRADE CONTRACTOR TO ACCOMMODATE NEW EQUIPMENT/SYSTEMS TO BE INSTALLED SHALL BE PERFORMED BY THE GENERAL CONTRACTOR FULLY COORDINATED BY THIS TRADE CONTRACTOR. THE GENERAL CONTRACTOR WILL PROVIDE REQUIRED X-RAY FOR THESE PENETRATIONS LARGER THAN 6" DIAMETER. ANY REQUIREMENTS FOR BOXED OR FRAME FOR THESE OPENINGS SHALL BE COORDINATED THE GENERAL CONTRACTOR AND THIS TRADE CONTRACTOR.
   5. GENERAL CONTRACTOR SHALL PROVIDE PATCHING AND SEALING OF ALL EXISTING WALL AND FLOOR PENETRATIONS NOT RE-USED WITH NEW WORK.
   6. THE FIRESTOPPING AND SEALING OF ALL NEW PENETRATIONS SHALL BE PROVIDED BY THIS TRADE CONTRACTOR. REFER TO DIVISION 07 SPECIFICATION FOR SPECIFIED ACCEPTABLE FIRESTOPPING MATERIALS.
   7. ALL ACCESS PANELS FOR BUILDING ELEMENTS (I.E. HARD CEILINGS, WALLS, FLOORS, ETC.) SHALL BE FURNISHED AND INSTALLED BY THE GENERAL CONTRACTOR. THIS TRADE CONTRACTOR SHALL FULLY COORDINATE THE REQUIREMENTS FOR ALL ACCESS PANELS WITH THE GENERAL CONTRACTOR. THE LOCATION AND SIZE OF NEW ACCESS PANELS SHALL BE COORDINATED DURING THE DEVELOPMENT OF THE FIELD TRADE COORDINATION DRAWINGS.

1.5 NOT USED

1.6 SUBMITTALS – SHOP DRAWINGS, PRODUCT DATA & SAMPLES

A. REFER TO GENERAL CONDITIONS (AND SUPPLEMENTARY CONDITIONS) FOR GENERAL REQUIREMENTS FOR SUBMITTAL AND IN ADDITION, NOTE THE FOLLOWING REQUIREMENTS:
   1. CONTRACTOR SHALL COORDINATE SUBMITTAL PACKAGES, REVIEW FOR COMPLIANCE WITH CONTRACT DOCUMENTS AND SUBMIT, WITH TRANSMITTAL LETTER, COPIES OF EACH PACKAGE TO THE ENGINEER.
   2. SUBMITTED PRODUCT DATA MUST BE CLEARLY MARKED TO CLEARLY INDICATE SELECTION DATA AND OPTIONS AS SPECIFIED BY THESE SPECIFICATIONS AND RELATED DRAWINGS. CORRECTIONS OR COMMENTS MADE ON SROP DRAWINGS DURING REVIEW WILL NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS. THIS CHECK IS ONLY FOR REVIEW OF GENERAL CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS.
   3. THE REVIEW OF SUBMITTALS DOES NOT RELIEVE THIS CONTRACTOR FROM THE RESPONSIBILITY OF SHOP DRAWING ERROR IN DETAILS, SIZES, QUANTITIES, WIRING DIAGRAM ARRANGEMENTS AND DIMENSIONS WHICH DEVIATE FROM THE SPECIFICATIONS, CONTRACT DRAWINGS, AND/OR JOB CONDITIONS AS THEY EXIST.
   4. CHANGES TO WORK ALREADY PERFORMED MADE NECESSARY BY DELAYS IN SHOP DRAWING REVIEW ARE THE RESPONSIBILITY OF THIS CONTRACTOR.
   5. COPIES OF EQUIPMENT AND SYSTEM WARRANTIES SHALL BE SUBMITTED WITH SHOP DRAWING PACKAGE.

B. SUBMIT CERTIFIED SHOP DRAWINGS AND PRODUCT SUBMITTALS TO THE ENGINEER FOR REVIEW AND APPROVAL. THE SUBMITTALS SHALL INCLUDE BUT NOT BE LIMITED TO:
   1. PLUMBING FIXTURES
   2. DRAINS
   3. PIPING AND FITTINGS
   4. VALVES, PIPING SPECIALTIES
   5. INSULATION
   6. IDENTIFICATION FOR VALVES, PIPES, AND EQUIPMENT
   7. PLUMBING SPECIALTIES
   8. SUPPORTS, HANGERS, AND SEISMIC RESTRAINT COMPONENTS
   9. PIPING PRESSURE TESTING REPORT

1.7 SUBSTITUTIONS OR DEVIATIONS FROM SPECIFIED PRODUCTS

A. REFER TO THE DIVISION 01 SPECIFICATION SECTION FOR REQUIREMENTS RELATED TO SUBSTITUTIONS OR DEVIATIONS FROM SPECIFIED PRODUCTS.

B. APPARATUS OR MATERIALS ARE SUBSTITUTED FOR THOSE SPECIFIED UNDER THIS SECTION, AND SUCH SUBSTITUTIONS NECESSITATE CHANGES IN OR ADDITIONAL CONNECTIONS, SUPPORTS OR CONSTRUCTION, SAME SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER. THIS CONTRACTOR SHALL ASSUME COST AND ENTIRE RESPONSIBILITY THEREOF. ENGINEER'S PERMISSION TO MAKE SUCH SUBSTITUTION SHALL NOT RELIEVE THIS CONTRACTOR FROM FULL RESPONSIBILITY FOR WORK.

1.8 NOT USED

1.9 NOT USED

1.10 WARRANTY

A. WARRANTY WORK OF THIS SECTION IN WRITING FOR ONE YEAR FROM DATE OF FINAL NOTICE OF ACCEPTANCE. REPAIR OR REPLACE DEFECTIVE MATERIALS, EQUIPMENT, WORKMANSHIP OR INSTALLATION MAY THAT DEVELOP WITHIN THIS PERIOD, PROMPTLY AND TO ENGINEER'S SATISFACTION AT NO COST TO OWNER. CORRECT DAMAGE CAUSED IN MAKING NECESSARY REPAIRS AND REPLACEMENTS UNDER GURANTEE AT NO COST TO OWNER.

B. IN ADDITION TO WARRANTY REQUIREMENTS OF DIVISION 1 AND ITEMS NOTED ABOVE, OBTAIN WRITTEN EQUIPMENT MATERIAL WARRANTIES OFFERED AS SPECIFIED IN THE OWNER'S NAME.

C. DAMAGE CAUSED IN THE PROCESS OF MAKING NECESSARY REPAIRS AND REPLACEMENTS UNDER WARRANTY SHALL BE CORRECTED TO THE OWNER'S SATISFACTION.

D. NOTHING HEREIN TENDS OR IMPLIES THAT THIS WARRANTY SHALL APPLY TO WORK THAT HAS BEEN ABUSED OR NEGLECTED BY THE OWNER.

E. THE CONTRACTOR SHALL NOT BE RESPONSIBLE FOR THE WARRANTY OF ANY EXISTING MATERIAL, OR EQUIPMENT RE-USED UNDER THE CONTRACT (E.G. PIPING). HOWEVER, IF REPAIRS TO ANY EXISTING MATERIAL OR EQUIPMENT ARE REQUIRED DUE TO THE MANNER IN WHICH THE EQUIPMENT WAS HANDLED, INSTALLED, AND/OR MODIFIED BY THE CONTRACTOR, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE FULL COST OF ANY NECESSARY REPAIRS.

1.11 FIREWATCH

A. THE PLUMBING CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING IF/WHEN A FIRE WATCH IS REQUIRED DURING THE COURSE OF WORK. THE CONTRACTOR SHALL DETERMINE THIS IN CONSULTATION WITH THE LOCAL FIRE DEPARTMENT. THE CONTRACTOR SHALL INCLUDE ALL SUCH COSTS IN HIS CONTRACT BID PRICE.

1.12 CODES, ORDINANCES AND PERMITS

A. ALL WORK PERFORMED UNDER THIS SECTION OF THE SPECIFICATIONS SHALL BE DONE IN ACCORDANCE WITH THE APPLICABLE NATIONAL, STATE AND LOCAL CODES, LAWS AND ORDINANCES AND THIS STATES FUEL GAS AND PLUMBING CODES.

B. ALL MATERIALS AND WORK PROVIDED SHALL BE IN ACCORDANCE WITH, BUT NOT LIMITED TO, THE FOLLOWING:
   1. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
   2. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
   3. BUILDING OFFICIALS AND CODE ADMINISTRATORS (BOCA)
   4. NATIONAL AND STATE ELECTRICAL CODE (NEC)
   5. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)
   6. NATIONAL FIRE PROTECTION ASSOCIATION CODES AND STANDARDS (NFPA)
   7. OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)
   8. THIS STATES STATE BUILDING CODE
   9. THIS STATES STATE PLUMBING CODE

C. WHERE CODE REFERENCES ARE GIVEN, THE LATEST ISSUE OF THAT CODE IN EFFECT AT THE TIME OF BIDDING, SHALL BE USED. CODE REFERENCES GIVEN TO INDICATE THE MINIMUM QUALITY AND PERFORMANCE ACCEPTABLE. WHERE SPECIFICATIONS AND/OR DRAWINGS INDICATE MORE STRINGENT REQUIREMENTS, THE SPECIFICATION SHALL GOVERN.

D. PERMITS: BE RESPONSIBLE FOR FILING ALL DOCUMENTS, PAYMENT OF ALL FEES AND SECURING OF ALL INSPECTIONS AND APPROVALS NECESSARY FOR THE INSTALLATION AND OPERATION OF ALL SYSTEMS FURNISHED UNDER THIS SECTION.

1.13 RECORD DRAWINGS

A. THIS CONTRACTOR SHALL MAINTAIN AT THE JOB SITE, AT ALL TIMES, A COMPLETE AND SEPERATE SET OF RECORD DRAWINGS OF THIS TRADE'S WORK, ON WHICH HE SHALL MARK CLEARLY, NEATLY, ACCURATELY AND PROMPTLY, AS THE WORK PROGRESSES, THE FOLLOWING:
   1. CHANGES MADE, WHETHER RESULTING FROM JOB CONDITIONS, FORMAL CHANGE ORDERS, OR OTHER INSTRUCTIONS ISSUED BY THE ARCHITECT OR ENGINEER. INCLUDE ALL CHANGES IN SIZE, LOCATION AND DIMENSION.
   2. REGULAR PROGRESS, OF THE VARIOUS PLUMBING SYSTEMS, APPARATUS, AND ASSOCIATED APPURTENANCES, EXACTLY AS THEY ARE ERECTED, INCORPORATING BOTH CHANGES NOTED ABOVE AND ALL OTHER DEVIATIONS FROM THE ORIGINAL DRAWINGS, WHETHER RESULTING FROM JOB CONDITIONS, OR FROM ANY OTHER CAUSE. LOCATIONS AND PRINCIPAL DIMENSIONS OF CONCEALED WORK SHALL BE RECORDED.

B. AT PROJECT COMPLETION, THIS CONTRACTOR SHALL USE RECORD DRAWINGS TO PREPARE "AS-BUILT" CONDITIONS, INCLUDING ALL CHANGES, WHETHER DUE TO APPROVED CHANGES, FIELD CONDITIONS, OR ANY SITUATIONS. WHEN THIS PROCESS IN COMPLETE, THE 'AS BUILTS' SHALL BE SUBMITTED FOR REVIEW AND APPROVAL BY THE PLUMBING ENGINEER. REFER TO PROJECT CLOSEOUT FOR PROCEDURE IN DIVISION 1 REGARDING HANDLING OF THESE DOCUMENTS.

C. THE CONTRACTOR SHALL BEAR ALL COSTS FOR DELIVERY, PRINTING, DRAFTING, RECORD-KEEPING, ETC. INVOLVED IN THE REPRODUCTION OF THE ABOVE REQUIRED AS BUILT DRAWINGS.

PLUMBING LEGEND

—S—	UNDERSLAB SANITARY DRAIN PIPING
S	ABOVE GROUND SANITARY DRAIN PIPING
—SD—	STORM DRAIN PIPING
—OV—	OVERFLOW DRAIN PIPING
—V—	SANITARY VENT PIPING
—DHW—	DOMESTIC HOT WATER SUPPLY PIPING
—DCW—	DOMESTIC COLD WATER SUPPLY PIPING
—DHWR—	DOMESTIC HOT WATER RECIRCULATION PIPING
—DTW—	DOMESTIC TEPID WATER SUPPLY PIPING
G	NATURAL GAS PIPING
	DIRECTION OF FLOW
	DIRECTION OF PITCH
	DROP IN PIPE
	RISE IN PIPE
	PIPE TEE DOWN
	PIPE TEE UP
	PIPE CONTINUATION
WCO/CO	WALL/END CLEANOUT
FCO	FLOOR CLEANOUT
	MECHANICAL EQUIPMENT
	PUMP
	PIPE REDUCER
M	WATER/GAS METER
	PRESSURE REDUCING VALVE
	SAFETY RELIEF VALVE
	MIXING VALVE
	THERMOMETER
	STRAINER
	VENT THROUGH ROOF
	ROOF DRAIN
	FLOOR DRAIN
CFF	PIPE CAP FOR FUTURE CONNECTION
	PIPE CONNECTION TO FIXTURE
	PRESSURE GUAGE
	TEMPERATURE SENSOR
CD	CONDENSATE DRAIN
RD / SD	ROOF DRAIN
S	SANITARY SEWER

1.14 PROJECT CLOSEOUT DOCUMENTS

A. PROVIDE THE FOLLOWING ITEMS AS PART OF THE PROJECT CLOSEOUT DOCUMENTS. ADDITIONALLY, PROVIDE ANY ADDITIONAL DOCUMENTS/ITEMS REQUIRED IN THE DIVISION 01 SPECIFICATIONS SECTIONS AND ANY ITEMS REQUIRED BY THE GENERAL CONTRACTOR.

B. THE PROJECT CLOSEOUT DOCUMENTS SHALL BE SUBMITTED FOR REVIEW BY THE ENGINEER PRIOR TO BEING ISSUED TO THE OWNER. THE REVIEWED DOCUMENTS SHALL BE A PREREQUISITE FOR PROJECT ACCEPTANCE.

C. COORDINATE WITH THE GENERAL CONTRACTOR HOW MANY HARD COPIES ARE REQUIRED AND ADDITIONALLY PROVIDE (1) FULL COMPLETE ELECTRONIC FILE OF ALL CLOSEOUT DOCUMENTS NOTED BELOW:
   1. AS-BUILT 'RECORD' DRAWINGS
   2. COPIES OF RECORD SUBMITTALS
   3. LISTING OF EQUIPMENT SUPPLIERS
   4. VALVE TAG LIST
   5. WARRANTY DOCUMENTATION FOR PROJECT AND MANUFACTURER'S WARRANTIES
   6. COPIES OF APPLICABLE SERVICE CONTRACTS
   7. COPIES OF TEST REPORTS, BY MANUFACTURER AND 3RD PARTY IF SPECIFIED
   8. COPIES OF ALL PERMITS AND INSPECTION REPORTS
   9. O&M MANUALS FOR ALL FURNISHED EQUIPMENT

1.15 OWNER'S REQUIREMENTS FOR WORKMAN'S CONDUCT

A. IDENTIFICATION: THE OWNERS PHOTO IDENTIFICATION BADGE WITH THE PICTURE SHOWING OR A TEMPORARY BADGE WILL BE VISIBLY WORM ABOVE THE WAIST AT ALL TIMES WHILE ON HOSPITAL PROPERTY. A LOST OR STOLEN BADGE MUST BE REPORTED IMMEDIATELY TO THE THE OWNERS POLICE AND SECURITY DEPARTMENT.

B. BEHAVIOR: NO COARSE OR VULGAR LANGUAGE. CASUAL DRESS OR WORK CLOTHES. SHIRTS AND SHOES MUST BE WORN FOR SAFETY. SPECIAL EQUIPMENT MUST BE WORN AS APPROPRIATE (RESPIRATORS, GLOVES, ETC.).

C. PERFORMANCE STANDARDS: WHEN THE JOB IS FINISHED, LEAVE THE AREA IN A NEAT AND CLEAN CONDITION. AREAS SHOULD BE CLEANED AND REMAINING STOCK REMOVED FROM PREMISES UPON COMPLETION OF JOB.

D. SEXUAL HARASSMENT IT IS THE POLICY OF THE OWNERS TO ENSURE THAT ALL EMPLOYEES WORK IN AN ENVIRONMENT FREE FROM SEXUAL HARASSMENT OR ACTIVITIES THAT CAN BE VIEWED IN THIS MANNER.

PART 2 PRODUCTS

2.1 NOT USED

2.2 DRAINS

A. FURNISH AND INSTALL ALL FLOOR DRAINS WHERE SHOWN ON DRAWINGS. DRAINS SHALL BE AS MANUFACTURED BY JR SMITH COMPANY, ZURN COMPANY OR JOSAM.

B. FD-1 FLOOR DRAIN JAR R SMITH FLOOR DRAIN 2005-P (TRAP PRIMER CONNECTION) CHROME PLATED DUCO CAST IRON BODY WITH FLASHING COLLAR AND ADJUSTABLE ROUND STRAINER HEAD.

2.3 HANGERS, ANCHORS, GUIDES AND PIERS

A. ALL PIPING SHALL BE SUPPORTED FROM THE BUILDING STRUCTURE BY MEANS OF APPROVED HANGERS AND SUPPORTS. PIPING SHALL BE SUPPORTED TO MAINTAIN REQUIRED GRADING AND PITCHING OF LINES TO PREVENT VIBRATION AND TO SECURE PIPING IN PLACE AND SHALL BE SO ARRANGED AS TO PROVIDE FOR EXPANSION AND CONTRACTION.
   1. CAST IRON SOIL PIPE/NO HUB PIPING: 5 FEET AT THE HUBS FOR 5 FOOT LENGTHS AND FOR 10 FOOT LENGTHS USE ONE HANGER AT HUB AND ONE AT MIDPOINT OF EACH LENGTH (PROVIDE METAL SWAY BRACING TO CONTROL SWAYING ON NO HUB SYSTEMS).

2.4 NOT USED

2.5 PIPE AND FITTINGS

A. PIPE AND FITTINGS SHALL BE OF U.S. MANUFACTURE AND SHALL CONFORM TO THE LATEST ANSI, ASTM, CS AND/OR FS STANDARDS.

B. UNDERGROUND: PROVIDE FITTINGS OF SAME WEIGHT AND MANUFACTURE AS PIPE IN WHICH INSTALLED. JOINTS SHALL BE BELL AND SPIGOT PUSH-ON TYPE NEOPRENE GASKET CONFORMING TO CIPI STANDARD 301 UNLESS NOTED OTHERWISE ON DRAWINGS.

C. INSTALL 3" AND LARGER HORIZONTAL SOIL AND WASTE PIPING TO 1/8" PER FOOT SLOPE. PIPING 2-1/2" AND SMALLER SHALL BE INSTALLED AT A SLOPE OF 1/4" PER FOOT. RUN HORIZONTAL VENT LINES TO A MINIMUM GRADE BACK TO STACKS AND VERTICAL VENT LINES AS DIRECT AND FREE FROM BENDS AS POSSIBLE.

2.6 PIPE JOINTS

A. ALL THREADED PIPE JOINTS SHALL BE MADE WITH TEFLON TAPE WRAPPED ON MALE THREADS ONLY.

B. BELL AND SPIGOT TYPE JOINT SHALL BE MADE WITH PUSH-ON COMPRESSION TYPE, NEOPRENE GASKET CONFORMING TO ASTM A74.

2.7 NOT USED

2.8 NOT USED

2.9 NOT USED

2.10 CLEANOUTS

A. FURNISH AND INSTALL ALL CLEANOUTS AS INDICATED ON THE DRAWINGS AND WHERE REQUIRED IN SOIL AND WASTE PIPES SO THAT A 50 FOOT SNAKE CAN BE USED IN PIPING LARGE THAN 4 INCHES. CLEANOUTS SHALL BE INSTALLED AT THE BASE OF ALL RISERS AND AT EACH CHANGE OF DIRECTION.

B. CLEANOUT PLUGS SHALL BE OF HEAVY CAST BRASS OF SCREWED TYPE. PLUGS SHALL BE FULL SIZE UP TO 4 INCHES.

2.11 TRAPS

A. FURNISH AND INSTALL TRAPS WITH CLEANOUTS ON ALL FIXTURES AND EQUIPMENT REQUIRING CONNECTION TO THE SANITARY SYSTEM OF THE SAME SIZE AND MATERIAL AS THE PIPE ON WHICH THEY OCCUR.

2.12 NOT USED

PLUMBING FIXTURE SCHEDULE

TAG	FIXTURE TYPE	MAKE	MODEL	PIPE CONNECTION SIZES: SOIL	CW	HW	TRAP	FITTINGS / ACCESSORIES	WATER USED	ADA COMPLIANT	NOTES
FD-1	FLOOR DRAIN	ZURN	Z520	3"			3"	FIXTURE RECEIVES WEEKLY WASHDOWN FROM SPACE, TRAP PRIMER NOT REQUIRED.	-	-	-

Petersen Engineering

ISSUE FOR	Date	By
APPROVAL	12/17/21	TGP
CONSTRUCTION	1/31/22	TGP
RECORD DRAWING	-	-

NO.	REVISIONS	APP'D

Drawn/Chk. AH/EA
Designed JMI
Checked SC
Approved JFP
Date 2/4/22
Book No. -
Project No. 2575
Dwg. ID -
Scale AS SHOWN

JAMES F. PETERSEN No. 8129 LICENSED PROFESSIONAL ENGINEER – STATE OF NEW HAMPSHIRE

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

PLUMBING BOD, SPECS & SCHEDULES

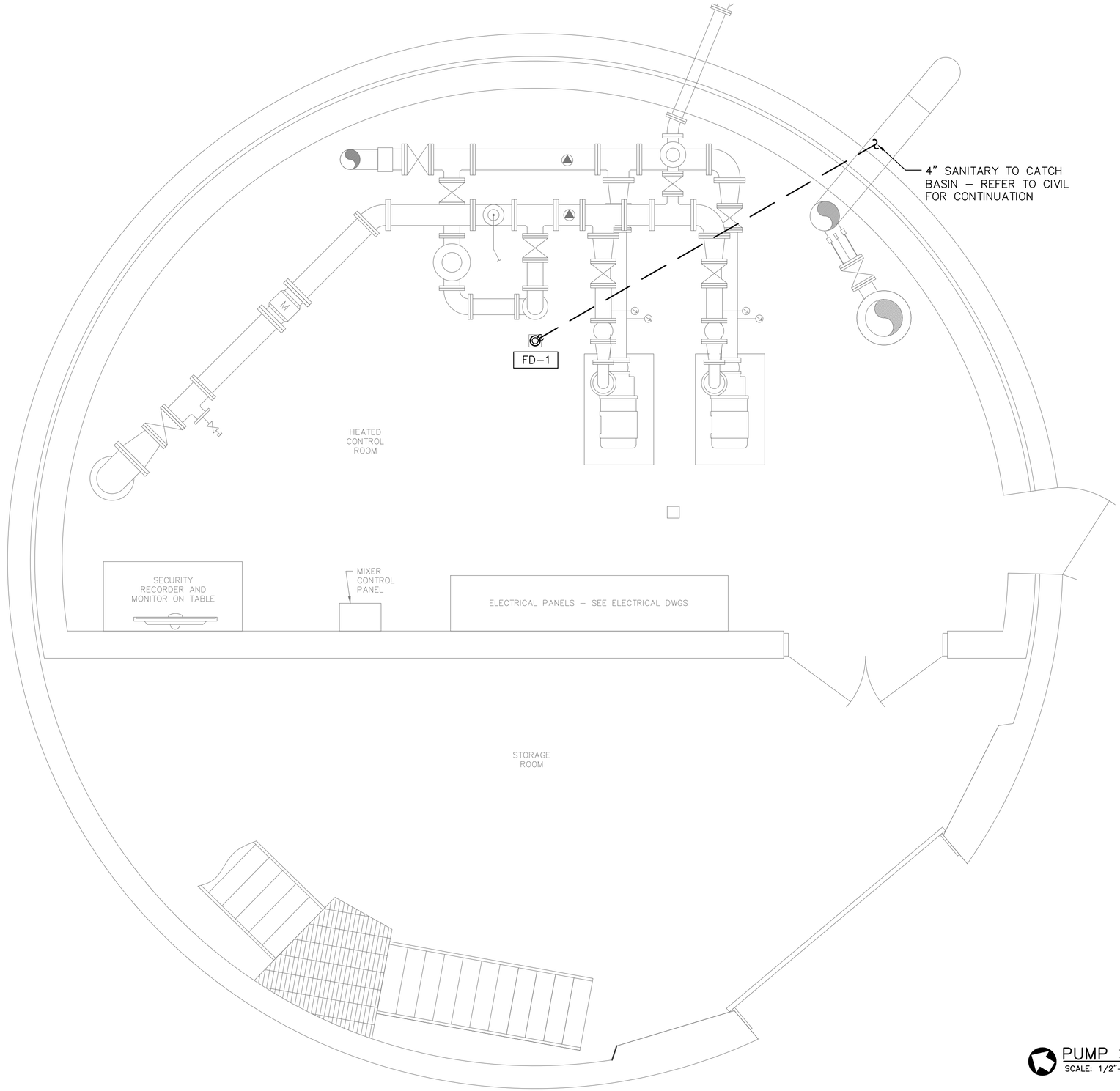
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO M-4

SHEET 30 OF 43



PUMP STATION FLOOR PLAN
SCALE: 1/2"=1'–0"

Petersen Engineering

ISSUE FOR	Date	By
APPROVAL	12/17/21	TGP
CONSTRUCTION	1/31/22	TGP
RECORD DRAWING	–	–

NO.	REVISIONS	APP'D

Drawn/Chk. AH/EA
Designed JMI
Checked SC
Approved JFP
Date 2/11/22
Book No. –
Project No. 252/5
Dwg. ID
Scale AS SHOWN

STATE OF NEW HAMPSHIRE – JAMES F. PETERSEN No. 8182 – LICENSED PROFESSIONAL ENGINEER

© COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

PLUMBING PUMP STATION FLOOR PLAN

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

DWG NO	SHEET
M–5	31 OF 43

POWER LEGEND

RECEPTACLE OUTLETS – NUMERAL BY THE SIDE OF THE SYMBOL INDICATES CIRCUIT NUMBER

- DUPLEX CONVENIENCE OUTLET MOUNTED AT +18" OR AS NOTED.
- DOUBLE DUPLEX OUTLET (FOURPLEX) RECEPTACLE MOUNTED AT +18" OR AS NOTED.
- GFCI DUPLEX CONVENIENCE OUTLET MOUNTED ABOVE COUNTER. VERIFY EXACT MOUNTING HEIGHT WITH ARCHITECTURAL ELEVATIONS.
- SPECIAL OUTLET AS NOTED ON DRAWINGS.
- DEDICATED OUTLET AT +18" OR AS NOTED. 'HUBBELL' #IG5262 (ORANGE) RECEPTACLE WITH ISOLATED GROUND.
- CAT-5 DATA JACK MOUNTED AT +18" OR AS NOTED.
- TELEPHONE JACK MOUNTED AT +18" OR AS NOTED.
- MULTI-OUTLET ASSEMBLY
- FLUSH MOUNTED PANELBOARD AND CABINET. MOUNT 6'-6" TO TOP
- SURFACE MOUNTED PANELBOARD AND CABINET. MOUNT 6'-6" TO TOP
- PB PULL BOX
- 4X COMBINATION MOTOR CONTROLLER – FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR. SIZE AS NOTED. NUMBER INDICATES NEMA TYPE CONSTRUCTION.
- 1 MOTOR – SIZE AS INDICATED ON DRAWINGS.
- DISCONNECT SWITCH – SIZE AND FUSES AS PER MANUFACTURER'S RECOMMENDATIONS (WEATHERPROOF WHERE OUTSIDE).
- J JUNCTION BOX IN ACCESSIBLE LOCATION.
- J JUNCTION BOX IN ACCESSIBLE LOCATION WITH FLEXIBLE CONDUIT CONNECTION TO EQUIPMENT AS NOTED.
- PE PHOTOCELL ON ROOF (AIM NORTH).
- SEALING FITTING
- VS 12 MOTOR CONTROLLER OR VFD – INSTALLED AND WIRED BY ELECTRICAL CONTRACTOR. NUMBER INDICATES NEMA TYPE CONSTRUCTION, VS INDICATES VENDOR SUPPLIED.
- EQUIPMENT SHOWN LIGHT & DASHED INDICATES EXISTING EQUIPMENT EXCEPT, FOR UNDERGROUND CONDUITS AND/OR AS OTHERWISE NOTED.
- EQUIPMENT SHOWN LIGHT, DASHED, & HATCHED INDICATES EXISTING EQUIPMENT TO BE REMOVED. EXCEPT UNDERGROUND CONDUITS
- UTILITY POLE

RACEWAYS AND CONDUCTORS

- INDICATES HOMERUN TO PANELBOARD OR AS NOTED.
- CONDUIT TURNING UP
- CONDUIT TURNING DOWN
- —OHP— PROPOSED OVERHEAD PRIMARY CABLE
- —EX— EXISTING UNDERGROUND ELECTRICAL CONDUIT
- —E— PROPOSED UNDERGROUND ELECTRICAL CONDUIT
- —EP— PROPOSED UNDERGROUND PRIMARY ELEC CONDUIT
- —S— PROPOSED UNDERGROUND SIGNAL CONDUIT
- —T— PROPOSED UNDERGROUND TELEPHONE CONDUIT

LIGHTING

LIGHTING FIXTURES – CAPITAL LETTER INDICATES THE FIXTURE TYPE AS SHOWN ON FIXTURE SCHEDULE. NUMERAL INDICATES CIRCUIT NO. AND SMALL LETTER DESIGNATES THE CONTROL SWITCH. EXACT MOUNTING PER SCHEDULE.

CEILING	WALL	DESCRIPTION
○	○	SURFACE OR PENDANT INCANDESCENT, HID OR SIMILAR LAMP FIXTURE.
		SURFACE OR PENDANT INDIVIDUAL FLUORESCENT FIXTURE.
		SURFACE OR PENDANT CONTINUOUS
		BARE LAMP FLUORESCENT STRIP.
		SURFACE OR PENDANT EXIT LIGHT. ARROWS INDICATE ROUTE OF EGRESS.
		EMERGENCY LIGHTING FIXTURE BATTERY OPERATED. ARROWS INDICATE AIMING DIRECTION.
		POLE MOUNTED LIGHT FIXTURE, SINGLE POLE W/SINGLE AND/OR DOULBLE FIXTURE.

SWITCHED OUTLET

SMALL LETTER BY THE SIDE OF SYMBOLS INDICATES THE PARTICULAR SWITCH.
SAMPLE: S^{a} = SWITCH "a"

- S SINGLE POLE SWITCH MOUNTED AT +48" ℄ OR AS NOTED.
- S_2 TWO POLE SWITCH MOUNTED AT +48" ℄ OR AS NOTED.
- S_3 THREE WAY SWITCH MOUNTED AT +48" ℄ OR AS NOTED.
- S_4 FOUR WAY SWITCH MOUNTED AT +48" ℄ OR AS NOTED.
- S_P SINGLE POLE SWITCH WITH PILOT LIGHT MOUNTED AT +48" ℄ OR AS NOTED.
- S_K SINGLE POLE KEY OPERATED SWITCH MOUNTED AT +48" ℄ OR AS NOTED.
- S_M H.P. RATED MANUAL MOTOR STARTER (WEATHERPROOF WHERE OUTSIDE).
- S_D INCANDESCENT SLIDE CONTROL DIMMER AT +48" ℄ OR AS NOTED (1500 WATT UNLESS OTHERWISE NOTED).
- S_T 0-60 MINUTE TIMER SWITCH MOUNTED AT +48" ℄ OR AS NOTED.

PROJECT GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE (N.E.C.) LATEST EDITION.
2. COORDINATE ALL ELECTRICAL EQUIPMENT LOCATIONS AND MECHANICAL APPURTENANCES WITHIN THE EXISTING CONDITIONS TO PROVIDE ADEQUATE WORKING AND ACCESS PER N.E.C. REQUIREMENTS.
3. WHERE EXISTING ELECTRICAL DEVICES AND PROCESS DEVICES ARE INDICATED THOSE LOCATIONS ARE APPROXIMATE AND NOT ALL ELECTRICAL DEVICES MAY BE INDICATE. (FIELD VERIFY ALL ELECTRICAL ITEMS WHERE POSSIBLE.)
4. CONDUITS, RACEWAYS AND CABLES SHALL BE PROPERLY AND SECURELY ATTACHED TO BUILDING STRUCTURAL COMPONENTS AS REQUIRED BY N.E.C. ALL FASTENERS AND HARDWARE SHALL BE APPROVED FOR THE INSTALLATION AND THE CONDITIONS ENCOUNTERED.
5. EACH JUNCTION IN ANY OF THE WIRING SYSTEMS SHALL BE MADE IN AN APPROVED JUNCTION BOX. SUCH BOX SHALL BE SUITABLE FOR THE SIZE AND NUMBER OF CONDUCTORS AND DEVICES TO BE INSTALLED, AS WELL AS THE CONDITION ENCOUNTERED. ALL SPLICES SHALL BE MADE WITH APPROVED, MECHANICAL CONNECTORS.
6. CONTRACTOR SHALL VERIFY ALL STRUCTURAL, PROCESS AND MECHANICAL CONDITIONS PRIOR TO ROUGH-IN FOR ELECTRICAL WIRING AND EQUIPMENT.
7. ALL ELECTRICAL WORK SHALL BE CAREFULLY COORDINATED WITH THE ON-SITE CONDITIONS. WHERE CUTTING, DRILLING OR ALTERATION TO THE WORK OF OTHERS IS NECESSARY FOR THE PROPER INSTALLATION OF ELECTRICAL EQUIPMENT, SUCH WORK SHALL BE PLANNED IN ADVANCE AND SHALL BE CAREFULLY DONE. ANY DAMAGE TO THE BUILDINGS OR EQUIPMENT SHALL BE REPAIRED BY PROPERLY TRAINED PERSONNEL TO THE SATISFACTION OF THE OWNER AT NO ADDITIONAL COST TO THE OWNER.
8. DURING ROUGH-IN AND FINISHED STAGES OF CONSTRUCTION, THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT AND KEEP CLEAN ALL ELECTRICAL EQUIPMENT, PANELS, FIXTURES AND DEVICES AS WELL AS ALL EXISTING EQUIPMENT AND RELATED WORK AREAS.
9. THE CONTRACTOR SHALL PROVIDE ALL INFORMATION ABOUT EQUIPMENT WHICH HE/SHE IS FURNISHING TO THE ENGINEER/OWNER FOR REVIEW PURPOSES. THE CONTRACTOR SHALL PROVIDE ALL INSTALLATION DETAILS AND SUPPORT COMPONENTS SO THAT THESE MAY BE BUILT INTO THE CONSTRUCTION IN A TIMELY MANNER.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF THE FINAL LOCATIONS OF INSTRUMENTATION, CONTROL AND POWER CONNECTION DETAILS SO THAT THE ASSOCIATED ELECTRICAL WORK WILL BE PROPERLY COORDINATED AND INSTALLED.
11. EQUIPMENT LAYOUT AND EXACT LAYOUT OF NEW ELECTRICAL EQUIPMENT AND INSTRUMENTATION SHALL BE COORDINATED WITH PROCESS AND MECHANICAL EQUIPMENT.
12. DRAWINGS SHOW A LAYOUT OF ELECTRICAL/INSTRUMENTATION SYSTEMS AND EQUIPMENT DIAGRAMMATICALLY. EXACT LOCATION OF EQUIPMENT AND ROUTING OF RACEWAYS SHALL BE DETERMINED BY FIELD CONDITIONS AND DIRECTION BY ENGINEER AND OWNER. BY SUBMITTING A BID, CONTRACTOR WARRANTS THAT HE HAS VISITED THE SITE WHERE WORK IS TO BE PERFORMED, AND HAS EXAMINED THE EXISTING CONDITIONS AND EXTENT OF LABOR AND MATERIALS TO BE PROVIDED. COORDINATION WITH ALL TRADES, UTILITIES, ETC. SHALL BE PROVIDED. THE ENGINEER SHOULD BE NOTIFIED OF ANY DISCREPANCIES, OMISSIONS, CONFLICTS OR INTERFERENCES WHICH OCCUR BETWEEN VARIOUS DRAWINGS AND SPECIFICATIONS. IF SUCH NOTIFICATION IS NOT RECEIVED, THE INSTALLING CONTRACTOR(S) SHALL BE RESPONSIBLE FOR THEIR INTERPRETATIONS.

DEMOLITION GENERAL NOTES:

1. REMOVE AND DISCONNECT EXISTING ELECTRICAL EQUIPMENT, PANELS, MCC'S, LIGHTING WIRING DEVICES, SWITCHES, ETC. AND RELATED ELECTRICAL DEVICES, WIRING / CONDUIT AS INDICATED ON DEMOLITION PLANS.
2. ANY DEMOLITION INDICATED ON THESE DRAWINGS IS SHOWN IN GENERAL TO INDICATE THE EXTENT OF DEMOLITION AND IS NOT TO BE CONSIDERED AS A RECORD DRAWING OF EXISTING CONDITIONS. ACCORDINGLY, THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETE DEMOLITION OF ELECTRICAL WORK INDICATED INCLUDING ANY BURIED ITEMS OR EXISTING ITEMS NOT SHOWN ON THESE DRAWINGS. BEFORE DEMOLITION, THE CONTRACTOR SHALL BE RESPONSIBLE TO CONDUCT APPROPRIATE FIELD TESTING TO DETERMINE THE NATURE OF THE EXISTING WORK TO BE DEMOLISHED TO PROTECT EXISTING WORK REMAINING IN PLACE AND TO PROTECT THE PUBLIC.
3. REPAIR AND RESTORE TO ORIGINAL CONDITION ALL ITEMS OR PORTIONS OF ELECTRICAL WORK WHICH ARE NOT NOTED TO BE DEMOLISHED, BUT ARE DAMAGED BY WORK UNDER THIS CONTRACT. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO PROTECT AND RETAIN POWER TO ALL EXISTING ACTIVE EQUIPMENT WHICH SHALL REMAIN. ELECTRICAL CONTRACTOR SHALL RECONNECT ANY EQUIPMENT BEING DISTURBED BY THIS RENOVATION.
4. WHERE WORK BY THE GENERAL CONTRACTOR (WALL REMOVAL, NEW OR RELOCATED WALL OPENINGS), REQUIRES THE REMOVAL, RELOCATION, OR REFEEDING OF ELECTRICAL DEVICES OR LIGHTING FIXTURES, THE ELECTRICAL CONTRACTOR SHALL DISCONNECT AND MAKE SAFE OR RECONNECT AS REQUIRED ALL ACTIVE DEVICES REMAINING ON THAT CIRCUIT.
5. CONTRACTOR SHALL VERIFY CIRCUITS IN EXISTING PANEL AFFECTED BY THIS ALTERATION. WHERE ADDITIONAL CIRCUITS ARE NEEDED, USE AVAILABLE SPARE BREAKERS IN THE PANEL. TIGHTEN ALL CONNECTIONS AS REQUIRED.
6. DO NOT PROCEED WITH DEMOLITION WITHOUT WRITTEN AUTHORITY TO PROCEED. PROCEED WITH DEMOLITION IN A SYSTEMATIC MANNER AND COORDINATE WITH ALL TRADES INVOLVED. COORDINATE AND SEQUENCE DEMOLITION SO AS NOT TO CAUSE A SHUTDOWN OF OPERATION OF SURROUNDING AREAS.
7. DISCONNECT OR SHUT OFF SERVICE TO AREAS WHERE ELECTRICAL WORK IS TO BE REMOVED. REMOVE ALL ELECTRICAL PANELS, EQUIPMENT, AND RELATED CONDUIT, AND WIRING WHICH ARE NOT A PART OF THE FINAL PROJECT IN ALL AREAS WHERE WORK OF THIS CONTRACT ARE TO BE PERFORMED. ALL REMOVED EQUIPMENT SHALL BE DISPOSED OF BY THIS CONTRACTOR UNLESS DIRECTED TO DO OTHERWISE BY THE OWNER. REMOVE ALL CONDUIT, WIRE, BOXES, AND FASTENING DEVICES AS REQUIRED TO AVOID ANY INTERFACE WITH NEW INSTALLATIONS. ABANDONED CIRCUITS TO BE CAPPED AT BOTH ENDS. REMOVE THE EXISTING WIRE NO LONGER IN USE FROM DEVICE LOCATION BACK TO PANEL.
8. ARRANGE TIMING SHUTDOWN PERIODS OF ALL-INSERVICE PANELS WITH OWNER OR HIS/HER REPRESENTATIVE. DO NOT SHUT DOWN ANY UTILITY WITHOUT PRIOR WRITTEN APPROVAL.
9. WHERE EXISTING CIRCUITS ARE INDICATED TO BE REUSED, CONTRACTOR TO USE SENSING MEASURING DEVICES TO VERIFY THAT CIRCUITS FEEDING PROJECTS ARE OR ARE NOT IN USE.
10. EXISTING ELECTRICAL EQUIPMENT NECESSARY FOR EXISTING INSTALLATION TO REMAIN OPERATIONAL WILL HAVE TO BE PROTECTED DURING CONSTRUCTION.
11. THE ELECTRICAL CONTRACTOR SHALL TAKE INTO ACCOUNT IN FILING HIS/HER BID HIS/HER OBLIGATION TO PROVIDE FOR THE DISMANTLING AND REMOVAL OR MODIFICATION OF EXISTING ELECTRICAL EQUIPMENT, CONDUIT, WIRING AND RELATED ITEMS FOR THEIR REPLACEMENT OR MODIFICATION AS SPECIFIED.
12. CONTRACTOR SHALL COORDINATE WITH OWNER FOR POSSIBLE SALVAGE OF OF ANY OF THE ABOVE LISTED EQUIPMENT INCLUDING BUT NOT LIMITED TO MCC, STARTERS, GENERATORS, INSTRUMENTATION, PANELS, WIRING & CONDUIT.
13. THE CONTRACTOR SHALL UTILIZE EXISTING BRANCH CIRCUITS WHEREVER POSSIBLE. DISCONNECT CIRCUITS BACK TO LAST DEVICE (FIXTURE OR OUTLET) UNAFFECTED BY THE DEMOLITION. EXTEND CIRCUITS FROM LAST DEVICE TO NEW DEVICE LOCATIONS AND CIRCUIT AS SHOWN ON FLOOR PLAN.
14. THE ELECTRICAL DEVICES AND PROCESS EQUIPMENT INDICATED ON THIS DRAWING REPRESENT EQUIPMENT TAKEN FROM EXISTING PLANS FURNISHED BY THE OWNER AND SITE VISITS BY THE ENGINEER AND DO NOT REPRESENT ALL EQUIPMENT AND WIRING WITHIN THE DEMOLITION AREA. THESE DOCUMENTS HAVE BEEN PREPARED TO ASSIST THE CONTRACTOR IN PRICING DEMOLITION WORK. CONTRACTOR IS TO VISIT THE SITE AND EXAMINE ALL EXISTING CONDITIONS. NO EXTRA COMPENSATION OR TIME EXTENSION WILL BE PERMITTED BECAUSE OF LACK OF COMPLIANCE WITH THIS REQUIREMENT.

ABBREVIATIONS

ACB	AIR CIRCUIT BREAKER
ALT	ALTERNATE
AC	ALTERNATING CURRENT
AL	ALUMINUM
AWG	AMERICAN WIRE GAUGE
A	AMPERE(S)
ATS	AUTOMATIC TRANSFER SWITCH
BW	BUSWAY
CLG	CEILING
CKT	CIRCUIT
CB	CIRCUIT BREAKER
CCTV	CLOSED CIRCUIT TELEVISION
COND	CONDUCTOR
C	CONDUIT (SEE RACEWAYS)
CONN	CONNECT
CC	CONTROL CABINET
CP	CONTROL PANEL
CU	COPPER
CT	CURRENT TRANSFORMER
DC	DIRECT CURRENT
DIM	DIMENSION
DISC	DISCONNECT
DMC	DIMMER CONTROL
DPP	DISTRIBUTION POWER PANEL
DP	DOUBLE POLE
DT	DOUBLE THROW
E	ELECTRIC
E.C.	ELECTRICAL CONTRACTOR
EUH	ELECTRIC UNIT HEATER
EWC	ELECTRIC WATER COOLER
EMT	ELECTRICAL METALLIC TUBING
EM	EMERGENCY
ELR	END LINE RESISTOR
EXIST	EXISTING
FDR	FEEDER
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
F.P.C.	FIRE PROTECTION CONTRACTOR
FLUOR	FLUORESCENT
FL	FLOOR
F.S.C.	FOOD SERVICE CONTRACTOR
HZ	FREQUENCY IN CYCLES PER SECOND
F	FUSE
FS	FUSIBLE SWITCH
GEN	GENERATOR
G.C.	GENERAL CONTRACTOR
GRD	GROUND
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
H.I.D.	HIGH INTENSITY DISCHARGE
HP	HORSEPOWER
HOA	HAND-OFF-AUTO
H.P.S.	HIGH PRESSURE SODIUM
IMC	INTERMEDIATE METALLIC CONDUIT
INC	INCANDESCENT
IC	INTERCOM
ISO	ISOLATED NEUTRAL
JB	JUNCTION BOX
K	KEY OPERATED
KVAR	KILOVAR(S)
KVA	KILOVOLT AMPERE(S)
KW	KILOWATT(S)
LP	LIGHTING PANEL
L.P.S.	LOW PRESSURE SODIUM
LV	LOW VOLTAGE
MCB	MAIN CIRCUIT BREAKER
MGST	MAGNETIC STARTER
MLO	MAIN LUGS ONLY
MH	MANHOLE
MTS	MANUAL TRANSFER SWITCH
MC	MECHANICAL CONTRACTOR
MIKE	MICROPHONE
MTR	MOTOR
MCC	MOTOR CONTROL CENTER
KCMIL	THOUSAND CIRCULAR MIL(S)
NF	NON-FUSED
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NTS	NOT TO SCALE
N.I.C.	NOT IN CONTRACT
OL	OVERLOAD ELEMENT
OC	OVER COUNTER
PNL	PANEL
PB	PULL BOX
P	PILOT INDICATOR
PVC	POLYVINYL CHLORIDE
PLG.C	PLUMBING CONTRACTOR
PT	POTENTIAL TRANSFORMER
PF	POWER FACTOR
PP	POWER PANEL
PRI	PRIMARY
PS	PULL SWITCH
RECP	RECEPTACLE
R	RELAY
RC	REMOTE CONTROL
RGS	RIGID GALVANIZED STEEL CONDUIT
RWT	REFECTED WAVE TRAP
S	SIGNAL
SEC	SECONDARY
SP	SINGLE POLE
ST	SINGLE THROW
SPK	SPEAKER
SMR	SURFACE METAL RACEWAY
S.S.	SOLID STATE
SW	SWITCH
SWBD	SWITCHBOARD
T.C.C.	TEMPERATURE CONTROL CONTRACTOR
TEMP	TEMPORARY
T	TELEPHONE
TV	TELEVISION
TB	TERMINAL BOX
XFMR	TRANSFORMER
XP	EXPLOSION PROOF
TYP	TYPICAL
UE	UNDERGROUND ELECTRIC
UG	UNDERGROUND
UH	UNIT HEATER
UNG	UNGROUNDED
UNP	UNGROUNDED PRIMARY
UPS	UNINTERRUPTED POWER SYSTEM
US	UNDERGROUND SIGNAL
VP	VAPORPROOF
VAR	REACTIVE VOLT AMPERES
V	VOLT(S)
VA	VOLTAMP(S)
VFD	VARIABLE FREQUENCY DRIVE
W	WATT(S)
WP	WEATHERPROOF

DIAGRAM SYMBOLS

- FUSED SWITCH
- CIRCUIT BREAKER
- LINE REACTOR
- DISCONNECT SWITCH
- TRANSFER SWITCH
- SOLID-STATE SOFT STARTER
- POTENTIAL TRANSFORMER
- CURRENT TRANSFORMER
- VFD
- METER: X INDICATES TYPE
  V = VOLTMETER H = KILOWATT HOUR METER
  A = AMMETER D = KILOWATT HOUR DEMAND METER
  W = WATT METER
- AS AMMETER SWITCH
- VS VOLTMETER SWITCH
- DMM DIGITAL MULTI METER
- PM PHASE MONITOR
- GFI GROUND FAULT INTERRUPTER
- K KIRK KEY INTERLOCK
- XX MOTOR CONTROLLER: XX INDICATES TYPE:
  - SS = SOLID STATE STARTER
  - AF = ADJUSTABLE FREQUENCY STARTER
  - AT = AUTO TRANSFORMER STARTER
  - PW = PART WINDING STARTER
  - Y-Δ= WYE-DELTA STARTER
  - WR = WOUND ROTOR STARTER
  - 22 = TWO SPEED TWO WINDING
  - 21 = TWO SPEED ONE WINDING
  - FVNR = FULL VOLTAGE NON REVERSING STARTER
  - FVR = FULL VOLTAGE REVERSING STARTER
  - LC = LIGHTING CONTACTOR
  - VFD = VARIABLE FREQUENCY DRIVE
- CAPACITOR
- TVSS/LIGHTNING ARRESTER
- EARTH GROUND
- TRANSFORMER
- PLUG OR DRAWOUT DEVICE AND RECEPTACLE
- X MOTOR
- G GENERATOR
- X GENERAL LOADS

X – INDICATES HORSEPOWER OR KILOWATTS

ABBREVIATED LIST OF NEMA ENCLOSURE TYPES

TYPE 1: GENERAL PURPOSE. INDOOR.
TYPE 2: DRIP-PROOF. NONCORROSIVE. INDOOR.
TYPE 3: DUST-TIGHT. RAINTIGHT. OUTDOOR.
TYPE 3R: RAINPROOF. OUTDOOR.
TYPE 4: WATERTIGHT AND DUST-TIGHT. NONCORROSIVE. INDOOR AND OUTDOOR.
TYPE 4X: WATERTIGHT AND DUST-TIGHT. CORROSION RESISTANT. INDOOR AND OUTDOOR.
TYPE 6: WATERTIGHT. DUST-TIGHT. SHORT-TIME SUBMERSIBLE. INDOOR AND OUTDOOR.
TYPE 6P: WATERTIGHT. DUST-TIGHT. LONG-TIME SUBMERSIBLE. INDOOR AND OUTDOOR.
TYPE 7: CLASS 1, GROUPS A, B, C, OR D. INDOOR.
TYPE 8: CLASS 1, GROUPS A, B, C, OR D. INDOOR OR OUTDOOR.
TYPE 9: CLASS II, GROUPS E OR G. INDOOR.
TYPE 12: DUST-TIGHT. WATERTIGHT. NONCORROSIVE LIQUID. INDOOR.
TYPE 13: WATERTIGHT. DUST-TIGHT. OILTIGHT. NONCORROSIVE LIQUID INDOOR.

DETAIL & SECTION MARK LEGEND

- 2 / E-3 DETAIL NUMBER; SHEET NUMBER – WHERE DETAIL IS LOCATED
- A / E-1 DIRECTION SECTION IS BEING CUT; SECTION LETTER; SHEET NUMBER – WHERE SECTION IS LOCATED

DIRECTION OF NORTH



SMR ENGINEERING, PC
Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603/429-3313 Fax: 603/429-3466

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY WAY WITHOUT THE EXPRESSED WRITTEN CONSENT OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.
SMR ENGINEERING, PC ©

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL — By TGP — Date 12/17/21
CONSTRUCTION — By TGP — Date 2/9/22
RECORD DRAWING — By - — Date -

Drawn/Chk. JWC
Designed JWC
Checked SMR
Approved RAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2474-E1-GN
Scale AS SHOWN



UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

GENERAL ELECTRICAL NOTES & LEGEND

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO E1
SHEET 54 OF 43

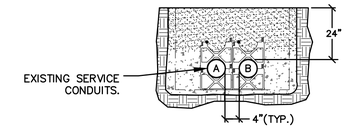
FILE: C:\Users\jcond\local settings\temp\AcPublish_28644\2575-E1-GN.dwg Feb 10, 2022 - 2:40pm

ELECTRICAL DUCT BANK SCHEDULE

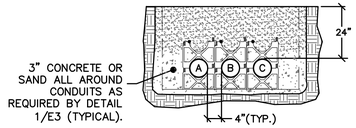
DUCT BANK SECTION NO.	CONDUIT	EQUIPMENT	WIRE	CONNECTION
A / E2	EXIST (A) 4" C	SERVICE DISCONNECT SWITCH	EXISTING (4)#4/0	EXISTING SERVICE CONDUITS FROM RISER POLE WITH POLE MOUNTED TRANSFORMERS TO NEW SERVICE DISCONNECT SWITCH AND NEW UTILITY METER.
	EXIST (B) 4" C	SERVICE DISCONNECT SWITCH	NEW (4)#4/0	EXISTING SERVICE CONDUITS FROM RISER POLE WITH POLE MOUNTED TRANSFORMERS TO NEW SERVICE DISCONNECT SWITCH AND NEW UTILITY METER.
B / E2	(A) NEW 4" C	NEW PANEL PPB	NEW (4)#250 KCMIL, & 1#2G	FEEDER CONDUIT FROM MCC-A INSIDE SMITH/CUMMINGS WELL BUILDING TO PANEL PPB INSIDE STORAGE TANK VIA HANDHOLES.
	(B) NEW 4" C	NEW SPARE	NEW PULL ROPE	SPARE CONDUIT FROM SMITH/CUMMINGS WELL BUILDING TO 12" AFF UNDER PANEL PPB INSIDE STORAGE TANK VIA HANDHOLES.
	(C) NEW 3" C	NEW RTU-2A	NEW FIBER OPTIC CABLE	FIBER OPTIC CONDUIT FROM RTU-2 INSIDE SMITH/CUMMINGS WELL BUILDING TO RTU-2A PANEL INSIDE STORAGE TANK VIA HANDHOLES.

UNDERGROUND CONDUIT NOTES:

1. PROVIDE RIGID GALVANIZED SWEEPS ON ALL 90° TURNS.
2. PROVIDE RIGID GALVANIZED STEEL CONDUIT & SWEEPS AT ALL 90° TURNS AS REQUIRED.
3. COORDINATE NEW UNDERGROUND CONDUIT LOCATION WITH EXISTING UNDERGROUND ELECTRIC CONDUIT, PROCESS PIPING AND STRUCTURES PRIOR TO EXCAVATION.
4. REPAIR EXISTING PAVED AND GRASSED AREAS TO CONDITION EXISTING PRIOR TO EXCAVATION.
5. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE, MUST BE NOTIFIED, INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN, PRIOR TO DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORING OR REPAVING.
6. REFER TO DETAIL 1/E3 FOR TYPICAL TRENCHING DETAIL FOR ELECTRICAL/SIGNAL CONDUITS.
7. CONTRACTOR SHALL FURNISH AND INSTALL POLYESTER PULLING TAPE IN ALL SPARE CONDUITS RATED @ 2500 LBS, WITH FOOTAGE MARKINGS AS MANUFACTURED BY NEPT CO., MODEL# WP2500 OR APPROVED EQUAL.

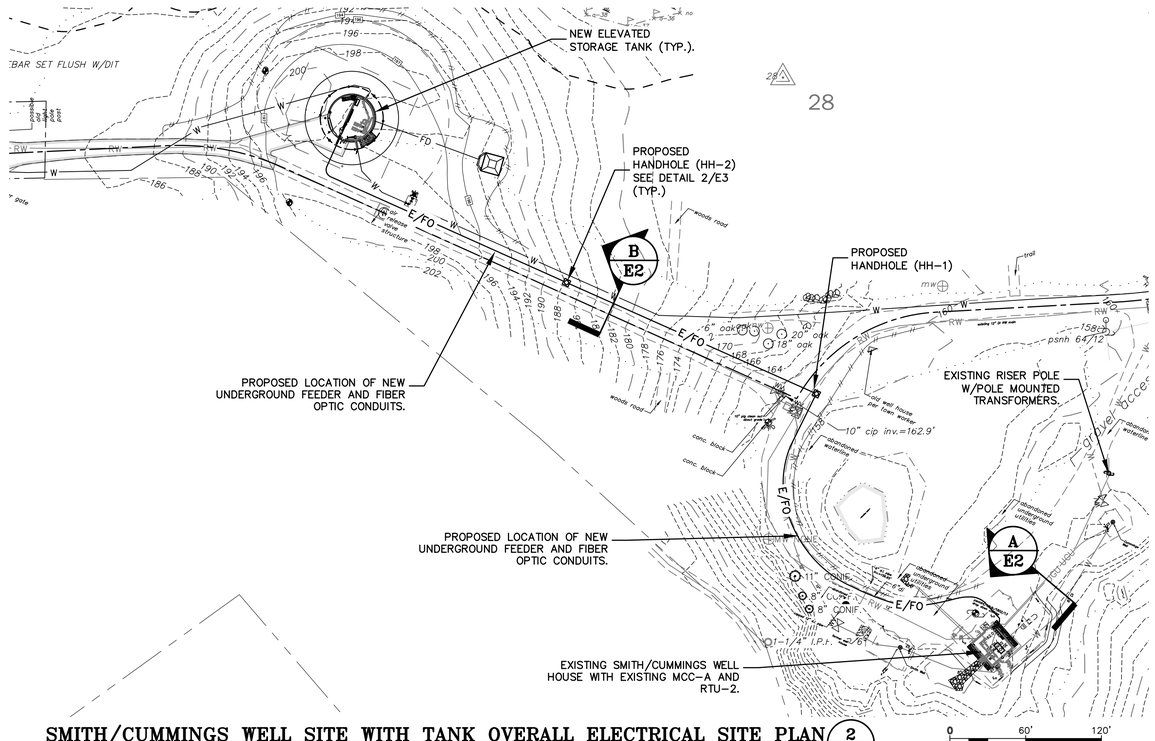


DUCT BANK SECTION A / E2
SCALE: NONE



DUCT BANK SECTION B / E2
SCALE: NONE

ELECTRICAL DUCT BANK SCHEDULE WITH DUCT BANK SECTIONS 1 / E2
SCALE: NONE

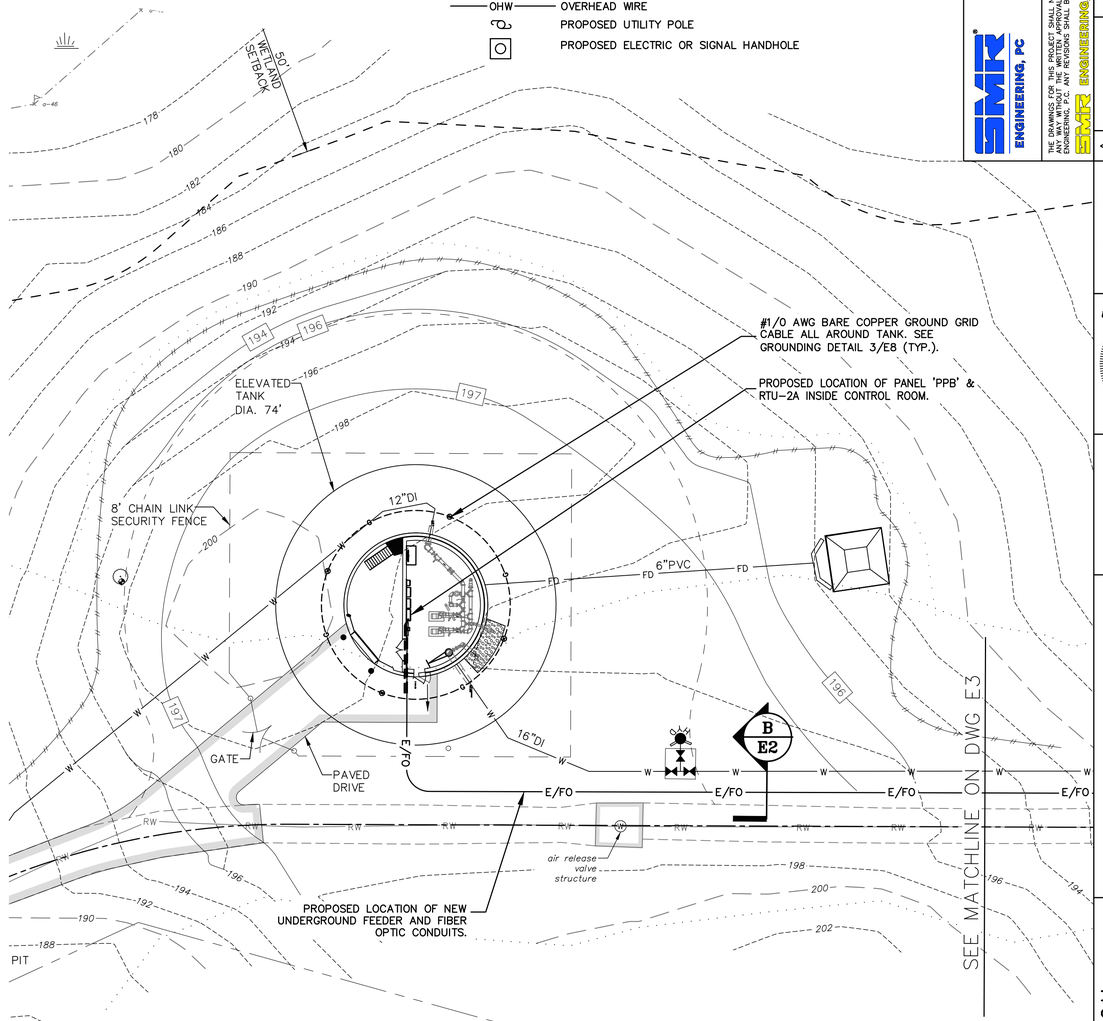


SMITH/CUMMINGS WELL SITE WITH TANK OVERALL ELECTRICAL SITE PLAN 2 / E2
SCALE: 1"=60'-0"

0 60' 120'
SCALE: 1" = 60'

ELECTRICAL SITE LEGEND

- —ES/T— PROPOSED UNDERGROUND ELECTRICAL SERVICE & TELEPHONE CONDUIT
- —E— PROPOSED UNDERGROUND ELECTRICAL CONDUIT
- —S— PROPOSED UNDERGROUND SIGNAL CONDUIT
- —E/S— PROPOSED UNDERGROUND ELECTRIC & SIGNAL CONDUIT
- —E/FO— PROPOSED UNDERGROUND ELECTRIC/FIBER OPTIC CONDUITS
- —G— PROPOSED UNDERGROUND GROUNDING GRID CABLE
- EX EXISTING UNDERGROUND ELECTRIC CONDUIT
- OHW OVERHEAD WIRE
- PROPOSED UTILITY POLE
- PROPOSED ELECTRIC OR SIGNAL HANDHOLE



STORAGE TANK ENLARGED ELECTRICAL SITE PLAN 3 / E2
SCALE: 1"=20'-0"

0 20' 40'
SCALE: 1" = 20'

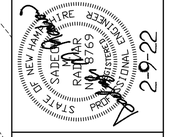
Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466
SMR ENGINEERING, PC

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY MANNER WITHOUT THE EXPRESSED WRITTEN CONSENT OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL Date 12/17/21 By TGP
CONSTRUCTION Date 2/9/22 By TGP
RECORD DRAWING Date - By -

Drawn/Chk. JWC
Designed JWC
Checked SMR
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575_prbase
Scale AS SHOWN



UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

STORAGE TANK ELECTRICAL SITE PLAN

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC./ ALL RIGHTS RESERVED

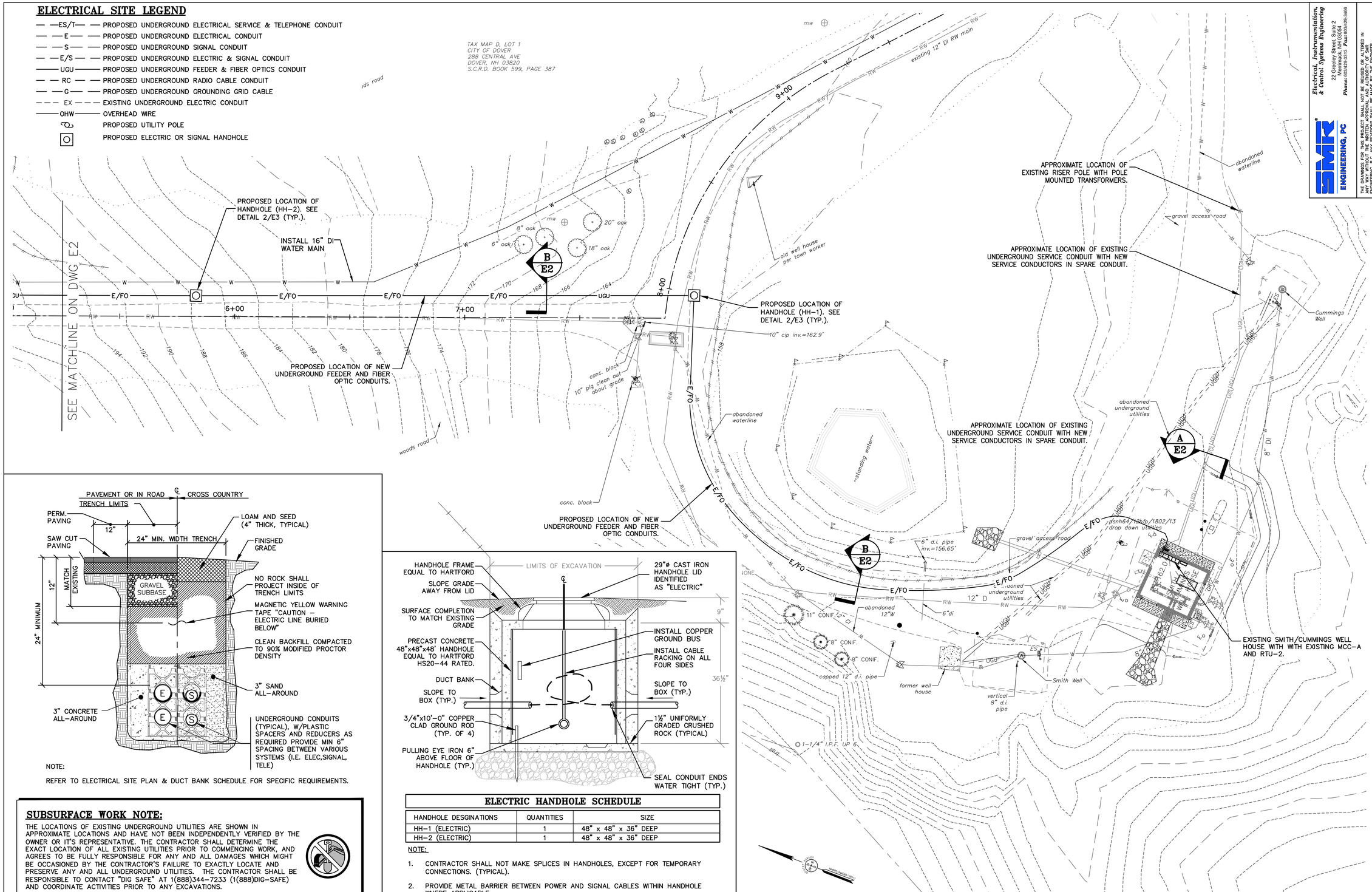
DWG NO E2
SHEET OF 43

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E2-E3-Site Plans.dwg Feb 10, 2022 - 2:40pm

ELECTRICAL SITE LEGEND

- —ES/T— PROPOSED UNDERGROUND ELECTRICAL SERVICE & TELEPHONE CONDUIT
- —E— PROPOSED UNDERGROUND ELECTRICAL CONDUIT
- —S— PROPOSED UNDERGROUND SIGNAL CONDUIT
- —E/S— PROPOSED UNDERGROUND ELECTRIC & SIGNAL CONDUIT
- UGU PROPOSED UNDERGROUND FEEDER & FIBER OPTICS CONDUIT
- RC PROPOSED UNDERGROUND RADIO CABLE CONDUIT
- —G— PROPOSED UNDERGROUND GROUNDING GRID CABLE
- EX EXISTING UNDERGROUND ELECTRIC CONDUIT
- OHW OVERHEAD WIRE
- PROPOSED UTILITY POLE
- PROPOSED ELECTRIC OR SIGNAL HANDHOLE

TAX MAP D, LOT 1
CITY OF DOVER
288 CENTRAL AVE
DOVER, NH 03820
S.C.R.D. BOOK 599, PAGE 387



NOTE:

REFER TO ELECTRICAL SITE PLAN & DUCT BANK SCHEDULE FOR SPECIFIC REQUIREMENTS.

TYPICAL ELECTRICAL TRENCHING DETAIL 1/E3

SCALE: NONE

ELECTRIC HANDHOLE SCHEDULE

HANDHOLE DESIGNATIONS	QUANTITIES	SIZE
HH–1 (ELECTRIC)	1	48" x 48" x 36" DEEP
HH–2 (ELECTRIC)	1	48" x 48" x 36" DEEP

NOTE:

1. CONTRACTOR SHALL NOT MAKE SPLICES IN HANDHOLES, EXCEPT FOR TEMPORARY CONNECTIONS. (TYPICAL).
2. PROVIDE METAL BARRIER BETWEEN POWER AND SIGNAL CABLES WITHIN HANDHOLE WHERE APPLICABLE.
3. THE HANDHOLE DESIGN LOADING SHALL BE: AASHTO – HS–25.

TYPICAL HANDHOLE INSTALLATION DETAIL 2/E3

SCALE: NONE

SUBSURFACE WORK NOTE:

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN APPROXIMATE LOCATIONS AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR IT'S REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE TO CONTACT "DIG SAFE" AT 1(888)344–7233 (1(888)DIG–SAFE) AND COORDINATE ACTIVITIES PRIOR TO ANY EXCAVATIONS.

STORAGE TANK/WELL HOUSE ENLARGED ELECTRICAL SITE PLAN CONTINUATION 3/E3

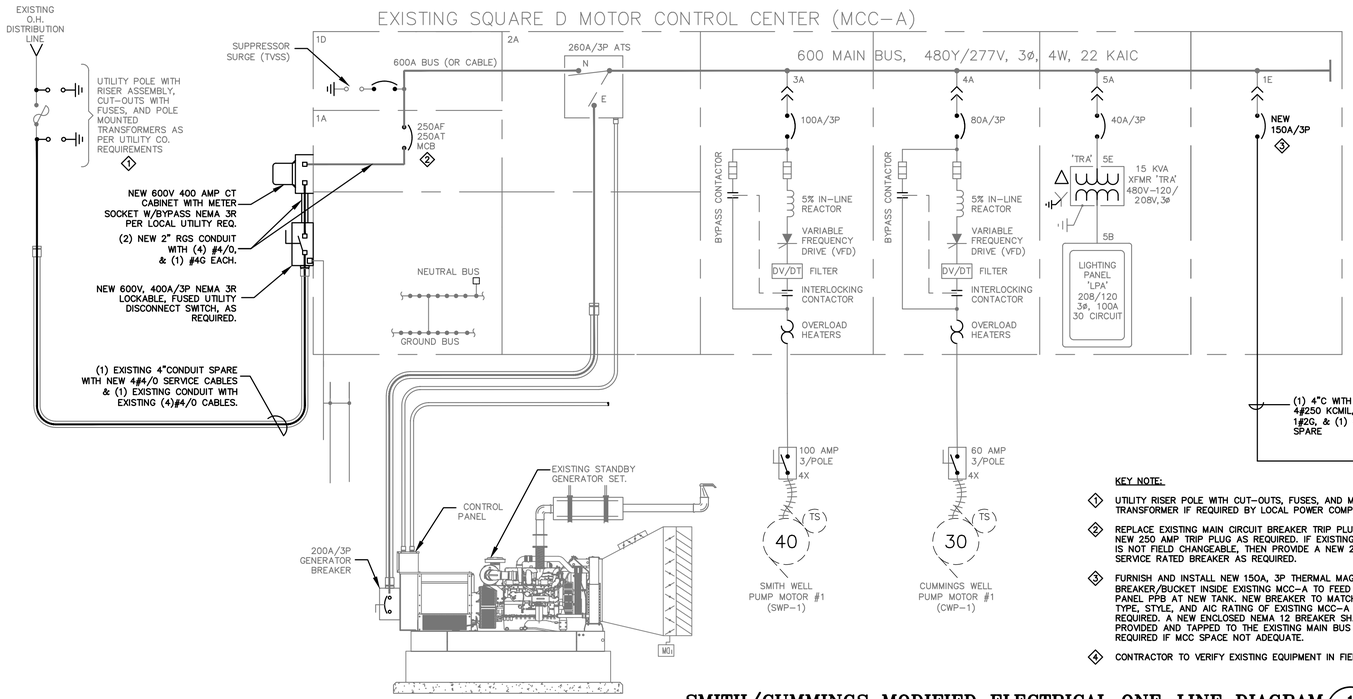
SCALE: 1"=20'–0"

0 20' 40
SCALE: 1" = 20'

SMR ENGINEERING, PC
Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3315 Fax: 603-429-3466

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY WAY BY ANYONE WITHOUT THE WRITTEN AUTHORIZATION OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.
SMR ENGINEERING, PC ©

NO.	REVISIONS	APP'D

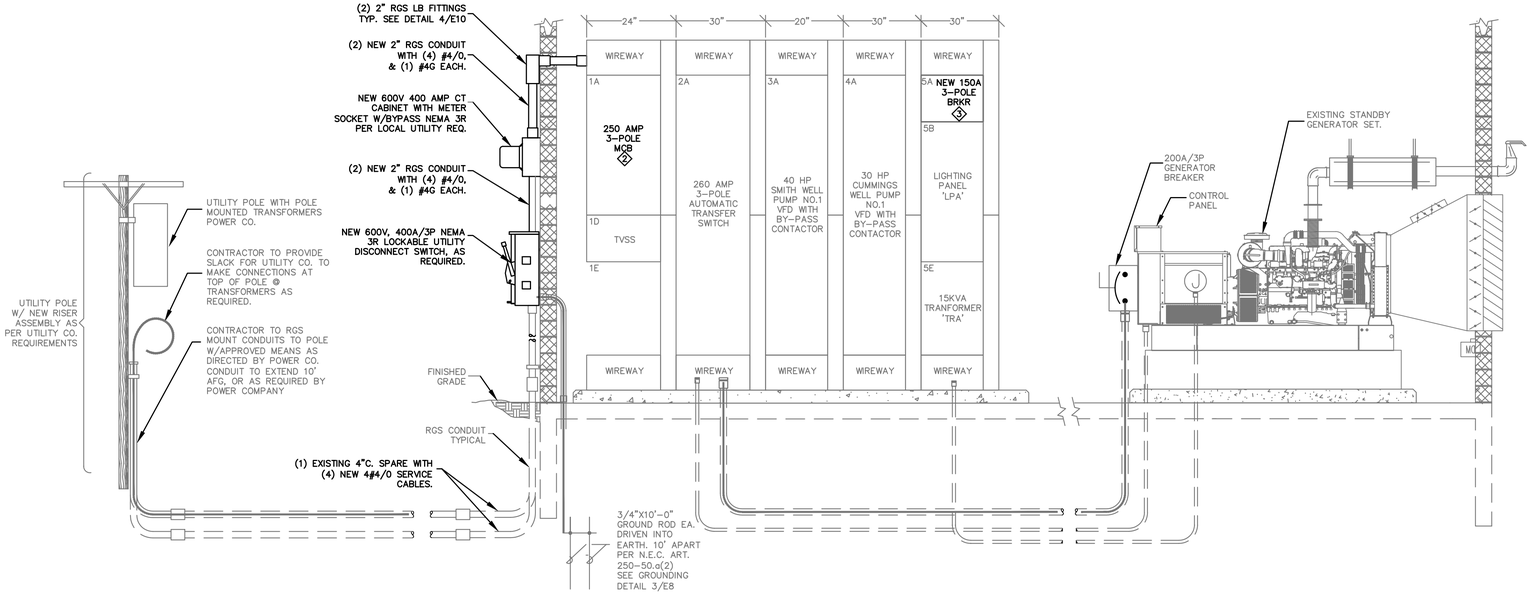


KEY NOTE:

1. UTILITY RISER POLE WITH CUT-OUTS, FUSES, AND MOUNTED TRANSFORMER IF REQUIRED BY LOCAL POWER COMPANY.
2. REPLACE EXISTING MAIN CIRCUIT BREAKER TRIP PLUG WITH NEW 250 AMP TRIP PLUG AS REQUIRED. IF EXISTING BREAKER IS NOT FIELD CHANGEABLE, THEN PROVIDE A NEW 250A, 3P SERVICE RATED BREAKER AS REQUIRED.
3. FURNISH AND INSTALL NEW 150A, 3P THERMAL MAGNETIC BREAKER/BUCKET INSIDE EXISTING MCC-A TO FEED NEW PANEL PPB AT NEW TANK. NEW BREAKER TO MATCH EXISTING TYPE, STYLE, AND AIC RATING OF EXISTING MCC-A AS REQUIRED. A NEW ENCLOSED NEMA 12 BREAKER SHALL BE PROVIDED AND TAPPED TO THE EXISTING MAIN BUS AS REQUIRED IF MCC SPACE NOT ADEQUATE.
4. CONTRACTOR TO VERIFY EXISTING EQUIPMENT IN FIELD.

SMITH/CUMMINGS MODIFIED ELECTRICAL ONE-LINE DIAGRAM (1/E4)

SCALE: NONE



SMITH/CUMMINGS MODIFIED ELECTRICAL EQUIPMENT ELEVATION (2/E4)

SCALE: NONE

TRANSIENT VOLTAGE SURGE SUPPRESSER (TVSS) SCHEDULE:

	LOCATION	MODEL NO.	SYSTEM VOLTAGE	PEAK SURGE CURRENT
A	PPB	PTE200-3Y201-D	480, 3Ø,4W	200,000 AMPS PER Ø

NOTE:

1. SURGE PROTECTORS SHALL BE MANUFACTURED BY INNOVATIVE TECHNOLOGY OR APPROVED EQUAL.
2. UNIT SHALL HAVE: 10 MODE MOV DESIGN, SINE-WAVE TRACKING, 20 YEAR WARRANTY, & SURGE COUNTER, AND INTERNAL BREAKER

TVSS SCHEDULE (3/E4)

SCALE: NONE

Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466
SMR ENGINEERING, PC

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY WAY WITHOUT THE EXPRESS WRITTEN CONSENT OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL — By TGP — Date 12/17/21
CONSTRUCTION — By TGP — Date 2/9/22
RECORD DRAWING — By - — Date -

Drawn/Chk. JWC
Designed JWC
Checked SMR
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575-E4-1L
Scale AS SHOWN

NEW HAMPSHIRE PROFESSIONAL ENGINEER KARA A. PAPE 13876 SADE STATE OF 2-9-22

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

SMITH/CUMMINGS ONE-LINE DIAGRAM

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

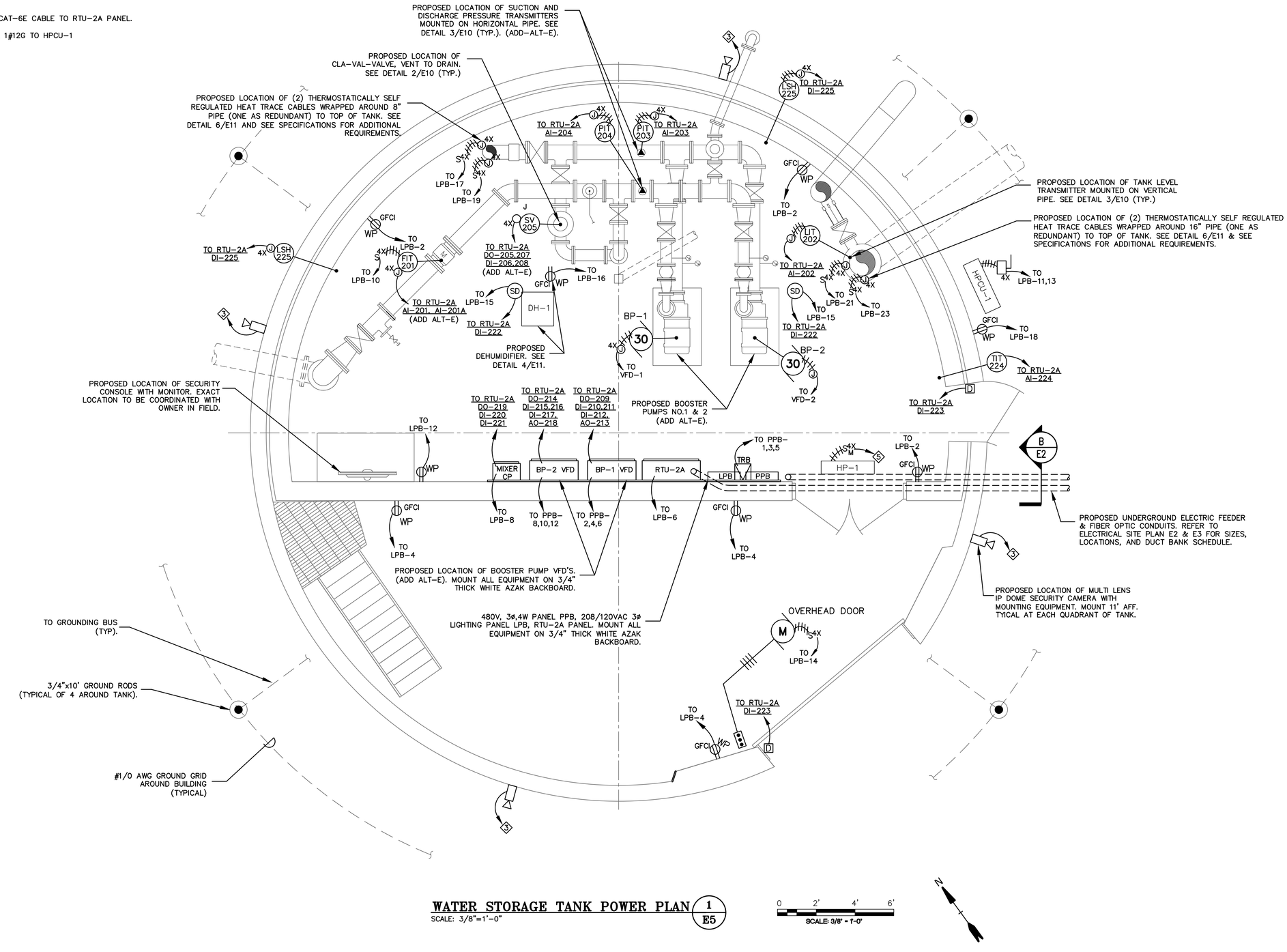
©COPYRIGHT BY UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO E4 | SHEET OF 43

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E4-One-Line Diagram.dwg Feb 10, 2022 - 2:40pm

KEY NOTES:

1. PROVIDE 3/4" THICK WHITE AZAK BACKBOARD FOR ALL PANELS, CABINETS ETC. AS REQUIRED.
2. ALL WIRING IN ALL TANK AREAS SHALL BE WITHIN RIGID GALVANIZED STEEL CONDUITS EXCEPT AS NOTED. ALL ELECTRICAL PANELS, DISCONNECT SWITCHES, PULL BOXES, J-BOXES, ETC. SHALL BE PROVIDED WITH NEMA 12 METAL CONSTRUCTION UNLESS OTHERWISE NOTED. ALL CONDUIT HANGING HARDWARE SHALL BE STAINLESS STEEL CONSTRUCTION.
3. (1) NEW 3/4" CONDUIT WITH VIDEO CAMERA CABLE & CAT-6E CABLE TO SECURITY CONSOLE/PANEL PANEL.
4. (1) NEW 3/4" CONDUIT WITH (1) CAT-6E CABLE TO RTU-2A PANEL.
5. (1) NEW 3/4 CONDUIT WITH 3#12, 1#12G TO HPCU-1



WATER STORAGE TANK POWER PLAN (1/E5)

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

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

Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY WAY BY ANYONE WITHOUT THE EXPRESSED WRITTEN CONSENT OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D

ISSUE FOR

APPROVAL — Date 12/17/21 — By TGP

CONSTRUCTION — Date 2/9/22 — By TGP

RECORD DRAWING — Date - — By -

Drawn/Chk. JWC
Designed JWC
Checked SMR
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575-E5-PP
Scale AS SHOWN

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

STORAGE TANK/BPS POWER PLAN

COMPOSITE ELEVATED WATER STORAGE TANK

PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

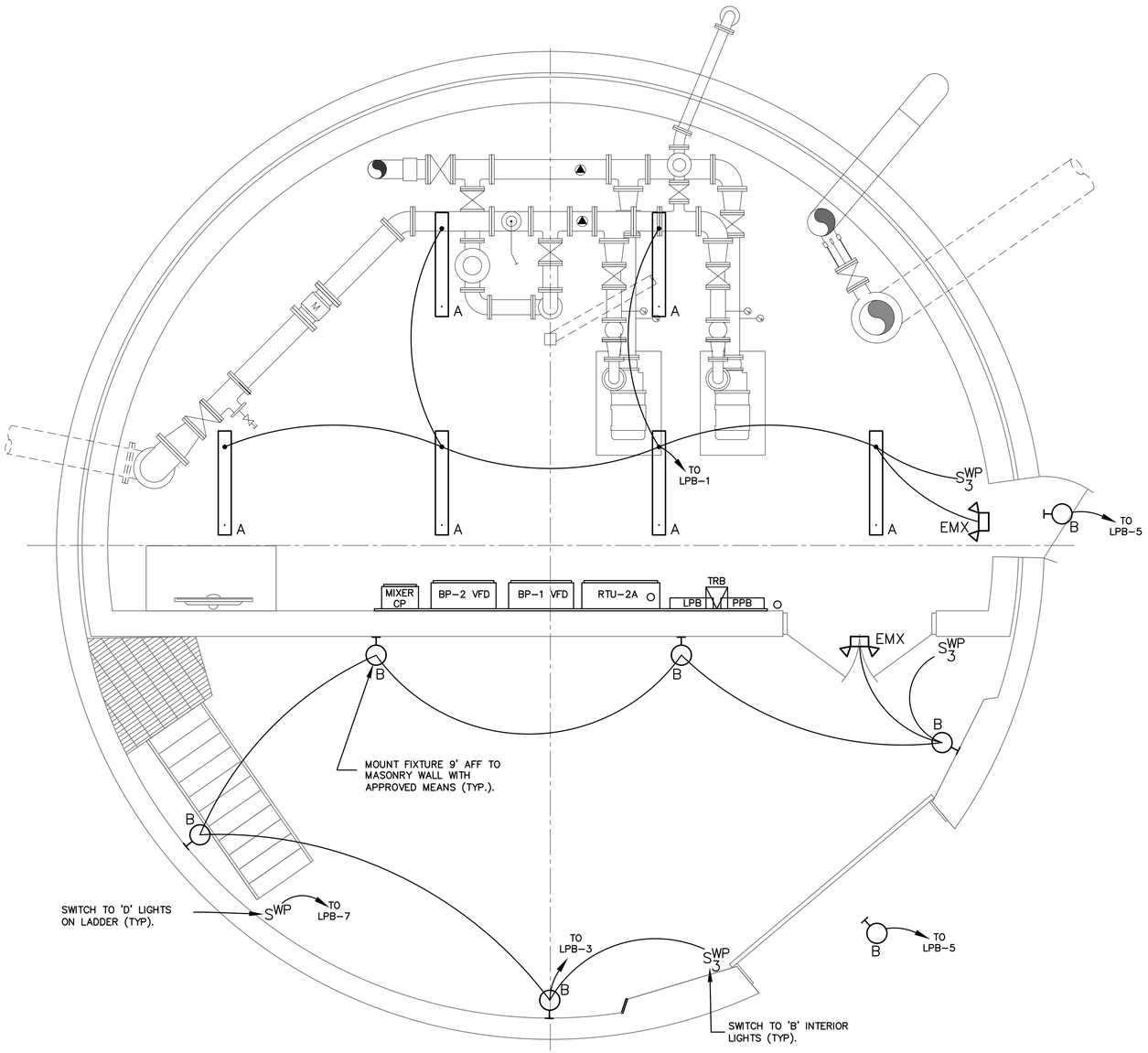
DWG NO E5

SHEET OF 43

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E5-Tank-Power-Lighting Plans.dwg Feb 10, 2022 - 2:40pm

KEY NOTES:

1. PROVIDE 3/4" THICK WHITE AZAK BACKBOARD FOR ALL PANELS, CABINETS ETC. AS REQUIRED.
2. ALL WIRING IN ALL TANK AREAS SHALL BE WITHIN RIGID GALVANIZED STEEL CONDUITS EXCEPT AS NOTED. ALL ELECTRICAL PANELS, DISCONNECT SWITCHES, PULL BOXES, J-BOXES, ETC. SHALL BE PROVIDED WITH NEMA 12 METAL CONSTRUCTION UNLESS OTHERWISE NOTED. ALL CONDUIT HANGING HARDWARE SHALL BE STAINLESS STEEL CONSTRUCTION.



WATER STORAGE TANK LIGHTING PLAN

1 / E6

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

0 2' 4' 6'

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

N

SMR ENGINEERING, PC
Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY MANNER WITHOUT WRITTEN AUTHORIZATION OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D
	ISSUE FOR	
	APPROVAL	
	Date 12/17/21	By TGP
	CONSTRUCTION	
	Date 2/9/22	By TGP
	RECORD DRAWING	
	Date -	By -

Drawn/Chk JWC
Designed JWC
Checked SMR
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575-E6-LP
Scale AS SHOWN



UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

STORAGE TANK/BPS
LIGHTING PLAN

COMPOSITE ELEVATED WATER
STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

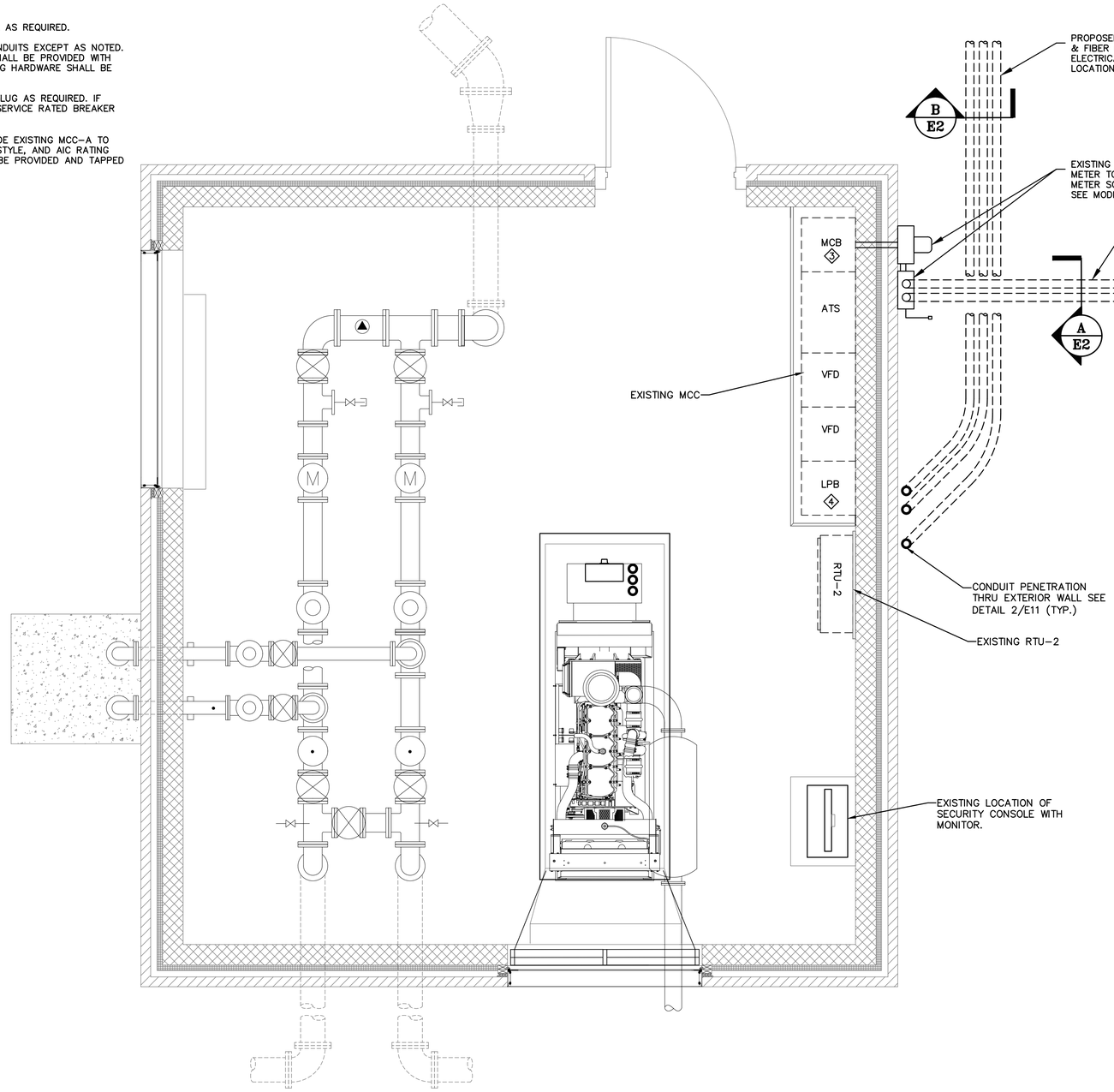
DWG NO E6

SHEET OF 43

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E5-Tank-Power-Lighting Plans.dwg Feb 10, 2022 - 2:40pm

KEY NOTES:

1. PROVIDE 3/4" THICK WHITE AZAK BACKBOARD FOR ALL PANELS, CABINETS ETC. AS REQUIRED.
2. ALL WIRING INSIDE PUMP STATION SHALL BE WITHIN RIGID GALVANIZED STEEL CONDUITS EXCEPT AS NOTED. ALL ELECTRICAL PANELS, DISCONNECT SWITCHES, PULL BOXES, J-BOXES, ETC. SHALL BE PROVIDED WITH NEMA 12 METAL CONSTRUCTION UNLESS OTHERWISE NOTED. ALL CONDUIT HANGING HARDWARE SHALL BE STAINLESS STEEL CONSTRUCTION.
3. REPLACE EXISTING MAIN CIRCUIT BREAKER TRIP PLUG WITH NEW 250 AMP TRIP PLUG AS REQUIRED. IF EXISTING BREAKER IS NOT FIELD CHANGEABLE, THEN PROVIDE A NEW 250A, 3P SERVICE RATED BREAKER AS REQUIRED.
4. FURNISH AND INSTALL NEW 150A, 3P THERMAL MAGNETIC BREAKER/BUCKET INSIDE EXISTING MCC-A TO FEED NEW PANEL PPB AT NEW TANK. NEW BREAKER TO MATCH EXISTING TYPE, STYLE, AND AIC RATING OF EXISTING MCC-A AS REQUIRED. A NEW ENCLOSED NEMA 12 BREAKER SHALL BE PROVIDED AND TAPPED TO THE EXISTING MAIN BUS AS REQUIRED IF MCC SPACE NOT ADEQUATE.



SMITH/CUMMINGS WELL BUILDING MODIFIED POWER PLAN 1/E7

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

0 1' 2' 4'
SCALE: 1/2" = 1'-0"

N

Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466
SMR ENGINEERING, PC

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY MANNER WITHOUT THE WRITTEN AUTHORIZATION OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D

PANEL No. PPB

BUS 200 AMPERE
PANEL RATING 14 KAIC
SUPPLY VAC 480Y/277V
SERVICE 3-PHASE, 4W W/GND BUS

LOCATION INSIDE TANK
MOUNTING SURFACE
DWG No.

WIRING # OF WIRES	WIRING CONDUIT	DESCRIPTION	VA OR W øA	VA OR W øB	VA OR W øC	BREAKER POLE	BREAKER AMPS	CKT. NO	BUS A	BUS B	BUS C	CKT. NO	BREAKER POLE	BREAKER AMPS	VA OR W øA	VA OR W øB	VA OR W øC	DESCRIPTION	WIRING CONDUIT	WIRING # OF WIRES
3#10, 1#10G	3/4"	15 KVA TRANSFORMER TRB				3	30	1	X			2	3	80				BOOSTER PUMP NO.1 (BP-1) VFD	1-1/2"	3#4, 1#6G
								3		X		4								
								5			X	6								
		SPARE				2	30	7	X			8	3	80				BOOSTER PUMP NO.2 (BP-2) VFD	1-1/2"	3#4, 1#6G
								9		X		10								
		SPARE				3	30	11			X	12								
								13	X			14	1	20						
								15		X		16	1	20						
		SPARE				2	20	17			X	18	1	20						
								19	X			20	1	20						
		SPARE				2	20	21		X		22	1	20						
								23			X	24								
								19	X			26								
								21		X		28								
								23			X	30								
												TOTAL 2								
		TOTAL 1																		
		TOTAL 2																		
		TOTAL 1 + 2																		
		TOTAL CONNECTED LOAD AMPERES																		

MAIN BREAKER 150/3P
FEEDER ENTRANCE TOP
FEEDER SIZE 4#250 KCMIL, 1#2G, 4"C
SOURCE MCC-B @ SMITH/CUMMINGS WH
PANEL TYPE BOLT-ON

MAIN LUGS N/A
ENCL. TYPE NEMA 1
ACCRIES

PANEL No. LPB

BUS 100 AMPERE
PANEL RATING 10 KAIC
SUPPLY VAC 208Y/120V
SERVICE 3 PHASE, 4W W/GND BUS

LOCATION INSIDE TANK
MOUNTING SURFACE
DWG No.

WIRING # OF WIRES	WIRING CONDUIT	DESCRIPTION	VA OR W øA	VA OR W øB	VA OR W øC	BREAKER POLE	BREAKER AMPS	CKT. NO	BUS A	BUS B	BUS C	CKT. NO	BREAKER POLE	BREAKER AMPS	VA OR W øA	VA OR W øB	VA OR W øC	DESCRIPTION	WIRING CONDUIT	WIRING # OF WIRES
2#12, 1#12G	3/4"	INTERIOR LIGHTING				1	20	1	X			2	1	20				RECEPTACLES - INTERIOR	3/4"	2#12, 1#12G
2#12, 1#12G	3/4"	INTERIOR LIGHTING				1	20	3		X		4	1	20				RECEPTACLES - INTERIOR	3/4"	2#12, 1#12G
2#12, 1#12G	3/4"	EXTERIOR LIGHTING				1	20	5			X	6	1	20				RTU-2A PANEL	3/4"	2#12, 1#12G
2#10, 1#10G	3/4"	LADDER LIGHTS				1	20	7	X			8	1	20				MIXER MOTOR	3/4"	2#12, 1#12G
		SPARE				1	20	9		X		10	1	20				MAG METER		
2#10, 1#10G	3/4"	HPCU-1				2	30	11			X	12	1	20				SECURITY CONSOLE/PANEL	3/4"	2#12, 1#12G
								13	X			14	1	20				OVERHEAD DOOR OPENER MOTOR	3/4"	2#12, 1#12G
2#12, 1#12G	3/4"	SMOKE DETECTORS				1	20	15		X		16	1	20				DEHUMIDIFIER	3/4"	2#12, 1#12G
2#12, 1#12G	3/4"	HEAT TRACE CABLE				1	20	17			X	18	1	20				RECEPTACLES - EXTERIOR	3/4"	2#12, 1#12G
2#12, 1#12G	3/4"	HEAT TRACE CABLE				1	20	19	X			20	1	20				SPARE		
2#12, 1#12G	3/4"	HEAT TRACE CABLE				1	20	21		X		22	1	20				SPARE		
2#12, 1#12G	3/4"	HEAT TRACE CABLE				1	20	23			X	24	1	20				SPARE		
		TOTAL 1										TOTAL 2								
		TOTAL 2																		
		TOTAL 1 + 2																		
		TOTAL CONNECTED LOAD AMPERES																		

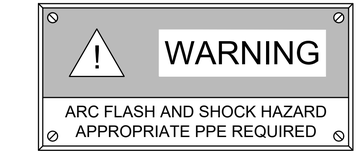
MAIN BREAKER 50/3P
FEEDER ENTRANCE TOP
FEEDER SIZE 4#6, 1#8G, 1"C
SOURCE 15-KVA TRANSFORMER - TRB
PANEL TYPE BOLT-ON

MAIN LUGS N/A
ENCL. TYPE NEMA 1
ACCRIES

LIGHTING FIXTURE SCHEDULE

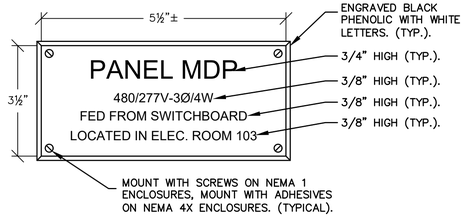
TYPE	MANUFACTURER	CATALOG NUMBER	TYPE	COLOR	MOUNTING	VOLTAGE	LAMPS	REMARKS	TOTAL WATTS
A	COLUMBIA	LXEM-440-VL-RFA-EU-SSL	LED	WHITE	CEILING SURFACE	120	LED	MOUNT FLUSH TO CEILING OR WALL MOUNTED AS SHOWN ON DWGS.	200
B	PHILIPS	LMC-30LU-4K-3-2-PC4	LED	BRONZE	WALL 9'-4"	120	LED	W/WIRE GUARD.	16
EMX	CARPENTER	N4X7-12V	EMERG.	GRAY	WALL@ 8'	120	(2) 9W	MOUNT FLUSH ON WALL ABOVE DOOR @ 8' A.F.F.	23
D	HUBBELL	LBLV15-VL15LG	LED	GRAY	WALL MOUNT	120	LED	WITH VW1/VX1 VAPOR TIGHT WITH GLOBE & WIRE GUARD.	100
EM	CARPENTER	NX12-36-E-N1	EXIT	GRAY	WALL@ 8' ABOVE DOOR	120	LED	MOUNT FLUSH ON WALL ABOVE DOOR @ 8' A.F.F. AND ON TANK LADDER	-

ELECTRIC PANEL & LIGHTING FIXTURE SCHEDULES (1/E8)
SCALE: NONE



INSTALL ON ALL METER SOCKETS, SWITCHBOARDS, MOTOR CONTROL CENTERS, PANELBOARDS IN ACCORDANCE TO NEC ART 110.16 (TYPICAL).

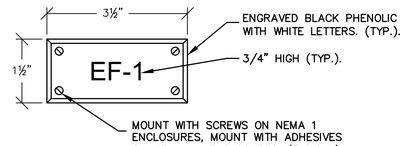
TYPICAL FLASH PROTECTION WARNING LABEL
NO SCALE



TYPICAL PANEL NAMEPLATE
NO SCALE

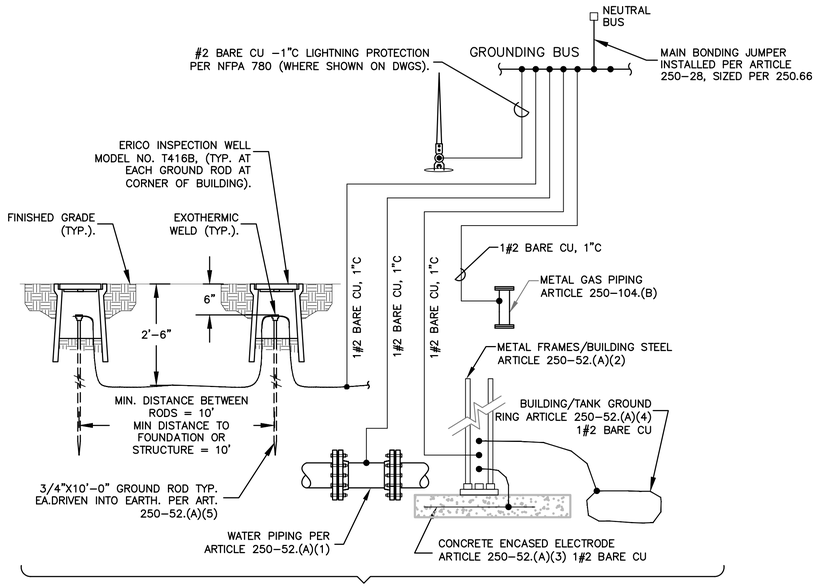
GENERAL NOTE:

1. NAMEPLATES ARE REQUIRED TO BE INSTALLED ON ALL ELECTRICAL EQUIPMENT FURNISHED ON PROJECT INCLUDING BUT NOT LIMITED TO: DISCONNECT SWITCHES, STARTERS, MOTOR CONTROL CENTERS, CONTROL STATIONS, SWITCHGEAR, SWITCHBOARDS, PANELBOARDS, ELECTRICAL CONTROL CENTERS (PROCESS PANELS) AND RELATED ITEMS.
2. REFER TO SPECIFICATIONS FOR NAMEPLATE REQUIREMENTS.
3. ALL NAMEPLATES TO BE 1/16" THICK PHENOLIC WITH WHITE CENTER LAMINATION



TYPICAL EQUIPMENT OR DISC. SWITCH NAMEPLATE
NO SCALE

ELECTRICAL IDENTIFICATION AND TAGGING (TYP.) (2/E8)
SCALE: NONE



GROUNDING ELECTRODE & BONDING
CONDUCTORS WHERE APPLICABLE PER ARTICLE 250 OF N.E.C.

GROUNDING AND BONDING INSTALLATION DETAIL AT TANK (3/E8)
SCALE: NONE

Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466
SMR ENGINEERING, PC

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY WAY BY ANYONE WITHOUT THE EXPRESS WRITTEN CONSENT OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL Date 12/17/21 By TGP
CONSTRUCTION Date 2/9/22 By TGP
RECORD DRAWING Date - By -

Drawn/Chk. JMC
Designed JMC
Checked SMR
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575-E8-WD
Scale AS SHOWN



UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

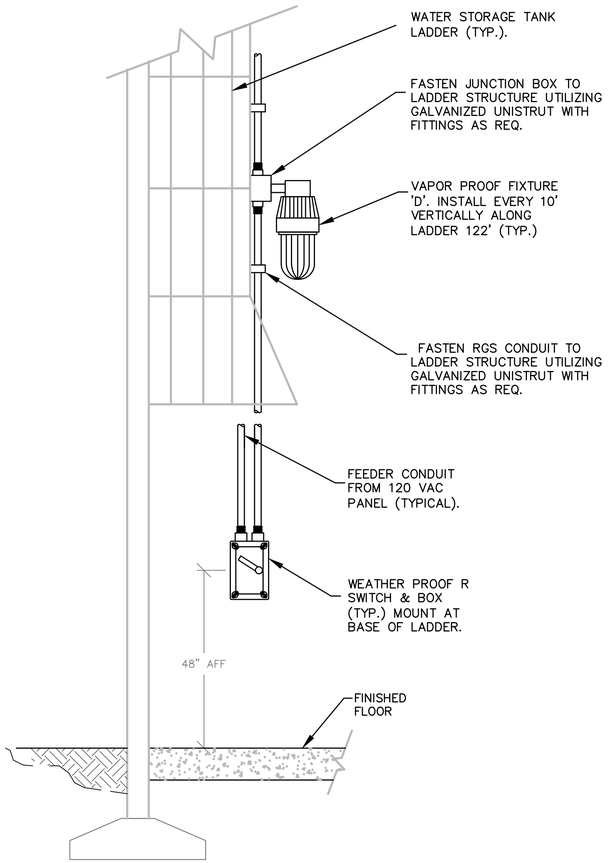
ELECTRIC PANEL & LIGHTING FIXTURE SCHEDULES WITH DETAILS

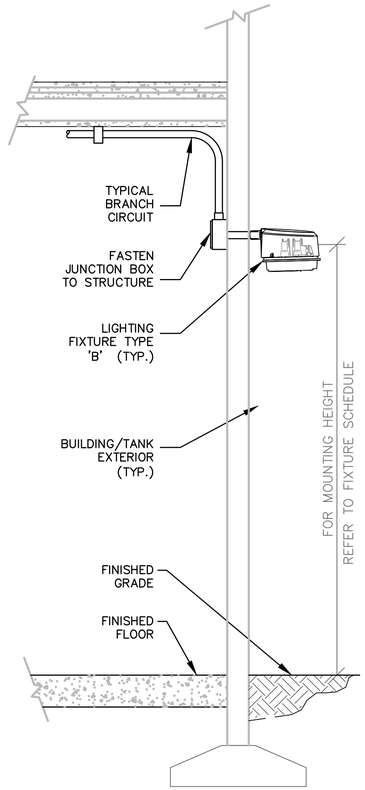
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

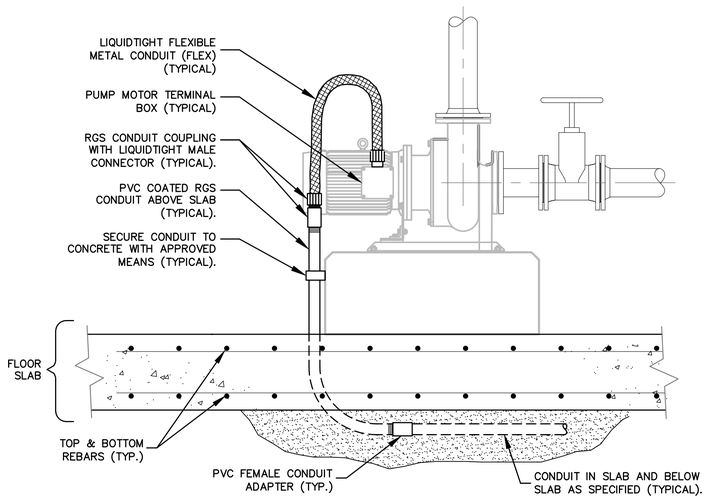
CITY OF DOVER, NEW HAMPSHIRE

DWG NO E8
SHEET OF 43

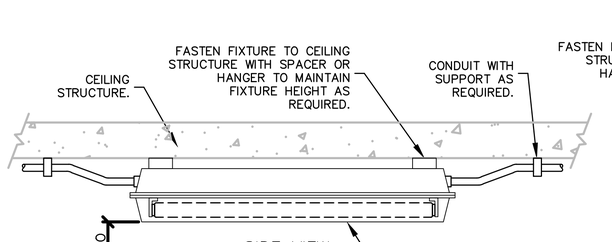
FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E8-E12-WD.dwg Feb 10, 2022 - 2:40pm

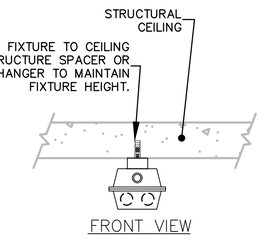


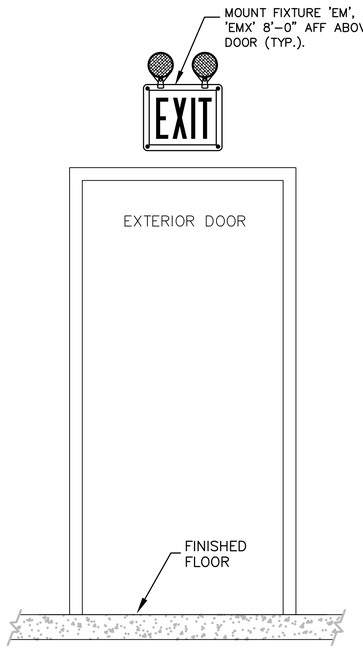


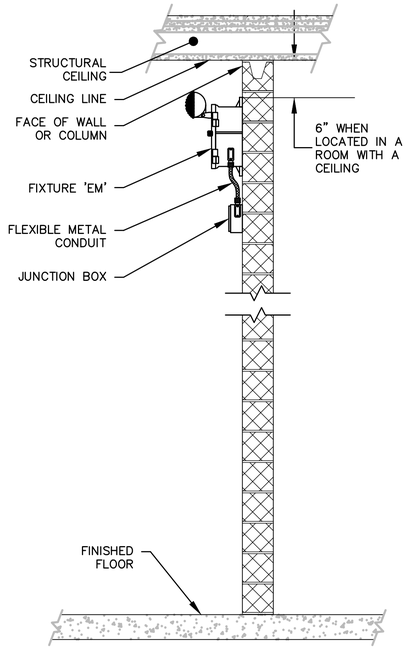


ELECTRICAL CONNECTION AT MOTOR (TYP.) 2/E9
SCALE: NONE









LIGHTING FIXTURE MOUNTING DETAILS 1/E9
SCALE: NONE

SMR ENGINEERING, PC
Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 *Fax:* 603-429-3466

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY MANNER FOR ANY OTHER PROJECT WITHOUT THE WRITTEN APPROVAL OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D

ISSUE FOR
APPROVAL — Date 12/17/21 — By TGP
CONSTRUCTION — Date 2/9/22 — By TGP
RECORD DRAWING — Date - — By -

Drawn/Chk. JMC
Designed JMC
Checked SMR
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575-E9-WD
Scale AS SHOWN



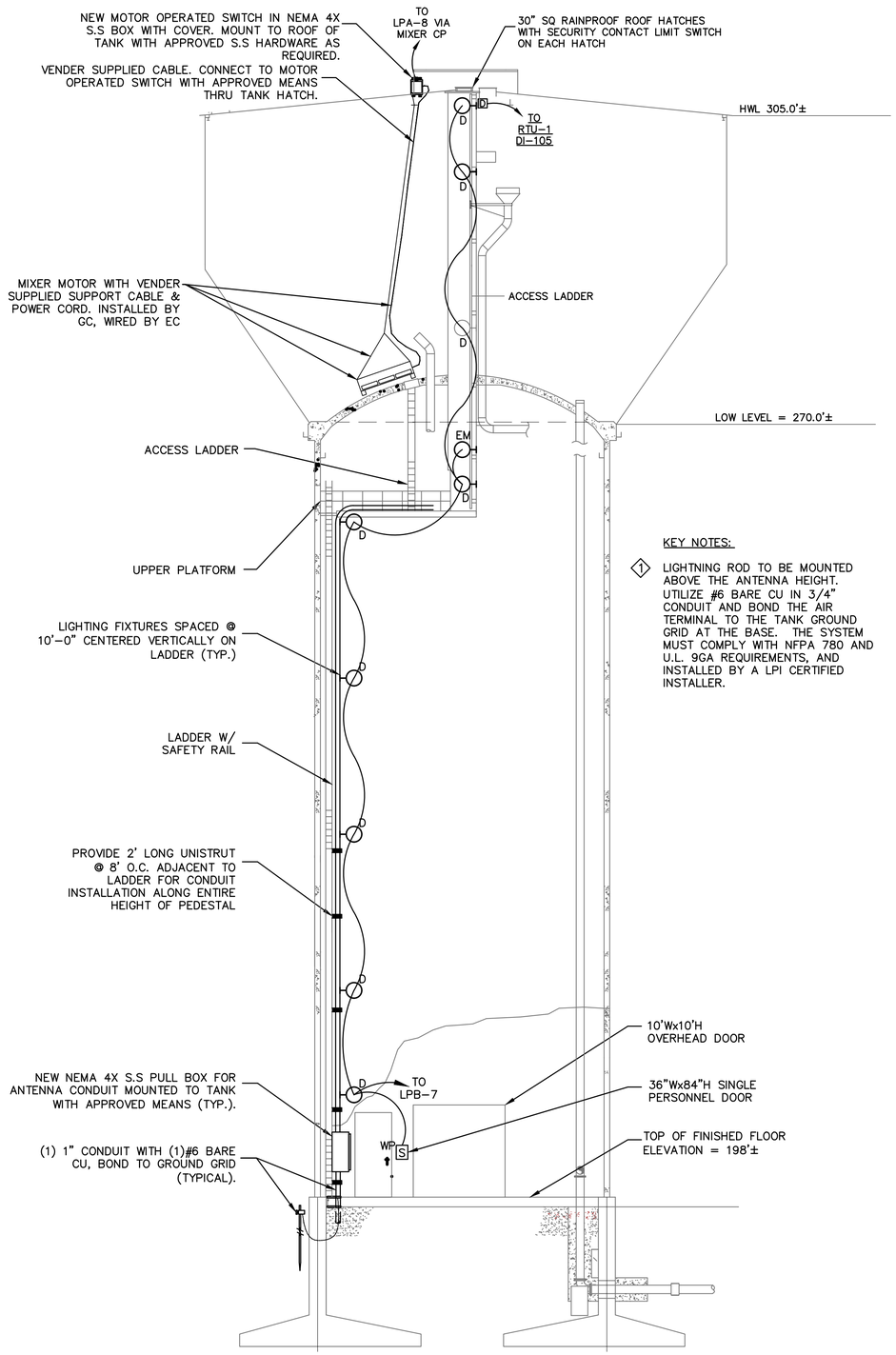
UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

LIGHTING FIXTURE MOUNTING DETAILS
COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02
CITY OF DOVER, NEW HAMPSHIRE

DWG NO E9
SHEET OF 43

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E8-E12-WD.dwg Feb 10, 2022 - 2:40pm

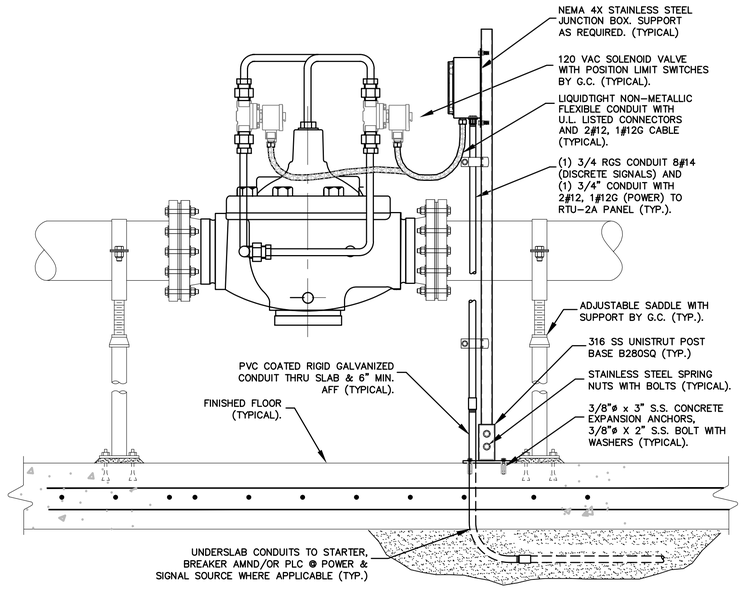


KEY NOTES:

1. LIGHTNING ROD TO BE MOUNTED ABOVE THE ANTENNA HEIGHT. UTILIZE #6 BARE CU IN 3/4" CONDUIT AND BOND THE AIR TERMINAL TO THE TANK GROUND GRID AT THE BASE. THE SYSTEM MUST COMPLY WITH NFPA 780 AND U.L. 9GA REQUIREMENTS, AND INSTALLED BY A LPI CERTIFIED INSTALLER.

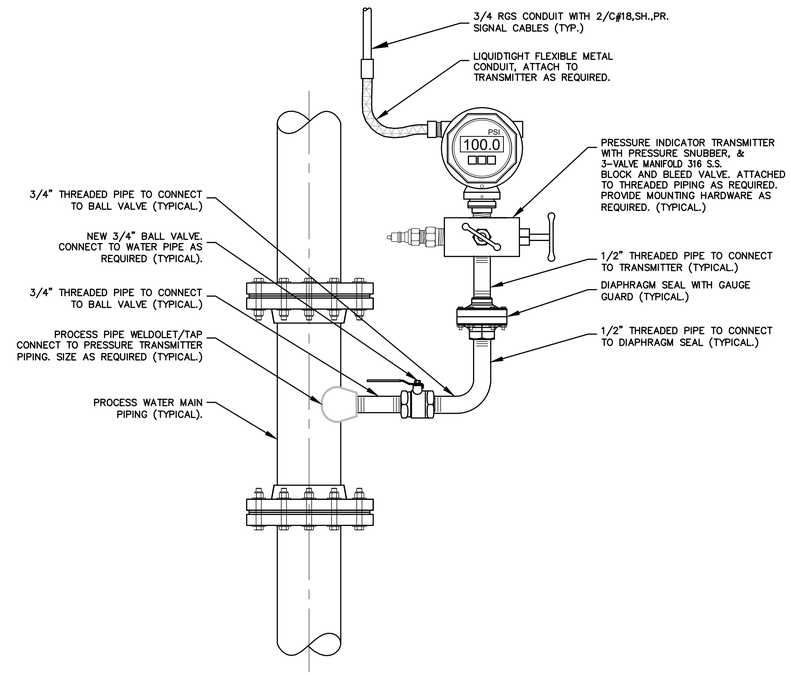
LIGHTING FIXTURE MOUNTING & MIXER MOTOR CONNECTIONS INSIDE TANK 1/E10

SCALE: NONE



ELECTRICAL/SIGNAL CONNECTION AT CLA-VAL-VALVE (TYP.) 2/E10

SCALE: NONE



ELECTRICAL CONNECTION AT TANK LEVEL TRANSMITTER 3/E10

SCALE: NONE

SMR ENGINEERING, PC
Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY MANNER WHATSOEVER WITHOUT THE WRITTEN AUTHORIZATION OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D

ISSUE FOR

APPROVAL — Date 12/17/21 — By TGP

CONSTRUCTION — Date 2/9/22 — By TGP

RECORD DRAWING — Date - — By -

Drawn/Chk. JWC
Designed JWC
Checked SMR
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575-E10-WD
Scale AS SHOWN



UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

ELECTRICAL DETAILS

COMPOSITE ELEVATED WATER STORAGE TANK

PLANNING FILE NO. 22-02

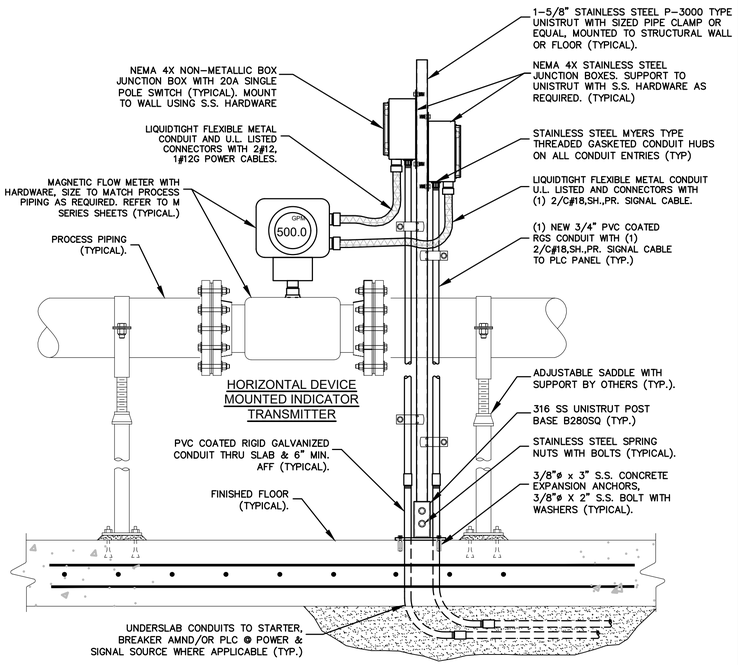
CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO E10

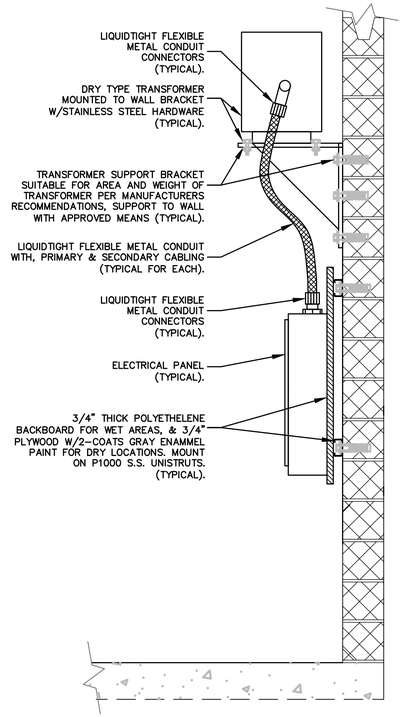
SHEET OF 43

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E8-E12-WD.dwg Feb 10, 2022 - 2:40pm



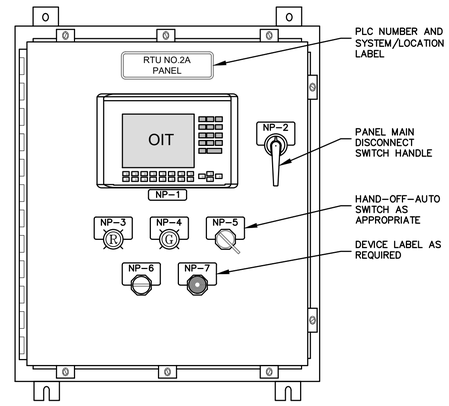
ELECTRICAL/SIGNAL CONNECTION AT MAG METER (TYP.) 1/E11

SCALE: NONE



WALL MOUNTED TRANSFORMER & PANEL (TYP.) 3/E11

SCALE: NONE



TYPICAL PANEL NAMEPLATE SCHEDULE:

NP-1	OPERATOR INTERFACE TERMINAL (OIT)
NP-2	PANEL DISCONNECT SWITCH
NP-3	COMMUNICATION FAIL
NP-4	POWER ON
NP-5	H-O-A SWITCH (TYP. AS NEEDED)
NP-6	RESET
NP-7	SONALERT AUDIBLE ALARM HORN

TYPICAL CONTROL PANEL SYMBOLS:

GPM 150.0 — LCD, 3-1/2 LARGE DIGIT INDICATOR

(R) — INDICATING LIGHTS
A: AMBER
B: BLUE
G: GREEN
R: RED
W: WHITE
Y: YELLOW

SELECTOR SWITCH, TWO OR THREE POSITION

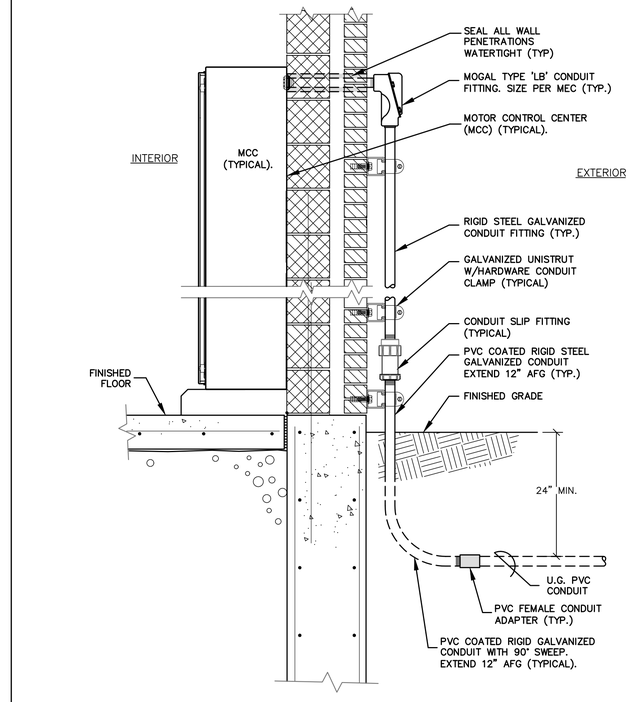
PUSHBUTTON STATION – MOMENTARY

METERING PUMP SPEED POT

SONALERT

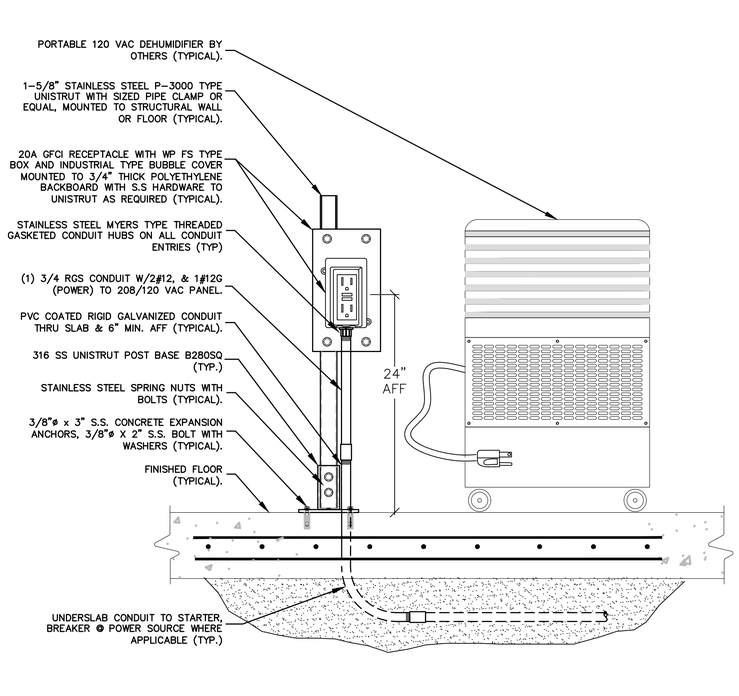
RTU-2A PANEL ELEVATION (TYP.) 5/E11

SCALE: NONE



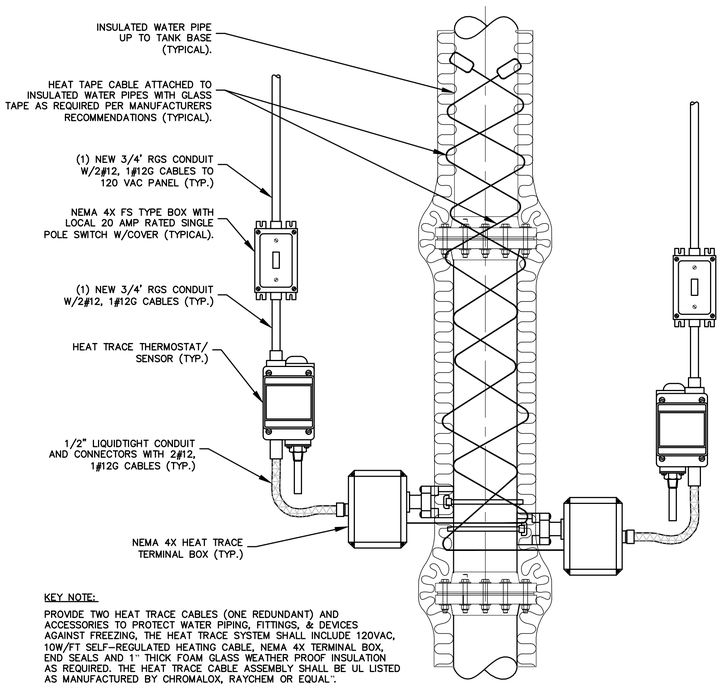
CONDUIT PENETRATION THRU EXTERIOR WALLS (TYP.) 2/E11

SCALE: NONE



ELECTRICAL CONNECTION AT DEHUMIDIFIER (TYP.) 4/E11

SCALE: NONE



KEY NOTE:

PROVIDE TWO HEAT TRACE CABLES (ONE REDUNDANT) AND ACCESSORIES TO PROTECT WATER PIPING, FITTINGS, & DEVICES AGAINST FREEZING, THE HEAT TRACE SYSTEM SHALL INCLUDE 120VAC, 10W/FT SELF-REGULATED HEATING CABLE, NEMA 4X TERMINAL BOX, END SEALS AND 1" THICK FOAM GLASS WEATHER PROOF INSULATION AS REQUIRED. THE HEAT TRACE CABLE ASSEMBLY SHALL BE UL LISTED AS MANUFACTURED BY CHROMALOX, RAYCHEM OR EQUAL".

HEAT TAPE CABLE CONNECTION AT WATER PIPE (TYP.) 6/E11

SCALE: NONE

Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466
SMR ENGINEERING, PC

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY WAY WITHOUT THE WRITTEN CONSENT OF SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

NO.	REVISIONS	APP'D

ISSUE FOR

APPROVAL — Date 12/17/21 — By TGP

CONSTRUCTION — Date 2/9/22 — By TGP

RECORD DRAWING — Date - — By -

Drawn/Chk. JMC
Designed JMC
Checked SMR
Approved KAP
Date 2/9/22
Book No. -
Project No. 2575
Dwg. ID 2575-E11-WD
Scale AS SHOWN



UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

ELECTRICAL DETAILS

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

DWG NO E11 — SHEET OF 43

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E8-E12-WD.dwg Feb 10, 2022 - 2:40pm

DESCRIPTION				DESCRIPTION	FUNCTION	HARDWARE												SOFTWARE																								REMARKS
						WIRE				INPUT/OUTPUT						OUTPUT FUNCT.			STATUS			LOGGING					SCHEDULING			APPLICATION PROGRAM		ALARMS							MISC.			
										DIGITAL			ANALOG			DIGITAL		ANALOG																									
LOOP NUMBER	INPUT/OUTPUT LOCATION	EQUIPMENT TAG ID	EQUIPMENT/STARTER LOCATION	TO		2#14 AWG – 3/4"C	3#14 AWG – 3/4"C	2/C #18 SH. PR. – 3/4"C	CAT–5E – 1"C	DI (DIGITAL INPUT)	DO (DIGITAL OUTPUT)	AI (ANALOG INPUT)	AO (ANALOG OUTPUT)	PULSE – POSITION	START/STOP	OPEN/CLOSE	PACING	MODULATING	@ GUI	LOCAL INDICATOR	LOCAL OPERATOR INTERFACE	DAILY	WEEKLY	MONTHLY	CHANGE OF STATE	HISTORICAL	MANUAL @ G.U.I.	TOTALIZATION	MAINTENANCE TIME REM.	PEAK SHAVING	RES. @ PLC	P.I.D.	HIGH ALARM	LOW ALARM	FAIL ALARM	OFF NORMAL	ANNUNCIATE @ GUI	ANNUNCIATE @ PRINTER	ANNUNCIATE TO MODEM	SET POINT ADJ. @ PLC	TREND LOG	CALCULATION NO.	
DOVER, NH – COMPOSITE ELEVATED WATER STORAGE TANK PROJECT																																									
REMOTE TERMINAL PANEL NO.1 (RTU–2A) @ TANK																																									
201	RTU–2A	FIT–201		Mag Meter – System Flow	System – Flow			X				X							X	X	X	X	X	X	X		X	X		X		X	X			X	X	X		X		X	
201A	RTU–2A	FIT–201		Mag Meter – System Reverse Flow	System – Reverse Flow			X				X							X	X	X	X	X	X	X		X	X		X		X	X			X	X	X		X		X	
202	RTU–2A	LIT–202		Storage Tank – Level Transmitter	Storage Tank – Level			X				X							X	X	X	X	X	X	X		X	X		X		X	X			X	X	X		X		X	
203	RTU–2A	PIT–203		Suction – Pressure Transmitter	Suction – Pressure Level			X				X							X	X	X	X	X	X	X			X		X		X	X	X	X	X	X	X	X		X	X	
204	RTU–2A	PIT–204		Discharge – Pressure Transmitter	Discharge – Pressure Level			X				X							X	X	X	X	X	X	X			X		X		X	X	X	X	X	X	X	X		X	X	
205	RTU–2A	SV–205		Solenoid Controlled Pressure Reducing Valve No.205	Valve – Open Signal	X					X					X			X	X	X	X	X	X	X				X	X					X	X	X		X			
206	RTU–2A	SV–205		Solenoid Controlled Pressure Reducing Valve No.205	Valve – Open Status	X				X									X	X	X					X		X		X					X							
207	RTU–2A	SV–205		Solenoid Controlled Pressure Reducing Valve No.205	Valve – Close Signal	X					X					X			X	X	X	X	X	X	X				X	X					X	X	X		X			
208	RTU–2A	SV–205		Solenoid Controlled Pressure Reducing Valve No.205	Valve – Close Status	X				X									X	X	X					X		X		X					X							
209	RTU–2A	BP–1	VFD	Booster Pump Motor No.1 – VFD	Pump Motor – Start/Stop	X					X				X				X	X	X	X	X	X	X			X	X	X					X	X	X		X			
210	RTU–2A	BP–1	VFD	Booster Pump Motor No.1 – VFD	Pump Motor – Status	X				X									X	X	X					X		X		X					X							
211	RTU–2A	BP–1	VFD	Booster Pump Motor No.1 – VFD	Pump Motor – Fail Alarm	X				X												X	X	X							X				X	X	X				
212	RTU–2A	BP–1	VFD	Booster Pump Motor No.1 – VFD	Pump Motor – Not in Auto	X				X												X	X	X							X					X	X	X				
213	RTU–2A	BP–1	VFD	Booster Pump Motor No.1 – VFD	Pump Motor – Speed Signal			X					X				X		X	X	X										X	X							X		X	
214	RTU–2A	BP–2	VFD	Booster Pump Motor No.2 – VFD	Pump Motor – Start/Stop	X					X				X				X	X	X	X	X	X	X			X	X	X					X	X	X		X			
215	RTU–2A	BP–2	VFD	Booster Pump Motor No.2 – VFD	Pump Motor – Status	X				X									X	X	X					X		X		X					X							
216	RTU–2A	BP–2	VFD	Booster Pump Motor No.2 – VFD	Pump Motor – Fail Alarm	X				X												X	X	X							X				X	X	X				
217	RTU–2A	BP–2	VFD	Booster Pump Motor No.2 – VFD	Pump Motor – Not in Auto	X				X												X	X	X							X					X	X	X				
218	RTU–2A	BP–2	VFD	Booster Pump Motor No.2 – VFD	Pump Motor – Speed Signal			X					X				X		X	X	X										X	X							X		X	
219	RTU–2A	MCP–1		Mixer Control Panel	Mixer – Start/Stop	X					X				X				X	X	X	X	X	X	X			X	X	X					X	X	X		X			
220	RTU–2A	MCP–1		Mixer Control Panel	Mixer – Status	X				X									X	X	X					X		X		X					X							
221	RTU–2A	MCP–1		Mixer Control Panel	Mixer – Fail Alarm	X				X												X	X	X							X				X	X	X				
222	RTU–2A	SD		Tank Fire Alarm – Smoke Detector	Tank – Fire Alarm	X				X												X	X	X							X		X			X	X				
223	RTU–2A	D		Tank – Security Alarm	Tank – Security Alarm	X				X												X	X	X							X					X	X				
224	RTU–2A	TIT–224		Temperature Transmitter – Tank	Tank – Temperature							X							X	X	X	X	X	X	X		X	X		X		X	X			X	X	X	X	X	X	
225	RTU–2A	LSH–225		Tank Flood Alarm – Float Switch	Tank Flood – Alarm					X												X	X	X							X					X	X	X				

KEY NOTES:

1. MAG METER SHALL BE SET UP TO MEASURE FLOW IN BOTH DIRECTIONS

Electrical, Instrumentation, & Control Systems Engineering
22 Greeley Street, Suite 2
Merrimack, NH 03054
Phone: 603-429-3313 Fax: 603-429-3466

SMR ENGINEERING, PC

THE DRAWINGS FOR THIS PROJECT SHALL NOT BE REUSED OR ALTERED IN ANY WAY BY ANYONE WITHOUT WRITTEN AUTHORIZATION BY SMR ENGINEERING, P.C. ANY REVISIONS SHALL BE MADE BY THE ENGINEER.

ISSUE FOR		
APPROVAL	Date 12/17/21	By TGP
CONSTRUCTION	Date 2/9/22	By TGP
RECORD DRAWING	Date –	By –

NO.	REVISIONS	APP'D

Drawn/Chk. JWC
Designed JWC
Checked SMR
Approved KAP
Date 2/9/22
Book No. –
Project No. 2575
Dwg. ID 2575-E12-LS
Scale AS SHOWN



2-9-22

UNDERWOOD engineers
25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603-431-4733

©COPYRIGHT AT UNDERWOOD ENGINEERS, INC. ALL RIGHTS RESERVED

LOOP, WIRE, AND CONDUIT SCHEDULE

COMPOSITE ELEVATED WATER STORAGE TANK
PLANNING FILE NO. 22-02

CITY OF DOVER, NEW HAMPSHIRE

DWG NO	SHEET
E12	OF 43

FILE: C:\SMR Engineering\Underwood Engineering\Dover NH\Dover Tank\2575-E8-E12-WD.dwg Feb 10, 2022 - 2:40pm

PROJECT MANUAL

DOVER
NEW HAMPSHIRE

WATER STORAGE FACILITY IMPROVEMENTS

COMPOSITE ELEVATED WATER STORAGE TANK

City of Dover Project No. B22035

FOR CONSTRUCTION

February 9, 2022

Portsmouth, New Hampshire
UE Project No. 2575

UNDERWOOD engineers

DOVER,
NEW HAMPSHIRE

WATER STORAGE FACILITY IMPROVEMENTS

COMPOSITE ELEVATED WATER STORAGE TANK

FOR CONSTRUCTION

City of Dover Project No. B22035

STATE OF NEW HAMPSHIRE
THOMAS G. PAGE
No. 10959
LICENSED PROFESSIONAL ENGINEER

STATE OF NEW HAMPSHIRE
KEITH A. PRATT
No. 8531
LICENSED PROFESSIONAL ENGINEER

February 9, 2022

Prepared and Copyrights by

UNDERWOOD engineers

25 Vaughan Mall
Portsmouth, New Hampshire 03801

UE Project 2575

TABLE OF CONTENTS

A. BIDDING REQUIREMENTS ..... Page No. through Page No.

Advertisement for Bids A-1.1
Information for Bidders ..... A-2.1 ..... A-2.4
Bid* ..... A-3.1 ..... A-3.3
Bid Schedule* ..... A-3.4 ..... A-3.14
Bid Bond* A-4.1

B. CONTRACT

Notice of Award B-1.1
Acknowledgement of Notice B-1.2
Agreement ..... B-2.1 ..... B-2.2
Payment Bond ..... B-3.1 ..... B-3.2
Performance Bond ..... B-4.1 ..... B-4.2
Notice to Proceed B-5.1
Change Order B-6.1
Certificate of Substantial Completion ..... B-7.1 ..... B-7.2
Certificate of Final Completion B-8.1
Contractor's Affidavit B-9.1
Contractor's Final Release & Waiver of Lien B-10.1
Field Order B-11.1

C. GENERAL CONDITIONS

General Conditions (State of NH) ..... C-1.1 ..... C-1.28
Special Conditions (UE) ..... C-2.1 ..... C-2.9

* Denotes items to be submitted with Bid.

E. TECHNICAL SPECIFICATIONS

Division 1 – General Requirements
Division 2 – Site Work
Division 9 – Finishes
Division 10 – Specialties
Division 11 – Equipment
Division 13 – Instrumentation & Special Construction
Division 15 – Mechanical
Division 16 – Electrical

F. APPENDICES

Appendix A – Geotechnical Information
Appendix B – City of Dover Trench Rules and Regulations

All project documents furnished by Engineer are instruments of his service. They are not represented to be suitable for reuse by Owner or other on Project extension or on other projects. Reuse without written verification by Engineer will be at Owner's sole risk and without liability to Engineer. Owner shall indemnify Engineer from all claims and expenses resulting there from.

2021

NHDES Front End Documents

Section A: Bidding Requirements

Advertisement for Bids

Owner Name: City of Dover, New Hampshire		Project Number: B22035		
Project Address:	288 Central Avenue	Dover	NH	03820

Separate sealed BIDS for the construction of the **Composite Elevated Water Storage Tank** will be received by the City of Dover at the Finance and Purchasing Office, 288 Central Avenue (2nd floor), Dover NH until **2PM** Local Time on **March 23, 2022,** and at which time the Bids will be publicly opened and read aloud.

1. Completion time for the project will be calculated as calendar days from the date specified in the "Notice to Proceed" as follows:
   560 calendar days for substantial completion.
   600 calendar days for final completion
   Liquidated damages will be in the amount of $1,000, for each calendar day of delay from the date established for substantial completion, and $500 for each calendar day of delay from the date established for final completion.
2. Each General Bid shall be accompanied by a Bid Security in the amount of 5% of the Total Bid Price.
3. The successful Bidder must furnish 100% Performance and Payment Bonds and will be required to execute the Contract Agreement within 10 days following notification of the acceptance of this Bid.
4. No Bidder may withdraw a Bid within 60 days after the actual date of opening thereof.
5. There will be a non-mandatory pre-bid meeting for all prospective bidders held on **March 2, 2022,** at **10AM** at Dover City Hall in the Council Conference Room (2nd Floor), 288 Central Avenue, Dover, NH. To join the meeting remotely, RingCentral Invite information will be posted on the City's website.
6. Technical questions must be forwarded to Libby Simmons (l.simmons@dover.nh.gov) no later than seven (7) calendar days before the Bid due date and time.
7. Pre-Bid conference notes and engineer's response to bidders questions will be distributed by addendum prior to bidding.
8. The project site may be viewed by appointment by calling the Community Services office at (603) 516-6450.

   The Contract Documents may be examined at the following locations:

City of Dover Purchasing Office, City Hall, 288 Central Ave., Dover, NH 03820
City of Dover Community Services, 271 Mast Road, Dover, NH 03820
Underwood Engineers, Inc., 99 North State Street, Concord, NH 03303
Underwood Engineers, Inc., 25 Vaughan Mall, Portsmouth, NH 03801
Construction Summary of NH, Inc., 734 Chestnut Street, Manchester, NH 03104
Associated General Contractors, 48 Grandview Road, Bow, NH 03304

9. To submit a bid for this project, Bid Documents can be downloaded from the City website. Addenda to these bid documents, if any, will be posted on the City's website.

Libby M. Simmons, CPP
Purchasing Agent
l.simmons@dover.nh.gov

A-2.1

Information for Bidders

Bids will be received by : City of Dover, New Hampshire herein called the "OWNER" at:
Address: Finance and Purchasing Office, 288 Central Ave Dover NH 03820

Each BID must be submitted in a sealed envelope, addressed to:

City of Dover, New Hampshire at 288 Central Ave, Dover, NH 03820.

Each sealed envelope containing a BID must be plainly marked on the outside as BID for **B22035 Composite Elevated Water Storage Tank** and the envelope should bear on the outside the BIDDER's name, address and license number if applicable and the name of the project for which the BID is submitted. If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to the OWNER at Purchasing/Finance Office, 288 Central Ave, Dover, NH 03820.

All BIDS must be made on the required BID form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed and executed when submitted. Only one copy of the BID form is required.

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. No BIDDER may withdraw a BID within **60** days after the actual date of the opening thereof. Should there be reasons why the contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the OWNER and the BIDDER.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID SCHEDULE by examination of the site and a review of the drawings and specifications including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

The OWNER shall provide to BIDDERS prior to BIDDING, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the OWNER or any other person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve him from fulfilling any of the conditions of the contract.

Each BID must be accompanied by a BID BOND payable to the OWNER in the amount of five percent (5%) of the total amount of the BID. As soon as the BID prices have been compared, the OWNER will return the BONDS of all except the three lowest responsive BIDDERS. When the AGREEMENT is executed, the bonds of the two remaining unsuccessful BIDDERS will be returned. The BID BOND of the successful BIDDER will be retained until the PAYMENT BOND and PERFORMANCE BOND have been executed and approved, after which it will be returned. A certified check may be used in lieu of a BID BOND.

A PERFORMANCE BOND and a PAYMENT BOND, each in the amount of 100 percent of the CONTRACT PRICE, with a corporate surety approved by the OWNER, will be required for the faithful performance of the contract.

Attorneys-in-fact who sign BID BONDS or PAYMENT BONDS and PERFORMANCE BONDS must file with each BOND a certified and effective dated copy of their power of attorney.

The party to whom the contract is awarded will be required to execute the AGREEMENT and obtain the PAYMENT BOND and PERFORMANCE BOND within ten (10) calendar days from the date when NOTICE OF AWARD is delivered to the BIDDER. The NOTICE OF AWARD shall be accompanied by the necessary AGREEMENT and BOND forms. In case of failure of the BIDDER to execute the AGREEMENT, the OWNER may at his option consider the BIDDER in default, in which case the BID BOND accompanying the proposal shall become the property of the OWNER.

The OWNER within ten (10) days of receipt of acceptable PAYMENT BOND, PEERFORMANCE BOND and AGREEMENT signed by the party to whom the AGREEMENT was awarded shall sign the AGREEMENT and return to such party an executed duplicate of the AGREEMENT. Should the OWNER not execute the AGREEMENT within such period, the BIDDER may by WRITTEN NOTICE withdraw his signed AGREEMENT. Such notice of withdrawal shall be effective upon receipt of the notice by the OWNER.

The NOTICE TO PROCEED shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period, the time may be extended by mutual agreement between the OWNER and CONTRACTOR. If the NOTICE TO PROCEED has not been issued within the ten (10) day period or within the period mutually agreed upon, the CONTRACTOR may terminate the AGREEMENT without further liability on the part of either party.

The OWNER may make such investigations as Owner deems necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the OWNER all such information and data for this purpose as the OWNER may request. The OWNER reserves the right to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy the OWNER that such BIDDER is properly qualified to carry out the obligations of the AGREEMENT and to complete the WORK contemplated therein.

A conditional or qualified BID will not be accepted.

Award will be made to the lowest responsive and responsible BIDDER.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT shall apply to the contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to complete any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to his BID.

The low BIDDER shall supply the names and addresses of major material SUPPLIERS and SUBCONTRACTORS when requested to do so by the OWNER.

MANUFACTURER'S EXPERIENCE

Wherever it may be written that an equipment manufacturer must have a specified period of experience with his product, equipment which does not meet the specified experience period can be considered if the equipment supplier or manufacturer is willing to provide a bond or cash deposit for the duration of the specified time period which will guarantee replacement of that equipment in the event of failure.

PROJECT SIGN

The Contractor shall construct a sign in accordance with the Standard Detail included in these specifications. Final wording on Project Sign dependent on funding source. The sign shall be erected in a location selected by the Engineer or Owner in coordination with NHDES. The Contractor shall maintain the sign throughout the duration of the contract.

SAFETY AND HEALTH REGULATIONS

This project is subject to all of the Safety and Health Regulations (CFR 29 Part 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974. Contractors shall comply with the requirements of these regulations.

NONDISCRIMINATION IN EMPLOYMENT

Contracts for work under this proposal will obligate the contractors and sub-contractors not to discriminate in employment practices.

STATE INSPECTION

Work performed on this project shall be subject to inspection by representatives of the New Hampshire Department of Environmental Services (NHDES). Such inspection shall in no sense make the State Government a party to this contract, unless said Government is also the Owner, and will in no way interfere with the rights of either party hereunder.

Representatives of NHDES shall be given Right of Access to all portions of the proposed work, including but not limited to actual work site, storage yards, offsite manufacturing and fabricating location and job records.

COPIES OF THE CONTRACT

There shall be at least three (3) executed copies of the Contract to be distributed as follows:

a) One (1) copy each to the Owner, Engineer and Contractor.
b) One electronic copy in PDF format to NHDES.
c) Additional copies as required for other federal or state agencies contributing to or participating in project costs.

NON-RESIDENT CONTRACTORS

The successful bidder, if a corporation established under laws other than the State of New Hampshire, shall file, at the time of the execution of the contract, with the Owner, notice of the name of its resident attorney, appointed as required by the laws of the State of New Hampshire.

The successful bidder, if not a resident of New Hampshire, and not a corporation, shall file, at the time of execution of the contract, with the Owner a written appointment of a resident of the state of New Hampshire, having an office or place of business therein, to be his true and lawful attorney upon whom all lawful processes in any actions or proceedings against him may be served; and in such writing, which shall set forth said attorney's place of residence, shall agree that any lawful process against him which is served on said attorney shall be of the same legal force and validity as if served on him and that the authority shall continue in force so long as any liability remains outstanding against him in New Hampshire.

The power of attorney shall be filed in the office of the Secretary of State if required, and copies certified by the Secretary shall be sufficient evidence thereof. Such appointment shall continue in force until revoked by an instrument in writing, designating in a like manner some other person upon whom such processes may be served, which instrument shall be filed in the manner provided herein for the original appointment.

A Non-resident Contractor shall be deemed to be:

a) A person who is not a resident of the State of New Hampshire.
b) Any partnership that has no member thereof resident of the State of New Hampshire.
c) Any corporation established under laws other than those of the State of New Hampshire.

BIDDERS QUALIFICATIONS

No award will be made to any Bidder who cannot meet all of the following requirements:

A. He shall not have defaulted nor turned the work over to the bonding company on any contract within three years prior to the bid date.
B. He shall maintain a permanent place of business.
C. He shall have adequate personnel and equipment to perform the work expeditiously.
D. He shall have suitable financial status to meet obligations incidental to the work.
E. He shall have appropriate technical experience satisfactory to the Engineer and the Division in the class of work involved.
F. He shall be registered with the Secretary of State to do business in New Hampshire.
G. He shall have performed to the satisfaction of the Engineer and the Division on previous contracts of a similar nature.
H. He shall not have failed to complete previous contracts on time, including approved time extensions.

WITHDRAWAL OF BIDS

Prior to Bid Opening, bids may be withdrawn upon written or telegraphic request of the Bidder provided confirmation of any telegraphic withdrawal over the signature of the Bidder is placed in the mail and postmarked prior to the time set for Bid Opening. Bid documents and security of any Bidder withdrawing his bid in accordance with the foregoing conditions will be returned.

Further, the BIDDER agrees to abide by the requirements under Executive Order No. 11246, as amended, including specifically the provisions of the equal opportunity clause set forth in the GENERAL CONDITIONS.

Bidders shall, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of contract.

Successful bidders shall, if requested, submit a list of all subcontractors who will perform work on the project, and written signed statements from authorized agents of labor pools with which they will or may deal for employees on the work together with supporting information to the effect that such labor pools' practices and policies are in conformity with Executive Order No. 11246; that they will affirmatively cooperate in or offer no hindrance to the recruitment, employment, and equal treatment of employees seeking employment and performing work under the contract or, a certification as to what efforts have been made to secure such statements when such agents or labor pools have failed or refused to furnish them prior to award of the contract.

Successful bidders must be prepared to comply in all respects with the contract provisions regarding non-discrimination.

Bid

Proposal of _____ [company](hereinafter called the "BIDDER", organized and existing under the laws of the State of __ doing business as _____ (Corporation, Partnership, Individual) to the City of Dover, New Hampshire (herein after called "OWNER").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all WORK For the construction of **Composite Elevated Water Storage Tank** in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to his own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to the BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence WORK under this contract on or before a date to be specified in the NOTICE TO PROCEED and to complete the PROJECT within:

560 calendar days for substantial completion.
600 calendar days for final completion

Liquidated damages will be in the amount of $ 1,000 for each calendar day of delay from the date established for substantial completion and $500 for each calendar day of delay from the date established for final completion, as provided in Section 18 of the General Conditions.

BIDDER acknowledges receipt of the following ADDENDUM:

1 _____
2 _____
3 _____
4 _____
5 _____

The Bidder shall state below what works of a similar character to that of the proposed contract he has performed and provide such references as will enable the Owner to judge his experience, skill, and business standing.

All questions must be answered, and the data given must be clear and comprehensive. This statement must be notarized. If necessary, add separate sheets.

Bidder Name:			
Permanent Main Office Address:	Street # and name	City/Town	State ZIP
When was it organized?		Where incorporated?	
☐ Yes	☐ No	Is the bidder registered with the Secretary of State to do business in NH?	
For how many years has your firm engaged in the contracting business under its present name? Please list previous firm names and dates if applicable.			
Years		Previous Name	
Contracts on hand, attach a schedule or list showing gross amount of each contract and the approximate anticipated dates of completion.			
Describe the general character of work performed by your company.			
☐ Yes	☐ No	Have you ever failed to complete any work awarded you in the scheduled contract time, including approved time extensions? If so where and why?	
☐ Yes	☐ No	Have you ever defaulted on a contract? If so where and why?	
☐ Yes	☐ No	Have you ever had liquidated damages assessed on a contract? If so where and why?	

List the more important contracts recently executed by your company:

Recent Contract Name	Approximate Cost	Month/Year Completed

List your major equipment **available for this contract**: (Attach additional sheets as necessary.)

List your key personnel **available for this contract**: (Attach additional sheets as necessary.)

Staff Name	Role (i.e. Project Superintendent, Foreman)

List any subcontractors whom you would expect to use for the following (unless this work is to be done by your own organization)		
Civil Engineering Utility Installation Other please describe:		
Please list banks with whom you conduct business.		
☐ Yes	☐ No	Do you grant the Engineer permission to contact this (these) institutions?
NOTE: Bidders may be required to furnish their latest financial statement as part of the award process.		

Respectfully Submitted:

Signature: _____ Date:

Printed Name: Title:

Street # and name City/Town State ZIP

[Signed Name] Being duly sworn, deposes and says that they are [Position Title]of [Organization] and all the answers to the foregoing questions and all statement contained therein are true and correct.

Sworn to before me this day of , 20

, Notary Public

My Commission Expires

Seal

Attest:

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices or lump sum:

NOTE: BIDS shall include sales tax and all other applicable taxes and fees.

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION	UNIT PRICE			ITEM TOTAL
BASE BID - SCHEDULE 1 - FACILITY IMPROVEMENTS & ALLOWANCES							
1	1	LS	Furnish and install composite elevated tank _____ Dollars and _____ Cents per	LS		LS	
2	1	Allow	Utility allowance TWENTY THOUSAND Dollars and Zero Cents per	Allow	$20,000.00	Allow	$20,000.00
3	1	Allow	Contingency allowance THREE HUNDRED THOUSAND Dollars and Zero Cents per	Allow	$300,000.00	Allow	$300,000.00
					SUBTOTAL - SCHEDULE 1		
BASE BID - SCHEDULE 2 - SITE WORK							
10A	2,370	LF	Furnish & install 16-inch dia. class 52 ductile iron water main with polyethylene encasement _____ Dollars and _____ Cents per	LF		LF	
10B	40	LF	Furnish & install 12-inch dia. class 52 ductile iron water main with polyethylene encasement _____ Dollars and _____ Cents per	LF		LF	

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
10C	20	LF	Furnish & install 8-inch dia. class 52 ductile iron water main with polyethylene encasement _____ Dollars and _____ Cents per	LF		LF	
11A	5	EA	Furnish & install 16-inch dia. Horizontal beveled-geared gate valve and valve box _____ Dollars and _____ Cents per	EA		EA	
11B	2	EA	Furnish & install 12-inch dia. gate valve and valve box _____ Dollars and _____ Cents per	EA		EA	
11C	1	EA	Furnish & install 8-inch dia. gate valve and valve box _____ Dollars and _____ Cents per	EA		EA	
12	170	EA	Furnish & Install 1" Copper Water Service Pipe _____ Dollars and _____ Cents per	EA		EA	
13	6	EA	Furnish & Install 1" Corporation Stop _____ Dollars and _____ Cents per	EA		EA	

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
14	6	EA	Furnish & Install 1" Curb Stop w/box _____ Dollars and _____ Cents per	EA		EA	
15	4	EA	Furnish and install hydrant assembly, including hydrant, hydrant tee, pipe, appurtenances, and 6-inch gate valve _____ Dollars and _____ Cents per	EA		EA	
16.1	100	LF*	Furnish and Install 2-inch thick Rigid Insulation Where Shown and As Directed _____ Dollars and _____ Cents per	LF*		LF*	
17	1	LF	Furnish & Install Air Release Structure _____ Dollars and _____ Cents per	LF		LF	
201.21	1	EA*	Removal of Small Tree _____ Dollars and _____ Cents per	EA*		EA*	
201.4	1	EA*	Removal of Stumps _____ Dollars and _____ Cents per	EA*		EA*	

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
202.43	40	LF*	Removal of AC Pipe (0-24" Dia.) _____ Dollars and _____ Cents per	LF*		LF*	
206.19	50	CY*	Common Structure Excavation- Exploratory _____ Dollars and _____ Cents per	CY*		CY*	
206.2	50	CY*	Rock Structure Excavation _____ Dollars and _____ Cents per	CY*		CY*	
214	1	Unit	Fine Grading _____ Dollars and _____ Cents per	Unit		Unit	
304.2	100	CY*	Furnish and install bank run gravel _____ Dollars and _____ Cents per	CY*		CY*	
304.3	355	CY*	Furnish and install crushed gravel _____ Dollars and _____ Cents per	CY*		CY*	

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
304.4	40	CY	Furnish and install crushed stone inside fenced area at Tank _____ Dollars and _____ Cents per	CY		CY	
306.108	1150	SY	Reclaimed Stabilized Base, Processed in Place (8" Depth) _____ Dollars and _____ Cents per	SY		SY	
403.11A	270	Ton	Hot Bit. Pavement, Machine Method (Binder Course) _____ Dollars and _____ Cents per	Ton		Ton	
403.11B	160	Ton	Hot Bit. Pavement, Machine Method (Wearing Course) _____ Dollars and _____ Cents per	Ton		Ton	
403.12	40	Ton	Hot Bit. Pavement, Hand Method _____ Dollars and _____ Cents per	Ton		Ton	
403.99	20	Ton*	Temporary Bit. Pavement (where directed) _____ Dollars and _____ Cents per	Ton*		Ton*	

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
417	180	SY	Cold planing bituminous surfaces _____ Dollars and _____ Cents per	SY		SY	
618.7	400	Hrs	Uniformed Flaggers _____ Dollars and _____ Cents per	Hrs		Hrs	
619.1	1	LS	Maintenance of Traffic _____ Dollars and _____ Cents per	LS		LS	
912	1	LS	R&R Landscaping _____ Dollars and _____ Cents per	LS		LS	
					SUBTOTAL - SCHEDULE 2		
					TOTAL BASE BID (SCH 1 + SCH 2)		

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
Add/Deduct Alt. A - HDPE PIPE							
1010	1800	LF	Furnish & Install 20" DR 11, 200 psi, iron pipe size (IPS) HDPE Water Main in lieu of 16" DI Main **Show negative amount if Deduct** Net Change to Bid Price: _____ Dollars and _____ Cents per	LF		LF	
					SUBTOTAL ADD/DEDUCT ALT. A		
Add Alt. B - DRAINAGE							
603.82	50	LF	Furnish & Install 12" PE Drain Pipe _____ Dollars and _____ Cents per	LF		LF	
604.12	2	EA	Furnish & Install Catch Basins Type B, 4 ft dia. _____ Dollars and _____ Cents per	EA		EA	
					SUBTOTAL ADD ALT. B		

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
Add Alt. C - SEWER							
18	435	LF	Furnish & Install 8" PVC Sewer Pipe (SDR 35) _____ Dollars and _____ Cents per	LF		LF	
19	150	LF	Replace and/or Re-align Existing 4" or 6" Sewer Service (Where Directed) _____ Dollars and _____ Cents per	LF		LF	
20	3	EA	Sewer Manhole, 4' Diameter (w/frame & cover) _____ Dollars and _____ Cents per	EA		EA	
					SUBTOTAL ADD ALT. C		
Add Alt. D - CONNECTION TO WEBB PLACE/HIGH PRESSURE ZONE							
10B	345	LF	Furnish & install 12-inch dia. class 52 ductile iron water main with polyethylene encasement _____ Dollars and _____ Cents per	LF		LF	
11B	3	EA	Furnish & install 12-inch dia. gate valve and valve box _____ Dollars and _____ Cents per	EA		EA	
304.3	65	CY	Furnish and install crushed gravel _____ Dollars and _____ Cents per	CY		CY	

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
403.11A	90	Ton	Hot Bit. Pavement, Machine Method (Binder Course) _____ Dollars and _____ Cents per	Ton		Ton	
403.11B	50	Ton	Hot Bit. Pavement, Machine Method (Wearing Course) _____ Dollars and _____ Cents per	Ton		Ton	
403.12	25	Ton	Hot Bit. Pavement, Hand Method _____ Dollars and _____ Cents per	Ton		Ton	
403.99	25	Ton	Temporary Bit. Pavement (where directed) _____ Dollars and _____ Cents per	Ton		Ton	
20	1	LS	Curb and Sidewalk Repair _____ Dollars and _____ Cents per	LS		LS	$0
					SUBTOTAL ADD ALT. D		

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION		UNIT PRICE		ITEM TOTAL
Add Alt. E - BOOSTER PUMP STATION							
22	1	LS	Furnish and install booster pump station including piping, valves, instrumentation, pumps, VFDs, PLC programming, electrical and startup _____ Dollars and _____ Cents per	LS		LS	
					SUBTOTAL ADD ALT. E		
Add Alt. F - RAW WATER MAIN							
10B	1710	LF	Furnish & install 12-inch dia. class 52 ductile iron water main with polyethylene encasement _____ Dollars and _____ Cents per	LF		LF	
15E	1	EA	Furnish and install hydrant assembly, including hydrant, hydrant tee, pipe, appurtenances, and 6-inch gate valve _____ Dollars and _____ Cents per	EA		EA	
					SUBTOTAL ADD ALT. F		

CONTRACTOR'S BID SCHEDULE

BID ITEM	EST QTY	UNIT	DESCRIPTION	UNIT PRICE			ITEM TOTAL
Add Alt. G - SEGMENTED CIRCULAR STAIRWAY IN PEDESTAL							
23	1	LS	Furnish and install segmented circular stairway from concrete slab to upper platform _____ Dollars and _____ Cents per	LS		LS	
					SUBTOTAL ADD ALT. G		
					BASE BID (SCH 1 + SCH 2) + Add/Deduct Alt. A + Add Alt. B + Add Alt. C		
					TOTAL BID (SCH 1 + SCH 2 + Add/Deduct Alt. A + Add Alt. B + Add Alt. C + Add Alt. D + Add Alt. E + Add Alt. F + Add Alt. G)		

Name of Contractor: _____ **Date:** _____

Notes to Bidders:

1. This Bid Schedule shall be filled in by the BIDDER with the prices written in both words and numerals and the extensions made by them.
2. In case of discrepancy between words and numerals, the amount shown in words shall govern.
3. In the case of discrepancy between the Unit Price given and the Total Price of an Item, the Unit Price shall govern.
4. The Owner reserves the right to waive any informalities or minor bid discrepancies, or to reject any or all bids, and to take any action that is in their own best interest.
5. The apparent Low Bidder will be determined based upon the lowest price bid for BASE BID (SCH 1 + SCH 2) + Add/Deduct Alt. A + Add Alt. B + Add Alt. C
6. * Means Indeterminate Quantity
7. The Owner reserves the right to select none, all or any combination of Bid Alternates.

Bid Bond

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned as _____ Principal, and as _____ Surety, are hereby held and firmly bound unto City of Dover, New Hampshire as OWNER in the penal sum of _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this _____ day of _____ in the year ____.

The condition of the above obligation is such that whereas the Principal has submitted to City of Dover, New Hampshire a certain BID, attached hereto and herby made a part hereof to enter into a contract in writing, for the **Composite Elevated Water Storage Tank** .

NOW, THEREFORE,

(a) If said BID shall be rejected, or

(b) If said BID shall be accepted and the Principal shall execute and deliver a contract in the Form of Contract attached hereto (Properly completed in accordance with said BID) and shall furnish a BOND for faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said BID, then this obligation shall be void, otherwise, the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety , for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal Signature	Witnessed By:
Surety Signature	Witnessed By:

IMPORTANT-Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state of New Hampshire

2021

NHDES Front End Documents
Section B: Contract

NOTICE OF AWARD

Dated _____

TO:

ADDRESS:

Street Address | City/Town | State | ZIP

Project Number	Owner Contract Number B22035
Project : Composite Elevated Water Storage Tank	Contract For: Composite Elevated Water Storage Tank

You are notified that your bid dated _____ for the above contract has been considered. You are the apparent successful bidder and have been awarded a contract for: **Composite Elevated Water Storage Tank**.
The Contract Price of your contract is _____ dollars ($_____).
6 copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award. The same number of sets of the drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within 10 days of receiving this Notice of Award.

1. You must deliver to the OWNER all of the fully executed counterparts of the Agreement including all the Contract Documents. This includes the sets of drawings. Each of the Contract Documents must bear your signature on (the cover) (every) page.
2. You must deliver with the executed Agreement the Contract Security (Bonds) as specified in the Information for Bidders and General Conditions.
3. (List all other conditions of precedent.)
   A. Provide four (4) copies of the necessary Certificates of Insurance listing the City of Dover, NH and Underwood Engineers, Inc. (as applicable) as named insured for review and approval.
   B. Provide four (4) copies of the necessary bonds for review and approval.
   C. Provide construction schedule.

Failure to comply with these conditions within the time specified will entitle **OWNER** to consider your bid abandoned, to annul this Notice of Award and to declare your Bid Security forfeited.

Within 10 days after receipt of acceptable performance **BOND**, payment **BOND** and agreement signed by the party to whom the Agreement was awarded, the **OWNER** will return to you one fully signed counterpart of the Agreement with the Contract Documents attached.

City of Dover, New Hampshire
(OWNER)

_____
(Authorized Signature)

_____
(Title)

ACKNOWLEDGEMENT OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged:
By: _____, The _____ day of _____, 20___ by
_____ title _____.
Copy to ENGINEER (Use Certified Mail, Return Receipt Requested)

AGREEMENT

THIS AGREEMENT, made this _____ day of _____, 20___ by and between City of Dover, New Hampshire, hereinafter called "**OWNER**" and _____ doing business as _____ (an individual, a partnership or a corporation) hereinafter called "**CONTRACTOR**".

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned:

1. The **CONTRACTOR** will commence and complete the construction of Composite Elevated Water Storage Tank .
2. The **CONTRACTOR** will furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the **PROJECT** described herein.
3. The **CONTRACTOR** will commence the work required by the **CONTRACT DOCUMENTS** within _____calendar days after the date of the **NOTICE TO PROCEED** unless the period for completion is extended otherwise by the **CONTRACT DOCUMENTS**. Completion time for the project will be calculated as calendar days from the date specified in the **NOTICE TO PROCEED** as follows:
   560 calendar days for substantial completion.
   600 calendar days for final completion.
   Liquidated damages will be in the amount of $1,000 for each calendar day of delay from the date established for the substantial completion and $500 for each calendar day of delay from the date established for final completion.
4. The **CONTRACTOR** agrees to perform all of the **WORK** described in the **CONTRACT DOCUMENTS** and comply with the terms therein for the sum of $_____ or as shown in the **BID** schedule.
5. The term "**CONTRACT DOCUMENTS**" means and includes the following:
   a. ADVERTISEMENT FOR BIDS
   b. INFORMATION FOR BIDDERS
   c. BID
   d. BID BOND
   e. NOTICE OF AWARD
   f. AGREEMENT
   g. PAYMENT BOND
   h. PERFORMANCE BOND
   i. CERTIFICATE OF INSURANCE
   j. NOTICE TO PROCEED
   k. CHANGE ORDER(S)
   l. CERTIFICATON OF SUBSTANTIAL COMPLETION
   m. CERTIFICATION OF FINAL COMPLETION
   n. CONTRACTOR'S AFFIDAVIT
   o. CONTRACTOR'S RELEASE
   p. GENERAL CONDITIONS
   q. SUPPLEMENTAL GENERAL CONDITIONS
   r. SPECIAL CONDITIONS
   s. FEDERAL PROVISIONS, RULES, REGULATIONS AND FORMS
   t. DRAWINGS prepared by: Underwood Engineers, Inc. numbered 1 through 43 and dated February 9, 2022.
   u. SPECIFICATIONS prepared or issued by: Underwood Engineers, Inc. and dated February 9, 2022.

v. ADDENDA

No. _____ dated _____, 20___

No. _____ dated _____, 20___

No. _____ dated _____, 20___

No. _____ dated _____, 20___

6. The **OWNER** will pay to the **CONTRACTOR** in the manner and at such times as set forth in the General Conditions such amounts as required by the **CONTRACT DOCUMENTS.**
7. This agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials this Agreement in four (4) copies, each of which shall be deemed an original on the date first above written.

OWNER: City of Dover, New Hampshire

By: _____

NAME: _____

(SEAL)
ATTEST: _____

NAME: _____

TITLE: _____

CONTRACTOR: _____

BY: _____

NAME: _____

ADDRESS: _____

(SEAL)
ATTEST: _____

NAME: _____

TITLE: _____

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that _____, (contractor name), _____, (contractor address), a _____(corporation partnership, individual), hereinafter called Principal, and _____, (surety name), _____, (surety address) herein after called surety, are held and firmly bound unto City of Dover, New Hampshire, (owner name), 288 Central Avenue, Dover, NH 03820, (owner address) hereinafter called OWNER and unto all persons, firms, and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns, in the total aggregate penal sum of _____dollars, ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the **OWNER**, dated the _____ day of _____, 20___, a copy of which is hereto attached and made a part hereof for the construction of **Composite Elevated Water Storage Tank** .

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, and corporations furnishing materials for or performing labor in the prosecution of the **WORK** provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such **WORK**, and for all labor cost incurred in such WORK including that be a subcontractor, and to any mechanic or materialman lienholder whether it acquires its lien by operation of State or Federal Law; then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, that beneficiaries or claimants hereunder shall be limited to the subcontractors, and persons, firms, and corporations having a direct contract with the PRINCIPAL or its SUBCONTRACTORS.

PROVIDED FURTHER, that the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the **WORK** to be performed thereunder or the **SPECIFICATIONS** accompanying the same shall in any way affect its obligation on this **BOND**, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the **WORK** or to the **SPECIFICATIONS**.

PROVIDED, FURTHER that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL shall have given written notice to any two of the following: The PRINCIPAL, the OWNER, or the SURETY above named within ninety (90) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the PRINCIPAL, OWNER, or SURETY, at any place where an office is regularly maintained for the transaction business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer; (b) After the expiration of one (1) year following the date on which PRINCIPAL ceased work on said CONTRACT, it being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

PROVIDED, FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

PROVIDED FURTHER, that no final settlement between the **OWNER** and the **CONTRACTOR** shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in Six (6) counterparts, each one of which shall be deemed an original this day of _____, 20___

ATTEST:

_____
(PRINCIPAL)

BY: _____
(Principal) Secretary

BY: _____

_____
(ADDRESS)

_____

BY: _____
Witness as to Principal

_____
(ADDRESS)

_____
(SURETY)

ATTEST:

BY: _____
(ATTORNEY in FACT)

BY: _____
Witness to Surety

_____
(ADDRESS)

_____

_____

_____

NOTE: Date of **BOND** must not be prior to date of Contract.
If **CONTRACTOR** is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing **BONDS** must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of New Hampshire.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

_____, (contractor name), _____, (contractor address), a _____(corporation partnership, individual), hereinafter called Principal, and _____, (surety name), _____, (surety address) herein after called surety, are held and firmly bound unto City of Dover, New Hampshire, (owner name), 288 Central Avenue, Dover, NH 03820, (owner address) hereinafter called **OWNER** in the total aggregate penal sum of _____dollars, ($_____)in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the **OWNER**, dated the _____ day of _____, 20___, a copy of which is hereto attached and made a part hereof for the construction of **Composite Elevated Water Storage Tank**.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extension thereof which may be granted by the **OWNER**, with or without notice to the Surety and during the one year guaranty period, and if the **PRINCIPAL** shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the **OWNER** from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the **OWNER** all outlay and expense which the **OWNER** may incur in making good any default, then this obligation shall be void: otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to **WORK** to be performed thereunder or the specifications accompanying same shall in any way affect its obligation on this **BOND**, and it does hereby waive notice of any such change, extension of time alteration or addition to the terms of the contract or to the **WORK** or to the specifications.

PROVIDED, FURTHER, that it is expressly agreed that this **BOND** shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 20 percent, so as to bind the **PRINCIPAL** and the **SURETY** to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this **BOND** and whether referring to this **BOND**, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

PROVIDED, FURTHER, that no final settlement between the **OWNER** and the **CONTRACTOR** shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in Six (6) counterparts, each one of which shall be deemed an original this day of _____, 20___

ATTEST:

_____
(PRINCIPAL)

BY: _____
(Principal) Secretary

BY: _____

_____
(ADDRESS)

_____

BY: _____
Witness as to Principal

_____
(ADDRESS)

_____
(SURETY)

ATTEST:

BY: _____
(ATTORNEY in FACT)

BY: _____
Witness to Surety

_____
(ADDRESS)

_____

_____

_____

NOTE: Date of **BOND** must not be prior to date of Contract.
If **CONTRACTOR** is partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing **BONDS** must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of New Hampshire.

NOTICE TO PROCEED

Dated _____ , 20 _____

TO: _____
(Insert Name of Contractor as it appears in the Bid Documents)

ADDRESS: _____

OWNER'S PROJECT NO. B22035

PROJECT: Composite Elevated Water Storage Tank

OWNER'S CONTRACT NO. _____

CONTRACT FOR: Composite Elevated Water Storage Tank

You are notified that the Contract Time under the above contract will commence to run on _____, 20__. By that date, you are to start performing your obligations under the Contract Documents. In accordance with paragraph 3 of the Agreement, the dates of Substantial Completion and Final Completion are _____, 20__ and _____, 20__, respectively.

Before you may start any Work at the site, paragraph 27 of the General Conditions provides that you and Owner must each deliver to the other (with copies to ENGINEER) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents. Also, before you may start any Work at the site, you must:

_____

_____

Copy to ENGINEER
(Use Certified Mail, return receipt Requested)

BY: City of Dover
(Owner)

_____

_____
(Title)

ACKNOWLEDGEMENT OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by:

_____
(Contractor)

This the _____, day of 20__, by _____

Employee Identification Number: _____

CHANGE ORDER

No. _____

PROJECT NAME:	Composite Elevated Water Storage Tank	DATE OF ISSUANCE:			
OWNER:	City of Dover, New Hampshire	OWNER PROJECT NO.	B22035		
OWNER ADDRESS:	288 Central Avenue	Dover		NH	03820
	Street Name	City/Town		State	ZIP
CONTRACTOR:					
CONTRACT FOR:					
ENGINEER:	UNDERWOOD ENGINEERS, INC.	ENG. PROJECT NO.	2575		
ENGINEER ADDRESS:	25 Vaughan Mall	Portsmouth		NH	03801
	Street Name	City/Town		State	ZIP

You are directed to make the following changes in the Contract Documents.
Description: _____
Purpose of Change Order: _____
Justification: _____
Attachments: (List documents supporting change)

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIME
Original Contract Price	Original Contract Time days ____ date
Previous Change Orders	Net change from previous Change Orders days ____ date
Contract Price prior to this Change Order	Contract Time prior to this Change Order days ____ date
Net Increase (Decrease) of this Change Order	Net Increase (decrease) this Change Order days ____ date
Contract Price with all approved Change Orders	Contract Time with all Change Orders days ____ date

This document will become a supplement to the CONTRACT and all provisions will apply hereto. The attached Contractor's Revised Project Schedule reflects increases or decreases in Contract Time as authorized by this Change Order.

Stipulated price and time adjustment includes all costs and time associated with the above described change. Contractor waives all rights for additional time extension for said change. Contractor and Owner agree that the price(s) and time adjustment(s) stated above are equitable and acceptable to both parties.

RECOMMENDED BY:	APPROVED BY:	APPROVED BY:	APPROVED BY:
Engineer (Underwood Eng.)	Owner	Contractor	NHDES
Date	Date	Date	Date

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner Project No. B22035 Engineer Project No. 2575
Project: Composite Elevated Water Storage Tank
Contractor: _____
Contract For: Composite Elevated Water Storage Tank Contract Date: _____

This Certificate of Substantial Completion applies to all work under the Contract Documents or to the following specified parts thereof:

_____
_____
_____

To City of Dover
(Owner)

And to _____
(Contractor)

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on Documents on _____.
(Date of Substantial Completion)

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR within _____ calendar days of the above Substantial Completion.

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as follows:

RESPONSIBILITIES:

OWNER: City of Dover, New Hampshire

CONTRACTOR: _____

The following documents are attached to and made a part of this Certificate:

_____
_____
_____
_____

This certificate does not constitute an acceptance of work not in accordance with the Contract Documents nor is it a release of CONTRACTOR's obligation to complete the work in accordance with the Contract Documents.

Executed by the Engineer on _____, 20__

UNDERWOOD ENGINEERS, INC.
(Engineer)

By: _____

CONTRACTOR accepts this Certificate of Substantial Completion on _____, 20__

_____
(Contractor)

By: _____

OWNER accepts this Certificate of Substantial Completion on _____, 20__

City of Dover, New Hampshire
(Owner)

By: _____

CERTIFICATE OF FINAL COMPLETION

Owner Project No. B22035 Engineer Project No. 2575

Project: Composite Elevated Water Storage Tank

Owner: City of Dover, New Hampshire

Contractor: _____

Engineer: UNDERWOOD ENGINEERS, INC.

Agreement Date: _____

Notice to Proceed Date: _____

Contractual Substantial Completion date as modified by change orders: _____

Actual Substantial Completion date _____

Contractual final completion date as modified by Change Orders _____

The work to which this certificate applies has been inspected by authorized representatives of Owner, Contractor, Engineer and NHDES, the punch list has been completed and the work of the contract is hereby declared to be Finally Complete in accordance with the Contract Documents on _____.
(Date of Final Completion)

This certificate does not constitute an acceptance of any work not in accordance with the Contract Documents nor is it a release of contractor's obligation to complete the work in accordance with the Contract Documents. The warranty for all work completed subsequent to the date of Substantial Completion expires one year from the date of this Final Acceptance.

Executed by Engineer on _____, 20__

By: _____

Contractor Accepts this Certificate of Final Completion on _____, 20__

By: _____

Owner Accepts this Certificate of Final Completion on _____, 20__

By: _____

NHDES Accepts this Certificate of Final Completion on _____, 20__

By: _____

CONTRACTORS AFFIDAVIT

STATE OF: _____

COUNTY OF: _____

Before me the undersigned a _____ (Notary Public, Justice of the Peace, Alderman) in and for said County and State Personally appeared _____ (Individual, partner or duly) who being duly sworn according to law deposes and says that the cost of all the Work, and outstanding claims and indebtedness of whatever nature arising out of the performance of the contract between City of Dover, New Hampshire (Owner) and _____ (Contractor) of _____ (Contractor Address) dated _____ for the construction of the Composite Elevated Water Storage Tank (Project Name) and necessary appurtenant installations have been paid in full.

_____
(Individual, Partner, or duly authorized representative of corporate contractor)

_____
(Title)

Sworn to and subscribed before me
this _____ day of _____, 20__

_____
(Notary Public)

CONTRACTOR'S FINAL RELEASE AND WAIVER OF LIEN

Project Name: Composite Elevated Water Storage Tank

Project Address: _____

Street Name City/Town State ZIP

Owner Name: City of Dover, New Hampshire

Contractor Name: _____

Contractor Address: _____

Street Name City/Town State ZIP

TO ALL WHOM IT MAY CONCERN:

For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the undersigned Contractor hereby waives, discharges, and releases any and all liens, claims, and rights to liens against the above-mentioned project, and any and all other property owned by or the title to which is in the name of the above-referenced Owner and against any and all funds of the Owner appropriated and available for the construction of said project, and any and all warrants drawn upon or issued against any such funds or monies, which the undersigned Contractor may have or may hereafter acquire or process as a result of the furnishing of labor, materials and/or equipment, and the performance of work by the Contractor on or in connection with said project, whether under and pursuant to the above-mentioned contract between the Contractor and the Owner pertaining to said project or otherwise, and which said liens, claims or rights of lien may arise and exist.

The undersigned further hereby acknowledges that the sum of:

_____ Dollars ($ _____) constitutes the entire ***unpaid*** balance due the undersigned in connection with said project whether under said contract or otherwise and that the payment of said sum to the contractor will constitute payment in full and will fully satisfy any and all liens, claims, and demands which the contractor may have or assert against the owner in connection with said contract or project.

Dated this _____ day of _____ 20__

_____
(Contractor)

Witness to Signature

BY: BY:

_____ _____
Title Title

B – 11.1

Field Order

No. _____

Date of Issuance:	Effective Date:	
Project: Composite Elevated Water Storage Tank	Owner: City of Dover	Owner's Contract No.: B22035
Contract:		Date of Contract:
Contractor:		Engineer's Project No.:

Attention:
You are hereby directed to promptly execute this Field Order issued in accordance with General Conditions Paragraph 3, for minor changes in the Work without changes in Contract Price or Contract Times. If you consider that a change in Contract Price or Contract Times is required, please notify the Engineer immediately and before proceeding with this Work.

Reference:

_____ _____
(Specification Section(s)) (Drawing(s) / Detail(s))

Description:

Attachments:

	Engineer:
Receipt Acknowledged by Contractor:	Date:

Copy to Owner

2020

NHDES Front End Documents
Section C: General Conditions

General Conditions

Section C: General Conditions

1. Contract and Contract Documents 1
2. Definitions. 1
3. Additional Instructions and Detail Drawings. 2
4. Shop or Setting Drawings. 3
5. Materials, Services, Facilities and Workmanship 3
6. Contractor's Title To Materials. 4
7. Inspection and Testing of Materials 4
8. "Or Equal " Clause, Substitutions and Contractor Options. 5
9. Patents. 6
10. Surveys. Surveys of land, property and construction 6
11. Contractor's Obligations 7
12. Weather Conditions. 7
13. Protection of Work and Property shall be provided as follows: 7
14. Inspection of work for conformance with plans and specifications. 8
15. Reports, Records and Data 8
16. Superintendence by Contractor 9
17. Extra Work and Change Orders 9
18. Time For Completion and Liquidated Damages 10
19. Defective Work. 11
20. Differing Site Conditions. 11
21. Claims For Extra Cost. 11
22. Right of Owner to Terminate Contract 12
23. Construction Schedule and Periodic Estimates 13
24. Payments to Contractor. 13
25. Acceptance and Final Payment 14
26. Payments by Contractor. 16
27. Insurance 16
28. Contract Security 17
29. Additional or Substitute Bond 17
30. Assignments. 17
31. Mutual Responsibility of Contractors. 17
32. Subcontracting. 18
33. Authority of the Engineer. 18
34. Stated Allowances. 19

General Conditions

35. Use of Premises, Removal of Debris, Sanitary Conditions. 19
36. Quantities of Estimate. 19
37. Lands and Rights-of-Way. 20
38. General Guarantee 20
40. Notice and Service Thereof. 20
41. Required Provisions Deemed Inserted 20
42. Protection of Lives and Health. 21
43. OSHA Construction Safety Program. 21
44. Equal Employment Opportunity. 21
45. Interest of Federal, State or Local Officials. 22
46. Other Prohibited Interests. 22
47. Use and Occupancy Prior to Acceptance. 22
48. Suspension of Work. 22
49. [Reserved] 23
50. [Reserved] 23
51. [Reserved] 23
52. Project Sign. 23
53. [Reserved] 23
54. Public Convenience and Traffic Control 23
55. Pre-Construction Conference. 23
56. Maintenance During Construction 23
57. Cooperation with Utilities. 24
58. Work Performed at Night and on Sundays and Holidays 24
59. Laws to be Observed. 24
60. Permits. 25
61. Control of Pollution due to construction 25
62. Use of Explosives. 26
63. Arbitration by Mutual Agreement. 26
64. Taxes. 26
65 Separate Contracts 26

Project Sign Detail 28

General Conditions

1. Contract and Contract Documents.

The plans, information for bidders, bids, advertisement for bids, bid payment and performance bonds, agreements, change orders, notice to proceed, specifications and addenda, hereinafter enumerated in the agreement, shall form part of this Contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light on the interpretation of the provisions to which they refer.

2. Definitions.

2.1 "Addenda" means written or graphic instruments issued prior to the execution of the agreement which modify or interpret the Contract Documents, drawings and specifications, by additions, deletions, clarifications or corrections. Such written or graphic instruments will be issued no less than five days before the bid opening.

2.2 "Bid" means the offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the work to be performed.

2.3 "Bidder" means any person, firm or corporation submitting a bid for the work.

2.4 "Bonds" means bid, performance, and payment bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.

2.5 "Change Order" means a written order to the Contractor authorizing an addition, deletion or revision in the work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.

2.6 "Contract Documents" means the Contract, including any advertisement for bids, information for bidders, bid, bid bond, agreement, payment bond, performance bond, notice of award, notice to proceed, change orders, drawings, specifications and addenda.

2.7 "Contract Price" means the total monies payable to the Contractor under the terms and conditions of the Contract Documents.

2.8 "Contract Time" means the number of calendar days stated in the Contract Documents for the completion of the work.

2.9 "Contractor" means the person, firm or corporation with whom the owner has executed the agreement.

2.10 "Division" means the state of New Hampshire Department of Environmental Services, Water Division. "Drawings" mean the part of the Contract Documents which show the characteristics and scope of the work to be performed and which have been prepared or approved by the engineer.

2.11 "Engineer" means the person, firm or corporation named as such in the Contract Documents.

2.12 "Field order" means a written order effecting a change in the work not relating to an adjustment in the Contract price or an extension of the Contract time and issued by the engineer to the Contractor during construction.

2.13 "Notice of Award" means the written notice of the acceptance of the bid from the owner to the successful Bidder.

2.14 "Notice to Proceed" means the written communication issued by the owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the work.

2.15 "Owner" means a public or quasi-public body or authority, corporation, association, partnership, or individual for whom the work is to be performed.

2.16 "Plans" means the Contract drawings or exact reproductions thereof which show the scope, character, dimensions and details of the work and which have been prepared or approved by the engineer.

2.17 "Project" means the undertaking to be performed as provided in the Contract Documents.

2.18 "Resident Project Representative" means the authorized representative of the owner who is assigned to the project site or any part thereof.

2.19 "Shop Drawings" means all drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a subcontractor, manufacturer, supplier or distributor, which illustrates how specific portions of the work shall be fabricated or installed.

2.20 "Special conditions" means revisions or additions to these general conditions, supplemental general conditions or specifications applicable to an individual project.

2.21 "Specifications" means a part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

2.22 "Subcontractor" means an individual, firm or corporation having a direct Contract with the Contractor or with any other Subcontractor for the performance of a part of the work at the site.

2.23 "Substantial Completion" means that date as certified by the engineer when the construction of the Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the project or specified part can be utilized for the purposes for which it is intended.

2.24 "Supplemental General Conditions" means modifications to these general conditions required by a federal agency for participation in the Project and approved by the agency in writing prior to inclusion in the Contract Documents, or such documents that may be imposed by applicable state laws.

2.25 "Supplier" means any person or organization who supplies materials or equipment for the work, including that fabricated to a special design, but who does not perform labor at the site.

2.26 "Work" means all labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the project.

2.27 "Written Notice" means any notice to any party of the agreement relative to any part of this agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the work.

3. Additional Instructions and Detail Drawings.

The Contractor may be furnished additional instructions and detail drawings as necessary to carry out the work included in the Contract. The additional drawings and instructions thus supplied to the Contractor will coordinate with the Contract Documents and will be so prepared that they can be reasonably interpreted as part thereof.

4. Shop or Setting Drawings. Shop or setting drawings shall be in accordance with the following:

4.1 The Contractor shall furnish 6 copies of the manufacturer's shop drawings, specific design data as required in the detailed specifications, and technical literature covering all equipment and fabricated materials which he proposes to furnish under this Contract in sufficient detail to indicate full compliance with the specifications. Shop drawings shall indicate the method of installing, the exact layout dimensions of the equipment or materials, including the location, size and details of valves, pipe connections, etc.

4.2 No equipment or materials shall be shipped until the manufacturer's shop drawings and specifications or other identifying data, assuring compliance with these specifications, are approved by the engineer.

4.3 The Contractor shall check and verify all field measurements and shall be responsible for the prompt submission of all shop and working drawings so that there shall be no delay in the work.

4.4 Regardless of corrections made in or approval given to such drawings by the engineer, the Contractor will nevertheless be responsible for the accuracy of such drawings and for their conformity to the plans and specifications. The Contractor shall notify the engineer in writing of any deviations at the time he furnishes such drawings. He shall remain responsible for the accuracy of the drawings showing the deviations but not for the acceptance of the deviations from the original design shown in the plans and specification. Approval by the engineer and the owner of any deviation in material, workmanship or equipment proposed subsequent to approval of the shop drawings or design data, shall be requested in writing by the Contractor.

4.5 When submitted for the engineer's review, shop drawings shall bear the Contractor's certification that he has reviewed, checked and approved the shop drawings and that they are in conformance with the requirements of the Contract Documents.

5. Materials, Services, Facilities and Workmanship shall be furnished as follows:

5.1 Except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, superintendence, temporary construction of every nature, and all other services and facilities of every nature whatsoever necessary to execute, complete, and deliver the work within the specified time.

5.2 Unless otherwise specifically provided for in the specifications, all workmanship, equipment, materials and articles incorporated in the work shall be new and the best grade of the respective kinds for the purpose.

5.3 The Contractor shall furnish to the engineer for approval the manufacturer's detailed specifications for all machinery, mechanical and other special equipment, which he contemplates installing together with full information as to type, performance characteristics, and all other pertinent information as required.

5.4 Materials which are specified by reference to the number or symbol of a specific standard, such as an ASTM standard, a federal specification or other similar standard, shall comply with requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the advertisement for bids, except as limited to type, class or grade, or modified in such reference. The standards referred to shall have full force and effect as though printed therein.

5.5 For equipment or for materials, when requested by the engineer, the Contractor shall submit certificates of compliance from the manufacturer, certifying that the equipment or the materials comply with the requirements of the specifications or the standards.

5.6 Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

5.7 Materials, supplies, and equipment shall be in accordance with samples submitted by the Contractor and approved by the engineer.

6. Contractor's Title To Materials.

No material, supplies, or equipment to be installed or furnished under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale, lease purchase or other agreement by which an interest therein or in any part thereof is retained by the seller or supplier. The Contractor shall warrant good title to all materials, supplies, and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed thereon by him to the owner free from any claims, liens, or charges. Neither the Contractor nor any person, firm or corporation furnishing any material or labor for any work covered by this Contract shall have any right to a lien upon any improvement or appurtenance thereon. Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any bond given by the Contractor for their protection or any rights under any law permitting such persons to look to funds due the Contractor in the hands of the owner. The provisions of this paragraph shall be inserted in all Subcontracts and material Contracts and notice of its provisions shall be given to all persons furnishing materials for the work when formal Contract is entered into for such materials.

7. Inspection and Testing of Materials shall be as follows:

7.1 All materials and equipment used in the construction of the project shall be subject to inspection and testing by the engineer in accordance with accepted standards at any and all times during manufacture or during the project construction and at any or all places where such manufacture is carried on.

7.2 The Contractor shall furnish promptly upon request by the engineer, all materials required to be tested. All tests made by the engineer shall be performed in such manner and ahead of scheduled installation, as not to delay the work of the Contractor. When required, testing of concrete, masonry, soils, pipe and pipe materials will be made in accordance with provisions in the specifications.

7.3 Material required to be tested which is delivered to the job site shall not be incorporated into the work until the tests have been completed and approval or acceptance given in writing by the engineer.

7.4 Each sample submitted by the Contractor for testing shall carry an identification label containing such information as is requested by the engineer. It shall also include a statement that the samples are representative of the remaining materials to be used on the project.

7.5 Approval of any materials shall be general only and shall not constitute a waiver of the owner's right to demand full compliance with the Contract requirements.

7.6 The engineer may, at his own discretion, undertake the inspection of materials at the source. In the event plant inspection is undertaken, the following conditions shall be met:

a. The engineer shall have the cooperation and assistance of the Contractor and the producer with whom he has Contracted for materials.

b. The engineer shall have full entry at all reasonable times to such areas as may concern the manufacture or production of the materials being furnished.

c. If required, the Contractor shall arrange for a building for the use of the inspector; such building to be located near the plant, independent of any building used by the material producer, in which to house and use the equipment necessary to carry on the required tests. Cost for such arrangement shall be paid by the owner as a stated allowance in the bid.

d. Adequate safety measures shall be provided and maintained at all times.

7.7 Except as otherwise specifically stated in the Contract, the costs of sampling and testing will be divided as follows:

a. The Contractor shall furnish the engineer, without extra cost, all samples required for testing purposes. All sampling and testing including the number and selection of samples shall be determined by the engineer for his own information and use.

b. When testing of materials is specified in the appropriate section of the specifications, the cost of the same shall be charged to the owner or Contractor, as detailed in the specifications. However, costs of equipment performance tests shall be borne by the Contractor, as detailed in the appropriate section of the specifications.

c. When the Contractor proposes a material, article or component as equal to the ones specified, reasonable tests may, or may not, be required by the engineer. If the engineer requires tests of a proposed equal item, the Contractor will be required to assume all costs of such testing.

d. Any material, article or component which fails to pass tests required by the Engineer or by the specifications, will be rejected and shall be removed from the project site. However, if, upon request of the Contractor, retesting or further tests are permitted by the Engineer, the Contractor shall assume all costs related to such retesting or further tests.

e. Neither the Owner nor the Engineer will in any way be charged for the manufacturer's costs in supplying certificates of compliance.

7.8 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested or approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer with the required certificates of inspection, testing or approval.

7.9 Inspections, tests, or approvals by the engineer or others shall not relieve the Contractor from obligations to perform the Work in accordance with the requirements of the Contract Documents.

8. "Or Equal " Clause, Substitutions and Contractor Options.

8.1 Whenever a material, article, or piece of equipment is identified on the plans or in the specifications by reference to manufacturer's or vendor's names, trade names, catalogue numbers, etc., it is intended merely to establish a standard of quality and performance. Any material, article, or equipment of other manufacturers and vendors, which will perform satisfactorily the duties imposed by the general design, shall be considered equally acceptable provided the material, article, or equipment so proposed is, in the opinion of the Engineer, of equal quality and function. The Engineer shall determine equality based on such information, tests, or other supporting data that may be required of the Contractor.

8.2 Upon acceptance and approval by the Engineer of an equal product, it shall remain the responsibility of the Contractor to coordinate installation of the item with all other items to be furnished to assure proper fitting together of all items. Similar responsibility applies to items which are left to the Contractor's option. Any

additional cost of equal items and any additional cost incidental to the coordination and/or fitting together of such items shall be borne by the Contractor at no extra cost to the Owner.

8.3 If a specified or equal item is not available to meet the construction schedule, the Contractor may propose a substitute item of less than equal performance and quality. If this substitute is acceptable to the Engineer, any difference in purchase cost or costs incidental to the installation of such item will be negotiated between the parties to the Contract.

8.4 Neither equal nor substitute items shall be installed without written approval of the Engineer.

8.5 The Contractor shall warrant that if substitutes are approved, no major changes in the function or general design of the Project will result.

9. Patents. Patent information is as follows:

9.1 The Contractor shall hold and save the owner and its officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the owner, unless otherwise specifically stipulated in the Contract Documents.

9.2 License and/or royalty fees for the use of a process used in wastewater plant design which is authorized by the owner for the project, must be reasonable, and paid to the holder of the patent, or his authorized licensee.

9.3 If the Contractor uses any design, device or materials in the construction methods for the project covered by patents or copyrights, he shall provide for such use by suitable agreement with the owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, that, without exception, the Contract prices shall include all royalties or costs arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the owner of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this Contract, and shall indemnify the Owner for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the construction of the work or after completion of the work.

10. Surveys. Surveys of land, property and construction shall be as follows:

10.1 The owner will provide all land surveys and will establish and locate all property lines relating to the project.

10.2 For structures, the Engineer will establish and stake out one or more base lines as needed and will establish bench marks in and around the project site for the use of the Contractor and for the Engineer's own reference in checking the work in progress. For structures such as pipelines, the Engineer will establish the location of the pipe, manholes and other appurtenances, and will establish bench marks along the route of the pipeline at intervals for the using of the Contractor and for his own reference in checking the pipe and manhole inverts and other elevations throughout the project. The Contractor shall utilize the lines and bench marks established by the Engineer to set up whatever specific detail controls he may need for establishing location, elevation lines and grades of all structures. All this work is subject to checking, approval, and continuous surveillance by the Engineer to avoid error. The Contractor shall provide the Engineer with a qualified man or men to assist in this checking as needed and on request of the Engineer.

10.3 For construction other than pipelines and appurtenances in roadways and cross country, the Contractor shall be responsible for the location and setting lines and grades. The Contractor shall establish the location for pump

station and wastewater treatment facility structures, associated yard piping including electrical conduits, internal piping and all equipment. Base lines and benchmarks for setting of the lines and grades for the above shall be provided by the Engineer.

10.4 Protection of stakes. The Contractor shall protect and preserve all of the established baseline stakes, bench marks, or other controls placed by the Engineer. Any of these items destroyed or lost through fault of the Contractor will be replaced by the Engineer at the Contractor's expense.

11. Contractor's Obligations are as follows:

The Contractor shall and in good workmanlike manner, do and perform all work and furnish and pay for all supplies and materials, machinery, equipment, facilities and means, except as herein otherwise expressly specified, necessary or proper to perform and complete all the work required by this Contract, within the time stated in the proposal in accordance with the plans and drawings covered by this Contract, and any and all supplemental plans and drawings, in accordance with the directions of the Engineer as given from time to time during the progress of the work, whether or not he considers the direction in accordance with the terms of the Contract. He shall furnish, erect, maintain and remove such construction plant and such temporary works as may be required. The Contractor shall observe, comply with, and be subject to all terms, conditions, requirements, and limitations of the Contract Documents, and shall do, carry on and complete the entire work to the satisfaction of the Engineer and Owner.

Contractor shall carry on the work and adhere to the progress schedule during all disputes, disagreements or unresolved claims with the owner. No work shall be delayed or postponed pending the resolution of any disputes, disagreements, or claims except as the owner and Contractor may otherwise agree in writing.

12. Weather Conditions.

In the event of temporary suspension of work, or during inclement weather, or whenever the Engineer shall direct, the Contractor and his Subcontractors shall protect their work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any work or material shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors to so protect his work, such materials shall be removed and replaced at the expense of the Contractor.

13. Protection of Work and Property shall be provided as follows:

13.1 The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this Contract. He shall at all times safely guard and protect his own work, and that of adjacent property, from damage. The Contractor shall replace or make good any such damage, loss or injury unless caused directly by errors contained in the Contract, or by the Owner, or his authorized representatives. The Contractor will notify owners of adjacent utilities when prosecution of the Work may affect them.

13.2 The Contractor shall take all necessary precautions for the safety of employees on the work site, and shall comply with all applicable provisions of federal, state and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the work is being performed. He shall erect and properly maintain at all times, as required by the conditions and progress of the work, all necessary safeguards for the protection of the workmen and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hoists, well holes, elevator hatchways, scaffolding, window openings, stairways, trenches and other excavations, and falling materials, and he shall designate a responsible member of his organization on the work, whose duty shall be the prevention of accidents. The name and position

of any person so designated shall be reported to the Engineer by the Contractor. The person so designated shall be available by phone during nonworking hours.

13.3 In case of emergency which threatens loss or injury of property, and/or safety of life, the Contractor is allowed to act, without previous instructions from the Engineer. He shall notify the Engineer immediately thereafter. Any claim for compensation by the Contractor due to such extra work shall be promptly submitted in writing to the Engineer for approval.

13.4 When the Contractor has not taken action but has notified the Engineer of an emergency threatening injury to persons or damage to the work or any adjoining property, he shall act as instructed or authorized by the Engineer.

13.5 The intention is not to relieve the Contractor from acting, but to provide for consultations between Engineer and Contractor in an emergency which permits time for such consultations.

13.6 The amount of reimbursement claimed by the Contractor on account of any emergency action shall be determined in the manner provided in Article 17 (extra work and change orders) of the general conditions.

14. Inspection of work for conformance with plans and specifications.

14.1 For purposes of inspection and for any other purpose, the Owner, the Engineer, and agents and employees of the Division or of any funding agency may enter upon the work and the premises used by the Contractor, and the Contractor shall provide safe and proper facilities therefore. The Engineer shall be furnished with every facility for ascertaining that the work is in accordance with the requirements and intention of this Contract, even to the extent of uncovering or taking down portions of finished work.

14.2 During construction and on its completion, all work shall conform to the location, lines, levels and grades indicated on the drawings or established on the site by the Engineer and shall be built in a workmanlike manner, in accordance with the drawings and specifications and the supplementary directions given from time to time by the Engineer. In no case shall any work which exceeds the requirements of the drawings and specifications be paid for as extra work unless ordered in writing by the Engineer.

14.3 Unauthorized work and work not conforming to plans and specifications shall be handled as follows:

a. Work considered by the Engineer to be outside of or different from the plans and specifications and done without instruction by the Engineer, or in wrong location, or done without proper lines or levels, may be ordered by the Engineer to be uncovered or dismantled.

b. Work done in the absence of the Engineer or his agent may be ordered by the Engineer to be uncovered or dismantled.

c. Should the work thus exposed or examined prove satisfactory, the uncovering or dismantling and the replacement of material and rebuilding of the work shall be considered as "Extra Work" to be processed in accordance with article 17.

d. Should the work thus exposed or examined prove to be unsatisfactory the uncovering or dismantling and the replacement of material and rebuilding of the work shall be at the expense of the Contractor.

15. Reports, Records and Data shall be furnished as follows: The Contractor shall submit to the owner such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as are required by the Contract Documents or as the owner, division or any funding agency may request concerning work performed or to be performed under this Contract.

16. **Superintendence by Contractor** shall be furnished as follows: At the site of the work, the Contractor shall employ a competent construction superintendent or foreman who shall have full authority to act for the Contractor. The superintendent or foreman shall have been designated in writing by the Contractor as the Contractor's representative at the site. It is understood that such representative shall be acceptable to the Engineer and shall be the one who can be continued in that capacity for the particular job involved unless he ceases to be on the Contractor's payroll. Such representative shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

17. **Extra Work and Change Orders** shall be processed as follows:

17.1 The Engineer may at any time by written order and without notice to the sureties require the performance of such extra work or changes in the work as may be found necessary. The amount of compensation to be paid to the Contractor for any extra work so ordered shall be made in accordance with one or more of the following methods in the order of precedence listed below:

a. A price based on unit prices previously approved; or

b. A lump sum price agreed upon between the parties and stipulated in the order for the extra work;

c. A price determined by adding 15 percent to the "reasonable cost" of the extra work performed, such "reasonable cost" to be determined by the Engineer in accordance with the following paragraph.

17.2 The Engineer shall include the reasonable cost to the Contractor of all materials used, of all labor, both common and skilled, of foreman, trucks, and the fair-market rental rate for all machinery and equipment for the period employed directly on the work. The reasonable cost for extra work shall include the cost to the Contractor of any additional insurance that may be required covering public liability for injury to persons and property, the cost of workmen's compensation insurance, federal social security, and any other costs based on payrolls, and required by law. The cost of extra work shall not include any cost or rental of small tools, buildings, or any portion of the time of the Contractor, his project supervisor or his superintendent, as assessed upon the amount of extra work, these items being considered covered by the 15 percent added to the reasonable cost. The reasonable cost for extra work shall also include the premium cost, if any, for additional bonds and insurance required because of the changes in the work.

17.3 In the case of extra work which is done by Subcontractors under the specific Contract, or otherwise if so approved by the Engineer, the 15 percent added to the reasonable cost of the work will be allowed only to the Subcontractor performing the work. On such work an additional 5 percent for reasonable cost will be paid to the Contractor for their work in directing the operations of the Subcontractor, for administrative supervision, and for any overhead costs. If two or more tiers of Subcontractors are involved in the extra work, a maximum of 27 percent of the cost incurred by the Subcontractor actually performing the work will be allowed to be added to the reasonable cost of the work. The 27 percent maximum represents 15 percent added to the reasonable cost of the work allowed by the Subcontractor performing the work, an additional 5 percent allowed to the next tier higher subcontractor and 5 percent allowed to the Contractor for their work in directing the operations of the Subcontractor, for administrative supervision, and for any overhead costs.

17.4 The Engineer may authorize minor changes or alterations in the work not involving extra cost and not inconsistent with the overall intent of the Contract Documents. These shall be accomplished by a written field order. However, if the Contractor believes that any minor change or alteration authorized by the Engineer entitles him to an increase in the Contract price, he may make a claim therefore as provided in article 21.

18. Time For Completion and Liquidated Damages. The following paragraphs address time for completion and liquidated damages:

18.1 It is hereby understood and mutually agreed, by and between the Contractor and the Owner, that the date of beginning and the time for completion as specified in the Contract of the work to be done hereunder are Essential Conditions of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the "Notice to Proceed."

18.2 The Contractor agrees that said work shall be pursued regularly, diligently and continuously at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the work described herein is a reasonable time, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

18.3 If the Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay to the Owner the amount specified in the Contract, not as a penalty but as liquidated damages for such breach of Contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work.

18.4 The liquidated damages amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain. Said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be deducted from time to time by the owner from current periodical payments.

18.5 It is further agreed that "time is of the essence" of each and every portion of this Contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall "be of the essence." Provided, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; provided, further, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in the completion of the work is due to:

a. A preference, priority or allocation order duly issued by the government.

b. An unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a Contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and severe weather.

c. Any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article.

18.6 The Contractor shall promptly notify the Owner in writing of the causes of the delay. The Owner shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of his decision in the matter.

19. Defective Work. Defective work shall be processed as follows:

19.1 The Contractor shall promptly remove from the premises all materials and work condemned by the Engineer as failing to meet Contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute his own work in accordance with the Contract and without expense to the Owner and shall bear the expense of making good all work of other Contractors which was destroyed or damaged by such removal or replacement.

19.2 All removal and replacement work shall be done at the Contractor's expense. If the Contractor does not take action to remove such condemned work and materials within10 days after receipt of written notice, the Owner may remove them and store the material at the expense of the Contractor. If the Contractor does not pay the expense of such removal and storage within 10 days time thereafter, the Owner may, upon 10 days written notice, sell such materials at auction or at private sale and shall pay to the Contractor any net proceeds thereof, after deducting all the costs and expenses that should have been borne by the Contractor.

20. Differing Site Conditions. Claims for differing site conditions shall be processed as follows:

20.1 The Contractor shall promptly and before such conditions are disturbed, notify the Engineer in writing of:

a. Subsurface or latent physical conditions at the site differing materially from those indicated in this Contract; or,

b. Unknown physical conditions at the site, differing materially from those ordinarily encountered and generally recognized as inherent in the type of work provided for in this Contract.

20.2 The Engineer shall promptly investigate the conditions. If he finds that conditions differ materially and will cause an increase or decrease in the Contractor's cost or the time required to perform any part of the work under this Contract whether or not changed as a result of such conditions, the Engineer will notify the Owner and recommend an equitable adjustment. Contractor and Owner will enter into negotiations via the Engineer to modify the contact in writing.

20.3 No claim of the Contractor under this clause shall be allowed unless the Contractor has given proper notice as required in paragraph 20.1 of this clause.

20.4 No claim by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this Contract.

21. Claims For Extra Cost. Claims for extra cost shall be processed as follows:

21.1 No claim for extra work or cost shall be allowed unless the same was done pursuant to a written order by the Engineer, approved by the Owner and the claim presented for payment with the first estimate after the changed or extra work is done. When work is performed under the terms of article 17, the Contractor shall furnish satisfactory bills, payrolls and vouchers covering all items of cost when requested by the Owner and shall allow the Owner access to accounts relating thereto.

21.2 If the Contractor claims that any instructions by drawings or similar documents issued after the date of the Contract involve extra cost under the Contract, he shall give the Engineer written notice after the receipt of such instruction and before proceeding to execute the work, except in an emergency which threatens life or property, then the procedure shall be as provided for under article 17, "Extra Work & Change Orders." No claim shall be valid unless so made.

22. Right of Owner to Terminate Contract.

22.1 In the event that any of the provisions of this Contract are violated by the Contractor, or by any of his Subcontractors, the Owner may serve written notice upon the Contractor and the surety of its intention to terminate the Contract, and unless within 10 days after the serving of such notice upon the Contractor, such violation or delay shall cease and satisfactory arrangement for correction be made, the Contract shall, upon the expiration of said 10 days cease and terminate. In the event of any such termination, the Owner shall immediately serve notice thereof upon the surety and the Contractor and the surety shall have the right to take over and perform the Contract; provided, however, that if the surety does not commence performance thereof within 10 days from the date of the mailing to such surety of notice of termination, the Owner may take over the work and prosecute the same to completion by Contract or by force account for the account and at the expense of the Contractor and the Contractor and his surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefore.

22.2 If the Contractor should be adjudged bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he should refuse or should fail, except in cases for which extensions of time are provided, to supply enough skilled workmen or materials, or if he should fail to make payments to Subcontractors or for material or labor, so as to affect the progress of the work, or be guilty of a violation of the Contract, then the Owner, upon the written notice of the Engineer that sufficient cause exists to justify such action may, without prejudice to any other right or remedy and after giving the Contractor and his surety 7 days' written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools, equipment and other facilities installed on the work and paid for by the Owner, and finish the work by whatever method he may deem expedient. In the case of termination of this Contract before completion from any cause whatever, the Contractor, if notified to do so by the Owner, shall promptly remove any part or all of his equipment and supplies at the expense of the Contractor. If such expense exceeds such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, and the damage incurred through the Contractor's default, shall be approved by the Engineer.

22.3 Where the Contract has been terminated by the Owner, said termination shall not affect or terminate any of the rights of the Owner as against the Contractor or his surety then existing or which may thereafter accrue because of such default. Any retention or payment of monies by the Owner due the Contractor under the terms of the Contract, shall not release the Contractor or his surety from liability for his default.

22.4 After ten (10) days from delivery of a Written Notice to the Contractor and the Engineer, the Owner may, without cause and without prejudice to any other remedy, elect to abandon the Project and terminate the Contract. In such case the Contractor shall be paid for all Work executed and any expense sustained plus reasonable profit.

22.5 If through no act or fault of the Contractor, the work is suspended for a period of more than ninety (90) days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any request for payment within thirty (30) days after approved by the engineer, or the Owner fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within thirty (30) days of its approval and presentation, then the Contractor may, after ten (10) days from delivery of a Written Notice to the Owner and the Engineer terminate the Contract and recover from the Owner payment for all Work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment or if the Owner has failed to make any payment as aforesaid, the Contractor may upon ten (10) days written notice to the Owner and the Engineer stop the Work until paid all amounts then due, in which event and

upon resumption of the Work Change Orders shall be issued for adjusting the Contract Price or Extending the Contract Time or both to compensate for the costs and delays attributable to the stoppage of the work.

22.6 If the performance of all or any portion of the Work is suspended, delayed, or interrupted as a result of failure of the Owner or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, an adjustment in the Contract Price or an extension of the Contract Time, or both, shall be made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the Owner or Engineer.

23. Construction Schedule and Periodic Estimates shall provide for the following:

23.1 Before starting the work or upon request by the Engineer during its progress, the Contractor shall submit to the Engineer a work plan showing construction methods and the various steps he intends to take in completing the work.

23.2 Before the first partial payment is made, the Contractor shall prepare and submit to the Engineer:

a. A written schedule fixing the dates for submission of drawings; and

b. A written schedule fixing the respective dates for the start and completion of segments of the work. Each such schedule shall be subject to review and change during the progress of the work.

c. Respective dates for submission of Shop Drawings and for the beginning of manufacture, the testing, and the installation of materials, supplies, and equipment.

d. A schedule of payments that the Contractor anticipates will be earned during the course of the Work.

24. Payments to Contractor. Payments to the Contractor shall be made as follows:

24.1 Progress payments. The Owner will once each month make a progress payment to the Contractor on the basis of an estimate of the total amount of work done to the time of the estimate and its value as prepared by the Contractor and approved by the Engineer.

24.2 Retainage by Owner. The Owner will retain a portion of the progress payment, each month, in accordance with the following procedures:

a. The Owner will establish an escrow account in the bank of the Owner's choosing. The account will be established such that interest on the principal will be paid to the Contractor. The principal will be the accumulated retainage paid into the account by the Owner. The principal will be held by the bank, available only to the Owner, until termination of the Contract.

b. Until the work is 50% complete, as determined by the Engineer, retainage shall be 10% of the monthly payments claimed. The computed amount of retainage will be deposited in the escrow account established above.

c. After the work is 50% complete, and provided the Contractor has satisfied the Engineer in quality and timeliness of the work, and provided further that there is no specific cause for withholding additional retainage no further amount will be withheld. The escrow account will remain at the same balance throughout the remainder of the project, unless drawn upon by the Owner in accordance with articles 19, 22, and 56.

d. Upon substantial or final completion (as defined in article 25), the amount of retainage will be reduced to 2% of the total Contract Price plus an additional retainage based on the Engineer's estimate of the fair value of

the punch list items and the cost of completing and/or correcting such items of work, with specified amounts for each incomplete or defective item of work. As these items are completed or corrected, they shall be paid for out of the retainage until the entire project is declared completed (See article 25). The final 2% retainage shall be held during the one-year warranty period and released only after the Owner has accepted the project.

24.3 In reviewing monthly estimates for payments of the value of work done, the Engineer may accept in the estimate, prior to subtracting the retainage, the delivered cost of certain equipment and nonperishable material which have been delivered to the site or off-site location and which are properly stored and protected from damage. With the estimate, the Contractor shall submit to the Engineer invoices as evidence that the material has been delivered to the site. Prior to submitting the next monthly estimate, the Contractor shall provide the Engineer with paid invoices or other evidence that the materials have been paid for. If the Contractor fails to submit such evidence, the Engineer may then subtract the value of such materials or equipment for which the Owner has previously paid, from the next monthly estimate. The type of equipment and material eligible for payment prior to being incorporated in the work will be at the Engineer's discretion. Material and equipment made specifically for the subject job will be eligible for payment.

24.4 All material and work for which partial payments have been made shall thereupon become the sole property of the Owner. This provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of materials and work upon which payments have been made or for the restoration of any damaged work, or as a waiver of the right of the Owner to require compliance with all of the terms of the Contract.

24.5 Owner's right to withhold payments and make application. The Contractor agrees that he will indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, material men, and furnishers of machinery and parts, equipment, power, tools and all supplies, including commissary, incurred in the furtherance of the performance of this Contract. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all claims of the nature hereinabove designated have been paid, discharged, or waived. If the Contractor fails to do so, then the Owner may, upon written notice to the Contractor either pay unpaid bills of which the Owner has written notice directly, or withhold from the Contractor's unpaid compensation a sum of money to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged. Payment to the Contractor shall then be resumed in accordance with the terms of this Contract but in no event shall the above provisions be construed to impose any obligations upon the Owner to either the Contractor or his surety or any third party. In paying any unpaid bills of the Contractor, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner shall be considered as payment made under Contract by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.

24.6 If the Owner fails to make payment forty-five (45) days after approval by the Engineer, in addition to other remedies available to the Contractor, there shall be added to each such payment interest at an annual rate of 10% commencing on the first day after said payment is due and continuing until the payment is received by the Contractor.

25. Acceptance and Final Payment provisions shall be as follows:

25.1 Substantial completion and payment.

a. Substantial completion shall be that point, as certified by the Engineer, at which the Contract or specified part thereof, has been completed to the extent that the Owner may occupy and/or make use of the work

performed for the purposes for which it was intended. Upon substantial completion there may be minor items, such as seeding, landscaping, etc., yet to be completed or items of work to be corrected.

b. Upon receipt of written notice from the Contractor that the work is substantially complete, the Engineer shall promptly make an inspection, and when he finds the work complies with the terms of the Contract and the Contract is substantially completed, he will issue a signed and dated certificate, and a list of all items to be completed or corrected, stating that the work required by this Contract has been substantially completed and is accepted by him.

c. Upon substantial completion, the entire balance due and payable to the Contractor less 2 percent of the Contract Price, and less a retention based on the Engineer's estimate of the fair value for the cost of completing or correcting listed items of work with specified amounts for each incomplete or defective item of work shall be made.

d. The general guarantee period for the work shall begin on the date certified by the Engineer that the work is substantially completed.

25.2 Final completion shall be that point at which all work has been completed and all defective work has been corrected. Unless the Engineer has issued a certificate of substantial completion, the general guarantee period shall begin upon certification by the Engineer of final completion.

25.3 At the end of the general guarantee period for the entire Contract which has been certified finally completed or substantially completed, the Owner, through the Engineer, shall make a guarantee inspection of all or portions of the work. When it is found that the work is satisfactory and that no work has become defective under the terms of the Contract, the Owner will accept the entire project and make final payment, including the reimbursement of monies retained pursuant to the guarantee period.

25.4 If the guarantee inspection discloses any work as being unsatisfactory, the Engineer will give the Contractor the necessary instructions for correction of such work, and the Contractor shall immediately execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the guarantee inspection, provided the work has been satisfactorily completed.

25.5 Before issuance of final payment, the Contractor shall certify in writing to the Engineer that all payrolls, material bills, and other indebtedness connected with the work have been paid or otherwise satisfied; except that in case of disputed indebtedness or liens, if the Contract does not include a payment bond, the Contractor may submit in lieu of certification of payment a surety bond in the amount of the disputed indebtedness or liens, guaranteeing payment of all such disputed amounts, including all related costs and interest in connection with said disputed indebtedness or liens which the Owner may be compelled to pay upon adjudication.

25.6 If upon substantial completion, full completion is delayed through no fault of the Contractor, and the Engineer so certifies, the Owner may, upon certificate of the Engineer, and without termination of the Contract, make payment of the balance due for that portion of the work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

25.7 The acceptance by the Contractor of final payment shall release the Owner from all claims and all liability to the Contractor for all things relating to this work and for every act and neglect of the Owner and others relating to or arising out of this work. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations of the performance and payment bond under this Contract.

26. Payments by Contractor. The Contractor shall pay the costs:

26.1 For all transportation and utility services not later than the 20th day of the calendar month following that in which services are rendered;

26.2 For all materials, tools, and other expendable equipment to the extent of 90 percent of the cost thereof, not later than the 20th day of the calendar month following that in which such materials, tools and equipment are delivered at the site of the work and the balance of the cost thereof not later than the 30th day following the completion of that part of the work in or on which such materials, tools and equipment are incorporated or used; and

26.3 To each of his Subcontractors, not later than the 5th day following each payment to the Contractor, the respective amounts allowed the Contractor on account of the work performed by his Subcontractors to the extent of each Subcontractor's interest therein.

27. Insurance. The Contractor and any Subcontractor shall obtain all the insurance required under this article and such insurance shall be approved by the Owner.

27.1 The Contractor and all Subcontractors shall procure and shall maintain during the life of this Contract workmen's compensation insurance as required by applicable state law. The Contractor shall provide and shall cause each Subcontractor to provide adequate employer's liability insurance.

Limits of Liability: $100,000 each accident;
$500,000 disease - policy limit;
$100,000 disease - each employee.

27.2 The Contractor shall procure and shall maintain during the life of this Contract Commercial General liability insurance to include Contractual liability, explosion, collapse and underground coverages.

Limits of liability: $1,000,000 each occurrence bodily injury and property damage;
$2,000,000 general aggregate-include per project aggregate endorsement;
$2,000,000 products/completed operations aggregate.

If blasting or demolition or both is required by the Contract, the Contractor or Subcontractor shall obtain the respective coverage and shall furnish the Engineer a certificate of insurance evidencing the required coverages prior to commencement of any operations involving blasting or demolition or both.

27.3 The Contractor shall procure and shall maintain during the life of this Contract comprehensive automobile liability insurance to include all motor vehicles including owned, hired, borrowed and non-owned vehicles. Limits of liability: $1,000,000 combined single limit for bodily injury and property damage.

27.4 The Contractor shall either:

a. Require each of his Subcontractors to procure and to maintain during the life of his subcontract commercial general liability insurance and comprehensive automobile liability insurance of the type and in the amounts specified in articles 27.2 and 27.3; or

b. Insure the activities of his Subcontractors in his policy.

27.5 The required insurance shall provide adequate protection for the Contractor and his Subcontractors, respectively, against damage claims which may arise from work under this Contract, whether such work be by the insured or by anyone employed by him and also against any of the special hazards which may be encountered in the performance of this Contract.

27.6 The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates and dates of expiration of policies. Such insurance shall not be canceled or materially altered, except after 10 days written notice has been received by the Owner.

27.7 For builder's risk insurance (fire and extended coverage) and until the work is completed and accepted by the Owner, the Contractor is required to maintain builder's risk type insurance on a 100 percent completed value basis on the insurable portion of the work for the benefit of the Owner, the Contractor, and Subcontractors as their interests may appear.

27.8 The Contractor shall take out and furnish to the Owner and maintain during the life of this Contract, complete Owner's protective liability insurance.

Limits of Liability: $1,000,000 each occurrence;
$2,000,000 aggregate.

28. Contract Security. The Contractor shall within ten (10) days after the receipt of the Notice of Award furnish the Owner with a performance bond and a payment bond in penal sums equal to the amount of the Contract price conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the Contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact business in the state in which the Work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these Bonds shall be borne by the Contractor.

29. Additional or Substitute Bond. If at any time a surety on any such Bond is declared as bankrupt or loses its right to do business in the state in which the Work is to be performed, or is removed from the list of Surety Companies accepted on Federal Bonds, the Contractor shall within ten (10) days after notice from the Owner to do so, substitute an acceptable bond (or bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the Owner. The premiums on such bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished such an acceptable bond to the Owner.

30. Assignments. The Contractor shall not assign the whole or any part of this Contract or any monies due or to become due hereunder without written consent of the Owner. In case the Contractor assigns all or any part of any monies due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any monies due or to become due to the Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

31. Mutual Responsibility of Contractors. If, through acts of neglect on the part of the Contractor, any other Contractor or any Subcontractor shall suffer loss or damage on the work site, the Contractor agrees to settle with such other Contractor or Subcontractor by agreement or arbitration if such other Contractor or Subcontractors will so settle. If such other Contractor or Subcontractors shall assert any claim against the Owner on account of any damage alleged to have been sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any such claim.

32. Subcontracting. When subcontracting, the Contractor:

32.1 May utilize the services of specialty Subcontractors on those parts of the work which, under usual Contracting practices, are performed by specialty Subcontractors.

32.2 Shall be as fully responsible to the Owner for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

32.3 Shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that the Owner may exercise over the Contractor under any provision of the Contract Documents.

32.4 Shall not create any Contractual relation between any Subcontractor and the Owner.

32.5 Shall not award Work to Subcontractor(s), in excess of fifty percent (50%) of the Contract Price, without prior written approval of the Owner.

33. Authority of the Engineer. In performing his duties, the Engineer or his representative shall:

33.1 Have the authority to suspend the work in whole or in part for such periods as he may deem necessary due to the failure of the Contractor to carry out provisions of the Contract or for failure of the Contractor to suspend work in weather conditions considered by the Engineer to be unsuitable for the prosecution of the work. The Engineer shall give all orders and directions under this Contract, relative to the execution of the work. The Engineer shall determine the amount, quality, acceptability, and fitness of the several kinds of work and materials which are to be paid for under this Contract and shall decide all questions which may arise in relation to the work. The Engineer's estimates and decisions shall be final and conclusive, except as otherwise provided. In case any question shall arise between the parties hereto relative to said Contract or specifications, the determination or decision of the Engineer shall be a condition precedent to the right of the Contractor to receive any money or payment for work under this Contract affected to any extent by such question. The Engineer shall decide the meaning and intent of any portion of the specifications and of any plans or drawings where the same may be found unclear. Any differences or conflicts in regard to their work which may arise between the Contractor under this Contract and other Contractors performing work for the Owner shall be adjusted and determined by the Engineer.

a. The purpose of the above article is not in any way to relieve the Contractor of his responsibilities for the safety of workmen or general public in the execution of the work. Attention is drawn to Article 13 of these Conditions which refers to the safety obligations of the Contractor.

b. The Engineer, acting on behalf of the Owner, has the authority to enforce corrective action for work not in accordance with the specifications.

c. In addition, the Engineer, acting on behalf of the Owner, is to ensure that the work is in accordance with the Contract Documents. He is not held responsible, however, for the methods of construction, sequences, schedules and procedures in the execution of the work. The Engineer does have the opportunity under 33.1 to reject the method of construction, work plan schedule, procedures, as he thinks appropriate.

33.2 Appoint assistants and representatives as he desires, and they shall be granted full access to the work under the Contract. They have the authority to give directions pertaining to the work, to approve or reject materials, to suspend any work that is being improperly performed, to make measurements of quantities, to keep records of

costs, and otherwise represent the Engineer in all matters except as provided below. The Contractor may, however, appeal from their decision to the Engineer himself, but any work done pending its resolution is at the Contractor's own risk. Except as permitted and instructed by the Engineer, the assistants and representatives are not authorized to revoke, alter, enlarge, relax, or release any requirements of these specifications, nor to issue instructions contrary to the plans and specifications. They are not authorized to act as superintendents or foremen for the Contractor, or to interfere with the management of the work by the Contractor. Any advice which the assistants or representatives of the Engineer may give the Contractor shall not be construed as binding the Engineer or the Owner in any way, nor as releasing the Contractor from the fulfillment of the terms of the Contract. All transactions between the Contractor and the representatives of the Engineer which are liable to protest or where payments are involved shall be made in writing.

34. **Stated Allowances.** The Contractor shall include in his proposal for costs of materials not shown in his bid under "cash allowances" or "allowed materials," any cash allowances stated in the supplemental general conditions or other Contract Documents. The Contractor shall purchase the "allowed materials" as directed by the Owner on the basis of the lowest and best bid of at least 3 competitive bids. If the actual price for purchasing the "allowed materials" is more or less than the "cash allowance," the Contract price shall be adjusted accordingly. The adjustment in Contract price shall be made on the basis of the purchase price without additional charges for overhead, profit, insurance or any other incidental expenses. The cost of installation of the "allowed materials" shall be included in the applicable sections of the Contract specifications covering this work.

35. **Use of Premises, Removal of Debris, Sanitary Conditions.** In the use of premises or removal of debris, the Contractor expressly undertakes at his own expense: to take every precaution against injuries to persons or damage to property; to maintain sanitary conditions; to store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the work as will not interfere with the progress of his work or the work of any other Contractors; to place upon the work or any part thereof only such loads as are consistent with the safety of that portion of the work; to clean up frequently all refuse, rubbish, scrap materials and debris caused by his operations, to the end that at all times the site of the work shall present an orderly and workmanlike appearance; before final payment to remove all surplus material falsework, temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations, and to put the site in an orderly condition; to effect all cutting, fitting or patching of his work required to make the same conform to the plans and specifications and, except with the consent of the Engineer, not to cut or otherwise alter the work of any other Contractor; to provide and maintain in a sanitary condition such toilet accommodations for the use of his employees as may be necessary to comply with the requirements of the state and local boards of health, or of other bodies or authorities having jurisdiction.

36. **Quantities of Estimate.** Wherever the estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is specifically reserved except as herein otherwise specifically limited, to increase or decrease them as may be deemed reasonably necessary by the Owner to complete the work contemplated by this Contract, and such increase or decrease shall in no way invalidate this Contract, nor shall any such increase or decrease give cause for claims or liability for damages. Such increases or decreases shall not exceed 25 percent of the estimated quantities of work. An increase or decrease in quantities for subsurface materials (e.g. ledge, unsuitable backfill), which overrun or underrun by 25% or more of the bid quantity may be the basis for a Contract price adjustment, at the rate of a negotiated adjusted unit rate. Negotiated unit price rates shall be equitable and shall take into account, but not be limited to the following factors; bid unit rate, distribution of rates and bid balance, and the scope of work as affected by the changed quantities. Claims for extra work resulting from changed quantities shall be processed under article 21.

37. Lands and Rights-of-Way. Acquisition and usage of lands and rights-of-way shall be as follows:

37.1 Prior to issuing the Notice to Proceed, the Owner shall legally obtain all lands and rights-of-way necessary for carrying out and completing the work to be performed under this Contract.

37.2 The Contractor shall not (except after written consent from the Owner) enter or occupy with men, tools, materials, or equipment, any land outside the rights-of-way or property of the Owner. A copy of the written consent shall be given to the Engineer.

37.3 The Owner shall provide to the Contractor information which delineates and describes the lands owned and the rights-of-way acquired.

37.4 The Contractor shall provide at its own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

38. General Guarantee. With reference to warranties, neither the final certificate of payment nor any provision in the Contract Documents, nor partial or entire occupancy of the premises by the Owner, shall constitute an acceptance of work not done in accordance with the Contract Documents or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom, which appear within the warranty period one year or longer if required by the Contract, from the certified date of completion or substantial completion of the work. The Owner will give notice of observed defects within two working days of their discovery.

39. Errors and Inconsistencies. With reference to errors and inconsistency in Contract Documents, any provisions in any of the Contract Documents which may be in conflict with the paragraphs in these general conditions shall be subject to the following order of precedence for interpretation:

39.1 Drawings will govern technical specifications.

39.2 General conditions will govern drawings and technical specifications.

39.3 Supplemental general conditions will govern general conditions, drawings and technical specifications.

39.4 Special conditions will govern supplemental general conditions, general conditions, drawings and technical specifications.

39.5 The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers such an error or omission, he shall notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

39.6 Figure dimensions on Drawings shall govern over general drawings.

40. Notice and Service Thereof. Any notice to the Contractor from the Owner relative to any part of this Contract will be in writing and will be considered delivered and the service completed, when said notice is mailed, by certified registered mail, to the Contractor at his last given address, or delivered in person to the Contractor or his authorized representative on the work.

41. Required Provisions Deemed Inserted. Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted or is not correctly

inserted (example; miswording, etc.), then upon the application of either party the Contract shall forthwith be physically amended to make such insertion or correction.

42. Protection of Lives and Health. The work under this Contract is subject to the safety and health regulations (CRF 29, part 1926, and all subsequent amendments) as promulgated by the U.S. Department of Labor on June 24, 1974. Contractors are urged to become familiar with the requirements of these regulations.

43. OSHA Construction Safety Program.

43.1 Pursuant to NHRSA 277:5-a, the Contractor shall provide an Occupational Health and Safety Administration (OSHA) 10-hour construction safety program for its on-site employees. All employees are required to complete the program prior to beginning work. The training program shall utilize an OSHA-approved curriculum. Graduates shall receive a card from OSHA certifying the successful completion of the training program.

43.2 Any employee required to complete the OSHA 10-hour construction safety program, and who cannot within 15 days provide documentation of completion of such program, shall be subject to removal from the job site.

43.3 The following individuals are exempt from the requirements of the 10-hour construction safety program: law enforcement officers involved with traffic control or jobsite security; flagging personnel who have completed the training required by the Department of Transportation; all relevant federal, state and municipal government employees and inspectors; and all individuals who are not considered to be on the site of work under the federal Davis-Bacon Act, including, but not limited to, construction and non-construction delivery personnel and non-trade personnel.

44. Equal Employment Opportunity. Under equal employment opportunity requirements and during the performance of this Contract the Contractor agrees to the following:

44.1 The Contractor will not discriminate against any employee or applicant for employment because of race, creed, color, national origin, or sex. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, national origin, or sex. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

44.2 The Contractor will in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment, without regard to race, creed, color, national origin, or sex.

44.3 The Contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other Contract or understanding, a notice to be provided advising the labor union or worker's representative of the Contractor's commitment under section 202 of executive order no. 11246 of September 24, 1965, and 11375 of October, 13, 1967, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

44.4 The Contractor will comply with all provisions of executive orders no. 11246 and 11375.

44.5 The Contractor will furnish all information and reports required by executive orders no. 11246 and 11375.

44.6 In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of such rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part by the Owner or the Department of Labor and the Contractor may be declared ineligible for further government Contracts or federally-assisted construction, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction by the Department of Labor, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

44.7 A breach of this article may be grounds for termination of this Contract and for debarment as provided in 29 CFR 5.6.

45. Interest of Federal, State or Local Officials. No federal, state or local official shall be admitted to any share or part of this Contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this Contract if made with a corporation for its general benefit.

46. Other Prohibited Interests. No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept or approve, or to take part in negotiating, making, accepting, or approving any architectural, Engineering, inspection, construction or material supply Contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or in any part hereof. No officer, employee, architect, attorney, Engineer or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply Contract, subcontract, insurance Contract, or any other Contract pertaining to the project.

47. Use and Occupancy Prior to Acceptance. Use and occupancy of a portion or unit of the project, upon completion of that portion or unit, and before substantial completion of the project, shall be a condition of this Contract with the following provisions:

47.1 The Owner will make his request for use or occupancy to the Contractor in writing.

47.2 There must be no significant interference with the Contractor's work or performance of duties under the Contract.

47.3 The Engineer, upon request of the Owner and agreement by the Contractor, will make an inspection of the complete part of the work to confirm its status of completion.

47.4 Consent of the surety and endorsement of the insurance carrier must be obtained prior to use and/or occupancy by the Owner. Also, prior to occupancy, the Owner will secure the required insurance coverage on the building.

47.5 The Owner will have the right to exclude the Contractor from the subject portion of the project after the date of occupancy but will allow the Contractor reasonable access to complete or correct items.

47.6 The warranty period shall begin upon substantial completion.

48. Suspension of Work. The Owner may, at any time and without cause, suspend the work or any portion thereof for a period of not more than 90 days by notice in writing to the Contractor and the Engineer. The Owner shall fix the date on which work shall be resumed. The Contractor will be allowed an increase in the Contract price or an extension of the Contract time, or both, directly attributable to any suspension if he makes a claim therefore as provided in articles 17 and 21.

49. [Reserved]

50. [Reserved]

51. [Reserved]

52. Project Sign. Furnish and erect a sign at the project site to identify the project and to indicate that the State Government is participating in the development of the project. Place the sign in a prominent location as directed by the Engineer. Do not place or allow the placement of other advertising signboards at the project site or along rights-of-way furnished for the project work. See Exhibit 1 for details of construction.

53. [Reserved]

54. Public Convenience and Traffic Control requirements:

54.1 The Contractor shall at all times so conduct his work as to assure minimal obstruction to traffic. The safety and convenience of the general public and the residents along the work site route and the protection of property shall be provided for by the Contractor. The Contractor shall be responsible for timely notification to local residents before causing any interruptions of their access.

54.2 Fire hydrants and water holes for fire protection on or adjacent to the work site shall be kept accessible to fire apparatus at all times, and no obstructions shall be placed within 10 feet of any such facility. No footways, gutters, drain inlets, or portions of highways adjoining the work site shall be obstructed. In the event that all or part of a roadway is officially closed to traffic during construction, the Contractor shall provide and maintain safe and adequate traffic accessibility, satisfactory to the Engineer, for residences and businesses along and adjacent to the roadway so closed.

54.3 When the maintenance of traffic is considered by the Engineer to be minimal, the Contract may not show this work as a pay item. In such cases, the Contractor shall bear all expense of maintaining traffic over the sections of road undergoing improvement and of constructing and maintaining such approaches, crossings, intersections, and other features as may be necessary, without direct reimbursement.

55. Pre-Construction Conference. The Contractor shall not commence work until a pre-construction conference has been held at which representatives of the Contractor, Engineer, Division and Owner are present. The pre-construction conference shall be scheduled by the Engineer.

56. Maintenance During Construction.

56.1 The Contractor shall maintain the work during construction and until it is accepted by the Owner. This maintenance shall be continuous and effective work prosecuted day by day, with adequate equipment and forces, to the end that roads or structures are kept in satisfactory condition at all times.

56.2 All cost of maintenance during construction and before the work is accepted by the Owner shall be included in the unit prices bid on the various pay items and the Contractor shall not be paid an additional amount for such maintenance.

56.3 If the Contractor, at any time, fails to comply with the provisions above, the Engineer may direct the Contractor to do so. If the Contractor fails to remedy unsatisfactory maintenance within the time specified by the Engineer, the Engineer may immediately cause the project to be maintained and the entire cost of this maintenance will be deducted from money to become due the Contractor on this Contract.

57. Cooperation with Utilities.

57.1 The Owner will notify all utility companies, all pipe line owners, or other parties affected, and have all necessary adjustments of the public or private utility fixtures, pipe lines, and other appurtenances within or adjacent to the limits of construction made as soon as practicable.

57.2 Water lines, gas lines, wire lines, service connections, water and gas meter boxes, water and gas valve boxes, light standards, cableways, signals, and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted are to be moved by the owners of such utilities at their expense, except as may otherwise be provided for in the special conditions or as noted on the plans.

57.3 It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility appurtenances in their present or relocated positions as shown on the plans and as evident on the site, and that no additional compensation will be allowed for any delays, inconvenience, damage sustained by him due to any interference from such utility appurtenances or the operation of moving them.

57.4 The Contractor shall cooperate with the Owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner, that duplication of rearrangements may be reduced to a minimum, and that services rendered by those parties will be minimal.

57.5 In the event of interruption to a water or utility service as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with said authority in the restoration of services. If water service is interrupted, repair work shall be continuous until the service is restored. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority. If any utility service is interrupted for more than 4 hours, the Contractor shall make provisions for temporary service at his own expense until service is resumed.

58. Work Performed at Night and on Sundays and Holidays shall comply with the following:

58.1 No work will be permitted at night or on Sundays or holidays except as approved in writing by the Engineer, and provided such work is not in violation of a local ordinance. When working at night, the Contractor shall provide flood lighting sufficient to insure the same quality of workmanship and the same conditions regarding safety as would be achieved in daylight.

58.2 Whenever Memorial Day or Fourth-of-July is observed on a Friday or a Monday and during the weekend of Labor Day, the Contractor may be required to suspend work for the 3 calendar days. Prior to the close of work, the work site shall be placed in a condition acceptable to the Engineer for the comfort and safety of the traveling public. An arrangement shall be made for responsible personnel acceptable to the Engineer to maintain the project in the above conditions.

59. Laws to be Observed. With reference to laws that shall be observed:

59.1 The Contractor shall keep fully informed of all federal and state laws, all local laws, ordinances, and regulations, and all orders and decrees of tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work. He shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the state and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by himself or his employees.

59.2 Indemnification

The Contractor will indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses, and expenses including attorney's fees arising out of or resulting from the performance of the Work, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

In any and all claims against the Owner or the Engineer, or any of their agents of employees, by any employees of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by disability benefit or other employee benefit acts.

The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, Drawings, opinions, reports, surveys, Change Orders, designs or Specifications.

60. Permits. Permits to be obtained by the Contractor shall be in accordance with the following:

60.1 Permits and licenses of a temporary nature necessary for the prosecution of the work shall be obtained and paid for by the Contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities will be secured and paid for by the Owner. Permits may include:

a. New Hampshire Department of Transportation Highway Trench Permits.

b. RSA 485-A:17 and 483-A N.H. DES Wetlands Bureau Dredge and Fill Permit.

c. RSA 485-A:17 - N.H. DES Site Specific Permit (Water Quality)

d. RSA 149-M:10 N.H. DES Solid Waste Management Bureau - disposal of construction debris and/or demolition waste.

e. N.H. Department of Environmental Services Air Resources Division (burning permits).

f. Other permits, as required by State and Local laws and ordinances.

g. Notice of intent for coverage under EPA's General NPDES Permit for construction dewatering activities.

61. Control of Pollution due to construction shall comply with the following:

61.1 During construction, the Contractor shall take precautions sufficient to avoid the leaching or runoff of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride and any other polluting materials which are unsightly or which may be harmful to humans, fish, or other life, into groundwaters and surface waters of the State.

61.2 In waters used for public water supply or used for trout, salmon, or other game or forage fish spawning or nursery, control measures must be adequate to assure that turbidity in the receiving water will be increased not more than 10 standard turbidity units (s.t.u.) in the absence of other more restrictive locally-established limitations, unless otherwise permitted by the Division. In no case shall the classification for the surface water be violated.

61.3 In water used for other purposes, the turbidity must not exceed 25 s.t.u. unless otherwise permitted by the Division.

62. Use of Explosives.

62.1 When the use of explosives is necessary for the prosecution of the Work, exercise the utmost care not to endanger life or property. The Contractor shall be responsible for any and all damage resulting from the use of explosives.

62.2 Store all explosives in a secure manner, in compliance with all State and local laws and ordinances, and legally mark all such storage places. Storage shall be limited to such quantity as may be needed for the work underway.

62.3 Designate as a "Blasting Area" all sites where electric blasting caps are located and where explosive charges are being placed. Mark all blasting areas with signs as required by law. Place signs as required by law from each end of the blasting area and leave in place while the above conditions prevail. Immediately remove signs after blasting operations or the storage of caps is over.

62.4 Notify each property Owner and public utility company having structures in proximity to the site of the work sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property. Such notice shall not relieve the Contractor of any of his responsibility for damage resulting from his blasting operation. Warn all persons within the danger zone of blasting operations and do not perform blasting work until the area is cleared. Provide sufficient flagmen outside the danger zone to stop all approaching traffic and pedestrians. Provide watchmen during the loading period and until charges have been exploded. Place adequate protective covering over all charges before being exploded.

63. Arbitration by Mutual Agreement.

63.1 All claims, disputes, and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by making an acceptance of final payment as provided in Section 25, may be decided by arbitration if the parties mutually agree. Any agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

63.2 Notice of the request for arbitration shall be filed in writing with the other party to the Contract Documents and a copy shall be filed with the Engineer. Request for arbitration shall in no event be made on any claim, dispute, or other matter in question which would be barred by the applicable statute of limitations.

63.3 The Contractor will carry on the Work and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing.

64. Taxes. The Contractor shall pay all sales, consumer, use, and other similar taxes required by the laws of the place where the Work is performed.

65 Separate Contracts.

65.1 The Owner reserves the right to let other Contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate the Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall inspect

and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.

65.2 The Owner may perform additional Work related to the Project or the Owner may let other Contracts containing provisions similar to these. The Contractor will afford the other Contractors who are parties to such Contracts (or the Owner, if the Owner is performing the additional Work) reasonable opportunity for the introduction and storage of materials and equipment and the execution of the Work, and shall properly connect and coordinate the Work with theirs.

65.3 If the performance of the additional Work by other Contractors or the Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice shall thereof be given to the Contractor prior to starting such additional Work. If the Contractor believes that the performance of such additional Work by the Owner or others involves it in additional expense or entitles it to an extension of the Contract Time, the Contractor may make a claim thereof as provided in Sections 17 and 18.

SPECIAL CONDITIONS

Special Conditions

The following special conditions modify, change, delete, or add to the "General Conditions." Where any part of the General Conditions is modified or voided by these Sections, the unaltered provisions of that part shall remain in effect.

Section No.	Section Title	Page No.	
Index	7. Inspection and Testing of Materials	C-2.2	
Index	14. Inspection	C-2.2	
SC-7	Inspection and Testing of Materials	C-2.2	
SC-10	Surveys	C-2.2	
SC-14.1	Inspection	C-2.2	
SC-17	Extra Work and Change Orders	C-2.2	C-2.3
SC-20.2	Differing Site Conditions	C-2.3	
SC-24	Payments to Contractor	C-2.3	
SC-25.1	Acceptance and Final Payment	C-2.3	
SC-27	Insurance	C-2.4	C-2.6
SC-28	Contract Security	C-2.6	
SC-35	Use of Premises, Removal of Debris, Sanitary Conditions	C-2.6	
SC-36	Quantities of Estimates	C-2.6	C-2.7
SC-52	Project Sign	C-2.7	
SC-59	Laws to be Observed	C-2.7	C-2.8
SC-60.1.f	Permits	C-2.8	
SC-63	Arbitration by Mutual Agreement	C-2.8	
SC-66	Appropriations	C-2.8	
SC-67	Immunity	C-2.8	
SC-68	Confidentiality	C-2.9	

SPECIAL CONDITIONS

Index 7. - Inspection and Testing of Materials

Replace the word “Inspection” with the word “Observation”.

Index 14. - Inspection

Replace the word “Inspection” with the word “Observation”.

SC-7 - Inspection and Testing of Materials

Replace the word “inspection” with the word “observation” as it appears throughout the Section (Section title, 7.1, 7.6 – 2 times and 7.9).

Replace the word “inspector” with the word “Engineer” as it appears in Section 7.6.c.

SC-10 – Surveys

Delete paragraph 10.2 and **Replace** with the following:

10.2 The Engineer will provide baseline and elevation information (x,y coordinates and elevation) to be used for layout. It will be the responsibility of the Contractor to lay out the proposed improvements based on the information provided. It will be the responsibility of the Contractor to set, protect and maintain control points provided by the Engineer. The Contractor shall utilize the base lines and bench marks provided by the Engineer and to set up whatever specific detail controls he may need for establishing location, elevation lines and grades of pipelines and structures. All this work is subject to checking, approval, and surveillance by the Engineer. The Contractor shall provide the Engineer with a qualified man or men to assist in this checking as needed and on request of the Engineer.

Delete paragraph 10.3 and **Replace** with the following:

10.3 For construction other than pipelines and appurtenances in roadways and cross country, the Contractor shall be responsible for the location and setting lines and grades.

Add the following paragraph:

10.5 The Contractor shall be responsible for the construction survey layout and as-built survey of the constructed pipeline, including GIS coordinates and elevations along the pipeline, coordinates of pipe fittings and changes in pipe slope.

SC-14.1 - Inspection

Replace the word “inspection” with the word “observation” as it appears throughout the Section (Section title and 14.1).

SC-17 - Extra Work and Change Orders

Insert the following to Article 17.2:

a. Rentals of all construction equipment and machinery, and the parts thereof in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

b. Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the "Rental Rate Blue Book" latest edition. The Contractor shall supply a copy of the book with the claim. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than $1,000 will be considered small tools.

SC-20.2 - Differing Site Conditions

Delete paragraph 20.2 in its entirety. **Replace** with the following:

The Engineer shall promptly investigate the conditions. If he or she finds that conditions differ materially and will cause an increase or decrease in the Contractor's cost or the time required to perform any part of the work under this Contract whether or not changed as a result of such conditions, the Engineer will notify the Owner and recommend an equitable adjustment. Contractor and Owner will enter into negotiations to modify the Contract in writing.

SC-24 – Payments to Contractor

Delete the following sentence from Paragraph 24.2.a:

"The account will be established such that the interest on the principal will be paid to the Contractor".

Add Paragraph 24.7 as follows:

"24.7 The Contractor shall furnish the Owner with lien waivers from subcontractors and suppliers as evidence that all claims of the nature described in Paragraph 24.5 have been paid, discharged, or waived."

SC-25.1 - Acceptance and Final Payment

Insert the following to Article 25.1:

e. Work required to be performed prior to Substantial Completion includes:
- Concrete support pedestal, steel tank, connecting water mains, and appurtenances installed and tested satisfactorily and available for use by the Owner.
- HVAC, plumbing, electrical and SCADA systems installed and tested satisfactorily and available for use by the Owner.
- Site work including drainage and paving base course placed.
- Training provided to Owner's personnel in operation and maintenance of equipment, including pumps, HVAC, electrical and SCADA systems.
- Manuals provided.
- Record information provided including GPS coordinates and elevations for as-built pipes and fittings and valves and structures.
- Water and sewer services complete and tested.

f. The guarantee period shall extend one year from substantial completion and shall include a minimum 2% retainage.

SC-27 - Insurance

Under 27.1, the limits should be:

Limits of Liability:

$500,000 each accident;
$500,000 disease - policy limit;
$500,000 disease - each employee.

Revise the "Limits of Liability" under Article 27.2 to read:

Limits of liability:

$500,000 each person/$2,000,000 each occurrence bodily injury
$1,000,000 each occurrence/$2,000,000 aggregate property damage;
$2,000,000 general aggregate - include per project aggregate endorsement;
$2,000,000 products/completed operations aggregate, including extended term to be carried for one (1) year beyond the date of completion of the work.

Add the following to Article 27.2:

Coverage amounts may be satisfied by excess or umbrella policies provided the Owner is listed as an additional insured on the excess/umbrella policy as well as the general liability policy.

The Owner, Engineer, and Engineer's Subconsultants shall be named as additional insured on the Contractor's Commercial General Liability insurance policy.

Revise the "Limits of Liability" under Article 27.3 to read:

Limits of liability:

Bodily Injury – Each Person $500,000 / Each Occurrence $2,000,000
Property Damages – Each Occurrence $200,000 / Aggregate $200,000

Add the following to Article 27.3:

Coverage amounts may be satisfied by excess or umbrella policies provided the Owner is listed as an additional insured on the excess/umbrella policy as well as the general liability policy.

The Owner shall be named as additional insured on this policy.

Change the following in Article 27.6:

The second sentence shall read: "Such insurance shall not be cancelled or materially altered, except after 30 days written notice has been received by the Owner and the Engineer."

Insert the following in Article 27.7:

a Installation Floater: For construction projects to which a "Builder's Risk" type of insurance is not applicable, the Contractor shall purchase and maintain an "Installation

Floater" in an amount not less than the value of materials for the project covered under the policy.

b Be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than caused by flood), and such other perils or causes of loss as may be specifically required herein;

c At a minimum, the following should be named as additional insured:
(1). City of Dover, New Hampshire
(2). Underwood Engineers, Inc.

Revise the "Limits of Liability" under Article 27.8 to read:

Limits of liability:

$1,000,000 each occurrence;
$2,000,000 aggregate (for bodily injury and property damage).

Insert the following to Article 27.8:

Underwood Engineers, Inc., the Engineer and Engineer's Subcontractors shall be named as Additional Insured on the Owners policy provided by the Contractor.

Insert the following after Article 27.8:

27.9.1 Waiver of Rights: Owner and Contractor waive all rights against each other for all losses and damages caused by any of the perils covered by the policies of insurance provided in response to Paragraphs 27.2, 27.3 and 27.8 and any other property insurance applicable to the Work, and also waive all such rights against Subcontractors, Engineer, Engineer's consultants and all other parties named as insureds in such policies for losses and damages so caused. As required by Paragraph 27.4 each subcontract between Contractor and a Subcontractor will contain similar waiver provisions by the Subcontractor in favor of Owner, Contractor, Engineer, Engineer's consultants and all other parties named as insureds. None of the above waivers shall extend the rights that any of the insured parties may have to proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.

27.9.2 Policy Provisions: OWNER and CONTRACTOR intend that any policies provided in response to Paragraphs 27.2 and 27.7 shall protect all of the parties insured and provide primary coverage for all losses and damages caused by the perils covered thereby. Accordingly, all such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any of the parties named as insureds or additional insureds, and if the insurers require separate waiver forms to be signed by the ENGINEER or ENGINEER's consultant OWNER will obtain the same, and if such waiver forms are required of any Subcontractor, Contractor will obtain the same.

Insert the following after Article 27.9.2:

27.10 Certificates of Insurance

a. Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

b. Failure of Owner to demand such certificates or other evidence of full compliance with these insurance requirements or failure of Owner to identify a deficiency from evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

c. By requiring such insurance and insurance limits herein, Owner does not represent that coverage and limits will necessarily be adequate to protect Contractor and such coverage and limits shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

Add the following after Paragraph 27.9 of the General Conditions:

"27.10 Umbrella or excess liability: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies."

SC-28 - Contract Security

Insert the following paragraph to Article 28 of the General Conditions:

The payment bond and performance bond furnished by the contractor shall be in the form of the bonds shown on Page B-3.1 and B-3.2 and B-4.1 and 4.2, unless approved otherwise by the engineer.

The terms contained in the performance bond shall in no way invalidate the provisions of the contract documents or the right of the owner to terminate the contract as specified therein.

SC-35 - Use of Premises, Removal of Debris, Sanitary Conditions

Insert the words "and potable water" after the word "toilet" and before the word "accommodations"

Insert the words ", subcontractors and Engineer" after the words "use of his employees" and before the words "as may be necessary"

SC-36 - Quantities of Estimate

Delete Article 36 and **Replace** it with the following:

36. Quantities of Estimate

SPECIAL CONDITIONS

36.1 Wherever the estimated quantities of work to be done and materials to be furnished under this contract are shown in any of the documents including the proposal, they are given for use in comparing bids and the right is specifically reserved except as herein otherwise specifically limited, to increase or decrease them as may be deemed reasonably necessary by the Owner to complete the work contemplated by this contract, and such increase or decrease shall in no way invalidate this contract, nor shall any such increase or decrease give cause for claims or liability for damages.

36.2 Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

36.3 Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 21:

a. If the Bid price of a particular item of Unit Price Work amounts to more than 5 percent of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement, and there is no corresponding adjustment with respect to any other item of Work; and

b. The Contractor believes that they are entitled to an increase in Contract Price as a result of having incurred additional expense, and the additional expense is documented by the Contractor, or Owner believes that Owner is entitled to a decrease in Unit Contract Price as a result of extra work requested by the Engineer in accordance with Article 17.

SC-52 - Project Sign

Insert the following:

See specification Section 01580 for Project Sign detail.

SC-59 - Laws to be Observed

Insert the following to 29.1:

This Contract shall be interpreted as a City of Dover, New Hampshire, Contract and in accordance with the ordinances of the City of Dover, New Hampshire.

Add ", defend (with counsel acceptable to the Owner)" to the first sentence in Paragraph 59.2 after the words "The Contractor will indemnify".

Add "or in relation to" after the words "arising out of" to the first sentence in Paragraph 59.2.

Add the following after Paragraph 59.2 concerning Indemnification.

"In consideration of the utilization of Contractor's services by the City of Dover and other valuable consideration, the receipt of which is hereby acknowledged, Contractor agrees that all persons furnished by Contractor shall be considered the Contractor's employees or agents and that Contractor shall be responsible for payment of all unemployment, social

security and other payroll taxes including contributions from them when required by law. CONTRACTOR, hereby agrees to protect, indemnify, and hold the City of Dover and its employees, agents, officers, consultants, and servants free and harmless from any and all losses, claims, liens, demands and causes of action of every kind and character including but not limited to, the amounts of judgements, penalties, interests, court costs, legal fees and all other expenses incurred by the City arising in favor of any party, including claims, liens, debts, personal injuries, including employees of the City, death or damages to property (including property of the City) and without limitation by enumeration, all other claims or demands of every character occurring or in any way incident to, in connection with or arising directly or indirectly out of this Contractor Agreement. CONTRACTOR agrees to investigate, handle, respond to, provide defense for and defend any such claims, demands, or suits at the sole expense of the CONTRACTOR. CONTRACTOR also agrees to bear all other costs and expenses related thereto, even if the claim or claims alleged are groundless, false or fraudulent. This provision is not intended to create any cause of action in favor of any third party against CONTRACTOR or the City or to enlarge in any way the CONTRACTOR's liability but is intended solely to provide for indemnification of the City from liability for damages or injuries to third persons or property arising from CONTRACTOR's performance hereunder."

Add Paragraph 59.3 as follows:

"The parties agree that this Agreement is entered into in New Hampshire, and that interpretation and administration of this Agreement and all Contract Documents are governed exclusively by the laws of the State of New Hampshire. The parties also consent and agree to personal jurisdiction in New Hampshire and further that the exclusive venue for any dispute is the New Hampshire Strafford County Superior Court."

SC-60.1.f – Permits

Insert the following:

See section 01010 Summary of Work for additional permits.

SC-63 – Arbitration by Mutual Agreement

Delete this paragraph in its entirety.

SC-66 – Appropriations

Add new General Condition for Appropriations as follows:

"**66 Appropriations**

66.1 The continuation of the Agreement is contingent upon the appropriation of funds. All obligations of the City of Dover stated in this agreement, including, but not limited to, the continuance of payments hereunder, are contingent upon the availability and continued appropriation of funds by the Dover City Council and in no event will the City of Dover be liable for any payments or obligation hereunder in excess of such appropriated funds. The City of Dover shall not be required to transfer funds from any other account to satisfy payments hereunder. Vendor will have the right to terminate this agreement immediately upon receiving notice of such termination due to the non-appropriation of funds."

SPECIAL CONDITIONS

SC-67 – Immunity

Add new General Condition for Immunity as follows:

"**67 Immunity**

67.1 Nothing within this Agreement shall be deemed to constitute a waiver of any immunity of the City of Dover, which immunities are hereby reserved to the City of Dover. This covenant shall survive the termination of this contract's conclusion."

SC-68 – Confidentiality

Add new General Condition for Confidentiality as follows:

"**68 Confidentiality**

68.1 Confidentiality of any and all information/data held by the City of Dover under or related to this Agreement shall be governed by New Hampshire RSA Chapter 91-A."

2021

Section E: Technical Specifications

Scope of Work

The scope of this Division covers the General Administrative Requirements and the general work related provisions of the Construction Contract.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division

Section No.	Section Title
01000	Prosecution of Work
01010	Summary of Work
01019	Dig-Safe
01020	Coordination
01025	Measurement and Payment
01045	Cutting and Patching
01070	Abbreviations and Symbols
01090	Reference Standards
01200	Project Meetings
01201	Preconstruction Meeting
01310	Construction Schedules
01340	Submittals
01350	Groundwater Protection Plan
01380	Construction Photographs
01400	Construction Quality Control
01510	Temporary Utilities
01540	Security
01562	Dust Control
01580	Project Identification
01590	Temporary Field Office
01611	Owner’s Right to Materials
01630	Substitution and Product Options
01701	Project Closeout Procedures
01710	Project Cleaning
01720	Project Record Documents
01730	Operation and Maintenance Manuals
01800	Equipment, Startup, Certification and Operator Training

SECTION 01000

PROSECUTION OF WORK

INTRODUCTION

This section is intended as a summary of the Contract Documents. The information is provided for convenience only and is not a comprehensive list of all Project requirements. The Prosecution of Work shall be used together with the rest of the Project Manual and the Drawings.

1. DESCRIPTION OF WORK (refer to Section 01010)

This construction contract includes, but is not limited to, the following:

Base Bid (Schedule 1 and Schedule 2):

- New 1.0 MG composite elevated tank including process piping, plumbing, HVAC, instrumentation and electrical systems.
- Heated Control Room in tank pedestal.
- Site improvements including yard piping, driveway, grading, drainage, fencing.
- Electrical and SCADA connections to existing Smith/Cummings well house.
- New 2,370 LF of 16" DI finished water main and water services on Smith Well Road.
- Reclaim, grading, paving and restoration.

Add/Deducts:

- New 1,800 LF of 20" HDPE finished water main.

Add-Alts:

- Minor drainage replacements.
- Sewer relocation including sewer services.
- New 1,710 LF of 12" DI raw water main.
- Water Main connection to Webb Place/High Pressure Zone (North End Pressure Zone).
- Booster Pump Station.
- Segmented Circular Stairs in pedestal.

2. EXCAVATIONS

Excavations adjacent to the traveled way or shoulders shall not remain open through non-work hours unless adequately protected by temporary traffic control barriers (at the Contractor's expense and specifically authorized by the Owner's representative). Pedestrian access shall also be protected.

3. SCHEDULE OF WORK

Prior to the start of any work, the Contractor shall submit for approval a proposed work schedule. Schedule updates or alterations shall be presented at regular progress meetings.

4. CONSTRUCTION LAYOUT

The Engineer will provide baseline and elevation information (x,y,z) to be used for layout. These points are shown on the plans. No additional points will be provided. It will be the responsibility of the Contractor to lay out the proposed improvements based on the information provided. It will be the responsibility of the Contractor to protect and maintain control points identified by the Engineer. The Engineer will review layout but not establish layout.

The Contractor shall engage survey services as required for setting layout and control.

5. FIELD TESTING

Field testing includes geotechnical and structural testing as specified for quality control during construction.

The Owner will engage the testing agency and pay associated fees to conduct tests and perform other services specified for quality control during construction. The Contractor shall coordinate with the testing agency to permit the testing agency to be on-site in a timely manner. The Contractor shall communicate directly with the testing agency to coordinate the testing agency's presence on the project site when needed.

6. WATER SYSTEM COORDINATION AND CONSTRUCTION PHASING

Water Supply

The existing raw water main in the project area is used to supply water from the Willand Pond wells and Smith and Cummings wells to the Lowell Avenue Water Treatment Plant. Normally the plant runs continuously.

The raw water main shall remain in service at all times between June and September unless otherwise approved by the Owner. The main may be taken out of service in the winter months from October to May with advance permission from the Owner for up to 30 days.

The time the raw water main is out of service shall be minimized. If the raw water main replacement Add-Alt B included, the new main shall be constructed to the extent practical before taking the existing main out of service to make final connections.

Distribution System / Water Mains

Test pits are necessary to locate existing water mains at tie in locations and other utilities.

The Contractor shall not operate any existing water valves without permission of the City. All such operations shall be coordinated with and performed by the City. The final position of all new and existing valves in the project area shall be verified by the Contractor and witnessed by the Owner prior to Substantial Completion.

Other

The City will provide water in sufficient quantity to disinfect and test new water main, the new tank and equipment in accordance with these Specifications. The Contractor shall be responsible for providing water for all other uses including but not limited to cleaning, operating equipment, dust control.

Connections

Tie-ins to existing water mains (Glenwood Avenue, Barry Street and Webb Place) shall require advance permission from the City. The duration of temporary shutdowns shall be minimized and may be required to be at night per the City at no additional cost.

7. ADDITIONAL UTILITY COORDINATION (POWER, TELEPHONE, CABLE, NATURAL GAS)

The Contractor is responsible to coordinate with utility companies. Utilities – in addition to water, sewer, and drainage – in the project area may include Eversource (power), Spectrum (telephone), Comcast (cable), and Unitil (natural gas).

The location of underground wires and cables shown on the Drawings is based on information available at the time of bidding. The Contractor is responsible to protect all utilities within the project area.

The Contractor is responsible to stabilize/protect utility poles within the project area as necessary during construction. Fees charged by the utility to hold poles shall be paid by the Contractor.

Fees, if any, charged by the utilities for permanent services will be paid out of the Utility Allowance bid item. Utility costs for temporary services required or requested by the Contractor during the prosecution of the work shall be the responsibility of the Contractor. The Contractor is responsible to perform all work not performed by the utility, including by not limited to, excavation and backfill, and furnishing and installing conduit and electrical gear as required by applicable codes and the utility.

The Contractor shall be responsible for utility fees associated with new equipment until acceptance by the Owner through the Substantial Completion process.

8. BURIED UTILITIES

The Contractor is responsible for contacting Dig Safe. Underground electric and telecommunication lines may exist within the project area. Not all potential conflicts with these or other utilities may be identified on the plans. The Contractor may need to conduct exploratory excavations where there is a potential for utility conflicts, and coordinate removal, relocation or replacement of utilities with the respective utility company, prior to proceeding with the work.

9. SCADA INTEGRATION

SCADA programming and communications shall be completed by the Contractor's SCADA hardware/software integrator, under contract with the Contractor and shall be paid under lump sum Item 1. The SCADA hardware/software integrator shall be approved by the Owner per Section 13360. Contractor is responsible for coordination of all SCADA work with the City's IT Technician and existing SCADA infrastructure.

10. ROADWAY RECONSTRUCTION AND REPAIRS

A new gravel drive from Webb Place to the tank is shown on drawings (see Limit of Work for Base Bid and Alternates). Pavement is provided under Add-Alt., except the paved drive at the tank site is included in the Base Bid. Unit price items are provided in the Bid Schedule for select gravels and paving. All site work required for construction at the tank site (Base Bid) where a unit price item is not provided including excavation, grading and others is incidental to Lump Sum item 1.

Pavement repairs on Smith Well Road shall be reclamation with new full width courses unless noted otherwise on the drawings. Pavement repair shall be paid for under bid items provided for pavement. Existing structures shall be adjusted as necessary at no additional cost.

11. ACCESS ROADS

Improvements to existing gravel access roads and site grading necessary to accomplish the work shall be at no additional cost to the Owner. The Contractor shall restore the roads to equal or better condition following construction at no additional cost, unless directed by the Owner to make additional improvements

The Contractor shall maintain access to active facilities (Smith/Cummings Wells) with adequate space for delivery vehicles to turn around.

12. REFLECTIVE PAVEMENT MARKINGS

The Contractor shall furnish and install all reflective pavement markings where impacted, at no additional cost to the Owner.

13. COORDINATION MEETINGS (refer to Section 01200)

A. Preconstruction Meeting – A preconstruction meeting shall be held prior to the start of construction. The meeting shall be attended by the Contractor, Owner, Engineer, regulatory officials, funding agency officials, and subcontractors as appropriate. The Contractor shall provide a proposed schedule for construction and schedule of values for payment for approval by the Engineer **prior to** the meeting. Agenda items shall include but not be limited to:

- Scheduling and sequencing.
- Special requirements during construction.
- Access and traffic control.
- Safety.
- Any specific scheduling or coordination efforts needed for Contractor's Operations to minimize impacts to the Owner and residents.
- Procedures for tracking and addressing complaints.
- Funding agency requirements.

B. Monthly meetings are anticipated with Owner's Representatives, Contractor, sub-contractors and regulatory officials, as necessary to discuss the following. Frequency of meetings may be increased during critical project phases.

- Coordination of work.
- Project issues.
- Schedules.
- Traffic control.
- Complaints.
- Maintenance of work areas.
- Payment, measurement of unit items and documentation of changes in work.

The above list is not all-inclusive; therefore, these and any other matters may be discussed during these meetings for the betterment of the project.

14. DEWATERING AND SHORING (refer to Sections 02402 and 02650)

The Contractor's attention is directed to the provisions of Sections 02402 and 02650 of the Project Manual. Site dewatering is anticipated during construction of the improvements. As noted in the Geotechnical Report (project manual appendix), dewatering efforts may be required. The Contractor shall prepare and submit for review and approval by the Owner and Engineer a **Dewatering Plan** to include shoring design, method of removing water from excavations, method of transporting water from the site, discharge location, method to remove sediment from the collected water, method to preserve downgradient natural resources and property. The shoring design (if required) shall be sealed by a Professional Engineer licensed in the State of New Hampshire. The Contractor shall install observation wells and/or piezometers to measure groundwater levels during construction. Implementation of the Dewatering Plan is incidental to the lump sum bid item and shall be at no additional cost to the Owner.

The Contractor shall comply with the Environmental Protection Agency's (EPA) National Pollutant Discharge Elimination System (NPDES) General Permit for Construction Dewatering

before proceeding with the work. The Contractor is responsible for all application fees. Appropriate sediment and erosion controls (see below) shall be operational prior to commencing trench and/or structure de-watering operations.

15. EROSION CONTROL (refer to Section 02540)

The Contractor's attention is directed to the provisions of Section 02540 of the Project Manual. The Contractor shall install erosion control measures in accordance with the construction sequencing outlined on the project plans. Spillage, sediment, turbidity, or pollution into the waterways or adjacent properties around the project area shall be prevented.

EPA Forms and Requirements

A Storm Water Pollution Prevention Plan (SWPPP) will be required. The Contractor will be responsible for filing the Notice of Intent (NOI) and maintaining the SWPPP onsite at all times. The NOI must be submitted to the EPA at least seven (7) days prior to the start of construction. The SWPPP must be in place prior to submittal of the NOI.

The Contractor must submit the SWPPP to the Engineer for review within two (2) weeks of Notice to Proceed.

The SWPPP may be amended as necessary to provide continued erosion and sediment control, throughout the project. Appropriate measures shall be implemented to prevent sedimentation migration resulting from the Contractor's construction operations.

The Contractor shall be responsible for all sampling and analysis required by the CGP and for any costs thereof.

In summary, erosion control and dewatering submittals include but are not limited to:

- **SWPPP.**
- **NOI.**
- **Dewatering Plan, including shoring design where required.**
- **SWPPP inspection reports, at required frequency.**

16. GROUNDWATER PROTECTION PLAN

The Contractor's attention is directed to the provisions of Section 01350 of the Project Manual. The Contractor shall exercise caution to minimize the intrusion of any spillage, sediment, turbidity, or pollution within the protected well radius. Sediment and erosion controls shall be operational prior to commencing any site work operations.

A Groundwater Protection Plan (GPP) shall be submitted by the Contractor for approval before proceeding with the work. The GPP shall be amended as necessary to provide continued protection to the well radius throughout the project.

The Contractor will require all subcontractors to read the GPP and fill out the form of acknowledgement included in Section 01350.

If granular material is required to be imported, only virgin material shall be allowed within 400-foot well sanitary protective radii to reduce the risk of groundwater contamination.

17. CITY TRENCH RULES AND REGULATIONS

A copy of the "Trench Rules and Regulations for the City of Dover, New Hampshire" is provided in the Appendix for information. Should discrepancies occur between the City's Trench Rules and these Specifications or the Construction Drawings, the Specifications and Drawings will take precedence. The City will waive the deposit and inspection fee.

18. GEOTECHNICAL INFORMATION

To assist the Contractor in preparing a bid, borings logs, groundwater readings, and a geotechnical report are included in Appendix A of the Project Manual.

The Contractor is responsible for all temporary excavation lateral support and construction dewatering as needed to complete construction.

If shoring such as driven sheet piles is needed, the design of such support systems shall be by a licensed NH Professional Engineer hired by the contractor at no additional cost to the owner.

19. DUST CONTROL

The Contractor is required to use a mechanically enclosed street sweeper on paved surfaces when necessary to control dust. Water and/or Calcium Chloride is required on unpaved surfaces to control dust. Dust Control is subsidiary to the work and will not be measured for payment. **Calcium Chloride is prohibited in the 400 foot well protective radius.**

20. TIME OF WORK

Paving shall be done within the dates of April 15 to November 15.

It is anticipated that the Work will be completed during daylight hours unless specifically noted otherwise.

- Allowable work days and hours shall be as follows:
    - Monday through Friday: 7:00 AM – 5:00 PM
    - Saturday and Sunday No work allowed.
    - Recognized Federal Holidays No work allowed.

Requests to perform work on nights, weekends, or holidays must be submitted and approved by the Owner's Representative 2 weeks prior to the anticipated construction operations. Additional costs associated with night time or weekend operations will be at the Contractor's expense

21. STAGING AREAS

The Contractor is required to locate and secure all staging and material storage areas. Staging areas may be located on City property in coordination with the Owner. Staging and storage areas must remain outside of the wetland areas. Storage of hazardous materials within the protective radius of the Wells is prohibited. Staging and storage areas must be secured by the Contractor with appropriate erosion and sediment control measures.

Location of the staging and storage areas and the erosion and sediment controls must be addressed in the Groundwater Protection Plan (see Section 01350).

At the completion of work, the property shall be restored to its pre-existing condition or otherwise improved as shown on the drawings.

22. EASEMENTS

No easements are anticipated for this project; all work is expected to occur within City rights-of-way or on City-owned property.

23. CONTRACT TIME AND SUBSTANTIAL COMPLETION:

Completion time for the project is calculated as calendar days from the Notice to Proceed as 560 calendar days to Substantial Completion and 600 days to Final Completion.

Work required to be performed prior to Substantial Completion includes:

- Concrete support pedestal, steel tank, connecting water mains, and appurtenances installed and tested satisfactorily and available for use by the Owner.
- HVAC, plumbing, electrical and SCADA systems installed and tested satisfactorily and available for use by the Owner.
- Site work including drainage and paving base course placed.
- Training provided to Owner's personnel in operation and maintenance of equipment, including pumps, HVAC, electrical and SCADA systems.
- Manuals provided.
- Record information provided including GPS coordinates and elevations for as-built pipes and fittings and valves and structures.
- Water and sewer services complete and tested.

The time to Substantial Completion shall continue through winter without stopping, assuming two construction seasons. The time between Substantial Completion and Final Completion is intended for completion of punch list items, final paving, and restoration. Requests for a shutdown or extension of contract time must be submitted to the Owner and Engineer for approval.

24. PIPE LAYOUT AND SUPPORT

The Contractor shall submit detailed process piping drawings for interior piping systems to the Engineer. The submittals shall indicate exact layout lengths, sizes, quantities, and locations of pipe, valves, and fittings. The contractor shall verify all equipment, valves, connections, and dimensions.

The contractor shall develop a detailed pipe support system per Section 15094. The design shall include piping for the inlet/outlet, pump station, and overflow.

25. AS-BUILT SURVEY AND RECORD INFORMATION (refer to Section 01720)

As-built survey information shall be provided by the Contractor to the Engineer (in an acceptable format, in both AutoCAD and hard copy). The Contractor shall record the horizontal and vertical location of the installed pipeline on a daily basis. As-built survey information shall include:

- GPS coordinates of the installed pipe locations
- Elevation of the pipe line as installed
- GPS coordinates and elevations of changes in slope and/or alignment
- Elevation and designation of utilities at crossings
- Final centerline and gutter lines of road reconstruction areas and where grading has changed from existing
- Final location of buildings and wells
- Changes to location of mechanical equipment from that shown on the plan sheets
- Paving repairs and restoration limits
- GPS coordinates and/or field ties to yard piping, transmission main fittings, bends, structures and gate valves
- GPS coordinates and/or field ties to any changes in materials

The Contractor shall designate personnel who will be responsible for layout, measurements, and as-built survey for the entire project. The Contractor shall submit copies of Field Engineering Survey to the Engineer for review on a monthly basis. Plan information provided shall be the same scale and datum as the design drawings.

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK UNDER THIS CONTRACT

A. Work to be completed includes but is not limited to:
   1. All construction as indicated in the Drawings (see Section 01000 "Prosecution of Work" for description).
   2. Complete restoration of all properties and structures both public and private.

1.2 CONTRACTOR'S RESPONSIBILITIES

A. The General Contractor shall have the following responsibilities:
   1. Complete this construction project in accordance with the bid documents within the allotted time schedule and maintain the required warranties.
   2. Furnish all labor, materials, equipment and incidentals required to complete all work in accordance with the bid documents within the allotted time schedule and maintain required warranties.
   3. Coordinate with the City of Dover, and other utilities, as required. Secure or work within the limits of any required permits.
   4. Perform all work on Owner's property or limits of easements as shown on the drawings unless written authorization is provided for further occupation of private properties.
   5. Throughout the entire construction project the Contractor shall be responsible for all security and protection against vandalism. All losses incurred due to vandalism are to be reimbursed by the Contractor or Contractor's insurance.
   6. Coordinate activities involving other utilities with the respective utility company.
   7. The work also includes but is not limited to furnishing all materials, labor and equipment to perform the following activities:
      a. Preparation and submittal of contract specified submittals.
      b. Testing of materials as specified herein.
      c. Project meetings.
      d. Dust control.
      e. Temporary utilities (electrical, heating, drinking water, and sanitary accommodations).
      f. Temporary field office.
      g. Traffic and pedestrian control.
      h. Stormwater Pollution Prevention Plan (SWPPP) and Notice of Intent (NOI).
      i. Pre-Construction videos.
      j. Public information, including meetings.
      k. Project sign.
      l. Training and startup.

m. Project closeout.
n. Project cleaning.
o. Project record documents.
p. Operation and Maintenance manuals.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

3.1 WORK SEQUENCE

A. It is the intention that work required to be completed under this contract be performed in an organized and workmanlike manner. Construction areas shall be restored as soon as practical in an effort to minimize disturbance to private and public property. Contractor shall be held responsible for scheduling work to meet these objectives.

B. Proposed test pits, as shown on the Drawings or as directed by the Engineer, shall be excavated in the presence of the Engineer. Test pits shall be excavated prior to the start of work so that adequate time is allowed to address any required field changes and to allow for sufficient material lead-time.

3.2 SPECIAL REQUIREMENTS

A. Contractor shall maintain existing utilities to all existing users at all times. Exceptions will be considered; however, the service interruption shall not exceed 4 hours.

B. Where possible the Contractor shall maintain access to all properties during construction.

C. Contractor shall maintain repair parts on-site for emergency repair of water system, sewer system, drain lines, etc.

D. No work shall be performed and no disturbance shall occur within wetland areas.

E. Areas of work on some sites will be performed within the protective sanitary radius of the water supply from wells; therefore, extreme care shall be taken when working with chemicals and construction equipment. See Section 01350 for additional requirements.

3.3 PERMITS, APPROVALS, EASEMENTS

A. NHDES Design Approval:
Owner's responsibility
Regulatory Authority: NHDES Drinking Water and Groundwater Bureau

B. Construction General Permit (including Stormwater Pollution Prevention Plan (SWPPP) and Notice of Intent (NOI)):
Contractor's responsibility; coordinate with Owner to file NOI. Submit SWPPP to Engineer for approval.
Regulatory Authority: USEPA

C. Construction General Permit for Construction Dewatering (including Notice of Intent (NOI)):
Contractor's responsibility

Regulatory Authority: USEPA

D. Excavation Permit:
   Contractor's responsibility
   Regulatory Authority: City of Dover

E. Building Permits (including but limited to building, electrical, plumbing):
   Contractor's Responsibility (fee waived)
   Regulatory Authority: City of Dover.

F. Groundwater Discharge Registration:
   Owner's Responsibility
   Regulatory Authority: NHDES

END OF SECTION

SECTION 01019

DIG-SAFE

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Contractor shall contact Dig-Safe, local public works and water and sewer authorities, and other utilities who are not members of Dig-Safe prior to performing any underground work.
   2. Meet all requirements, regulations, and laws concerning layout, notification, excavation, demolition, and explosive work.
   3. Meet the requirements of RSA 374:55.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

3.1 DIG-SAFE

A. Mark-out all locations where underground work will be performed prior to contacting the local Dig-Safe office.

B. Contact the local Dig-Safe office a minimum of 72 hours prior to, but no more than 30 days before any underground work on public or private property is performed.

C. The local Dig-Safe office is at 11 Upton Drive, Wilmington, MA 01887. Their telephone number is 1-888-344-7233.

D. The Contractor shall maintain the Dig-Safe ticket at the job site at all times. The ticket number shall be forwarded to the Owner and Engineer.

E. The Contractor shall call to renew the Dig-Safe ticket in accordance with Dig-Sage requirements throughout the duration of the underground work.

3.2 OTHER AUTHORITIES

A. The Contractor shall also contact the New Hampshire Public Utilities Commission in accordance with RSA 374:55 and local water and sewer authorities.

B. These contacts shall also be made within the minimum and maximum notice periods as noted above for Dig-Safe.

C. No underground work shall be performed before the water, sewer, and drain lines have been marked out.

3.3 EXCAVATION

A. Although utilities have been marked, the Contractor shall take precautions not to damage them during execution of the work. If the markings will knowingly become damaged during execution of the work, the Contractor shall take ties or place offsets to the marks before the marks become damaged.

B. The Contractor shall maintain the marks and/or offsets for the duration of the project. Costs for remarking shall be paid by the Contractor at no cost to the Owner.

END OF SECTION

SECTION 01020

COORDINATION

PART 1 -- GENERAL

1.1 DESCRIPTION

A. The Owner will be responsible for the operation of all existing facilities and any new facilities accepted during the construction period.

B. The Contractor shall notify the Engineer in writing when, in his opinion, a portion of the construction is ready to be accepted by the Owner. After inspection of the work the Engineer will either recommend that the Owner accept the portion of construction or shall identify remedial work needed to be performed by the Contractor.

C. These responsibilities of the Owner shall include the cost of all labor and utilities after acceptance. Prior to acceptance by the Owner, all costs shall be the responsibility of the Contractor.

D. All damage to existing or accepted equipment or structures, as a result of the Contractor's or his Subcontractor's operations shall be paid by the Contractor at no additional cost to the Owner.

E. All damage to existing structures, as a result of digging test pits, shall be paid by the Contractor. All materials shall be the responsibility of the Contractor.

F. All materials shall be the responsibility of the Contractor.

G. The Contractor will be responsible for State, Federal and local permits where applicable.

H. Coordinate activities involving other utilities with the respective utility owners.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 -- GENERAL

1.1 DESCRIPTION

A. For all items other than those to be paid for by lump sum amounts, after the work is completed and before final payment is made therefore, the Owner's resident Project Representative (RPR) shall make final measurements to determine the quantities of various items of work accepted as the basis for final settlement. The Contractor, in case of unit price items, will be paid for the actual amount of work accepted and for the actual amount of materials in place, as shown by the final measurements.

B. All units of measurement shall be standard United States convention as applied to the specific items of work by tradition and as interpreted by the Engineer.

C. **At the end of each day's work**, the Contractor's Superintendent or other authorized representative of the Contractor shall meet with the Owner's RPR and determine and agree upon the quantities of unit price work accomplished and/or completed during the work day.

D. The RPR will then prepare a **"Field Report" which shall be signed by both the RPR and Contractor's Representative** indicating complete agreement and approval of the quantities listed.

E. Once each month the RPR will prepare a "Monthly Progress Summation" form from the month's accumulation of "Field Report" which shall also be signed by both the RPR and Contractor's Representative indicating complete agreement and approval of quantities listed.

F. These completed forms will provide the basis of the Engineer's monthly quantity estimate upon which payment will be made. Items not appearing on both the Field Report and Monthly Progress Summation will not be included for payment. Items appearing on forms not properly signed by the Contractor will not be included for payment.

G. Samples of the above referenced forms are included at the end of this section of the Specifications.

H. The Contractor shall submit a cost breakdown of all lump sum items for payment purposes. This cost breakdown shall be submitted prior to contract signing and shall be approved by the Engineer.

1.2 SCOPE OF PAYMENT

A. Payments to the Contractor will be made for the actual quantities of contract items performed and accepted in accordance with the plans and specifications. Upon completion of the construction, if these actual quantities show either an increase or decrease from the quantities given in the Bid (form), the contract unit prices will still prevail, unless stated otherwise in the general conditions.

B. The Contractor shall accept compensation, as herein provided, in full payment for furnishing all materials, labor, tools, equipment and incidentals necessary to complete

the work and for performing all work included in the contract; for all loss or damage arising from the nature of the work, or from the action of the elements; or from any unforeseen difficulties which may be encountered during the prosecution of the work and until its final acceptance by the Engineer; and for all risks of every description connected with the prosecution of the work, except as provided herein, also for all expenses incurred in consequence of the suspension of the work as herein authorized.

C. The payment of any partial estimate or of any retained percentage except by and under the approved final invoice, in no way shall affect the obligation of the Contractor to repair or renew any defective parts of the construction or to be responsible for damage due to such defects.

1.3 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

A. When alterations in the quantities of work not requiring change orders are ordered and performed, the Contractor shall accept payment in full at the Contract price for the actual quantities of work done. No allowance will be made for anticipated profits. Increased or decreased work involving change orders will be paid for as stipulated in such change orders.

1.4 ELIMINATED ITEMS

A. Should any items contained in the Bid (form) be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items from the Contract, and such action shall in no way invalidate the Contract, and no allowance will be made for items so eliminated in making final payment to the Contractor.

1.5 PARTIAL PAYMENTS

A. Partial payments shall be made monthly as the work progresses. All partial payments and payments shall be subject to correction in the final quantity invoice and payment.

B. No monthly payment shall be required to be made when, in the judgment of the Engineer, the work is not proceeding in accordance with the provisions of the contract, or when, in his judgment, the total value of the work done since the last payment amounts to less than $1,000.00.

C. The partial payments will be based upon invoices prepared by the Engineer of the value of the work performed, and materials complete in place in accordance with the contract. Retainage shall be as specified in the General Conditions as modified by the Supplemental General Conditions. The Owner shall pay the Contractor within the time period specified in the General Conditions.

1.6 PAYMENT FOR MATERIAL DELIVERED

A. At the discretion of the Owner, the Engineer may act upon the request of the Contractor, prepare an invoice, accompanied by receipted bills for payment of all or part of the value of acceptable, non-perishable materials and equipment which are to be incorporated into the work, and which have been delivered to the site of the work or in acceptable storage places, and not used at the time of such invoice. Materials, when so paid for by the Owner, shall become the property of the Owner, and in the event of default on the part of the Contractor, the Owner may use, or cause to be used, these materials in the construction of the work provided for in the contract. The Contractor

shall be responsible for any damage to, or loss of, these materials in accordance with Contract insurance requirements. The amount thus paid by the Owner shall go to reduce estimated amounts due the Contractor as the material is used in the work.

B. No partial payment shall be made upon fuels, supplies, lumber, false work, aggregates, or other materials, or on temporary structures of any kind which are not a permanent part of this contract.

1.7 FINAL PAYMENT

A. The Engineer shall make, as soon as practicable after the completion of the project, a final quantity invoice of the amount of work performed under the Contract and establish the value of such work.

B. The Owner shall retain the specified percentage of the final contract cost for a one-year warranty period commencing on the date of substantial completion as stipulated in the General Conditions and/or Agreement.

C. The Owner shall then pay the entire sum found to be due, after deducting therefrom all previous payments and the aforementioned retainage. In addition other amounts to be retained or deducted under the provisions of the Contract may be held by the Owner for a period of thirty (30) days after the completion of the final quantity invoice, or until such time as the Contractor submits satisfactory evidence that all bills for labor and materials used under this Contract have been paid and all required documents submitted to the Engineer.

1.8 INCIDENTAL WORK

A. Incidental work items for which separate payment items are not measured shall be included in the work. Unless paid for under a specific bid item, these items may include but are not limited to the following (bonds, insurance, and administrative costs covered under the lump sum item):

1. Clearing, Grubbing and Stripping
2. Excavation, fill and grading, required for construction of paved drive and gravel access areas.
3. Loaming and turf establishment with mulch and soil conditioning, unless otherwise paid for.
4. Restoration of property.
5 Repairs to existing utilities.
6. Utility crossings, unless otherwise paid for.
7. Utility relocation unless otherwise paid for.
8. Minor items - Such as replacement of fences, guardrails, rockwalls, mailboxes, signs, etc.
9. Dewatering of site and excavations.
10. Steel and/or wood sheeting utilized by the Contractor other than sheeting left in place or removed when directed by the Engineer and paid for under a separate item.
11. Temporary water lines to maintain water service, where required.
12. Temporary sewer lines, by-pass pumping or piping necessary to maintain sewer flows, where required.
13. Temporary control of drainage.

14. Additional items needed as a result of the Contractor's sequencing.
15. Repairing damage to existing guardrail.
16. Repairing damage to existing drainage.
17. Mechanically cutting of all pavement to provide square edges to complete pavement repairs.
18. Field surveying including construction layout, survey control and as-built survey with the vertical and horizontal alignment of completed water mains.
19. All other work shown or described on the drawings, or within the specifications, for which there is no payment item, is subsidiary and will not be measured for payment.

1.9 DESCRIPTION OF PAY ITEMS

A. The following describes the measurement of and payment for the work to be complete under the respective items listed in the Bid (form).

B. Each unit item or lump sum prices stated in the Bid (form) shall constitute full compensation, as herein specified, for each item of the work completed.

C. Refer to NHDOT Standard Specification for Road and Bridge Construction (Latest Edition) for unit items not described in this section. Amendments to the NHDOT Standard Specifications are included following Division 2 of the specifications.

BASE BID - SCHEDULE 1 - FACILITY IMPROVEMENTS & ALLOWANCES

ITEM NO. 1: FURNISH AND INSTALL COMPOSITE ELEVATED TANK

A. Method of Measurement:
   1. Construction of the Composite Elevated Tank including all appurtenances, shall be measured on a percent complete basis, in place, in accordance with the Contract Drawings and Specifications.
   2. Includes all work for which there is not a separate pay item provided.

B. Basis of Payment:
   1. The lump sum price for this item of the project shall be payment for the complete construction of the Composite Elevated Tank with all appurtenances as shown on the Contract Drawings and as described in the Specifications. This price and payment shall constitute full compensation for all materials, labor, tools, equipment, restoration and incidentals thereto required to complete the work.
   2. The Bidder agrees to accept as full payment for the lump sum portion of the work proposed under this project based upon the Bidder's own estimate of quantities and costs, the lump sum base bid.
   3. The Contractor shall submit a cost breakdown of the lump sum item prior to Contract signing for the Engineer's approval. Cost breakdown shall be provided for each of the following components of construction, as a minimum:
      a. Bonds and Insurance
      b. Mobilization/Demobilization
      c. Sitework, including clearing, excavation, backfill, loam and seed, fencing

d. Foundation
e. Concrete pedestal
f. Steel tank
g. Tank coating
h. Windows & Doors
i. Equipment
j. Instrumentation and Controls
k. Piping and Valves (inside pedestal, up to the limit of work as shown on drawings and to outside of foundation).
l. Heated Room
m. Electrical and Instrumentation
n. HVAC
o. Painting
p. Architectural Finishes
q. Drainage systems (piping, catch basin and plunge pool)
r. Startup and testing
s. Restoration
t. Operation and Maintenance Manuals
u. Record Drawings

ITEM NO. 2: UTILITY ALLOWANCE

A. Method of Measurement:
   1. This item shall include the allowance identified in the bid schedule.
   2. Utility fees shall be measured on a percentage complete basis, in place, in accordance with the Contract Drawings and Specifications and the approved Schedule of Values.

B. Basis of Payment:
   1. Payment for utility fees shall be based on actual invoices from the utility submitted to the Engineer. Work by the Contractor and not the utility shall be carried in the Contractor's bid under the appropriate lump sum bid item.
   2. Fees for temporary utilities shall not be paid under this item and shall be carried in the lump sum costs for each facility.
   3. The following utilities are included in this allowance:
      - electric
   4. Payment shall be without markup.

ITEM NO. 3: CONTINGENCY ALLOWANCE

A. Method of Measurement
   1. Extra work to be measured for payment shall be on an allowance basis and shall only be authorized by Change Order. This amount or a portion of this amount may only be used if additional scope and cost is required and only if it is authorized in advance by an executed Change Order.
   2. The actual amount approved will be as stated in the Change Order.

B. Basis of Payment
   1. Payment will be made for extra work as stipulated in the Change Order.

BASE BID - SCHEDULE 2 - SITE WORK

ITEM No's. 10A, 10B and 10C: FURNISH AND INSTALL 16 IN. 12 IN AND 8 IN DUCTILE IRON WATER MAIN w/POLYETHYLENE ENCASEMENT

A. Method of Measurement:

1. New water main installed under these items shall be measured for payment by the linear foot along the horizontal centerline of the pipe as laid.
2. Pipe shall be measured from start point to end point, measured through the valves and fittings.
3. Measurement shall be to the nearest 1.0 foot.
4. 6-inch diameter ductile iron piping used for hydrant assembly installation will not be measured for payment under these items and is included in item 15 Furnish and Install Hydrants.
5. Measurement shall begin at the outside face of structures.

B. Basis of Payment:

Pipe shall be paid for at the Contract unit price per linear foot.

1. Said unit price shall constitute full compensation for furnishing and installing all materials, fittings, labor, equipment and tools necessary for hauling, handling, laying, jointing and testing pipe.
2. Said unit price shall include, but not be limited to; removing trees, brush, and stumps as needed to install the new water main; cutting, removing, and disposing of existing pavement; excavating (except ledge and rock); storing existing roadway base material for reuse; storing material removed from the trench for reuse; temporarily holding utility poles; providing excavation supports; dewatering; furnishing and installing bedding material, pipe, polyethylene encasement, thrust rod systems (where shown on the drawings), fittings, blanket materials, and detectable locator tape; joining; backfilling (unless select material is ordered by the Engineer); reinstalling existing roadway base material (in accordance with trench pavement repair details); compacting all lifts; furnishing and installing additional crushed gravel or crushed stone material to maintain a suitable travel surface; restoration of grassed areas, restoration of all other surfaces damaged during the construction of the water main; and all other work required for or incidental to the satisfactory completion of this item.
3. Said unit price shall include furnishing and installing all materials, labor, equipment, and tools necessary for connecting new water mains to existing mains as shown, unless otherwise paid for under a separate bid item.
4. Said unit price shall include all construction dewatering work required to pre-drain soils prior to final excavation and to install the pipe in-the-dry including furnishing, installing, operating and removing of dewatering systems and monitoring wells.
5. Said unit price shall include full compensation for the relocation of utilities (including but not limited to existing water, gas, drain, electric and telephone) which interfere with the proposed water main as shown on the Drawings, and for the repair of utilities damaged by the Contractor.

6. Said unit price shall include temporary piping, temporary facilities, and temporary services to maintain water service during construction.
7. Said unit price shall include removal and proper disposal of existing water main, in-line valves, and other items that are abandoned and are required to be removed.
8. Said unit price shall include restoration of existing conditions including, but not limited to driveways (paved and gravel), lawns, curbs, drainage, etc., unless specifically paid under a separate pay item.
9. Said unit price shall include sheeting, if necessary.
10. Said unit price shall include pressure testing, disinfection, and bacteriological testing.
11. Actual payment for this item shall be broken down in accordance with the following percentages:
    a. Water pipe in place and backfilled - 90%
    b. Water pipe successfully cleaned and tested, and cleanup and/or corrections completed - 10%

ITEM No's. 11A, 11B and 11C: FURNISH AND INSTALL 16 IN, 12 IN AND 8 IN GATE VALVES AND VALVE BOXES

A. Method of Measurement:
   1. The quantity of gate valves to be furnished and installed under this item shall be per each valve and valve box installed as indicated on the Drawings unless paid for as part of a separate item.
   2. Valves installed for hydrant assemblies will not be measured for payment under this item and is included in item 15 Furnish and Install Hydrants.

B. Basis of Payment:
   1. Gate valves and valve boxes installed shall be paid at the Contract unit price per each.
   2. Said unit price shall be full compensation for furnishing all materials, including foster adaptors at tee connections, labor, equipment, and tools; for installing, setting, joining; for restraining joints and thrust blocks; for testing all valves; and for all other incidental work and expenses.
   3. Said unit price shall include all necessary earth excavation, bedding, sheeting, backfill, compaction, sheeting, bracing, cleaning and testing and other applicable incidental work, as described above for water main installation.
   4. Said unit price shall include full compensation for all construction dewatering work required to pre-drain soils prior to final excavation and to install the pipe in-the-dry including furnishing, installing, operating and removing of dewatering systems and monitoring wells.

ITEM NO. 12: FURNISH AND INSTALL 1" DIA. COPPER WATER SERVICE PIPE

A. Method of Measurement:
   1. Copper service tubing will be measured by the linear foot along the centerline of the pipe from the corporation stop to the curb stop as shown on the plans, or as directed.

2. Pipe shall be measured to the nearest 1.0 foot.

B. Basis of Payment:
   1. Copper service tubing will be paid for at the contract price per linear foot.
   2. Said unit price shall constitute full compensation for furnishing and installing all materials, labor, equipment and tools necessary for hauling, handling, laying, joining and testing pipe.
   3. Said unit price shall also include all necessary earth excavation, dewatering, bedding, backfill, sheeting/bracing, compaction, cleaning and testing, and other incidental work.
   4. Said unit price shall also constitute full compensation for the removal and restoration of curbs, drives (paved and gravel), bushes, plantings, sod, and all necessary grading and reseeding of grassed areas disturbed by the Contractor's operations not paid for under a separate item.

ITEM NO. 13: FURNISH AND INSTALL CORPORATION STOPS

A. Method of Measurement:
   1. Corporation Stops will be measured as a single unit, complete and in place at locations shown on the drawings or where directed by the Engineer.

B. Basis of Payment:
   1. Corporation stops will be paid for at the Contract per each unit price.
   2. Said unit price shall constitute full compensation for the furnishing of all labor, equipment and materials associated with installing corporation stops in accordance with the Contract Drawings and Specifications.
   3. Said unit price shall include, but not be limited to; excavating (except ledge and rock); providing excavation supports; dewatering; furnishing and installing bedding material, corporation stop, and blanket material; joining; backfilling (unless select material is ordered by the Engineer); compacting all lifts; and all other work required for or incidental to the satisfactory completion of this item.
   4. Said unit price shall also include service saddles for corporation stops exceeding 1" diameter.

ITEM NO. 14: FURNISH AND INSTALL CURB STOPS AND BOXES

A. Method of Measurement:
   1. Curb Stops will be measured as a single unit, complete and in place at locations shown on the drawings or where directed by the Engineer.
   2. Relocation of replacement of existing curb stops where directed by the Owner or the Engineer will be measured for payment under this item.

B. Basis of Payment:
   1. Curb stops and boxes will be paid for at the Contract per each unit price.
   2. Said unit price shall constitute full compensation for the furnishing of all labor, equipment and materials associated with installing curb stops and boxes to both temporary water systems and new water service piping, in accordance with the Contract Drawings and Specifications.
   3. Said unit price shall include, but not be limited to; excavating (except ledge and rock); providing excavation supports; dewatering; furnishing and

installing bedding material, curb stop, service box, and blanket material; joining; backfilling (unless select material is ordered by the Engineer); compacting all lifts; adjusting the boxes; and all other work required for or incidental to the satisfactory completion of this item.

4. Said unit price shall be considered full compensation for all unions and transition couplings required to connect the new water service to the existing water service.

ITEM NO. 15: FURNISH AND INSTALL HYDRANT ASSEMBLIES

A. Method of Measurement:
   1. Hydrant assemblies installed shall be measured per each as indicated on the Drawings or as directed.

B. Basis of Payment:
   1. Hydrant assemblies installed shall be paid at the Contract unit price per each.
   2. Said unit price shall also constitute payment for installing 6" ductile iron branch piping from the main line regardless of length of pipe installed, anchoring tee, gate valve (or tapping sleeve and valve), mechanical joint retainer glands, thrust block, valve box, hydrant, cleaning, testing, and painting as shown on the Drawings and as specified herein.
   3. Said unit price shall also constitute full compensation for all necessary excavation, dewatering, backfill, compaction, sheeting, bracing, cleaning and other incidental work not specifically included for payment under other items.
   4. Said unit price shall also constitute full compensation for the removal and restoration of curbs, drives (paved and gravel), bushes, plantings, sod, and all necessary grading and reseeding of grassed areas disturbed by the Contractor's operations unless paid for under separate item.
   5. Actual payment for this item shall be broken down in accordance with the following percentages:
      a. Hydrant assembly in place and backfilled - 90%.
      b. Hydrant assembly successfully cleaned and tested, and cleanup and/or corrections completed - 10%.

ITEM NO. 16.1: FURNISH AND INSTALL 2-INCH THICK RIGID INSULATION

A. Method of Measurement:
   1. 2-inch thick rigid insulation installed under these items shall be measured for payment by the linear foot along the horizontal centerline of the 16" diam. pipe.
   2. Measurement shall be to the nearest 1.0 foot.

B. Basis of Payment:
   1. Rigid insulation shall be paid for at the Contract unit price per linear foot.
   2. Said unit price shall constitute full compensation for furnishing and installing all materials, labor, equipment and tools necessary furnish and install rigid insulation in areas where the depth of cover is less than 5 feet or as directed by Engineer.

ITEM NO. 17: FURNISH AND INSTALL COMBINATION AIR VALVE STRUCTURES

A. Method of Measurement:
   1. The quantity of combination air valve (air release) structures to be furnished and installed under this item shall be per each structure as indicated on the Drawings unless paid for as part of a separate item.

B. Basis of Payment:
   1. Combination air valve structures installed shall be paid at the Contract unit price per each.
   2. Said unit price shall be full compensation for furnishing all materials, labor, equipment, and tools; for installing, setting, joining; for restraining joints and thrust blocks; for testing air and vacuum relief valves; and for all other incidental work and expenses.
   3. Said unit price shall include all necessary earth excavation, bedding, sheeting, backfill, compaction, sheeting, bracing, cleaning and testing and other applicable incidental work, as described above for water main installation.
   4. Said unit price shall include full compensation for all construction dewatering work required to pre-drain soils prior to final excavation and to install the pipe in-the-dry including furnishing, installing, operating and removing of dewatering systems and monitoring wells.

Refer to the respective NHDOT Standard Specifications and Adjustment Special Attentions for unit items not described in this section.

ADD/DEDUCT ALT. A - HDPE PIPE

ITEM No. 1010: FURNISH AND INSTALL 20 INCH DIA. DR 11, 200 PSI, IRON PIPE SIZE HDPE WATER MAIN IN LIEU OF 16 INCH DIAM. DUCTILE IRON MAIN

A. Method of Measurement:
   1. New water main installed under these items shall be measured for payment by the linear foot along the horizontal centerline of the pipe as laid.
   2. Pipe shall be measured from start point to end point, measured through the valves and fittings.
   3. Measurement shall be to the nearest 1.0 foot.

B. Basis of Payment:
   Pipe shall be paid for at the Contract unit price per linear foot.
   1. Payment for this item shall constitute of either ADDING or DEDUCTING a net change to bid price detailed on Item 10B of Schedule A.
   2. Said unit price shall constitute full compensation for furnishing and installing all materials, fittings, labor, equipment and tools necessary for hauling, handling, laying, jointing and testing pipe.
   3. Said unit price shall include, but not be limited to; removing trees, brush, and stumps as needed to install the new water main; cutting, removing, and disposing of existing pavement; excavating (except ledge and rock); storing existing roadway base material for reuse; storing material removed from the trench for reuse; temporarily holding utility poles; providing excavation

supports; dewatering; furnishing and installing bedding material, pipe, thrust rod systems (where shown on the drawings), fittings, blanket materials, and detectable locator tape; joining; backfilling (unless select material is ordered by the Engineer); reinstalling existing roadway base material (in accordance with trench pavement repair details); compacting all lifts; furnishing and installing additional crushed gravel or crushed stone material to maintain a suitable travel surface; restoration of grassed areas, restoration of all other surfaces damaged during the construction of the water main; and all other work required for or incidental to the satisfactory completion of this item.

4. Said unit price shall include furnishing and installing all materials, labor, equipment, and tools necessary for connecting new water mains to existing mains as shown, unless otherwise paid for under a separate bid item.
5. Said unit price shall include all construction dewatering work required to pre-drain soils prior to final excavation and to install the pipe in-the-dry including furnishing, installing, operating and removing of dewatering systems and monitoring wells.
6. Said unit price shall include full compensation for the relocation of utilities (including but not limited to existing water, gas, drain, electric and telephone) which interfere with the proposed water main as shown on the Drawings, and for the repair of utilities damaged by the Contractor.
7. Said unit price shall include temporary piping, temporary facilities, and temporary services to maintain water service during construction.
8. Said unit price shall include removal and proper disposal of existing water main, in-line valves, and other items that are abandoned and are required to be removed.
9. Said unit price shall include restoration of existing conditions including, but not limited to driveways (paved and gravel), lawns, curbs, drainage, etc., unless specifically paid under a separate pay item.
10. Said unit price shall include sheeting, if necessary.
11. Said unit price shall include pressure testing, disinfection, and bacteriological testing.
12. Actual payment for this item shall be broken down in accordance with the following percentages:
    a. Water pipe in place and backfilled - 90%
    b. Water pipe successfully cleaned and tested, and cleanup and/or corrections completed - 10%

ADD ALT. B - DRAINAGE

Refer to the respective NHDOT Standard Specifications for unit items in this section.

ADD ALT. C - SEWER

ITEM NO. 18: FURNISH AND INSTALL 8-INCH DIA. SDR 35 SEWER PIPE

A. Method of Measurement:

1. The length of pipe for sewer mains shall be measured by the linear foot along the horizontal centerline of the pipe including service connection fittings as laid from the inside edge of the manhole to the inside edge of the next manhole.

B. Basis of Payment:
1. Pipe shall be paid for at the Contract price per foot.
2. Said unit price shall constitute full compensation for furnishing and installing all materials, fittings and adapters, stubs with cap ends, sewer lateral cleanouts, materials, labor, equipment and tools necessary for hauling, handling, laying, jointing and testing pipe, complete and in place as shown on the drawings.
3. Said unit price payment will also be considered full compensation for all necessary clearing and grubbing, earth excavation, removal of existing structures, existing (non-asbestos) pipe removal and disposal, bedding including geo-textile wrap if specified, backfill, compaction, cleaning and other incidental items, such as, segregation of suitable backfill materials, stockpiling and placement of pavement materials and roadway gravels, and the disposal of excess fill material.
4. Said unit price shall include full compensation for installing and maintaining trench dewatering systems (i.e. trench sump dewatering) required to install the pipe in the dry as specified, if necessary.
5. Said price shall also include manhole corings, fittings, adapters, and joining not covered under a separate bid item.
6. This item will be considered full compensation for maintenance of all existing sewer flows (where applicable).
7. Said unit price shall also constitute full compensation for the removal and restoration of all property including of bushes, plantings, sod, loaming and reseeding of grassed areas disturbed by the Contractor's operations, and replacement of curb, unless payment is provided for under another item.
8. Payment for sewer mains shall be broken down in accordance with the following percentages:
   a. Sewer main line in place and backfilled - 90%
   b. Sewer main line successfully cleaned and tested - 10%. A sewer main will only be considered tested when pressure, deflection and lamping tests have all been completed and accepted by the Owner, Engineer and NHDES.

ITEM No. 19: REPLACE EXISTING 4 INCH OR 6 INCH DIA. SEWER SERVICE (WHERE DIRECTED)

A. Method of Measurement:
1. The length of pipe for sewer service connections shall be measured by the linear foot along the horizontal centerline of the pipe from the sewer main to the connection of existing sewer at each property line.

B. Basis of Payment:
1. Item shall be paid for at the Contract price per foot.
2. Said unit price shall constitute full compensation for replacing and/or realigning all materials, fittings and adapters, stubs with cap ends, labor,

equipment and tools necessary for hauling, handling, laying, jointing and testing pipe, complete and in place as shown on the drawings.

ITEM NO. 20: FURNISH AND INSTALL STANDARD 4' DIA. SEWER MANHOLES

A. Method of Measurement:
   1. Sewer manholes will be measured per each unit installed.

B. Basis of Payment:
   1. Manholes shall be paid at the Contract unit price per each unit installed.
   2. Said unit price shall be considered full compensation for furnishing and installing precast sections or cast in place structures with penetrations and boots, frames and covers, screened gravel subbase, concrete and masonry materials, water-proofing as specified, construction fabric, manhole testing, and all work incidental thereto.
   3. Said unit price shall be considered full compensation for the furnishing of materials, labor, tools and equipment necessary to complete the above described work.
   4. Said unit price shall constitute full payment to adjust the frame and cover assembly, to binder course grade and finish elevation. Additional adjustments requested shall be incidental.
   5. Said unit price shall also constitute payment for all field core penetrations, sealing devices, (i.e., boots) and stub pipes and caps for future connections of the size and type as shown on the drawings and as specified herein.
   6. Said unit cost shall include full compensation for additional concrete or brick masonry as necessary to construct inverts and special structures as shown on the Drawings.
   7. Said unit price shall be considered full compensation for maintenance of sewer flows through bypass pumping.
   8. Said unit price shall include full compensation for installing and maintaining trench dewatering systems (i.e. trench sump dewatering) required to install the pipe in the dry as specified.
   9. Actual payment for these shall be broken down in accordance with the following percentages:
      a. Manhole in place and backfilled - 80%.
      b. Manhole successfully tested - 10%.
      c. Manhole cleaned and invert built – 10%

ADD ALT. D - CONNECTION TO WEBB PLACE/HIGH PRESSURE ZONE

ITEM No. 10B: FURNISH AND INSTALL 12 INCH DIA. DUCTILE IRON WATER MAIN w/POLYETHYLENE ENCASEMENT

A. Method of Measurement:
   1. New water main installed under this item shall be measured for payment by the linear foot along the horizontal centerline of the pipe as laid.
   2. Pipe shall be measured from start point to end point, measured through the valves and fittings.
   3. Measurement shall be to the nearest 1.0 foot.

4. 6-inch diameter ductile iron piping used for hydrant assembly installation will not be measured for payment under these items and is included in the Hydrant item.

B. Basis of Payment:

Pipe shall be paid for at the Contract unit price per linear foot.

12. Said unit price shall constitute full compensation for furnishing and installing all materials, fittings, labor, equipment and tools necessary for hauling, handling, laying, jointing and testing pipe.
13. Said unit price shall include, but not be limited to; removing trees, brush, and stumps as needed to install the new water main; cutting, removing, and disposing of existing pavement; excavating (except ledge and rock); storing existing roadway base material for reuse; storing material removed from the trench for reuse; temporarily holding utility poles; providing excavation supports; dewatering; furnishing and installing bedding material, pipe, polyethylene encasement, thrust rod systems (where shown on the drawings), fittings, blanket materials, and detectable locator tape; joining; backfilling (unless select material is ordered by the Engineer); reinstalling existing roadway base material (in accordance with trench pavement repair details); compacting all lifts; furnishing and installing additional crushed gravel or crushed stone material to maintain a suitable travel surface; restoration of grassed areas, restoration of all other surfaces damaged during the construction of the water main; and all other work required for or incidental to the satisfactory completion of this item.
14. Said unit price shall include furnishing and installing all materials, labor, equipment, and tools necessary for connecting new water mains to existing mains as shown, unless otherwise paid for under a separate bid item.
15. Said unit price shall include all construction dewatering work required to pre-drain soils prior to final excavation and to install the pipe in-the-dry including furnishing, installing, operating and removing of dewatering systems and monitoring wells.
16. Said unit price shall include full compensation for the relocation of utilities (including but not limited to existing water, gas, drain, electric and telephone) which interfere with the proposed water main as shown on the Drawings, and for the repair of utilities damaged by the Contractor.
17. Said unit price shall include temporary piping, temporary facilities, and temporary services to maintain water service during construction.
18. Said unit price shall include removal and proper disposal of existing water main, in-line valves, and other items that are abandoned and are required to be removed.
19. Said unit price shall include restoration of existing conditions including, but not limited to driveways (paved and gravel), lawns, curbs, drainage, etc., unless specifically paid under a separate pay item.
20. Said unit price shall include sheeting, if necessary.
21. Said unit price shall include pressure testing, disinfection, and bacteriological testing.

22. Actual payment for this item shall be broken down in accordance with the following percentages:
    a. Water pipe in place and backfilled - 90%
    b. Water pipe successfully cleaned and tested, and cleanup and/or corrections completed - 10%

ITEM No. 11B: FURNISH AND INSTALL 12 INCH DIA. GATE VALVES AND VALVE BOXES

A. Method of Measurement:
   3. The quantity of gate valves to be furnished and installed under this item shall be per each valve and valve box installed as indicated on the Drawings unless paid for as part of a separate item.
   4. Valves installed for hydrant assemblies will not be measured for payment under this item and is included in the Hydrant item.

B. Basis of Payment:
   1. Gate valves and valve boxes installed shall be aid at the Contract unit price per each.
   2. Said unit price shall be full compensation for furnishing all materials, including foster adaptors at tee connections, labor, equipment, and tools; for installing, setting, joining; for restraining joints and thrust blocks; for testing all valves; and for all other incidental work and expenses.
   3. Said unit price shall include all necessary earth excavation, bedding, sheeting, backfill, compaction, sheeting, bracing, cleaning and testing and other applicable incidental work, as described above for water main installation.
   4. Said unit price shall include full compensation for all construction dewatering work required to pre-drain soils prior to final excavation and to install the pipe in-the-dry including furnishing, installing, operating and removing of dewatering systems and monitoring wells.

ITEM NO. 20: CURB AND SIDEWALK REPAIR

A. Method of Measurement:
   1. Fence and sidewalks repairs shall be measured on a percentage complete basis, in place, in accordance with the Contract Drawings and Specifications and the approved Schedule of Values.

B. Basis of Payment:
   1. The lump sum price for this item shall be made based on the repairs of the granite curb and sidewalk as needed on Webb Place due to water main construction.
   2. Said unit price shall constitute full compensation for all materials, labor, equipment and tools necessary to repair fence and curb sidewalk on Webb Place as necessary after construction or as directed by Engineer.

Refer to the respective NHDOT Standard Specifications for unit items not described in this section.

ADD ALT. E - BOOSTER PUMP STATION

ITEM NO. 22: FURNISH AND INSTALL BOOSTER PUMP STATION INCLUDING PIPING, VALVES, PLC PROGRAMMING, ELECTRICAL AND STARTUP

A. Method of Measurement:
   1. This item shall include the furnish and installation of a booster pump station in the pedestal heated room, shall be measured on a percent complete basis, in place, in accordance with the Contract Drawings and Specifications.
   2. Includes all work for which there is not a separate pay item provided.

B. Basis of Payment:
   1. The lump sum price for this item of the project shall be payment for the complete construction of a booster pump station in the pedestal heated room as shown on the Contract Drawings and as described in the Specifications. This price and payment shall constitute full compensation for all materials, labor, tools, equipment, restoration and incidentals thereto required to complete the work.
   2. This item includes pumps, piping and valves to limits shown on the drawings, electrical, instrumentation, SCADA programming, startup and testing.
   3. The Bidder agrees to accept as full payment for the lump sum portion of the work proposed under this project based upon the Bidder's own estimate of quantities and costs, the lump sum bid.
   4. The Contractor shall submit a cost breakdown of the lump sum item prior to Contract signing for the Engineer's approval. Cost breakdown shall be provided for each of the following components of construction, as a minimum:
      a. Process piping and fittings
      b. Booster Pumps
      c. Valves
      d. SCADA programming
      e. Electrical
      f. Startup

ADD ALT. F - RAW WATER MAIN

ITEM No. 10B: FURNISH AND INSTALL 12 INCH DIAM. DUCTILE IRON WATER MAIN w/POLYETHYLENE ENCASEMENT

A. Method of Measurement:
   1. New water main installed under these items shall be measured for payment by the linear foot along the horizontal centerline of the pipe as laid.
   2. Pipe shall be measured from start point to end point, measured through the valves and fittings.
   3. Measurement shall be to the nearest 1.0 foot.
   4. 6-inch diameter ductile iron piping used for hydrant assembly installation will not be measured for payment under these items and is included in item 15 Furnish and Install Hydrants.

B. Basis of Payment:

Pipe shall be paid for at the Contract unit price per linear foot.

23. Said unit price shall constitute full compensation for furnishing and installing all materials, fittings, labor, equipment and tools necessary for hauling, handling, laying, jointing and testing pipe.
24. Said unit price shall include, but not be limited to; removing trees, brush, and stumps as needed to install the new water main; cutting, removing, and disposing of existing pavement; excavating (except ledge and rock); storing existing roadway base material for reuse; storing material removed from the trench for reuse; temporarily holding utility poles; providing excavation supports; dewatering; furnishing and installing bedding material, pipe, polyethylene encasement, thrust rod systems (where shown on the drawings), fittings, blanket materials, and detectable locator tape; joining; backfilling (unless select material is ordered by the Engineer); reinstalling existing roadway base material (in accordance with trench pavement repair details); compacting all lifts; furnishing and installing additional crushed gravel or crushed stone material to maintain a suitable travel surface; restoration of grassed areas, restoration of all other surfaces damaged during the construction of the water main; and all other work required for or incidental to the satisfactory completion of this item.
25. Said unit price shall include furnishing and installing all materials, labor, equipment, and tools necessary for connecting new water mains to existing mains as shown, unless otherwise paid for under a separate bid item.
26. Said unit price shall include all construction dewatering work required to pre-drain soils prior to final excavation and to install the pipe in-the-dry including furnishing, installing, operating and removing of dewatering systems and monitoring wells.
27. Said unit price shall include full compensation for the relocation of utilities (including but not limited to existing water, gas, drain, electric and telephone) which interfere with the proposed water main as shown on the Drawings, and for the repair of utilities damaged by the Contractor.
28. Said unit price shall include temporary piping, temporary facilities, and temporary services to maintain water service during construction.
29. Said unit price shall include removal and proper disposal of existing water main, in-line valves, and other items that are abandoned and are required to be removed.
30. Said unit price shall include restoration of existing conditions including, but not limited to driveways (paved and gravel), lawns, curbs, drainage, etc., unless specifically paid under a separate pay item.
31. Said unit price shall include sheeting, if necessary.
32. Said unit price shall include pressure testing, disinfection, and bacteriological testing.
33. Actual payment for this item shall be broken down in accordance with the following percentages:
    a. Water pipe in place and backfilled - 90%
    b. Water pipe successfully cleaned and tested, and cleanup and/or corrections completed - 10%

ITEM NO. 15E: FURNISH AND INSTALL HYDRANT ASSEMBLIES

A. Method of Measurement:
   1. Hydrant assemblies installed shall be measured per each as indicated on the Drawings or as directed.

B. Basis of Payment:
   1. Hydrant assemblies installed shall be paid at the Contract unit price per each.
   2. Said unit price shall also constitute payment for installing 6" ductile iron branch piping from the main line regardless of length of pipe installed, anchoring tee, gate valve (or tapping sleeve and valve), mechanical joint retainer glands, thrust block, valve box, hydrant, cleaning, testing, and painting as shown on the Drawings and as specified herein.
   3. Said unit price shall also constitute full compensation for all necessary excavation, dewatering, backfill, compaction, sheeting, bracing, cleaning and other incidental work not specifically included for payment under other items.
   4. Said unit price shall also constitute full compensation for the removal and restoration of curbs, drives (paved and gravel), bushes, plantings, sod, and all necessary grading and reseeding of grassed areas disturbed by the Contractor's operations unless paid for under separate item.
   5. Actual payment for this item shall be broken down in accordance with the following percentages:
      a. Hydrant assembly in place and backfilled - 90%.
      b. Hydrant assembly successfully cleaned and tested, and cleanup and/or corrections completed - 10%.

ADD ALT. G - SEGMENTED CIRCULAR STAIRWAY

ITEM NO. 23: FURNISH AND INSTALL SEGMENTED CIRCULAR STAIRWAY FROM CONCRETE SLAB TO UPPER PLATFORM

A. Method of Measurement:
   1. This item shall include the furnish of all materials and construction of a Segmented Circular Stairway as identified in the bid schedule.

B. Basis of Payment:
   1. The lump sum price for this item of the project shall be payment for the complete construction of a Segmented Circular Stairway from the concrete slab to the top platform with access to Tank, as shown on the Contract Drawings and as described in the Specifications. This price and payment shall constitute full compensation for all materials, labor, tools, equipment, restoration and incidentals thereto required to complete the work.
   2. The Bidder agrees to accept as full payment for the lump sum portion of the work proposed under this project based upon the Bidder's own estimate of quantities and costs, the lump sum bid.
   3. The Contractor shall submit a cost breakdown of the lump sum item prior to Contract signing for the Engineer's approval.

PART 2 – PRODUCTS

(Not Part of This Section)

PART 3– EXECUTION

(Not Part of This Section)

END OF SECTION

SECTION 01045

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included - This Section establishes general requirements pertaining to cutting (including excavation), fitting and patching of the Work required to:
   1. Make the several parts fit properly.
   2. Uncover work to provide for installation and/or review of ill timed work.
   3. Remove and replace work not conforming to requirements of the Contract Documents.
   4. Remove and replace defective work.
   5. Upon the Engineer's request, uncover the Work to provide for observation by the Engineer and remove samples of installed materials for testing.

B. Quality Assurance:
   1. Perform all cutting and patching in strict accordance with pertinent requirements of these Specifications, and in the event no such requirements are determined, in conformance with the Engineer's written direction.
   2. Do not cut or alter the Work performed under a separate Contract without the Engineer's written permission.

C. Submittals:
   1. Request for the Engineer's written consent:
      a. Prior to cutting which affects structural safety. Submit written request to the Engineer for permission to proceed with cutting.
      b. Prior to proceeding with Work requiring a change of materials or methods for cutting and patching due to conditions or scheduling.
   2. Notices to the Engineer
      a. Prior to cutting and patching performed pursuant to the Engineer's instructions, submit a cost estimate to the Engineer. Secure the Engineer's approval of cost estimates and type of cost reimbursement before proceeding with cutting and patching.
      b. Submit written notice to the Engineer designating the time and date the Work will be uncovered, to provide for the Engineer's observation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For replacement of Work removed, use materials which comply with the pertinent sections of these Specifications and/or Drawings.

2.2 PAYMENT FOR COSTS

A. The Owner will reimburse the Contractor for cutting and patching performed pursuant to the Engineer's written request after a claim for such reimbursement is submitted by the Contractor. Perform all other cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 CONDITIONS

A. Inspection:
   1. Inspect and document the existing conditions, including elements subject to movement or damage prior to cutting and patching Work.
   2. After uncovering the work, inspect conditions affecting installation of new Work.

B. Discrepancies:
   1. If uncovered conditions are not as anticipated, immediately notify the Engineer and obtain the needed directions.
   2. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PREPARATION PRIOR TO CUTTING

A. Provide all required protection including but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.

3.3 PERFORMANCE

A. Prior to cutting which may affect structural safety of the Work, submit written request to the Engineer for permission to proceed with cutting.

B. Should conditions of the Work, or schedule, indicate a required change of materials or methods for cutting and patching, notify the Engineer and obtain written permission prior to proceeding.

END OF SECTION

SECTION 01070

ABBREVIATIONS & SYMBOLS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Where any of the following abbreviations are used in these Specifications, they shall have the meaning set forth opposite each.

AASHTO	American Association of State Highway and Transportation Officials
AC	Alternating Current
ACI	American Concrete Institute
ACP	Asbestos Cement Pipe
AGA	American Gas Association
AIC	Ampere Interrupting Capacity
AGMA	American Gear Manufacturers Association
AIEE (IEEE)	American Institute of Electrical Engineers (Institute of Electrical and Electronics Engineers, Inc.)
AISC	American Institute of Steel Construction
amp	Ampere
125-16 Amer. Std.	American Standard for Cast Iron Pipe Flanges and Flanged Fittings, Class 125 (ASA B16 11960)
ANSI	American National Standards Institute
API	American Petroleum Institute
ARRA	American Recovery & Reinvestment Act
ASA	American Standards Association
ASCE	American Society of Civil Engineers
ASH & AE	American Society of Heating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWG	American or Brown and Sharpe Wire Gage
AWWA	American Water Works Association
BOD	Biochemical Oxygen Demand
cf	Cubic Foot
cfm	Cubic Foot Per Minute
cfs	Cubic Foot Per Second
CI	Cast Iron
CIPRA	Cast Iron Pipe Research Association
CPE	Corrugated Polyethylene
CSI	Construction Specifications Institute
cy	Cubic Yards
DC	Direct Current

DEP	Department of Environmental Protection
DES	Department of Environmental Services
DI	Ductile Iron
dia.	Diameter
DOT	Department of Transportation
DRED	Department of Resources and Economic Development
EDR	Equivalent Directional Radiation
EPA	U.S. Environmental Protection Agency
Elev.	Elevation
FmHA	Farmers Home Administration (RD)
FF	Finished Floor
FG	Finished Grade
fps	Feet Per Second
ft.	Feet
gal.	Gallons
gpd	Gallons Per Day
gpm	Gallons Per Minute
HDPE	High Density Polyethylene
HP	Horsepower
IBR	Institute of Boiler and Radiator Manufacturers
in.	Inches
inter.	Interlock
inv.	Invert
ISA	Instrument Society of America
kva	Kilovolt-ampere
kw	Kilowatt
lb.	Pound
lf	Linear Foot
max.	Maximum
MCB	Master Circuit Board
MGD	Million Gallons Per Day
Min.	Minimum
MJ	Mechanical Joint
NBS	National Bureau of Standards
NEC	National Electrical Code, Latest Edition
NEMA	National Electrical Manufacturers Association
NEWWA	New England Water Works Association
NHF&G	New Hampshire Fish & Game Department
NOI	Notice of Intent
NPT	National Pipe Thread
OS&Y	Outside Screw and Yoke
PCA	Portland Cement Association
PE	Polyethylene
ppm	Parts Per Million
%	Percent
psi	Pounds Per Square Inch

psig	Pounds Per Square Inch Gage
PVC	Polyvinyl Chloride
R.D.	Rural Development (Formerly FmHA)
rpm	Revolutions Per Minute
sf	Square Foot
STL.W.G.	U.S. Steel Wire, Washburn and Moen, American Steel and Wire Cos., or Roebling Gage
sy	Square Yard
TDH	Total Dynamic Head
USAS	Standards of the United States of America Standards Institute (formerly American Standards Association)
USS GAGE	United States Standard Gage
VC	Vitrified Clay
WSP	Working Steam Pressure
Fed. Spec.	Federal Specifications issued by the Federal Supply Service of the General Service Administration, Washington, D.C.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 -- GENERAL

1.1 QUALITY ASSURANCE

A. For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on the date of Contract Documents.

C. Should specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.2 SCHEDULE OF REFERENCES

AA	Aluminum Association
AABC	Associated Air Balance Council
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGC	Associated General Contractors of America
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
APA	American Plywood Association
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating,
ASME	American Society of Mechanical Engineers
ASPA	American Sod Producers Association
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BIA	Brick Institute of America
BOCA	Building Officials and Code Administrators

CDA	Copper Development Association
CLFMI	Chain Link Fence Manufacturers Institute
CRSI	Concrete Reinforcing Steel Institute
DHI	Door and Hardware Institute
EJCDC	Engineers' Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association
FGMA	Flat Glass Marketing Association
FM	Factory Mutual System
FS	Federal Specification
GA	Gypsum Association
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IMIAC	International Masonry Industry All Weather Council
MBMA	Metal Building Manufacturer's Association
MFMA	Maple Flooring Manufacturers Association
MIL	Military Specification
ML/SFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal
NCMA	National Concrete Masonry Association
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NSWMA	National Solid Wastes Management Association
NTMA	National Terrazzo and Mosaic Association
NWMA	National Woodwork Manufacturers Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	Product Standard
RIS	Redwood Inspection Service
RCSHSB	Red Cedar Shingle and Handsplit Shake Bureau
SDI	Steel Deck Institute
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors'
SSPC	Steel Structures Painting Council
TCA	Tile Council of America, Inc.
UL	Underwriters' Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WWPA	Western Wood Products Association

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.1 INTRODUCTION

A. Project meeting requirements

1.2 PROJECT MEETINGS

A. The Contractor shall attend project meetings throughout the progress of the work.
B. Meetings shall be held at a frequency no greater than twice per month.
C. The following representatives of the Contractor shall attend:
    1. Project Manager and Superintendent
    2. Representative of major subcontractors (when requested)
    3. Representatives of major suppliers (when requested)
    4. Other representatives as appropriate to agenda topics
D. The Engineer shall prepare and distribute project meeting notes.
E. Sample Agenda
    1. Work progress
    2. Progress schedule
    3. Delivery schedules
    4. Submittals
    5. Payment applications
    6. Change Orders and Field Orders
    7. Status of Complaints
    8. Other items

1.3 SCADA INTEGRATION MEETING

A. The Contractor is responsible to coordinate a SCADA integration meeting with the Owner and Engineer after shop drawing approval and prior to construction.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01201

PRECONSTRUCTION MEETING

PART 1 -- GENERAL

1.1 INTRODUCTION

A. Preconstruction meeting requirements.

1.2 PROJECT MEETINGS

A. The Contractor shall attend preconstruction meetings prior to the commencement of work.

B. The following representatives of the Contractor shall attend:
   1. Project Manager and Superintendent
   2. Representative of major subcontractors (when requested)
   3. Representatives of major suppliers (when requested)
   4. Other representatives as appropriate to agenda topics

C. The Engineer shall prepare and distribute project meeting notes.

D. Sample Agenda
   1. Submittal of executed bonds and insurance certificates
   2. Execution and Distribution of the Contracts
   3. Designation of responsible personnel
   4. Contractor's submittals:
      a. List of subcontractors
      b. Project Schedule
      c. Schedule of Values
      d. Shop drawings
   5. Description of Procedures:
      a. Submittals
      b. Substitutions
      c. Field decisions
      d. Applications for payment
      e. Certified payroll
      f. Proposal requests
      g. Change orders
      h. Contract closeout procedures
   6. Critical work scheduling
   7. Work of other Contracts
   8. Preconstruction photos
   9. Field Engineering
   10. Project Inspection
   11. Right-of-Way and easements
   12. Security
   13. Housekeeping procedures
   14. Erosion control and Groundwater Protection Plan

15. Winter maintenance
16. Record drawings
17. Substantial completion
18. Final completion

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULES

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included: Within ten days after the effective date of the Agreement between Owner and Contractor, submit to the Engineer an estimated progress schedule.

B. Form of Schedules:
   1. Narrative: Completely describe the construction methods to be employed.
   2. Horizontal Bar Chart (i.e., Gantt chart):
      a. Provide a separate horizontal bar column for each trade or operation.
      b. Order: Chronological, for each trade and/or operation.
      c. Horizontal scale: Identify first work day of each week, allow space for updating and revision.

C. Content of Schedules:
   1. Provide complete sequence of construction by activity:
      a. Shop Drawings, Project Data and Samples:
         1) Submittal Dates
         2) Dates reviewed copies will be required.
      b. Decision dates for:
         1) Products specified by allowances.
         2) Selection of finishes (when applicable).
      c. Product procurement and delivery dates.
      d. Dates for beginning and completion of each element of construction.
   2. Identify work of separate phases and logically grouped activities.
   3. Show the projected percentage of completion for each item of work as of the first day of each month.
   4. Provide separate sub-schedules, if requested by the Engineer, showing submittals, review times, procurement schedules, and delivery dates.

D. Updating:
   1. The schedules shall be updated at least every month and for each project meeting.
   2. Show all changes occurring since previous submission.
   3. Indicate progress of each activity, show completion dates.
   4. Include:
      a. Major changes in scope.
      b. Activities modified since previous updating.
      c. Revised projections due to changes.
      d. Other identifiable changes.
   5. Provide narrative report, including:
      a. Discussion of problem areas, including current and anticipated delay factors.
      b. Corrective action taken, or proposed.

c. Description of revisions that may affect schedules.

1.2 SUBMITTALS

A. Submit periodically updated schedules when requested by the Engineer.
B. Submit 4 copies of initial and updated schedules to the Engineer.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01340

SUBMITTALS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Submit to the Engineer, Shop Drawings, Operation and Maintenance Manuals, Manufacturers' Certificates, Project Data, and Samples required by the Specification Sections.

B. Alternates
   1. If the Contractor elects to submit an Alternate that is considered a "substitute", the Contractor will be responsible to make all modifications to the Work resulting from the use of the Alternate at no additional cost to the Owner.
   2. If the Contractor elects to submit on a substitute, the Contractor must follow the procedures listed in Section 01630 - Substitutions & Product Options.

1.2 SHOP DRAWINGS

A. Shop Drawings are required for each and every element of the work. Each shop drawing shall be assigned a sequential number for purposes of easy identification, and shall retain its assigned number, with appropriate subscript on resubmission.

B. Shop Drawings are defined as all fabrication and erection drawings, diagrams, brochures, schedules, bills of material, manufacturers data, spare parts lists, and other data prepared by the Contractor, his subcontractors, suppliers, or manufacturers which illustrate the manufacturer, fabrication, construction, and installation of the work, or a portion thereof.

C. Electronic shop drawings (PDF) shall be provided for review purposes. Additionally, the Engineer may request up to three (3) hard copies for review. Upon approval the Contractor shall submit to the Engineer a minimum of six (6) paper copies of Shop Drawings and approved data. The Engineer will retain three (3) copies (for Owner's, Engineer's and Field Representative's files) and return three (3) copies to the Contractor for distribution to subcontractors, suppliers and manufacturers. If the Contractor requires more than three (3), then the number of copies submitted shall be adjusted accordingly.

D. The Contractor shall provide a copy of a completed submittal certification form which shall be attached to every copy of each shop drawing. The completed submittal certification form shall be included in the PDF version of the shop drawing. A separate file will not be acceptable. Shop Drawings shall show the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for the work.

E. The Contractor shall be responsible for the prompt and timely submittal of all shop and working drawings so that there shall be no delay to the work due to the absence of such drawings.

F. No material or equipment shall be purchased or fabricated especially for the Contract until the required shop and working drawings have been submitted as hereinabove provided and reviewed and accepted for conformance to the Contract requirements.

G. Until the necessary review has been made and shop drawings have been accepted, the Contractor shall not proceed with any portion of the work (such as the construction of foundations), the design or details of which are dependent upon the design or details of work, materials, equipment or other features for which review is required.

H. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. Shop drawings shall be of standardized sizes to enable the Owner to maintain a permanent record of the submissions. Approved standard sizes shall be: (a) 24 inches by 36 inches; (b) 11 inches by 17 inches, and (c) 8-1/2 inches by 11 inches. Provision shall be made in preparing the shop drawings to provide a binding margin on the left hand side of the sheet. Shop drawings submitted other than as specified herein may be returned for re-submittal without being reviewed.

I. Only drawings, which have been checked and corrected by the fabricator, should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Drawings and Specifications in all respects. All drawings which are found to be correct by the Contractor shall be marked with the date, checker's name, and indication of the Contractor's approval, and then shall be submitted to the Engineer.

J. If a shop drawing shows any deviation from the Contract requirements, the Contractor shall make specific mention of the deviations in his letter of transmittal.

K. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires and appurtenances, layout, etc., detailed on the Drawings, he shall also submit details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do all work necessary to make such modifications.

L. A maximum of two re-submissions of each Shop Drawing will be reviewed, checked, and commented upon without charge to the Contractor. Any additional submissions which are required by the Engineer to fulfill the stipulations of the Drawings and Specifications, and which are required by virtue of the Contractor's neglect or failure to comply with the requirements of the Drawings and Specifications, or to make those modifications and/or corrections ordered by the Engineer in the review of the first two submissions of each Shop Drawing, will be reviewed and checked as deemed necessary by the Engineer, and the cost of such review and checking, as determined by the Owner, and based upon Engineer's documentation of time and rates established for additional services in the Owner-Engineer Agreement for this Project, may be deducted from the Contractor to make all modifications and/or corrections as may be required by the Engineer in an accurate, complete, and timely fashion.

1.3 SAMPLES

A. The Contractor shall submit samples when requested by the Engineer to establish conformance with the specifications, and as necessary to define color selections available.

1.4 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall furnish the Engineer six (6) copies of a complete equipment manufacturer's instruction manual for installation, operation, maintenance, and lubrication of each item, equipment, and/or system specified. At least 2 months prior to the expected substantial completion date, the Contractor shall submit to the Engineer all manuals in accordance with the requirements specified herein, and within individual equipment specification sections.

B. Manuals shall include operating and maintenance information on all systems and items of equipment. The data shall consist of brochures, bulletins, charts, maintenance schedules, equipment numbers, shop drawings corrected to as-built conditions, wiring diagrams, and assembly drawings which shall describe capacity location, operation, maintenance, lubrication, operating weight, lubrication charts showing manufacturer recommended lubricants for each rotating or reciprocating unit, and other necessary information for the Owner to establish a complete maintenance program.

C. The submittal shall also include details of all replacement parts; "Nameplate" data for all equipment; detailed instructions for start-up, normal operation, shutdown procedures, safety procedures and control techniques; and a guide to troubleshooting the system.

1.5 MANUFACTURER'S CERTIFICATES

A. Prior to acceptance of the installation, the Contractor shall submit manufacturer's inspection certificates for each item specified.

B. Such manufacturer's certificates shall state that the equipment has been installed under either the continuous or periodic supervision of the manufacturer's authorized representative, that it has been adjusted and initially operated in the presence of the manufacturer's authorized representative, and that it is suitable for operating in accordance with the specified requirements, to the manufacturer's satisfaction. All costs for meeting this requirement shall be included in the Contractor's bid price.

C. Certified performance test data will also be submitted to the Engineer for individual equipment and/or systems as required by the specifications.

1.6 RECORD DRAWINGS

A. The Contractor shall submit, at the end of the Project, a clean, legible, and accurate set of red-lined drawings indicating any and all field changes that occurred during the course of construction. These drawings shall document all differences between what was called for in the executed contract drawings and what was actually constructed in the field. These drawings shall constitute record drawings for the Project.

1.7 SUBMISSION REQUIREMENTS

A. Submittals not meeting these requirements will be returned to the CONTRACTOR without review by the ENGINEER for completion of this information and resubmittal by the Contractor without a claim of lost time being allowed for this deficiency.

B. Accompany submittals with transmittal form on Page 01340-6, containing:
   1. Date.
   2. Project title and number.
   3. Contractor's name and address.
   4. The number of each Shop Drawing, Project Data and Sample submitted.
   5. Notification of deviations from Contract Documents.
   6. Other pertinent data.

C. Submittals shall include:
   1. Date and revision dates.
   2. Project title and number.
   3. The names of:
      a. Engineer.
      b. Contractor.
      c. Subcontractor.
      d. Supplier.
      e. Manufacturer.
      f. Separate detailer when pertinent.
   4. Identification of product or material.
   5. Relation to adjacent structure or materials.
   6. Field dimensions, clearly identified as such.
   7. Specification section number.
   8. Applicable standards, such as ASTM number or Federal Specification.
   9. A blank space, 4" x 4", for the Engineer's stamp.
   10. Identification of deviations from Contract Documents.
   11. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements and compliance with Contract Documents.
   12. Where specified or when requested by the Engineer, manufacturer's certification that equipment, accessories and shop painting meet or exceed the Specification requirements.
   13. Where specified, manufacturer's guarantee.

1.8 RESUBMISSION REQUIREMENTS

A. Revise initial submittals as required and resubmit as specified for initial submittal.

B. Indicate on submittals any changes which have been made other than those required by Engineer.

1.9 ENGINEER'S REVIEW

A. The review of shop and working drawings hereunder will be general only, and nothing contained in this specification shall relieve, diminish or alter in any respect the responsibilities of the Contractor under the Contract Documents and in particular, the specific responsibility of the Contractor for details of design and dimensions

necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance specified thereunder.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

SUBMITTAL CERTIFICATION FORM

PROJECT: Water Storage Improvements CONTRACTOR'S PROJ. NO: _____

CONTRACTOR: _____ ENGINEER'S PROJ. NO: 2575

ENGINEER: UNDERWOOD ENGINEERS, INC.

TRANSMITTAL NUMBER: _____ SHOPDRAWING NUMBER:_____

SPECIFICATION SECTION OR DRAWING NO: _____

DESCRIPTION: _____

MANUFACTURER: _____

The above referenced submittal has been reviewed by the undersigned and I/we certify that the material and/or equipment meets or exceeds the project specification requirements with

___ NO DEVIATIONS

or

___ A COMPLETE LIST OF DEVIATIONS AS FOLLOWS[a]:

_____
_____
_____
_____
_____

By:_____ By:_____
Contractor[b] Manufacturer[c]

Date: _____ Date: _____

[a] Any deviations not brought to the attention of the Engineer for review and concurrence shall be the responsibility of the Contractor to correct, if so directed.

[b] Required on all submittals

[c] When required by specifications

END OF SECTION

SECTION 01350

GROUNDWATER PROTECTION PLAN

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Provide a Groundwater Protection Plan.
   2. Implement approved Groundwater Protection Plan.

B. Components of Plan:
   1. The Groundwater Protection Plan will include, but not be limited to, a discussion of and procedures for the following items:
      a. Work restrictions within the protective well radius
      b. Waste disposal
         1) Trash
         2) Sanitary waste
      c. Handling storage, and disposal of regulated substances, regulated contaminants, and hazardous substances in accordance with Federal, State, and Local regulations
      d. Spill prevention measures
      e. Fueling of equipment
      f. Response and control measures in the event of a release of regulated substances, regulated contaminants, and hazardous substances
      g. Inventory of regulated substances, regulated contaminants, and hazardous substances that may be present on site
      h. Emergency and regulatory contact information in the event of a spill.
   2. The plan will also include a summary of earthwork activities and erosion control measures.

1.2 SUBMITTALS

A. Submit a Groundwater Protection Plan to the Engineer within 15 days of the contract signing, prior to the anticipated start of work.

1.3 SCHEDULING WORK

A. No work will be allowed until the Groundwater Protection Plan has been reviewed and approved by the Engineer.

B. Prior to working onsite, Subcontractors must sign an acknowledgement that states they have read and will comply with the restrictions in the Groundwater Protection Plan (sample form is included at the end of this section).

1.4 REGULATORY COMPLIANCE

A. Groundwater Protection Plan must show conformance with NHDES Best Management Practices for Groundwater Protection (NHDES Fact Sheet WD-DWGB-22-4) and Best Management Practices for Refueling and Maintenance of Excavation and Earthmoving Equipment (NHDES Fact Sheet WD-DWGB-22-6) (Fact Sheets attached for convenience).

B. The plan must also show compliance with all other applicable Federal, State, and Local regulations pertaining to the protection of groundwater and surface water.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

A. Best management practices must be in place before work is allowed to proceed.

B. Maintain all necessary best management practices during authorized suspension of the Work, weekends, holidays or other times when the Work is not in progress.

END OF SECTION

GROUNDWATER PROTECTION PLAN ACKNOWLEDGEMENT

OWNER'S CONTRACT NO.: _____ ENGINEER' PROJECT NO.: 2575

CONTRACT TITLE: Water Storage Improvements

OWNER: CITY OF DOVER

I, the undersigned, have read or have had read to me the Groundwater Protection Plan for the Water Facilities Improvements Project. I understand that it is my responsibility to follow these rules at all time and that if I do not understand a safety rule that I am obliged to ask my supervisor.

I have also been informed of the environmental sensitivity of the location of this project and will take every precaution to prevent spills, misuse, and the improper storage of hazardous materials.

I understand that violations to these rules and regulations could lead to my dismissal on this project.

GENERAL CONTRACTOR: _____

SUBCONTRACTOR COMPANY: _____

NAME: _____

SIGNATURE: _____

DATE: _____

OSHA 10-HOUR CARD #: _____

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Take a minimum of fifty (50) pre-construction photographs.
2. Take digital photographs throughout the entire construction period, at no additional cost to the Owner.
3. The photographs are generally to be taken in groups of four at a time and are taken at the installation of each structure and for each repair.

PART 2 - PRODUCTS

2.1 QUALITY

A. Photographer: The construction photographs shall be taken by a professional photographer, subject to approval by the Engineer.

PART 3 - EXECUTION

3.1 SUBMITTAL OF PHOTOGRAPHS

A. Submit to the Engineer a CD containing all photographs.

END OF SECTION

SECTION 01400
CONSTRUCTION QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Construction Quality Control (Construction QC) is the means by which the Contractor assures that the Contractor's construction complies with the requirements of the Contract Documents. The control shall be adequate to cover all construction operations, including both on-site and off-site operations, and shall be keyed to the proposed construction sequence.

B. The quality controls shall include at least three phases of inspection for all definitive features of work as follows:
   1. Preconstruction Inspection
   2. Construction Inspection
   3. Post-Construction Inspection

C. The controls shall also include site testing, reporting of noncompliance conditions, field change activities and auditing of all site activities.

1.2 SUBMITTALS

A. Related Sections:
   1. General Conditions
   2. Coordination - Section 01020
   3. Construction Schedules - Section 01310
   4. Submittals - Section 01340
   6. Earthwork - Division 2
   7. Concrete Testing - Division 3
   8. Electrical - General - Division 16
   9. Other sections as applicable.

B The Contractor shall prepare, a Construction Quality Control (Construction QC) Program for equipment and material supplied to the work site, and controlling the quality of construction (non-chemical) activities. No work shall begin until the QC program has been approved.

C. The Construction QC Program shall include at a minimum, the following:
   1. Schedule of inspection activities to cover at least the following items:
      a. Site preparation construction
      b. Excavation, grading and concrete form work
      c. Concrete placement
      d. Mechanical installation
      e. Equipment delivery and storage
      f. Electrical and instrumentation
      g. Building construction
   2. Procedures for implementing and scheduling inspections, documentation, and submittals, including those of subcontractors, off-site fabricators, suppliers and purchasing agents.
   3. Noncompliance conditions control procedure.

4. Procedures for field changes.
5. Procedures for auditing construction activities.

PART 2 - PRODUCTS

NOT PART OF THIS SECTION

PART 3 - EXECUTION

3.1 CONTROL INSPECTIONS

A. The Contractor shall be responsible for performing all QC inspections required by the approved Construction QC program.

B. The execution of the Construction QC Program shall be in accordance with the following:

1. Pre-construction
   a. The inspection shall be performed prior to beginning any work on any definable feature of the construction work.
   b. It shall include a review of Contract requirements; a check to assure that the appropriate shop drawings have been prepared, submitted and accepted by the Engineer; a check to assure that all materials and/or equipment have been tested, submitted and accepted by the Engineer; a check to assure provisions have been made to provide required testing; examination of the work area to ascertain all preliminary work has been completed; and a physical examination of materials, equipment and samples to assure they conform to accepted shop drawings or submittal data.
   c. Verification shall be made that all materials and/or equipment are on hand, and all equipment is properly calibrated and in proper working condition.
   d. The Engineer shall be notified at least 24 hours in advance of the preparatory inspection and such inspection shall be recorded in the Contractor's Quality Control documentation as required below.
   e. Subsequent to the preparatory inspection and prior to commencement of work, the Contractor shall instruct each applicable subcontractor or tradesman as to the level of workmanship required in his plan in order to meet the requirements of the Contract documents.
   f. The Contractor shall appoint an individual to be designated to act as CQC Manager.
2. Construction Inspection
   a. The initial inspection shall be performed as soon as a representative portion of a particular feature of work has been accomplished.
   b. The inspection shall include examination of the quality of workmanship and a review of testing for compliance with contract requirements.

c. The Engineer shall be notified at least 24 hours in advance of the initial inspection and such inspection shall be recorded in the Construction QC documentation as required below.
d. Follow-up inspection shall be performed daily to assure continued compliance with contract requirements, including control testing, until completion of the particular feature of work.
e. Such inspections shall be recorded in the Construction QC documentation.
f. Final follow up inspections shall be conducted, and test deficiencies corrected, prior to the addition of new features of work.

3. Post Construction Inspection
   a. At the completion of all work or any increment thereof established by a completion time stated elsewhere in the Contract Documents, the Construction QC Manager shall conduct a post construction inspection of the work and develop a "punch list" of items which do not conform to the approved plans and specifications.
   b. Such a list shall be included in the Construction QC documentation and shall include the estimated date by which the deficiencies will be corrected.
   c. The CQC Manager or his designee shall make a second completion inspection.
   d. Deficiencies requiring correction shall be accomplished within the time stated for completion of the entire work.

3.2 TESTS

A. Test Procedures:
   1. The Contractor shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to contract requirements.
   2. The Contractor shall procure the services of an industry recognized testing laboratory or he may establish a testing laboratory at the project site.
      a. The Contractor shall direct testing laboratories or agencies to provide carbon copies of all test results directly to the Engineer, immediately upon their transmittal to the Contractors office.
   3. The name and qualifications of the laboratory shall be submitted to the Engineer for review and acceptance.
   4. A list of tests which the Contractor understands he is to perform shall be furnished as a part of the Construction QC Program to the Engineer.
   5. The list shall give the test name, specification paragraph containing the test requirements, and the personnel and laboratory responsible for each type of test.
   6. The Contractor shall perform the following activities and record and provide the following data:
      a. Verify that testing procedures comply with Contract requirements.
      b. Verify that facilities and testing equipment are available and comply with testing standards.
      c. Check test instruments calibration data against certified standards.

3.3 DOCUMENTATION

A. The Contractor shall maintain current records of quality control operations, activities, and tests performed including the work of suppliers and subcontractors.

B. Records shall be on an acceptable form and indicate a description of trades working, the weather conditions encountered, delays encountered, and acknowledgments of deficiencies noted along with the corrective actions taken on current and previous deficiencies

C. These records shall include factual evidence regarding required site-specific activities or tests and their results. These records shall include but not limited to the following:

1. Type and number of control activities and test involved.
2. Results of control activities or tests, with authorized signature.
3. Nature of defects, causes for rejection, proposed remedial action, and corrective actions taken.
4. Results of retests if required.

D. These records shall cover both conforming and defective or deficient features and shall include a statement indicating that supplies and materials incorporated in the work comply with the Contract.

E. Legible copies of these records shall be furnished to the Engineer for review on an on-going basis throughout construction of the project.

3.4 NOTIFICATION OF NONCOMPLIANCE

A. The Engineer will notify the Contractor of any noncompliance with the foregoing requirements of which he or she may become aware.

1. A copy of the noncompliance notification will be forwarded to the Owner and Government Parties by the Engineer.
2. The Contractor shall, after receipt of such notice, immediately take corrective action.
3. Such notice, when delivered to the Contractor or his representative at the site of work, shall be deemed sufficient for the purpose of notification.

B. The Contractor shall notify the Engineer of proposed corrective actions to be taken to address noncompliance items. The corrective action shall address the specific item not in compliance and shall also address any systematic conditions of the Contractor's operations that may have contributed to the noncompliance.

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Provide and pay for all temporary applicable utilities required to properly perform the Work at no additional cost to the Owner including the placement and removal of the utilities.
2. Completely remove all temporary equipment and materials upon completion of the Work and repair all damage caused by the installation of temporary utilities.
3. Make all necessary applications and arrangements for electric power, light, water, telephone and other utilities with the local utility companies. Notify the local electric power company if unusually heavy loads, such as welders, will be connected.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Obtain permits as required by local governmental authorities.
2. Obtain easements, when required, across private property other than that of the Owner for temporary power service.
3. Comply with the latest National Electrical Code.
4. Comply with all local, State and Federal codes, laws, and regulations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Electrical:

1. Provide all required facilities, including as applicable, but not limited to, transformers, conductors, poles, conduits, raceways, fuses, switches, fixtures, and lamps.
2. Use new or used material adequate in capacity for the purposes intended.
3. Materials must not create unsafe conditions or violate the requirements of applicable codes.
4. Conductors:
   a. Wire, cable or busses of appropriate type, sized in accordance with the latest National Electrical Code for the applied loads.
   b. Use only UL approved wire.
5. Conduit:
   a. Rigid steel, galvanized: ANSI C80.1.
   b. Electrical metallic tubing: ANSI C80.3.
   c. Other material approved by NEC

6. Equipment: Provide appropriate enclosures for the environment in which used in compliance with NEMA Standards.

B. Heating:
1. When heat is required for the protection of the Work, provide and install a non-hazardous type of heating apparatus, and provide adequate and proper fuel.
2. Use heating equipment and materials that are in proper condition.

C. Water:
1. Provide drinking water equipment and material that will prevent contamination and health hazards.

D. Sanitary Accommodations:
1. Comply with all local, State and Federal codes, laws and regulations.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Electrical:
1. Provide electrical energy to:
   a. All necessary points on the construction site so that power can be obtained at any desired point with extension cords no longer than 100 feet.
   b. Construction site offices.
   c. Lighting as required for safe working conditions at any location on the construction site.
   d. Night security lights.
   e. When applicable, Owner's present facilities during the changeover of electrical equipment.
2. Maintain electrical energy throughout the entire construction period
3. Capacity:
   a. Provide and maintain adequate electrical service for construction use by all trades during the construction period at the locations necessary.
4. Installation:
   a. Install all work with a neat and orderly appearance.
   b. Have all installations performed by qualified electricians.
   c. Modify service as job progress requires.
   d. Locate all installations to avoid interference with construction and materials handling equipment, storage areas, traffic areas and other Work.

B. Heating:
1. Maintain a heated environment for the Work at the temperature and for the length of time specified and as otherwise needed.
2. Precaution:
   a. Operate temporary heating apparatus in a manner that finished Work will not be damaged.

b. Repair all damage, caused by temporary heating operations, to the complete satisfaction of the Engineer, at no additional cost to the Owner.

C. Water:

1. Provide and maintain a safe water supply for drinking and construction purposes as required for the proper execution of the Work.

D. Sanitary Accommodations:

1. Provide and maintain sanitary accommodations for the use of the employees of the Contractor, subcontractors, and Engineer.
2. Sanitary accommodations shall meet the requirements of all local, State and Federal health codes, laws and regulations.

END OF SECTION

SECTION 01540

SECURITY

PART 1 -- GENERAL

1.1 REQUIREMENTS INCLUDED

A. Providing a project security program, to:
   1. Protect the Work, stored products and construction equipment from theft and vandalism.
   2. Protect premises from entry by unauthorized persons.

1.2 MAINTENANCE OF SECURITY

A. Initiate security program promptly after job mobilization.
B. Maintain security program throughout construction period, until OWNER occupancy or OWNER acceptance precludes the need for CONTRACTOR security.

1.3 EXCLUSION OF UNAUTHORIZED PERSONS

A. Persons not properly authorized or identified shall be excluded from site.

1.4 ENTRANCE CONTROL

A. Provide control of all persons and vehicles entering and leaving Project site. Require proper identification by each person.
B. OWNER will control deliveries and vehicles related to his own operations.

PART 2 -- PRODUCTS

Not Used

PART 3 -- EXECUTION

3.1 RESPONSIBILITIES

A. The CONTRACTOR shall be fully responsible for injury to persons and damage to any and all of the OWNER'S property resulting from construction activities and/or failure to provide adequate security.

END OF SECTION

SECTION 01562

DUST CONTROL

PART 1 -- GENERAL

1.1 DESCRIPTIONS

A. Work Included: Furnish and apply water or calcium chloride on the road surfaces within the construction site, when needed to control dust.

B. Dust Control Work shall be incidental to the appropriate items of the Contract and not a separate payment item.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Water for Sprinkling: Clean, free of salt, oil, and other injurious matter.

B. Calcium Chloride: Meet the requirements of AASHTO M144.

PART 3 -- EXECUTION

3.1 APPLICATION

A. Water: Use suitable equipment including a tank with gauge equipped pump or spray bar.

B. Calcium Chloride: Apply at a rate sufficient to maintain a damp surface but low enough to assure non-contamination of water courses.

3.2 PROTECTION

A. Perform all Dust Control Work in a manner that will prevent damage to public and private property from dust and the materials used.

B. Repair, replace or make payment for all damage caused by Dust Control Work at no additional cost to the Owner.

C. **Calcium chloride is prohibited in the 400 ft well protective radius.**

END OF SECTION

SECTION 01580

PROJECT IDENTIFICATION

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Furnish and erect a sign at the project site to identify the project and to identify that the Federal and State Governments are participating in the development of the project (if applicable).

B. Do not place, or allow the placement of, other advertising sign boards at the project site or along rights-of-way furnished for the project work.

PART 2 -- PRODUCTS

2.1 MATERIALS AND DESIGN

A. Construct a sign of 3/4 inch exterior grade, high density overlaid plywood or other approved material suitable for signs.

B. Construct the sign in accordance with the following sample Drawing.

C. Submit sign for review and approval by Engineer of final wording and funding.

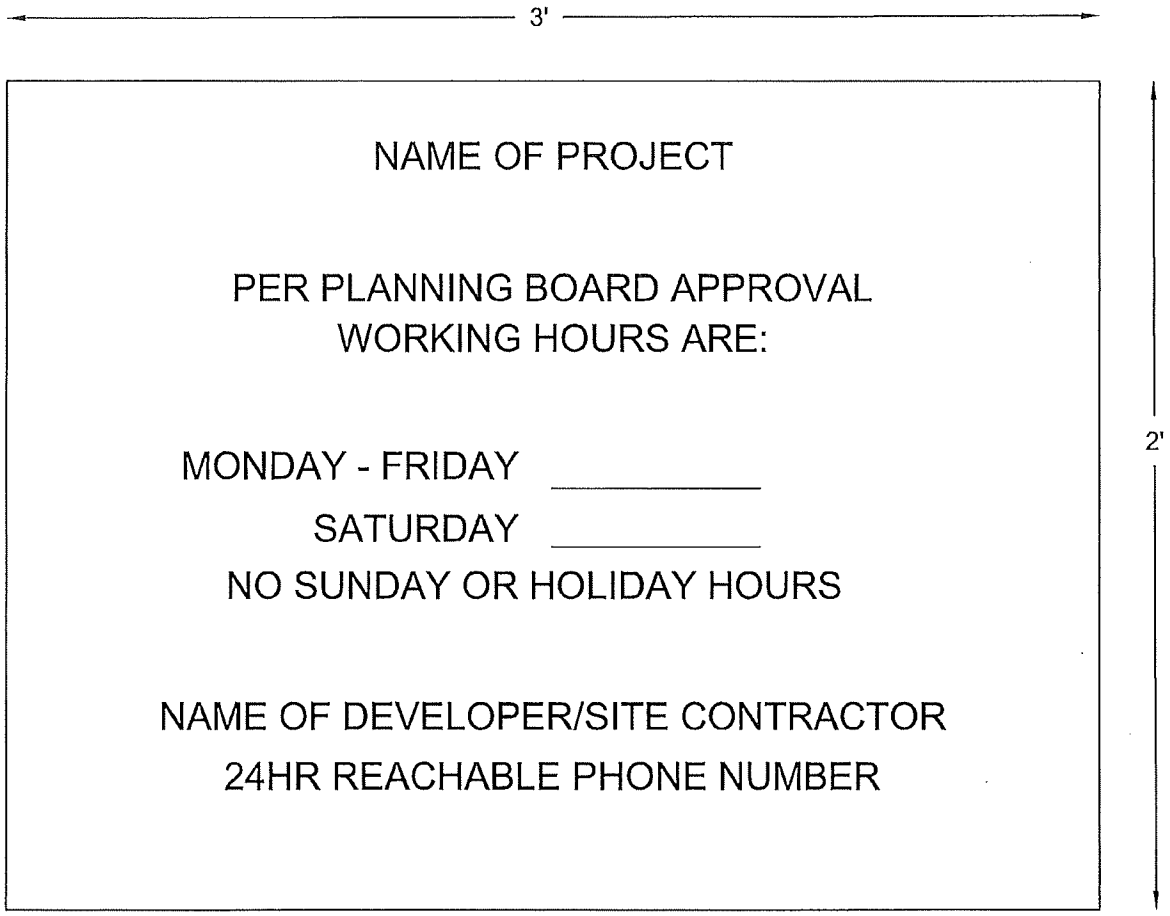
PART 3 -- EXECUTION

3.1 GENERAL

A. Place the sign in a prominent location approved by the Owner.

B. The following information should be placed on the sign:
   1. Project Number: B22035
   2. Project Name: Composite Elevated Water Storage Tank
   3. Owner: City of Dover

END OF SECTION



NOTES:

1. SIGN SHALL HAVE BLACK LETTERS ON A WHITE BACKGROUND

CITY OF DOVER - CONSTRUCTION SIGN

NOT TO SCALE

SECTION 01590

TEMPORARY FIELD OFFICE

PART 1 -- GENERAL

1.1 WORK INCLUDED

A. Provide and maintain a field office electrical power and communications for the exclusive use of the Engineer during the entire life of the Contract. The office shall be completely furnished prior to the start of any work.

B. Pay for all utilities for the duration of the project.

1.2 QUALITY ASSURANCE

A. Install all office components in accordance to all local, state, and federal regulations.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Products may be new or used, but must be in good condition.

B. Products that require frequent maintenance shall be replaced immediately.

C. All products shall not violate any applicable code or regulation.

2.2 PRODUCTS

A. Provide a separate structure, such as a mobile field office trailer:

1. Size: Equivalent to 10 feet by 30 feet in area.
2. A minimum of two windows arranged for cross ventilation with screens.
3. Door with closer and secure lock.
4. Adequate lights over all work areas and convenient electrical outlets on each wall.
5. Adequate heating and air conditioning system with thermostat control.
6. Sanitary conveniences meeting the requirements of all local and state health codes (portable facilities are acceptable).
7. Provide communications service for the exclusive use of the Engineer.
   a. Provide one line for Broadband Internet service (wireless hotspot or DSL/Cable).
8. Portable water supply. Supply may be a water cooler.

B. Provide furnishings:

1. One (1) flat top desk, 30 inches by 60 inches, with drawers at each side.
2. Eight (8) linear feet of book shelf.
3. One (1) plywood drawing table with suitable drawing surface, 3 feet by 6 feet.
4. One (1) desk or table suitable for supporting the copy machine, fax machine and computer.
5. Eight (8) straight chairs plus one (1) stool suitable for use with drawing table.
6. One (1) 8-foot-long folding table.

7. One (1) four-drawer steel filing cabinet with lock and key.
8. One (1) large wastebasket.
9. One (1) rack suitable for storing drawings.
10. One (1) 30”x36” tack board.
11. One (1) outdoor thermometer.
12. One (1) 3-hole paper punch.
13. One (1) stapler with a full box of refills.
14. One (1) wall mounted fire extinguisher.

C. Provide Equipment:
1. One (1) combination plain paper fax machine, copier, printer and scanner. Capable of 11” x 17” printing. Color.
a. Hewlett Packard.
b. or approved equal.
2. Refrigerator.
3. Microwave.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Install in a location approved by the Owner and properly set up for all anticipated weather conditions.
B. Install office on a secure foundation.
C. Provide electric power and heat for the duration of the Work.
D. The Contractor shall pay all utility charges (including telephone) relating to this Contract.
E. Install thermometer such that it is not directly in the sunlight; however, it shall be visible from the inside of the office.

3.2 CLEANING

A. The Contractor shall perform periodic cleaning of the office, including washing floors and dusting. At a minimum, the office shall be cleaned every 2 weeks, but shall be cleaned upon the request of the Engineer.
B. The Contractor shall empty the wastebaskets at the end of each week.

3.3 MAINTENANCE

A. Repair deficiencies immediately upon notice by the Engineer.
B. Maintain an adequate supply of water, copy paper, and fax paper/rolls.

3.4 REMOVAL

A. Upon completion of the project, remove the Field Office from the site and thoroughly clean the area.

B. The Field Office, furnishings, and equipment shall remain the property of the Contractor.
C. Restore the surface to a condition at least as good as what existed prior to construction.

END OF SECTION

SECTION 01611

OWNER'S RIGHT TO MATERIAL

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. The Owner retains the right to claim all suitable and unsuitable granular materials.
   2. The Owner retains the right to claim all components as noted on the Contract Drawings.
   3. Deliver all material claimed by the Owner to a location designated by the Owner within 5 miles of the work site unless otherwise directed by the Engineer.

B. Work Specified Elsewhere. The following is a list of Sections that note work related to this Section. The list is provided for the Contractor's convenience and is not intended to relieve the Contractor of requirements noted in Sections that are not listed below.
   1. Division 2
   2. Division 9
   3. Division 11
   4. Division 13
   5. Division 15
   6. Division 16

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01630

SUBSTITUTIONS & PRODUCT OPTIONS

PART 1 -- DESCRIPTION

1.1 DESCRIPTION

A. If stated in these Specifications that a substitute that is equal to any material or equipment specified may be furnished, and if the Contractor wishes to furnish or use a substitute, submit a written request to the Engineer for approval of the substitute.

B. The Engineer shall be the judge of equality.

1.2 SUBMITTALS

A. Submit approval request promptly after the award of the Contract.

B. Completely describe the proposed substitution including, as applicable:

1. Manufacturer's catalog data,
2. Illustrations,
3. Specifications stamped by a professional engineer in the State where the work is being performed as required,
4. Samples,
5. Copies of previous approvals,
6. List similar projects, date of installation, and names of the engineer and owner for which the product was previously used.
7. Provide an itemized comparison of the proposed product to the specified product. The comparison shall list all variations and reference the appropriate paragraph numbers.
8. Provide quality and performance comparison.
9. Provide cost difference and proposed net change order amount.
10. Provide availability of maintenance service and replacement material.
11. Provide operational and maintenance requirements.
12. State the effects of the substitution on the project schedule and subsequent required changes in work due to the substitution.
13. Other data that may be requested by the Engineer to determine equality.

PART 2 -- PRODUCTS

2.1 CRITERIA

A. The following criteria will be used by the Engineer in determining the equality of the proposed substitutions:

1. Adaptability to the design,
2. Functional performance,
3. Appearance (when applicable)
4. Quality of materials,
5. Strength of materials,

6. Complexity, frequency and cost of maintenance.

PART 3 -- EXECUTION

3.1 ORDERING AND INSTALLING

A. Do not order and do not install any substituted material or equipment without the written approval of the Engineer.

3.2 SUBMITTAL PROCEDURE

A. The Contractor shall submit 6 copies of each substitution request to the Engineer on the form provided at the end of this Section.
B. The Engineer will respond to each substitution request within 14 days from receipt of the request.
C. The Engineer will respond to the Contractor in writing as to the acceptability of the proposed product.
D. For accepted products, the Contractor shall submit a formal shop drawing in accordance with Section 01340 Submittals.

3.3 RESULTING CHANGES

A. If proposed substitutions are judged as being acceptable, make all changes to structures, buildings, piping, mechanical, electrical, instrumentation and other items necessary to accommodate substitutions, at no additional cost to the Owner, including costs which may later become apparent.
B. Whenever it may be written that a manufacturer must have a specified period of experience with his product, a product which does not meet the specified experience period can be considered if the manufacturer is willing to provide a bond or cash deposit for the duration of the specified time period which will guarantee replacement of that product in the event of failure. However, this does not necessarily mean the substitution will be accepted.
C. There shall be no shortening of the warranty period for the proposed product over the specified product.

3.4 ENGINEERING SERVICES

A. If the Contractor requests substitutions which require design or other engineering services, the services will be provided only by a Professional Engineer registered in the state in which the project is located.
B. All engineering services for substitutions shall be performed at the expense of the Contractor.

SUBSTITUTION REQUEST FORM

Date: _____

1. Name of product to be substituted: _____
2. Name of product requested as substitute: _____
3. Specification Section Reference: _____
4. Drawing Number Reference: _____
5. Attached to this form are the following:
   a. Manufacturer's Catalog Data.
   b. Illustrations,
   c. Specifications,
   d. Samples,
   e. Copies of previous approvals
6. List similar projects using this product (provide at least 4):

	Project Name and Location	Date of Installation	Name & Number of Engineer	Name & Number Owner
a.	_____	_____	_____	_____
	_____		_____	_____
	_____		_____	_____
b.	_____	_____	_____	_____
	_____		_____	_____
	_____		_____	_____
c.	_____	_____	_____	_____
	_____		_____	_____
	_____		_____	_____
d.	_____	_____	_____	_____
	_____		_____	_____
	_____		_____	_____

7. Attach itemized comparison by Specification Paragraph, including quality, performance, cost, and O&M requirements.

8. Availability of Maintenance and Service and Replacement Material: _____

_____

9. State effect of substitution on:

   i. Construction Schedule: _____

   ii. Project Cost: _____

   iii. Changes Required in Other Work: _____
   _____
   _____

10. Contractor Representations:

    i. Contractor has complied with Section 01630 in its entirety.

    ii. Contractor has investigated proposed substitution and has determined that it is equal or superior to the product specified.

    iii. Contractor will provide same warranty as required for the specified product, as a minimum.

    iv. Contractor will coordinate installation of substitution through completion.

    v. Contractor waives all claims for additional costs related to substitution which may later become apparent.

    vi. Contractor agrees to pay all reasonable fees of the Engineer and other consultants in making an evaluation of this substitution request whether such request is ultimately accepted or not.

11. Certification:

    Signature _____

    Name & Title _____

    Company _____
    (Contractor)

END OF SECTION

SECTION 01701

PROJECT CLOSE-OUT PROCEDURES

PART 1 - GENERAL

1.1 INTRODUCTION

A. Contractor's requirements of the Contract to closeout the project.

1.2 PROJECT CLOSE-OUT REQUIREMENTS

A. Prior to final payment the Contractor shall submit the following to the Engineer:
   1. Contractor's Affidavit
   2. Consent of Surety to final payment.
   3. Certificate of Inspections
   4. Evidence of payment and release of liens
   5. Project Record Documents (Section 01720)
   6. Operation and Maintenance data (Section 01730)
   7. Submission of warrantees

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

(NOT PART OF THIS SECTION)

END OF SECTION

SECTION 01710

PROJECT CLEANING

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.
   2. At completion of Work, remove waste materials, tools, equipment, machinery, and surplus materials, and clean all sight-exposed surfaces. Leave project clean and ready for use.

1.2 QUALITY ASSURANCE

A. Conduct cleaning and disposal operations in accordance with all applicable local and state laws, ordinances, and code requirements.

PART 2 -- PRODUCTS

A. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

PART 3 -- EXECUTION

3.1 PERFORMANCE

A. Cleaning During Construction (where applicable):
   1. Execute cleaning operations to ensure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
   2. Entirely remove and dispose of material or debris during the progress of the Work that has washed into or has been placed in watercourses, ditches, gutters, drains, catch basins, or elsewhere as a result of the Contractor's operations.
   3. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
   4. At reasonable intervals during the progress of work, clean the site and dispose of waste materials, debris, and rubbish.
   5. Clean interiors of buildings, when applicable, prior to finish painting, and continue on an as-needed basis until buildings are ready for occupancy.
   6. Handle materials in a controlled manner with as few handlings as possible. Do not drop or throw materials from heights.
   7. Where applicable, schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.

B. Sweep all roads where work had been completed on a daily basis.

C. Control of Hazards:

1. Store volatile wastes in covered metal containers, and remove from premises daily.
2. Prevent accumulation of wastes which may create hazardous conditions.
3. Provide adequate ventilation during use of volatile or noxious substances.

D. Disposal:
1. Dispose of all material at an approved disposal area.
2. Do not burn or bury rubbish and waste material on project site.
3. Do not dispose of hazardous wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
4. Do not dispose of wastes into streams or waterways.
5. Do not dispose of waste material in excavations.

E. Final Cleaning (where applicable):
1. Employ experienced and/or professional cleaners for final cleaning.
2. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from all sight-exposed interior and exterior finished surfaces.
3. Repair, patch and touch up marred surfaces to specified finishes.
4. Broom clean paved surfaces.
5. Rake clean non-paved surfaces on the project site.
6. Restore to their original condition those portions of the site not designated for alterations by the Contract Documents.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included: Keep accurate Record Documents of all additions, substitutions of material, variations in work, and any other additions or revisions to the Contract.

B. Provide field survey of completed water system including GPS coordinates and elevations of pipe, fittings and changes in slope.

PART 2 -- PRODUCTS

2.1 DOCUMENTS

A. Maintain at the job site, one copy each of:

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Reviewed Shop Drawings.
5. Change Orders.
6. Any other modifications to the Contract.
7. Field Test Reports.
8. Inspection certificates

PART 3 -- EXECUTION

3.1 STORAGE AND MAINTENANCE

A. Store Record Documents in approved files and racks apart from documents used for construction.

B. File Record Documents in accordance with Project Filing Format of Uniform Construction Index.

C. Maintain Record Documents in clean, dry, legible condition.

D. Do not use Record Documents for construction purposes.

E. Make Record Documents available at all times for inspection by the Engineer and Owner.

3.2 RECORDING

A. Label each document "PROJECT RECORD" in large printed letters.

B. Keep Record Documents current and do not permanently conceal any work until required information has been recorded.

C. Contract Drawings: Legibly mark to record actual construction (when applicable)

1. Method of locations and recording shall have prior approval of the Engineer.
2. Depths of various elements of foundations in relation to survey datum.

3. Horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
    a. Include all water, sewer, steam, air, instrumentation and fuel piping systems and all electrical and communications circuits including all direct burial cables.
    b. Whenever any existing utility line is uncovered in the course of excavation for new utility installation, record the location dimensions of such lines.
4. Location of house service connection points with any utility (water, sewer, electrical, telephone, etc.) and the location of capped or plugged ends of these same house service lines.
    a. Locations shall be recorded by accurate "swing ties" or other methods approved by the Engineer.
5. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
    a. Electrical equipment such as conduits, piping, instrumentation located in slabs, walls and ceilings and to include approximate locations and routing.
    b. Schematic diagram of actual electric conduit or instrument tubing routing between equipment and supply.
6. Field changes of dimension and detail and changes made by Change Order or Field Order.
7. Details not on original Contract Drawings.

D. Specifications and Addenda: Legibly mark up each Section to record:
1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.

3.3 SUBMITTALS

A. At the completion of the project, deliver Record Documents to the Engineer.
1. Record Drawings shall be submitted in electronic (PDF) format in addition to full size 22'' x 34'' hard copy.

B. Accompany submittal with transmittal letter, in duplicate, containing:
1. Date, project title and number.
2. Contractor's name and address.
3. Title and number of each Record Document with certification that each document is completed and accurate.
4. Signature of Contractor, or his authorized representative.

C. Failure to record these locations on the Project Record Drawings shall result in non-approval of the final payment to the Contractor and/or if contract time (as specified in the Contract and/or modified in accordance with the Standard General Conditions of the Construction Contract) has elapsed, this shall be grounds for the assessment of the liquidated damages as specified.

END OF SECTION

SECTION 01730

OPERATION AND MAINTENANCE MANUALS

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Submit to the Engineer, all Operation and Maintenance Manuals required by the individual Specification Sections.

1.2 SUBMISSION REQUIREMENTS

A. At least 2 months prior to the expected substantial completion date, the Contractor shall submit to the Engineer all manuals in accordance with the requirements specified herein Specification Section 01730, and within individual equipment specification sections.

B. The Contractor shall furnish the Engineer a minimum of six (6) copies of a complete instruction manual for installation, operation, maintenance, and lubrication of each item specified. The Engineer will retain four (4) copies (for Owner's, Engineer's and Field Representative's files) and return two (2) copies to the Contractor for distribution to subcontractors, suppliers and manufacturers. If the Contractor requires more copies, then the number of copies submitted shall be adjusted accordingly. In addition, the Contractor shall furnish electronic (PDF) copies of all final submissions.

1.3 CONTENTS

A. Table of contents

B. Operating and maintenance information on all systems and items of equipment. The data shall consist of:
   1. Catalogs, brochures and bulletins of parts
   2. Charts and graphs
   3. "Nameplate" data for all equipment including equipment serial and model number
   4. Wiring diagrams
   5. Assembly drawings of location
   6. Schedule of maintenance
   7. Lubrication requirements
   8. Lubrication charts showing manufacturer recommended lubricants for each rotating or reciprocating unit
   9. Operating weight
   10. Name, address and telephone number of subcontractors, manufacturers and suppliers for each piece of equipment.
   11. Shop drawings corrected to as-built conditions
   12. Operation descriptions
   13. Warranties
   14. List of replacement parts

15. Detailed instructions for start-up, normal operation, shutdown procedures, and control techniques
16. Guide to troubleshooting the system
17. Description of controls including sequencing, diagrams, charts of valve tag numbers, etc.
18. Other necessary information for the Engineer to establish a complete maintenance program

C. Materials and Finishes. The data shall consist of:
1. Building products
2. Instructions for care and maintenance
3. Additional requirements

1.4 FORMAT
A. Provide binders with covers identifying detail title.
B. Provide tabs for each separate product and system
C. Provide drawings bound in with text or folded to text size pages.

PART 2 -- PRODUCTS

(NOT USED)

PART 3 -- EXECUTION

(NOT USED)

END OF SECTION

SECTION 01800

EQUIPMENT STARTUP, CERTIFICATION AND OPERATOR TRAINING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. General: The work included in this Section includes startup of equipment, certified equipment testing and manufacturer provided operator training of the facility personnel in the proper operations and maintenance of the furnished equipment. This shall include all equipment provided for the project, regardless of specification Division, unless specifically noted otherwise. Clean, test and adjust each piece of equipment and/or system to the complete satisfaction of the Engineer.
2. One Year Service Call: In addition to the manufacturer's installation and startup/testing services, the Contractor shall arrange for the manufacturer to provide one additional service call of one 8 hour working day on site upon demand of the Owner for each type of equipment within the first year of operation (commencing upon date of Final Completion) at no additional cost to the Owner.

B. General Definitions:

1. Operational Readiness Inspection and Testing (ORT) shall be generally defined as the initial placing into operation of the equipment in question by representatives of the General Contractor, any Sub-Contractors directly responsible for the equipment provided, and the equipment manufacturer.
2. Performance Acceptance Testing (PAT) shall generally be defined as the formal and scheduled demonstration of operations in accordance with the requirements of the Contract Documents. This formal demonstration shall be performed in the presence of the Engineer by representatives of the General Contractor, any Sub-Contractors directly responsible for the equipment provided, and the equipment manufacturer.
3. Process Performance Testing shall generally be defined as the formal and scheduled demonstration of the treatment process as a whole in accordance with the requirement of the Contract Documents. This formal demonstration shall be performed in the presence of the Engineer by representatives of the General Contractor, any Sub-Contractors directly responsible for the equipment provided, and the equipment manufacturer.
4. Operator Training shall generally be defined as the formal and scheduled instruction of plant personnel and other Owner designated representatives in the proper operations of provided equipment, and in the techniques, methods, schedules, etc. associated with maintenance. This formal training shall be performed in the presence of the Engineer, by representatives of the General Contractor, any Sub-Contractors directly responsible for the equipment provided, and the equipment manufacturer. Operator Training shall also include assistance to plant personnel by manufacturer representatives during the initial operations of the equipment.

C. Related Work Specified Elsewhere:

1. Process equipment/systems are specified in Division 11.
2. Instrumentation systems are specified in Division 13.
3. Hoisting equipment is specified in Division 14.
4. HVAC Systems are specified in Division 15.
5. Plumbing systems are specified in Division 15.
6. Electrical systems are specified in Division 16.

D. Submittals:
1. A minimum of ten (10) days prior to the Pre-Startup Meeting, Contractor shall provide a preliminary equipment start-up schedule and plan for the Certified Equipment Test and the Operator Training for each piece of equipment to the Engineer for review. This preliminary plan will include a written outline description of the means and methods to be employed during the Certified Equipment Test of each piece of equipment. The schedule and means and methods of testing will be discussed with the Engineer at the Pre-Startup Meeting for acceptance.

E. Schedules:
1. The Pre-Startup Meeting shall be held at least 14 days prior to the startup of the first piece of equipment supplied under the Contract. At that time, the Contractor shall present their plan as detailed in the previous submittal and accept Engineer's comments and concerns associated with the general features of each piece of equipment which must be demonstrated.
2. Contractor shall provide Engineer with at least 72 hours notice of their desire to perform testing and training to allow necessary coordination with Owner representatives. Contractor shall be responsible for any and all coordination necessary with the daily operations of the facility to accommodate their testing schedule. Actual date and time for testing and/or training will be the first mutually acceptable date and time available to all parties subsequent to receipt of the request.
3. Operator Training may be conducted concurrently with the Certified Equipment Testing with prior approval of the Engineer. However, under no circumstances will conditions of the testing interfere with the ability of Owner's representatives to observe necessary features, to hear and understand instructions, or to ask questions. Under such conditions, Operator Training will be conducted separately from, and subsequent to, the Certified Equipment Testing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 OPERATIONAL READINESS INSPECTION AND TESTING

A. ORT shall be performed by a duly authorized representative of the manufacturer, who is fully trained in the installation, startup and operation of the equipment, including, but not limited to, drive system alignment, equipment calibration, and other mechanical or electrical components of the equipment.

B. The equipment startup shall be performed prior to PAT and Operator Training.

C. No form of energy shall be applied to any part of the system prior to receipt by the Engineer of a certified statement of approval of the installation from the Contractor. This certification shall contain a statement by an authorized representative of the equipment manufacturer that the equipment is ready for testing.

D. As part of the ORT, the Contractor shall:
   1. Verify that the equipment is installed properly and in accordance with manufacturer's requirements and instructions, and as such, it is appropriate to apply power to the units in question.
   2. Verify that all manual, automatic and safety control features of the equipment functions properly, including all alarm, activation and deactivation sequences.
   3. Verify that the equipment can operate without excessive noise, vibration, overheating, overloading, jamming, etc. during normal operating conditions.
   4. Check amperage draws on all power feeds with equipment running under normal operating conditions.

E. Each piece of equipment shall be tested sufficiently to ensure that all features required to be demonstrated and/or verified during the ORT are within acceptable limits. The startup shall not be considered complete until the unit is fully capable of passing the Equipment Certification Testing.

F. Where multiple units are provided, each unit shall under go startup procedures.

G. The Contractor shall provide all power, chemical, tools, equipment, labor, water fuel, coordinate with owner to ensure availability of sludge, etc. as required for startup. All waste materials shall be disposed of by the Contractor in an environmentally acceptable manner at no additional cost to the Owner.

H. The manufacturer representative shall fill out the ORT form included within this Section. Startup will not be considered complete until this form has been provided to the Engineer.

3.2 PERFORMANCE ACCEPTANCE TESTING

A. PAT shall be performed after the Equipment Startup is completed and it has been verified that equipment functions in accordance with the requirements of the Contract Documents in all aspects. It is required that a duly authorized representative of the manufacturer, who is fully trained in the installation, startup and operation of the equipment, be in attendance for the PAT.

B. PAT shall not be scheduled concurrently with the ORT without the prior approval of the Engineer. In all cases, if the Engineer has arrived on-site for the scheduled Certified Equipment Testing and the equipment is not capable of demonstrating complete compliance with the Contract Documents, or if the manufacturer's representative is not present, the Contractor shall be responsible for all costs to the Engineer associated with failed testing, including travel expenses. The importance of prior and proper equipment startup demonstrations to verify the requirements of the Certified Equipment Testing is strongly stressed.

C. At a minimum during the PAT, the Contractor shall demonstrate to the complete satisfaction of the Engineer the following:
   1. That the equipment is installed properly and in accordance with manufacturer's requirements and instructions, and as such, it is appropriate to apply power to the units in question.

2. That all manual, automatic and safety control features of the equipment functions properly, including all alarm, activation and deactivation sequences.
3. That the equipment can operate without excessive noise, vibration, overheating, overloading, jamming, etc. during normal operating conditions.
4. Amperage draws on all power feeds with equipment running under normal operating conditions.
5. The noise level of equipment, drives and motors, unless otherwise noted, shall not exceed 90 dBA, as measured 3 feet from the unit under free field conditions.
    i) Each unit shall be monitored for compliance independently with other area equipment deactivated.
    ii) For monitoring, the equipment will be run under normal operation conditions.
    iii) Contractor shall provide certified proof of calibration for instrument utilized to measure noise level.
6. Other specific requirements as outlined within the individual specification sections.

D. Each piece of equipment shall be tested sufficiently to ensure that all features required to be demonstrated and/or verified are within acceptable limits.

E. Where multiple units are provided, each unit shall under go PAT procedures.

F. The Contractor shall provide all power, chemical, tools, equipment, piping, labor, water fuel, etc. as required for startup. All waste materials shall be disposed of by the Contractor in an environmentally acceptable manner at no additional cost to the Owner.

G. All equipment provided on the project shall be demonstrated to function properly. It is considered acceptable to demonstrate proper operation of individuals items as components of an overall system test. Demonstration as a component of an overall system shall not relieve the Contractor of their responsibilities to demonstrate proper operation or verify specific requirements for each individual component.

H. Minimum PAT Requirements for Pumps
1. If sufficient sewage or water is not available for tests, Contractor will provide water at their expense for testing, if so directed.
2. For chemical feed pumps or pumps moving products that could pose a hazard if spilled, water or products of a similar specific gravity may be substituted for testing purposes with approval of the Engineer.
    a. If a product other than water is used, pumps and piping systems shall be purged prior to placing them in service.
3. During tests, observe and record head, flowrate output, rpm and motor input. Sufficient test points shall be obtained to develop accurate pump system curve. If multiple operational points are specified, compliance with all points must be sufficiently demonstrated.
4. Fully demonstrate ability to operate at specified conditions without motor overload.
5. For mechanical seals, after a run-in period of 30 minutes, the seal area shall be wiped dry. The pump shall be operated for a 10 minute period. No measurable leakage shall be detected from the mechanical seal.
6. Refer to Division 11 and 15, as applicable, for additional details.

I. Minimum PAT Requirements for Blowers/Fans.
   1. During tests, observe and record pressure, unit rpm and motor input. If multiple operational points are specified, compliance with all points must be sufficiently demonstrated.
   2. Fully demonstrate ability to operate at specified conditions without motor overload.
   3. Refer to Divisions 11, 15 and 16 as applicable, for additional details.

J. Minimum PAT Requirements for Instrumentation/Control Systems.
   1. All instruments shall be calibrated in the presence of the Engineer.
   2. All transmitters or direct-operated receivers shall be calibrated to imposed input values representing zero percent, ten percent, and eighty percent of full scale.
   3. The inputs and outputs of devices, as appropriate, shall be connected to manometers for differential pressure devices, or compared to measured levels, rates or quantities, during calibration. The receiving devices shall be adjusted to read the calibrated output of the initial calibration.
   4. After placing each measuring system in service, an actual comparison of the measured variable versus readout shall be made. For each differential pressure based measuring system, a manometer shall be connected to the connections provided in the piping, tank or other appropriate device. Each system shall meet the manufacturer's standard accuracy.
   5. Secondary functions, such as sequencing, timing features, alarm actuation and pacing shall be adjusted during initial calibration and demonstrated after the system is placed in service.
   6. Linkage or range adjustments shall be sealed by colored lacquer in the presence of the Engineer immediately following calibration.
   7. Process calibration, such as volumetric drawdown tests on flows and level measurements, shall be conducted on all measuring systems as requested by the Engineer. Once established as being within acceptable accuracy limits, future tests which require use of the measuring device to demonstrate system operations can utilize generation of mA signals to simulate level, flow or similar variable variations.
   8. Refer to Divisions 13 and 15 as applicable, for additional details.

K. Minimum PAT Requirements for Electrical Systems.
   1. Refer to Division 16.

3.3 PROCESS PERFORMANCE TESTING (COMPOSITE ELEVATED TANK / BOOSTER PUMP STATION)

A. Prior to placing the new facilites on line the following procedure shall be followed.

B. Disinfection:
   1. The Contractor shall disinfect all surfaces contacting treated water, including pipes, valves, pumps, and tank prior to conducting the performance testing.
   2. Disinfection Standards:
      a) Pipelines – AWWA C-651.
      b) Tank – AWWA C-652.

C. Each component will be checked individually under simulated operating conditions to verify that it functions according to the specifications.

D. Operating setpoints shall be adjusted as necessary for satisfactory operation with the approval of the Engineer.
E All instrumentation and Control Operations shall be demonstrated to function as specified including simulation of all alarms, indications, and notifications.
F. Once the equipment is determined to operate correctly, testing of the entire process may begin. The proposed water quality testing frequency and methods shall be reviewed by the Engineer prior to start-up and performance testing.
G. The Contractor shall make all necessary repairs and adjustments to provide a complete properly functioning system and complete the testing.
H. Following the initial process test and upon written authorization from the Engineer, the Contractor shall make final connections to connect tank and pump station to the Water Distribution System.
I. The Contractor, with the assistance of the Owner, shall be responsible for running the new processes until substantial completion.

3.4 OPERATOR TRAINING

A. Operator Training shall be performed by a duly authorized representative of the manufacturer, who is fully trained in the installation, startup and operation of the equipment.
B. Unless otherwise noted within the specific specification sections, provide minimum of one day (8-hour days, not including travel time) of combined training and operational assistance for plant operators for each piece of equipment in the proper operations of provided equipment, and in the techniques, methods, schedules, etc. associated with maintenance.
C. The level of detail and the extent of the training and operational assistance provided shall be sufficient to ensure long-term operations of the equipment, and continuation of the warranty. Should manufacturer require time in addition to the minimums indicated herein, or within the individual specification sections, to sufficiently detail the proper operations and maintenance of the equipment, it will be provided at no additional cost to Owner. Under absolutely no circumstances shall warrantees become void due to Owner's failure to follow operational and maintenance procedures which were not fully detailed and described to Owner's representatives during these sessions.
D. At the Owner's discretion, the training sessions may be video recorded for Owner's future use.
E. Refer to individual equipment specification sections for further requirements.
F. The manufacturer representative shall fill out the Equipment Training Certification form included within this Section. Training will not be considered complete until this form has been provided to the Engineer.

EQUIPMENT PERFORMANCE CERTIFICATION

Owner: _____ Date: _____

Project: _____

Contractor: _____

Equipment Manufacturer: _____

Equipment: _____

As an authorized representative of the Equipment Manufacturer, the undersigned certifies that the equipment listed above conforms to the requirements of the construction contract between the Contractor and the Owner. The undersigned further certifies that the equipment has been installed in accordance with the Manufacturer's written instructions, that it is ready for permanent operation and that nothing in the installation will render the Manufacturer's warranty null and void.

_____ _____

(Authorized Representative of the Manufacturer) (Date)

_____ _____

(Witness) (Date)

EQUIPMENT TRAINING CERTIFICATION

Owner: _____ Date: _____

Project: _____

Contractor: _____

Equipment Manufacturer: _____

Equipment: _____

1. I have trained the Owner's personnel in the proper operation and maintenance of the above equipment.

_____ _____
(Authorized Representative of the manufacturer) (Date)

2. The personnel listed below attended the training session.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

_____ _____
(Owner's Representative) (Date)

3. Witnessed by

_____ _____
(Underwood Engineers, Inc.) (Date)

Underwood Engineers, Inc.
25 Vaughan Mall
Portsmouth, NH 03801

(page left blank intentionally)

END OF SECTION

EQUIPMENT PERFORMANCE CERTIFICATION

Owner: _____ Date: _____

Project: _____

Contractor: _____

Equipment Manufacturer: _____

Equipment: _____

As an authorized representative of the Equipment Manufacturer, the undersigned certifies that the equipment listed above conforms to the requirements of the construction contract between the Contractor and the Owner. The undersigned further certifies that the equipment has been installed in accordance with the Manufacturer's written instructions, that it is ready for permanent operation and that nothing in the installation will render the Manufacturer's warranty null and void.

_____ _____
(Authorized Representative of the Manufacturer) (Date)

_____ _____
(Witness) (Date)

EQUIPMENT TRAINING CERTIFICATION

Owner: _____ Date: _____

Project: _____

Contractor: _____

Equipment Manufacturer: _____

Equipment: _____

1. I have trained the Owner's personnel in the proper operation and maintenance of the above equipment.

_____ _____
(Authorized Representative of the manufacturer) (Date)

2. The personnel listed below attended the training session.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

_____ _____
(Owner's Representative) (Date)

3. Witnessed by

_____ _____
(Underwood Engineers, Inc.) (Date)

Underwood Engineers, Inc.
25 Vaughan Mall
Portsmouth, NH 03801

Scope of Work

Furnish, install and test all site work and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division Section No.	Section Title
02011	Test Pits
02118	Stripping & Stockpiling Topsoil
02220	Excavation - Earth
02229	Backfill and Compaction
02275	Construction Fabrics
02279	Stone Fill
02402	Dewatering - General
02444	Chain Link Fence & Gates
02540	Temporary Erosion Control
02551	Bituminous Concrete Paving (NH)
02555	Removal & Replacement of Paving (NH)
02601	Manholes, Cover and Frames (NH)
02610	Pipe & Pipe Fittings - General
02611	Ductile Iron Pipe & Fittings
02622	PVC Pipe and Fittings
02623	HDPE Pipe and Fittings
02625	Corrugated Polyethylene (CPE) Pipe & Fittings
02626	Water Service Pipe
02630	Couplings, Connectors, Caps & Plugs
02641	Resilient-Seated Gate Valves
02642	Corporation Stops
02643	Curb Stops
02644	Hydrant Assemblies
02645	Curb Boxes
02646	Valve Boxes
02649	Service Saddles
02650	Dewatering – Pre-Draining
02675	Disinfection
02935	Loaming and Seeding
02950	Trees, Plants, and Groundcover
02990	Miscellaneous Work and Cleanup

NHDOT Standard Specifications and Amendments

SECTION 02011

TEST PITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Excavate test pits at the locations and to the depths shown on the Drawings and as directed by the Engineer.

1.2 QUALITY ASSURANCE

A. The test pit excavation must be observed by the Engineer

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials shall be as shown and specified on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavate test pits at the locations and to the depths and widths as directed by the Engineer.

B. Excavated material shall be reused as backfill if it is determined suitable. If the material encountered becomes contaminated or is determined to be unsuitable, the Contractor shall replace it with suitable material at no additional cost.

C. Measurement and Payment for Test Pits shall be in accordance with Section 01025.

D. Contractor is responsible to verify that there are no utilities at the location of the test pit, and is responsible to repair any damage to other unforeseen utilities damaged during the excavation.

END OF SECTION

SECTION 02118

STRIPPING AND STOCKPILING TOPSOIL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Segregate topsoil prior to excavation, trenching and grading operations and stockpile it for use in the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil shall consist of friable loam, reasonably free of subsoil, clay lumps, brush, roots, weeds, and other objectionable vegetation, stones and similar objects larger than two (2) inches in any dimension, litter and other materials unsuitable or harmful to plant growth.

B. The quality of the topsoil material to be used shall be suitable to perform the Work.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Remove topsoil from the areas that are likely to be disturbed as a result of construction operations.

B. Remove topsoil from all designated areas prior to the performance of normal excavation.

C. Replace all lost topsoil with new suitable material.

3.2 STORAGE

A. Transport topsoil and deposit in storage piles convenient to the areas which are subsequently to receive the application of topsoil.

B. Stockpile topsoil separate from other excavated materials.

C. Take all necessary precautions to prevent other excavated material and objectionable material from becoming intermixed with the topsoil before, during and after stripping and stockpiling operations.

D. Neatly trim and grade stockpiles to provide drainage from surfaces and to prevent depressions where water may become impounded.

E. Construct temporary erosion control devices for all stockpiled material, subject to the Engineer's approval.

F. Any excess topsoil shall become the property of the Owner.

END OF SECTION

SECTION 02220

EXCAVATION – EARTH

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. All excavation shall be classified as earth.
   2. Earth excavation work includes the removal of all subsurface materials except ledge and rock as necessary to install the facilities as designed.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.
   1. Refer to Geotechnical Report included in the Appendices of the Project Manual.
   2. Refer to Specification Section 02275 Construction Fabrics and 02229 Backfill and Compaction.

1.2 JOB CONDITIONS

A. Utilities:
   1. The information about known utilities was collected from the owning agency and may or may not have been supplemented by additional field survey or investigation.
   2. The approximate locations of known buried and overhead utilities are shown on the Drawings. No guarantee is made as to the accuracy or correctness of the locations shown and to the completeness of the information given. The Contractor is responsible for confirming the location of utilities in the field prior to commencement of work.
   3. Discontinue excavation by machinery when the excavation approaches pipes, conduits, or other underground structures of which the approximate locations are known. Use manual excavation methods to locate the utilities.
   4. See Section 01019 – Dig-Safe for utility notification and marking requirements.

B. Existing Structures:
   1. Perform excavation in such a manner that will prevent any possibility of undermining or disturbing existing structures, utilities, and work previously completed under this Contract.
   2. Where existing buildings and other structures are in close proximity to the proposed construction, exercise extreme caution and utilize sheeting, bracing, and all other precautionary measures that may be required.

C. Repairing Damage: Repair all damage to existing utilities, structures, grassed, or paved areas which results from construction operations, at no additional cost to the Owner, to the complete satisfaction of the Owner, the Engineer, the utility company and the property owner.

D. Do not leave any trenches open overnight.

E. Unless authorized otherwise in writing by the Owner, all roadways shall be opened to full width two-lane traffic at the end of each day.
F. Erect a fence around all structure excavations to prevent the entry of unauthorized individuals.

PART 2 -- PRODUCTS

A. Unsuitable Material:
   1. If, in the opinion of the Engineer, the material encountered above the indicated grade as shown on the Drawings for excavation is unsuitable the Contractor shall remove the material to the widths and depths as directed by the Engineer. Replace this material as specified in Section 02229 – Backfill and Compaction.
   2. If, in the opinion of the Engineer, the material encountered at or below the indicated invert or grade shown on the Drawings for excavation is unstable (as determined by the Engineer), the Contractor shall remove the material. Replace this material with thoroughly compacted bank-run gravel or crushed stone bedding material as shown on the Drawings, or as directed by the Engineer.
   3. Materials made unsuitable by Contractor's construction methods shall be suitably dried for reuse or removed from the site and replaced with suitable materials at no additional cost to the Owner. This material shall not be eligible for payment as unsuitable material.
   4. Materials determined unsuitable only due to moisture content shall be aerated and stockpiled and may be used as suitable backfill with the approval of the Engineer.
B. Disposal of Excess Material:
   1. All excess material that is, in the opinion of the Engineer, suitable shall remain the property of the Contractor unless specified otherwise.
C. Disposal of Unsuitable Material:
   1. All unsuitable material shall become the property of the Contractor unless specified otherwise.
D. Disposal of Material:
   1. Disposal of excess and unsuitable material shall be the responsibility of the Contractor.
   2. Dispose of suitable and unsuitable material in accordance with applicable environmental law and if applicable at the locations acceptable to the Owner and/or funding agency.
   3. The property owners where the material is disposed of shall sign a release form indemnifying all the Owner, Engineer, and Contractor from any liability of disposal of the said material.
E. Embankment Material:
   1. Obtain prior approval and instructions from the Engineer prior to undertaking the excavation for pipe placement of any fill material that has been in an embankment for less than one year.
   2. Prior to the installation of any pipe, determine by means of compaction testing in accordance with Section 02229 – Backfill and Compaction, that the base material is suitably dense to support the pipe.

PART 3 -- EXECUTION

3.1 PERFORMANCE

A. Structure Excavation:

1. Amount of excavation:

a. Excavate areas large enough to provide sufficient space to permit erection of forms and shoring, drains, masonry and the inspection of foundations. Remove native materials to a minimum of 0'-6" below bottom of footing elevation for the building footprint plus 2 feet.

b. Excavate a minimum of 4 ft beyond the building footprint to allow for structural fill as backfill within 2 ft of footings and piers and 4 ft. from foundation walls.

c. The extent of open excavation shall be controlled by prevailing conditions and comply with OSHA regulations.

d. No structural fill is needed beneath footings if the subgrade is suitable. If necessary, prior to placing structural fill under building foundation and slab compact the exposed subgrade with a minimum of 4 passes using a 5-ton min. vibratory roller to densify the subgrade and underlying fill. A biaxial geogrid is to be wrapped around crushed stone if it is used in place of compacted structural fill. See Specification Section 02275.

e. The Engineer shall be allowed reasonable time to inspect the bottom of all foundation excavation prior to commencement of foundation and footing work to verify the bearing value of the soil encountered.

f. If suitable bearing for foundations is not encountered at the depth indicated on the Drawings, the Contractor shall notify the Engineer immediately and shall not proceed further until instructions are given and necessary measurements made for the purpose of establishing additional volume of excavation. Placing of footings, foundation wall, or compacted fill, on unsuitable material will not be permitted.

g. Bottoms of excavations shall be protected from frost. Foundations, footings or slabs shall not be placed on frozen ground. Shoring and piling shall be removed before backfilling is completed, but not until permanent supports are in place. Excavations of earth and/or rock beyond indicated or authorized limits shall be refilled with specified engineering fill, compacted to 95 percent of the maximum dry density at optimum moisture as specified herein, or concrete, as required by the Engineer at no additional cost to the Owner.

h. Refer to Geotechnical Report included in the Appendices of the Project Manual for additional excavation requirements.

B. Trench Excavation:

1. General:

a. Unless otherwise specifically directed or permitted by the Engineer, begin trench excavation at the low end gravity lines and proceed upgrade.

b. Perform excavation for force mains and water mains in a logical sequence.

2. Amount of Excavation:

a. Trench width: As shown on the Drawings.
b. Trench depth: As shown on the Drawings.
c. Open Excavation:
    1). The extent of open excavation shall be controlled by prevailing conditions.
    2). Open excavation shall, at all times, be confined to the limits acceptable to the Owner.
d. Excavation of soil subgrades beneath spread footings and floor slab shall be performed by earthwork equipment fitted with smooth-edge buckets. Any loose, softened or disturbed material due to construction activities shall be removed prior to subgrade compaction and geogrid placement.

C. Unauthorized Excavation:
1. Backfill and compact to the specified grade, any excavation beyond the limits stated above for trench excavation and as shown on the Drawings (unless specifically ordered otherwise by the Engineer) with material approved by the Engineer. Backfill material may be crushed gravel or crushed stone.
2. Backfill and compact unauthorized excavation at no additional cost to the Owner.

D. Sheeting, Shoring and Bracing:
1. Structures: Provide, install, and maintain sheeting, shoring, and bracing as necessary to support the sides of the excavation and to prevent any movement of earth which could diminish the width of the excavation or otherwise injure the Work, adjacent structures and property in accordance with all State and OSHA safety standards.
2. Trenches: As trench excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the Local, State and OSHA safety standards.

E. Dewatering:
1. Refer to the Geotechnical Report included in the Appendices of the Project Manual.

F. Fencing:
1. Structures: Erect suitable fences around structure excavation and other dangerous locations created by the Work to prevent entry of unauthorized personnel at no additional cost to the Owner.
2. Trenches: If the end of the trench is allowed to be left open during non-working hours by the Owner, the Contractor shall place fences to prevent entry of unauthorized personnel at no additional cost to the Owner.
3. Place fences around equipment and material to prevent damage, theft, and injury to individuals.

END OF SECTION

SECTION 02229

BACKFILL AND COMPACTION

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Work includes backfilling trenches and/or excavation around structures with suitable material removed in the course of excavating and other suitable materials.
   2. Testing soils..

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.
   1. Refer to Geotechnical Report included in the Appendices of the Project Manual.
   2. Refer to Specification Section 02220 Excavation – Earth and 0275 Construction Fabrics.

1.2 REFERENCE STANDARDS

A. Sieve Analysis of Fine and Coarse Aggregates: ASTM C136
B. Sampling Aggregates: ASTM D75
C. Moisture Density Relations of Soils (Modified Proctor): ASTM D1557
D. Density of Soil In-Place by Nuclear Methods: ASTM D2922
E. State of New Hampshire Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction (latest edition)

1.3 QUALITY ASSURANCE

A. The Engineer shall obtain and arrange for payment for all services of a geotechnical testing firm to perform the necessary soil and compaction tests. The independent soils laboratory shall be approved by the Engineer prior to testing.

B. The Contractor shall make necessary arrangements to allow compaction testing to be performed at a time, place and elevation determined by the Engineer.

C. Pre-placement testing.
   1. The Contractor shall coordinate with the Testing Agency to take one sample of each material proposed to be used on the project. The samples shall be taken in the presence of the Engineer and in accordance with ASTM D75.
   2. Subgrade Material: Modified proctor density tests shall be performed on the existing subgrade in accordance with the following schedule and in accordance with ASTM D1557 Method “B”:
      a. At the bottom of excavations where structures or slabs will be placed.
      b. One after every 5,000 cubic yards has been relocated on the site.
      c. Whenever the material has changed in the opinion of the Engineer.

3. Select and Borrow Materials: Sieve and modified proctor density tests shall be performed on all select and borrow material in accordance with the following schedule and in accordance with ASTM C136 and ASTM D1557 Method "B":
   a. Before any materials are brought to the site.
   b. One after every 5,000 cubic yards has been brought to the site.
   c. Whenever the source changes.
4. The result shall be submitted to the Engineer for approval prior to placement.

D. Post-placement testing:

1. The trench and/or excavation shall be prepared using the normal backfill technique employed by the Contractor. No special or additional preparation will be allowed.
   a. Trench backfill from top of pipe cover and up to the bottom of pavement subbase or ground surface in unpaved areas should be compacted to a minimum of 92% of ASTM D1157.
   b. Heavy self-propelled compaction equipment should not be used until the pipe depth of cover is a minimum of 3 ft.
2. Determine in-place density in accordance with ASTM D2922 or by other methods as approved by the Engineer.
3. Compaction tests shall be performed in accordance with the following table:

	Material	**Testing Frequency**	**Percent Compaction**
Under Slabs-on-grade or Spread Footings for Structures and as backfill within 2 feet of footings and 4 feet of foundation walls:			
	Structural fill or crushed gravel	See notes 2,3 & 4.	95% 6" lifts
Around Structures/Foundation Backfill:			
	Borrow material or other material noted on the drawings	One for every 100 l.f. of wall for every 2 lifts of material placed.	95% 12" lifts*
* 6" lifts in confined areas & within 4 feet of foundation wall structural fill			
In Trenches:			
	Native material or borrow material	From the blanket material to the underside of the gravel or loam. See Note #1 Below	95% 12" lifts
	Gravels	One for every 1,000 l.f. of trench for every lift of material placed	95% 6" lifts
Under Paved Areas:			
	Native material or borrow material	One for every 10,000 s.f. of surface area for every 2 lifts of material placed.	95% 12" lifts
	Gravel	One for every 10,000 s.f. of surface area for every lift of material placed.	95% 6" lifts

	Crushed Gravel	One for every 10,000 s.f. of surface area for every lift of material placed.	95% 6" lifts

Under Grassed or Landscaped Areas			
	Native material or borrow material	One for every 20,000 s.f. of surface area for every 2 lifts of material placed.	92% 12" lifts*
* use 6" lifts compacted with hand operated compaction equipment when within 4 feet of new or existing structure foundation.			

Notes:

1. *The Contractor shall propose a method for backfill at the preconstruction conference (including a description of the method to be used to compact around manholes and other structures), which shall be confirmed in the field when work is initiated. This proposed method will be tested and modified as required to meet the compaction requirements noted in the above table. The first day of testing shall include testing of a minimum of 4 lifts. This compaction method shall be used until the soil characteristics have changed in the opinion of the Engineer. At that point new compaction tests shall be performed to determine if the requirements are still being met. If they are, the method shall continue, if they are not, the method shall be modified until the requirements are met. Confirmatory testing shall include testing of a minimum of 2 lifts. The Engineer shall determine the location of all tests.*
2. *Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify compaction to required density. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Engineer.*
3. *Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.*
4. *Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet (30 m) or less of wall length, but no fewer than two tests along a wall face. Test interior and exterior faces.*

4. Should compaction tests fail to meet the specified densities, the Contractor shall modify backfill methods as necessary to obtain passing results. The modified method shall be used from that point on.

1.4 SUBMITTALS

A. The Contractor shall submit at the preconstruction meeting his proposed compaction technique which shall include compaction around field structures (i.e manholes, catch basins, etc.) and valve boxes.

B. The Contractor shall arrange for the Testing Agency to perform and submit sieve and proctor curves to the Engineer for approval 7 days before any material is brought to the site.

C. The Testing Agency shall submit compaction test result sheets to the Engineer no later than 7 days after the test were performed.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Excavated Material Suitable for Reuse:

1. Material shall be friable natural material comprised of gravels, sand, silts, or clayey gravel and sands.
2. Material shall be free from peat, muck, other organic matter, frozen material, ice, and/or snow.
3. Material shall be free from stones and ledge/rock fragments over 8” in the largest dimension, and shall be free of all asphalt.
4. The material shall not have a moisture content over 2% of its optimum moisture content.

B. Select and Borrow Materials:

1. Crushed Stone (Bedding Material):
   a. Crushed stone shall be well graded in size from 1/4 inch to 3/4 inch and conform to ASTM C33 stone size No. 67.
   b. Clean, hard, and durable particles or fragments.
   c. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening
1"	100
3/4"	90 - 100
3/8"	20 - 55
No. 4	0 - 10
No. 8	0 - 5
No. 200	1% Max.

2. Sand (Sand Blanket or Bedding):
   a. Clean, hard and durable particles or fragments.
   b. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening
3/8"	100
No. 4	95 - 100
No. 16	50 - 85
No. 50	10 - 30
No. 100	2 - 10

3. Structural Fill (Crushed Gravel Base Course):
   a. Well graded granular crushed gravel material for use as a crushed gravel base, below foundations and under slab on grade.
   b. Only structural fill to be used as backfill within 2 feet of footings, pier and within 4 feet of foundation walls .
   c. Material shall be hard and durable, free from frost, organic material, loam, debris and other unsuitable material.
   d. At least 50% of material retained on the 1 inch sieve shall have a fractured face.
   e. Maximum particle size should be limited to 3" within 2 feet of foundation wall, footings and under floor slab, or if compacted by hand guided equipment.
   f. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening	
6"	100	
3"	70 - 100	
No. 4	35 - 70	
No. 40	5 - 35	
No. 200	0 - 5	(of the sand portion)

   g. As an alternative to structural fill as described above, New Hampshire Department of Transportation (NHDOT) item 304.3, *Crushed Gravel,* or NHDOT item 304.4, *Crushed Stone Fine*, may be used as structural fill.

4. Bank Run Gravel or Granular Gravel Borrow (Gravel Subbase Course):
   a. Well graded granular bank-run gravel material for use as gravel subbase.
   b. Material shall be hard and durable, free from frost, organic material, loam, debris and other unsuitable material. Shall not have excess amounts of clay or silt and shall be so sized that the material can be laid out and graded in smooth uniform 8" lifts.

c. Sieve Analysis:

Sieve Designation	% Passing by Weight Square Opening	
6"	100	
No. 4	25 - 70	
No. 200	0 - 12	(of the sand portion)

5. Common Borrow (i.e. Sand):
   a. Consist of earth suitable for embankment construction; free from frozen material, perishable rubbish, peat and other unsuitable material.
   b. The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4 percent above optimum.
   c. The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D.
   d. 100% shall pass the 3" sieve and 70-100% shall pass the No. 4 sieve.
6. Gravel Borrow (i.e. Gravel):
   a. Well graded granular material suitable for placement in authorized excavations below the bottom of the bedding layer to replace deficient excavated material, for road construction, pipeline construction, and other designate uses.
   b. 95-100% shall pass the 3" sieve and 25-70% shall pass the No. 4 sieve.
7. Riverstone:
   a. River rock shall be sound and free from organic and inorganic debris and trash, and from structural defects.
   b. Rock shall be one to eight inch (1" to 8") washed rock, non-uniform (poorly graded) in size.
   c. All fines shall be screened from the aggregate within a one-quarter inch (1/4") tolerance.
   d. Rock shall be composed of round rocks that may be varied in color. River rock shall be as similar to the native substrate as possible.

PART 3 -- EXECUTION

3.1 PERFORMANCE

A. General:
   1. Provide and place all necessary backfill material.
   2. Do not allow large masses of backfill to be dropped into the excavation, as from a grab bucket, in such a manner that may endanger pipes and structures.
   3. Place material in a manner that will prevent stones and lumps from becoming nested.
   4. Completely fill all voids between stones with fine material.

5. Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.
6. Deposit backfill material evenly on all sides of structures to avoid unequal soil pressures.
7. Place backfill material evenly in the trench in an effort to maximize compaction.
8. Do not backfill with, or on, frozen materials.
9. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.
10. Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet. Fill material that is too wet to be properly placed back in the trench it its current state shall be dried (disced, harrowed, etc.) to within 2% of optimum moisture content. This material shall not be classified as unsuitable material and ineligible for payment as such.
11. Material made unsuitable by the Contractor's construction methods shall be replace with Gravel Borrow at no additional cost to the Owner.
12. Fill that is too dry shall be uniformly watered. The water shall be placed over a loose lift to allow for the water to migrate through the entire lift before compaction.
13. Do not continue backfilling until the previously placed and/or new materials have dried sufficiently to permit proper compaction.
14. When original excavated material is, in the opinion of the Engineer, unsuitable, use only approved gravel borrow for backfilling.
15. Backfill excavation/trench as early as possible to allow for the maximum time for natural settlement.
16. Slope grade away from structures at a minimum slope of 1.5%.
17. The Contractor shall remove excess fill material from the site.

B. Preparation to receipt of Granular Structural Fill

1. No structural fill is needed beneath footings if the subgrade is suitable. If necessary, prior to placing structural fill under building foundation and slab compact the exposed subgrade with a minimum of 4 passes using a small/light vibratory roller to densify the subgrade and underlying fill. A biaxial geogrid is to be placed around crushed stone if it is used instead of compacted structural fill.. See Specification Section 02275.
2. Prior to placing fill under structures and paved areas, "Proof Roll" the bottom of excavation, subgrade as excavated in 3.8 (B) by a minimum of three coverages from the rear wheel assembly of a fully loaded ten-wheel dump truck. If, in the judgment of the Engineer, compaction of receiving surfaces is not required, or will disturb the natural soil, the subgrade compaction requirements in these areas will be waived. "Proof Rolling" will not be required in cut areas, where granular fill is not required.
3. Prior to placing fill in trench areas, thoroughly compact the trench bottoms and fill all depressions to a smooth uniform surface.
4. Do not place fill until the existing subgrade is approved by the Engineer.
5. Grade Stakes:

a. Place grade stakes, spaced as conditions require, to permit checking of elevations until final grading has been completed.

C. The mat slab for the wet well/pipe gallery shall be underlain by a minimum of 6 inches of compacted structural fill or crushed stone wrapped in filter fabric.
1. Compact sub-base course to required cross sections and thickness prior to underlayment of structural fill.
2. Place in equal layers not more than 6 inches (150 mm) thick nor less than 3 inches (75 mm) thick when compacted.

D. Under slabs-on-grade, place 12" structural fill underlayment on prepared subgrade below bottom of slab.
1. Compact sub-base course to required cross sections and thickness prior to underlayment of structural fill.
2. Place in equal layers not more than 6 inches (150 mm) thick nor less than 3 inches (75 mm) thick when compacted.

E. Backfilling Around Trench Obstacles
1. Material must be properly compacted around trench obstacles (i.e. manholes, catch basin, valve boxes, etc.).
2. The Contractor shall provide adequate excavation supports to allow for a safe work environment in which to properly compact the excavation/trench.
3. The Contractor shall use methods that compensate for the space limitations in the immediate area around these obstacles.

F. Backfilling in Paved Areas:
1. Backfill trenches in streets and other paved areas by maintaining a moisture content within 2% of optimum.
2. In an effort to allow the road to heave uniformly, backfill material that was removed from the top portion of the trench shall be replaced back into the top of the trench. Similarly, the material removed from the middle of the trench shall be replaced back into the middle of the trench. Existing material removed from the bottom of the trench (i.e. where the pipe box is located) shall be stockpiled for later use.
3. Backfill in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value for paving immediately after backfilling is completed. See 1.3.D.1.
4. Where required, place excavated material, that is acceptable to the Engineer for surfacing or pavement subbase, at the top of the backfill to the depths as needed to adequately support pavement.

G. Backfilling Trenches in Nonpaved Areas:
1. Grade the ground to a reasonable uniformity.
2. Leave the mounding over the trenches in a uniform and neat condition, satisfactory to the Engineer.

H. Bedding & Backfilling of Pipelines:
1. Install pipe bedding and cushion and primary backfill in accordance with the requirements noted herein, in the specific pipe Specification Section, and on the Drawings.
2. Deposit and thoroughly compact the remainder of the backfill as noted herin.

I. Placing and Compacting Backfill:

1. Water Jetting: Shall not be allowed without the approval of the Engineer.
2. Puddling: Shall not be allowed without the approval of the Engineer.
3. Tamping:
    a. Deposit and spread the backfill material in uniform parallel layers not exceeding the lift thicknesses noted herein.
    b. Tamp each layer as required to obtain a thoroughly compacted mass.
    c. If necessary, furnish and use an adequate number of power driven tampers, each weighing at least 150 lbs.
4. Rolling:
    a. Compact material by rolling only when the width and depth of the excavation are sufficient to accommodate the rollers, dozers, mechanical tampers, or other similar powered equipment, as may prove to be acceptable, and when it can be performed without causing damage to pipes and structures installed in the excavation.
    b. Deposit and spread the backfill material in uniform parallel layers not exceeding the lift thicknesses noted herein.
    c. Roll each layer as required to obtain a thoroughly compacted mass.
5. Other placing and compacting methods may be employed only when approved by the Engineer.

J. Improper Backfill

1. When, in the opinion of the Engineer, excavation and trenches have been improperly backfilled, or if settlement occurs, reopen the excavation to the depth required, as directed by the Engineer.
2. Refill and compact the excavation or trench with suitable material and restore the surface to the required grade and condition.
3. Excavation, backfilling, compacting work and testing performed to correct improper backfilling shall be performed at no additional cost to the Owner.

END OF SECTION

SECTION 02275

CONSTRUCTION FABRICS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install the appropriate construction fabric at locations shown on the Drawings.

B. Related Work Specified Elsewhere:
   1. Temporary Erosion Control - Section 02540.
   2. Pipe and Pipe Fittings - General - Section 02610
   3. Earthwork - Section 02200

1.2 SUBMITTALS

A. Shop drawings for each type of fabric to be used on the project shall be submitted to the Engineer for approval prior to installation. The Contractor will demonstrate that the strength of the chosen fabrics, while meeting the physical characteristics given below, shall withstand without failure the stresses which will be applied by his equipment and activity using his proposed construction techniques.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Geotextiles shall be a product tested under the AASHTO National Transportation Product Evaluation Program (NTPEP).

B. Construction fabrics shall be divided into four (4) Application categories, four (4) strength classes and three (3) fabric types:
   1. Application:
      a. Application 1 – Subsurface Drainage
      b. Application 2 – Separation
      c. Application 3 – Stabilization
      d. Application 4 – Permanent Erosion Control
   2. Strength Class:
      a. Class 0 – Extra High Strength
      b. Class 1 – High Strength
      c. Class 2 – Medium Strength
      d. Class 3 – Low Strength

   3. Structure Type:
      a. 1 Non-woven (Default for applications 1 & 4)
      b. 2 Monofilament, Woven
      c. 3 Slit Filament, Woven

C. Acceptable Manufactures shall be listed in the NHDOT Qualified Product list (latest edition) for Application, Strength Class and Structure

PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

A. The fabric shall be stored and handled in such a way as to prevent any damage and according to manufacturer's recommendations.

3.2 INSTALLATION

A. The fabric shall be installed to in strict accordance with the manufacturer’s recommendations.

B. The fabric shall be staked, stapled, joined or overlapped, as may be appropriate for the application according to the manufacturer’s recommendation or as shown on the drawings.

C. Care shall be used during installation. Repairs shall be made in accordance with manufacturer recommendation.

END OF SECTION

SECTION 02279

STONE FILL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and properly place in position stone fill of the size and type at pipe outlets and when shown on the Drawings.

B. Requirements of Regulatory Agencies: New Hampshire Department of Transportation Standard Specifications, latest edition, herein abbreviated N.H.D.O.T.

C. Related Work Specified Elsewhere: Construction Fabrics Section 02275.

1.2 QUALITY ASSURANCE

A. Source: Furnish to the Engineer the name, address, and telephone number of the original sources (quarries) of all stone to be used under this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quarry stone or broken rock fragments used for stone fill shall be sound and free from structural defects. The stones and spalls shall be so graded as to produce a dense fill with a minimum of voids.

B. Stone fill types shall have the following minimum dimensions and volumes: (Refer to N.H.D.O.T. Standard Specification 585.)

1. Class A
   a. 50% of mass: minimum volume of twelve (12) cubic feet.
   b. 30% of mass: volume ranging from three (3) to twelve (12) cubic feet.
   c. 10% of mass: volume ranging from one (1) to three (3) cubic feet.
   d. Remainder of mass composed of spalls.
2. Class B
   a. 50% of mass: minimum volume of three (3) cubic feet.
   b. 40% of mass: volume ranging from one (1) to three (3) cubic feet.
   c. Remainder of mass composed of spalls.
3. Class C stone shall consist of clean, durable fragments of ledge rock of uniform quality, reasonably free from thin or elongated pieces. The stone shall be made from rock which is free from topsoil and other organic material. The stone shall be graded as follows:

Sieve Size	Percentage by Weight Passing
12 inch	100
4 inch	50 - 90
1 - 1/2 inch	0 - 30
3/4 inch	0 - 10

4. Class D shall have the following gradation:

Sieve Size	Percentage by Weight Passing
2 inch	100
1 - 1/2 inch	95 - 100
3/4 inch	35 - 70
3/8 inch	10 - 30
No. 4	0 - 5
Nominal Size	1 - 1/2" - No. 4

C. Spalls for filling voids shall be stones or broken rock ranging from a maximum of one (1) cubic foot.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lay the stone fill from the bottom of slopes upward with the larger stones embedded in the toes of the slopes.
B. Fill open joints with spalls.
C. The spalls shall be tamped in to place using an equipment bucket or other approved methods.

END OF SECTION

SECTION 02402

DEWATERING - GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. The Contractor shall provide all materials, equipment, and labor necessary for the removal of surface water and as required providing silt and erosion control devices.
2. The Contractor shall build all drains and do all ditching, pumping, bailing, and all other work necessary to keep the excavation clear of ground water, sewage, or storm water during the progress of the work and until the finished work is safe from damage.

1.2 RECOMMENDED GUIDES

A. AASHTO Highway Drainage Guidelines, Volume III, Guidelines for Erosion and Sediment Control in Highway Construction, American Association of State Highway and Transportation Officials, Inc., 444 North Capital St. N.W., Suite 249, Washington, D.C. 20001.

B. Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire, New Hampshire Department of Environmental Services, Public Information Office, P.O. Box 95, 6 Hazen Drive, Concord, New Hampshire.

C. Storm Water Phase II Compliance Assistance Guide, Section 5 Small Construction Activity, United State Environmental Protection Agency, Publication No. 833-R-00-003.

1.3 SUBMITTALS

A. The Contractor shall furnish to the Engineer and the USEPA, in writing, the Stormwater Pollution Prevention Plan (SWPPP) for dewatering and diverting surface water before beginning the construction work for which the diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

B. The Contractor shall provide the appropriate National Pollutions Discharge Elimination System (NPDES) permit number prior to the start of construction.

PART 2- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

3.1 REMOVAL OF WATER

A. Water pumped from excavations shall be piped to points discharging into approved treatment facilities prior to discharging into water courses.

B. Water considered to be contaminated shall not be discharged to water courses.

C. Water shall not be conducted onto adjacent property.

3.2 DIVERTING SURFACE WATER

A. The Contractor shall build, maintain, and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protection works needed to divert stream flow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, stream diversion must discharge into the same natural drainage way in which its headworks are located. Storm runoff from disturbed areas must discharge into a sedimentation pond prior to discharge into a natural drainage way.

3.3 EROSION CONTROL PROVISIONS

A. The discharge from pumping operations during dewatering operations shall be contained by a device so constructed as to prevent silt from spreading off-site.

B. Prior to removal of all sediment control devices all retained silt or other materials shall be removed at no additional cost to the Owner.

3.4 REMOVAL OF TEMPORARY WORKS

A. After the temporary works have served their purpose, the Contractor shall remove them or level and grade them to the extent required to present a sightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

3.5 ENVIRONMENTAL PERMITS (IF APPLICABLE)

A. All work under this section shall be done in accordance with all federal, state, and local regulations, laws, and rules which may apply and any individual permits that have been obtained for the project.

END OF SECTION

SECTION 02444

CHAIN LINK FENCE & GATES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish all materials and install chain link fence of the types, sizes and in the location(s) shown on the Drawings and specified herein.

1.2 QUALITY ASSURANCE

A. Acceptable Manufacturers:
   1. USS Cyclone
   2. National Fence Mfg. Co, Inc.
   3. Anchor Fence, Inc.
   4. Or approved equal.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit satisfactory guarantees by the fence manufacturer covering all faults and defects in all parts of the fence arising from defective workmanship or materials for a period of one year from the date of installation.

PART 2 - PRODUCTS

2.1 FENCE MATERIALS

A. Posts:
   1. All posts: Galvanized steel, 35% minimum carbon content, 50,000 lbs. per square inch minimum tensile strength.
   2. Line Posts: 2-3/8 inch O.D. pipe weighing 3.12 lbs. per lin. ft. or 2 inch x 2-1/4 inch H section weighing 4.10 lbs per lin. ft.
   3. End, Corner and Pull Posts: 2-7/8 inch O.D. pipe weighing 4.64 lbs. per lin. ft.
   4. Gate Posts: For single swing gates, and each leaf of double gates:
      a. Up to 6 feet wide: 2-7/8 inch O.D. pipe weighing 5.79 lbs per lin. ft.
      b. 6 Feet to 13 feet wide: 4 inch O.D. pipe weighing 9.11 lbs. per lin. ft.
   5. Post Tops: Tubular post tops designed to prevent moisture from entering posts and to support top rail.

B. Top Rails:
   1. 1-5/8 inch O.D. galvanized steel pipe weighing 1.84 lbs. per lin. ft.
   2. Minimum zinc coating shall be 1.8 oz. per square foot of surface.
   3. Provide and install galvanized, outside sleeve, self-centering 7 inch long couplings approximately every 20 feet.
   4. Top rails shall pass through the post tops and form a continuous brace from end to end of each stretch of fence.

5. Securely fasten top rails to the terminal and corner posts with heavy galvanized steel brace bands and rail end connections.

C. Horizontal Braces:
1. Provide and install horizontal braces (brace rails) at all pull, corner, and terminal posts midway between top rails and ground and extend to the first adjacent line posts.
2. Securely fasten braces to the line posts by brace ends and brace bands and to pull, corner and terminal posts by rail ends and brace bands.
3. Braces shall be 1-5/8 inch O.D. galvanized steel pipe weighing 1.84 lbs. per lin.ft. with plain ends.
4. Minimum zinc coating shall be 1.8 oz. per square foot of surface.
5. Brace each corner and pull post on two sides.
6. Brace each terminal post on one side.

D. Diagonal Braces:
1. Provide diagonal braces (truss rods) from the brace ends on the line posts back to the bottom of pull, corner or terminal posts and fastened by brace bands.
2. Diagonal braces shall be 3/8 inch diameter galvanized steel rods.
3. Diagonal braces shall be provided with heavy galvanized turnbuckles to adjust the tension.

E. Fence Fabric:
1. Wire: 9 gauge galvanized steel wire, of medium high carbon quality, minimum tensile strength of 80,000 lbs. per sq. inch, interwoven into 2 inch diamond mesh.
2. Fabric: 72 inches wide, top and bottom edges shall have twisted and barbed salvages formed by cutting wire on the bias.

F. Fabric Connections: Securely fasten fabric to:
1. All terminal posts by 1/4 inch x 1/4 inch galvanized tension bars with 11 gauge galvanized pressed steel bands spaced approximately 14 inches apart.
2. All line posts with 6 gauge galvanized wire clips spaced approximately 14 inches apart.
3. All top rails with 9 gauge galvanized tie wires spaced approximately 24 inches apart.

G. Barbed Wire (When Applicable):
1. Wire: 3 strands of 12-1/2 gauge galvanized steel.
2. Barbs:
   a. Fabricated from 14 gauge galvanized steel wire.
   b. 4 point.
   c. Spaced approximately 5 inches apart.

H. Barbed Wire Extension Arms (When Applicable):
1. Construct at 45 degree angle from posts.
2. Fit with clips or other means for attaching 3 lines of barbed wire.
3. Place top outside wire approximately 12 inches horizontally from the line of fence.

4. Space other wires uniformly between top of fence fabric and the top outside wire.

2.2 GATE MATERIALS

A. Gate Frames:
   1. Fabricate from 2 inch O.D. steel pipe weighing 1.84 lbs. per lin. ft.
   2. All welded construction with malleable iron or pressed steel corner fittings.
   3. Frames shall be rigid enough to be free of twist or sag.
   4. Galvanize all gate frames after fabrication.

B. Truss Rods: Install 3/8 inch diameter truss rods on each gate.

C. Gate Fabric:
   1. Material and Fabrication: Identical to fence fabric.
   2. Installation: Securely fasten to gate with tension bars and hook bolts spaced approximately 15 inches apart.

D. Hinges:
   1. Bottom Hinges: Ball and socket type designed to carry the weight of the gate.
   2. Upper Hinges: Wraparound adjustable type.

E. Locking Devices: Positive type latching device with provision for padlocking.

F. Gate Keeper:
   1. Install on centerline of double gates.
   2. Adjust with gate keeper rod to prevent opening of gate levers when padlocked.
   3. Fabricate from a 1-3/4 inch wide by 1-3/4 inch deep galvanized channelway approximately 7 inches long.
   4. Anchor into a 12 inch by 12 inch by 3 feet deep concrete foundation with a 1-1/2 inch O.D. galvanized steel pipe, 18 inches long, welded to the channelway.
   5. Slope top edges of channelway from center toward each end.
   6. Form concrete foundation to meet tops of channelway sides to prevent its removal

G. Outer Gate Catches:
   1. Material: Galvanized malleable iron or steel.
   2. Designed to anchor securely into 12 inch diameter by 3 feet deep concrete footing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Post Spacing:
   1. Equidistant in the fence line.
   2. Maximum spacing 10 feet on centers.

B. Post Settings:
   1. Set all posts plumb with tops aligned.
   2. Set all posts not less than 36 inches deep in concrete footings or as otherwise shown on the Drawings.
   3. Slope top of all footings to shed water.

C. Alignment and Grade:
   1. Install fencing to the alignment shown on the Drawings or as directed by the Engineer.
   2. Changes in alignment of 30 degrees or more shall be considered as corners.
   3. Install fencing to follow the general contour of the finished grades, unless otherwise shown on the Drawings or as directed by the Engineers.
   4. Install bottom edge of fence fabric approximately 2 inches above finished grade.

D. Placement of Fabric and Barbed Wire:
   1. Stretch fabric and barbed wire to a uniform finish as tight as possible without pulling the material out of shape.
   2. Place fabric on the faces of the posts away from the structures.
   3. Place top edge of the fabric parallel with and one half diamond above the top rail.
   4. Provide all stretcher bars, bands, ties, and all other fastening devices, accessories, and appurtenances for the complete installation of fencing and gates.

END OF SECTION

SECTION 02540

TEMPORARY EROSION CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Description of Work:

1. Comply with all Federal, State and local regulations pertaining to erosion and sediment control and stormwater management.
2. Prepare a Stormwater Pollution Prevention Plan (SWPPP) for review and approval prior to the start of any construction activities.
3. Submit NOTICE OF INTENT letter to the USEPA for approval. Post the appropriate permit number on site.
4. Provide all labor, equipment, materials and maintain temporary erosion control devices as described in the Plan.
5. Provide such erosion control measures as may be necessary to correct conditions that develop prior to the completion of permanent erosion control devices and/or as required to control erosion that occurs during normal construction operations.
6. Provide such sediment control measures as may be necessary to address conditions created by construction dewatering methods and/or stormwater runoff.
7. After award of the Contract, prior to commencement of construction activities, meet with the Engineer to discuss the Plan and develop a mutual understanding relative to.
8. Conduct all construction in a manner and sequence that causes the least practical disturbance of the physical environment.
9. Stabilize disturbed earth surfaces in the shortest practical time and employ such temporary erosion control devices as may be necessary until such time as adequate soil stabilization has been achieved.

1.2 RECOMMENDED GUIDES

A. AASHTO Highway Drainage Guidelines, Volume III, Guidelines for Erosion and Sediment Control in Highway Construction, American Association of State Highway and Transportation Officials, Inc., 444 North Capital St. N.W., Suite 249, Washington, D.C. 20001.

B. Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire, New Hampshire Department of Environmental Services, Public Information Office, P.O. Box 95, 6 Hazen Drive, Concord, New Hampshire.

C. Storm Water Phase II Compliance Assistance Guide, Section 5 Small Construction Activity, United State Environmental Protection Agency, Publication No. 833-R-00-003.

PART 2 - PRODUCTS

2.1 PLAN

A. Prior to the start of construction submit the Plan in accordance with the Shop Drawing review process in Section 01340 – Submittal.

B. Prior to the start of construction submit a Notice of Intent for Storm Water Discharges Associated with CONSTRUCTION ACTIVITY Under a NPDES General Permit.

C. To assist in Plan preparation, the Engineer will supply the following as available:
   1. Specific Reproducible plan sheet and, if available, cross sections of the project.
   2. Drainage calculations as available.
   3. Permits obtained for the project.
   4. Geotechnical reports.

2.2 ACCEPTABLE MATERIALS

A. Baled Hay: At least 14" x 18" x 30" securely tied and staked twice per bale.

B. Stone Check Dams: Washed ¾ inch crushed septic system stone free of sand and silts.

C. Sand Bags: Heavy cloth bags of approximately 1 cubic foot capacity filled with sand or gravel.

D. Mulches:
   1. Asphalt emulsion, gravel, crushed stone, loose hay, straw, peat moss, pine straw or needles, sawdust, wood chips, wood excelsior, or wood fiber cellulose.
   2. Type and use shall be suitable for the Work.

E. Mats and Netting:
   1. Twisted craft paper, yarn, jute, excelsior, wood fiber mats, glass fiber, and plastic film.
   2. Type and use shall be suitable for the Work.

F. Seed:
   1. Standard conservation mix of 100% annual rye grass or field broomgrass.
   2. Equivalent seed mixture may be used, as approved by the Engineer, based on its suitability for use is controlling erosion of the various soil types and slopes.

G. Sod:
   1. Grown from seed of adapted varieties to produce high quality sod, free of any serious thatch, weeds, insects, diseases and other pest problems.
   2. At least one year old and not older than three years. Cut with 1/2" to 1" layer of soil.

H. Drains:
   1. Flexible drains consisting of collapsible neoprene pipe, minimum of 8" in diameter, or an approved equal.
   2. Corrugated metal pipe and inlet of a gauge consistent with the loading conditions. A minimum size of 12 inches in diameter or approved equal.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Temporary Stone Checks:
   1. Construct temporary erosion checks in ditches and other locations as needed.
   2. Terrace side slopes to retard runoff velocities.

B. Temporary Berms (When Applicable):
   1. Construct temporary barriers along the toe of embankments.
   2. Construct temporary side drains in intervals as needed.

C. Temporary Slope Drains: Shall be collapsible pipe with corrugated metal pipe inlet with a crescent shaped barrier placed at each slope drain.

D. Debris Basin:
   1. A barrier or dam constructed across waterway or other suitable location to form a silt or sediment basin.
   2. Capacity shall be equal to the volume of sediment expected to be trapped at the site during the planned use for life of the structure or, if the periodic removal of debris would be practical, the capacity shall be proportionally reduced.

3.2 PERFORMANCE

A. Install erosion control devices as described in the Plan.
   1. Apply seed for temporary cover at a rate of 40 lbs. per acre.
   2. Apply hay or straw at a rate of 2 tons per acre.
   3. Hydroseed all temporarily seeded areas.

B. Protection:
   1. Protect streams and channels from fuel, lubricants and other pollutants.
   2. Locate storage of materials in shop yards where erosion and sediment hazards are slight.

3.3 REMOVAL AND DISPOSAL

A. General: When permanent soil stabilization has been achieved, remove all temporary materials and devices that are unsightly.

B. Reuse: Materials and devices of suitable type and conditions may be reused at other onsite locations. Materials and devices, determined by the Engineer to be unsuitable for reuse, shall become the Contractor's property and shall be disposed of in a manner and location approved by the Owner.

C. Onsite Disposal when Applicable: The locations and methods of onsite disposal are subject to the Owner's approval. Onsite disposal that results in unsightly conditions, precludes proper maintenance and is detrimental to the physical environment will not be permitted.

END OF SECTION

SECTION 02551

BITUMINOUS CONCRETE PAVING (NH)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish all plant, labor, equipment and materials required to install subgrades and bituminous concrete pavement courses as shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. Materials: Use only materials furnished by a bulk bituminous concrete producer regularly engaged in the production of hot mixed, hot laid bituminous concrete.

B. Equipment: Provide, maintain and operate pavers, dump trucks, tandem, 3-wheel and pneumatic tired rollers well suited to the mixtures being placed. Provide, maintain and operate hand equipment as required. When applicable, provide, maintain and operate trimming equipment and materials.

C. Requirements of Regulatory Agencies: New Hampshire Department of Transportation Standard Specifications, latest edition, herein abbreviated N.H.D.O.T.

D. N.H.D.O.T. "Measurement" and "Payment" paragraphs shall not apply.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate subbase courses shall be in accordance with Division 300 Bases; section 304, Sand, Gravel and Crushed Gravel Base Courses of the N.H.D.O.T. Standard Specifications, latest edition.

B. Materials shall conform to Division 700 Materials; Section 702, Bituminious Materials and Section 703, Aggregates of the N.H.D.O.T. Standard Specifications, latest edition.

C. Base course of bituminous pavement shall be as shown on the Drawings and shall conform to Division 400, Section 401, Plant Mix Pavements - General of the N.H.D.O.T. Standard Specifications, latest edition.

D. Wearing course of bituminous pavement shall be as shown on the Drawings and shall conform to Division 400, Section 401 "Plant Mix Pavements - General" of the N.H.D.O.T. Standard Specifications, latest edition.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Methods of construction shall be in accordance with Division 400, Pavements, Section 403, Hot Bituminous Paving of the N.H.D.O.T. Standard Specifications, latest edition.

B. Place permanent pavement only when the underlying surface is dry, when the atmospheric temperature in the shade is above 40 degrees F, and when the weather is not foggy or rainy, provided however, that the Engineer may permit in case of sudden

rain, the placing of the mixture then in transit from the plant, if laid at the proper temperature and if the roadbed is free from pools of water.

C. Such permission shall in no way relax the requirements for quality of the pavement and smoothness of surface.

D. Do not lay material upon frozen base course or when wind conditions are such that rapid cooling will prevent satisfactory compaction.

END OF SECTION

SECTION 02555

REMOVAL & REPLACEMENT OF PAVING (NH)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Remove bituminous asphaltic and/or portland cement pavement, and replace pavement, subgrade, base courses and surface courses, including temporary pavement, within the area(s) shown on the Drawings and as directed by the Engineer.
   2. Keep pavement removal to a minimum width suitable for the required construction.

B. Work Not Included:
   1. Removal and replacement of paving for the convenience of the Contractor will not be eligible for payment.

1.2 QUALITY ASSURANCE

A. Materials: Use only materials furnished by a bulk bituminous concrete producer regularly engaged in the production of hot mixed, hot laid bituminous concrete.

B. Equipment: Provide, maintain and operate pavers, dump trucks, tandem, 3-wheel and pneumatic tired rollers well suited to the mixtures being placed. Provide, maintain and operate hand equipment as required. When applicable, provide, maintain and operate trimming equipment and materials.

C. Requirements of Regulatory Agencies:
   1 New Hampshire Department of Transportation Standard Specifications, latest edition, herein abbreviated N.H.D.O.T.
   2. N.H.D.O.T. 'Measurement" and "Payment" paragraphs shall not apply.

D. Joint Make-Up:
   1. General:
      a. Exercise extreme care in the removal of pavement so that pavement will not be unnecessarily disturbed or destroyed. Mechanically cut pavement to be removed to a straight line, unless otherwise directed by the Engineer.
   2. Pavement Removal:
      a. Payment limits for pavement removal shall be as shown on the Payment Limits detail on the Drawings.

1.3 RELATED SECTIONS

A. Section 02200 – Earthwork
B. Section 02551 – Bituminous Concrete Paving
C. Section 02557 – Pavement Reclamation

PART 2 - PRODUCTS

2.1 MATERIALS

A. Subgrade courses shall be in accordance with Division 300 "Bases"; Section 304, "Sand, Gravel and Crushed Gravel Base Courses" of the N.H.D.O.T. Standard Specifications, latest edition.

B. Materials shall conform to Division 700, "Material Details"; Section 703, “Aggregates” of the N.H.D.O.T. Standard Specification, latest edition.

C. Base course of bituminous pavement shall be as shown on the Drawings and shall conform to Division 400, Section 401 "Plant Mix Pavements - General" of the N.H.D.O.T. Standard Specifications, latest edition.

D. Wearing course of bituminous pavement shall be as shown on the Drawings and shall conform to Division 400, Section 401 "Plant Mix Pavements - General" of the N.H.D.O.T. Standard Specifications, latest edition.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Methods of construction shall be in accordance with Division 400, Pavements; Section 403, Hot Bituminous Pavement of the N.H.D.O.T. Standard Specifications, latest edition. See Drawings for payment limits.

B. Place the permanent pavement only when the underlying surface is dry, when the atmospheric temperature in the shade is above 40 degrees F, and when the weather is not foggy or rainy, provided however, that the Engineer may permit in case of sudden rain, the placing of the mixture then in transit from the plant, if laid at the proper temperature and if the roadbed is free from pools of water.

C. Such permission shall in no way relax the requirements for quality of the pavement and smoothness of surface.

D. Do not lay material upon a frozen base course or when wind conditions are such that rapid cooling will prevent satisfactory compaction.

E. Temporary Pavement Repairs

1. Temporary pavement repairs shall be made when deemed necessary by the Engineer in order to assure safety of the traveled way or when permanent repairs cannot be made expediency.
2. Temporary pavement shall be as shown on the Drawings.

F. Permanent Pavement Repairs - Final Patch @ Trench

1. After suitable exposure, the pavement shall be mechanically cut on either side of the trench to provide overlap of final patch on undisturbed material as shown on the Drawings.
2. Within the cut limits of the final patch, the existing pavement and temporary patch material shall be removed and replaced as shown on the Drawings to meet the cut edge exactly.

G. Full Width Permanent Pavement Overlay

1. When ordered by the Engineer, Contractor shall furnish a full width overlay from curb to curb or edge of traveled way to edge of traveled way as shown on the Drawings.
2. The overlay shall be completed after one freeze / thaw cycle.
3. Work shall include:

a. Mechanically cut the existing pavement on both sides of the trench to provide overlap of base course on undisturbed material as shown on the Drawings.
b. Remove all temporary paving and existing paving within the cut limits of the trench repair area.
c. All driveways shall be mechanically ground (cold planed) or saw cut prior to installation of pavement overlays. Feathering will not be acceptable.
d. The full width permanent pavement overlay shall consist of hot bituminous concrete wearing course over the existing pavement and trench repair base course.
e. Contractor shall be responsible for raising all utility covers and shimming.

H. Full Width Reconstruction
1. When ordered, contractor shall complete full width road reconstruction as shown on the drawings and as described in the specifications, including section 02557.
2. Following completion of the utility work including testing, the contractor shall place pavement base course.
3. After the freeze / thaw cycle the contractor shall place the pavement wearing course.
a. The driveways shall be sawed prior to placement of the wearing course.
4. The contractor shall re-install pavement markings.

I. Maintaining Permanently Placed Surfaces
1. Maintain permanently placed surfaces under this Contract until expiration of the guarantee period.
2. Should an area that the Contractor has permanently paved settle:
a. Remove the entire pavement in the area.
b. Add the necessary subgrade material as specified and shown on the Drawings to the depth of the applicable pavement course.
c. Replace the base course as specified
d. Replace the surface course as specified.
e. Do not feather edges, except where shown on the Drawings.

END OF SECTION

SECTION 02601

MANHOLES, COVERS AND FRAMES (NH)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install manholes, cast iron frames and covers in conformance with the dimensions, elevations, and locations shown on the Drawings and as specified herein.

B. Test manholes upon installation, prior to paving.

1.2 QUALITY ASSURANCE

A. Construct all manholes in conformance with the New Hampshire Department of Environmental Services - Water Division- Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities.

B. Construct all manholes of a quality to withstand loads of 8 tons (H-20 loading) without failure for a period of time in excess of 25 years.

C. Construct all manholes of a quality to prevent leakage in excess of 1 gallon per day per vertical foot of manhole.

D. Construct all manholes throughout the entire project from the same materials unless otherwise shown on the Drawings.

E. All essential details of design shall be as shown on the Drawings.

F. Masonry: See specification Section 04201.

G. Waterproofing: Shall be with a product with demonstrated five (5) years successful use in similar applications.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

B. A description of all methods of jointing.

C. All Certificates of Compliance.

D. Provide Fabrication Schedule that shows:

a. Orientation and elevation of opening.

b. Section dimensions and assembly order.

PART 2 - PRODUCTS

2.1 PRECAST MANHOLE SECTIONS

A General

1. Risers and tops shall be precast reinforced or non-reinforced concrete, or cast-in-place reinforced or non-reinforced concrete.
2. Manhole bases shall be monolithic to a point 6 inches above the crown of the incoming pipe and shall be constructed of reinforced or non-reinforced concrete.
3. Use concrete that conforms to the requirements of Class A concrete in Section 520 of the N.H.D.O.T. Standard Specifications for manhole bases and cast-in-place manholes.

4. Use reinforcing steel for cast-in-place concrete that conforms to the requirements of the N.H.D.O.T. Standard Specifications for Billet-Steel Bars or Welded Steel Wire Fabric.
5. Construct pipe to manhole joints that are approved by the New Hampshire Department of Environmental Services – Water Division. In general, use approved non-shrinking mortar or elastomeric or mastic like sealants to unsure these joints are watertight.
6. Do not install manhole steps unless shown on the Drawings.
7. All sewer manhole covers shall be 30 inches in diameter unless shown otherwise on the Drawings and have the letter "S" or the word "SEWER" in 3-inch letters cast into the top surface.
8. All drain manhole covers shall be 30 inches in diameter unless shown otherwise on the Drawings and have the letter “D” or the word “DRAIN” in 3-inch letters cast into the top surface.
9. All castings shall be of good quality, strong, tough, even-grained cast iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended.
10. Contact surfaces of covers and frame seats shall be machined at the foundry before shipment to prevent rocking of covers in any orientation.
11 All castings shall be thoroughly cleaned and subject to a careful hammer inspection.
12. Prior to being shipped from the foundry, castings shall be sandblasted.
13. Repair all coatings that have been damaged in transit or handling to the satisfaction of the Engineer.

B. Openings:
   1. Provide openings in the risers to receive pipes entering the manhole.
   2. Make openings at the manufacturing plant.
   3. Size: To provide a uniform annular space between the outside wall of pipe and riser.
   4. Location: To permit setting of the entering pipes at the correct elevations.
   5. Openings shall have a flexible watertight union between pipe and the manhole base.
      a. Cast into the manhole base and sized to the type of pipe being used.
      b. Type of flexible joint being used shall be approved by the Engineer. Install materials according to the Manufacturer's instructions.
         1. Lock Joint Flexible Manhole Sleeve made by Interpace Corporation.
         2. Kor N Seal made by National Pollution Control System, Inc.
         3. Link Seal by Thunderline Corporation (Wayne, MI).
         4. Approved Equal.

C. Joints:
   1. Joint gaskets to be flexible self-seating butyl rubber joint sealant installed according to manufacturer's recommendations. For cold weather applications, use adhesive with joint sealant as recommended by manufacturer.
      Acceptable Materials:
      a. Kent-Seal No. 2
      b. Ram-Nek
      c. Or equivalent.

2. Joints between precast sections shall conform to related standards and manufacturer's instructions.
3. All manholes greater than 6 ft. diameter and all manholes used as wet wells, valve pits and other dry-pit type structures shall be installed with exterior joint collars. The joint collar shall be installed according to the manufacturer's instructions. Acceptable materials:
   a. MacWrap exterior joint sealer as manufactured by Mar-Mac Manufacturing Company.
   b. Or equivalent.

D. Waterproofing:
1. The exterior surface of all manholes shall be given two coats of bituminous waterproofing material.
2. The coating shall be applied after the manholes have cured adequately and can be applied by brush or spray in accordance with the manufacturer's written instruction.
3. Sufficient time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.

2.2 FRAMES AND COVERS

A. Standard Units:
1. Shall be **Hinged**.
2. Constructed to support an HS-20 wheel loading.
3. Dimensions and Style shall conform to the Drawings; Standard castings differing in non-essential details are subject to approval by the Engineer:
   a. Covers - solid 3-inch letters diamond pattern.
   b. Frame - minimum 30-inch diameter clear opening, with flange bracing ribs.
4. Minimum weight of frame and cover shall be 239 lbs.
5. Hinged manhole covers shall be Liftmate as manufactured by Neenah Foundry.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Manhole Bases:
1. Place bases on a 6-inch layer of compacted bedding consisting of crushed stone and/or natural stone graded to the following specifications:
   a. 100 percent passing a 1-inch screen.
   b. 90 to 100 percent passing a 3/4-inch screen.
   c. 20 to 55 percent passing a 3/8-inch screen.
   d. 0 to 10 percent passing a number 4 sieve.
   e. 0 to 5 percent passing a number 8 sieve.
   f. Equivalent to Standard Stone Size Number 67, Section 703 of N.H.D.O.T. Standard Specifications.
2. Properly dewater the excavation while placing the bedding material and placing the structure or concrete.
3. Use waterstops at the horizontal joint of cast-in-place manholes.

B. Construct inlet and outlet stubs as shown on the Drawings.

C. Invert Channels:
   1. Construct smooth and semicircular in shape conforming to the inside of the adjacent sewer section.
   2. Make changes in direction of flow with smooth curves having a radius as large as permitted by the size of the manhole.
   3. Stop the pipes at the inside face of the manhole where changes of direction occur.
   4. Form invert channels as shown on the Drawings.
   5. Slope the floor of the manhole outside the flow channel as shown on the Drawings or as directed by the Engineer.

D. Precast Risers and Tops:
   1. Use the appropriate combinations of risers and top lengths.
   2. Seal joints with an approved type mastic as shown on the Drawings.
   3. Test the manhole as soon as practical after installation.
   4. Perform jointing in accordance with the manufacturer's recommendations and as approved by the Engineer.
   5. Install risers and tops level and plumb.
   6. Do not permit water to rise over newly made joints until after inspection by the Engineer.
   7. Make all joints watertight.
   8. Solidly fill annular spaces around pipes entering the manholes with non-shrink mortar or as otherwise shown on the Drawings.
   9. When necessary, core openings carefully to prevent damage to risers and tops. Replace all damaged risers and tops at no additional cost to the Owner.
   10. Cutting opening shall not be allowed without the expressed written permission of the Engineer.

E. Cast-In-Place Manholes:
   1. Place a special plastic waterstop in the joint between the base and the sides of all manholes.
   2. Obtain the Engineer's approval of the type of waterstop and the installation.
   3. Cast all pipes entering the manholes in accordance with pipe manufacture recommendations.

F. Drop Manholes:
   1. No free drop shall be permitted at the pipe inlet.
   2. Where the vertical distance between inlet and outlet pipe inverts exceeds 24 inches, construct a drop manhole as shown on the Drawings.

G. Adjustment to Grade: If necessary, adjust tops of manholes to grade, a maximum of 12 inches, with brick masonry.

H. Set manhole frames with the tops conforming accurately to the grade of the pavement or finished ground surface or as shown on the drawings.

I. Set frames concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange at the frame shall be completely filled and made watertight.

J. Place a thick ring of mortar extending to the outer edge of the masonry all around and on the top of the bottom flange.

K. Finish the mortar so that it will be smooth and have a slight slope to shed water away from the frame.

L. When the work on each manhole is complete, clean the frame seat and set the cover in place.

3.2 LEAKAGE TESTS

A. General:
1. Perform vacuum tests on all manholes.
2. The Engineer shall observe tests.
3. Repairs to manholes found to leak by any test method shall be performed both inside and outside the structure by a method approved by the Engineer.

B. Preparation:
1. After manholes have been assembled in place, fill and point all lifting holes.
2. Test all manholes with pipes and or stubs installed. Testing with through pipes to be removed and replaces is not acceptable.
3. Manholes in which the pipe to manhole connection is disassembled after testing shall be retested at the Contractors expense.
5. Make the tests prior to placing the shelves and inverts and before filling and pointing the horizontal joints below the 6-foot depth line.
6. Suitably plug all pipes and other openings into the manholes.

C. Test Procedure: Vacuum
1. Use only an approved testing machine.
   a. National Pollution Control, Inc.
   b. Or equal.
2. Securely brace all plugs.
3. Check cone section to insure good seal with Test Machine Bladder.
4. Bring test vacuum to 10 in. Hg gauge.
   a. Time:
      Manholes 0'-10' - 2 minutes
      Manholes 10'-15'- 2.5 minutes
      Manholes 15'-25'- 3 minutes
   b. Allowable leakage is 1" Hg or less per times given.
   c. If pressure drop exceeds 1" Hg in the required time, the manhole shall be repaired and retested.
   d. If the manhole fails after being repaired, the manhole shall be "Water Exfiltration Tested" according to the criteria of the specification.
5. When a leak is identified, repair the area from both inside and out by a method approved by the Engineer. Methods to be considered include parging with hydraulic cement and pressure application of polyurethane grout.

E. Backfilling:
1. Manhole testing shall be conducted before backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at Contractor’s own risk and it shall be incumbent upon the Contractor to determine the reason for any failure of the test.
2. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss during the test is a result of leaks through the joints or through the concrete.

F. All repairs to manholes shall be performed to the exterior of the structure.

G. Accident Prevention: Following the satisfactory completion of the leakage test, place the frame and cover on the top, or provide other means of preventing accidental entry by unauthorized persons, children, animals, etc., until ready to make final adjustment to grade.

END OF SECTION

SECTION 02610

PIPE & PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install, support and test pipe and pipe fittings of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

B. If requested by the Engineer, submit manufacturer's "Certification of Conformance" that pipe and pipe fittings meet or exceed the requirements of these Specifications.

C. Submit other documents as specified in the appropriate Sections of this Division.

1.3 DELIVERY, STORAGE AND HANDLING

A. Exercise care during loading, transporting, unloading, and handling to prevent damage of any nature to interior and exterior surfaces of pipe and fittings.

B. Do not drop pipe and fittings.

C. Store materials on the project site in enclosures or under protective coverings in accordance with manufacturer's recommendations and as directed by the Engineer.

D. Assure that materials are kept clean and dry.

E. Do not store materials directly on the ground.

F. Follow manufacturer's specific instructions, recommendations and requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Marking Tape

1. Shall be coded in accordance with the NPWA Standards.
2. Shall be indelibly marked indicating the type of utility it is placed over.
3. Shall be three (3) inches wide Terra Tape Sentry Line 1350 (Detectable) by Reef Industries, Houston, TX, or approved equal.

B. Pipe Lubricant or glue

1. Use only lubricants or glues suitable for the type of pipe and application.
2. For potable water pipe use only lubricants or glues clearly marked “For Use with Potable Water”.

C. Tracer Wire (where shown on the Drawings or required by specific pipe Specification sections)

1. Tracer wire shall be No. 10 AWG copper wire with TW insulation.
   a. Insulation shall be blue for drinking water lines.
   b. Insulation shall be green for sanitary sewers, forcemains and low pressure sewers.
   c. Tracer wire connections shall be made with DryConn waterproof connectors for direct bury, for #22 to #8 AWG wire, or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Provide all labor and equipment necessary to assist the Engineer to inspect pipe, fittings, gaskets, and other materials.
   1. This shall include all air quality testing equipment, harnesses and manlifts necessary to comply with the appropriate OSHA regulation.
   2. The Engineer shall comply with the Contractor's regulations and policies regarding below grade or confined space entry.

B. Carefully inspect all materials at the time of delivery and just prior to installation.

C. Carefully inspect all pipe and fittings for:
   1. Defects and damage.
   2. Deviations beyond allowable tolerances for joint dimensions.
   3. Removal of debris and foreign matter.

D. Examine areas and structures to receive piping for:
   1. Defects, such as weak structural components, that adversely affect the execution and quality of work.
   2. Deviations beyond allowable tolerances for pipe clearances.

E. All materials and methods not meeting the requirements of these Specifications shall be rejected.

F. Immediately remove all rejected materials from the project site.

G. Start work only when conditions are corrected to the satisfaction of the Engineer.

3.2 INSTALLATION

A. General:
   1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations and as instructed by the Engineer.
   2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
   3. Install adapters, approved by the Engineer, when connecting pipes constructed from different materials.
   4. When applicable, support all piping not being installed in trenches in accordance with the "Pipe Hangers & Supports" Section of these Specifications.

B. Installation and Trenches:
   1. Firmly support the pipe and fittings on bedding material as shown on the Drawings and as specified in the appropriate Sections of these Specifications.
      a. Sand cushion 6" below, around, and above the top of the pipe shall be clean sand as specified in Section 02200 Section 2.1.E.
      b. Where, in the opinion of the Engineers, the subgrade material is unsuitable to support the pipe, over-excavate the unsuitable material and replace the same with suitable gravel or granular borrow.
      c. If the subgrade material encountered consists of saturated clays or silts, the Engineer may direct the installation of the bedding material and pipe inside a construction fabric wrap as shown on the Drawings.
   2. Do not permanently support the pipe or fittings on saddles, blocking stones, or any material which does not provide firm and uniform bearing along the outside length of the pipe.

3. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.
4. Excavate suitable holes for the joints so that only the barrel of the pipe receives bearing pressure from the supporting material after placement.
5. Lay each pipe length so it forms a close joint with the adjoining length and bring inverts to the required grade.
6. Set the pipe true to line and grade. Use a transit for line. Use a laser beam aligner for grade.
7. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer or any other unyielding object.
8. Make all pipe joints watertight and no sand, silt, clay or soil of any description entering the pipeline at the joints.
9. Immediately after making a joint, fill the holes for the joint with bedding material, and compact.
10. When each pipe length has been properly set, place and compact enough of the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.
11. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.
12. Take all necessary precautions to prevent flotation of the pipe in the trench.
13. Where there is evidence of water or soil entering the pipeline, repair the defects to the satisfaction of the Engineer.

C. Temporary Plugs:
1. When pipe installation work in trenches is not in progress, close open ends of the pipe with temporary watertight plugs.
2. If water is in the trench when work is resumed, do not remove plugs until all danger of water entering the pipe is eliminated.
3. Do not use the pipe lines as conductors for trench drainage during construction.

D. Protection of Water Supplies:
1. There shall be no physical connection between a public or private potable water supply system and a sewer.
2. Sewer shall be a minimum of ten feet horizontally unless shown otherwise on the drawings.
3. Whenever sewers must cross water mains, the sewer shall be constructed as follows (unless shown otherwise on the Drawings):
   a. Sewer pipe shall be class 52 ductile iron or PVC pressure rated pipe (DR-25 min. or SDR-32.5 min.) for a minimum distance of 9 feet each side of the crossing.
   b. Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1-1/2 times working pressure for force mains, and joints shall not be located within 9 feet of the crossing.
   c. Vertical separation of sewer and water main shall not be less than 18".

3.3 CLEANING AND TESTING

A. Cleaning and Testing Piping - General:

1. Thoroughly clean all piping prior to testing. Remove all dirt, dust, oil, grease and other foreign material. Exercise care while cleaning to avoid damage to linings and coatings.
2. When the installation is complete, test all pipelines, including service laterals, in the presence of the Engineer and the plumbing or building inspector in accordance with the requirements of the local and state plumbing codes and the appropriate Sections of these Specifications, at no additional cost to the Owner.
3. Equipment: Supply all labor, equipment, materials, gages, and pumps required to conduct the tests.
4. If sufficient man power and equipment are not provided to prosecute this phase of work, the Engineer, together with the Owner may engage an independent firm to perform the flushing, testing, and chlorinating work. If the Owner shall have reasonable suspicion of the methods or test results, an independent firm shall be brought in. The cost for this work will be deducted from payments due the Contractor, and he shall not place any claims against the Owner , Engineer, or said independent contractor for any leaks, damages to public or private property, production loss, profits, etc. incurred by this work.
5. Retesting: Perform all retesting required due to failure at no additional cost to the Owner and to the complete satisfaction of the Engineer.
6. The City of Dover Utility Division must be notified at (603)743-6078 prior to discharging into the City system.

B. Outside Potable Water Piping (When Applicable)
1. Pressure Test:
   a. Perform testing in accordance with Section 5 of AWWA Standard C600.
   b. Pressure and leakage tests are required.
   c. The Contractor, with assistance from the Dover Utility Division, shall fill mains as slowly as practicable so as not to cause dirty water and serious pressure drops within the existing system.
2. Chlorination of Pipelines:
   a. Chlorinate all new potable water lines in accordance with the procedure outlined in AWWA C651, latest revision.
   b. Locate chlorination and sampling points as approved by the Engineer.
   c. Use a dosage which will produce not less that 10.0 ppm chlorine residual after a contact period of not less than 24 hours.
   d. During the chlorination period, exercise care to prevent the contamination of water in existing water mains.
   e. After chlorination, flush the piping with clean potable water until there is only background chlorine residual.
   f. Chlorinated effluent shall be dechlorinated prior to release to surface waters.
3. Bacteriological Testing:
   a. Test all new potable water lines for total Coliform bacteria at no additional cost to the Owner.
   b. The length of pipe to be tested and the time of the test shall be as approved by the Engineer.
   c. The Engineer will observe the taking of samples.

d. Have all samples tested by a laboratory approved by the State and submit test results to the Engineer.
e. Any segment of a potable water line shall be considered unsuitable for service if a Coliform bacteria count is obtained from that sample.
f. Re-disinfect all segments of piping considered unsuitable and retest. Continue to disinfect and test until no Coliform bacteria are present.
g. Place piping into service when it has been successfully tested for pressure, leakage and total Coliform bacteria.

C. Building Interior Water Lines (When Applicable):
1. Clean and test in accordance with the "Plumbing General" Section in these Specifications.

D. Sewer Lines:
1. Outside Sewer Lines: Test with a low pressure air test, a visual inspection, and for PVC or other flexible piping, test with a deflectometer after suitable settling time has elapsed..
2. Building Interior Sewer System: Clean and test in accordance with the "Plumbing General" Section in these Specifications.

E. All Other Piping Systems:
1. Pressure Test:
a. Perform a pressure test for all other piping systems at 1-1/2 times maximum system pressure, or at the maximum working pressure of the piping system, or at a pressure indicated in the appropriate Sections of this Specification.
b. Tests shall be hydrostatic water, or air pressure as specified or as approved by the Engineer.
2. Cleaning: Perform all specialized cleaning as specified or required by system.

END OF SECTION

SECTION 02611

DUCTILE IRON PIPE & FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install ductile iron pipe and ductile iron fittings of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. Standards:
   1. Cement-mortar lining for water: ANSI A21.4/AWWA C104.
   2. Rubber gasket joints: ANSI A21.11/AWWA C111.
   3. Ductile iron pipe thickness: ANSI A21.50/AWWA C150.
   4. Ductile iron pipe, centrifugally cast: ANSI A21.51/AWWA C151.
   5. Threaded flanges: ANSI A21.15/AWWA C115.
   6. Ductile iron fittings: ANSI 21.53/AWWA C153.
   7. Pipe flanges and fittings: ANSI B16-1, ANSI A-21.12.
   8. Bolts: COR-TEN ASTM A588.
   9. Polyethylene encasement: ANSI/A21.5/AWWA C105

1.3 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

B. If requested by the Engineer, submit manufacturer's "Certification of Conformance" that pipe and fittings meet or exceed the requirements of these Specifications.

C. If joint restraints are to be used in place of thrust blocks, submit restraint calculations for review by the Engineer. Restraint calculation shall be in accordance with DIPRA and AWWA standards.

1.4 DELIVERY, STORAGE AND HANDLING

A. Exercise extra care when handling pipe and fittings.

B. Exercise extra care when handling cement lined pipe and fittings because damage to the lining will render it unfit for use.

C. Protect the spherical spigot ends and the plain ends of all pipe during shipment by wood lagging securely fastened in place.

1.5 INSPECTION

A. Provide all labor necessary for the Engineer to inspect pipe, fittings, gaskets, and other materials.

B. Carefully inspect all materials at the time of delivery and just prior to installation.

C. Carefully inspect all pipe and fittings for:
   1. Defects and damage.
   2. Deviations beyond allowable tolerances for joint dimensions.
   3. Removal of debris and foreign matter.

D. Examine areas and structures to receive piping for:

1. Defects, such as weak structural components that adversely affect the execution and quality of work.
2. Deviations beyond allowable tolerances for pipe clearances.

E. All materials and methods not meeting the requirements of the Contract Documents will be rejected.

F. Immediately remove all rejected materials from the project site.

G. Start work only when conditions are corrected to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe:

1. Pipe shall be manufactured in North America, per City of Dover standards.
2. All pipes shall conform to the latest AWWA specification C151. Unless otherwise shown on the Drawings, the minimum thickness of ductile iron pipe shall be:
   a. All ductile iron pipe shall be Class 52, double cement lined.
   b. Pipe with flanges: Class 53 (formerly Class 3).
   c. All ductile iron pipe shall have cement lining of double thickness.
3. Pipe for use with sleeve type couplings shall have plain ends (without bells or beads) cast or machined at right angles to the axis.
4. Pipe for use with split type couplings shall have ends with cast or machined shoulders or grooves that meet the requirements of the manufacturer of the couplings.
5. Factory applied bituminous coatings, as approved by the Engineer, shall be furnished for all underground piping.
6. Each ductile iron pipe shall have conspicuously marked on the exterior the pressure, class, and weight of the pipe.
7. All ductile iron pipe furnished to the project shall be one uniform length, either 18 feet or 20 feet.

B. Joints (as shown on the Drawings, specified and applicable):

1. General: All joints shall be the same pressure class as the pipe unless otherwise shown on the Drawings.
2. Flanged:
   a. Provide specially drilled flanges when required for connection to existing piping or special equipment.
   b. Flanges shall be long-hub screwed tightly on pipe by machine at the foundry prior to facing and drilling.
   c. Gaskets:
      (1) Ring type of rubber with cloth insertion.
      (2) Thickness of gaskets 12 inches in diameter and smaller: 1/16 inch.

(3) Thickness of gaskets larger than 12 inches in diameter: 3/32 inch.

d. Fasteners:
(1) Make joints with bolt, stubs with a nut on each end, or one tapped flanged with a stud and nut.
(2) The number and size of bolts shall meet the requirements of the same American National Standard as the flanges.
(3) Nuts, bolts and studs shall be Grade B meeting the requirements of ASTM A307.
(4) After jointing, coat entire joint with bituminous material compatible with pipe coating.

e. When applicable, provide and install flange clamps as shown on the Drawings.

f. Uniflange type connection shall be positively restrained by use of threaded rods (2) or other approved restraint device.

3. Push-on and Mechanical Joint:
a. The plain ends of push-on pipes shall be factory machined to a true circle and chamfered to facilitate fitting the gasket.
b. Provide gaskets manufactured from a composition material suitable for exposure to the liquid to be contained within the pipe.

4. Grooved split ring couplings, sleeve couplings, flexible joints and couplings: As specified and shown on the Drawings.

5. Joint Bracing:
a. Provide joint bracing to prevent the piping from pulling apart under pressure as required.
b. Types of bracing:
(1) Joint restraining gasket using wedging action for positive restraint.
(2) Thrust blocks of sufficient size in accordance with DIPRA and AWWA standards for thrust restraint.
(3) Mechanical joint ductile iron pipe shall have joint restraint equal to Mega-Lug, as manufactured by EBAA Iron.
(4) Pipe and fittings with approved lugs or hooks cast integrally for use with socket pipe clamps, tie rods, or bridles. Bridles and tie rods shall be a minimum of 3/4 inch diameter except where they replace flange bolts of a smaller size, in which case they shall be fitted with a nut on each side of the pair of flanges. The clamps, tie rods, and bridles shall be coated with an approved bituminous paint after assembly or, if necessary, prior to assembly.
(5) Other types of bracing as shown on the Drawings.

C. Standard Fittings:
   1. All joints shall conform to the latest AWWA specification C-153.
   2. Class 350, Ductile Iron, Cement Lined except as shown on the Drawings or as specified.
   3. Joints the same as the pipe with which they are used or as shown on the Drawings.
   4. Provide fittings with standard bases where shown on the Drawings.
   5. Provide retainer glands on all fittings.
   6. Outside surface coated to specifications applicable to pipe.

D. Non-Standard Fittings:
   1. Fittings having non-standard dimensions shall be subject to the Engineer's approval.
   2. Non-standard fittings shall have the same diameter and thickness as standard fittings and shall meet the specification requirements for standard fittings.
   3. The laying lengths and types of joints shall be determined by the particular piping to which they connect.
   4. Flanged fittings not meeting the requirements of ANSI A21.10 (i.e., laterals or reducing elbows) shall meet the requirements of ANSI B16.1 in Class 125.

E. Polyethylene encasement shall be V-Bio enhanced polyethylene installed snugly around pipe and fittings per manufacturer’s specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations.
   2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
   3. Install adapters, approved by the Engineer, when connecting pipes constructed from different materials.
   4. All pipe shall be encased in V-Bio enhanced polyethylene installed tightly around pipe and fittings and in accordance with manufacturer’s recommendations, per City of Dover standards.

B. Installation in Trenches:
   1. Firmly support the pipe and fittings on bedding material as shown on the Drawings and as specified in the appropriate Sections of these Specifications.
   2. Do not permanently support the pipe or fittings on saddles, blocking stones, or any material which does not provide firm and uniform bearing along the outside length of the pipe.
   3. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.
   4. Cut a section of V-Bio polyethylene tube approximately 2 feet longer than pipe section to be joined. Remove all limps of clay, earth, mud or other material accumulated on pipe. Slip the polyethylene tube around the pipe starting at the spigot end.

5. Take up the slack in the PE tube to make a snug fit. Fold excess polyethylene back over the top of the pipe and tape securely.
6. Excavate suitable holes for the joints so that only the barrel of the pipe receives bearing pressure from the supporting material after placement.
7. Lay each pipe length so it forms a close joint with the adjoining length and bring the pipe to the required grade, taking care to not rip or puncture polyethylene encasement. Set the pipe true to line and grade. Use a transit and level or a laser beam aligner as appropriate to the pipe application.
8. Make the polyethylene overlap at the pipe joint and/or fitting by slightly suspending the pipe enough to easily slide the PE tube along the pipe. Make sure that no dirt or other bedding material becomes trapped between the PE wrap and the pipe.
9. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer, or any other unyielding object.
10. Make all pipe joints watertight with no visible leakage and no sand, silt, clay or soil of any description entering the pipeline at the joints. Overlap and tape PE encasement to adjoining pipe sections.
11. Immediately after making a joint, fill the holes for the joints with bedding material and compact. Allow adequate slack in the PE tube at joints and fittings. Backfill shall be free of rocks, cinders, sticks or other materials that might damage the polyethylene.
12. When each pipe length has been properly set, carefully place and compact the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.
13. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.
14. Take all necessary precautions to prevent water or soil from entering the pipe line.
15. Where there is evidence of water or soil entering the pipeline, repair the PE tube and other defects.

C. Temporary Plugs:
1. When pipe installation work in trenches is not in progress, close the open ends of the pipe with temporary watertight plugs.
2. If water is in the trench when work is resumed, do not remove plugs until all danger of water entering the pipe is eliminated.
3. Do not use the pipelines as conductors for trench drainage during construction.

D. Assembling Joints:
1. Push-on Joints:
   a. Insert the gasket into the groove of the bell.
   b. Uniformly apply a thin film of special lubricant over the inner surface of the gasket that will contact the spigot end of the pipe.
   c. Insert the chamfered end of the plain pipe into the gasket and push until it seats against the bottom of the socket.

2. Bolted Joints:
   a. Remove rust preventive coatings from machined surfaces prior to assembly.
   b. Thoroughly clean and carefully smooth all burrs and other defects from pipe ends, sockets, sleeves, housings and gaskets.
3. Flanged Joints:
   a. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
   b. Execute care when tightening joints to prevent undue strain upon valves, pumps, and other equipment.
4. Mechanical Joints:
   a. Thoroughly clean, with a wire brush, surfaces that will be in contact with the gaskets.
   b. Lubricate the gasket, bell, and spigot.
   c. Slip the gland and gasket, in that order, over the spigot and insert the spigot into the bell until properly seated.
   d. Evenly seat the gasket in the bell at all points, center the spigot, and firmly press the gland against the gasket.
   e. Insert the bolts, install the nuts finger tight, and progressively tighten diametrically opposite nuts uniformly around the joint to the proper tension with a torque wrench.
   f. The correct range of torque (as indicated by a torque wrench) shall not exceed 60-90 Ft.-lbs.
   g. If effective joint sealing is not attained at the maximum torque specified above, disassemble, thoroughly clean, and reassemble the joint. Do not overstress the bolts to tighten a leaking joint.
5. Bell and Spigot Joints:
   a. Thoroughly clean the bell and spigots and remove excess tar and other obstructions.
   b. Apply a liberal coat of manufacturer supplied lubricant to both the gasket and the spigot end. Lubricant shall be appropriate for the pipe application.
   c. Insert the spigot firmly into place and hold securely until the joint has been properly completed.

E. Fabrication:
1. Tapped Connections:
   a. Make all tapped connections where shown on the Drawings or where directed by the Engineer.
   b. Make all connections watertight and of adequate strength to prevent pullout.
   c. Drill and tap normal to the longitudinal axis of the pipe.
   d. The maximum sizes of taps in pipes and fittings without busses shall not exceed the sizes listed in the appendix of ANSI A21.51 based on 3 full threads for cast iron and 2 full threads for ductile iron.

2. Cutting:
   a. Perform all cutting with machines having rolling wheel cutters or knives designed to cut cast or ductile iron. Do not use a hammer and chisel to cut pipe.
   b. After cutting, examine all cut ends for possible cracks.
   c. Carefully chamfer all cut ends to be used with push-on joints to prevent damage to gaskets when pipe is installed.

F. Polyethylene encasement shall be installed in agreement with ANSI/AWWA C105/A21.5 and per manufacturer's recommendations. Tube end shall be overlapped and secured with adhesive tape or plastic string. Repair any rips or deflects prior to backfilling.

G. Pipe Deflection:
   1. Push-on and Mechanical Joints:
      a. The maximum permissible deflection of alignment at joints, in inches for 18 foot lengths:

Size of Pipe	Push-On	Mechanical
6	19	27
8	19	20
10	19	20
12	11	20
14	11	13.5
16	11	13.5
18	11	11
20	11	11
24	11	9

      b. The maximum permissible deflection for other lengths shall be in proportion of such lengths to 18 feet.
   2. Flexible Joints: The maximum deflection in any direction shall not exceed the manufacturer's instructions and recommendations.

H. Testing to be performed in accordance with the appropriate section of Section 02610 - Pipe and Pipe Fittings – General.

END OF SECTION

SECTION 02622

PVC PIPE & FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install and test PVC pipe of the size(s), type(s) and in the location(s) shown on the Drawings and or specified herein.

B. Related work Specified Elsewhere (When Applicable):

1. Site work is specified in this Division.
2. Concrete is specified in Division 3.

1.2 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of five (5) years experience in the manufacture of PVC sewer pipe.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit manufacturer's literature, test reports, and certificates in accordance with the General Conditions of the Construction Contract.

1.4 DELIVERY, STORAGE & HANDLING

A. Deliver as job progress requires and store on a smooth bed to prevent point loading.

B. Stack pipe in accordance with manufacturer's instructions.

C. Exercise extra care when handling.

1.5 INSPECTION

A. Provide all labor necessary to assist the Engineer to inspect pipe, fittings, gaskets, and other materials.

B. Carefully inspect all materials at the time of delivery and just prior to installation.

C. Carefully inspect all pipe and fittings for:

1. Defects and damage.
2. Deviations beyond allowable tolerances for joint dimensions.
3. Removal of debris and foreign matter.

D. Examine areas and structures to receive piping for:

1. Defects, such as weak structural components, that adversely affect the execution and quality of work.
2. Deviations beyond allowable tolerances for pipe clearances.

E. All materials and methods not meeting the requirements of the Contract Documents will be rejected.

F. Immediately remove all rejected materials from the project site.

G. Start work only when conditions are corrected to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers:
   1. IPEX, North Carolina;
   2. Charlotte Pipe and Foundry Company, North Carolina;
   3. Or approved equal.

B. Pipe & Fittings:
   1. Type - Polyvinylchloride (PVC) plastic pipe with integral bell and spigot joints. Polymer compounding and classification shall be in accordance with ASTM D1784 (Class 12454-B).
   2. Gravity Sewers:
      a. 4" - 15" nominal diameter sizes shall conform to ASTM D3034 and SDR=35.
      b. 18" - 36" nominal diameter sizes shall conform to ASTM F679 (wall thickness T-1).
      c. 42” – 48” nominal diameters shall conform to ASTM 794.
   3. Pressure Sewers shall conform to ASTM D2241 and D1784, Class 12454-B, with maximum SDR=26. A safety factor of 2.5 shall be used for pressure rating determination.
   4. Furnish straight pipe in standard laying lengths, 12.5 and 20 feet for 18" diameter and less, 12 and 19.5 feet for 21", 24" and 27" diameter.
   5. Furnish fittings of approved equal to the pipe and having bell and spigot configuration identical to that of the pipe.

C. Joints:
   1. Type - Flexible elastomeric seal conforming to ASTM D3212 with push-on bell and spigot.
   2. Gaskets shall conform to ASTM F477.
   3. Rubber rings for pressure sewer shall conform to ASTM D1869 and ASTM F477.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with the manufacturer's written instructions and as shown on the Drawings.

B. Exercise extra care during winter construction as pipes impact strength is lower.

C. Prior to backfilling, exercise extra care to maintain water level in open excavation below the pipe invert to avoid flotation of pipe already set to line and grade.

3.2 CLEANING AND TESTING

A. Clean and test PVC pipes: Refer to Final Sewer Testing section in these specifications.

END OF SECTION

SECTION 02623

HIGH DENSITY POLYETHYLENE PLASTIC PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install, anchor, support and test pipe and pipe fittings of the types and sizes in the locations shown on the Drawings and/or as directed by the Engineer.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 REFERENCE STANDARDS

A. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the bid date of the project.

B. Pipe shall be high density polyethylene (PE) conforming to the following standard referenced specifications:

1. ANSI/AWWA C906-07 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.
2. ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
3. ASTM F905 Standard Practice for Qualification of Polyethylene Saddle-Fused Joints.
4. ASTM F 1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
5. ASTM F 2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
6. ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock.
7. ASTM D 2239 Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
8. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
9. ASTM F 2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
10. ASTM D 2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
11. ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing.
12. ASTM D 2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

13. ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
14. ASTM D 3350-08 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

1.3 SUBMITTALS

A. Submit manufacturer's literature, test reports, and certificates in accordance with the General Conditions and Section 01340 – Submittals.
B. If requested by the Engineer, submit manufacturer's "Certification of Compliance" that pipe and fittings meet or exceed the requirements of these Specifications.

1.4 QUALITY ASSURANCE

A. Provide all labor necessary for the Engineer to inspect pipe, fittings, gaskets, and other materials.
B. Carefully inspect all materials at the time of delivery and just prior to installation.
C. Carefully inspect all pipe and fittings for:
    1. Defects and damage, gouges greater than 10% shall be removed. .
    2. Deviations beyond allowable tolerances for joint dimensions.
    3. Removal of debris and foreign matter.
D. Examine areas and structures to receive piping for:
    1. Defects, such as weak structural components that adversely affect the execution and quality of work.
    2. Deviations beyond allowable tolerances for pipe clearances.
E. All materials and methods not meeting the requirements of the Contract Documents will be rejected.
F. Immediately remove all rejected materials from the project site.
G. Start work only when conditions are corrected to the satisfaction of the Engineer.
H. HDPE Pipe and HDPE fittings shall be provided by a single manufacturer.

PART 2 - PRODUCTS

2.1 HDPE PIPE AND FITTINGS

A. Pipe
    1. Pipe to be fabricated from polyethylene resin compound of the types qualified as **PE 4710** by the Plastic Pipe Research Institute method for the determination of Hydrostatic Stress.
    2. For drinking water applications, the pipe shall comply with AWWA C906 Standards, and the material shall be listed and approved for potable water in accordance with NSF Standard 61.
    3. Sizes
        a. Outside diameters shall be in accordance with the ductile iron sizing system (DIPS) unless otherwise noted.
        b. Dimension ratio shall be **DR-11** or as otherwise as noted on the Drawings.
        c. In no case shall the wall thickness be less than 0.070".

4. Sanitary sewer pipe shall have a green exterior color or green striped exterior co-extruded into the pipe outside surface. Interior color shall be light in color for internal video inspection.
5. Water pipe shall have a blue exterior color or blue striped exterior co-extruded into the pipe outside surface.
6. Stripes printed on the outside surface shall not be acceptable.
7. Pipe shall be homogenous throughout and free of visible cracks, holes, foreign materials, blisters, or other deleterious faults.

B. HDPE Fittings
1. Polyethylene fittings from 1/2 - 2" inclusively shall be manufactured by molding techniques.
2. Molded fittings shall be manufactured and tested in accordance with ASTM D3261 and shall be so marked. Molded fittings shall be tested in accordance with AWWA C906.
3. Polyethylene fittings above 2" shall be manufactured by fabrication from polyethylene pipe described above and by means of thermal butt-fusion.
4. Polyethylene fittings shall have the same pressure rating as the pipe itself.

C. Acceptable Manufacturers:
1. Chevron Phillips Chemical Company, Performance Pipe;
2. ISCO;
3. Or approved equal.

2.2 JOINING SYSTEMS AND ADAPTERS

A. The following methods shall be deemed suitable to connect polyethylene pipe to auxiliary equipment such as valves, pumps, tanks and other piping systems.
1. HDPE Pipe to HDPE Pipe Joints: Thermal butt fusion.
2. HDPE Pipe to HDPE Fitting Joints: Thermal butt fusion.
3. HDPE Pipe to Valves, Ductile Iron Fittings, or Ductile Iron Pipe (MJ Bell End): HDPE mechanical joint adapter with restraining device.
4. HDPE Pipe to AWWA C900 PVC or C905 Pipe: HDPE Bell MJ Adapter including mechanical joint restraint.
5. HDPE Pipe to Buried Ductile Iron Pipe (Plain End): HDPE Bell MJ Adapter including mechanical joint restraint.
6. HDPE Pipe to Exposed Ductile Iron Pipe: HDPE flange adapter.

B. Thermal Butt-Fusion
1. The pipe shall be joined to itself, to polyethylene fittings and to polyethylene flange connections by means of thermal butt-fusion, whereby the two pipes or fittings to be joined are held in a machine, their ends are softened by means of heat and then pressed together under controlled pressure, resulting in their joining.
2. The butt fusion procedures used shall be procedures that are recommended by the pipe and fitting manufacturer. The Contractor shall ensure that persons making heat fusion joints have received training in the manufacturer’s recommended procedure. The Contractor shall maintain records of trained personnel and shall certify that training was received not more than 12 months before commencing construction.

3. The polyethylene pipe lengths, fittings and flanged connections to be joined by thermal butt-fusion shall be from the same type grade and class of polyethylene compound and supplied from the same raw material supplier.
4. Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or Electrofusion. SDRs for polyethylene pipe are 7.3, 9, 11, 13.5, 17, 21, 26, 32.5 and 41.
5. Joint strength must be equivalent to or greater than that of the adjacent pipe.
6. Each length of pipe shall be cleaned before joining.
7. External and internal beads shall not be removed.

C. HDPE Mechanical Joint Adapter
1. Mechanical Joint Adapter shall be compatible with AWWA C111/ANSI A21.11.
2. A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling (joint sleeve) is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance.
3. MJ adapters 14” and above shall be provided with heavy duty backup ring kits.
4. A mechanical joint restraint shall be installed at all HDPE to iron pipe transitions and shall be Series 2000PV as manufactured by EBAA Iron, or equal.

D. HDPE Bell MJ Adapter
1. HDPE Bell MJ Adapter assemblies shall consist of an HDPE Bell MJ Fitting butt fused to the HDPE pipe; a stainless steel, reinforced support ring; a ductile iron, AWWA C110, heavy body gland ring; a gasket; extra-long T-bolts; and a mechanical joint restraint for PVC or ductile iron pipe.

E. Flange Adapters
1. A polyethylene flange connection called a "Collar" shall be thermally butt-fused to the ends of the pipe.
2. Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder.
3. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing, or restrain the gasket against blowout.
4. A metal back-up flange of either nylon coated, high silica aluminum alloy, or Type 304 stainless steel shall be sized to USAB B16.1.
5. Bolts and nuts of materials suitable to resist corrosion from the outside media and electrolythically compatible with the flanges unit to which the polyethylene pipe may be connected shall be used or alternatively the nuts and bolts shall be insulated from the same.
    a. Bolts shall be of sufficient length to show a minimum of three (3) complete threads when tightened to manufacturer’s specification. Bolts shall be re-torqued after four (4) hours

6. Red rubber, asbestos composition, or other material gaskets shall be cut to fit the joint.

PART 3 - EXECUTION

3.1 TRANSPORTING, HANDLING AND STORING PIPE

A. Transporting

1. Care shall be taken during the transportation of the pipe in trucks and trailers so that it is not damaged from cuts and kinks.

B. Handling

1. The handling and lifting of pipe lengths and fittings shall be such as to avoid damage and shall be done by means of ropes, fabric or rubber protected slings and straps.
2. The pipe shall not be lifted by means of metal slings, chains, cables or hooks inserted into the pipe ends. Slings shall be positioned to prevent excessive flexing of the pipe lengths to avoid kinking or damage to the pipe ends.
3. The pipe lengths shall not be dragged from the transportation media or allowed to fall onto unprepared or rocky ground.
4. The handling of the joined pipe line shall be done in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects.
5. Slings for handling the pipeline shall not be positioned at butt fused joints.
6. Sections of the pipes with cuts and gouges of the pipe wall shall be removed and the ends of the pipeline rejoined.
7. The practice of stuffing cloth or paper in the open end of the pipe will be considered unacceptable. Proper end plugs shall be used.

C. Storing

1. The stacking of the polyethylene pipe shall be limited to such a height as to not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions.
2. The surface where the pipe shall be stored shall be level and free of foreign objects which could damage the pipe.
3. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers of sufficient bearing and spacing.
4. Pipe coils shall be laid flat on their flat side and not stacked.

3.2 INSTALLING PIPES AND FITTINGS

A. Pipe

1. Install in accordance with the manufacturer's written instructions and as shown on the Drawings.
2. The polyethylene pipe shall be lifted and lowered into the trench with proper equipment and in such a manner to ensure that the pipe is not damaged or twisted.
3. The pipe and fittings shall be laid down on the trench bottom. At flanges, valves and such connections, the trench bottom shall be dug out with sufficient length, width and depth to ensure clearance between the undisturbed trench bottom and the flanges valves and such connections.

4. Where required, concrete thrust blocks shall be installed at fittings as indicated on the contract Drawings or as directed by the Engineer.

B. Fittings (except PE Fittings fused directly to PE pipe)
   1. Install in accordance with the manufacturer's written instructions and as shown on the Drawings.
   2. MJ Adapters and Flanges shall be centered and aligned to the mating component before assembling and tightening bolts.
   3. In no case shall MJ gland or flange bolts be used to draw the connection into alignment.
   4. Where recommended by the manufacturer, bolt threads shall be lubricated, and flat washers shall be used under the nuts.
   5. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer.
   6. At least 4 hours after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer.
   7. The final tightening torque shall be as recommended by the Manufacturer.
   8. Flange connections at heavy fittings, manholes and rigid structures shall be done in such a manner that there is no subsequent relative movement between the polyethylene pipe at the flanged joint and the rigid structures.

3.4 CLEANING AND TESTING

A. The Contractor shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the Contractor's fusion operator while on site. Upon request by the Owner, the Contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps shall be cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions.

B. Refer to Sections 02610 or 02651 of these specifications, as applicable, for additional testing requirements.

END OF SECTION

SECTION 02625

CORRUGATED POLYETHYLENE (CPE) PIPE & FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install, anchor, support and test pipe and pipe fittings of the types and sizes in the locations shown on the Drawings and/or as directed by the Engineer.

1.2 QUALITY ASSURANCE

A. Pipe shall be high density polyethylene (HDPE) conforming to the following standard referenced specifications:
   1. AASHTO M294
   2. ASTM: D1248 Polyethylene Moulding & Extrusion materials.
   3. ASTM D3350 Polyethylene Plastic Pipes and Fittings.

B. Pipe and fittings shall be provided by a single manufacturer, and a certificate of compliance will be submitted to the Engineer for approval.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General
   1. The prescribed sizes of pipes are nominal inside diameters. Pipes shall be of the size and length shown on the plans.

B. Smooth Interior Corrugated Polyethylene Pipe
   1. The product supplied under this specification shall be high density polyethylene corrugated exterior/smooth interior pipe. Twelve - to 36 - inch diameters shall conform to AASHTO M294 Type S. Forty-two and 48 - inch diameters shall have minimum pipe stiffness of 20 and 17 psi, respectively, at 5% deflection; and shall meet all other requirements of AASHTO M294.
   2. Material shall meet ASTM D1248 Type III, Category 4, Grade P33, Class C; or ASTM D3350 Cell Classification 324420C.

C. Coupling Bands and Fittings
   1. Coupling bands shall cover at least one full corrugation on each section of pipe. When gasketed coupling bands are required, the gasket shall be made of closed-cell synthetic expanded rubber meeting the requirements of ASTM D1056, Type 2. Gaskets shall be installed on the coupling band by the pipe manufacturer. All coupling bands shall

meet or exceed the soil-tightness requirement of the AASHTO Standard Specification for Highway Bridges, section 23, paragraph 23.3.1.5.4(e).

2. Furnish fittings of approved equal to the pipe and having connection configurations identical to that of the pipe.
3. Pipe fittings shall conform to AASHTO M294.

D. Acceptable Manufacturers:
1. Hancor, Inc., Findlay Ohio
2. Advanced Drainage Systems, Columbus Ohio
3. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with manufacturer's recommendations and as shown on the drawings.

B. Prior to backfilling, exercise extra care to maintain water level in open excavation below the pipe invert to avoid flotation of pipe already set to line and grade.

C. Flared end sections shall be fully supported.

D. Stones larger than 3 inches in diameter shall not contact the pipe, fittings or appurtenances.

3.2 INSPECTION AND CLEANING

A. Inspect all drain pipes in the presence of the Owner and the Engineer. All pipes not demonstrating uniform slope and alignment shall be replaced at no additional cost to the Owner.

END OF SECTION

SECTION 02626

COPPER SERVICE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install copper service pipe of the type and size and in the locations shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. Seamless copper water tube, ASTM B88.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type K, soft annealed, 3/4" (minimum) through 2".

PART 3 - EXECUTION

A. Jointing:
   1. Compression Joints
      a. Ream or file the pipe to remove burrs.
      b. Slip compression nut over pipe and slide pipe into corporation.
      c. Tighten compression nut.
      d. Inspect for cracks, splits or other damages and replace if necessary.
   2. Adapters: Use as required to connect to existing services.

B. Bending Pipe:
   1. Bend pipe with suitable tools and provide smooth bend free of any cracks or buckles.

END OF SECTION

SECTION 02630

COUPLINGS, CONNECTORS, CAPS & PLUGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install couplings and connectors of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.

B. Related Work Specified Elsewhere: "Pipe & Pipe Fittings - General" is specified in this Division.

1.2 QUALITY ASSURANCE

A. Minimum pressure rating equal to that of the pipeline in which they are to be installed.

B. Couplings and connectors, other than those specified herein, are subject to the Engineer's approval.

C. Cap and plug shop drawing submissions must be accompanied by a manufacturer's written certification that the cap or plug will effectively and permanently seal the inactivated or abandoned utility.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All couplings and Connectors:

1. Gasket Materials: Composition suitable for exposure to the liquids to be contained within the pipes.
2. Diameters to properly fit the specific types of pipes on which couplings and connectors are to be installed.

B. Sleeve Type Couplings (When Applicable):

1. Exposed Couplings (When Applicable):
   a. Steel middle ring,
   b. Two steel follower rings,
   c. Two wedge-section gaskets,
   d. Sufficient steel bolts to properly compress the gaskets,
   e. Acceptable Manufacturers:
      (1) Dresser Manufacturing Co. - Style 38,
      (2) Smith-Blair Inc. - Style 411,
      (3) Or approved equal.
2. Buried Couplings (When Applicable):
   a. Sleeve Type design consisting of center sleeve, one end ring and multi-range two layered EPDM gasket and stainless steel spanner per end, one type 304 stainless steel nut and bolt per end.
   b. Coupling body: carbon steel. Ductile iron (ASTM A536).

c. Compression End Rings: One gasket compression end ring per coupling end. End rings to be of one bolt design (or two for large diameter), fabricated of carbon steel.
d. Hydraulic Wide Range Gasket: EPDM gasket, approved for contact with drinking water, designed with a multi-layered wide range removable outer layer. Gasket hydraulically actuated with a pressure-equalizing dam, pressure cavity and sealing lip for working pressures as indicated (ASTM D2000, NSF 61).
e. Nuts and bolts: AISI 304 (ISO 683, DIN 1.4301) grade Stainless Steel. Unless the manufacturer recommends otherwise, bolts shall be coated with anti-seize coating to prevent galling.
f. Coating: Interior and Exterior: Fusion Bonded Epoxy coating approved for contact with drinking water (NSF 61)
g. Acceptable Manufacturers/Models:
(1) Romac Industries, Inc.
(2) Or approved equal.

C. Split Type Couplings (When Applicable):
1. Constructed from malleable or ductile iron.
2. For use with grooved or shouldered end pipe with minimum wall thickness as required so as not to weaken pipe.
3. Cast in two sections for 3/4 inch through 14 inch pipe sizes, four segments for 15 inch through 24 inch pipe sizes, and six segments for pipe sizes over 24 inch.
4. Coating: Enamel.
5. Bolts: Carbon steel.
6. Acceptable Manufacturers:
a. Victaulic Company of America, Style 77,
b. Or approved equal.

D. Flanged Adapters (When Applicable):
1. For joining plain end or grooved end pipe to flanged pipes and fittings.
2. Adapters shall conform in size and bolt hole placement to ANSI standards for steel and/or cast iron flanges 125 or 150 pound standard unless otherwise required for connections.
3. Exposed Sleeve Type:
a. Constructed from steel.
b. Coating: Enamel.
c. Bolts: Carbon steel.
d. Acceptable Manufacturers:
(1) Foster Adapter - ductile iron 3 to 24-inch: 350psi rating. Asphalt or epoxy coating. Epoxy coating is standard on sizes 14 to 36-inch.
(2) Dresser Manufacturing Co. - Style 128 for cast iron, ductile iron and steel pipes with diameters of 2 inches through 96 inches.
(3) Or approved equal.
4. Buried Sleeve Type:
a. Constructed from cast iron.

b. Bolts: Galvanized steel.
c. Acceptable Manufacturers:
(1) Dresser Manufacturing Co. - Style 127 locking type for cast iron, ductile iron, asbestos cement and steel pipes with diameters of 3 inches through 12 inches.
(2) Or approved equal.

5. Split Type:
a. Constructed from malleable or ductile iron.
b. For use with grooved or shouldered end pipe.
c. Coating: Enamel.
d. Acceptable Manufacturers:
(1) Victaulic Company of America - Style 741 for pipe diameters of 2 inches through 12 inches,
(2) Victaulic Company of America - Style 742 for pipe diameters of 14 inches through 16 inches,
(3) Or approved equal.

E. Flexible Joints:
1. Expansion Joints:
a. Materials shall be capable of withstanding the temperature, pressure and type of material in the pipeline.
b. Shall be the filled arch type that will prevent sediment build up for all sludge, sewage, and other lines with similar service.
c. Supplied with control rods to restrict elongation and compression.
d. Metal retaining rings shall be split and beveled galvanized steel for placement against the flange of the expansion joint.

2. Deflection Joints:
a. Joints designed to permit a nominal maximum deflection of 15 degrees in all directions from the axis of the adjacent pipe length, will prevent pulling apart, and will remain watertight at any angle of deflection under 15 degrees.
b. Material to be manufactured from a composition material suitable for exposure to the liquid, pressure and temperature to be contained within the pipe.
c. Supplied with control rods as required.

F. Caps and Plugs
1. Cap and plug material shall be as indicated on the Drawings and shall be adaptable to the inactive or abandoned utility to be capped or plugged.
2. DI caps shall be restrained with grip rings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sleeve Type Couplings (When Applicable):
1. Thoroughly clean pipe ends for a distance of 8 inches from the ends prior to installing couplings, and use soapy water as a gasket lubricant.

2. Slip a follower ring and gasket (in that order) over each pipe and place the middle ring centered over the joint.
3. Insert the other pipe length into the middle ring the proper distance.
4. Press the gaskets and followers evenly and firmly into the middle ring flares.
5. Insert the bolts, finger tighten and progressively tighten diametrically opposite bolts uniformly around the flange to the torque recommended by the manufacturer.

B. Split Type Flange Adapters (When Applicable): Install in the same manner as Split Type Couplings.

C. Buried Couplings, Adapters and Connectors (When Applicable): Thoroughly coat all exterior surfaces, including nuts and bolts, after assembly and inspection by the Engineer with a heavy-bodied bituminous mastic as approved by the Engineer.

D. Install thrust rods, supports and other provisions to properly support pipe weight and axial equipment loads.

E. Install caps and plugs in accordance with manufacturer's recommendations to ensure a permanent seal of the inactive or abandoned utility.

END OF SECTION

SECTION 02641

RESILIENT-SEATED GATE VALVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install gate valves of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. All gate valves of the same type and style shall be manufactured by one manufacturer.

B. Meet or exceed AWWA C509 Resilient-Seated Gate Valves for Water and Sewerage Systems or C515 Reduced – Wall Resilient Seated Gate Valves.

C. Acceptable Manufacturers:
   1. Mueller
   2. Kennedy
   3. Clow
   4. American Flow Control

1.3 VALVE LOCATION AND USE

A. As shown on the Drawings.

B. Accessories: As shown and required for proper operation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Resilient wedge valves shall be used for valves up to 12 inches. Gate Valves exceeding 12 inches shall be Horizontal – Bevel Geared.

B. Resilient wedge valves shall be Waterworks type NRS valves (AWWA C509 or C515), with mechanical joints and all accessories including retainer gland.

C. Horizontal – Bevel Geared valves shall meet all applicable requirements of AWWA C515 Standard and certified to ANSI/NSF 61.
   1. Iron body bronze mounted (IBBM), coated inside and out with fusion bonded epoxy (AWWA C550).
   2. Non rising stem (NRS).
   3. End Connections: As shown on the Drawings and as required for pipe.
   4. Working pressure:
      a. 4” to 12”: 200 psi water.
      b. 14” to 20”: 250 psi water.
      c. Unless otherwise shown on the Drawings.
   5. Stem Sealing:
      a. Rust-proofed bolting.
      b. "O" ring design.
      c. Capable of replacing under pressure with valve open.
   6. Buried Valves:

a. Gate box required.
b. Sufficient quantity of tee-handle valve wrenches for operating valves of various depths.
c. 2 inch square operating nut, securely fastened to shaft.

7. Valve operation: Open by turning LEFT –COUNTER CLOCKWISE.
8. Arrow showing direction of opening plainly cast on valve bonnet.
9. All Gate Valves shall have stainless steel nuts and bolts on the bonnet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Buried Valves:
1. Stem vertical
2. Box vertical and centered over operating nut.
3. Thrust blocks installed as shown on the Drawings.
4. Gate box supported during backfilling and maintained.
5. Gate box shall not transmit shock load or stress to valve.

END OF SECTION

SECTION 02642

CORPORATION STOPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install corporation stops of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. All corporation stops shall be manufactured by one manufacturer.
B. Qualifications of Manufacturer: Products have proven reliable in similar installations over a reasonable number of years.
C. Meet or exceed ANSI/AWWA C800.
D. Acceptable Manufacturers:
   1. A.Y. McDonald Mfg. Co.
   2. Ford;
   3. Hayes;
   4. Or equivalent.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ball valve type corporation with 300 psi rating.
B. Construction shall be in accordance with AWWA C800 latest revision.
C. Outlet shall have a compression pack joint (CPPJ) for copper tubing or plastic tubing (CTS) O.D.
D. Inlet shall have AWWA (CC) Tapered Pipe Threads.
E. Stainless steel insert stiffeners shall be used where plastic tubing (CTS) is specified.
F. Shall be “lead free” as defined in the Safe Drinking Water Act, amended January 4, 2011. Specifically, fittings shall contain not more than a weighted average of 0.25% lead when used with respect to their wetted surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install at locations shown on the Drawings and as specified in accordance with manufacturer's instructions.
B. Spiral wrap the thread area completely with Teflon tape prior to insertion.
C. One to three threads of the installed corporation stop must be showing outside the water main.
D. Use service saddle as noted on Drawings.
E. Check and adjust all corporation stops for smooth operation.

END OF SECTION

SECTION 02643

CURB STOPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install curb stops of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. All curb stops shall be manufactured by one manufacturer.
B. Qualifications of Manufacturer: Products shall have proven reliable in similar installations over a reasonable number of years.
C. Meet or exceed ANSI/AWWA C800.
D. Acceptable Manufacturers:
   1. A.Y. McDonald Mfg. Co.
   2. Ford;
   3. Hayes;
   4. or equivalent.

PART 2 – PRODUCTS

A. Curb ball valve, quarter turn check.
B. Construction shall be in accordance with AWWA C800 latest revision.
C. Inlet and outlet shall have compression type connections (CPPJ).
D. Working pressure shall be 300 psi.
E. Stainless steel insert stiffeners shall be used where plastic tubing (CTS) is specified.
F. Inverted key and plug type curb stops are not acceptable.
G. Shall be “lead free” as defined in the Safe Drinking Water Act, amended January 4, 2011. Specifically, fittings shall contain not more than a weighted average of 0.25% lead when used with respect to their wetted surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install at locations shown on the Drawings and in accordance with manufacturer's instructions.

3.2 ADJUSTMENTS

A. Check and adjust all curb stops for smooth operation.

END OF SECTION

SECTION 02644

HYDRANT ASSEMBLIES

PART 1 - GENERAL

1.1. DESCRIPTION

A. Work Included: Furnish and install hydrant assemblies of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

B. Hydrant Assemblies consist of:

1. Hydrant tee.
2. 6 inch gate valve and valve box.
3. 6 inch hydrant branch piping.
4. Hydrant.
5. Thrust blocking and retainer glands.

1.2 QUALITY ASSURANCE

A. Hydrants shall conform to AWWA C502 and all hydrants shall be from one manufacturer.

B. Hydrants shall comply with Factory Mutual Research Corporation and Underwriters' Laboratories UL246 Standard.

C. Gate valves shall conform to AWWA C500.

D. Acceptable Manufacturer/Model:

1. Eddy, as manufactured by Clow, per City of Dover Standards.
2. Because the City of Dover has an established standard, other manufacturers/models are not acceptable.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fire Hydrants:

1. Dry barrel type with a 5-1/4 inch minimum valve opening.
2. Two (2) 2-1/2 inch hose connections and one (1) 4-1/2 inch pumper connection.
   a. 2-1/2 inch outlets: 60 degree V threads, 7-1/2 threads to the inch, external threads 3-1/16 inches, O.D. National Standard threads.
   b. 4-1/2 inch outlet: 4 threads to the inch, external threads 5-3/4 inches, O.D. National Standard threads.
3. 200 pounds working pressure and 400 pounds hydrostatic test pressure, minimum.
4. Working parts shall be bronze and open LEFT (COUNTERCLOCKWISE). Operating nut shall open by turning to the LEFT (per City of Dover) and be five-sided, 1 1/2 inch point to flat.
5. Designed with standpipe breaking ring or breakable sections.
6. Supply one (1) collision repair kit for every twenty-five (25) hydrants installed.
7. **Hydrants shall be manufactured without drain holes (no plugs).**
8. Caps shall be attached to hydrant body by chains.

B. Gate Valves: Waterworks type non-rising stem AWWA valve as specified in Section "Gate Valves".
C. Valve Boxes:
   1. Cast or ductile iron, with the word "WATER" cast in covers.
   2. Be of such length as required without full extensions. Minimum lap 12 inches.
D. Restraints: All hydrant assemblies from tee to hydrants shall have joint restraint equal to Mega-Lug, as manufactured by EBAA Iron or Grip Ring as manufactured by Romac Industries.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install hydrants as shown in the details and using manufacturer's written instructions.
B. No hydrant assembly shall be backfilled until approved by the Engineer.
C. Provide thrust blocks as shown.
D. Provide barrel extensions as required for hydrant to be installed at proper grade at no additional cost to the Owner.
E. **Hydrants shall be manufactured without drain holes (no plugs).**
F. Provide finish paint on all exposed surfaces. Color must meet Owner's requirements.
G. Anchoring tees shall be installed at all branches for hydrants.
H. Each hydrant shall be set on firm material and be well buried and anchored by depositing a concrete thrust block between the hydrant and the undisturbed earth at the end of the trench.

3.2. CLEANING

A. Clean all hydrants of concrete, etc. and repaint as necessary to the satisfaction of the Engineer and Owner.

END OF SECTION

SECTION 02645

CURB BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install curb boxes of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. All curb boxes shall be manufactured by one manufacturer.

B. Qualifications of Manufacturer: Products have proven reliable in similar installations over a reasonable number of years.

C. Acceptable Manufacturers/Suppliers:

1. Ford;
2. Or approved equal

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cast iron base piece, steel upper, cast iron lid, and threaded bronze plug with pentagon nut with rope thread.

2.2 STYLE

A. Extension type and arch pattern base with 5/8 inch diameter stationary operating rod of adequate length.

B. "Water" shall be cast in raised letters on the box lid.

C. Erie Style Boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as shown on the Drawings and/or as directed by the Owner.

1. Curb boxes shall be set plumb and flush with finish grade.
2. When installation is complete, no pressure shall be exerted by the curb box on either the curb stop or the service pipe.
3. No obstruction shall be placed to obstruct use of shut-off valve wrench within a 6 foot circumference from center of curb box.

END OF SECTION

SECTION 02646

VALVE BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install valve boxes of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. All valve boxes shall be manufactured by one manufacturer.

B. Qualifications of Manufacturer: Products to have been proven reliable in similar installations over a reasonable number of years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For valves 10 inches and smaller the valve box shall be cast iron, slip type two-piece integral base, with a top flange, 5-1/4 inch shaft.

B. For valves 12 inches and larger the valve box shall be cast iron, slip type, three piece (separate base), with a top flange, 5-1/4 inch shaft.

C. Cast or ductile iron, with the word "WATER" cast in covers.

D. Valve boxes shall be 6’ tall.

E. The upper section of the box shall be top-flange type to prevent settlement. The lower section shall be belled type to enclose the operating nut of the valve.

F. Acceptable Manufacturers:

1. Tyler Union.
2. Or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation as shown on the Drawings and/or as specified herein:

1. When installation is complete, no pressure shall be exerted by valve box on the water main or on the valve.
2. Be of such length as required without full extension. Minimum lap 12 inches.
3. Install so cover is exactly level to 1/4 inch lower than pavement.

END OF SECTION

SECTION 02649

SERVICE SADDLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install service saddles of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. All service saddles shall be manufactured by one manufacturer.

B. Qualifications of Manufacturer: Products to have been proven reliable in similar installations over a reasonable number of years.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For cast iron, ductile iron, asbestos cement, and C900 PVC pipe
   1. Body - ductile iron.
      a. Fusion bonded epoxy coated (10 mils min.)
   2. Gasket - NBR compound.
   3. Bolts, Washers and nuts - heavy hex constructed of type 304 (18-8) stainless steel.
   4. Threads-American Tapered Pipe Threads.

B. Straps: 304 Stainless Steel double strap for all sizes.

C. Acceptable Manufacturers:
   1. Smith-Blair
   2. Dresser
   3. Or equivalent

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation as shown on the Drawings and/or as specified herein:
   1. Install at locations with 2 inch or larger services on ductile iron pipe, or at any size service on A.C. or PVC pipe, or as specified by the pipe and saddle manufacturers.
   2. Check for leaks prior to backfilling as appropriate.
   3. Tap pipe with tools and methods specifically furnished by pipe manufacturer.

END OF SECTION

SECTION 02650

DEWATERING - PREDRAINING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Design, furnish, install, operate, maintain and remove temporary dewatering systems as necessary to lower and control (predrain) water levels below subsurface water entering excavations.

B. Provide, maintain and remove temporary surface water control measures.

1.2 DESIGN AND PERFORMANCE RESPONSIBILITY

A. The Contractor shall be solely responsible for the proper design and execution of methods for controlling surface water and predraining groundwater.

B. The Contractor shall be solely responsible for damage to properties, buildings or structures, sewers and other utility installations, pavements, sidewalks, and work that may result from his dewatering or surface water control operations.

C. Design review and field monitoring activities by the Engineer shall not relieve the Contractor of his responsibilities for the Work.

1.3 SUBMITTALS TO THE ENGINEER

A. Plan of proposed dewatering method including, the number, type, size, power supply and location of proposed dewatering units; schedule of operation; and method of disposal of water.

B. Water level readings in observation wells, including the well locations, wellpoint tip elevation and elevation of water in the wells.

C. Include provisions for the dewatering system in the Stormwater Pollution Prevention Plan (SWPPP) described in Section 02540 – Temporary Erosion Control.

D. At least two weeks prior to the start of construction in any areas of anticipated dewatering, submit a proposed initial plan for removal of water, method of excavation and support of the excavation to the Engineer for review. Do not proceed with construction in any of these areas until the initial plan has been reviewed and commented upon by the Engineer. Concurrence by the Engineer with the Contractor's initial plan shall be the Engineer's agreement that the plan is satisfactory for initial trial. It is expected that the initial plan may need modifications to suit the variable soil/water conditions to be encountered.

1.4 SUBSURFACE CONDITIONS

A. When available, locations of test borings and pits are shown on the Drawings. The boring logs are included in the Appendix of these Specifications.

B. Variations in subsurface conditions should be anticipated by the Contractor when planning and estimating the work. Water levels can be expected to vary with season, precipitation and stages of nearby brooks and, therefore, water levels encountered at the time of construction may differ from any that are shown on the boring and test pit logs.

PART 2 - PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 - EXECUTION

3.1 GENERAL

A. Control surface water and predrain groundwater such that excavation to final grade is made in-the-dry, maintain undisturbed bearing soils and insure that softening and/or disturbance due to the presence of seepage of water does not occur.

B. Perform all construction and backfilling in-the-dry. Flotation of completed portions of the Work is prohibited.

3.2 SURFACE WATER CONTROL

A. Construct surface water control measures, including dikes, ditches, sumps and other methods to prevent, as necessary, flow of surface water into excavations.

3.3 TEMPORARY GROUNDWATER OBSERVATION WELLS

A. Prior to commencing excavation and at locations designated by the Engineer, install temporary groundwater observation wells on the alignment of the pipe centerline.

B. The required spacing of the wells will be determined by the Engineer based on the methods and sequence of excavation and dewatering and the soil and water conditions encountered. It is anticipated that temporary well spacings will generally vary within the range of 100 feet to 300 feet.

C. Evaluate water level readings in the wells to confirm that the groundwater level has been lowered as specified such that excavation to final grade can be made in-the-dry.

D. Make water level readings and submit to the Engineer, to confirm effectiveness of dewatering prior to final excavation. Permit the Engineer to make independent readings of water levels in wells.

E. Temporary groundwater observation wells shall consist of a screened or slotted wellpoint and riser pipe. The wellpoint tip shall be placed at least two feet below the proposed bottom of excavation level.

F. Leave temporary groundwater observation wells in place until immediately prior to final excavation at the well locations.

3.4 EXCAVATION DEWATERING

A. Construct all pipelines, structures, concrete work, pipe bedding, and backfill in-the-dry. Excavate in-the-dry and not until the water level, as indicated by groundwater observation wells, is a minimum of six inches below the proposed bottom of final excavation within the trench limits.

B. Provide and maintain, at all times during construction, proper equipment and facilities to promptly and adequately remove and dispose of all water entering excavations. Keep undisturbed subgrade foundation conditions until the fill, structure or pipes to be built thereon have been completed to such an extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

C. Conduct dewatering, at all times, in such a manner to preserve the natural undisturbed capacity of the subgrade soils at the bottom of excavations.

D. Evaluate the impact of the anticipated subsurface soil/water conditions on the proposed method of excavation and removal of water.

E. Where groundwater level is above the bottom of the proposed excavation level, install and operate a pumped dewatering system, including wellpoints or closely spaced wells. Predrain the soils prior to final excavation, and maintain the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged. The type of system, spacing of dewatering units and other details of the work will vary depending on soil/water conditions at particular locations.

F. Dewater and excavate in a manner which does not cause loss of ground or disturbance to the pipe bearing soil or soil supporting overlying or adjacent structures.

G. Surround wellpoints and other dewatering units with suitable filter sand to prevent fines from being removed by pumping.

H. Pump the dewatering system continuously until pipe or structure is adequately backfilled, and provide stand-by pumps.

I. Collect water entering the excavation from precipitation or surface runoff in shallow ditches around the perimeter of the excavation, drain to sump and pump from the excavation to maintain a bottom free from standing water.

J. Dispose of drainage in an approved area so that backflow, pollution, or public nuisance will not occur.

END OF SECTION

SECTION 02675

DISINFECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes the cleaning, chlorinating and flushing of all pipelines, storage tanks and all structures which shall carry or hold potable water, including all chemicals required.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American Water Works Association (AWWA), latest revision:
   C651 - Standard for Disinfecting Water Mains
   C652 - Standard for Disinfection of Water-Storage Facilities
   C653 - Standard for Disinfection of Water Treatment Plants

1.3 USE OF WATER

A. Permission shall be obtained from the Owner of the water system before the use of water from any existing system. The Contractor shall:

1. Conform to the requirements of the Owner.
2. Pay all costs associated with the taking or use of water.
   Note: Owner shall provide to the Contractor at no charge sufficient quantity of water to perform the disinfection requirements one (1) time.
3. Give notice at least 24 hours before the use of water for any reason.

B. All work under this section shall be performed in the presence of the designated inspector chosen by the Engineer.

C. Chlorination shall be scheduled such that sampling and flushing will be performed during normal daylight working hours.

1.4 SUBMITTALS

A. Material safety data sheets for all chemicals to be used.

PART 2 - PRODUCTS

2.1 MATERIALS AND CONSTRUCTION

A. Chlorination shall be by the use of a solution of water and liquid chlorine, calcium hypochlorite or sodium hypochlorite.

B. The disinfecting solution shall be contained in the pipe or structure as specified.

PART 3 - EXECUTION

3.1 APPLICATION

A. Disinfection of water storage tanks shall be performed in accordance with Method 3 (two-step process) per AWWA C652.

B. Prior to chlorination all dirt and foreign matter shall be removed by a thorough cleaning and flushing of the pipeline or structure.

C. The chlorine solution shall be admitted to pipelines through corporation stops place in the horizontal axis of the pipe, and to structures by means of tubing extending directly into the structure or other approved methods.

D. The application of the chlorine solution shall be means of a solution feed device. The rate of chlorine solution flow shall be in such proportion to the rate of water entering the pipe or structure, that the resulting free chlorine residual shall not be less than specified per AWWA standard.

E. The chlorine treated water shall be retained in the pipe, storage tank or structure at least 24 hours, unless otherwise directed. During the retention period, all valves and hydrants within the treated sections shall be operated.

F. When using Liquid Chlorine to disinfect water mains by the Continuous Feed Method per AWWA C651, the chlorine residual shall not be less than 10 mg/L at the end of the retention period.

G. The slug method may be used for chlorination of pipelines with the prior approval of the Engineer and shall be in accordance with AWWA C651.

H. When making repairs to (or when specified), structures other than water storage tanks and portions of pipelines shall be chlorinated in accordance with the Spray Method per AWWA C651.

3.2 FLUSHING

A. After the required retention of chlorinated water in the pipe or structures they shall be thoroughly flushed until the replacement water shall, upon test, both chemically and bacteriologically, be proven equal to the water quality served to the public from the existing water supply system.

B. The disposal of chlorinated water from any pipe or structure shall be such that it will not cause damage to any vegetation, fish, or animal life and shall be in accordance with any requirements specified herein.

C. Contractor to obtain Discharge General Permit as necessary.

3.3 FIELD TESTING

A. The Contractor shall be responsible for making all arrangements and costs for the testing of the water quality. In areas where the testing of water quality is not performed by the public health authority, the Contractor shall have the required test completed by an approved independent laboratory. The results of all tests shall be forwarded to the Engineer and the public health authority having jurisdiction.

B. At least two (2) samples of water shall be tested for compliance with this Section.

C. The Contractor shall provide the means and tools as may be required by the Engineer or the public health authority for the sampling and testing of water quality.

D. All water quality requirements shall be fulfilled prior to the passage of any water through the new system to a public supply or the use of the new system.

E. All testing shall be performed in accordance with the Standard Methods for the Examination of Water and Wastewater.

END OF SECTION

SECTION 02935

LOAMING & SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, place, and test topsoil, seed, lime, and fertilizer, and protect and maintain seeded areas disturbed by construction work, where shown on the Drawings and as directed by the Engineer.

1.2 SUBMITTALS AND TESTING

A. Seed:
   1. Furnish the Engineer with duplicate signed copies of a statement from the vendor, certifying that each container of seed delivered to the project site is in accordance with these Specifications.
   2. Each lot of seed shall be subject to sampling and testing, at the discretion of the Engineer.

B. Topsoil:
   1. Inform the Engineer, within 30 days after the award of the Contract, of the sources from which the topsoil is to be furnished.
   2. Obtain representative soil samples, taken from several locations in the area under consideration for topsoil removal, to the full stripping depth.
   3. Have soil samples tested by an independent soils testing laboratory, approved by the Engineer, at no additional cost to the Owner.
   4. Have soil samples tested for physical properties and pH (or lime requirement), for organic matter, available phosphoric acid, and available potash, in accordance with standard practices of soil testing.
   5. Use only soil that is suitable as shown by the tests.

1.3 DELIVERY, STORAGE & HANDLING

A. Seed:
   1. Furnish all seed in sealed standard containers, unless the Engineer grants exception in writing.
   2. Containers shall be suitably labeled.

B. Fertilizer:
   1. Furnish all fertilizer in unopened original containers.
   2. Containers shall be labeled with the manufacturer's statement of analysis.

1.4 JOB CONDITIONS

A. Topsoil: Do not place or spread topsoil when the subgrade is frozen, excessively wet or dry, or in any condition otherwise detrimental to the proposed planting or to proper grading.

B. Seeding:
1. Planting Seasons: Perform seeding work only between the dates of 15 May to 20 June and 15 August to 15 October, except as otherwise directed in writing by the Engineer.
2. Weather Conditions:
a. Do not perform seeding work when weather conditions are such that beneficial results are not likely to be obtained, such as drought, excessive moisture, or high winds.
b. Stop the seeding work when weather conditions are not favorable.
c. Resume the work only when conditions become favorable, or when approved alternative or corrective measures and procedures are placed into effect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seed shall be in accordance with NHDOT Sections 644 2.2 and 2.3. Measurement and Payment sections will not apply.
1. Park Seed Type 15 (Table 1) shall normally be used on loam areas with a flat or shallow slopes as shown on the drawings unless otherwise specified.
2. Slope Seed Type 44 (Table 2) shall normally be used for slope work where additional erosion control is necessary as shown on the drawings unless otherwise specified.
3. Provide the grass seed mixture approved by the Engineer, having the following composition:

Table 1 Park Seed Type 15:

Kind of Seed	Minimum Purity (%)	Minimum Germination (%)	Lb./Acre
Creeping Red Fescue	96	85	45
Perennial Rye Grass	98	90	55
Kentucky Bluegrass	97	85	30
Redtop	95	80	5

Table 2 Slope Seed Type 44:

Kind of Seed	Minimum Purity (%)	Minimum Germination (%)	Lb./Acre
Creeping Red Fescue	96	98	40
Perennial Ryegrass	98	90	35
Redtop	95	80	5
Alsike Clover	97	90	5
Birdsfoot Trefoil	98	80	5

4. **Crownvetch** shall be used at a rate of 10 lb./acre on all slopes (with or without slope seed type 44) where shown on the plans or as directed by the

Engineer because of steep slopes, excessive erosive forces or poor topsoil conditions.

5. Do not use seed which has become wet, moldy, or otherwise damaged in transit or during storage.
6. For mixes including Birdsfoot Trefoil or Crownvetch, provide an appropriate quantity of pure culture nitrogen fixing bacteria with a demonstrated ability to transform nitrogen from the air into soluble nitrates and to deposit them into the soil.

B. Topsoil:

1. Provide the quantity of topsoil necessary to complete the work.
2. The term as used herein shall mean that portion of the soil profile defined technically as the "A" soil horizon by the Soil Science Society of America.
3. Provide topsoil that is natural, friable clay-loam possessing the characteristics of representative soils in the vicinity which produce heavy growths of crops, grass, and other vegetation.
4. Provide topsoil which is reasonably free from subsoil, brush, objectionable weeds, other litter, clay lumps, stones, stumps, roots, objects larger than 2 inches in diameter, and toxic substances which might be harmful to plant growth or be a hindrance to grading, planting, and maintenance operations.
5. Topsoil shall have the following characteristics:

		Min.	Max.	
a.	pH	5.5	7.6	
b.	Organic Matter	3%	10%	(determined by loss by ignition)

c. Not more than 65% shall pass a No. 200 sieve as determined by the wash test and in no instance shall more than 20% of that material passing the No. 4 sieve consist of clay size particles.

1. Obtain topsoil from naturally well drained areas.

C. Lime:

1. Provide lime which is ground limestone containing not less than 85% of total carbonate and of such fineness that 90% will pass a NO. 20 sieve and 50% will pass a No. 100 sieve.
2. Coarser materials will be acceptable provided the specified rates of application are increased proportionately on the basis of quantities passing a No. 100 sieve. Apply the increased quantity at no additional cost to the Owner.

D. Fertilizer:

1. Provide a suitable commercial fertilizer.
2. Provide fertilizer containing the following minimum percentage of plant food by weight:
   10% Available phosphoric acid
   10% Available potash
   10% Available nitrogen (75% of the nitrogen shall be organic).

PART 3 - EXECUTION

3.1 PREPARATION

A. Equipment:
   1. Use all equipment necessary for the proper preparation of the ground surface and for the handling and placing of all required materials.
   2. Use equipment that will apply materials at suitable rates.

B. Soil: Perform the following work prior to the application of lime, fertilizer or seed:
   1. Scarify the subgrade to a depth of 2 inches to allow the bonding of the topsoil with the subsoil.
   2. Apply topsoil to the areas to be seeded to the depth specified on the plans.
   3. Trim and rake the topsoil to true grades free from unsightly variations, humps, ridges or depressions.
   4. Remove all objectionable material and form a finely pulverized seedbed.

3.2 PERFORMANCE

A. Grading:
   1. Grade the areas to be seeded within the areas shown on the Drawings or as directed by the Engineer.
   2. Leave all surfaces in even and properly compacted condition.
   3. Maintain grades on the areas to be seeded in true and even conditions, including any necessary repairs to previously graded areas.

B. Placing Topsoil:
   1. Uniformly distribute and evenly spread topsoil on the designated areas.
   2. Spread the topsoil in such a manner that planting work can be performed with little additional soil preparation or tillage.
   3. Correct all irregularities in the surface resulting from placing topsoil or other operations to prevent the formation of depressions where water may stand.
   4. Thoroughly till the topsoil to a depth of at least 3 inches by plowing, discing, harrowing, or other approved method until the condition of the soil is suitable.

C. Placing Lime:
   1. Uniformly distribute lime immediately following or simultaneously with the incorporation of fertilizer.
   2. Distribute lime at a rate determined from the pH test sufficient to raise the loam pH to a minimum 5.5 or as directed by the Engineer.
   3. Distribute the lime to a depth of at least 3 inches by discing, harrowing, or other suitable methods.
   4. Lime may be distributed by the hydraulic method which includes seed and fertilizer.

D. Placing Fertilizer:
   1. Distribute fertilizer uniformly at a suitable rate over the areas to be seeded.
   2. Fertilizer may be place by dry application in accordance with the tillage operation specified above (3.2 B. 4.).
   3. Distribution by means of a seed drill equipped to sow seed and distribute fertilizer at the same time will be acceptable or by the hydraulic method which includes seed distribution.

E. Seeding:
   1. Level out all undulations and irregularities in the surface resulting from tillage, fertilizing, liming and other operations before starting seeding operations.
   2. Drill Seeding:
      a. Drill seeding may be performed with approved equipment having drills not more than 2 inches apart.
      b. Sow the seed uniformly over the designated areas to a depth of 1/2 inch and at rate specified.
   3. Broadcast Seeding:
      a. Broadcast seeding may be performed with suitable equipment.
      b. Sow the seed uniformly over the designated areas at the rate specified.
      c. Sow half the seed with the equipment moving in one direction and the remainder of the seed with the equipment moving at right angles to the first sowing.
      d. Cover the seed to an average depth of 1/2 inch by means of a brush harrow, spike-tooth harrow, chain harrow, cultipacker, or other suitable devices.
      e. Do not perform broadcast seeding work during windy weather.
   4. Hydraulic Method (Hydroseeding)
      a. Use an approved spraying machine specifically designed to keep the mixture agitated and applies seed, lime, fertilizer and fiber mulch in one operation.
      b. The Contractor shall provide for review and approval by the Engineer, coverage calculations specific to the machine being used documenting the application rates. The calculations shall provide the number of pounds to be used per complete tank load. The calculation shall also demonstrate the appropriate coverage per tank load.
      c. Only complete tank loads will be prepared and applied.
      d. If the grass seed requires innoculum and remains in the hydroseeder longer than 30 minutes, fresh innoculum shall be added.
      e. The Contractor, with the approval of the Engineer, shall delineate and prepare the coverage area for each tank load to be applied prior to loading the hydroseeder.
      f. The hydroseeder shall be completely cleaned at the end of each day.
      g. Only fiber mulch appropriate for use in a hydroseeder shall be used.
      h. When hydroseeding is used compaction or rolling may not be required.

i. If the results of the hydroseeding are unsatisfactory, the Contractor will be required to abandon the method and use either the drill or broadcasting method, including the rolling or compaction.

F. Mulching:
1. If hydroseeding is the selected seeding method and the Contractor intends to use fiber mulch mixed in the hydroseeder tank:
a. The mulch shall be from one manufacture, with the appropriate documentation that the mulch is designed for use with a hydroseeder.
b. Shall be completely biodegradable with no inert or residual byproducts. Natural organic dyes may be factory applied to color the mulch.
2. Dry Distribution methods
a. Straw or hay mulch shall be applied immediately following seeding operations.
b. Mulch should cover ground enough to shade it but should not be so dense that ground is not visible.
c. When hand applied, the Contractor may place light brush over the mulch to prevent blow-away.
d. Straw or hay mulch may be applied by use of an appropriate chopper/blower.
e. A tackifier approved for use with mulch may be applied with the chopper/blower method.
f. Remove all matted mulch.
g. Immediately collect and remove from the site all baling wire or rope.
h. Bark mulch shall only be used at areas designated on the plans or as directed by the Engineer.

G. Compacting:
1. Compact the entire area immediately after the seeding operations have been completed. (Compaction may not be required for the hydroseed method.)
2. Compact by means of a cultipacker, roller, or other suitable equipment weighing 60 to 90 pounds per linear foot of roller.
3. If the soil is of such type that a smooth or corrugated roller cannot be operated satisfactorily, use a pneumatic roller (not wobbly wheel) that has tires of sufficient size to obtain complete coverage of the soil.
4. When using a cultipacker or similar equipment, perform the final rolling at right angles to the prevailing slopes to prevent water erosion, or at right angles to the prevailing wind to prevent dust.

3.3 PROTECTION & MAINTENANCE

A. Protection:
1. Protect the seeded area against traffic or other use.
2. Erect barricades and place warning signs as needed.

B. Maintenance:

1. Properly care for the seeded areas during the period when the grass is becoming established.
2. Protect seeded areas for 12 months after the completion of the entire project, unless the desired cover, in the opinion of the Engineer, is established in a shorter period of time.
3. On slopes, the Contractor shall provide means to protect areas against washout. Any washout which occurs shall be regraded and reseeded at the Contractors own expense until seeded areas are completely stabilized.

END OF SECTION

SECTION 02950

TREES, PLANTS AND GROUNDCOVER

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Engage the services of a reputable nursery in the area to furnish and plant such trees and shrubs as recommended by the nursery and as approved by the Owner.
   2. Locations of new trees, plants and groundcover shown on Contract Drawings are conceptual only. Submit a plan to the Engineer showing the recommended locations of all trees and shrubs.

B. Work Specified Elsewhere:
   1. Loaming and Seeding is specified in Section 02935.

1.2 QUALITY ASSURANCE

A. All trees and shrubs shall conform to the requirements of the current edition of the "American Standard for Nursery Stock" sponsored by the American Associate of Nurserymen, Inc., unless otherwise shown on the Drawings.

1.3 DELIVERY, STORAGE AND HANDLING

A. Ball and burlap, or grow and deliver in approved containers. Secure root balls by strong, tight, heavy wrapping. Trees must come from a soil that will hold a firm root ball.

B. Handle all plants so that the roots are adequately protected at all times. See that balls of balled or burlapped plants are well protected immediately upon delivery. Do not plant such plants if the ball is cracked or broken either before or during the process of planting.

C. Keep all balled or burlapped plants constantly moist from the time of arrival until planting. If plants must be stored more than two days before planting, completely cover the root balls with at least a six inch thick layer of moist hay, leaves or loam, to protect against drying.

1.4 GUARANTEE

A. The Contractor shall be responsible for all plants for a period of one full growing season following the final acceptance of the planting work, and during that period, shall promptly replace all plants that, in the opinion of the Owner, have died, or have made unsatisfactory growth. Replace with plants of the same variety and size, plant and maintain at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Trees and Plants:
   1. All Trees: First class representatives of their species or varieties.

2. All Plants: Good, healthy, well formed upper growth and a large, fibrous, compact root system.
3. Large Deciduous Trees: Straight trunks and a single leader, or as may be characteristic of the species. Tops shall be fully branched, densely foliated, well balanced, and in good proportion to the height of the tree. Trees with weak trunks, thinly or irregularly branched, or with unnatural shape or proportion due to undesirable pruning practices or for any other cause, will be rejected. Trees with leaders or branches too severely cut back or with bottom limbs trimmed too high will be rejected.
4. Small Growing Deciduous Trees: Well branched, natural shape. Plants which are poorly furnished or have been grown or pruned into unnatural shapes will be rejected.
5. Coniferous (Evergreen) Trees: Uniformly and thickly branched from the ground up, with a shape characteristic of the species.

B. All trees shall have been grown under climatic conditions similar to those in the locality of the project site or have been acclimated to such conditions for at least two years.

C. All trees must be healthy, vigorous, and free from disease, injurious insects, and their eggs or larvae, mechanical wounds, broken branches, decay or any other defects.

D. Planting soil: Mixed in the following ratio: 4 cubic yards of loam, one cubic yard rotted cattle manure, 15 pounds 6-10-4 part organic commercial fertilizer.

E. Stakes:
1. Material: Good quality spruce or fir.
2. Size: 2 inches x 3 inches x 8 feet.
3. Apply a heavy coat of oil painting before setting.

F. Hose:
1. Material: 2-ply fabric bearing rubber.
2. Size: Not less than 1/2 inch inside diameter.

G. Wire:
1. Material: Zinc-coated iron.
2. Type: 10 gauge double strand twisted.

H. Wrapping Materials:
1. Material: Waterproof crinkly kraft paper or approved equal.
2. Size: Not less than 6 inches nor more than 10 inches wide.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform all site work, including all excavation and disposal of surplus material, prior to the delivery of plants to the site.

B. All excavations shall have as near to vertical sides as possible.

C. Dispose of surplus soil.

D. Construct planting pits one foot wider in diameter than the root mass with a depth of six inches deeper than the root mass.

E. Have all planting soil, stakes, hose and other necessary materials on the site prior to delivery of the plants.

3.2 INSTALLATION

A. Remove all boulders encountered in the excavations to the depths necessary to permit the proper excavation of pits for plants. Fill the resulting spaces with suitable compacted earth.

B. Planting:

1. Set all plants at a level that, after settlement, a natural relationship of the crown of the plant with the ground surface will be established.
2. Set all trees and shrubs in the center of individual pits or pockets.
3. Carefully and thoroughly tamp planting soil under and around the base of each ball to fill all voids. Do not use frozen or muddy soil.
4. Pull all ropes, wires and other such material from under the root balls without pulling out the burlap.
5. Form a shallow depression at each plant by placing a mound of topsoil around the edge of each pit or pocket.

C. Prune all new plant materials at the site in accordance with standard, modern practices. Paint cuts over 1/2 inch in diameter with a suitable tree paint.

D. Guy all plants or stake and wrap as required immediately after planting. Do not twist stakes or pull in any manner which might cause injury to root balls or roots. Set all stakes vertically. Draw taut all wires used to guy trees to the upper end of each stake and securely fasten. Encase all guy wires in hose to prevent contact with the bark of the plant. Drive stakes for guying 30 inches deep into the ground. Drive all stakes plumb and free from splitting.

E. Wrap the trunks of all trees spirally to the height of the lowest branches. Hold the wrapping material in place by a suitable cord. All wrapping shall neat and snug.

3.3 MAINTENANCE

A. Immediately upon completion of planting, begin to provide all operations of maintenance as required to keep the plants in a healthy growing condition including the repair or replacement of all staking and wrapping materials.

3.4 FIELD QUALITY CONTROL

A. The Owner shall have the right to reject all trees and shrubs that are unsatisfactory as to growth or condition, or do not meet the Specifications.

END OF SECTION

SECTION 02990

MISCELLANEOUS WORK AND CLEANING UP

PART 1 -- GENERAL

1.1 WORK INCLUDED

A. Furnishing all labor, materials, equipment and incidentals required to do all miscellaneous work and cleaning up not otherwise show on the drawings and included in the specifications including, but not limited to, the following:
   1. Cleaning up the construction site.
   2. Disposing of material and debris.
   3. The extra work of crossing existing gas mains, sewers, drains, electrical and telephone conduits, and water mains.
   4. Miscellaneous work associated with connecting to existing utilities and well.
   5. Furnishing, installing and removing project signs.
   6. Reinstallation of roadway signs.
   7. All other work incidental to completing the project.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

PART 2 -- PRODUCTS

(NOT PART OF THIS SECTION)

PART 3 -- EXECUTION

3.1 CLEANUP

A. Remove all construction material, excess excavation, equipment or other debris remaining on the construction site as a result of construction operations and shall render the site of the work in a neat and orderly condition at least equal to that which existed prior to the start of construction.

B. Dispose of all materials and debris off-site in accordance with local, state and federal regulations.

3.2 INCIDENTAL WORK

A. Do all incidental work not otherwise specified but obviously necessary to the proper completion of the Contract as specified and as shown on the Drawings.

END OF SECTION

NHDOT STANDARD SPECIFICATIONS AND AMENDMENTS
NHDOT Standard Specifications for Road and Bridge Construction
(Current Edition by reference)

NHDOT TECHNICAL SPECIFICATIONS

Work itemized with NHDOT item numbers shall be in accordance with current edition of the State of New Hampshire, Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction, (Standard Specifications) and as amended. Although not included within the Project Manual, the Standard Specifications shall be considered part of the Contract Documents.

The following sections from the NHDOT Standard Specification (English Units) apply to this project by reference:

Section Number	Title
201	Clearing and Grubbing
202	Removal of Structures and Obstructions
206	Structure Excavation for Pipes and Other Minor Structures
214	Fine Grading
304	Aggregate Base Course
306	Reclaimed Stabilized Base
403	Hot Bituminous Pavement
417	Cold Planing Bituminous Surfaces
603	Culverts and Storm Drains
604	Catch Basins, Drop Inlets and Manholes
618	Uniformed Officers and Flaggers
619	Maintenance of Traffic
646	Turf Establishment

The Contractor shall comply with these and other project specifications included within the Project Manual. In the case where two specifications for one installation is provided the more stringent specifications apply.

A complete set of NHDOT Standard Specifications for Road and Bridge Construction may be purchased from: NHDOT, Records Section, 1 Hazen Drive, P.O. Box 483, Concord, NH 03302-0483, Phone No.: 603-271-3514, or viewed on line. Amendments to NHDOT specifications are included herein.

AMENDMENTS TO NHDOT SPECIFICATIONS

The NHDOT specifications for the purposes of this project are hereby amended as follows:

General:

Reference made to the "Department" or "Bureau" or "State" or "District Engineer" shall mean "City of Dover, their Agents or Engineer".

Section 100

Delete: Division 100-General Provisions in its entirety with the exception of:

- Section 101-Definitions and Terms
- Section 105-Control of the Work (subsections 105.01 through 105.07, and 105.12,
- Section 106-Control of the Material
- Section 109.01-Measurement of Quantities.

Section 201 – Clearing and Grubbing

Add 1.4 (f)

1.4 (f) Multiple trunks: trees with multiple trunks, but one (1) root system shall be considered as one (1) tree. Size will be determined by (c) and (d) of this subsection and dimensionally measured by the largest trunk.

Construction Requirements

Revise section 3.1.2, to read:

3.1.2 All trees ordered cut shall be disposed of by the Contractor unless the wood is requested by the Property Owner, whereas the Contractor shall cut and stack (in 4' lengths) at the edge of the property.

Method of Measurement

Add section 4.6:

4.6 Tree trimming and pruning under this project shall be considered a lump sum item.

Add section 4.7:

4.7 Restoration of any disturbance or damage to surrounding property resulting from stump removal will not be measured for payment.

Basis of Payment

Add 5.2.5

5.2.5 Restoration of any disturbed or damaged area or property resulting from stump removal shall be subsidiary to the unit item of tree removal or stump removal.

Delete 5.5 and **replace** with:

5.5 Payment will be made for tree trimming and pruning required under this contract on a lump sum basis. The Lump Sum Price for the tree trimming and pruning includes all labor, materials and equipment necessary for or incidental to the completion of the work.

Pay Items and Units

Add the following item:

201.321 Tree Pruning and Trimming

Section 206 – Structure Excavation for Pipes and Other Minor Structures

Delete and **Replace** Paragraph 2.2 with the following**:**

2.2 Rock structure excavation shall consist of all solid rock that can be removed only by blasting or ripping. It shall also consist of boulders and parts of masonry structures when found to measure 2 cubic yards or more.

Section 304 – Aggregate Base Course

Method of Measurement

Add Section 4.5:

4.5 Testing of materials is subsidiary to unit items and will not be measured for payment.

Basis of Payment

Add Section 5.4

5.4 Testing of materials is subsidiary to unit item being provided and will not be paid separately.

Section 306 – Reclaimed Stabilized Base

Amend Section 2.1.2 to read as follows:

2.1.2 Additional stone as required to meet the above gradation shall meet the requirement of Section 703, stone size #357

Add Part 306.3.3.1

3.3.1 Use of Calcium Chloride for dust control may be authorized by the Engineer under Item 619.

Amendment: Remove and Replace Method of Measurement and Basis of Payment with the following:

Method of Measurement

4.1 Reclaimed stabilized base, of the depth specified will not be measured by volume but shall be the square yard final pay quantity for material within the limits shown on the plans. The unit price under this Item shall constitute full compensation for processing reclaimed stabilized base material in place to a depth as specified on the Drawings, as directed by the Engineer and as herein specified.

4.1.1 Item shall include but is not limited to scarifying existing pavement; pulverizing scarified pavement; mixing pulverized material with existing gravel base; rough grading; compaction; and all work required to complete installation of reclaimed stabilize base material.

4.1.1.1 Reclaim in-place: Any rehandling or relocating of material generated to satisfy the proposed grading as shown on the Drawings shall be subsidiary.

4.1.1.2 Reclaim, Remove & Rehandle: Item number shall include all components of Reclaim In-Place plus removal, stockpile, rehandling and placing reclaimed material in addition to shaping and compaction subgrade. Subbase adjustments and construction to achieve proper subgrades shall be paid under respective Common Excavation (Item 203.1) and/or Gravel (Item 304.3) Items, where applicable.

4.1.1.3 All costs associated with removal of large stone and pavement particles regardless of method shall be subsidiary to this item.

4.2 In addition to the above, the unit cost of this item shall also include compaction as well as the removal of any excess material, or the relocation of any reclaimed material, as may be needed to achieve the finished grades desired by the City of Dover.

4.3 Excess reclaimed base course material shall become the property of the Owner unless otherwise directed by the Engineer. Contractor shall remove excess material from the work site and haul and stockpile material in a location to be determined by the Owner. Excess reclaimed base course material not claimed by the Owner shall become the property of the Contractor and shall be promptly removed from the Project. All hauling costs associated with the above shall be included in the unit cost of this item, and no additional compensation shall be given therewith.

4.4 Additional stone will be measured by the ton in accordance with 109.01.

Basis of Payment

5.1 Measurement for payment for reclaimed stabilized base shall be by the square yard (sy) to the nearest square yard of material placed within the limits as shown on the Drawings complete in place in accordance with 109.11. This item shall constitute full compensation for processing reclaimed stabilized base material to depth specified on the Drawings, as directed by the Engineer and as herein specified.

5.1.1 Excavation, removal and disposal from the site of any excess material generated by reclaiming operation shall be subsidiary to this item.

5.1.2 Rehandling or relocating of reclaimed material generated to satisfy the proposed grading as shown on the Drawings shall be subsidiary.

5.1.3 Removal of large stone and pavement particles regardless of method shall be subsidiary to this item.

5.1.4 Excavation of the existing sub-base material to achieve proper subgrade elevations shall be paid under item 203.1.

5.1.5 Placement of new gravels to the sub-base to achieve proper subgrade elevations shall be paid under item 304.2.

5.1.6 The accepted quantity of stone will be paid for at contract unit price per ton, complete in place.

5.1.7 The accepted quantities of asphalt will be paid for at the Contract unit price per ton or pound, complete in place.

Section 403 – Hot Bituminous Pavement

Description

Amend 1.1.2 to Read:

1.1.2 Machine method shall include all paving operations not classified as hand method. Machine method shall also include all roadway crossings.

Section 618 - Uniformed Officers and Flaggers

Delete Paragraph 3.1 and **Replace** with the following:

3.1 Uniformed Officers and Police Details are subject to the Owner's approval. Contact Dover Police department 48 hours in advance for Police Details at approved locations.

Delete Paragraph 4.1.2

Paragraph 5.1 - Replace **"5%"** with "**0%".**

Section 619 - Maintenance of Traffic

Delete Sections 1.1 and 1.2 and **Replace** with the following:

1.1 This work shall consist of providing and maintaining safe and passable traffic accommodations for public travel; preventing dust nuisance; and furnishing, erecting

and maintaining necessary traffic signs, barricades, lights, pavement markings, and other traffic control warning devices required for the safe guidance of traffic through the work zone. The Contractor shall be responsible for this work and shall perform it in accordance with the current MUTCD, Work Zone Traffic Control Standard Plans, the approved Traffic Control Plan (TCP) and these specifications.

1.2 The Contractor shall provide all permanent and operations construction signs and warning devices based on the needs of the Contractor's operations in accordance with the approved Traffic Control Plan (TCP).

Add the following Section 1.3:

1.3 The work will also include positioning and maintaining Portable Changeable Message (PCM) signs provided by the Owner, which will remain the property of the Owner.

Construction Requirements

Add the following Sections:

3.2.9 Contractor will place Portable Changeable Message Signs in locations approved by the Owner.

3.2.9.1 PCM signs will be programmed to address changing traffic conditions and Contractor's operations

3.2.9.2 The Contractor will relocate and reprogram PCM signs upon request by the Owner.

Method of Measurement

4.2.2 Positioning and maintaining portable changeable message signs provided by the Owner is subsidiary to Item 619.1 and will not be measured for payment.

4.4 Temporary pavement marking is subsidiary to maintenance of traffic and will not be measured for payment.

Delete and **Replace** Section 5.1.3 with the following:

5.1.3 Dust control, including use of calcium chloride is subsidiary to item 619.1.

Delete and **Replace** Section 5.1.4 with the following:

5.1.4 All costs associated with permanent or temporary construction signs shall be included in the Maintenance of Traffic lump sum price.

Add Section 5.1.7

5.1.7 The unit price under this Item shall constitute full compensation for furnishing all labor, equipment and materials necessary to always maintain safe and passable traffic conditions for pedestrians and vehicles (day and night). Item 619.1 shall include, but

not be limited to: dust control (all methods), protection and maintenance of excavated, backfilled and graded areas; traffic signs, barricades, lights, signals, delineators, pavement markings, concrete barriers and other traffic control warning devices; and all work incidental to guiding vehicular and pedestrian traffic through the work zone in a safe and convenient manner. MUTCD standards must be followed.

Delete and **Replace** Section 5.1.8 with the following:

5.1.8 Portable changeable message signs, provided by the Owner for the Contractors use during construction, is subsidiary to Item 619.1. Payment under this item shall constitute full compensation for maintenance of message signs provided by the Owner throughout construction, including all necessary moves to approved sign location sites.

Delete Section 5.2 and 5.2.1 and **Replace** Section 5.2 with the following:

5.2 Temporary retroreflective paint pavement markings shall be provided where pavement markings are obliterated from trench excavation, subsidiary to Item 619.1.

Delete Paragraph 5.3

Delete Paragraph 5.4

Note: Where two specifications may apply, Amendments to NHDOT specifications and Special Provisions will take precedent over NHDOT Standard Specifications.

SPECIAL PROVISIONS

SPECIAL PROVISIONS

The following Special Provisions are to be used in conjunction with the NHDOT Standard Specifications and are herein made a part of the Construction Documents and apply to this project:

Special Provisions

Section	Description
202	Amendment to Section 202 – Removal of Structures and Obstructions
912	R&R Landscaping

S P E C I A L P R O V I S I O N

AMENDMENT TO SECTION 202 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Item 202.43 – Removal and Disposal of Asbestos (ACM) Pipe, 0 – 24" Diameter

Add to 1.2:

1.2.1 The work shall consist of furnishing all labor, materials, services (including, but not limited to, an Asbestos Abatement Contractor), equipment and supplies required for removal and proper disposal of asbestos pipe. The Asbestos Abatement Contractor will oversee the asbestos abatement phases of this project.

1.2.1.1 This work shall also include handling, stockpiling (as necessary), rehandling (as necessary), transportation, associated fees, required permits, and profiling, when required, for the disposal of the asbestos pipe, which hereafter shall be referred to as asbestos-containing-material (ACM).

Add the following section:

Materials

2.1 Materials required for removal, temporary storage and disposal shall be in accordance with applicable regulations.

Replace 3.5 with the following:

3.5 Asbestos-Containing-Material (ACM) Cement Pipe.

3.5.1 The Asbestos Abatement Contractor shall be a licensed entity per applicable State of New Hampshire rules and regulations

3.5.1.1 The Contractor and their Asbestos Abatement Contractor shall be on site at all times monitoring air quality when any activity that may disturb the ACM occurs.

3.5.2 The Contractor and Asbestos Abatement contractor shall comply with the following Federal, State, and local standards, regulations, and codes pertaining to abatement, storage, transportation, and disposal of ACM's. Whenever regulations are in conflict, the more stringent will prevail.

a. U.S. Department of Labor (DOL), Occupational Safety and Health Act of 1970. (Particular attention is drawn to the Asbestos Regulations: CFR Title 29, Part 1910, Sec 1910.1001 and Part 1926, Sec 1926.1101, and the Respirator Regulations; CFR 29, Part 1910, Sec 1910.134 and Hazard Communication, CFR Title 29, Part 1910.1200).

b. U.S. Environmental Protection Agency (EPA), CFR, Title 40, Part 61, Subparts A and M, National Emission Standards for Hazardous Air Pollutants; Asbestos NESHAP Revision; Final Rule, Dated Tuesday, November 20, 1990.

c. U.S. Department of Transportation (DOT) regulations, 49 CFR Parts 172 and 173.

d. All State of New Hampshire laws, regulations and standards, including the Department of Environmental Services (DES), Asbestos Management and Control, Chapter Env-A 1800; Waste Management Division Solid Waste Rules – Management of Certain Wastes - Chapter Env-Sw 901 Asbestos. Contacts and Phone numbers:

NHDES Air Resources Division – Asbestos Management Section
(603-271-1373)

NHDES Waste Management Division – Solid Waste Management Bureau
(603-271-6467)

3.5.2.1 All regulations by these and other governing agencies in their most current version are applicable. It is the Contractor's responsibility to know, understand, and abide by all such regulations and common practices. If there are conflicting regulations, the more stringent regulations will apply.

3.5.3 The Contractor shall provide an Asbestos Abatement Work Plan for documentation 15 working days prior to the start of the removal of the asbestos pipe removal work. The plan shall ensure that the scope of work is defined, address the required actions, adhere to all rules and regulations, and identify storage site(s) and the disposal site, as well as any other information required by appropriate rules and regulations. The Asbestos Abatement Work Plan shall include:

- Proposed means and methods. These means and methods shall be protective of human health and the environment and conform to all applicable state and federal rules and regulations unless a waiver has been obtained.
- A list of equipment that will be used during the abatement and or associated site work disturbing ACM.
- Copies of the abatement contractors' licenses and certifications and a list of qualified personnel that will be on site and their contact information.
- Copies of all associated permits, notifications, or waivers (including any correspondence or approvals) necessary to complete the work.
- The proposed locations within the project where ACM is located, where ACM is anticipated to be impacted, and proposed locations for temporary on-site storage, or stockpiles.
- Description of equipment, and personnel decontamination procedures.
- Description of access controls and site security plans (stockpile and storage locations shall be included).
- Description of best management practices (BMPs) and/or Engineering controls, as well as physical and visual controls to be deployed in or around the regulated areas and temporary storage/stockpile locations.

- Steps to inspect and maintain stockpiles until ACM is properly disposed.
- Proposed means and methods of ACM disposal and proposed licensed ACM disposal facility.

3.5.3.1 The Asbestos Abatement Work Plan shall be prepared in accordance with NHDOT Section 105.02.

3.5.3.2 The Contractor shall not begin abatement work until the plan has been reviewed for project conformance.

3.5.4 The Owner's Consultant will be on site at all times during ACM removal to observe the Contractor's work procedures for compliance with applicable regulations and the approved Asbestos Abatement Work Plan. Representative air samples shall be supplied by the Asbestos Abatement contractor, in accordance with the NIOSH 7400 method. Should representative air samples exceed 0.05 f/cc or visible emissions (dust, debris) observed from the ACM removal operations, work shall stop and the work area cleaned up. Work shall not resume until Contractor submits a revised Asbestos Abatement Work Plan that is in conformance with these specifications. Note that the limit of 0.05 is half the OSHA PEL. This level was selected to provide a level of safety before actually reaching or exceeding the PEL.

3.5.5 During the impact to the asbestos pipe, the Contractor shall provide qualified personnel per NHDES Chapter Env-A 1800 and Chapter Env-Sw 901 at the job site to conduct work inspections for asbestos hazards in accordance with the Asbestos Abatement Work Plan. The abatement personnel shall be properly trained and supervised.

3.5.6 Health and safety precautions shall conform to the Contractor's Project Health and Safety Plan as required by law.

3.5.7 Temporary storage of ACM and/or equipment prior to transporting to a stockpile site shall be on a surface that is impermeable, such as a liner (min. 20 mil poly sheeting), sealed asphalt, or concrete, and shall be approved by the Engineer. The temporary storage shall be covered with a liner (min. 20 mil poly sheeting) and in such a way as to prevent any leaching of material. The ACM shall be transported to a stockpile site as soon as possible and no material shall be left at the temporary site overnight.

3.5.8 The ACM shall be appropriately secured and covered with liners during stockpiling. The liners shall be secured to prevent damage to the liners and minimize emissions and leaching effect of rain or other adverse weather in accordance with regulations.

3.5.9 Processing, stockpile and storage areas shall be fenced and posted with asbestos warning signs to eliminate unauthorized entry. The temporary fence shall be a 6-foot high chain link fence conforming to Section 607 and include a gated entrance. The fence shall have at least one "NO TRESPASSING" sign per side, and be mounted approximately 4 feet from the bottom of the fence. The signs shall be kept clearly visible at all times.

3.5.10 The ACM stockpile(s) shall be appropriately disposed of within 30 days of completion of asbestos abatement work, or as directed by the Engineer.

3.5.11 Asbestos Pre-Construction Meeting.

3.5.11.1 The Asbestos Abatement Contractor shall meet with the Engineer, the Contractor, and the Owner, prior to beginning abatement work. The Contractor shall present evidence that all requirements for initiation of the work have been met. The minimum agenda for the meeting shall be:

1. Review of Pre-Job Submittals.
2. Channels of communication.
3. Construction schedule, including sequence of critical work.
4. Designation of responsible personnel.
5. Procedures for safety, security, quality control, housekeeping, and related matter.
6. Use of premises, facilities, and utilities.

3.5.11.2 The Contractor is required to provide one copy of the following at the pre-construction meeting:

1. Asbestos Abatement contractor's Entity License.
2. State and Local Notifications, as required.
3. A list of abatement employees to be used on the project. Copy of licenses, training certificates and fit-tests of all workers and supervisors who will work on the project.
4. Documentation of medical records as required by OSHA or a notarized statement by examining medical doctor that such examinations took place and when, for each employee to be used on the project (preferred).
5. Copy of State or local license for waste hauler and waste disposal site.

3.5.12 Regulatory Submittals. The Contractor shall be responsible for securing all necessary permits for Asbestos-related work (including removal, hauling, and materials usage), and any other permits required to perform the work; and fulfilling all reporting and notification requirements.

3.5.12.1 The Contractor, as applicable, shall notify the following agencies in the appropriate manner of the work:

1. Appropriate notification to NHDES, Air Resources Division (NHDES-ARD) and the Town/City at least 2 weeks days prior to the beginning work.
2. Local emergency authorities including, but not limited to, fire, police, and medical services, of the site location(s), regarding schedules of work and hazards anticipated, per NHDES Asbestos Management and Control, Chapter Env-A 1800.

3.5.13 Collection and Storage.

3.5.13.1 Temporary storage of ACM and/or equipment prior to transporting and stockpiling shall be on a surface that will be impermeable, such as a liner (min. 20 mil poly sheeting), sealed asphalt, or concrete, and shall be approved by the Engineer. The stockpile shall be covered with a liner (min. 20 mil poly sheeting) and in such a way as to as to prevent any leaching of material. The ACM shall be transported to a stockpile site as soon as possible and no material shall be left at the temporary site overnight.

3.5.13.2 The ACM shall be appropriately secured and covered with liners during stockpiling. The liners shall be secured to prevent damage to the liners and minimize emissions and leaching effect of rain or other adverse weather.

3.5.13.3 Processing, stockpile and storage areas shall be fenced and posted with asbestos warning signs to eliminate unauthorized entry. The temporary fence shall be a 6-foot (1.8 meter) high chain link fence conforming to Section 607 and include a gated entrance. The fence shall have at least one "NO TRESPASSING" sign per side, and be mounted approximately 4 feet (1.2 meters) from the bottom of the fence. The signs shall be kept clearly visible at all times.

3.5.14 Disposal.

3.5.14.1 The ACM shall be considered “asbestos waste” (ORME-9, NA22122) in accordance with the National Emission Standard of Hazardous Air Pollutants (NESHAP) and transported and disposed of as such.

3.5.14.2 The Contractor shall dispose of the ACM at a licensed, approved disposal site in accordance with current EPA, NHDES, State, and Federal rules and regulations.

3.5.14.3 The ACM stockpile(s) shall be appropriately disposed of within 30 days of substantial completion of asbestos abatement work. If the project involves phased work, the ACM stockpile(s) shall be appropriately disposed of within 30 days of substantial completion of asbestos abatement work per phase.

3.5.14.4 The Contractor shall obtain and pay for all permits, material, fees, and taxes, submit all necessary documents, obtain all permits and certificates and all necessary approvals from the appropriate authorities and provide copies of all permits, approvals, and certificates to the Engineer.

3.5.14.5 Hauling/transportation of ACM shall be in accordance with current EPA, NHDES, State, and Federal rules and regulations.

3.5.15 The Contractor shall submit Waste Shipment Records, including Weight Slips and Disposal Invoices from the disposal facility to the Engineer within thirty (30) days of shipment of the asbestos waste.

3.5.16 If ACM of a different type than outlined herein, it shall be provided for in Accordance with NHDOT Section 107.17. The Contractor shall stop work and notify the Owner.

3.5.17 Schedule work such that the removal of all asbestos cement pipe occurs in one operation. Should the Contractor choose to remove the asbestos cement pipe in separate operations, remobilization of required personnel and equipment will be at the Contractor's expense.

Add to Basis of Payment:

5.10 The accepted quantity of removal of asbestos pipe will be paid for at the contract price per linear foot.

5.10.1 Repair work to damaged or injured portions of the existing facilities made necessary due to the negligence or carelessness of the Contractor will not be paid for.

5.10.2 Removal, handling, stockpiling, re-handling, transporting, and disposal (including any associate fees, permit and/or profiling) of the ACM will be subsidiary to this item.

5.10.3 Liners, covers, fencing when required, and other materials for the storage site will be subsidiary to this item.

5.10.4 The Asbestos Abatement Work Plan will be subsidiary.

5.10.5 The Asbestos Abatement Contractor will be subsidiary.

5.10.6 Although Removal of Asbestos Pipe will be paid for by the linear foot, only 75% of the total removed pipe quantity will be paid until all Waste Shipment Records have been received by the Engineer. Once all Waste Shipment Records (stated in 3.5.14) have been received by the Engineer, the remaining 25% of the total pipe removed will be paid.

Add to pay items and units:

202.43	Removal and Disposal of Asbestos (ACM) Pipe, 0 – 24" Diameter	Linear Foot

SPECIAL PROVISION

SECTION 912 – R&R LANDSCAPING

Description

1.1 The work consists of removing replacing and or resetting existing plantings or lawn areas impacted by construction as identified on the drawings or by the Contractor, Engineer or the Owner.

1.2 The applicable sections of the NHDOT standard specifications shall apply to the work including but not limited to Section 646 – TURF ESTABLISHMENT, Section 650 – PLANTING GENERAL, Section 651 – EVERGREEN TREES, Section 652 and 653 DECIDUOUS TREES, Section 654 – EVERGREEN SHRUBS, Section S655 and 656 – DECIDUOUS SHRUBS, Section 657 – VINES AND GROUND COVERS and Section 658 – TRANSPLANTING PLANT MATERIAL.

1.3 All transplanting of existing plants shall be conducted under the direction of an Arborist employed by the Contractor.

1.4 The Contractor shall arrange for a site meeting to discuss the work of this Section with the Engineer and representatives from the individual property owners prior to executing the work.

Materials

2.1 Plant materials shall conform to the requirements of the NHDOT standard specifications, Section 650.2, except that plant material may consist of the existing plants, providing they are not damaged by the Contractor's operations.

2.2 Where plant materials are designated to be moved and insufficient root systems or other faults are found in the existing plants, the Engineer may direct that new plants from nursery stock of similar or approved species be substituted.

2.3 Bark Mulch areas shall be consistent in material type and color as the existing condition.

2.4 Items such as fences, walls and rocks shall consist of existing materials. Supplemental and/or replacement of material damaged as a result of the Contractor's work shall be replaced with materials of comparable type, color and general appearance acceptable to the Owner.

Construction Requirements

3.1 Construction requirements shall conform to the applicable construction requirements of Sections 646 through 657 of the NHDOT Standard Specifications for the type of material being transplanted.

Method of Measurement

4.1 No separate measurement will be made for the required individual removal and resetting of landscape items as indicated in the contract drawings. Removal and replacement or resetting of landscape items under this project shall be considered a lump sum item. Miscellaneous items such as edging, rocks, statues, brick borders, stone rings, etc where part of the landscape feature shall not be measured for payment and shall be considered part of the landscape reset item.

Basis of Payment

5.1 Payment will be made for removal and replacement or resetting of landscape items required under this contract on a lump sum basis. The Lump Sum Price for removal and replacement or resetting of landscape items includes all labor, materials and equipment necessary to complete of the work.

Scope of Work

Furnish, install and test all site work and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division

Section No.	Section Title
09912	Painting
09960	High Performance Coatings for Water Storage Tanks

SECTION 09912

PAINTING

PART 1 GENERAL

1.1 WORK INCLUDED

A. This section applies to piping, hangers, supports, appurtenances, equipment requiring field painting, and other architectural surfaces not included in Section 09960.

B. Preparing surfaces which are to receive finish.

C. Furnishing paint and related materials as indicated in schedule at end of this section.

D. Installation, application.

E. Cleanup.

1.2 QUALITY ASSURANCE

A. Qualifications of Applicator:

1. Paint applicator shall be a firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance. Applicators shall provide evidence of at least five (5) locations in which they have applied similar paints and coatings that have successfully weathered for a minimum of five (5) years in a similar environment.

1.3 REFERENCE STANDARDS

A. Steel Structures Painting Council (SSPC).

1.4 SUBMITTALS

A. Submit color chips for all paint types scheduled to be used on the project.

B. Submit manufacturer's product data for all paint types scheduled to be used on the project.

C. Submit manufacturer's preparation and application recommendations for all paint types scheduled to be used on the project.

1.5 MAINTENANCE MATERIALS

A. Furnish not less than one gallon of each color used for each type paint used, for maintenance.

B. Containers to be un-opened tightly sealed and clearly labeled for identification.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver paint materials in sealed original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation and instructions for mixing and/or reducing.

B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 70 degrees F in well ventilated area.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

D. Store all paint and solvents in accordance with state and federal regulations.

1.7 ENVIRONMENTAL CONDITIONS

A. Environmental conditions shall be in compliance with the manufacturer's recommendations.
B. Provide adequate continuous ventilation and sufficient heating facilities to maintain required temperature.
C. Provide minimum 15 foot candles of lighting on surfaces to be finished.

1.9 PROTECTION

A. Adequately protect other surfaces from paint and damage. Repair damage resulting from inadequate or unsuitable protection.
B. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.
C. Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove daily from site.
D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. This specification is based on material as manufactured by Tnemec Company, Inc., North Kansas, Missouri.
B. Acceptable manufacturers are Tnemec, Dupont, Sherwin-Williams (Industrial and Marine Coatings) or products demonstrated to be of equal or better quality, function, and performance.

2.2 MATERIALS

A. Paint and Fillers: Type and brand listed herein.
B. Paint Accessory Materials: (Linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve the finishes specified). Materials to be of high quality and approved manufacturer.
C. Paints to have good flowing and brushing properties and be capable of drying or curing free of streaks or sags.

PART 3 EXECUTION

3.1 INSPECTION

A. Thoroughly examine surfaces scheduled to be painted prior to commencement of work.
B. Correct defects and deficiencies in surfaces which may adversely affect work of this section.

3.2 PREPARATION OF SURFACES

A. Surface preparation shall be in full compliance with the manufacturer's recommendations.
B. Remove contamination from gypsum wallboard surfaces and repair defects, if any, which appear after prime painting.
C. Remove surface contamination and oils from galvanized surfaces and wash with solvent. Abrade surfaces in accordance with SSPC-SP7. .
D. Remove dirt stains, loose mortar, scale, powder and other foreign matter from concrete and concrete block surfaces which are to be painted.
E. Remove grease, rust, scale, dirt and dust from steel and iron surfaces. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Ensure steel surfaces are satisfactory before paint finishing. If shop primers are incompatible with painting systems submitted, remove shop priming and re-prime with a compatible primer.
F. Clean unprimed steel surfaces, ensuring weld joints, bolts and nuts are similarly cleaned. Repair defects, if any, which appear after prime painting.
G. Sand and scrape shop primed steel surfaces to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
H. Prime interior and exterior woodwork.

3.3 APPLICATIONS

A. Apply each coat at proper consistency.
B. Sand lightly between coats to achieve required finish.
C. Do not apply finishes on surfaces that are not sufficiently dry.
D. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.
E. Prime exterior woodwork, which is to receive paint finish, with exterior primer paint.
F. Prime interior woodwork, which is to receive paint or enamel finish, with enamel under coater paint.

3.4 MECHANICAL, ELECTRICAL AND PROCESS EQUIPMENT

A. Refer to mechanical and electrical sections with respect to painting and finishing requirements, color coding and identification banding of equipment, ducting, piping and conduit.
B. Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.
C. Finish paint primed equipment to color selected.

D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars and supports.
E. Replace identification markings on mechanical or electrical equipment when painted over or spattered.
F. Paint exposed conduit and electrical equipment. Color and texture to match adjacent surfaces.

G. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
H. Color code equipment, piping, conduit and exposed ductwork.
I. For concrete immersion, brush blast all surfaces prior to the commencement of finish painting.
J. Caulk all pipe flanges prior to priming or painting.

3.5 CLEANING

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered.
B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.
C. Upon completion of work leave premises neat and clean, to the satisfaction of ENGINEER.
D. Dispose of all paint and solvents in accordance with state and federal regulations.

3.6 PAINT SYSTEMS

A. Provide the following paint systems (based on Tnemec or Sherwin Williams products) for the various substrates, as indicated. All dry film thicknesses (DFT) are called for as total mils per coat specified and are considered minimums. OWNER to select colors.
B. Exterior:
   1. Miscellaneous ferrous metal items:

Surface Preparation:	SSPC-SP6 Commercial Blast-Cleaning
1st Coat:	Series 1 Omnithane on unpainted metal or touchup (2.5-3.5 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (4.0 – 6.0 mil DFT)
3rd Coat:	Series 73 Endura-shield (2.0 – 3.0 mil DFT) or Series 1095 EnduraShield (3.0 - 4.0 mil DFT).

   2. Ferrous metals, submerged:

Surface Preparation:	SSPC-SP10 Near White Metal Blast Cleaning with 4-5mil anchor profile
1st Coat:	Series 435 Perma-Glaze (40.0-50.0 mil DFT)

   3. Galvanized metal:

Surface Preparation:	Solvent Cleaned and SSPC-SP7 Brush off Blast Cleaning.
1st Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)
2nd Coat:	Series 73 Endura-shield (2.0-3.0 mil DFT) or Series 1095 EnduraShield (3.0 - 4.0 mil DFT).

***Note: Exterior galvanized electrical conduit shall be painted only if requested by Owner.**

   4. Exposed PVC (vents, etc.)

Surface Preparation:	Sand uniformly and wipe.
1st coat:	Series N69 Hi-Build Epoxoline II (2.0–3.0 mil DFT)
2nd coat:	Series 73 Endurashield (2.0-3.0 mil DFT)

C. Interior:

1. Interior concrete floors, walls, ceilings and concrete masonry:

Concrete Masonry Units	
Primer:	Sherwin Williams B25W00025 - PrepRite Interior/Exterior Latex Block Filter
Finish:	Sherwin Williams B20W12651 ProMar 200 Zero VOC Interior Latex Eg-Shel (2 coats)
Concrete Floors	
Sealer:	H&C Infusion water based premium quality acrylic emulsion clear sealer (2 coats)

2. Interior metals (non-architectural), including structural steel, piping, and equipment:

Surface Preparation:	SSPC-SP6 Commercial Blast Cleaning
1st Coat:	Series 1 Omnithane (2.5-3.5 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (3.0-5.0 mil DFT)
3rd Coat:	Series N69 Hi-Build Epoxoline II (3.0-5.0 mil DFT)

3. Submerged ferrous metals (surfaces **not in contact** with potable water):

Surface Preparation:	SSPC-SP10 Near White Blast with 4-5mil anchor profile
1st Coat:	Series 435 Perma-Glaze (40.0-50.0 mil DFT)

4. Submerged ferrous metals (surfaces **in contact** with potable water):

Surface Preparation:	SSPC-SP10 Near White Blast with 3-4mil anchor profile
1st Coat:	Series 22 Epoxoline (16-40 mil DFT)

5. PVC piping:

Surface Preparation:	Sand Uniformly and Wipe.
1st Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)

6. Galvanized metals and aluminum:

Surface Preparation:	Solvent Cleaned and SPC-SP7 Brush off Blast Cleaning.
1st Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)
2nd Coat:	Series N69 Hi-Build Epoxoline II (2.0-3.0 mil DFT)

Hot Dip Galvanized (HDG) structural steel does not require coating.

7. Painted woodwork:

1st Coat:	Sherwin Williams B51W00450 Multi Purpose Interior/Exterior Latex Primer (1-1.5 mil DFT)
2nd Coat and 3rd Coat:	Sherwin Williams B66W00661 Pro Industrial High Performance Acrylic Eg-Shel (2.0-3.0 mil DFT)

8. Canvas and cotton insulation coverings:

1st Coat:	Series 151 Elasto-Grip FC (1.0-1.5 mil DFT)
2nd and 3rd Coat:	Series 1029 Enduratone (2.0-3.0 mil DFT)

3.7 PREPARATION AND PRIMING

A. Condition of Surfaces: Painting shall start only after complete assembly of equipment components unless otherwise permitted by the ENGINEER in writing. Examine all surfaces to be painted for conditions that will adversely affect the work and which cannot be put into

an acceptable condition as hereinafter specified under "Preparation". Do not proceed with surface preparation or the application of coatings until conditions are suitable.

B. Preparation: Remove all rust and scale, oil and other items that may adversely affect paint film adhesion. Preparation shall include sandblasting.
   1. Exterior and Interior Ferrous Metals: The following surface preparation specifications of Steel Structures Painting Council are required for exterior and interior ferrous metals for use in connection with treatment operations and service areas including basins, chambers, clarifiers and interior service areas; non- submersible exposure shall require SSPC-SP-6, Commercial Blast Cleaning; submersible exposure shall require SSPC-SP-10, Near- White Blast Cleaning. Prime coat specified shall be applied within 8 hours after preparation.
   2. Galvanized and Aluminum Metal Surfaces: Surfaces shall be solvent cleaned and wiped dry with clean, dry cloths immediately prior to the application of special pre-treatment and primers as hereinafter specified.
   3. Concrete: All concrete shall be prepared in accordance to SSPC-SP13 Standard Surface Preparation for Concrete.

3.8 PIPING IDENTIFICATION

A. All piping shall be color coded as follows except as directed by the ENGINEER. Color code all exposed piping with special colors and colored bands no more than thirty inches apart.

System Name	Pipe Color	Marking Color on Band Color (Tnemec/Sherwin-Williams)
Finished Water	True Blue/Turbine Blue	White on Green
Sanitary Drains	None	White on Green
Tank Drains	Gray/Anchor Gray	White on Green
Tank Vents	Gray/Anchor Gray	Black on White
Sump Pump Discharges	None	White on Green
Instrumentation Air	None	White on Blue
Process Air	None	White on Blue
Fuel Oil	Safety Red	Black on White
Domestic Water (Cold)	None	White on Green
Domestic Water (Hot)	None	White on Green
Gas (LP or natural gas)	Safety Yellow	Black on Yellow
Fire Protection	Safety Red	White on Green

PVC chemical feed piping and stainless steel piping will not be coated.

B. After painting, piping shall be identified by self-adhesive pipe markers as manufactured by W. H. Brady Company, Seton Nameplate Corporation or approved equal. Markers shall be of wording and color as selected by the ENGINEER. The markers shall be 2-1/2 inches high for pipe 3 inches in diameter or larger, and 1-1/8 inches high for smaller pipe. Markers shall be placed no more than 20 feet apart with at least one marker on every straight run, and

additional markers at turns and where pipe passes through walls. An arrow indicating flow direction shall be placed adjacent to each marker.

END OF SECTION

SECTION 09960
HIGH-PERFORMANCE COATINGS FOR WATER STORAGE TANKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This Section includes shop and field surface preparation and shop and field painting related to the construction of welded steel water storage tanks.
   1. Surface preparation, including in the shop and applications of metal primer, and field applications of primers and finishes are specified in this Section.
   2. Specifications for disinfection and testing of interior surfaces prior to use for potable Water are included under section 02675.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. This Section contains references to the governing standards and documents listed below. They are a part of this Section as specified and modified; the current version shall apply unless otherwise noted. In case of conflict between the requirements of this section and those of the listed documents, the more stringent of the requirements shall prevail.
   1. NSF International
      a. NSF/ANSI Standard 61 Drinking Water System Components.
   2. SSPC: The Society for Protective Coatings
      a. SSPC 10/NACE No. 5 Near White Metal Blast Cleaning joint standard.
      b. SSPC 6/NACE No. 3 Commercial Blast Cleaning joint standard.
   3. NACE International
      a. NACE SP0188 – Standard Practice for Discontinuity (Holiday) Testing of Protective Linings

1.3 SUMMARY

A. This Section includes surface preparation and application of high-performance coating systems on the following substrates:
   1. Exterior Substrates:
      a. Steel.
   2. Interior Substrates:
      a. Steel, immersion.
      b. Steel, non-immersion.

B. Related Sections include the following:
   1. Division 1, Section 02675 “Disinfection”.

1.4 SUBMITTALS

A. Submit under provisions of Division 1.

B. Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Operation and maintenance data.
   5. Provide material analysis, including vehicle type and percentage by weight and by volume of vehicle, resin and pigment.
   6. Manufacturer’s certified test reports showing the substitute product(s) performance as outlined shall be submitted.
   7. Submit manufacturer’s Material Safety Data Sheets (MSDS) and other safety requirements.

C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

B. Applicator's Quality Assurance: Submit list of a minimum of 10 completed Tnemec Series FC22 or Series 22 projects of similar size and complexity to this Work. Include for each project:
   1. Project name and location.
   2. Name of owner.
   3. Name of contractor.
   4. Name of engineer.
   5. Name of coating manufacturer.
   6. Approximate area of coatings applied.
   7. Date of completion.

C. Pre-application Meeting: Convene a pre-application meeting before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Engineer, applicator, and manufacturer's representative. Review the following:
   1. Environmental requirements.
   2. Protection of surfaces not scheduled to be coated.
   3. Surface preparation.
   4. Application methods.
   5. Repair.
   6. Field quality control.
   7. Cleaning.
   8. Protection of coating systems.
   9. One-year inspection.
   10. Coordination with other work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.
2. Manufacturer.
3. Color name and number.
4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:
1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Weather:
1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's recommended limit.

C. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

D. Dust and Contaminants:
1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

1.8 SAFETY AND HEALTH REQUIREMENTS

A. General: Contractor shall observe all applicable occupational health and safety requirements set forth by regulatory agencies applicable to the construction and protection of workers from exposure to lead (if present), airborne dust, and other hazards of the work. Contractor shall provide and require use of personnel protective lifesaving equipment for persons working in or about the project site. Contractor shall be responsible for all worker protection including air monitoring

and record keeping associated with lead-based paint disturbance as may be required by the applicable regulations.

B. Contractor shall prevent discharge of lead or lead-contaminated materials into the air, water, soil or adjacent properties.

C. Head and Face Protection and Respiratory Devices: Equipment shall include protective helmets which shall be worn by all persons while in the vicinity of the work. In addition, workers engaged in or near the work during sandblasting shall wear eye and face protection devices and air purifying, half-mask or mouthpiece respirator with appropriate filter. Barrier creams shall be used on any exposed areas of skin.

D. Barriers: All work which may cause airborne lead levels to reach or exceed 30 micrograms per cubic meter as an eight-hour time weighted average shall be conducted within air-tight, hard wall barriers and in accordance with the requirements of 29 CFR l926.62. The CONTRACTOR shall provide security for all barriers to prevent unauthorized entry for the duration of the work.

E. Ventilation: where ventilation is used to control hazardous exposure, all equipment shall be explosion-proof. Ventilation shall reduce the concentration of air contamination to the degree a hazard does not exist. Air circulation and exhausting of solvent vapors shall be continued until coatings have fully cured.

F. Power Tools: used for surface preparation/ paint removal shall be equipped with high efficiency particulate air (HEPA) rated filters and shall function without excessive dust generation.

G. Sound Levels: Whenever the occupational noise exposure exceeds maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices.

H. Illumination: Adequate illumination shall be provided while work is in progress, including explosion-proof lights and electrical equipment. Whenever required by the Engineer, the Contractor shall provide additional illumination and necessary supports to cover all areas to be inspected. The level of illumination for inspection purposes shall be determined by the Engineer.

I. Temporary ladders and Scaffolding: All temporary ladders and scaffolding shall conform to applicable safety requirements. They shall be erected where requested by the Engineer to facilitate inspection and be moved by the Contractor to locations requested by the Engineer.

J. Waste Disposal: Contractor shall be responsible for disposal of all Waste materials generated, as hazardous or non-hazardous waste in strict accordance with applicable regulations, and shall furnish to the Owner a signed copy of all transport and disposal manifests within thirty (30) days following removal of waste from the site.

K. Take precautionary measures to prevent hazards and spontaneous combustions. Remove empty paint containers from site.

L. Place cotton Waste, cloths and hazardous material in containers, and remove from site daily. During application of solvent based materials, post No Smoking signs.

PART 2 - PRODUCTS

2.1 HIGH PERFORMANCE COATINGS GENERAL

A. Materials Compatibility:
   1. Provide shop and field primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   2. Provide products of same manufacturer for each coat in a coating system.

B. Coating systems shall conform to all current AWWA standards and carry appropriate approvals from NSF (National Sanitation Foundation) Standard 61 for coatings and linings.

2.2 MANUFACTURERS

A. Products specified are manufactured by Tnemec Company Incorporated, 6800 Corporate Drive, Kansas City, Missouri 64120-1372, (800) 863-6321, www.tnemec.com, and are specified as a standard of quality.

B. Materials specified herein shall not preclude consideration of equivalent or superior materials. Suggested equivalent materials or other substitutions shall be submitted to Engineer for consideration in compliance with substitution procedures in this Project Manual and include the following.
   1. Submittals shall be provided no later than (10) days after Owner/Owner's Agent letter of Notice to Proceed.
   2. Requests for substitution shall include evidence of satisfactory past performance in similar environment.
   3. Substitutions will not be considered that change the number of coats or do not meet specified dry film thicknesses.
   4. Manufacturer's certified test reports showing the substitute product(s) performance as outlined shall be submitted.
   5. After second submittal, Engineer/Engineer/ Owner or Owner's Agent hourly rates will be charged to review further submittals.

2.3 METAL PRIMERS, INTERIOR AND EXTERIOR

A. Urethane Primer, Zinc-Rich:
   1. Tnemec Series 94-H_2O
      a. VOC content: 96 grams/liter

2.4 POLYURETHANE INTERMEDIATE COAT, EXTERIOR

A. Aliphatic Acrylic Polyurethane, Two-Component, Pigmented, Semi-Gloss:
   1. Tnemec Series 1095 Endura-Shield
      a. VOC content: 232 grams/liter

2.5 FLUOROPOLYMER TOPCOAT, EXTERIOR

A. Advanced Thermoset Solution Fluoropolymer, Pigmented, Gloss:
   1. Tnemec Series 701 Hydroflon
      a. VOC content: [317 grams/liter]

2.6 EPOXY INTERMEDIATE COAT / FINISH COAT, INTERIOR DRY

1. Tnemec Series N140 or N140F Pota-Pox Plus
    a. VOC content: 184 g/L

2.7 100% SOLIDS EPOXY INTERIOR COATING, IMMERSION

1. Tnemec Series FC22 Epoxoline
    a. VOC content: 12 grams/liter

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.
    1. After completing coating application, reinstall equipment that was removed using workers skilled in the particular trade(s) involved.

3.3 SURFACE PREPARATION

A. Prepare surfaces in accordance with manufacturer's instructions.
B. Steel Substrates: Remove rust and loose mill scale.
    1. Fabrication defects:
        a. Correct steel and fabrication defects revealed by surface preparation.
        b. Remove weld spatter and slag.
        c. Round sharp edges and corners of welds to a smooth contour.
        d. Smooth weld undercuts and recesses.
        e. Grind down porous welds to pinhole-free metal.
        f. Remove weld flux from surface.
    2. Ensure surfaces are dry.
    3. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3, unless otherwise specified.
    4. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.
    5. Shop Primer: Prepare shop primer to receive field coat in accordance with manufacturer's instructions.

3.4 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

1. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
2. Keep containers closed when not in use to avoid contamination.
3. Do not use mixed coatings beyond pot life limits.
4. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

B. Uniformly apply coatings at spreading rate required to achieve specified DFT.

C. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

D. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.5 HOLIDAY DETECTION

A. Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE SP0188 and the Manufacturer’s printed application guide to verify a pinhole-free surface. Areas which do not pass the spark detection test shall be corrected at no cost to the Owner.

3.6 REPAIR

A. Materials and Surfaces Not Scheduled to Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.7 FIELD QUALITY CONTROL

A. Inspector's Services:
1. Verify coatings and other materials are as specified.
2. Verify surface preparation and application are as specified.
3. Verify DFT of each coat and total DFT of each coating system specified using wet film and dry film gauges.
4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
5. Report:
   a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
   b. Report nonconforming work not corrected.
   c. Submit copies of report to Engineer and Contractor.

B. Manufacturer's Technical Services: Coordinate with coating manufacturer's technical service department or independent sales representative for current technical data and instructions.

C. Contractor shall be responsible for providing Inspector Services.

3.8 CLEANING AND PROTECTION

A. Remove temporary coverings and protection of surrounding areas and surfaces.
B. Protect surfaces of coating systems from damage during construction.
C. Touch-up, or repair damaged products before Substantial Completion.
D. Disinfection:
    1. Disinfection of interior surfaces shall be performed in accordance with Section 02675.
    2. Disinfection shall be performed after protective coatings have been applied to the interior surfaces and allowed to thoroughly cure.

3.9 ONE-YEAR INSPECTION

A. Owner will set date for one-year inspection of coating systems.
B. Inspection shall be attended by Owner, Contractor, Engineer, and manufacturer's representative.
C. Repair deficiencies in coating systems as determined by Engineer in accordance with manufacturer’s instructions.

3.10 EXTERIOR HIGH PERFORMANCE COATING SCHEDULE

A. Tank Exterior:
    1. High-Performance Fluoropolymer System, Semi-Gloss:
        a. Surface Preparation: SSPC-SP6/NACE No. 3
        b. First Coat: Tnemec Series 94-H20 Hydro-Zinc at 2.5–3.5 mils DFT
        c. Second Coat: Tnemec Series 1095 EnduraShield at 2.0–3.0 mils DFT
        d. Third Coat: Tnemec Series 701 HydroFlon at 2.0–3.0 mils DFT

3.11 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Tank Interior, Immersion Service:
    1. 100% Solids Epoxy Liner:
        a. Surface Preparation: SSPC-SP10/NACE No. 2
        b. Pit Filler (As Necessary): Tnemec Series 215 Surfacing Epoxy
        c. First Coat: Tnemec Series 94-H20 at 2.5–3.5 mils DFT
        d. Stripe Coat: Tnemec Series N140 or N140F Pota-Pox Plus at 4.0-6.0 mils DFT at all welds, edges, corners, etc.
        e. Second Coat: Tnemec Series FC22 at 25.0–30.0 mils DFT

3.12 CLEAN UP/WASTE DISPOSAL

A. At completion of day’s work, remove from site rubbish and accumulated materials.
B. Leave storage area clean and in same condition indicated for equivalent spaces in Project.
C. The Contractor shall at times keep the premises free from accumulation of waste materials and rubbish caused by his employees or work.
D. Upon completion of the work, all staging, scaffolding and containers shall be removed from the site or destroyed in a manner approved by then Engineer. Coating or paint spots and oil or stains upon adjacent surfaces shall be removed and the job site cleaned. All damage to surfaces resulting from the work of this section shall be

cleaned, repaired, or refinished to the satisfaction of the Engineer at no cost to the Owner.

E. Place materials defined as hazardous or toxic waste in designated containers for proper disposal.

F. Do not dispose of paints or solvents by pouring on the ground. Place in designated containers for proper disposal.

G. Contractor shall be responsible for all costs associated with this containment, sediment and waste disposal that may result from execution of this project.

H. Waste disposal shall be in accordance with paragraph 1.7 Safety and Health Requirements, in strict conformance to all applicable laws and regulations at the Contractor's expense. Copies of all testing results for waste materials, as well as original manifests for all wastes disposed of, shall be submitted to the Owner within thirty (30) days following removal of waste from the site, including removal for storage at another location or transfer station.

END OF SECTION

Scope of Work

Furnish, install and test all equipment and appurtenant work in complete accordance with the Drawings and Specifications

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of work.

Contents of Division

Section No.	Section Title
11000	Equipment – General
11010	Miscellaneous Equipment
11210	Heat Trace System
11312	Centrifugal Close-Coupled Pumps
11970	Equipment Video Surveillance

SECTION 11000

EQUIPMENT - GENERAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install all equipment specified herein and as shown on the Drawings. This Equipment - General specification shall apply to all equipment regardless if the individual specifications reference this section.

1.2 QUALITY ASSURANCE

A. Furnish and install only equipment of proven reliability manufactured by reputable concerns.
B. Acceptable manufacturers are listed for each equipment item in this Division. Non-listed manufacturer's equipment must receive approval through the ADDENDUM process prior to bidding.
C. Submit certificates, patents, licenses or other required legalities, when applicable, as specified in each Section of this Division.
D. Manufacturer's names listed in equipment schedule are not intended to limit the supplier, but only to indicate the type and quality of materials desired.

1.3 SUBMITTALS TO THE ENGINEER

A. Provide Shop Drawings and samples as specified in the General Conditions of the Construction Contract, as specified in Section 01340, and as specified in Individual Specifications in this Division.
B. Catalog Data: Submit manufacturer's literature and illustrations for all equipment to be installed, including dimensions, construction details, and materials by generic name.
C. Installation Instructions: Submit complete sets of manufacturer's instructions for each equipment item.
D. Submit operating data including complete operating manuals.
E. Maintenance Data:
    1. Maintenance instructions.
    2. Parts list.
F. Certificates: Submit manufacturer's certification that equipment and accessories meet or exceed the Specification requirements.
G. The Contractor shall submit at a minimum the following:
    1. Dimensions, size and location of connections to other work and weight of equipment.
    2. Catalog information clearly marked to specify the materials, equipment, and all other applicable information.
    3. Installation drawings for equipment, drives and bases.
    4. Supporting calculations for equipment and associated supports and hangers specified to be designed by the manufacturer.
    5. Performance data and pump curves.

6. Suggested spare parts list with current price information.
7. Special handling instructions and requirements for storage and protection prior to installation.
8. Requirements for routine maintenance prior to start up and during the life of the equipment. The original and five copies shall be submitted to the Engineer typed on 8 " by 11" pages and have the following information:
    a. Title on first page and every page numbered.
    b. Equipment Name.
    c. Manufacturer.
    d. Equipment Identification Number(s).
    e. Weight of individual components.
    f. Nameplate data - HP, Voltage, speed, etc.
    g. Manufacturer's local representative address and phone number.
    h. Complete listing of all maintenance requirements. Manufacturer's standard forms will not be acceptable as a substitute for these requirements. This list shall take the form of a table showing the maintenance operation, the frequency, any lubrication required and the type of lubricant, and any other comments.
    i. The recommended spare parts that should be kept on the job by the Owner.
9. All Electrical equipment wiring and control diagrams of the system and equipment including motor data.
10. Copies of all field tests for certifying equipment performance.
11. Six copies of operation and maintenance manuals customized to fully describe the equipment actually furnished.

1.4 GUARANTEE

A. The Contractor shall warrant and guarantee the work and equipment in accordance with the General Conditions of the Contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish all standard recommended spare parts as indicated for each equipment item specified in this Division.
B. Wherever specified stainless steel shall be type 316.

2.2 DELIVERY, STORAGE AND HANDLING

A. All machined surfaces subject to corrosion shall be coated with an easily removable rust preventive compound prior to shipping.
B. Coordinate delivery with the progress of the work to minimize on-site storage requirements.
C. Ship fabricated assemblies in the largest sections permitted by carrier regulations, properly labeled for field erection.

D. Deliver equipment in manufacturer's original, unopened and undamaged packages.
E. Clearly identify the manufacturer, contents, stock number and order number on each package.
F. Packages showing indications of damage that may affect conditions of contents will NOT be accepted and must be promptly removed from the site of the Work.
G. Store in original packaging on site under protective covering and out of the way of normal construction activities.
H. Provide special storage in accordance with manufacturer's recommendations.
I. Handle equipment to prevent damage and disfigurement to product and finishes.
J. Label all spare parts when delivered and store in a place designated by the Owner.

PART 3 - EXECUTION

3.1 INSPECTION

A. Thoroughly inspect receiving structures and anchor supports for defects in workmanship prior to equipment arrival.
B. Thoroughly inspect all equipment for:
    1. Damage in shipping.
    2. Defects in workmanship and materials.
    3. Tightness of all nuts and bolts.
C. Inspection shall include, but not be limited to, the following as applicable:
    1. Soundness (no cracked or damaged parts).
    2. Correctness of setting, alignment, and relative arrangement of various parts.
    3. Adequacy and correctness of packing, sealing and lubricants.
    4. Completeness in all details, as specified.
D. Field Quality Control
    1. As part of the equipment cost the manufacturer shall provide a representative to assist the Contractor with equipment adjustment, start-up, and necessary testing to prove that the equipment is in proper and satisfactory operating condition.

3.2 PREPARATION

A. Provide adhesives, sealants, insulation, lubricants, waterproofing, fireproofing or other protection as specified in each Section of this Division.

3.3 INSTALLATION

A. Contractor shall install equipment in accordance with manufacturer's requirements.
B. Do NOT install equipment until all defects or inadequacies in receiving structure have been corrected to meet Specifications.
C. Erect and lubricate equipment in strict accordance with the manufacturer's instructions.
D. All equipment mechanisms shall withstand all stresses that may occur during fabrication, erection, and intermittent or continuous operation.

3.4 FIELD QUALITY CONTROL

A. Demonstrate the ability of all equipment to operate under normal operating conditions without defects such as binding, vibration, jamming, overheating, etc.
B. Replace all equipment found defective at no expense to the Owner.

3.5 ADJUSTMENTS

A. Check and adjust all equipment to insure proper operation and alignment.

3.6 MANUFACTURED EQUIPMENT

A. These Specifications are intended to provide standard equipment of a recognized manufacturer meeting all the requirements of the Specifications.
B. Due to the differences in such prefabricated equipment of various manufacturers, the Contractor shall submit complete shop drawings, cuts, and specifications to the Engineer for approval prior to ordering any equipment.
C. If the equipment differs from the dimensions given on the Drawings, the Contractor shall submit complete drawings showing elevations and dimensions as required for the installation.
D. If Engineer's approval is obtained for alternate equipment, the Contractor shall, at his own expense, make any changes in the structures, piping or electrical necessary to accommodate the equipment.

END OF SECTION

SECTION 11010

MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, deliver and install tools and equipment as listed and as shown on the Drawings.

1.2 SUBMITTALS TO THE ENGINEER

A. Shop Drawings: Submit illustrations and descriptive matter of the equipment listed in the schedules.

1.3 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver all tools and equipment in their shipping containers which shall be placed as directed by the Owner.
   1. All tools and equipment will be unpacked and checked as to completeness and condition by, and at the convenience of, the Owner shortly before completion of the work. A representative of the Contractor may be present during such unpacking and checking.
   2. Contractor shall supply items which are incomplete and replace items which have been damaged prior to being unpacked.

B. Storage and Handling:
   1. Do not make use of the tools or equipment herein specified for the prosecution of any work.
   2. Deliver new tools and equipment unused and in first class condition.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS EQUIPMENT

A. Equipment to be furnished is listed below. Where brand names are not indicated, it is the intention to obtain a "commercial quality" item acceptable to the Engineer.

B. Other sections of these Specifications may include lists of required spare parts and additional equipment not specified in this section.

Quantity/Location	**Equipment Schedule**
As required	Corrugated rubber floor mat runner, 4’ wide x 10’ long x 1/8” thick. Place in front of electrical panels.
One (1) at Heated Room (Pedestal)	Closed sides and back (bookcase type) steel shelving, maximum dimensions: 36” W x 13” D x 72" H, Norwood Commercial Furniture or equal

Quantity/Location	Equipment Schedule
One (1) at Heated Room (Pedestal)	Broom and dustpan
One (1) at Bar Gate	"No Trespassing - Authorized Personnel Only" sign, 18"x24", aluminum. Mount as required.
Two (2) at Chain Link Fence	"No Trespassing - Authorized Personnel Only" sign, 18"x24", aluminum. Mount as required.
One (1) at Heated Room (Pedestal)	Heavy duty adjustable height C-Channel leg work bench with maple butcher block top, 1 ¾" thick 30"x60", Global Industrial or equal.

PART 3 - EXECUTION

NOT USED.

END OF SECTION

SECTION 11210

HEAT TRACE SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, deliver, and install a REDUNDANT heat trace system, inclusive of cable, components and controls so that both systems, if needed, may be concurrently operational. The heat trace system shall consist of a complete UL Listed, CSA Certified, or FM Approved system of heating cables, components, and controls.

B. Function: To provide pipe freeze protection as shown on the drawings.

1.2 QUALITY ASSURANCE

A. Qualifications of Manufacturer:

1. The heat trace system shall be of a design and manufacture that has been used in similar applications. Manufacturers shall provide evidence of at least five (5) installations in which similar equipment has provided satisfactory performance for a minimum of five (5) years in a similar application.
2. All other specified accessories and appurtenances shall be furnished by the heat trace system manufacturer to insure compatibility and integrity of the individual components, and provide specified warranty for all components.

1.3 SUBMITTAL TO THE ENGINEER

A. Submittals shall be in accordance with requirements of the Contract General Conditions.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver in accordance with the manufacturer's recommendations.

B. Store in original packaging on site under protective covering and out of the way of normal construction activities.

C. Handle equipment to prevent damage of any nature.

1.5 WARRANTY

A. The heat trace system manufacturer shall warrant to the Owner the cable and components for 10 years from date of acceptance, and the controller for 2 years from date of acceptance, against defects in material. This warranty shall cover the cost of materials required to correct any warrantable defect, FOB, Manufacturer’s authorized Warranty Service Center.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURER

A. Acceptable manufacturers are Tyco (Pentair), Chromalox, or approved equal.

B. The self-regulating heating cable shall consist of two (2) 10 AWG nickel-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heating cable to be cut to length in the field. The heating cable shall be covered by a radiation-crosslinked, modified polyolefin dielectric jacket. To provide a ground path and to enhance the heating cable's ruggedness, the heating cable shall have a braid of tinned copper and an outer jacket of fluoropolymer (-CT), as required per section 427-23 of the NEC.

C. In order to conserve energy and to prevent overheating, the heating cable shall have a self-regulating factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heating cable output going from 40° F pipe temperature operation to 150° F pipe temperature operation.

D. The heating cable shall be rated at 10 watts per foot and shall operate on line voltages of 120 volts without the use of transformers.

E. The heating cable for metal-pipe freeze protection shall be equivalent to XL-TRACE as manufactured by Pentair.

F. Power connection, end seal, splice, and tee kit components shall be applied in the field.

G. Heating cable circuit shall be protected by a ground-fault device for equipment protection. This requirement is in accordance with section 427-22 of the latest NEC edition. All heating-cable components shall be UL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that us crimps or terminal blocks, shall not be acceptable. All components that make an electrical connection shall be re-enterable for servicing. No component shall use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.

H. The heat trace system shall be complete with a NEMA 4X control panel as shown on the electrical drawings. The panel shall include a 4-pole contactor, HOA selector switch and pilot light. A thermostat with a NEMA 4X enclosure shall be provided to be installed on the service cabinet exterior as shown on the drawings. The panel shall include branch breakers for operation of the heat trace cable.

I. Rigid polyurethane foam pre-molded insulation with a minimum R value of 14 shall be used (2" thick minimum).

J. A weatherproof galvanized steel or polyethylene outer insulation protection jacket shall be used for the process pipes and fittings as follows:

1. The buried Insulation protection jacket shall be 50 mil thick double helical counter wound black polyethylene.
2. The above ground insulation protection jacket for the portion of the pipe shall be 18 gauge galvanized steel 4 ply lock seam metal.

PART 3 - EXECUTION

3.1. INSTALLATION

A. CONTRACTOR shall install items in accordance with manufacturer's printed instructions and as indicated and specified.

B. Apply the heating cable linearly on the pipe after piping has been successfully pressure-tested. Secure the heating cable to piping with fiberglass tape. Additional heating cable shall be allowed for heat sinks.

C. Apply "Electric Traced" labels to the outside of the thermal insulation.

D. After the CONTRACTOR has installed all supporting systems and the units are capable of being operated, the equipment manufacturer shall furnish a qualified representative for a minimum of one (1) day (up to 8 hours) to inspect the equipment and to supervise start-up and field testing for the CONTRACTOR. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the OWNER.

E. The manufacturer shall be required to certify, in writing, that the system passed the necessary warranty certification criteria.

F. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation.

G. Contractor shall install accessories in accordance with manufacturer's written instruction.

3.2. FIELD TESTING

A. After installation, and before and after installing the thermal insulation, the CONTRACTOR shall subject heating cable to testing using a 2500-Vdc Megger in the presence of the Engineer. Minimum insulation resistance shall be 20 megohms or greater.

B. After final inspection, operation, testing, and adjustment have been completed by the Contractor in the presence of the Manufacturer's Field Service Technician, Contractor shall conduct a running test in the presence of the Engineer to determine its ability to operate within the performance limits specified a

C. Make all adjustments necessary to place equipment in specified and working order at the time of above tests.

D. Promptly correct or replace all defective equipment revealed by or noted during tests at no additional cost to the Owner and repeat tests until specified results acceptable to Engineer are obtained.

3.3. WARRANTY

A. The equipment furnished under this section shall be free of defects in materials and workmanship, including damages that may be incurred during shipping, storage and installation for a period of one (1) year from date of substantial completion.

3.4. OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be provided by the Contractor in accordance with specifications.

END OF SECTION

SECTION 11312

CENTRIFUGAL CLOSE COUPLED PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:
   1. Furnish and install all materials, labor, tools, and equipment necessary for the installation of centrifugal pumps with appropriate accessories in accordance with type and use as specified herein and as shown on the drawings.

B. Pump styles included in this Section:
   1. End suction horizontal

C. Related work specified elsewhere (when applicable):
   1. Section 11000 – Equipment General
   2. Division 13 – Instrumentation and Controls
   3. Division 16 – Electrical

1.2 QUALITY ASSURANCE

A. Qualifications of Manufacturer:
   1. Pumping equipment shall be of a design and manufacture that has been used in similar applications. Manufacturers shall provide evidence of at least five (5) installations in which similar equipment has provided satisfactory performance for a minimum of five (5) years in a similar application.
   2. Centrifugal pumps, complete with shaft, motor, coupling, base plate, necessary guards, and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to ensure compatibility and integrity of the individual components, and provide specified warranty for all components.

1.3 SUBMITTALS TO THE ENGINEER

A. Submittals shall be in accordance with requirements of the Contract General Conditions, Section 01340 and Section 11000. Submittals shall include shop drawings, catalog cut sheet, materials of construction, major dimensions, motor data, pump characteristic curves showing the design duty operating point capacity (gpm) and head (ft), net positive suction head required, and hydraulic brake horsepower.

B. Submit variable speed pump curves showing pump performance at full speed, 50% speed, and at least 3 intermediate speeds.

C. Manufacturer shall submit references for similar applications and installations upon request.

1.4 OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be provided in accordance with Section 01730 and as specified below:

B. Each Item of Equipment and Each System: Include a description of unit or system, and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves with engineering data, head loss, tests, and certifications where appropriate and complete nomenclature and commercial number of replaceable parts, where applicable. Provide serial numbers etc. for equipment supplied.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; alignment, adjusting, balancing, and checking instructions. Provide servicing and lubrication schedule, and list of lubricants required, cleaning requirements and frequency.

E. Provide list of contact information for manufacturer and manufacturer's representative for service and support.

F. O&M manuals shall be specific to the equipment supplied.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver in accordance with the manufacturer's recommendations.

B. Store in original packaging on site under protective covering and out of the way of normal construction activities.

C. Handle equipment to prevent damage of any nature.

1.6 WARRANTY

A. The Pump Manufacturer shall warrant to the Owner the pump units against defects in material and workmanship for a period of 1 year from date of acceptance at Substantial Completion.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURER

A. This specification is based on Model Series 3656 pumps as manufactured by GOULDS.

B. Acceptable manufacturers are GOULDS or products demonstrated to be of equal or better quality, function and performance.

1. Pumps shall have been manufactured within 1 year of supply.

2.2 CONDITIONS OF SERVICE/PUMP SCHEDULE

Pump ID	**Recycle Pumps**
Style	End Suction Horizontal, Close Coupled
Series/Size	3656
Primary Service Condition	Duty/Stand-By
Design Capacity (gpm)	680
Design Total Dynamic Head (feet)	110
Nominal suction diameter (inches)	6
Nominal discharge diameter (inches)	4
Minimum Efficiency at Duty Point (%)	84
Max. Operating Speed (rpm)	1800
Max. Motor Horsepower (hp)	30

2.3 PUMP DESIGN

A. End Suction Horizontal Close Coupled: Each pump shall be designed for clockwise rotation viewed from driven end and include the following design features.
   1. Casing - The pump casing shall be spiral volute type, back pull-out design with ANSI Class 125 flat faced flanged suction and discharge connections above 2-1⁄2" size and NPT threads 2-1⁄2" and smaller size and shall be constructed of Cast Iron, ASTM A48 CL20 material.
      a) The pump discharge nozzle shall be tangentially oriented.
      b) The complete pump unit shall be supported by the power frame.
      c) A pump casing drain shall be provided with a steel or brass pipe plug.
   2. Wear Ring - Replaceable casing and seal housing wear ring of Bizmuth brass shall be provided and held securely by means of interference fits.
   3. Impeller - The pump impeller shall be of enclosed design, constructed of Bronze ASTM B584 material and key driven. A stainless steel bolt and washer shall provide positive attachment of the impeller to the motor shaft.
   4. Seal Housing/Adapter - The seal housing and motor adapter shall be of 1-piece design, constructed of Cast Iron, ASTM A48 CL20. Registered mating fits to the pump casing and power frame shall maintain positive unit alignment and support. Sealing of casing pressure shall be maintained by an "O-ring" of BUNA-N material. Motor and casing connection shall be held securely by means of grade 5, high strength hex cap screws. A bottom drainage port shall be provided to allow condensation or seal leakage to drain and not be retained within the adapter.
   5. Shaft Seal - The shaft seal shall be Sil-Carbide/Sil-Carbide/Viton.
   6. Shaft Sleeve - The pump shaft sleeve shall be constructed of AISI Type 300 series stainless steel.

2.4 ELECTRIC MOTORS

A. The pump drive motor shall be non-overloading at flow rates up to 110% of rated flow and within the service factor at all points on the pump curve.
B. Motor shall be of NEMA standard design and close coupled to the pump unit as

described above.

C. Motors shall be provided with temperature switches embedded in each winding for high temperature alarm/shutdown.

D. The motor rating shall be per the following schedule:

Pump ID	**Booster Pump**
Motor Horsepower (hp)	30
Speed (rpm)	1800
System Input Power	460V, 3 ph., 60 Hz
Enclosure	Totally enclosed fan cooled
Service Factor	1.15
Efficiency	Premium efficiency
Inverter Rating	Inverter duty rated per NEMA MG-1 part 31.0 for use with VFD

2.5 TESTING

A. Each pump casing shall be hydrostatically tested by the manufacturer in accordance with Hydraulic Institute Standards at 250 PSIG, to acceptance grade 1U.

B. Production performance testing shall be conducted by the manufacturer on each pump unit. Head at shut off and a minimum of 2 operating points shall be measured at design speed to verify performance.

2.6 FINISHES

A. Exterior surfaces of the pump shall be finish coated with an epoxy paint system suitable for the service intended, 2 coats minimum.

2.7 CONTROLS

A. Pumps shall be controlled by a VFD and a PLC. (see Divisions 13 and 16 of these Specifications). Contractor shall coordinate between pump manufacturer, controls manufacturer, and integrator to provide a complete system.

2.8 SPARE PARTS

A. For each pump supplied:

1. Furnish one (1) complete set of gaskets for each pump.
2. Furnish one (1) replacement pump shaft seal including all necessary parts in a container with complete installation instructions for each pump.

PART 3 - EXECUTION

3.1 FIELD PREPARATION AND PAINTING

A. Finish field preparation and painting shall be performed as specified in Div. 9.

B. The CONTRACTOR shall touch-up all shipping damage to the paint and stainless steel as soon as the equipment arrives on the job site.

C. The CONTRACTOR shall supply paint for field touch-up and field painting.

D. The CONTRACTOR shall finish paint electrical motors, speed reducers, and other self-contained or enclosed components with oil-resistant enamel.

E. Prior to assembly, all stainless steel bolts and nut threads shall be coated with a

non-seizing compound by the CONTRACTOR.

3.2 INSTALLATION

A. CONTRACTOR shall install items in accordance with manufacturer's printed instructions and as indicated and specified.

B. The manufacturer shall schedule one (1) trip to the project site for equipment inspection, start-up assistance, and field testing as noted in paragraph 3.2.C. for the CONTRACTOR, and one (1) trip to the project site for operator training as noted in paragraph 3.4.A. for OWNER personnel.

C. After the CONTRACTOR has installed all supporting systems and the units are capable of being operated, the equipment manufacturer shall furnish a qualified representative as required to inspect the equipment and to supervise start-up and field testing for the CONTRACTOR. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the OWNER.

D. The manufacturer shall be required to certify, in writing, that the installation done by others is in accordance with manufacturer's requirements.

E. After the equipment has been placed into operation, the manufacturer's representative shall make all final adjustments for proper operation. Contractor shall install pumping equipment on a concrete pad and final alignments shall be made thereon.

F. Contractor shall install accessories in accordance with manufacturer's written instruction.

3.3 FIELD SERVICES

A. After installation of the pump(s), and after inspection, operation, testing, and adjustment have been completed by the Contractor in the presence of the Manufacturer's Field Service Technician, Contractor shall conduct a running test for each pump in the presence of the Engineer to determine its ability to operate within the performance limits specified and to deliver its rated capacity within the pressure requirements specified. Contractor shall provide labor, piping, equipment, and materials necessary for conducting all field tests.

B. Make all adjustments necessary to place equipment in specified and working order at the time of above tests.

C. Promptly correct or replace all defective equipment revealed by or noted during tests at no additional cost to the Owner and repeat tests until specified results acceptable to Engineer are obtained.

3.4 OPERATOR TRAINING

A. Equipment manufacturer shall furnish a qualified representative for a minimum of one (1) day (up to 8 hours) to provide operator training for OWNER'S personnel after system is fully operational, including supporting systems to the satisfaction of the Owner and Engineer. Training will take place on a date pre-approved by the OWNER.

END OF SECTION

SECTION 11970

VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install a video surveillance system for the facility. The surveillance system shall consist of four structure mounted cameras, wiring, connection to local video camera server, console monitor, and all other items necessary for a complete functional system.

B. Work shall include the following at no additional cost:
   1. All connectors, mounting equipment, cables, routers antennas, switches and all other hardware and labor required for a complete and fully functional installation.
   2. Onsite training of City personnel and technical support during the one year correction period.
   3. Camera three year warranty on parts beginning on the date of Substantial Completion.
   4. Wireless equipment one year warranty on parts beginning on the date of Substantial Completion.
   5. Labor one year warranty on the video surveillance system beginning on the date of Substantial Completion.

1.2 QUALITY ASSURANCE

A. Furnish and install only equipment of proven reliability manufactured by reputable concerns.

B. Acceptable or Specified manufacturers are listed for each equipment item in this Division. Where “or approved equal” is stated, the shop drawing submittals must include the requirements in Section 01630. Where there are acceptable Substitutes listed, the Acceptable Substitutes manufacturers’ shop drawing submittals must include the requirements in Section 01630.

C. Manufacturer's names listed in equipment schedule are not intended to limit the supplier, but only to indicate the type and quality of materials desired.

1.3 SUBMITTALS TO THE ENGINEER

A. Provide Shop Drawings, catalog data, and samples as specified in the General Conditions of the Construction Contract and as specified in Individual Specifications in this Division.

B. Installation Instructions: Submit complete sets of manufacturer's instructions for each equipment item.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Video Surveillance Camera
   1. Video surveillance camera shall be equal to MEGAPix IP Cameras and shall be the current version of the 4MP bullet IP DWC-MB44WiA model camera currently in use by the City of Dover at other water facilities.

2. Camera shall provide a clear picture at least 25 feet in all directions during both day and night operations.
3. Camera shall be IP based and IR capable.
4. All cameras must be NDAA compliant.

B. Network Video Recording System (NVRS)
1. Video Recorder Unit must be ExacqVision, model A-Series IPS 2UA per City standard.
2. NVRS shall have the ability to record up to 14 days of continuous monitoring using the ExacqVision Security NVR Solution. Storage will be based on 15 frames per second.
3. NVRS shall have a console monitor compatible with other monitors used by the City of Dover at its water system facilities. Contractor to furnish and install the monitor at the location shown in the drawings.
4. NVRS shall support up to 5.0 Megapixel recording resolution and recordings shall be compressed using H.265.
5. NVRS shall have VGA, CVBS and HDMI video outputs.
6. NVRS shall have multiple selectable recording modes, e.g. continuous, motion detection, schedule, and by event.
7. NVRS shall have the following features: event search, event log, email notification, and text notification.
8. NVRS shall be IP based.
9. NVRS shall be connected to a uninterruptable power supply (UPS) system provided by the contractor.
10. System shall be capable of using a future broadband connection (Comcast) to transmit video to City Police Department.
11. All video system components must be NDAA compliant.
12. System shall be Windows-based.
13. Data rack and network switches shall be provided by the Contractor.

PART 3 - EXECUTION

3.1 INSPECTION
A. Thoroughly inspect all equipment for:
1. Damage in shipping.
2. Defects in workmanship and materials.

3.2 INSTALLATION and COMMISSIONING
A. The Video Surveillance System shall be installed by the provider of the Video Surveillance System in accordance with manufacturer's requirements.
B. Location and direction of video surveillance cameras shall be determined in the field by the Owner and Engineer
C. Demonstrate the ability of the Video Surveillance System, i.e. cameras, camera server, console monitor, and video recorder, to operate under normal operating conditions.
D. Provide on-site training for City personnel.

C. Replace all equipment found defective at no expense to the Owner.

END OF SECTION

Scope of Work

Furnish, install and test all site work and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of the work.

Contents of Division

Section No.	Section Title
13301	Instrumentation Systems Basic Requirements
13305	Level Measurement
13310	Pressure Measurement
13315	Magnetic Flow Meters
13360	SCADA System
13440	Composite Elevated Water Storage Tank

SECTION 13301

INSTRUMENTATION SYSTEMS BASIC REQUIREMENTS

PART 1 – GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to implement general administrative and procedural requirements for instrumentation installations in accordance with the plans and as specified.

B. General:

1. All of the equipment shall be the manufacturer's latest and proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering into the design of the instrumentation system. The completed system shall be compatible with the functions required and the equipment furnished by the CONTRACTOR.
2. Where job conditions require reasonable changes in indicated locations and arrangements, the CONTRACTOR shall make such changes without extra cost to the OWNER.
3. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The CONTRACTOR shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through restricted areas in the building.
4. The CONTRACTOR shall examine the architectural, structural and mechanical plans and shop drawings for the various items of equipment in order to determine exact routing and final terminations for all wiring and cables.
5. All deviations from the Drawings or Specifications must be accepted in writing by the ENGINEER.
6. All controls for remote electrically operated or motor driven equipment shall be complete, including all necessary auxiliary relays so as to require only wiring and connections to the equipment control circuit. All contacts for control of remote motor operated or electrically operated equipment shall be rated not less than 10 amperes on 120 volts unless otherwise specified herein.
7. All necessary fuses or switches required by the instrumentation manufacturer for his equipment shall be provided with the equipment. All instruments requiring an internal power supply shall have an internal ON-OFF switch, or a plug-in receptacle.
8. The drawings and specifications indicate the energy sources that will be provided. Any other devices necessary to obtain proper operation of the instrument system from these energy sources shall be furnished with the instrumentation.
9. Components shall be finished to the manufacturer's standard for the service intended unless otherwise indicated in the specifications or on the drawings.
10. All equipment shall be designed and constructed so that normal operation will resume on power restoration after a power failure without requiring manual resetting or

recalibration.

11. All differential sensing devices, such as flow transmitters, shall have a brass or stainless steel bypass and manifold with the device.
12. All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, adaptors, and shut-off valves.
13. All components shall be tagged with the item number and nomenclature given in the specifications.
14. All wire ends shall be identified at both ends with wire markers.
15. All instrumentation wiring shall be shielded. The shield shall be continuous from source to destination and shall be grounded as per manufacturer's recommendations, but in no case shall be grounded in more than one point.
16. Interlock wiring between instrumentation equipment and equipment furnished under other divisions of the specifications. Interlocks shall include alarm contacts, control contacts, and 4-20 ma analog signals. Such interlocks are required by diagrams, schematics, notes, or narrative descriptions. Extend these interlocks to and land them on terminal strips provided in equipment, motor starters, motor control centers, etc.
17. The responsibilities of the Contractor shall include:
    a. Prepare instrument loop drawings.
    b. Provide and calibrate instruments and controls.
    c. Prepare schematics and layout drawings, and fabricate accordingly.
    d. Configuration and programming.
18. The Contractor shall provide operating instruction manuals with adequate information pertaining to the following:
    a. System specifications.
    b. Electrical power requirements.
    c. Application considerations.
    d. Assembly and installation procedures.
    e. Power up procedure.
    f. Troubleshooting procedure.
    g. Programming procedure.
    h. Explanation of internal fault diagnostics.
    i. Shutdown procedures.
    j. Recommended spare parts list.

1. 2 RELATED SECTIONS

A. The following divisions and sections contain requirements that relate to this section:
    1. Division 1 – "General/Requirements."
    2. Division 3 – Concrete
    3. Division 11 – "Process Equipment."
    4. Division 15 – "Mechanical Systems."
    5. Division 16 – "Electrical."
    6. Section 13310 – "Pressure Measurement."
    7. Section 13315 – "Magnetic Flow Meter."
    8. Section 13360 – "Instrumentation and Control System."

B. System Tests
   1. The Contractor shall prepare and submit to the Engineer for review, a detailed description of the test procedures that he proposes to perform to demonstrate performance of the complete system.
   2. The Contractor shall provide Instrument Calibration Sheets and a space for sign-off on individual items and list by the Contractor. A sample of an Instrument Calibration Sheet form shall be submitted for approval by the Engineer.

1.3 QUALITY ASSURANCE

A. Reference Standards.
   1. Instrument Society of America (ISA).
   2. National Electrical Code (NEC).
   3. National Electrical Manufacturers Association (NEMA).
   4. Institute of Electrical and Electronic Engineers (IEEE).
   5. American National Standards Institute (ANSI).
   6. National Fire Protection Association (NFPA).
   7. Scientific Apparatus Manufacturers Association (SAMA).
   8. Underwriters' Laboratories (UL).
   9. Joint Industrial Council (JIC).
   10. Factory Mutual (FM).
   11. International Standards Organization (ISO).
   12. American Society for Testing and Materials (ASTM).
   13. International Electrotechnical Commission (IEC).
   14. Electronic Industries Association (EIA).

B. Qualifications:
   1. Manufacturer's Qualifications.
      a. A financially sound firm with at least 5 years of experience in design, manufacture, supply, service, and support of instrumentation and control equipment specified for this project.
      b. A record of prompt shipments in accordance with contract obligations.
      c. A documented quality assurance program complying with industry and agency standards.
      d. A documented product safety policy relevant to the products being manufactured for this project.
   2. Installer's Qualifications:
      a. An approved manufacturer's representative factory educated in maintenance, installation, integration, and start-up of the instrumentation and control equipment to be supplied.
      b. A documented record of success in installation of instrumentation and control systems.
      c. An engineering and technical staff with knowledge of applicable processes and practices.

C. System Responsibility:

The instrumentation and control system shall be furnished by one integrator who shall be

responsible for the development of submittals, acceptance tests, start-up and support, and all warranty work for the entire system. Responsibility shall not be split among individual suppliers.

1.4 SUBMITTALS

A. Sequencing and Scheduling: Follow the procedures specified in Division 1 section "Submittals," and in addition, the Contractor shall prepare and submit a complete submittal list to the Engineer. The submittal list shall include all submittal items covered in the Division 13 specification sections. In addition, the submittal list shall contain dates for all items to be submitted and shall accompany the first submittal. The submittal list shall include the expected factory test, equipment shipping, installation, and operational test dates for each Division 13 specification section.

B. Shop Drawings: Submit shop drawings to substantiate that the materials and equipment comply with the specification requirements. All drawings, data sheets, lists, forms, etc., shall clearly state the job name, Owner, location, and date. Submit the following types of drawings in accordance with the specifications.

1. Materials List: Submit a list of materials giving quantities, manufacturer's name, and catalog numbers listed by equipment tag numbers. All equipment shall have a tag number. The list shall identify sheet numbers where each tag numbered item can be found.
2. Product Data: Submit manufacturers technical product data sheets for items listed in the instrument schedule and for any additional components required for a complete functional system. Delete or "x" out inappropriate or inapplicable information on each page of product data submittals.
3. Specification Form: A completed specification form similar to ISA Standard S20 shall be included for each instrument. The specification form shall include an instrument tag number as per ISA Standard S5.1 Section 3.1.
4. Dimensional Drawings: Submit dimensional drawings for instrument mounting, process connection details, instrument cabinets, panels, and each piece of equipment.
5. Wiring Diagrams. Submit the following:
   a. Field wiring diagrams for wiring into and out of control panels, identifying terminal numbers of the field equipment or other remote termination points.
   b. Master interconnection wiring and piping drawing showing all field and panel mounted equipment and terminal identifications. Each individual manufacturer's system drawings shall be furnished.
   c. Internal wiring drawings for each control panel identifying each and every component, numbered wire, numbered terminal, and terminal block. Loop diagrams shall follow ISA-S5.4 format.

C. Operation and Maintenance Manuals. Submit six bound and indexed operation and maintenance (O&M) manuals prior to delivery of the equipment. Each option and accessory shall be clearly and accurately shown. The O&M manuals shall include:

1. Installation instructions and details.
2. Start-up instructions.
3. O&M instructions.

4. Detailed parts list with name, address, and telephone number of supply source.
5. Troubleshooting guide.
6. Electrical and mechanical diagrams.

D. Spare Parts List. Submit a list of spare parts required to be supplied by the Contractor.
1. List: Include a current parts list indicating part name, equipment, name, stored quantity, manufacturer/source address, telephone number, and salespersons name within the secured storage area.

E. Test Procedures: Submit to the Engineer for review, a detailed description of field test procedures proposed to demonstrate performance of the complete system. Whenever possible "live" inputs and functional outputs shall be used. Whenever this is not possible, the Contractor shall simulate inputs and loads.

F. Contract Closeout Submittals:
1. O&M Manuals. Replace all affected drawings supplied in the O&M manuals with "As Built" revised drawings.
2. O&M Manuals. See Division 1. Contractor shall provide six bound copies of the manual, after approval, to the Owner.
3. Record Drawings. The Contractor shall furnish detailed wiring drawings for all instruments and controls. Drawings shall show all tag numbers, point-to-point wiring, and terminal numbers used on the external wires. In addition, any changes made by the Contractor to internal wiring of equipment or components inside enclosures furnished by the Contractor shall have "As Constructed" revisions to the original manufacturer's drawings detailing these additions or revisions. The record drawings shall include all wire numbers and terminals used plus a list of all settings for each instrument. Replace all affected drawings supplied in the O&M manuals with record drawings.

1.5 JOB CONDITIONS (not applicable)

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment properly packaged and mounted on pallets or skids to facilitate handling of heavy items. Utilize factory fabricated type containers or wrappings for components which protect equipment from damage.

B. Inspect equipment to ensure that no damage has occurred during shipment. Handle equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new. Inspect all equipment at time of delivery as to model, quantity, and physical condition. All equipment shall be identified by name and tag number. Site conditions must be clean, dry, heated, and dust free before equipment is removed from packaging or installed.

C. The Contractor shall store the items furnished under this section until they can be installed. Such storage shall meet the requirements of the system supplier and be approved by the Owner. Use all means necessary to protect the material of this section before, during, and after installation, and to protect the installed work and materials of all other trades. Provide factory applied end caps to protect all threads on pipes and valves.

1.7 SPECIAL WARRANTY

A. General: The Contractor shall retain the services of factory trained servicemen to provide repair services for the instrumentation and control system for 1 year, commencing with the time the system equipment is complete and accepted by the Owner, and including all repair and replacement parts needed during the warranty period.

1.8 MAINTENANCE

A. The Contractor shall provide an adequate supply of spare parts to the Owner for facilitating proper maintenance and minimizing downtime of the process control system. The spare parts list shall consist of the supplier's recommendations required to maintain the equipment in working order. The spare parts shall be modular plug-in type equipment.
   1. Each spare part used during the start-up, demonstration, and warranty period shall be replaced by the Contractor at no cost to the Owner.
   2. Spare parts documentation shall include instructions for removal of failed parts and installation of replacement parts. The spare parts list and descriptions shall be submitted for review prior to system installation.

PART 2 - PRODUCTS

2.1 GENERAL.

All equipment installed in wet locations shall be rated NEMA 4X.

2.2 MATERIALS

A. General: All materials shall be in accordance with the drawings and specifications. The following miscellaneous materials shall be furnished by the Contractor:
   1. Mounting hardware as specified in Division 16 section "Supporting Devices."
   2. Wire labels as specified in Division 16 section "Identification."
   3. Nameplates as specified in Division 16 section "Identification."
   4. Relays, timers, and pilot control devices as specified in Division 16 section "Control Devices."

B. Terminal Blocks:
   1. General. IEC style, corrosion resistant blocks, rail mounted rated for 300 volts minimum.
   2. Terminals. Screw type, stainless steel wire clamp, nickel plated copper conductor bar, wire range of No. 20 to No. 10 AWG.
   3. Accessories
      a. Din rail.
      b. End barriers and end anchors.
      c. Knife disconnect isolating switches.
      d. Fuse blocks with fuse puller for each.
   4. Manufacturers:
      a. Phoenix Contact
      b. Buchanan.
      c. Or approved equivalent.

C. Power Supplies:
   1. Regulated direct current (dc) power supplies for instrument loops shall be designed and arranged so that loss of one supply does not affect more than one instrument loop.
   2. Provide MOV type surge protectors on input and output. Each shall have visible indication of input and output, out of service.
   3. Power supplies shall be suitable for 120 volt input with a variation of ±10 percent, and the supply output shall be fused or short circuit protected.
   4. Output voltage regulation shall be as required by the instrumentation equipment being supplied with a minimum of 0.1 percent.
   5. Size and output voltage shall be as shown on the drawings or schedules.
   6. Manufacturers:
      a. Acopian Corporation.
      b. Moore Industries.
      c. Condor DC Power Supplies, Inc.
      d. Or approved equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the site and existing facilities. Compare the site and existing facilities with the drawings and specifications. With respect to the conditions of the premises, locate connections of existing facilities and any obstructions which may be encountered and conduct work to minimize disruption to existing conditions.
B. Field verify all locations and dimensions to ensure that the equipment will be properly located, readily accessible, and installed in accordance with all pertinent codes and regulations, the contract documents, and the referenced standards.

3.2 INSTALLATION - GENERAL

A. General:
   1. Location of instruments shown on the drawings are approximate unless specifically dimensioned. The Contractor shall install the instruments to perform their intended function in full coordination with existing conditions and the work of other trades.
   2. The Contractor shall furnish, fabricate, and mount all instrument stands and brackets. Mounting of stands and instruments shall be per installation detail drawings. All stands must be level, plumb, rigid, and free from vibration. Additional support shall be added where required for vibration free mounting.
   3. Perform “paper” layout using dimensions from approved shop drawings gear etc. to verify that equipment , panels gear etc. will fit within the available space without conflict w/other components. Notify Engineer immediately of conflicts.
B. Instrumentation wiring is shown schematically on the plan or described by narrative in the specifications. Contractor to provide type and quantity of wiring necessary to perform the function specified in Division 13 and shown on the plans. See Division 16 wire and cable sections for "uses permitted." Analog signal conductors and discrete signal conductors shall always be in separate conduits or cable tray compartments. Power wiring shall be in

conduits and cable tray compartments separate from all signal wiring. Power wiring wherever required by instruments or equipment provided as part of the instrument system is work of this section.

1. The Contractor shall terminate field wiring for equipment specified under this section. The system integrator shall check instrument installation and field wiring before instrument devices are electrically powered by Contractor. Wires shall be terminated at terminal blocks with crimp type, pre-insulated tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated. All signal shields shall have only one ground point which shall be located at the closest control panel. Use watertight seal (closed cell RTU foam type) entering or leaving every building. Install conduit water relief or "weep" on the system side of all seals to prevent intrusion of water into the equipment.
2. Spare Wiring. Signal and interlock wiring shall contain spare conductors in every raceway. Spare conductors shall be provided in pairs and shall be clearly and distinctly marked at every access point indicated where the pairs start and stop. The minimum number of spare pairs shall be 25 percent of the number of active pairs with a minimum of one spare pair.

C. Tagging:

1. All instrumentation equipment shall be provided with identification tags in accordance with the Process and Instrumentation Diagrams, Instrument Symbol sheets, and Div. 16, "Electrical Identification." Each field instrument shall have a stainless steel tag.
2. The device tags shall be mounted using stainless steel screws.

3.3 FIELD QUALITY CONTROL

A. System Tests:

1. A technical representative of the system integrator and the Contractor shall participate in the checkout of instruments and control systems. If interrelated devices furnished by other suppliers, such as valve actuators, motor controls, chemical feeders, and primary measuring devices do not perform properly when placed in service, the Contractor shall correct the problem. If such correction cannot be made in a timely manner and the Owner agrees, a temporary test condition may be created. The technical representative may use suitable test equipment to introduce simulated signals from those devices; however, he shall be required to locate the source of any trouble or malfunction.
2. All special testing materials and equipment shall be provided by the Contractor. Where it is not practical to test with real process variables, the Contractor shall provide suitable means of input and output signals and control strategy simulation. The simulation techniques shall be subject to the approval of the Owner's Representative.

3.4 ADJUSTING

A. Alarm and control set points shall be adjusted to their operational values during the demonstration period.

B. Calibration adjustments shall be performed during the demonstration period for an operational system. Testing shall commence after calibration verification for each instrument is provided to the Engineer.

3.5 CLEANING

A. The instrumentation system components shall be kept clean and free of dust during the storage, start-up, demonstration, and warranty period.
B. Clean dust and dirt accumulation inside and outside control panels and consoles, on a monthly basis, during start-up and demonstration period.

3.6 DEMONSTRATION

A. When all required tests have been performed and prior to final approval, a qualified representative of the system integrator shall thoroughly demonstrate to the Owner's personnel the operation of the complete instrumentation and control system. Submit report data to the Engineer.
B. During the operational demonstration period, the following process conditions shall be performed.
    1. Throttle valves and/or adjust pump speeds to demonstrate the minimum, maximum, and normal flow, level, and pressure conditions of each flow, level, and pressure transmitter.
    2. Demonstrate pressure switch and differential pressure transmitter operations. Differential pressure transmitters with square root extractors shall be demonstrated with minimum, maximum, and normal flow conditions.
    3. Demonstrate the operation of analytical instruments. If the analytical instrument is used in a chemical feed loop, coordinate for proper operation of chemical feed equipment. Create unusual conditions to test for proper system and equipment connection. During the demonstration period, simulate specified alarm conditions.
    4. Demonstrate the operation of signal conditioners and calculation modules. If the module is used to control equipment. The current trip relay set points and reset points shall be demonstrated.
    5. Each annunciator alarm shown on the contract drawings shall be demonstrated during this operational period, including reset at proper signal level.
    6. All components in the instrument panels and consoles shall function properly during the demonstration period.

3.7 INSTRUCTION OF OPERATING PERSONNEL

A. Field Training: Training shall be conducted for instrumentation in accordance with the Specifications and shall include equipment specified in this section, related electrical and interfaces to equipment provided by other division sections. Training sessions shall be conducted as described in section 13360 of the specifications. Follows. The training program shall provide the plant treatment personnel with the capability of operating, maintaining, and calibration of instrumentation system supplied.

END OF SECTION

SECTION 13305

LEVEL MEASUREMENT

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to install level measurement equipment in accordance with the contract drawings and as specified herein.

B. The types of equipment specified in this section shall include, but not limited to, the following:
   1. Float switches.
   2. Gauge pressure transmitter.

1.2 RELATED SECTIONS

A. The following divisions and sections contain requirements that relate to this section:
   1. Section 13301, “Instrumentation Systems Basic Requirements.”
   2. Section 13360, “Instrumentation and Control System.”

1.3 QUALITY ASSURANCE

A. Reference Standards:
   1. National Electrical Manufacturers Association (NEMA).
   2. National Electrical Code (NEC).
   3. Underwriters' Laboratories, Inc. (UL)
   4. See Section 13301, "Instrumentation Systems Basic Requirements."

B. Qualifications:
   1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of level measurement equipment whose products have been in satisfactory use in similar service for not less than 5 years.
   2. Installer's Qualifications: Qualified with at least 5 years of successful installation experience on projects with level measurement equipment similar to that required for this project. An approved manufacturer's representative for the maintenance, installation, and start-up of the level measurement equipment.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and material certifications as required. See Section 13301, "Instrumentation Systems Basic Requirements," for additional submittal requirements, all of which apply.

B. Submit a list of materials giving quantities, manufacturer's name, and catalog numbers.

C. Submit wiring diagrams showing all connections for all equipment furnished under this section.

D. Furnish two certified copies of calibrations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment properly packaged and mounted on pallets or skids to facilitate handling of heavy items. Utilize factory fabricated type containers or wrappings for components which protect equipment from damage.

PART 2 - PRODUCTS

2.1 Float Switches:

A. Features:
   a) Hermetically sealed and eccentrically weighted float housing.
   b) Tilt type, non-mercury, mechanical switch.
   c) Wide angle for pump control and narrow angle type for low/high alarm functions.
   d) Heavy duty, flexible, submersible cable connected to float with watertight seal.

B. Accessories:
   a) Stainless steel weight kit, bolt assembled to float cable. Weight shall be of sufficient size to prevent movement of the float(s) from turbulence within the tank.
   b) Stainless steel mounting bracket at hatches or where required by location.

C. Materials:
   a) Float. Impact and corrosion resistant ABS shell.
   b) Cable Jacket. Neoprene.

D. Sizes and Ratings:
   a) Environmental Limitations. Suitable for use with ambient and process fluid temperatures.
   b) Units to be installed in wastewater applications shall be suitable for installation in a Class 1, Division 1, Group D area, or shall be interconnected to controls though an intrinsically safe barrier.

E. Manufacturers:
   a) GEMS M Series or equal
   b) Or products of equal or better quality, function and performance.

2.2 Gauge Pressure (Level) Transmitter:

A. Features:
   a) Sensing Element. Sealed capacitance sensing with silicone oil fill.
   b) Solid state transmitter.
   c) Two wire operation.
   d) Field serviceable, noninteracting, zero and span controls.
   e) Zero elevation and suppression.
   f) Adjustable dampening.
   g) NEMA 4 housing with 1/4 inch NPT pressure connection.

A. Accessories:
   a) Shutoff valve, pulsation dampener, tubing, and fittings.
   b) Manual air release with threaded fitting for attachment of portable calibration unit.
   c) Local indicated reading in engineering units.
   d) Stainless steel tag.

B. Materials:

a) Sensor Body. 316 stainless steel.
b) Wetted Parts. 316 stainless steel.

C. Sizes and Ratings:
a) Overpressure Protection. 2,000 pounds per square inch gauge (psig) minimum.
b) Accuracy. ±0.2 percent of span.
c) Ambient Temperature. -20 to 180 degrees Fahrenheit (o F.).
d) Pressure Input Range.
e) Signal Output. 4-20 milliampere direct current (mAdc).

D. Manufacturer:
a) Foxboro.
b) Siemens.
c) Rosemount Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. In the event any discrepancies are discovered, immediately notify the Owner's Representative in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

A. General:
1. Install equipment as indicated in accordance with manufacturer's written instructions and in compliance with recognized industry practices.
2. Mount instruments so that they may be readily approached and easily serviced.
3. Install transmitters with local indicators in a position readily observable from the operating area.
4. Level Measurement Installation.
a) Coordinate the installation of level sensing devices with the process equipment and contract drawings.
b) Install manufacturer's supplied cable between level element and transmitter. If flexible conduit is not provided or where conditions dictate, furnish and install rigid conduit sized according to manufacturer's recommendations.

B. Install ground references as required by the manufacturer for the application.

3.3 FIELD QUALITY CONTROL

A. Upon completion of this portion of the work, the Contractor shall provide for services of a qualified representative of the manufacturer to inspect and approve installation.

B. Upon completion of all inspections and prior to acceptance by Owner, perform field tests outlined in Section 13301, "Instrumentation Systems Basic Requirements."

3.4 CLEANING

A. Level Measurement. Each level device shall be kept clean and free of dust during the storage, start-up, and demonstration.

3. 5 DEMONSTRATION

A. Reliable and accurate operation of each level sensor and all specified accessories shall be demonstrated over a range of levels to demonstrate proper and accurate operation. This shall include accuracy, stability, and repeatability as specified over a range inclusive of the maximum (full scale, overflow, high alarm, etc.) and the minimum (low level alarm, low level stop) levels which can occur.

3.6 TRAINING

A. Provide a minimum of one 4-hour of training to satisfaction of Engineer and Owner.

END OF SECTION

SECTION 13310

PRESSURE MEASUREMENT

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to install pressure measurement equipment in accordance with the contract drawings and as specified herein.

B. The types of equipment specified in this section shall include, but not limited to, the following:
   1. Gauge pressure transmitters.

1.2 RELATED SECTIONS

C. The following divisions and sections contain requirements that relate to this section:
   1. Section 13301, “Instrumentation Systems Basic Requirements.”
   2. Section 13360, “Instrumentation and Control System.”

1.3 QUALITY ASSURANCE

A. Reference Standards.
   1. National Electrical Manufacturers Association (NEMA).
   2. National Electrical Code (NEC).
   3. Underwriters' Laboratories, Inc. (UL)
   4. See Section 13301, "Instrumentation Systems Basic Requirements."

B. Qualifications
   1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pressure measurement equipment whose products have been in satisfactory use in similar service for not less than 5 years.
   2. Installer's Qualifications: Qualified with at least 5 years of successful installation experience on projects with pressure measurement equipment similar to that required for this project. An approved manufacturer's representative for the maintenance, installation, and start-up of the level measurement equipment.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and material certifications as required. See Section 13301, "Instrumentation Systems Basic Requirements," for additional submittal requirements, all of which apply.

B. Submit a list of materials giving quantities, manufacturer's name, and catalog numbers.

C. Submit wiring diagrams showing all connections for all equipment furnished under this section.

D. Furnish two certified copies of calibrations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment properly packaged and mounted on pallets or skids to facilitate handling of heavy items. Utilize factory fabricated type containers or wrappings for components which protect equipment from damage.

PART 2 - PRODUCTS

2.1 Gauge Pressure Transmitters

A. Features
   a) Sensing Element. Sealed capacitance sensing with silicone oil fill.
   b) Solid state transmitter.
   c) Two wire operation.
   d) Field serviceable, noninteracting, zero and span controls.
   e) Zero elevation and suppression.
   f) Adjustable dampening.
   g) NEMA 4 housing with 1/4 inch NPT pressure connection.

B. Accessories
   a) Shutoff valve, pulsation dampener, tubing, and fittings.
   b) Manual air release with threaded fitting for attachment of portable calibration unit.
   c) Local indicated reading in engineering units.
   d) Stainless steel tag.

C. Materials.
   a) Sensor Body. 316 stainless steel.
   b) Wetted Parts. 316 stainless steel.

D. Sizes and Ratings.
   a) Overpressure Protection. 2,000 pounds per square inch gauge (psig) minimum.
   b) Accuracy. ±0.2 percent of span.
   c) Ambient Temperature. -20 to 180 degrees Fahrenheit (º F.).
   d) Pressure Input Range.
   e) Signal Output. 4-20 milliampere direct current (mAdc).

E. Manufacturer.
   a) Foxboro.
   b) Siemens.
   c) Rosemount Inc.

2.2 Schedule

Function	Quantity	Range
Pump Discharge Pressure	1	0-150 psi
Pump Suction Pressure	1	0-150psi

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. In the event any discrepancies are discovered, immediately notify the Owner's Representative in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

A. General

1. Install equipment as indicated in accordance with manufacturer's written instructions and in compliance with recognized industry practices.
2. Mount instruments so that they may be readily approached and easily serviced.
3. Install transmitters with local indicators in a position readily observable from the operating area.
4. Pressure Measurement Installation.
    a) Coordinate the installation of pressure sensing devices with the process equipment and contract drawings.
    b) Install manufacturer's supplied cable between level element and transmitter. If flexible conduit is not provided or where conditions dictate, furnish and install rigid conduit sized according to manufacturer's recommendations.
    c) Install ground references as required by the manufacturer for the application.

3.3 FIELD QUALITY CONTROL

A. Upon completion of this portion of the work, the Contractor shall provide for services of a qualified representative of the manufacturer to inspect and approve installation.

B. Upon completion of all inspections and prior to acceptance by Owner, perform field tests outlined in Section 13301, "Instrumentation Systems Basic Requirements."

3.4 CLEANING

A. Pressure Measurement. Each pressure device shall be kept clean and free of dust during the storage, start-up, demonstration, and warranty period.

3.5 DEMONSTRATION

A. Reliable and accurate operation of each pressure sensor and all specified accessories shall be demonstrated. This shall include accuracy, stability, and repeatability as specified over a range inclusive of the maximum (full scale, overflow, high alarm, etc.) and the minimum (low level alarm, low level stop) levels which can occur without operator intervention.

B. Each pressure sensor being demonstrated by the Contractor shall be individually recorded on a 24 hour paper chart. Discrete sensors shall be temporarily connected to provide a recording showing "on-off" changes in the sensor. Recording meters shall be certified accurate, demonstrated accurate, and provided by the Contractor for testing of the provided pressure sensors.

3.6 TRAINING

A. Provide a minimum of one 8-hour day of training to satisfaction of Engineer and Owner

END OF SECTION

SECTION 13315

MAGNETIC FLOW METER

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install a flow metering system, including flow meter assembly, flow indicator, flow recorder and flow totalizer, complete for each pumping station as shown on the drawings and as specified herein.

1.2 QUALITY ASSURANCE

A. Acceptable Manufacturers:
   1. This specification is based on equipment manufactured by Badger Meter, Milwaukee, WI.

1.3 SUBMITTALS TO THE ENGINEER

A. Provide all submittals as required under Section 13301.
B. Submit piping layouts showing the recommended layout of the flow meter for the Engineer's approval.
C. Calibration Certificate.
D. O&M manuals, for distribution to Owner.

1.4 GUARANTEE

A. Submit the equipment manufacturer's warranty to the Engineer for approval.

PART 2 - PRODUCTS

2.1 Meter Schedule

Location	Size	Calibration Range (gpm)	Amplifier Location
NEPZ Connection	6”	0-1500	Integral

2.2 MATERIALS

A. Magnetic Flow Meter:
   1. The magnetic flow meter shall be of the electromagnetic induction type and shall produce a pulsed DC signal directly proportional to and linear with the liquid flow rate. The magnetic flow meter shall be Badger Meter Model ModMAG M2000 per City’s established Standards.
   2. The metering tube (detector) consists of stainless steel tube lined with a non-conductive material. Energized detector coils around tube create a magnetic field across the diameter of the pipe. As a conductive fluid flows

through the magnetic field, a voltage is induced across two electrodes; this voltage is proportional to the average flow velocity of the fluid.

3. The signal amplifier consists of unit which receives, amplifies, and processes the detector's analog signal. Signal is converted to both analog and digital signals that are used to display rate of flow and totalization. Processor controls zero-flow stability, analog and frequency outputs, serial communications and a variety of other parameters. Integrated LCD display indicates rate of flow, forward and reverse totalizers and diagnostic messages. Display guides user through programmable routines.
4. The flow meter system shall operate with a pulsed DC excitation frequency, and shall produce a signal output that is directly proportional and linear with the volumetric flow rate of the liquid flowing through the metering tube. The metering system shall include a metering sensor tube (detector), a signal amplifier, and the necessary connecting wiring. The metering system shall have the ability to incorporate a meter mounted or remote mounted amplifier.
5. The signal amplifier shall be program selectable to display the following units of measure: U.S. gallons, imperial gallons, million gallons (U.S.), cubic feet, cubic meters, liters, hector-liters, oil barrels, pounds, ounces or acre feet.
6. Metering Tube (Detector)
    a) The metering tube (detector) shall be constructed of 316 stainless steel, and rated for a maximum allowable non-shock pressure and temperature for steel pipe flanges, according to ANSI B16.5.
    b) The metering tube (detector) shall be available in line size from ¼" [6 mm] to 54" [1400 mm].
    c) The metering tube (detector) end connections shall be carbon steel or 316 stainless steel flanged, according to ANSI B16, Class 150 and AWWA Class B standards.
    d) The insulating liner material of the metering tube (detector) shall be made of a hard rubber elastomer and NSF-listed for meter sizes 4" and above, and shall be made of Teflon and NSF-listed for meter sizes less than 4" in conformance with manufacturer's recommendation for the intended service or an NSF-listed meter option with PTFE liner.
    e) The metering tube (detector) shall include two self-cleaning measuring electrodes. The electrode material shall be corrosion resistant and available in Alloy C or 316 stainless steel.
    f) The metering tube (detector) shall include a third "empty pipe detection" electrode located in the upper portion of the inside diameter of the flow tube in order to detect an empty pipe condition when the flow tube is running partially empty. Empty pipe detection that is not activated until the pipe is 50% empty is not acceptable.

g) The metering tube (detector) housing shall be constructed of carbon steel, welded at all joints, and rated to meet NEMA 4X/6P (IP66/IP67) ratings.
h) For remote amplifier applications, the metering tube (detector) junction box enclosure shall be constructed of cast aluminum (powder-coated paint) and shall meet NEMA 4X/6P (IP66/IP67) ratings.
i) When installed in non-metallic or internally lined piping, the metering tube (detector) shall be provided with a pair of corrosion resistant grounding rings. The grounding ring material shall be 316 stainless steel.

7. Signal Amplifier
   a) The signal amplifier shall be microprocessor based, and shall energize the detector coils with a digitally controlled pulsed DC. The excitation frequency shall be program selectable for the following: 1Hz, 3.75Hz, 7.5Hz, or 15Hz. (factory optimized to pipe size and application)
   b) The signal amplifier electrical power requirement shall be 85-265VAC, 45-65Hz. The power consumption shall not exceed 15W.
   c) The signal amplifier shall have an ambient temperature rating of -4°F to 140°F [-20°C to 60°C].
   d) The signal amplifier shall include non-volatile memory capable of storing all programmable data and accumulated totalizer values in the event of a power interruption.
   e) Automatic zero stability, low flow cut-off, empty pipe detection and bi-directional flow measurement shall be inherent capabilities of the signal amplifier.
   f) All signal amplifier outputs shall be galvanically isolated to 250 volts.
   g) The signal amplifier and remote junction enclosures shall be constructed of cast aluminum (powder-coated paint) and shall meet NEMA 4X/6P (IP66/IP67) ratings.
8. The signal amplifier shall provide a total of four digital outputs, one analog output and one digital input.
   a) Up to four open collector digital outputs, program selectable from the following: Forward pulse, reverse pulse, AMR pulse, flow set point, empty pipe alarm, flow direction, reset output, error alarm and 24V supply.
   b) Up to two active digital (24 Volt) outputs, program selectable from the following: Forward pulse, reverse pulse, AMR pulse, flow set point, empty pipe alarm, flow direction, preset output, error alarm and 24V supply.

c) Up to two AC solid-state relay outputs, program selectable from the following: Frequency output, flow set point, empty pipe alarm, flow direction, preset amount and error alarm.
d) One digital input, program selectable from the following: Remote reset, batch reset and positive return to zero.
e) Advanced protocol support using Modbus/RTU.
f) One analog output programmable and scalable from the following: 0-10mA, 0-20mA, 2-10mA or 4-20mA. Voltage sourced and isolated. Max. loop resistance = 800 ohms.

9. Control and Programming
   a) The signal amplifier shall be programmed via three function buttons. The programming functions shall be available in a user-friendly, menu driven software through the four-line LCD interface. The signal amplifier shall accommodate the following languages: English, German, Czech, French or Spanish.
   b) Programmable parameters of the amplifier include, but are not limited to: calibration factors, totalizer resets, unit of measure, analog and pulse output scaling, flow-alarm functions, language selection, low-flow cutoff, noise dampening factor and excitation frequency selection.
   c) The signal amplifier shall have a programming option allowing entry of a selected numeric password value for tamper protection.
10. System Performance
   a) The metering system shall operate over a flow range of 0.10 to 39.4 ft/s [0.03 to 12.0 m/s].
   b) The metering system shall perform to an accuracy ± 0.25 percent of rate for velocities greater than 1.64 ft/s [0.50 m/s], ± 0.004 ft/s [± 1 mm/s] for velocities less than 1.64 ft/s [0.50 m/s].
   c) The metering system shall be capable of measuring the volumetric flow rate of liquids having an electrical conductivity as low as 5.0 micromhos per centimeter.
   d) The system measuring repeatability shall be <0.10% of full scale.
11. Indication
   a) The signal amplifier shall include a four-line, 20-character, backlit LCD interface to display the following values:
      i. Flow rate in selectable rate units
      ii. Forward totalizer in selectable volume units
      iii. Reverse totalizer in selectable volume units
      iv. Net totalizer in selectable volume units
      v. Error or alarm messages
      vi. Software revision level

PART 3 - EXECUTION

3.1 GENERAL

A. Equipment

1. Install all equipment in accordance with the manufacturer's instructions.
2. Clean-up and touch-up all work to the satisfaction of the Engineer.
3. Calibrate the flow meter to the satisfaction of the Owner.
4. Provide one (l) day (up to eight (8) hours) of start-up assistance, installation certification, and operator training to the satisfaction of the Engineer and Owner by a qualified service representative.

END OF SECTION

SECTION 13360

INSTRUMENTATION AND CONTROL SYSTEM

PART 1- GENERAL

1.1 SCOPE

A. The contractor shall provide the labor, tools, equipment and material necessary to furnish and install the complete instrumentation and control system as specified herein and as shown on the contract drawings including but not limited to:
   1. New PLC-based remote terminal unit (RTU) complete with operator interface terminal, hardware and software as described herein and shown on the drawings.
   2. The new RTU shall communicate with the existing pump station RTU over new fiber optic link as shown on the drawings.
   3. All software and programming requirements including interfacing between the new RTU and the existing Lowell Ave WTP main PLC and the City wide SCADA system and data base reconfiguration to incorporate the new controls and monitoring functions for the new tank shall be provided by the project integrator.
   4. all necessary hardware and software to interface with the existing SCADA system as required.
   5. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, or other devices to interface with new and existing equipment shall be included whether specified or not.

B. Installation.

C. Operator training.

1.2 RELATED DOCUMENTS

A. General. Drawings and general provisions of the Contract, including General and Supplementary Conditions and division 1 specifications, apply to this section.

B. Related Sections. The following sections contain requirements that relate to this section.
   1. Division 16000, "Electrical Work"
   2. Section 13301, “Instrumentation Systems Basic Requirements”.
   3. Section 13305, “Level Measurement”.
   4. Section 13310, “Pressure Measurement”.
   5. Section 13315, “Magnetic Flowmeter”

1.3 GENERAL REQUIREMENTS

A. The Contractor's attention is directed to the fact that the new RTUs and instrumentation is an integrated system and as such shall be furnished by one hardware supplier, whom shall provide all of the equipment and appurtenances specified under this section regardless of manufacturer and accept responsibility

for satisfactory operation of the system. The Contractor is responsible for installing the control panel and associated equipment and to include all necessary power and data cable to provide a complete working system. An input/output (I/O) listing of all digital and analog signals at each remote pump station is shown on the instrumentation drawings which shall be integrated as part of the complete control system. These connections shall be to I/O provided at the RTU panel.

B. The Integrator shall supply a completely integrated, microprocessor based system design specifically for the monitor and control of various digital and analog functions at the tank as shown on the drawings. This shall include interfacing with the existing SCADA system. The system shall be user programmable and allow manual and or automatic control of equipment based on a variety of control parameters. The system shall provide for dedicated display and control of individual devices.

C. No system shall be considered for approval or accepted which does not wholly fulfill the intent and requirements of the functional description, hardware and software system as specified. Acceptance of an equal system must be by written acceptance of the engineer. The engineer reserves the right to request a full demonstration of any hardware, software, or other products which are submitted as approved equals prior to approval.

D. The PLC/RTU function is that of a control and monitoring system. However, it must be designed with flexibility to accommodate field changes and commissioned in accordance with this specification. Documentation drawings and spare parts shall be provided.

E. The Specifications and Drawings outline certain characteristics of the monitoring and control system but do not set forth all the details of system design and the various functions and equipment required. All equipment shall be complete with all necessary software, accessories, and appurtenances required for a properly operating system including all items recommended by respective manufacturers and not herein specified.

F. The CONTRACTOR shall assume complete system responsibility through the system integrator, and provide all necessary coordination with any and all subcontractors.

G. The CONTRACTOR shall coordinate the work of the system integrator for the installation, interconnection, testing, and calibration of the instruments, and the scheduling of the system integrator's personnel. The system integrator shall be responsible for assuring himself that this equipment properly meets the functional intent of the specifications. Substitutions on functions specified are not acceptable.

H. The system integrator shall provide the services of an experienced Project Manager as the overall coordinator during the course of the project. The supplier shall describe in detail the project management provided to the satisfaction of the ENGINEER.

I. The system integrator shall be required to demonstrate a minimum of ten years recent, past experience in the design, integration, and commissioning of SCADA, instrumentation and control system, at least five projects of comparable size, type,

and complexity to the proposed project. The system integrator supplier shall submit to the OWNER, a copy of his Quality Assurance Manual for review. The manual shall include, but not be limited to, a listing of recent completed projects as described above.

J. The system integrator shall have in his employ the capable personnel for detail engineering, coordination, drafting, procurement and expediting, scheduling construction, testing, inspection, installation, start-up service for calibration and commissioning, and warranty compliance for the period specified.

K. The ENGINEER upon written notice of at least one week's time may arrange to visit the system integrator's facility to review the progress of the project.

1.4 EXCEPTIONS AND ALTERNATIVES

A. The manufacturer shall offer a system in accordance with this specification. No exceptions written or implied will be made and the vendor shall be capable of meeting this specification as written.

B. Should any of the specified manufacturers offer alternatives, equipment or materials, he shall do so in accordance with the specifications and he shall through the shop drawing approval, list each alternative separately defining the advantages of the alternative and the impact on the overall system configuration. The manufacturer shall provide proof that the use of alternatives would improve control system performance and reduce operating and maintenance costs.

C. Where alternates are approved by the engineer and executed, the Contractor will be held responsible for all structural, mechanical, and electrical changes required for the installation of substituted items at no additional cost to the Owner.

1.5 QUALITY ASSURANCE

A. Reference Standards.

1. National Electrical Manufacturers Association (NEMA) Compliance.
2. National Electric Code (NEC) Compliance.
3. Instrument Society of America (ISA).
4. Institute of Electrical and Electronic Engineers IEEE).
5. Underwriters' Laboratories, Inc. (UL) Compliance and Labeling. Comply with provisions of UL safety standards pertaining to process controller equipment. Provide products and components which have been UL listed and labeled.

1.6 GUARANTEE

A. The complete system shall be guaranteed to meet or exceed the design requirements of the specifications and the drawings.

B. Equipment, software, and materials which do not achieve design requirements after installation shall be replaced or modified by the Contractor to attain compliance, at no additional cost to the Owner.

C. All equipment shall be guaranteed for twelve (12) months from date of Substantial Completion as defined by Engineer.

1.7 EXPANDABILITY

A. The system proposed shall be configurable to provide for minor changes and additions during manufacturing, installation, and commissioning phases, and on-site by the Owner's operating personnel.

1.8 SUBMITTALS

A. Submit six (6) sets of shop drawings prior to start of project construction to insure proper coordination between the various trades.

B. Shop drawings are to be complete including details of connections, wiring, piping, size, and dimensions. When correct fabrication of equipment depends upon field measurements, make such measurements and note such dimensions on the drawings prior to submittal for approval.

C. Complete instrument and control system block diagrams, showing in schematic form, the interconnections between major hardware components. The block diagram shall reflect the total integration of all digital and analog devices in the system. The diagram shall reference all interconnecting cabling requirements for digital components of the system including any data communications links.

D. Drawings of equipment to be supplied shall include, as a minimum, overall dimensional details for each unit including installation arrangements and door mounted operator devices including nameplate designations. Wiring diagrams of panel and other system equipment including field device connections shall be included and specific installation wiring responsibilities identified.

E. Software submittals shall provide a complete description of the system on a functional level. It is not the intent of this documentation to describe the individual programs.

F. At the time of shop drawing submittal or prior to uploading programming to the PLCs and OITs, provide six (6) color copies of all of the proposed OIT screens for each RTU for review and approval by the Engineer and Owner. Changes requested by the Engineer and Owner pertaining to the appearance of the screens or to the number of significant digits or units of the displayed values shall be performed at no additional cost to the Owner.

1.9 TESTING AND TRAINING REQUIREMENTS

A. Job Site Demonstration

1. Following final installation and calibration of the system, the integrator shall perform a demonstration of system performance. Satisfactory performance shall require the system to perform control functions, monitoring and display functions, alarming, and printout functions for a period of not less than one (1) month of continuous operation. During this demonstration, any system failure or software-related problem shall be corrected and the demonstration resumed. Acceptance of the control system by the owner shall require that the system operates continuously for a period of one (1) month without non-field or field repairable hardware or software interruption. Substantial completion shall not be

awarded until after the contractor has successfully completed the above required test.

B. Training

1. The integrator shall include at the site, operator and maintenance training for the Owner's personnel for five one-day periods, three days after start-up and two days at a later date, after the system has been in operation. The training shall be videoed with two (2) copies being provided to the Owner and shall include system operation, programming procedures set point changes and hands-on instructions utilizing the Owner's system.

C. System Calibration and Start-up

1. The integrator shall provide the initial calibration and start-up of the control system to perform the following:
   a. Supervise the installation and verify the final connections of all signal and power wiring to and from the control system.
   b. Perform all hardware calibration and diagnostic tests, and make all necessary equipment connections.
   c. Perform all configuration system tests, including diagnostics.
   d. Perform the acceptance test as described in the "Job Site Demonstration" section of this specification.
   e. Test the operation of the Communications Control System and Input/Output Subsystem.
   f. Verify the displays and functions of the control System at operator interface terminal. The screens shall be configured to represent the equipment graphics similar to the existing equipment graphics per the owner's requirements.

1.10 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall furnish via the vendor, six copies of clear, typewritten, easy-to-understand, tightly bound, hard cover instruction manuals for daily operation and maintenance of the system. Specifically, the manuals shall contain explicit instructions and well-diagramed procedures for process operations, loop tuning, and systems maintenance. The instruction manuals shall include as a minimum the following information.

1. Photographs and data sheets of major system components.
2. Input/Output terminal diagrams.
3. Logic and block diagrams.
4. Manufacturer-published operation and maintenance instructions on all equipment.
5. Description of systems operation.
6. Configuration language description.
7. Names, addresses, and telephone numbers of local equipment manufacturer representatives for each device in the system.
8. All the final application programs including the ladder logic diagrams and documentation on thumb drives.

1.11 SPARE PARTS

A. The manufacturer's recommended spare parts shall be supplied with the system along with the following items if they are not part of the recommended spares.

1. One spare I/O module for each modular digital input, digital output, analog input and analog output used within the system.
2. One spare power supply for each type used in the PLC panel.
4. Ten fuses of each type used by the system.
5. Ten indicating lamps used at panels.

1.12 FUNCTIONAL DESCRIPTION – APPLICATION PROGRAMS

A. New RTU @ Booster Pump Station:

1. Control
   a. The Booster Pump Station shall pump water from the Composite Elevated Tank in the Main Pressure Zone (MPZ) to the North End Pressure Zone (NEPZ).
   b. The station shall also have the ability to control flow from the NEPZ to the MPZ through a pressure reducing control valve.
2. Pump VFD Controllers
   a. The SCADA/PLC shall provide controls for automatic operation of the booster pumps as described herein.
   b. A HOA switch shall be provided for each booster pump VFD with "Not in Auto" status contacts. When the local HOA switch is in Hand the pump shall run with speed controlled via the VFD speed pot. When each HOA switch is in Auto the pump shall run based on SCADA control.
   c. The PLC shall have software HOA switches for each of the booster pumps. When the software switch is in Hand the pump shall start and the VFD speed shall be based on a software adjustable speed setting. When the software switch is in Auto mode the pump shall start automatically when composite elevated tank activation is called for by SCADA, and the VFD speed shall be automatically adjusted to maintain a constant speed setpoint. The Operator will set the desired speed setpoint to achieve the desired flowrate.
   d. A fault contact at each booster pump VFD will send a fault alarm to SCADA.
   e. A fail alarm shall be activated if the booster pump is commanded to start by the PLC but a run contact does not indicate the pump is activated after an adjustable delay period.
3. Duplex station w/simplex operation - duty/standby: one pump operates, with second pump in standby.
   a. Auto control sequence - Tank level mode
      i. Duty pump starts when NEPZ tank water level falls to "pump on" setpoint. Tank level signal shall be received from the SCADA MTU over radio channel.

ii. If the tank level continues to fall, the standby pump starts when tank level falls to the "standby pump start/low level water alarm" (except when backup generator is running at which only one pump is allowed to operate at a time).

iii. Duty pump and standby pump operate at constant speed (target speed to be set by operator via SCADA) to the tank level "pump off" set point.

iv. Pumps shall automatically alternate with each pump cycle to equalize the wear on each pump.

b. Auto control sequence - pressure mode (loss of tank level only)

i. Upon loss of the tank level signal, the controls shall automatically revert to pressure control receiving the system pressure from the gauge pressure transmitter located on the pump discharge header. The SCADA shall control the VFD of the duty pump to maintain a constant discharge pressure (operator adjustable, initial = 100 psi).

ii. Upon return of the tank level signal, the controls shall automatically revert to "Tank level mode".

4. Pressure Reducing Control Valve

a. The pressure reducing valve shall be Cla-Val 133-AV, or equal.

b. The valve shall be equipped with a NC solenoid valve. When the solenoid is activated the valve will be able to open and perform its standard pressure reducing function.

c. The solenoid shall be controlled manually from the pump control panel or remotely through SCADA.

d. The valve shall allow flow from the High Pressure Zone (HPZ) to the Main Pressure Zone (MPZ).

5. Flowmeters

a. The booster pump flow rate will be measured by an electromagnetic flowmeter provided in the station.

b. Flow in the reverse direction from the HPZ to the MPZ shall also be measured.

c. The PLC shall monitor flow and keep a running totalized volume in each direction.

d. A low flow alarm with time delay shall be provided by the PLC if the flow rate drops below an adjustable low flow setpoint while the booster pump(s) are operating. The low flow alarm will be interlocked to shut down the associated pump.

6. Pressure Indicator

a. The pressure in the suction head and in the discharge will be measured and displayed by a pressure indicator transmitter.

b. The PLC will generate a low water pressure alarm if the measured pressure drops below an adjustable alarm set point for an adjustable time delay period.

c. The PLC will generate a high water pressure alarm if the measured pressure rises above an adjustable alarm setpoint.

7. Tank Level Indicators
   a. A level transducer will monitor tank level by measuring pressure in the tank. A level indicator transmitter will display the tank level.
   b. A low level alarm will be activated if the measured water level in the tank drops below the low level setpoint.
   c. A high level alarm will be activated if the measured water level in the tank increases above the high level setpoint.
   d. A feature shall be added to SCADA to allow the operator to select which tank in the main pressure zone (Garrison or new CET) is the active tank for purposes of controlling the well pumps and treatment plants.
8. SCADA via RTU shall provide the following alarms, status, and controls:
   a. Booster pumps 1 and 2: pump run/stop status
   b. Booster pumps 1 and 2: pump start/stop command
   c. Booster pumps 1 and 2: pump local HOA switch status
   d. Booster pumps 1 and 2: pump fail and VFD fault alarm
   e. Booster pumps 1 and 2: pump elapsed time meter (hours)
   f. Booster pumps 1 and 2: pump speed (0 to 100%)
   g. Suction Pressure
   h. Discharge Pressure
   i. Tank: level
   j. Tank: low level and high level alarms
   k. Booster pump flow: rate and total flow
   l. Reverse flow: rate and total flow
   m. Booster pump: low flow alarm
   n. Station flood alarm
   o. Fire alarm
   p. Intrusion alarm
   q. Low and high temperature alarm
   r. Loss of power alarm
   s. High discharge pressure alarm
   t. Low suction pressure alarm
   u. Pressure Reducing Valve open
   v. Pressure Reducing Valve shut
   w. Mixer: start/stop, status and fail alarms
   x. Active tank for control of well pumps

PART 2- PRODUCTS

2.1 SYSTEM HARDWARE

A. RTU Panel

1. The panel shall be pre-assembled, pre-wired, and include all the necessary controls as specified herein and shown on the drawings. The Contractor

shall take full responsibility for unloading the panel and moving it into place as shown on the drawings.

2. The panel shall consist of wall mounted, non-modular assembly. The panel shall be NEMA 12 steel construction. Total access shall be available from the front with access door to all interior wiring and components.
3. Wiring shall be general purpose, open type, neatly bundled and laced or installed in plastic wiring troughs. Wire shall be No. 16 AWG minimum with 300 volt, 75°C rated thermoplastic insulation. Wiring shall comply with the latest Electrical Code. Power and low voltage DC signal wiring shall be routed in separate wiring troughs. Parallel troughs of different systems shall be separated by a minimum of six inches.
4. All panel wiring to external equipment shall be terminated on screw-type terminal strips. Terminal blocks shall be arranged in vertical rows and separated into groups (power, AC control, DC signal, etc.). All terminals shall be labeled or otherwise identified for field connections. The terminal strips shall be provided with a minimum of 25 percent spares.
5. The panel shall be provided with adequate size UPS and surge protection on incoming 120VAC power.
7. The complete panel shall be UL 508 listed and labeled.

B. Power Conditioning

1. Solid state and microprocessor based equipment, shall be protected by transient voltage surge suppressors to protect against power line spikes, surges, and transients.
2. Transient voltage surge suppressors shall be suitable for nominal 120 volt operation, have a minimum suppressed amperage of 21,000 amps for 20 microseconds. The suppressor shall have a minimum pulse current capability of 6500 amperes and a response time of not more than five seconds.
3. Transient voltage surge suppressors shall meet UL 1449 for Surge Suppression and IEEE 587 Guidelines for Surge Voltages.
4. Transient voltage surge suppressors shall be Model 51020-WM as manufactured by Leviton, Inc. or approved equal.
5. Provide an uninterruptible power supply UPS sized for panel load and wired to all PLC, OIT, two wire transmitters and related equipment. It shall be noted that during a normal loss of power and upon restoration of power the alarm equipment shall not be alarmed unless the device is in an actual alarm state.

C. Lightning/surge protection:

1. General:
   a. Lightning/surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines. The protection systems shall be such that the protective level shall not interfere with normal operation,

2. Signal line:
   a. All signal lines when they enter or leave a building shall be protected through the use of gas tube surge arresters, and Zener diode protectors. These shall be provided at both ends of the signal lines and as close to the instruments as possible. The protectors shall be MCG type DEP or approved equal.

D. PLC:
1. The PLC shall include memory and software to allow customer configurable programming in the field. Reprogramming shall be either by downloading from the SCADA computer over the communications channel or through the use of the programming unit to all PLC's.
2. The PLC shall control its local process through the use of an integral processor and modular real-time process control software.
3. The PLC shall be capable of communicating with the master PLC in continuous polling mode and shall be provided with built-in communication modem.
4. All Status inputs to the PLC shall be optically isolated.
5. Interposing relays for control output shall be provided with a minimal contact rating of 10 amps at 120 VAC.
6. The PLC shall be provided with two serial ports for communications with the portable computer and radio communication protocol.
7. Built-in real time clock and calendar which maintain the time and ate accurately through a power failure.
8. Operates from DC power which may vary from 12 to 30 Vdc. A 120 Vac source shall be the only power to the PLC.
9. The PLC shall have an operating temperature range of 0 to 55°C.
10. Runs comprehensive self-test diagnostics at power on, or upon command via the network, which verify the integrity of the PLC and its I/O hardware.
11. Includes watchdog circuitry which detects a failure of either the PLC hardware or software and provides an output signal if such a failure occurs.
12. Supports all industry standard communications baud rates from 300 baud to 38.4K baud. The communications rate shall be easily configurable by the user, and be compatible with the communication interface, i.e. modem, radio, etc.
13. Supports peer-to-peer network operation, allowing for PLC to PLC and host computer to PLC communications.
14. Uses an error detection and correction protocol for error-free communications over twisted pair wires, telephone leased lines, commercial telephone service, and radio data links.
15. Error detection protocol supports both character and block error checking with automatic error recovery.

16. Standard off-the-shelf communications software shall be available for an IBM/PC compatible computer which supports this protocol without writing custom drivers and interface software.
17. The PLC microprocessor software, configuration information and logged data shall be maintained in battery backed CMOS RAM memory, with a service life of ten years or greater.
18. User programmable to support custom logic functions using relay ladder logic.
19. Capable of performing control and data collection tasks as a stand-alone device, on-line or off-line from the communications network.
20. The PLC shall have the ability to have its programming and configuration software updated or replaced by download through the network communications port; either locally, or remotely (via the network) without local operator intervention.
21. All critical setpoints, time values and operating parameters shall be user configurable and retained in non-volatile memory.
22. Supports operation with the specified SCADA software operating on an IBM/PC compatible computer. The SCADA software driver must be currently available, not requiring custom programming for this project.
23. All PLC I/O and Power connections shall use high quality removable plug-on connectors for ease of installation and maintenance, and rapid field replacement.
24. The PLC shall be capable of supporting a minimum of 32 digital I/O points. Each digital point shall be easily field configurable for operation at either 24 Vdc or 120 Vac. Outputs shall be of solid state design, capable of switching loads of up to 3 Amps. All digital I/O points shall be fully optically isolated.
25. The PLC shall be capable of supporting up to 8 analog inputs and 4 analog outputs. Each analog input shall have 10-bit resolution, and shall be easily user configurable to support 0-1 Vdc, 0-10 Vdc, and a 4-20 mA. Input signal ranges, individually settable by channel. All analog inputs shall be fully isolated differential types, capable of rejecting electrical interference normally associated with industrial equipment including, but not limited to transformers, motor starters contactors, and electrical heaters. The analog outputs shall be configured for current loop operation (0-20 mA/4-20 mA).
26. The processor shall include additional instructions including PID messaging, selectable timed interrupts, floating-point math and on-line programming. The CPU shall be capable of at least 256 digital I/O of any mix. The SAU time shall be no greater than 2.5 MS/K of logic. In addition the processor shall support reading of writing ASCII strings.
27. The PLC shall perform all on-line local control functions by means of a control program maintained within the unit's memory. In the event of a system or communications failure, it shall continue to control its assigned process and shall store all necessary data for transmission when

communication resumes. It shall also be capable of store and forward message functionality for radio telemetry applications.

28. The MTU PLC shall function as the overall system coordinator, controller, telemetry master, and shall be provided with standard protocol for communication with remote units.
29. All new PLCs shall be Allen-Bradley CompactLogix series.

E. Operator Interface Terminal (OIT):
1. The new RTU shall be equipped with an operator interface terminal (OIT) for control and monitoring of the related process equipment as described in the functional description. The OIT shall permit direct editing and monitoring of the application software such as programming relays, timers, counters, latches, sequences, shift registers, data transfers, PID loops, and arithmetic calculation functions. In addition, the unit shall allow the plant operator to start/stop equipment, set target speed for variable speed pumps, open/close monitor operated valves and adjust process set points as required. The OITs shall be Allen-Bradley Panelview 1000, color, touch screen or an approved equal unit.
2. The following screens shall be configured at each OIT:
    - Main menu
    - Overall system screen
    - Required screens for the local process equipment controls and monitoring functions similar to those configured at the SCADA HMI screens.
    - Required screens for all process set points and interlock functions.
    - Required screens for the pressure mode PID loop and setpoints.
    - Intrusion alarm functions screen (armed, disarmed, password entry, etc.).
    - Screens for last 24-hour alarms.
    - Help screen.

F. Smoke/heat Detector (station fire alarm):
1. Provide photoelectric type smoke and heat detectors with status flashing LED, 120VAC power input, battery backup and dry contact closure for connection to the RTUs as shown on the drawings.
2. Simplex or equal.

G. Temperature Transmitter (Ambient temp):
1. Provide two-wire type temperature indicator-transmitter as shown on the drawings. The transmitter shall output a 4-20madc signal proportional to the measured ambient temperature for connection to the RTU.
2. Honeywell or equal.

H. Magnetic Door Contacts (station intrusion alarm)
1. Provide magnetic type door contacts for connection to the RTU as shown on the drawings. The armed/disarmed functions shall be through the RTU operator interface unit.
2. Simplex or equal.

I. Fiber Optic System:

1. Fiber optic system including the fiber optic cables, modules, and couplers shall be provided between the raw water pump station and the treatment facility as indicated on the drawings.

   All equipment shall be industry standards and shall include the following components:

   a. Fiber to Ethernet converters.
   b. Fiber optic cables, multimode, OM2, 6 fiber, industrial construction and suitable for underground, wet locations.
   c. ST-style connectors.
   d. Predetermined fiber cable with pulling eye kit

J. PLC Software:

1. PLC software shall consist of automatic analog monitoring logic, operator interface logic, alarm logic, and computer interfaces.
2. PLC software shall include arrangement of storage registers to hold necessary data to update displays, initiate alarms, and store comments and setpoints from the data input device. The data shall be organized to provide optimum data transmission time and system response time.
3. All PLC software shall be written in an easily understandable, organized manner resulting in efficient use of memory and rapid scan time.
4. The system shall be configured to ensure that all controlled variables and output signals are updated at an interval not greater than once every half-second.

K. Report Generation System:

1. Reports Formatting: Support all required logging and reporting. All logs, reports, and printouts will be free form, that is, the headings and format will be programmed and printed at time of generation. Preprinted sheets are unacceptable. Basic logs, reports, and printouts, are described herein, to give system supplier a general description of the quantity, complexity, and types. Final format and variables printed shall be developed by Engineer and Owner with system supplier. Any calculations required shall be made at the time of printing. Each page of the report shall have the name of the facility, type of report, time and date the report was prepared, and page number. All logs and summary reports, with the exception of the alarm and equipment status logs, shall be allowed to be initiated manually and canceled from central operator's console.

   a. Commands, Controls, and Set Points: The system shall be designed to enhance plant operation by centralizing the supervisory operator's activities. The operator shall have the capability of changing the values of analog signals, set points, and digital signals.
   b. Equipment Maintenance Scheduling: Provide maintenance scheduling for selected equipment and process units with operating time accumulation and periodic printout on the basis of either calendar or running time milestones. The software shall enable the operator to

forecast and schedule maintenance tasks and alert operations when scheduled tasks are overdue.

c. The maintenance logs shall be provided for process equipment such as pumps, blowers, drives, generators, and any equipment, which provides "run" status signal to the SCADA system.

a. Real variables processing: The equipment supplier shall supply real variables to represent process data for which there are analog signal inputs to the system. System to sample each of these input signals at its selected scan rates, and perform proper conversions and scaling to obtain instantaneous engineering values. These values then to be used to update real-time data on CRT displays, check for alarm conditions, and store for use with average calculations.

   Each hour the average of each of the variables to be calculated and stored along with the maximum and minimum values for the hour and totals where applicable.

   Each day the daily average value of each of the variables to be calculated and stored along with the maximum and minimum value for the day with time of occurrence, and totals if applicable. These data to be stored for at least 100 days.

   1. Instantaneous Values: Instantaneous values of all process control variable data are to be stored at the required scan rates and are to be available for use by the control algorithm at its "run" frequency.
   2. Instantaneous values of all variable data to be stored for at least one hour in resident memory. Individual one-minute averages to be used for real time trending; individual one-hour averages to be stored and used for daily reports.
   3. Variables: Variables, such as rate of flow, weight, and kilowatt usage, have their instantaneous values integrated with respect to time and the quantities totaled. Storage of each of these totals to be as follows:

      Current hourly total; each hourly total for 24 hours; each daily total for 40 days.
   4. Alarms: alarm conditions to be stored for up to 24 hours. In addition, an alarm description, time of occurrence, and time of return to normal also be stored. The intent is to accumulate a daily (24-hour) alarm summary for printout or display.
   5. Calculated Variables Processing: Calculated variables are to be provided to represent process parameters for which there are no direct analog inputs to the system. These variables to utilize real variables, and manually entered constants or laboratory data to compute their value. Examples of calculated variables are metering pumps where speed times known displacement integrated with respect to times becomes flow quantity in engineering units.

6. Support Software: Support system software shall consists of utility programs which permit the operator to transfer the data from master computer into portable computer for use in Windows 7 while the system is still actively controlling the process.
7. Security and Access: A security and access system shall be provided which will provide a method by which access to all or part of the distributed data base may be granted or restricted. This system checks that all function requests issued from the operator's console work station have an associated access code of sufficient authority to allow the request to be granted.

b. The system shall be capable of extracting the stored historical data into spreadsheet Excel file for further analysis and calculations for final report printing. The extraction process shall at a minimum, include the following mathematical functions: last value, standard deviation, area under survey, range, average, square root, maximum, minimum, and average for daily, weekly, monthly, and yearly reports. The final format of all reports shall be developed by the Engineer, Owner, and supplier during shop drawing process.

c. The system shall provide historical data recording of identified data points. The data file shall be user-selectable as daily, weekly, monthly, or yearly for each point recorded. Each point shall have an individual enable/disable of historical recording. The historical recording shall use a compression deadband technique to reduce the frequency and amount of data recorded when insignificant fluctuation in data occurs. The system shall utilize a preconfigured program template. The template shall allow the user an easy access and manipulation of the following: tag names, start time and date, engineering unit, color, scale, and grid.

L. Alarm System:

1. An alarm system shall be provided which monitors and reports all alarm conditions. Alarms and return-to-normal transition reports from the remote process controllers shall be collected at the operator's console. Upon receipt of these alarm reports, the console shall perform several automatic operations, which provide an interface for allowing the operator to interact with these alarm conditions.
2. Alarm classes shall be established at system configuration for those analog or logical signals that are assigned alarm limits, marginal or failed communication link and failure of a hardware device such as CRT, printers, input/output module or other major devices.
   The alarm system will have three classes of alarms; critical, non-critical, and process.
3. An audible alarm shall be activated whenever the operator's console receives an alarm report that must be acknowledged by the operator. To silence the audible alarm, the operator depresses the audible silence

function key on the work station keyboard. Silencing the alarm, however, does not constitute alarm acknowledgment.

M. Trending System:

1. Real-time trend displays shall plot samples of the selected points in a x-y format. A trend page shall consist of at least four trend plots with each plot using its unique color. The user shall be able to request exact numeric values for any point in the trend by moving an arrow to the point in the graphic. Provisions shall be made so that the points and scan frequency shall be assignable by the operator from display.
2. All analog signals stored at the database shall be extracted for monitoring and trending at SCADA computer. Minimum, maximum, and average values for hours, daily, or weekly trends shall be provided as required.
3. Provision shall be made for storing historical data and to recall that data on CRT for historical trending and display purposes.

N. Display System:

1. The system shall be designed to provide for the display of process graphics. These displays shall be the primary means by which real time process information shall be presented to the operator at the operator's console. The displays shall be generated by collecting data from throughout the plant and the remote sites. The displays of process graphics are to be configured during the shop drawing phase of the work in conjunction with the owner and the engineer.
2. All graphic pictures and characters must be editable by the operator from the operator station while the system remains on line. Graphic pages shall be called to the screen by their number, name, or from a menu of available pages.
3. The following custom graphics screens for the new tank/RTU shall be similar in style to existing SCADA screens in Dover and be configured as a minimum in addition to those required by the system:
   a. Screens for representing the tank process equipment:
      - Pump symbol and process piping.
      - Pump status.
      - Pump target speed.
      - Pump fail
      - Pump run time.
      - Pump software HOA selector switch.
      - Pump control setpoints.
      - Pump interlocks and override switches.
      - Mixer status.
      - Mixer fail,
      - Control Valve open/close status
      - Control valve software HAO and open/close controls.
      - Flow rates.
      - Tank level
      - Pump suction pressure.

- Pump discharge pressure.
- Fire Alarm.
- Intrusion alarm.
- Flood alarm.
- Mixer status and fail.

b. Two screens for plant miscellaneous process and non-process systems.

c. Two system help screens. One shall be an operator help display that provides a summary of basic keyboard functions designed to prompt an operator regarding system access and control. The second shall be a supervisor help display that provides a listing of commands to allow alarm, trending and display modifications.

d. PLC status displays: These displays shall show the PLC, and depict operational status of each module within the PLC throughout the system.

e. Communication link status displays: This display shall provide communication statistics alongside a pictorial representation of each communication link.

f. Each graphic display shall be provided with dynamic symbols to present equipment symbol and status (run, off, fail) process variables (flow, level, pressure, speed, analytical, etc., in engineering unit provided with flow control valve, gauge pressure, wet well, etc., symbols), control setpoints, analog limits, process and non-process alarm. In addition, system shall have the ability to print selected graphic displays including graphic symbols and parameters.

g. Preconfigured control displays for pump control, pump alternation and time of day control shall be provided for the equipment controlled from the SCADA system. As minimum the displays shall include the following: H-O-A local/remote control, start/stop setpoints, start/stop/fail over-ride, run time process variables (volume, totalization, etc.). Control displays shall be presented in a separate window allowing quick access while all other programs continue execution.

h. Alarm trending and log displays as specified herein.

i. One screen for process interlocks and override functions.

j. The final format and orientation of graphic displays shall be developed between ENGINEER, OWNER, and SYSTEM INTEGRATOR during software shop drawing process.

PART 3 EXECUTIONS

3.1 INSTALLATION

A. Prior to all work of this section, carefully inspect the existing facilities and install work of all other trades and verify that all such work is complete to the point where installation may properly commence.

B. The equipment shall be installed in accordance with the manufacturer's instructions and located as shown on the drawings, or as approved by the engineer. Local electrical shutoffs for power supplies to equipment shall be provided.

C. Discrepancies:

1. In the event of discrepancy, immediately notify the engineer.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

D. The control system and accessory equipment shall be installed in accordance with the manufacturer's instructions and located as shown on the drawings or as approved by the engineer.

E. It shall be the responsibility of the manufacturer of this section to ensure compatibility with existing system. If additional equipment or wiring is necessary, it shall be done at no cost to the owner.

3.2 MANUFACTURER'S SERVICES

A. The contractor shall furnish the services of the manufacturer's serviceman, all special tools, calibration equipment and labor required for the following:

1. Checking the installation of all components before power is applied.
2. Placing the software and hardware into operation and making necessary adjustment.

B. Should the equipment fail to operate in accordance with the specifications and manufacturer's data, corrective measures shall be taken by the contractor or the defective equipment shall be removed and replaced with equipment which will satisfy the specified conditions.

C. When all required approvals of this portion of the work have been obtained, and at a time designated by the owner, thoroughly demonstrate to the owner's maintenance personnel the operation and maintenance of all items installed under the work of this section.

3.3 INSPECTION

A. Installation: Supervision and assistance to ensure that proper procedures are followed during installation of the system.

B. Start-up: Energize and verify correct and satisfactory operation of all components of the system. This operation shall include verification of the accuracy of all inter-equipment wiring.

C. Subsystem Commissioning: Place into operation all component subsystems. This operation shall include loading and placing into operation all CPU software and

calibration of all system inputs and outputs. Simulation of system inputs and outputs that are not operational during this subsystem commissioning phase shall be allowed provided that all of these simulated inputs/outputs shall be subsequently verified during the system commissioning operation.

D. System Commissioning: Calibrate and place into operation the complete system. The validity of all data base information in the system shall be checked and corrected as part of this operation. Calibration of all process control loops external to the equipment being supplied by other equipment suppliers will be the responsibility of the contractor prior to system commissioning.

E. Additional programming services: Provide 40 hours of additional programming services to change/modify the application programs beyond those required by the functional description as specified. The 40 hours of additional programming services shall be logged separately from the required start-up services. Any unused hours will be deferred to future training as scheduled by the Owner.

END OF SECTION

SECTION 13440

COMPOSITE ELEVATED WATER STORAGE TANK

PART 1 – GENERAL

1.1. WORK INCLUDED

A. This section includes the design, construction, testing, and commissioning of a Composite Elevated Tank and related work including foundations, mechanical, electrical and appurtenances.

B. Work shall comply with AWWA D107 unless otherwise specified.

1.2. RELATED DOCUMENTS

A. Drawings and the general provisions of the Project Manual, including General Conditions, Supplemental Conditions and Special Provisions apply to work in this section.

B. Related Sections Include:

1. Division 1 - General
2. Division 2 - Site Work
3. Division 3 - Concrete
4. Division 9 - Coatings
5. Division 11 - Equipment
6. Division 13 - Instrumentation
7. Division 16 - Electrical

1.3. EVALUATION AND AWARD OF CONTRACT

A. Owner reserves the right to award the contract based on an evaluated bid analysis, not on the low bid.

B. Owner will be the sole judge with respect to the evaluation.

C. Evaluations will consider proposal submittals, capital cost and maintenance costs.

1.4. REFERENCES:

The following Specifications, Codes and Standards are referenced in this section. The most recent version shall apply.

ACI 117	Specifications for Tolerances for Concrete Construction Materials
ACI 228.1R-03	In-Place Methods to Estimate Concrete Strength
ACI 301.5	Specification for Structural Concrete
ACI 304	Guide for Measuring, Mixing, Transporting and Placing Concrete
ACI 305.1	Hot Weather Concreting
ACI 306.1	Cold Weather Concreting
ACI 318	Building Code Requirements for Structural Concrete
ACI 347	Guide to Formwork for Concrete
ACI 371R-08	Guide for the Analysis, Design and Construction of Elevated Concrete and Composite Steel-Concrete Water Storage Tanks

AISC 360	Specification for Structural Steel Buildings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ASCE 7-10	Minimum Design Loads for Buildings and Other Structures
ASTM A 123	Zinc Coatings on Iron and Steel Products
ASTM A 240	Stainless Steel Plate, Sheet and Strip for Pressure Vessels
ASTM A 285	Pressure Vessel Plates, Carbon Steel
ASTM A 774	Welded Stainless-Steel Fittings
ASTM A 778	Welded Stainless-Steel Tubular Products
AWWA D100	Welded Steel Tanks for Water Storage
AWWA D102	Coating Steel Water Storage Tanks
AWWA D107	Composite Elevated Tanks for Water Storage
AWWA C652	Disinfection of Water Storage Facilities
AC 70/7460-1L	Obstruction Marking and Lighting
NACE RP0178	Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be Lined for Immersion Service
NFPA NEC	National Electric Code
NFPA 780	Standard for the Installation of Lightning Protection Systems
NSF 61	Standard for Drinking Water System Components
OSHA 29 CFR	Part 1926 Safety and Health Regulations for Construction
SSPC VIS-1	Visual Standard for Abrasive Blast Cleaned Steel

1.5. SUBMITTALS - WITH BID

A. Proposal Evaluation
   1. The following required proposal submittals will be considered by the Owner in the evaluation of bids.
   2. Owner shall be the sole judge as to the acceptability of a tank contractor's qualifications.

B. Design Documentation
   1. Section view drawing of the proposed tank.
   2. Provide details to illustrate tank geometry, materials of construction, primary dimensions, support wall thickness and pour height, concrete floor slab thickness, elevation of low and high-water levels.
   3. Coating areas: Interior Wet, Interior Dry and Exterior surfaces.

C. EHS Documentation
   1. Design Standards Experience Modification Rate (EMR) for the last three (3) years.
   2. Total Recordable Incident Rate (TRIR) for the last three (3) years.
   3. OSHA 300 Logs for the last three (3) years.
   4. List and summary of recordable injuries and fatalities in the last three (3) years.
   5. Names and resumes of full-time health and safety employees. Minimum acceptable level of certification is Certified Health and Safety Technician (CHST).

1.6. SUBMITTALS - AFTER CONTRACT AWARD

A. Design Drawings

1. Provide drawings in accordance with the requirements of AWWA D107 Sec. 1.4.1.
2. Provide elevation, plan and sectional view drawings of the foundation, support structure, tank and all appurtenant equipment and accessories. Show the location, dimensions, material specifications and finish requirements.
3. The drawing shall include sufficient detail to illustrate tank geometry, materials of construction, primary dimensions, the high water level elevation, concrete support structure wall thickness and other information required to show compliance with this Specification.
4. Submission shall be sealed by professional engineer registered in the State of the project.
5. Foundation details shall include excavation, soil protection and backfill.
6. Reinforced concrete details shall include reinforcement identified by mark numbers that are used on the fabrication schedule.
7. Steel tank details shall include weld joints and a layout showing all primary and secondary shop and field welds

B. Design Data

1. Provide a summary of the design for the foundation, support structure, tank and other components.
2. Design basis shall include applicable codes and standards, methods of analysis, design coefficients, loads and load combinations and results.
3. Provide a finite element analysis that accurately models the interface region; those portions of the concrete support structure and steel tank affected by the transfer of forces from the tank cone and the tank floor to the concrete support wall. The analysis shall provide results including the shear, moment, and compression or tension caused by the intersecting elements in the interface region.
4. Provide a table showing capacity of the tank in gallons at all levels in one-foot increments.

C. Construction Procedures

1. Provide procedures for the support structure forming system. Procedures shall include form removal criteria and minimum elapsed time for adjacent concrete placement.
2. Details shall include location of form and construction joints, rustications and any form ties.
3. Provide shop and field weld procedures for all structural joints on the steel tank.

D. Quality Assurance Plan

1. Provide a plan with procedures for exercising control of fabrication and construction, and verification that materials, fabrication, and construction conform to the design requirements.
2. Identify required inspections, tests and procedures.

E. Product Data
   1. Provide a separate concrete mix design for each class of concrete compressive strength required or specified.
   2. Provide technical data and color samples of all coating products.
   3. Provide manufacturers descriptive information for appurtenant equipment and accessories.

F. Operation and Maintenance Manuals
   1. Provide operating instructions and maintenance procedures for the Composite Elevated Tank and applicable appurtenant equipment, mechanical components and miscellaneous accessories.

G. Record Drawings
   1. Provide complete set of drawings with "as-built" information.
   2. Two (2) printed copies and one (1) electronic copy (PDF).

H. Reports
   1. Provide documentation of all tests, inspections and certifications required by this specification.
   2. Provide qualifications of all welders.

I. Professional Engineer Requirements
   1. Contractor shall directly employ the Engineer of Record who is responsible for the design. Engineer of Record shall be licensed in the jurisdiction of the project.
   2. Minimum requirements are ten (10) years cumulative experience in the design and construction of composite elevated tanks.
   3. Design data, construction drawings, analysis/calculations and reports prepared by the Engineer of Record shall be sealed.
   4. Provide proof of insurance for Professional Liability with a minimum limit of $2,000,000 each occurrence and aggregate.

1.7. QUALITY ASSURANCE

A. Experience Requirements
   1. Work described in this section shall be performed by a company that specializes in the design and construction of composite elevated tanks. The tank contractor shall have the following qualifications.
   2. Minimum of ten (10) years-experience in composite elevated tank design and construction.
   3. Design, construction and commissioning of a minimum ten (10) composite elevated tanks of equal or greater capacity in successful operation. These tanks shall be of the same design and constructed using the same methods and forming systems as detailed by this specification.
   4. The Contractor shall own and maintain all equipment necessary for the turnkey construction of the Composite Elevated Tank as specified herein. This includes the formwork for the concrete support structure construction as well as the fabrication and erection equipment required for the welded steel water tank construction. Neither the concrete support structure construction or the welded steel water tank fabrication and erection shall be subcontracted.

B. Approved Tank Contractors
   1. Contractors pre-qualified to perform the work specified herein are:
      a. Landmark Structures
      b. Caldwell
      c. McDermott / CB&I Constructors, Inc.
   2. Other contractors may be considered only if they meet the experience criteria and the specification requirements.
   3. A pre-qualification request submission must be received by the Engineer a minimum of ten days prior to bid date.
   4. The Owner shall be the sole judge as to the acceptability of a tank contractor's qualifications. Bidders failing to obtain pre-qualification will be considered non-responsive and their bid will not be opened.

C. Pre-Qualification Request Submission Requirements
   1. Completed contracts summary demonstrating minimum ten years-experience and listing a minimum of ten composite elevated tanks of equal or greater capacity in successful operation for at least five years. Tanks shall be of the same design and constructed using the same methods and forming systems required by this specification. Provide the location, capacity, Owner contact with phone number, and year completed.
   2. Section view drawing of the tank proposed for this project. Include detail to illustrate tank geometry, materials of construction, primary dimensions, support wall thickness and placement height, domed concrete slab thickness, and the elevation of water levels.
   3. Detail drawings and photographs of the equipment and systems to be used for construction of the concrete support structure and erection of the steel tank. Describe the forming system, concrete placement equipment and method, the location of form and construction joints, rustications, ties, methods used to prevent grout leakage, and steel erection method.
   4. Written procedures for concrete and steel quality control including wall form alignment, segmented wall pour, and steel cone dimension control.
   5. Sample finite element analysis of the tank interface region.
   6. Written affidavit confirming that no exceptions are taken to the requirements and procedures described in the specifications.
   7. Proof of insurance for Professional Liability with a minimum limit of $2,000,000 each occurrence and aggregate.
   8. Photographic evidence that the concreting systems and procedures employed result in uniform color, uniform surface density and uniform alignment of rustication. Provide adequate detail to prove absence of surface defects at construction joints and structure penetrations. Submit a photographic resume of ten projects with a minimum of four images each project proving the architectural concrete requirements have been attained.

D. Quality Control and Supervision
   1. Composite elevated tank design, concrete support structure construction and steel tank construction shall not be subcontracted. These items shall be self-performed by the Contractor.

2. A qualified supervisor directly employed by the manufacturer shall be on site at all times during construction of the foundation, support structure and steel tank.
3. Provide quality assurance of shop fabricated components in accordance with AWWA D100.

E. Regulatory Requirements
1. Referenced specifications, codes and standards shall govern the work regarding materials, design, construction, inspection and testing to the extent specified.
2. Personnel safety equipment shall be provided in accordance with OSHA requirements and manufacturers documentation.

1.8. DELIVERY, STORAGE AND HANDLING

A. Handling and Shipping
1. The Contractor shall handle materials and fabricated components in a manner that will protect them from damage.
2. Allow painted materials adequate cure time prior to stacking or shipping.

B. Storage and Protection
1. Protect delivered materials and equipment from damage.
2. Store in well drained areas and provide blocking to minimize contact with the ground.

1.9. PROJECT CONDITIONS

A. Permits and Easements
1. Permits, licenses, and easements required for permanent structures, changes in existing facilities or advancement of the construction as specified shall be secured and paid for by the Owner prior to the start of construction. These include building permits, airspace authority approval, site access easements, highway crossing permits, etc.
2. Licenses or permits of a temporary nature required by specific trades shall be the responsibility of the Contractor.

B. Existing Conditions
1. A geotechnical investigation has been carried out at the site and a report has been incorporated within these specifications.
2. The net allowable bearing pressure of shallow foundations and/or the allowable capacity of deep foundation elements have been defined in this report.
3. Contractor shall be responsible for securing any further geotechnical information required beyond that provided in the geotechnical report.
4. The Owner shall retain the services of the Geotechnical consultant to verify the adequacy of the bearing stratum after the Contractor has carried out the excavation and before any concrete or reinforcement is placed.

C. Access
1. Contractor shall provide access from public roads to the tank site unless otherwise specified.

D. Working Conditions
1. Contractor shall comply with safe working practices and all health and safety regulations of OSHA, state and local health regulatory agencies and Material Safety Data Sheets (MSDS).
2. Provide protective and lifesaving equipment for persons working at the site.
3. Personnel safety equipment shall be provided in accordance with OSHA requirements and the manufacturers' documentation.
4. The Contractors certified health and safety technician (CHST) shall perform inspections of the field activities.

1.10. SEQUENCING AND SCHEDULING
A. Schedule
1. The Contractor shall provide an anticipated schedule for design, submittals, site work and the major components of construction including foundation, concrete support structure and welded steel water tank, tank painting, electrical installation and other significant activities.
2. Update the schedule as required.
B. Notification
1. The Contractor shall provide notification of the intent to start work at least seven days prior to commencing each major phase of work.
C. Certifications
1. Provide certification from the Engineer of Record that the Composite Elevated Tank has been completely designed in accordance with the requirements of the Specification.
2. Provide certification that field testing and inspection requirements have been performed and the results comply with the requirements of the specification.

1.11. WARRANTY
A. Warranty Coverage
1. Contractor shall warranty the structure, appurtenant equipment and accessories provided under this section against defective design, workmanship or materials.
2. Defects caused by damaging service conditions are not covered.
3. All guarantees for materials, equipment and accessories provided under this section shall be obtained by the Contractor and submitted.
B. Warranty Period
1. Warranty period is one year from the date of substantial completion.
2. If notified within this period, the Contractor shall repair any defects at no cost to the Owner.

PART 2 – PRODUCTS

2.1. SYSTEM DESCRIPTION
A. Composite Elevated Tank

1. Composite elevated tank configuration, dimensions and details shall comply with AWWA D107, this specification section and the project drawings.
2. Composite elevated tank shall consist of the following: foundation, reinforced concrete support structure, and a welded steel water tank.
3. Support structure shall extend vertically from the foundation as a circular concrete wall.
4. A reinforced concrete tank floor or dome shall be provided as structural support for the steel tank within the perimeter of the support wall.
5. A reinforced concrete ring beam shall be provided to connect the steel tank, concrete tank floor and concrete support wall.
6. Dimensions may be slightly adjusted to suit the Composite Elevated Tank Manufacturer's standard welded steel water tank shape.

B. Related Work
1. The work shall also include all labor, materials, and equipment necessary to construct the site improvements and site piping as shown on the Drawings and specified herein.
2. The work shall also include design and construction of the heated control room.

C. Operating Parameters

Tank Capacity (net volume)	1,000,000	Gallon
Elevation - Overflow	304.85	Feet (MSL)
Maximum Head Range	35.00	Feet
Maximum Inlet Fill Rate	5,000	GPM
Maximum Outlet Rate	10,000	GPM

D. Tank Configuration

Support Wall Diameter (+/- 2 feet)	38.00	Feet
Steel Tank Diameter (+/- 4 feet)	70.00	Feet
Pipe Diameter - Inlet/Outlet	16	Inch
Pipe Diameter - HPZ Connection/Booster Pump Suction	8	Inch
Pipe Diameter - Overflow	12	Inch

E. Site Parameters

Site Location - Latitude	43º 13' 09.80"	
Site Location - Longitude	70º 53' 21.80"	
Seismic Site Class	D	
Elevation - existing grade	Varies	Feet
Elevation - finished grade	197.90 ±	Feet
Elevation – slab-on-grade	198.00	Feet

F. Regulatory Requirements
1. Refer to AWWA D107 Appendix B Table B II.A & II.B for additional regulatory requirements.

2.2. DESIGN
A. AWWA D107 Design Requirements
1. The analysis, design and details of the Composite Elevated Tank shall comply with AWWA D107 unless otherwise specified or modified in this specification section.
B. Design Loads
1. Design loads shall comply with AWWA D107 Sec. 4.2.
2. Live loads shall comply with AWWA D107 Sec. 4.2.4. Minimum walkway and elevated platform live load shall be 60 psf.
3. Structural Design Loads developed using AWWA D107 and by reference ASCE 7 shall consider this to be a Risk Category IV structure.
C. Concrete Foundation Design
1. Foundation analysis and design shall comply with AWWA D107 Sec. 7.3, based on the recommendations of the geotechnical report.
D. Concrete Support Structure Design
1. Support structure analysis and design shall comply with AWWA D107 Sec. 6.3.
2. Maximum specified compressive strength of concrete f'c shall be 5500 psi.
3. Minimum vertical reinforcement ratio of 0.0075 shall be provided in the top 6 ft. of the support wall and extend into the concrete ringbeam.
E. Tank Floor Design
1. Tank floor analysis and design shall comply with AWWA D107 Sec. 6.4.
2. The average compressive stress due to the weight of the structure and stored water shall not exceed 0.13 f'c $\leq$ 550 psi.
3. Reinforcement shall be provided to control tension stress at the floor boundary due to direct loads and self-straining forces.
4. Ring beam axial tension shall not exceed 15,000 psi.
F. Interface Region
1. Interface region analysis and design shall comply with AWWA D107 Sec. 6.3.6.
2. Interaction of the steel tank and concrete tank floor shall be analyzed by finite element or finite difference methods for all combinations of loads required by AWWA D107 Sec. 4.3.
3. Include the effects of self-straining forces in the analysis.
G. Steel Tank Design
1. Steel tank analysis and design shall comply with AWWA D107 Sec. 5.3.
2. Structural members supporting the roof of the steel tank shall be flat bar or sealed square tubular sections. I-beams or other sections with horizontal projections may be used if nominal depth is 10 in. minimum.
3. All exposed lap joints and supports shall be continuously welded on both sides.

2.3. ACCESSORIES

A. General

1. Accessories shall comply with AWWA D107 Sec.8 as supplemented or modified by the following.

B. Ladders

1. Ladders shall be provided from the slab on grade inside the base of the support wall to the upper walkway platform located below the tank floor.
2. Ladders locations shall comply with AWWA D107 Sec.8.2.
3. The tank floor manhole shall be provided with ladder access from the upper platform.
4. Provide access from tank roof to tank floor (mounted on access tube exterior).
5. Ladders that terminate at platforms or landings shall extend a minimum of 48 in. above the platform elevations. A safety extension shall be provided at the top of the ladder under hatch(s). The safety extension shall be a Ladder Up Safety Post as manufactured by Bilco or equal. The post shall extend 42-inches above the top of the ladder and be constructed of hot dip galvanized steel. Mounting hardware shall be galvanized.
6. Ladders located in the concrete support structure, access tube interior and tank interior shall be galvanized steel. Tank interior and access tube ladders shall be coated in accordance with the tank interior coating system.
7. Ladder side rails shall be a minimum 3/8 in. by 2 in. with a 16 in. clear spacing. Rungs shall be minimum 3/4 in. diameter, spaced at 12 in. centers and plug welded into holes drilled in the side rails.
8. Ladder shall be secured to the adjacent structure by brackets located at intervals not exceeding 10 ft.
9. Ladder brackets shall provide a minimum distance of 7 in. from the center of rung to the nearest permanent object behind the ladder.
10. Ladder brackets located on the access tube exterior shall be reinforced at the access tube so that potential ice damage is confined to the ladder and bracket.

C. Fall Protection

1. High strength aluminum OSHA compliant, rigid rail safe climbing devices shall be provided on all ladders.
2. Rails shall be center mounted and extend from 3 ft. above the ladder bottom to the top of the ladder section.
3. Install mounting brackets, fasteners and splice bars required for a rigid installation.
4. Provide two trolleys with snap hooks designed to be operated with the aluminum rail.
5. Provide a safety body harness with front and side rings for each trolley.
6. Provide storage locker/hanger next to ladder.
7. A caution sign shall be provided at the lowest point of access to the ladder requiring safe climbing devices. The sign shall read “CAUTION – Safety Equipment Required When Climbing Ladder”. The sign shall be secured to the wall.

D. Rest Platforms
   1. Rest platforms shall be provided at maximum 30 ft. intervals along the support wall ladder. Platforms shall be minimum 3 ft. by 5 ft. and complete with handrails, mid rails and toe plates in accordance with OSHA requirements.
   2. Grating shall be used for the walking surface and shall be suitably hinged at the ladder penetration. Platforms shall be arranged for straight run ladder and operable without removing fall prevention equipment. All components shall be galvanized steel.

E. Platforms
   1. Platforms shall be provided with handrails, mid rails and toe boards in accordance with OSHA requirements. Grating shall be used for the walking surface. All components shall be galvanized steel.
   2. A 4 ft. wide upper walkway platform shall be located at the top of the support wall to provide access from the support wall ladder to the roof access ladder located on the interior of the access tube.
   3. Aluminum swing out rest seats shall be provided on support wall ladders at maximum of 50 ft. intervals. Rest seats shall be operable without removing fall prevention equipment.
   4. Provide tie off points at landings.

F. Roof Railing
   1. Provide a 42 in. high OSHA compliant roof handrail enclosing all centrally located roof accessories.
   2. Roof railing shall be minimum 14 ft. in diameter.

G. Personnel Door
   1. Door frames shall be 16-gauge with concealed reinforcement at hardware locations. Expansion type anchors for existing openings shall be installed near the top, bottom and intermediate point of each jamb to rigidly secure the frame.
   2. Doors shall be 1 3/4 in. thick insulated, reinforced, full, flush type with 18-gauge face sheets and concealed reinforcement at hardware locations. All edges shall be finished flush with watertight seams.
   3. Shop applied finish for the frame and door shall be baked on rust inhibitive primer. Provide one field coat of a semi-gloss exterior, industrial grade alkyd enamel.
   4. Provide with Hardware Set. No. 1 (see schedule below).
   5. Provide one 3 ft wide and 7 ft tall personnel door as shown on the drawings.

H. Overhead Vehicle Door
   1. Door installation shall be on the interior face of the support wall.
   2. The door frame shall be galvanized steel. Steel curtain guides shall be attached to the door frame.
   3. Basis of design: Overhead Door Corporation, AP Stormtite 627 Series or equal.
   4. Operation shall be electrically driven by top of hood mounted operator (120V, Single phase). Torsion springs shall be mounted on a solid torsion

rod, which is attached to an exterior mounted spring tension adjustment wheel.

5. Provide Safety Limit switches interlocked with interior mounted control station. Emergency manual operation shall be possible.
6. The curtain shall be formed of 20-gauge exterior, 24-gauge interior galvanized curtain, steel interlocking slats with end locks and wind locks designed for a wind loading of 20 psf. Curtain shall be insulated to R value of 10.9.
7. A 24-gauge steel hood shall be provided with a weather seal.
8. Steel brackets shall be installed to the interior face of the wall which enclose and support the counterbalance assembly with sealed bearings.
9. The curtain, bottom bar, brackets, guides, hood, pipe and chain shall be galvanized with PowderGuard powder coat finish, color per Owner.
10. Provide with locking device.
11. Size, quantity and location of vehicle door(s) shall be as shown on the drawings. Minimum 10 ft x 10 ft.
12. Bollards shall be installed as shown on the drawings.

I. Heated Room Door to pedestal storage area

1. Provide one 6’ wide x 7’ tall insulated double door in the CMU wall as shown on the Drawings. Door construction requirements shall be the same as for the personnel door.
2. Provide Hardware Set No. 2.

J. Door Hardware Schedule:

Hardware Set No. 1 (Single Door)

Mortise Lock	Sargent	8225 J O - Exit 32D
Hinge	Hager	BB1199 32D
Weather Strap, Door Bottom	Hager	2891AS, 368CN
Threshold	NGP	8113
Closer	LCN	4040XP Cush Metal Cover AL

Hardware Set No. 2 (Double Door)

Mortise Lock	Sargent	8225 J O - Exit 32D
Hinge	Hager	BB1199 32D
Weather Strap, Door Bottom	Hager	2891AS, 368CN
Threshold	NGP	8113
Flush Bolts	Ives	FB52

All lock cores to be ‘Best’ per City of Dover standard system.

K. Padlocks

1. Padlocks shall be removable core type; case, solid brass; shackle, hardened steel, triple plated; shackle locking, two hardened steel balls at heel and toe.
2. All padlocks shall be keyed alike per owner’s standard keying system. Four sets of keys shall be provided.

3. Padlocks shall be provided for the following locations:
   a. Roof and support wall hatches.
   b. Security fence gate.

L. Rigging Access
1. Exterior - Provide a 24 in. wide x 36 in. high opening at the top of the support wall for access of the exterior rigging rail located at the tank/support wall intersection. The opening shall be accessible from the top platform and provided with a removable vent.
2. Vent shall be stainless steel or aluminum.
3. Tank Interior – Provide a minimum 24 in. diameter opening on the tank roof for access to the tank interior rigging rail at the wall/roof connection. Provide a weatherproof cover.

M. Access Tube
1. Provide a minimum 60 in. diameter centrally located access tube through the steel tank to provide access to the tank roof from the upper walkway platform.
2. Provide a minimum 2 in. by 2 in. channel to collect condensation. A flexible 3/4 in. PVC hose complete with backflow preventer shall drain the channel to the overflow pipe.

N. Utility Rails
1. Provide permanently installed utility rails suitable for rolling trolleys on the interior of the welded steel tank at the wall/roof and access tube/roof connections. Provide an exterior utility rail at the base of the welded steel tank adjacent to the concrete support structure.
2. Provide an interior concrete support structure utility rail at the top of the concrete support structure in order to assure access for maintenance of piping.

O. Tank Roof Openings
1. Provide two 30 in. square weatherproof access hatches on the roof of the tank.
2. One hatch shall allow egress from the access tube to the roof.
3. The second hatch, located adjacent to the first, shall allow access to the interior of the tank via the ladder mounted on the exterior of the access tube.
4. The opening shall have a minimum 4 in. curb. Provide aluminum covers with a 2 in. down turned edge, stainless steel hardware, hold open arm and a locking mechanism.

P. Tank Floor Manhole
1. Provide a 30 in. diameter manhole through the tank floor that is operable from a ladder located on the upper platform.
2. It shall be designed to withstand the pressure of the tank contents without leakage.
3. The manhole assembly shall be galvanized with stainless steel hand wheel operator and threaded components.

Q. Permanent Rigging Devices
   1. Permanently installed rigging rails shall be galvanized steel suitable for rolling trolleys.
   2. Provide rigging rails at the following locations:
      a. Steel tank interior at the wall/roof connection.
      b. Steel tank interior at the access tube/roof connection.
      c. Steel tank exterior at the base of the tank adjacent to the support structure.

R. Ventilation
   1. Provide a support structure vent in accordance with AWWA D107 Sec. 8.6.1. Vent shall be galvanized steel with stainless steel or aluminum insect screen.
   2. Provide a tank vent and pressure-vacuum relief mechanism in accordance with AWWA D107 Sec. 8.6.2. The vent shall be provided with an insect screen.

S. Windows
   1. Provide up to eight (8) fixed windows in pedestal at locations recommended by tank vendor and approved by Owner. Windows shall be 2 ft wide and 3 ft tall, fiberglass frame and sash, insulating glass units.
   2. Marvin Essential Series or equal.

T. Piping - General
   1. Inlet, outlet and overflow piping configuration, material and design shall comply with AWWA D107 Sec. 8.7.
   2. Piping below grade shall be flanged cement lined ductile iron and provided with blocking and supports to prevent movement relative to the structure.
   3. Provide a tank drain to completely drain the tank contents if the outlet pipe does not intersect the low point of the tank.

U. Inlet/Outlet Pipes
   1. Provide 16 in. inlet/outlet pipe from the base of the support structure to the tank floor.
   2. Provide 8 in. inlet/outlet pipe from the base of the support structure to the tank floor. This pipe shall connect to the booster pump station suction header.
   3. Provide a minimum 6 in. high removable silt stop at each inlet/outlet pipe.
   4. Provide a flanged elastomeric expansion joint for each pipe designed to accommodate differential movement. The location shall be accessible for inspection and maintenance.
   5. Pipe material within the support structure shall be Type 304 stainless steel in accordance with AWWA D170 Sec. 8.7.3.
   6. Suitable galvanized brackets, guides and hangers shall be provided on the wall of the concrete support structure and welded steel water tank floor at intervals not exceeding 20 ft.
   7. Provide three 3/4 in. couplings welded to each inlet/outlet pipe 5 ft. above grade. Each coupling shall be provided with a bronze nipple and an isolation valve.

8. Provide a pressure gauge in accordance with ASME B40.1 Grade 2A. The dial shall be 4 1/2 in. diameter with black markings on white background. Pressure range is 0-100 psi.

V. Inlet/Outlet Pipe and HPZ/Booster Pump suction pipe - Insulation and Heat Trace
1. Provide insulation on the Inlet / Outlet pipe within unheated sections of the support structure. See section 11210.
2. Provide heat trace on the piping within unheated sections of the support structure.

W. Overflow Pipe
1. Provide 12 in. overflow pipe from the top capacity level (overflow elevation) to a discharge point at grade.
2. Provide a weir with vortex prevention device. The entrance to the overflow pipe shall be designed for the maximum specified inlet flow rate.
3. Provide a base elbow to direct the overflow through the support wall approximately 18 in. above grade. Terminate with a flap valve that discharges onto a riprap pad and drainage basin outside of the pedestal.
4. Pipe material within the steel tank shall be steel in accordance with AWWA D107 Sec. 8.7.2.
5. Pipe material within the support structure shall be Type 304 stainless steel in accordance with AWWA D107 Sec. 8.7.3.

X. Slab-on-Grade
1. Provide a slab on grade within the concrete support pedestal in accordance with AWWA D107 Sec. 8.10.2. The slab shall be sloped at 0.5% toward the overhead door for drainage.

Y. Lightning Protection
1. Provide a lightning protection system in accordance with AWWA D107 Sec. 8.8.
2. Provide a minimum of two 28 strand by 14-gauge copper conductors bonded to the steel tank 180 degrees apart.
3. Terminate with buried 5/8-inch diameter by 8-foot copper clad ground rods.
4. Provide air terminals at obstruction lights.

Z. Mixer
1. The mixer shall be Gridbee Submersible Electric Mixer Model GS-12 or equal.
2. The mixer shall have a standard 75 feet cable and chain, top of tank roof junction box, through-tank fitting, chain grab tools, one 5/16 in. hole saw, sealant, grip and cord seal.
3. The mixer shall have a control panel located in the heated room. The panel shall be connected to the SCADA RTU panel to allow remote monitoring and control of the mixer.

AA. Communication and Antenna Cable Provisions
1. Provide a bundle of four 6” Sch 40 PVC conduits complete with long radius 90-degree bends to route from exterior below grade to the interior support wall at the slab-on-grade.
2. Terminate conduit as close to the support wall as possible.

3. The grouping of conduits shall serve as the pedestal entry location suitable for a single provider.
4. Provide an interior rigging rail suitable for rolling trolleys at the top of the support wall accessible from the upper platform.
5. Provide cable mounting brackets at locations and spacing along pedestal wall and access tube to provide routing of cable to antenna.
6. Provide provisions for cable exit to exterior pedestal wall or steel tank roof.
7. Coordinate with Division 16 - Electrical.

BB. Segmented Circular Stairway - Pedestal (Bid Alternate)
1. General Requirements:
   a. Provide a segmented circular stairway from grade slab to the upper platform located below the tank floor.
   b. Stairway shall be attached to the interior of the concrete support structure as indicated on the drawings.
   c. Stairway shall meet all applicable OSHA requirements.
   d. Grating shall be used for the walking surfaces.
   e. All stairway and landing components shall be galvanized steel.
2. Stairway Stringers:
   a. Stringers shall be straight runs.
   b. Provide handrails and midrails in accordance with OSHA requirements on both sides of the stairs.
   c. Minimum stairway width shall be 3 ft.
3. Stairway Landings:
   a. Provided at vertical interval of maximum 12 ft. along the pedestal wall.
   b. Minimum width and length in direction of travel equal to stair tread width.
   c. Provide with handrails, midrails, and toe plates in per OSHA requirements.
4. Configuration:
   a. Stairway shall be arranged to allow all vertically running interior piping, wiring, cabling, conduit, and other fixed accessories to be mechanically attached directly to the concrete pedestal wall without the accessories deviating from a straight vertical alignment.

CC. Deviation of vertical runs to maneuver around the Stairway is not acceptable. Penetrations through the Segmented Circular Stairway are not acceptable.

DD. Heated Control Room
1. The Contractor shall design, furnish and install a heated control room for electrical and instrumentation equipment (Base Bid) in the tank pedestal. The heated room shall house the booster pump station and flowmeter and control valve (Alternate). The Contractor shall submit for approval by the Engineer, as part of the New Hampshire P.E. approved tank design, a design for the pump room. The room shall be isolated from the unheated portion of the pedestal by an insulated masonry wall with access through

doors as shown on the Drawings. The room ceiling shall be 10 feet high, and the galvanized steel trusses roof shall be designed to support a load of 125 psf for storage. The walls must support mounting of electrical panels and instrumentation as shown on the Drawings.

2. Masonry construction shall conform to Building Code requirements for Masonry Structures (TMS 402) and Specifications For Masonry Structures (TMS 602), referenced standards.
3. A waterproof system over the room shall be Sure-Seal 60-mil Non-Reinforced EPDM membrane, or equal, over the ¾ in APA Grade A-C T/G Plywood. Pressure-Sensitive Walkway Pads shall be as manufactured by Carlisle, or equal. Flashing shall be provided as recommended by the manufacturer. Products shall be installed in accordance with manufacturer's requirements. A copy of manufacturer's 5-year warranty to Owner shall be provided.
4. The walls and ceiling shall be finished and insulated according to the following schedule:

Control room and tank pedestal interior finish and insulation schedule

Item	Heated Room	Pedestal Storage Area
Concrete slab	Sealer	Sealer
Concrete pedestal walls	2" rigid insulation FRP panels (Color per owner)	None
CMU wall	2" rigid insulation FRP panels (Color per owner)	Paint per Section 09912 (Color per owner)
Ceiling	2" rigid insulation FRP panels (Color per owner)	N/A
Doors	Paint	Paint

5. FRP Panels:
   a. Crane Composites Inc, model Glasboard, 0.09" embossed or approved equal.
   b. Install over existing insulation using stainless steel mechanical fasteners to secure panels through insulation into concrete block. Do not use adhesive. Oversize fastener holes to allow for thermal expansion/contraction of the panels. Follow manufacturer's installation instructions for a high moisture environment.

2.4. ELECTRICAL AND LIGHTING

Provide Electrical and Lighting in accordance with AWWA D107 Sec. 8.9. Refer to the drawings and Division 16 of the Project Manual for additional electrical requirements. Fixtures shall be LED type per Electrical Drawings.

2.5. STEEL TANK COATINGS

A. Coatings - General

1. Stainless steel galvanized and concrete surfaces are not required to be coated.
2. A cathodic protection system shall not be provided.
3. Refer to Division 9 of the Project Specifications for tank painting and for all other painting.

B. Coating Systems

1. Unless otherwise specified, provide coatings systems in accordance with AWWA D102 and Division 9:
   a. Outside Coating System: OCS-4
   b. Inside Coating System: ICS-3

PART 3 – EXECUTION

3.1. GENERAL

Construction, inspection and testing of the Composite Elevated Tank and related work shall comply with AWWA D107 unless otherwise specified or modified in this section.

3.2. FOUNDATION CONSTRUCTION

A. Earthwork

1. Excavation shall comply with AWWA D107 Sec. 7.4.1.1. After verification of the foundation bearing surface, provide a 2 in. thick concrete working slab within the lower excavation limits.
2. Backfill shall comply with AWWA D107 Sec. 7.4.1.2. Grade the site to prevent runoff from entering the excavation.

B. Concrete Foundations

1. Foundation concrete mixtures, formwork, reinforcement, curing, protection, tolerances, and finishes shall comply with AWWA D107 Sec. 7.4.2.

3.3. CONCRETE SUPPORT STRUCTURE CONSTRUCTION

A. Support Structure - General

1. Fabrication, Materials for structural concrete shall comply with AWWA D107 Sec. 6.2.
2. Construction of reinforced concrete shall comply with ACI 318 and AWWA D107 Sec. 6.4.
3. Prior to performing any work, verify the expected temperature, humidity and weather conditions are within the specified limitations for executing the work.

B. Support Structure - Concrete Mix Design

1. Concrete mix designs and proportioning shall comply with AWWA D107 Sec. 6.4.2.
2. Concrete without high range water reducer shall be proportioned to produce slumps at the point of placement between 2 and 4 in.
3. After addition of high range water reducer, slump shall be a maximum of 8 in.

4. Concrete that arrives at the project with slump below that suitable for placing may have water added within the limits of the maximum permissible water-cement ratio. Maximum slump shall not be exceeded.
5. For concrete with site-administered high range water reducer, the pre-plasticized minimum slump requirement may be attained by addition of water and mixing prior to the addition of the high range water reducer.
6. Water shall be incorporated by additional mixing equal to at least half of the total mixing time required.

C. Support Structure - Reinforcement
1. Fabrication, placement, development, splicing, cover and support of reinforcement shall comply with ACI 318 and AWWA D107 Sec. 6.4.3.

D. Support Structure - Concrete Placement
1. Concrete shall be deposited in its final position in accordance with ACI 318.
2. Concrete shall be consolidated by vibration so that the concrete is thoroughly worked into the corners of forms and around the reinforcement and embedded items.
3. Internal vibrators shall be the largest practical size that can be used in the work.

E. Support Structure - Formwork
1. Formwork shall comply with AWWA D107 Sec. 6.4.4.

F. Support Structure - Curing and Protection
1. Comply with AWWA D107 Sec. 6.4.4.
2. Provide protection if concrete is placed during precipitation or extreme temperatures.
3. During cold weather, comply with the recommendations of ACI 306.1.
4. During hot weather, comply with the recommendations of ACI 305.1.

3.4. SUPPORT WALL - SPECIAL REQUIREMENTS

A. Architectural Concrete Construction
1. The exposed exterior surface of the concrete support wall is designated architectural concrete.
2. Concrete and formwork requirements of this section shall be strictly enforced to ensure concrete of the highest practicable architectural standard.
3. Formwork design, installation and removal shall comply with the minimum requirements of ACI 318, ACI 117 and the applicable requirements of ACI 347, except as modified by this Section.

B. Support Wall - Concrete Mix Design
1. Use the same concrete design mix throughout the support wall.
2. Proportion, type and source of cement and aggregates shall not be changed.
3. Maintain uniform moisture content and placing consistency.
4. Provide concrete with 3.5% to 6.5% air content.

C. Support Wall - Reinforcement
1. Support wall reinforcement shall be installed with plastic supports.

2. Provide supports for welded wire fabric at 5 ft. centers, horizontal and vertically.

D. Support Wall - Concrete Placement
1. Support wall concreting shall incorporate segmented placement procedures.
2. Temporary vertical bulkheads shall divide the wall pour into segments corresponding to a single truckload of concrete.
3. Bulkheads shall be located at rustications, braced rigid and tight to maintain vertical alignment under concrete load.
4. Wall segment concrete shall be placed vertically and continuously to full form height from a single truckload of concrete. Placement from multiple loads is not permitted.
5. Vertical pour rate shall be a minimum of 15 feet per hour.
6. Temporary bulkheads shall not be removed until adjacent concrete is placed.
7. Wall concrete shall be placed directly inside the reinforcement cage with drop chutes to prevent form splatter and the resulting surface finish variations.

E. Support Wall - Formwork
1. Support wall shall be constructed with a jump form process using form segments prefabricated to match the wall curvature.
2. Forming system shall be fully engineered and detailed with procedures to meet the increased demands of architectural concrete.
3. Concrete placement height shall be a minimum of 4 ft. and a maximum of 10 ft, according to manufacturer’s instructions and form height.
4. Form panels shall be designed for lateral pressures associated with full height plastic concrete head and eccentric loads resulting from the segmented wall placement procedure.
5. Form panels shall extend the full height of the concrete pour using only vertical panel joints. Form system shall be designed to lap and be secured to the previous wall lift.
6. The space between the form and the previous lift shall be sealed to prevent grout leakage.
7. Incorporate a positive means of adjustment to maintain dimensional tolerances specified. Lock forms into position with through wall form ties prior to concrete placement.
8. Form surfaces shall be steel, plastic or fiberglass coated material. Form surfaces shall be thoroughly cleaned of concrete residue and coated with a release agent prior to placement.
9. Steel forms shall be coated with a non-staining, rust preventative form oil or otherwise protected. Steel formwork with rust stains and damaged surfaces shall not be used.

F. Support Wall - Form Movements
1. Wall forms shall not be disturbed or removed until concrete has attained enough strength to prevent forming operations or environmental loads from causing surface damage or excessive stress.

2. The minimum concrete strength for form removal shall be established by the Contractor, based on an analysis of stress during form removal, installation and concrete operations.
3. Concrete operations shall occur a maximum of once per day. Multiple form movements and concrete placements within a day are not permitted.
4. Inspect wall finish prior to subsequent wall placement.
5. Form removal shall be based on early age concrete strength testing in accordance with ACI 228.1R-95.
6. Acceptable methods to determine early concrete strength: Pull Out testing (ASTM C 900-99), Maturity Method testing (ASTM C 1074-93), or field cured cylinders compressive strength tested (ASTM C 172).

G. Support Wall - Architectural Pattern
1. Form system shall incorporate a uniform pattern of vertical and horizontal rustications to provide architectural relief to the exterior wall surface.
2. Rustication strips shall be sealed to the form face to eliminate grout leakage that results in broken corners, color variations and rock pockets.
3. Locate construction joints and panel joints in rustications. Vertical panel joints shall be sealed using closures which combine with the form pattern to eliminate grout leakage and panel joint lines.
4. Proportion vertical and horizontal rustications and form ties to impart a symmetrical architectural pattern.
5. No architectural form treatment is required on the interior surface.

H. Support Wall - Finish
1. Provide a smooth form finish without rub for the interior and exterior support wall.
2. Tie holes shall be plugged using grout on the interior and manufactured plugs on the exterior which match the color of the cured concrete as closely as possible.
3. Provide a light sandblast to the exposed exterior concrete support wall surface.

I. Mock Up Panel
1. Construct a mock-up panel using the proposed support wall form surface and concrete. Minimum size: 4 ft wide by 6 ft high.
2. Mock-up panel shall be agreed upon by the Contractor and Owner as the reference standard with which to judge surface quality, appearance and uniformity of texture and color for each individual lift.
3. Review of formed concrete surface shall be made immediately upon form removal. Succeeding wall placements shall not be placed until the most recent wall placement has been stripped and the form surface inspected.
4. Contractor shall be responsible to inform the Owner with respect to wall placement schedule.
5. Concrete with surface defects exceeding limitations specified herein or not meeting the standard represented by the mock-up panel shall be repaired to meet that standard.

3.5. STEEL TANK FABRICATION AND CONSTRUCTION

A. Steel Tank - Fabrication and Erection

1. Layout, cutting, forming, edge preparation and workmanship for steel tank components, fabrications and construction shall comply with AWWA D107 Sec. 5.4.2.
2. After completion of each major component and prior to proceeding with the next stage of construction, verify that tolerance inspections and material quality control tests conform to this specification.

B. Steel Tank - Welding
1. Welding procedures and welder qualifications shall comply with AWWA D107 Sec. 5.4.1.
2. Welding operations shall comply with AWWA D107 Sec. 5.4.3.
3. Grinding of weld contour shall approximate Condition "D" of NACE Standard RP0178.

C. Steel Tank - Tolerances
1. Steel tank Steel tank tolerances shall comply with AWWA D107 Sec. 5.4.4.

D. Steel Tank - Liner Plate Grout
1. The interface between the steel tank floor liner plate and the supporting structural concrete dome slab shall be constructed with a minimum 1 in. void.
2. After air testing, the void shall be filled with a flowable grout mix.
3. Flat slab floors do not require grouting if the liner plate is fully supported by concrete.

3.6. INSPECTION AND TESTING

A. General
1. The evaluation and Testing agencies for concrete shall comply with AWWA D107 Sec. 9.1.3.
2. Inspection and testing personnel for welding shall comply with AWWA D107 Sec. 9.1.4.

B. Shallow Foundation Inspection
1. Exposed bearing stratum of shallow foundations shall be inspected by the geotechnical engineer to verify the applicable design and construction recommendations.
2. Geotechnical engineer shall be retained by the Owner and coordinated by the Contractor. Provide report of inspections.

C. Earthwork Inspection and Testing
1. Inspect and test structural fill and backfill materials for conformance to requirements of AWWA D107 Sec. 7.4.1.

D. Concrete Inspection and Testing
1. Concrete materials, inspection, testing and acceptance shall comply with AWWA D107 Sec. 9.3.
2. Slump, air, temperature and compressive cylinder testing shall be performed by an independent laboratory. The Owner shall retain the independent laboratory and provide the Contractor with copies of all test results. Three cylinders shall be made from each sample required. A 7-day compressive strength test shall be used to supplement the 28 day tests.

E. Concrete Support Structure Inspection

1. Perform measurements to confirm tolerance requirements of AWWA D107 Sec. 6.4.6.
2. Support wall radius, plumb and thickness shall be verified for each concrete lift at all vertical form panel joints and at a minimum of 45-degree intervals.
3. Provide report certified by the tank designer at project completion.

F. Steel Tank Inspection and Testing
1. Verify steel tank plate and structural material in accordance with AWWA D107 Sec. 9.4.1.
2. Perform tolerance inspection in accordance with AWWA D107 Sec. 9.4.2.
3. Perform welded joint inspection during fabrication and construction in accordance with AWWA D107 Sec. 9.5.
4. Weld joints of liner plate over the structural concrete floor shall be tested for leaks by vacuum box / soap solution testing prior to grouting.
5. Radiographic inspection shall be made by an independent inspection company retained by the Contractor. Provide report.

3.7. CLEANING

A. Site
1. The project site shall always be kept in a clean and safe condition.
2. Contractor shall remove all construction equipment and debris at project completion.

B. Tank Disinfection.
1. Water at pressure adequate for flushing, cleaning, disinfection and testing shall be supplied by Owner at no cost to Contractor.
2. Steel tank disinfection shall comply with Section 02675 - Disinfection.
3. Tank leakage in accordance with AWWA D107 Sec. 9.7.1 shall be performed during disinfection.
4. The proposed method shall be submitted to the Engineer and approved prior to execution.
5. Prior to the application of the disinfectant, the walls and bottom of the tank shall be flushed with water to remove all dirt and loose material. After disinfection is complete prior to placing the tank into service, at least two (2) samples of water shall be taken from the tank and submitted to a certified laboratory for total coliform analysis.
6. Copies of all test results shall be submitted to the Engineer. If results of the bacteriological tests are satisfactory, the disinfection process will be considered complete, and the tank may be placed into service. If test results are unsatisfactory, the complete disinfection process shall be repeated.
7. The Owner shall provide to the Contractor at no charge sufficient quantity of water to disinfect the tank once. All other sampling and analysis costs are the responsibility of the Contractor. Water required for repeated disinfection of the tank shall be purchased by the Contractor from the Owner at the current metered rate, or other agreeable pricing method.

END OF SECTION

Scope of Work

Furnish, install and test all mechanical systems and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically notes, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of work.

Contents of Division

Section No.	Section Title
15069	Ductile Iron Pipe and Fittings
15094	Pipe Hangers and Supports
15100	Valves and Specialties
15121	Pressure Reducing Valves
15220	Pressure Relief Valves

SECTION 15069

DUCTILE IRON PIPE AND FITTINGS-INTERIOR

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install ductile iron pipe and ductile iron fittings of the type(s) and size(s) in the location(s) shown on the Drawings and as specified herein.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 QUALITY ASSURANCE

A. Standards:

1. Cement-mortar lining for water: ANSI A21.4/AWWA C104.
2. Rubber gasket joints: ANSI A21.11/AWWA C111.
3. Ductile iron pipe thickness: ANSI A21.50/AWWA C150.
4. Ductile iron pipe centrifugally cast in metal or sand lined molds: ANSI A21.51/AWWA C151.
5. Threaded flanges: ANSI A21.15/AWWA C115.
6. Ductile iron fittings: ANSI A21.10/AWWA C100.
7. Pipe flanges and fittings: ANSI B16-1, ANSI A-21.12.
8. Bolts: COR-TEN ASTM A588.

1.3 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract.

B. If requested by the Engineer, submit manufacturer's "Certification of Conformance" that pipe and fittings meet or exceed the requirements of these Specifications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Exercise extra care when handling pipe and fittings.

B. Exercise extra care when handling cement lined pipe and fittings because damage to the lining will render it unfit for use.

C. Protect all pipe during shipment by wood lagging securely fastened in place.

1.5 INSPECTION

A. Provide all labor necessary for the Engineer to inspect pipe, fittings, gaskets, and other materials.

B. Carefully inspect all materials at the time of delivery and just prior to installation.

C. Carefully inspect all pipe and fittings for:

1. Defects and damage.
2. Deviations beyond allowable tolerances for joint dimensions.
3. Removal of debris and foreign matter.

D. Examine areas and structures to receive piping for:
   1. Defects, such as weak structural components, that adversely affect the execution and quality of work.
   2. Deviations beyond allowable tolerances for pipe clearances.
E. All materials and methods not meeting the requirements of the Contract Documents will be rejected.
F. Immediately remove all rejected materials from the project site.
G. Start work only when conditions are corrected to the satisfaction of the Engineer.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Pipe:
   1. All pipes shall conform to the latest AWWA specification C-151. Unless otherwise shown on the Drawings, the requirements of ductile iron pipe shall be:
      a. Pipe with flanges: Class 53 (formerly Class 3) unless otherwise noted.
      b. All ductile iron pipe shall have cement lining of double thickness.
      c. All ductile iron pipe shall be provided with a factory applied prime coat compatible with the finish painting system.
   2. Pipe for use with sleeve type couplings shall have plain ends (without bells or beads) cast or machined at right angles to the axis.
   3. Pipe for use with split type couplings shall have ends with cast or machined shoulders or grooves that meet the requirements of the manufacturer of the couplings.
   4. Factory applied bituminous coatings, as approved by the Engineer, shall be furnished for all underground piping.

B. Joints (as shown on the Drawings, specified and applicable):
   1. General: All joints shall be Class 125 unless otherwise shown on the Drawings.
   2. Flanged:
      a. Provide specially drilled flanges when required for connection to existing piping or special equipment.
      b. Flanges shall be long-hub screwed tightly on pipe by machine at the foundry prior to facing and drilling.
      c. Gaskets:
         1). Ring type of rubber with cloth insertion.
         2). Thickness of gaskets 12 inches in diameter and smaller: 1/16 inch.
         3). Thickness of gaskets larger than 12 inches in diameter: 3/32 inch.
      d. Fasteners:
         1). Make joints with bolt, stubs with a nut on each end, or one tapped flanged with a stud and nut.
         2). The number and size of bolts shall meet the requirements of the same American National Standard as the flanges.
         3). Nuts, bolts and studs shall be Grade B meeting the requirements of ASTM A307.

4). After jointing, coat entire joint with bituminous material compatible with pipe coating.

e. When applicable, provide and install flange clamps as shown on the Drawings.

3. Grooved split ring couplings, sleeve couplings, flexible joints and couplings: As specified and shown on the Drawings.

C. Standard Fittings:
1. All joints shall conform to the latest AWWA specification C-100 or ANSI 21.10.
2. Class 350, Ductile Iron, Cement Lined except as shown on the Drawings or as specified.
3. Joints the same as the pipe with which they are used or as shown on the Drawings.
4. Provide fittings with standard bases where shown on the Drawings.

D. Non-Standard Fittings:
1. Fittings having non-standard dimensions shall be subject to the Engineer's approval.
2. Non-standard fittings shall have the same diameter and thickness as standard fittings and shall meet the specification requirements for standard fittings.
3. The laying lengths and types of joints shall be determined by the particular piping to which they connect.
4. Flanged fittings not meeting the requirements of ANSI A21.10 (i.e., laterals or reducing elbows) shall meet the requirements of ANSI B16.1 in Class 125.

2.2 ACCEPTABLE MANUFACTURERS
A. US Pipe
B. Atlantic States
C. Griffin
D. Or approved equal (North American per City standards)

PART 3 -- EXECUTION

3.1 INSTALLATION
A. General:
1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations.
2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
3. Install adaptors, approved by the Engineer, when connecting pipes constructed from different materials.

B. Assembling Joints:
1. Bolted Joints:
a. Remove rust preventive coatings from machined surfaces prior to assembly.

b. Thoroughly clean and carefully smooth all burrs and other defects from pipe ends, sockets, sleeves, housings and gaskets.

2. Flanged Joints:
   a. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
   b. Execute care when tightening joints to prevent undue strain upon valves, pumps, and other equipment.

C. Fabrication:
1. Tapped Connections:
   a. Make all tapped connections where shown on the Drawings or where directed by the Engineer.
   b. Make all connections watertight and of adequate strength to prevent pullout.
   c. Drill and tap normal to the longitudinal axis of the pipe.
   d. The maximum sizes of taps in pipes and fittings without busses shall not exceed the sizes listed in the appendix of ANSI A21.51 based on 3 full threads for cast iron and 2 full threads for ductile iron.
2. Cutting:
   a. Perform all cutting with machines having rolling wheel cutters or knives designed to cut cast or ductile iron. Do not use a hammer and chisel to cut pipe.
   b. After cutting, examine all cut ends for possible cracks.
   c. Carefully chamfer all cut ends to be used with push-on joints to prevent damage to gaskets when pipe is installed.

3.2 FINISH

A. All pipe and fittings shall be painted in accordance with Section 09900.

3.3 TESTING

A. Procedure: Pipes shall be tested at one hundred and fifty percent (150%) of the maximum working pressure or a minimum of one hundred (100) psi whichever is greater. The test shall be run for four (4) ten minute cycles (i.e. on and off).

B. Acceptance: The piping will be deemed acceptable if there are no leakers during any of the cycle tests. If leakage is discovered, the test shall restart.

3.4 CHLORINATION

A. All potable water piping shall be chlorinated in accordance with AWWA C651 and as modified in Section -02610.

END OF SECTION

SECTION 15094

PIPE HANGERS AND SUPPORTS

PART I - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals and install a complete system of pipe hangers, supports, concrete inserts and anchor bolts including all metallic hanging and supporting devices for supporting non-buried piping as shown on the Drawings and as specified herein.

B. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of the responsibility for providing them. Pipe supports indicated on the Drawings are shown only to convey the intent of the design for a particular location and are not intended to represent a complete system.

1.02 RELATED WORK

A. Concrete is included in Division 3.

B. Field painting is included in Division 9.

C. Pipe and fittings are included in respective sections of Division 15.

D. Valves and appurtenances are included in Section 15100.

E. Hangers and supports pertaining to HVAC and Plumbing systems are included in their respective Sections.

1.03 SUBMITTALS

A. Submit to the Engineer in accordance with Section 01340, complete sets of shop drawings of all items to be furnished under this Section. Submittals shall include complete layouts, schedules, location plans and complete total bill of materials for all pipe support systems.

B. Submittals shall include a representative catalog cut for each different type of pipe hanger or support indicating the materials of construction, important dimensions and range of pipe sizes for which that hanger is suitable. Where standard hangers and/or support are not suitable, submit detailed drawings showing materials and details of construction for each type of special hanger and/or support. Provide detailed information on anti-seize compound.

C. Submittals shall include complete piping drawings as submitted for each piping submittal indicating type of hanger and/or support, location, magnitude of load transmitted to the structure and type of anchor, guide and other pipe supporting appurtenances including structural fasteners.

D. Types and locations of pipe hangers and/or supports shall also be shown on the piping layouts for each piping submittal as specified in the respective Division 13 and l5 pipe sections. Service conditions for each piping system, including service temperatures, and operating and test pressures, are tabulated in the piping sections.

E. Submit complete design data for pipe support systems to show conformance with this Section.

F. Support System Design:

1. Engage the services of an independent registered professional engineer ordinarily engaged in the business of pipe support systems analysis, to analyze system piping and service conditions and to develop a detailed support system, including support types and locations, specific to the piping material, pipe joints, valves and piping appurtenances proposed for use.
2. The proposed support system engineer shall have at least 5 years of experience in the analysis and design of similar systems, including the use of commercial and custom pipe supports.
3. After the work is installed, but before it is filled for start-up and testing, the support system design engineer shall inspect the work and shall certify its complete adequacy. Each system shall be inspected and certified in the same way. Submit statement of certification.
4. All aspects of the analysis and design shall comply with the provisions of ANSI B3 1.1 and the referenced standards.
5. Support arrangements shall be coordinated to eliminate interference with similar systems to be installed under HVAC, Plumbing and Electrical; to account for structural expansion joints and to maintain access for both personnel and for the removal of equipment. Support systems shall not include the use of monorail or bridge crane support. Nor shall they rely on the horizontal structural struts.
6. Commercial hardware and custom supports shall comply with the requirements of this Section.
7. Expansion joints shall comply with the provisions of Section 15088.
8. The design of the support system for the low pressure air systems blower intake and discharge piping shall take into consideration the effects of thermal expansion caused by air temperature changes in the piping as specified. The design of the support system shall include flexible couplings in addition to those shown on the Drawings required to control stresses imposed upon the piping or connected equipment caused by thermal expansion of the piping.

1.04 REFERENCE STANDARDS

A. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
   1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
   2. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.

B. American Society for Testing and Materials (ASTM)
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

C. American National Standards Institute (ANSI)
   1. ANSI B31.1 - Power Piping.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All hangers, supports and appurtenances shall conform to the latest applicable requirements of ANSI B31.1, except as supplemented or modified by the requirements of this Section.

B. All hangers supports and appurtenances shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10-ft of water filled pipe being supported.

C. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit certification stating that such requirements have been complied with.

1.06 DELIVERY, STORAGE AND HANDLING

A. All supports and hangers shall be crated, delivered and uncrated so as to protect against any damage.

B. All parts shall be properly protected so that no drainage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

C. Finished metal surfaces not galvanized, that are not of stainless steel construction, or that are not coated, shall be grease coated, to prevent rust and corrosion.

PART 2 PRODUCTS

2.01 GENERAL

A. All of the equipment specified herein is intended to support the various types of pipe and piping systems shown on the Drawings. It shall be the responsibility of the Contractor to develop final details and any details associated with special conditions not already covered to meet the system conditions specified in the respective Division 15 pipe specifications.

B. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, fittings and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces and all probable external forces such as equipment, pipe and personnel contact.

C. The Contractor may propose minor adjustments to the piping arrangements in order to simplify the supports, or in order to resolve minor conflicts in the work. Such an adjustment might involve minor change to a pipe centerline elevation so that a single trapeze support maybe used.

D. Where flexible couplings are required at equipment tanks, etc, the end opposite to the piece of equipment tank, etc, shall be rigidly supported, to prevent transfer of system forces to the equipment. No fixed or restraining supports shall be installed between a flexible coupling and the piece of equipment.

E. All pipe and appurtenances connected to the equipment shall be supported in a manner to prevent any strain from being imposed on the equipment or piping system.

F. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for interior pipe supports shall be furnished with galvanized finish, hot dipped or electro-galvanized coated, except where field welding is required, where cold-applied galvanizing may be used. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16 inch plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets and components for exterior pipe, submerged pipe and pipe within outdoor structures shall be of Type 304 stainless steel.

G. Supports shall be sufficiently close together such that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.

H. All uninsulated non-metallic piping such as PVC, CPVC, etc shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the Engineer. Where pipes are bottom supported 180 degrees, arc shields shall be furnished. Where 360 degree arc supports required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18 gauge minimum thickness, not be less than 12 inches in length and be securely fastened to pipe with stainless steel or galvanized metal straps not less than ½ inch wide.

I. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under respective pipe insulation. Provide protection shields as specified in at each support location.

J. Where pipe hangers and supports come in contact with copper piping provide protection from galvanic corrosion by; wrapping pipe with 1/16 inch thick neoprene sheet material and galvanized protection shield; isolators similar to Elcen figure number 228; or copper plated or PVC coated hangers and supports. All stainless steel piping shall be isolated from all ferrous materials, including galvanized steel by use of neoprene sheet material and protection shields, similar to above methods.

K. Pipe supports shall be provided as follows:

1. Cast iron and ductile iron, steel and stainless steel piping shall be supported at a maximum support spacing of 10-ft with a minimum of one support per pipe section at the joints.
2. In so far as is possible, floor supports shall be given preference. Typical concrete supports are shown on the structural drawings. Base elbow and base tees shall be used where possible.
3. Support spacing for steel and stainless steel piping 2-in and smaller diameter and copper tubing shall not exceed 5-ft.
4. For all stainless steel piping, provide neoprene isolators between the pipe and support components.
5. Supports for multiple runs of plastic piping shall be continuous wherever possible. Individually supported plastic pipes shall be supported as recommended by the manufacturer except that support-spacing shall not exceed 3-ft. Multiple, suspended, horizontal plastic pipe runs, where

possible, shall be supported by ladder type cable trays such as the Electray Ladder by Husky-Burndy; the Globetray by the Metal Products Division of United States Gypsum, or equal. Ladder shall be of galvanized steel construction. Rung spacing shall be 12 inches. Tray width shall be approximately 6 inches for single runs and 12 inches for double runs. Ladder type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps or fasteners equal to Globe Model M-CAC; Husky-Burndy Model SCR or equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers and supports in contact with plastic pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

6. All vertical pipes shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to insure rigid construction. All vertical pipes passing through pipe sleeves shall be secured using a pipe collar.
7. Pipe supports shall not induce point loadings but shall distribute pipe loads evenly along the pipe circumference.
8. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or as specified herein. No piping shall be supported from other piping or from metal stairs, ladders and walkways, unless specifically directed or authorized by the Engineer.
9. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings and sleeve type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.
10. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

L. Unless otherwise specified herein, pipe hangers and supports shall be standard catalogued components, conforming to the requirements of MSS-SP-58 and -69; and shall be as manufactured by Anvil International, Inc., Portsmouth, NH; Carpenter & Paterson, Inc., Woburn, MA; and Unistrut Northeast, Foxboro, MA, or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary.

M. Any required pipe supports for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes, concrete and anchor hardware similar to items previously specified herein and shall be subject to the approval of the Engineer.

N. Expansion anchors shall be equal to Kwik-Bolt manufactured by Hilti, Inc. of Tulsa, OK, or ANKR-Tite manufactured by *wej-it* Fastening Systems, Tulsa, OK. The length of expansion bolts shall be sufficient to place the wedge portion of the bolt a minimum of 1 inch behind the steel reinforcement.

O. Hanger rods shall be hot rolled steel, machine threaded and galvanized after fabrication. The strength of the rod shall be based on its root diameter. Hanger rods shall be attached to concrete structures using concrete insert similar to F&S

Figures 180,571 or 150; or continuous concrete inserts per F&S. Inserts shall be malleable iron, or steel with galvanized finish. Beam clamps, C clamps or welded beam attachments shall be used for attaching hanger rods to structural steel members where necessary and approved by the Engineer, expansion anchors shall be used for attaching to concrete structures.

2.02 SINGLE PIPE HANGERS

A. Single pipes shall be supported by hangers suspended by hanger rods from structural steel members, concrete ceilings, bottom of trapeze hangers and wall mounted steel angle brackets.

B. Except as otherwise specified herein, pipe hangers shall be of the adjustable clevis type similar to Anvil International Figure Numbers 65,260 and 590 as required.

C. Where pipes are near walls, beams, columns, etc, and located an excessive distance from ceilings or underside of beams, welded wall brackets similar to Carpenter and Paterson Figure numbers 69-78, 84 or 139 shall be used for hanging pipe. Where single pipes rest on top of bracket pipe supports, attachments shall meet requirements as specified under multiple pipe hangers.

2.03 MULTIPLE PIPE HANGERS

A. Suspended multiple pipes, running parallel in the same horizontal plane, which are adjacent to each other shall be suspended by trapeze type hangers or wall brackets. Trapeze hangers shall consist of galvanized structural steel channel supported from galvanized threaded rod or attached to concrete walls, columns or structural steel support members as required to meet the intent of this Section. Channel shall be similar to F&S Figure 710, rods, concrete inserts, 1C~clamps, beam clamps, welded beam attachments and expansion shields shall be as specified in Paragraph 2.02 above.

B. Except as otherwise specified herein pipe anchors used for attaching pipe to trapeze or multiple pipe wall brackets shall be anchor or pipe chairs similar to F&S Figures 158, 419, 160A, 160B as required. Material of construction shall be galvanized steel. Chair "U" bolts shall be tightened to allow freedom of movement for normal expansion and contraction except where pipe must be anchored to control direction of movement or act as a thrust anchor.

2.04 SINGLE AND MULTIPLE PIPE SUPPORTS

A. Single pipes located in a horizontal plane close to the floor shall be supported by one of the methods as specified herein.

B. Pipes 3 inch in diameter and larger shall be supported by adjustable stanchions similar to F&S Figure 427. Stanchions shall provide at least 4-inch adjustment and be flange mounted to floor.

C. Pipes less than 3 inches in diameter shall be held in position by support fabricated from steel "C' channel, welded post base similar to Unistrut Figure P2072A and pipe clamps similar to Unistrut Figures P1109 thru P1126. Where required to assure adequate support, fabricate supports using two vertical members and post bases connected together by horizontal member of sufficient load capacity to support pipe. Wherever possible supports shall be fastened to nearby walls or other structural member to provide horizontal rigidity. More than one pipe may be supported from a common fabricated support.

D. Where shown on the Drawings, pipe shall be supported using concrete anchor posts. Pipe shall be securely fastened to the posts using suitable metal straps as required and as approved.

2.05 WALL SUPPORTED PIPES

A. Single or multiple pipes located adjacent to walls, columns or other structural members, whenever deemed necessary, shall be supported using welded steel wall brackets similar to Carpenter and Patterson Figure numbers 69-78, 84, or 139; or "C" channel with steel brackets similar to Unistrut pipe clamps. All members shall be securely fastened to wall, column, etc, using double expansion shields or other method as approved by the Engineer. Additional wall bearing plates shall be provided where required.

B. Pipe shall be attached to supports using methods specified herein to meet the intent of this Section.

2.06 BASE ANCHOR SUPPORT

A. Where pipes change direction from horizontal to vertical via a bend, a welded or cast base bend support shall be instilled at the bend to carry the load. The base bend shall be fastened to the floor, pipe stanchion, or concrete pedestal using expansion anchors or other method as approved by the Engineer.

B. Where shown on the Drawings, pipe bends shall be supported using concrete anchor posts. Pipes shall be securely fastened to the concrete supports with suitable metal bands as required and approved by the Engineer. A felt insert shall be used to isolate the piping from the poured concrete.

2.07 VERTICAL PIPE SUPPORTS

A. Where vertical pipes are not supported by a Unistrut system as specified in Paragraph 2.08 below, they shall be supported in one of the following methods.

1. For pipes ¼ inch to 2 inches in diameter, an extension hanger ring shall be provided with an extension rod and hanger flange. The rod diameter shall be as recommended by the manufacturer for the type of pipe to be supported. Tile hanger ring shall be steel or PVC clad depending on the supported pipe. The hanger ring shall be equal to Carpenter & Paterson Fig. No.81 or 8ICT. The anchor flange shall be galvanized malleable iron similar to Carpenter and Paterson Figure No.85.
2. For pipes equal to or greater than 2 inches in diameter, extended pipe clamps similar to Carpenter and Patterson Figure No.267 may be used. The hanger shall be attached to concrete structures using double expansion shields, or to steel support members using welding lugs similar to Carpenter and Patterson Figure No.220.
3. Pipe riser clamps shall be used to support all vertical pipes extending through floor slabs. Riser clamps shall be steel similar to Carpenter and Paterson Figure No.126. Copper clad or PVC coated clamps shall be used on copper pipes. Insulation shall be removed from insulated piles prior to installing riser clamps. Insulation shall not be damaged by clamp installation.
4. Unless otherwise specified, shown, or specifically approved by the Engineer, vertical runs exceeding 12 feet shall be supported by base

elbows/tees, clamps, brackets, wall rests and pipe collars, all located as required to ensure a rigid installation.

2.08 SPECIAL SUPPORTS

A. Pipe supports shall be provided for closely spaced vertical piping systems required to provide a rigid installation. The interval of vertical support spacing shall be as specified, but in no case shall vertical interval exceed 10 feet. The support system shall consist of a framework suitably anchored to floors, ceilings or roofs.

B. Vertical and horizontal supporting members shall be U shaped channels similar to Unistrut Series P1000. Vertical piping shall be secured to the horizontal members by pipe clamps or pipe straps. All components shall be of steel.

C. For piping 3-in and smaller, the framework shall be as manufactured by the Unistrut Corporation; Globe-Strut as manufactured by the Metal Products Division of U.S. Gypsum or equal. For piping larger than 3-in, the support frame shall be fabricated from structural steel shapes and secured through the use of expansion anchors.

D. The assemblies shall be furnished complete with all nuts, bolts and fittings required for a complete assembly including end caps for all Unistrut members.

E. The design of each individual framing system shall be the responsibility of the Contractor. Shop drawings, as specified above, shall be submitted and shall show all details of the installation, including dimensions and types of supports. In all instances the completed frame shall be adequately braced to provide a complete rigid structure when all the piping has been attached.

F. Supports not otherwise described in this Section shall be fabricated or constructed from standard structural steel shapes in accordance with applicable provisions of Section 05500, or Unistrut-type frame; have anchor hardware similar to items previously specified herein, shall meet the minimum requirements listed below and be subject to the approval of the Engineer.

1. Pipe support systems shall meet all requirements of this Section and all related Sections.
2. Complete design details of the pipe support system and system components shall be submitted for review and approval as specified in PART 1. No hanger or support shall be installed without the written approval of the Engineer.
3. The pipe support system shall not impose loads on the supporting structures in excess of the loads for which the supporting structure is designed.

2.09 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. All mild steel surfaces shall be prepared and shop painted as part of the work of this Section. Surface preparation and shop painting shall be as specified in Section 09900.

B. All pipe hangers and supports and supporting systems that are not of galvanized steel or stainless steel shall be finish painted as specified in Section 09900.

PART 3 EXECUTION

3.01 INSTALLATION

A. Proceed with the installation of piping and supports only after any building structural work has been completed and new concrete has reached its 28-day compressive strength.

B. The installation of pipe support systems shall in no way interfere with the operation of the hoists, access hatches, etc.

C. The installed systems shall not interfere with maintenance and operational access to any equipment installed under this Section, or any other related Section.

D. All pipes, horizontal and vertical, requiring rigid support shall be supported from the building structure by approved methods. Supports shall be provided at changes in direction and elsewhere as shown in the Drawings or as specified herein. No piping shall be supported from metal stairs, ladders and walkways unless specifically directed or authorized by the Engineer.

E. All pipe supports shall be designed with liberal strength and stiffness to support the respective pipes under the maximum combination of peak loading conditions to include pipe weight, liquid weight, liquid movement and pressure forces, thermal expansion and contraction, vibrations and all probable externally applied forces. Prior to installation, all pipe supports shall be approved by the Engineer.

F. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split type couplings and sleeve type couplings (within four pipe diameters), and to minimize all pipe forces on pump housings. Pump housings shall not be utilized to support connecting pipes.

G. Inserts for pipe hangers and supports shall be installed on forms before concrete is placed. Before setting these items, all Drawings and figures shall be checked which have a direct bearing on the pipe location. Responsibility for the proper location of pipe supports is included under this Section.

H. Continuous metal inserts shall be embedded flush with the concrete surface.

I. Apply anti-seize compound to all nuts and bolts. Supports installed without the approved compound shall be dismantled and correctly installed, at no cost to the Owner.

3.02 TESTING

A. All pipe support Systems shall be tested for compliance with this Section. After installation, each pipe support system shall be tested in conjunction with the respective piping pressure tests. If any part of the pipe support system proves to be defective or inadequate, it shall be repaired or augmented under this Section to the satisfaction of the Engineer.

END OF SECTION

SECTION 15100

VALVES & SPECIALTIES

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish, install, support, and test valves and other process piping specialties (including valves, gates, hydrants, cocks, stops, hose bibs, faucets, valve operators, and pressure gauges), when applicable, in the location(s) and of the size(s) and quantities shown on the Drawings and as directed by the Engineer.

B. Work Specified Elsewhere. This Section is not a stand-alone Section. Other requirements which relate to this Section are noted elsewhere in these documents. The Contractor and all Subcontractors are required to review this entire document along with the Drawings in an effort to identify all requirements.

1.2 SUBMITTALS TO THE ENGINEER

A. Submit shop drawings in accordance with the General Conditions of the Construction Contract. Clearly indicate make, model, location, size, and pressure rating.

B. Catalog Data: Submit manufacturer's literature and illustrations for each size of valve furnished.

C. Certificates: Submit manufacturer's certification that valves and accessories meet or exceed the requirements of these Specifications.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Shipping:
   1. Prepare valves and accessories for shipment as required for complete protection.
   2. Seal valve ends to prevent entry of foreign matter into valve body.
   3. Box, crate, completely enclose and protect valves and accessories from accumulations of foreign matter.

B. Storage:
   1. Store valves and accessories in an area on the construction site protected from weather, moisture, or possible damage.
   2. Do not store valves or accessories directly on the ground.

C. Handling:
   1. Handle valves and accessories to prevent damage of any nature to the interior and the exterior surfaces.

D. Inspection:
   1. Carefully inspect all materials for:
      a. Defects in workmanship and materials.
      b. Removal of debris and foreign material in valve openings and seats.
      c. Proper functioning of all operating mechanisms.
      d. Tightness of all nuts and bolts.

PART 2 -- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide valves of the same manufacturer throughout where possible. Like items shall be of the same manufacturer.

B. Provide valves with manufacturer's name, valve size, and pressure rating clearly marked on outside of body, either cast on the body or bonnet or shown on a permanently attached plate in raised letters.

2.2 MATERIALS

A. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by the valve manufacturer for intended service but not of a lower quality than specified herein.

B. Valves and operators shall be suitable for the exposure they are subject to; buried, exterior, and corrosive, etc., as applicable. They shall have all safety features required by OSHA.

2.3 EQUIPMENT

A. Block Valves

1. Gate Valves

a. 2-1/2 inch and smaller: screwed or solder end, bronze body, rising stem, solid bronze disc, 125 psi steam pressure 200 psi W.O.G. Equal to Nibco T-111 or S-111.

b. 3-inch and larger: Cast Iron body, bronze trim, rising stem, OS&Y, solid wedge. Valves shall conform to the latest revision of AWWA Resilient Seated gate valve Standard C-509, be UL listed and FM approved for service to 250 PSI, cold water, non-shock water works service and 200 PSI fire protection service. Flanges drilled to ANSI B-16.1 (125#). Valves shall be KEN-SEAL II Resilient-Wedge Valves manufactured by Kennedy Valve Company, American Flow Control No. 2500, or approved equivalent.

2. Plug Valves

a. All valves shall be non-lubricated eccentric type with resilient faced plugs and shall be furnished with end type as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125 lb standard.

b. Valve bodies shall be of ASTM A126 Grade B cast iron. Bodies in 4" and larger valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel.

c. Plugs shall be of ASTM Class B Cast Iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.

d. Valves shall have sleeve type metal bearings and shall be sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF-8M or AISI Type 317L stainless steel.

e. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable under pressure without removing the bonnet or actuator from the valve.
f. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72"
g. All plug valves shall be provided with geared hand wheel operators.
h. Plug valves shall be manufactured by DeZurik/Copes-Vulcan, Kennedy, or approved equivalent.

3. Ball Valves:
   a. For PVC Piping: 3" and smaller shall be CPVC Socket True Union Ball Valves with O-ring seat and seals compatible for use with subject chemical and double union design. As manufactured by:
      1). Hayward;
      2). Spears;
      3). Or approved equal.
   b. For Copper Piping: 2" and smaller shall be have a bronze body and ball, seats and seals, level handle, solder ends, and 400 psi WOG.
      1). As manufactured by NIBCO S-595-W or approved equal.

B. Throttling/Control Valves
1. Hose Bibbs: Hose bibbs shall be heavy duty bronze or brass with replaceable hexagonal disc, removable handle, hose thread spout, and chrome plated. Hose bibbs shall be Model 2002 manufactured by A.Y. McDonald Mfg. Co., Nibco, or approved equivalent.
2. Non-freeze Hose Bibbs: Cast brass anti-siphon non-freeze wall hydrant, 3/4 inch hose thread outlet, polished brass face, key handle, brass wall casing of proper length, 3/4 inch straight IPS inlet, integral vacuum breaker. Non-freeze hose bibs shall be Zurn Z-1310, Watts, or approved equivalent.
3. Air Release Valves
   a. Combination air valves shall be provided at high points in the pipeline as shown on the Drawings. The valves shall be of the single housing style and provide features of both an air/vacuum and air release valve.
   b. The air/vacuum portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allow to re-enter the pipeline should the internal pressure of the pipeline approach a negative value due to draining of the pipeline etc. The air release portion shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure.
   c. The combination air valve shall have an inlet size as shown on the Drawings, outlet connection of at least 1" for vent piping and a maximum working pressure of at least 150 psi. The valve shall be easy to open for ease of maintenance or have a back flushing attachment. The valve shall be suitable for operating at low pressure of 2-60 psi.
   d. The materials of construction shall be as follows:

1).	Float	Stainless Steel or Polypropylene
2).	Internals	Stainless Steel, Glass Reinforced Nylon, or Polypropylene
3).	Seals	Buna N, EPDM or Viton
4).	Body	Ductile Iron

5). Cover PVC or Glass Reinforced Nylon

e. Valves with a diameter of 2" or greater shall be Bermad model C70 (DI body) and diameters of 1" or smaller shall be Bermad model C30 (DI body).

f. Copper or PVC drain piping shall be installed to direct overflow from the valve to a suitable discharge location

4. Manual Butterfly Valves

a. Valves shall be as manufactured by Henry Pratt Company or approved equal.

b. All butterfly valves are to be Class 150B as called out in AWWA Specification C504. Valve body shall be flanged type of ductile iron with a minimum shell thickness per Table 3, Class 150A, B.

c. The valve body shall have two (2) hubs for shaft bearing containment. Operator mounting flange shall be designed to allow operators to be field mounted or rotated to any of four (4) positions without removing the valve from the line.

d. Valve disc shall be streamlined for low pressure drop and resistance to cavitation. Disc edge to be smooth and polished to minimize torque and wear. Discs shall be 316 S.S. Disc shall be attached to the valve shaft use by use of precision taper pins with locknuts.

e. Valve shafts to be one (1) piece 316 Series stainless steel. Diameter per Table 4, Class 150B.

f. Valve seats shall be installed in the valve body and shall be field replaceable without special tools, valve seats may be bonded to the valve body or bonded to a phenolic ring which is inserted into the body. Material can be Buna N, Neoprene or EPDM or as dictated by the service conditions.

g. Valve shall be fitted with sleeve type, self-lubricated bearings in the valve body. Bearings shall be of ample size to properly guide and support the shaft under full load. Bearings shall be immediately outboard of the seat and at the operator end of the body. Where shaft projects through the body for the operator connection, a seal shall be provided. This seal may be of the double 0-ring type contained within a corrosion resistant housing.

h. Valves shall be handwheel operated except that chainwheel operators shall be provided for valves located seven (7) feet above the floor.

7. Needle Valves: PVDF valve with PTFE (Teflon) seal. Working pressure up to 232 psig at 73º F. Design based on George Fischer Type 522.

8. Pressure Relief Valves: Direct acting, spring loaded, diaphragm type, adjustable range as required by equipment, Cla-Val CRA or equal.

9. For Pilot operated pressure relief valves 1" and larger see Section 15220.

10. For Pilot operated pressure reducing valves see Section 15121.

C. Non-return Valves

1. Swing Check Valves

a. 2-1/2 inch and smaller: Screwed or solder end, bronze body, Buna-N disc, 200 psi WOG cold pressure. Valves shall be Nibco T-413-W or S-413-W, A. Y. McDonald, or approved equivalent.

b. 3-inches and larger:

1. Check valves shall be resilient seated type manufactured from ductile iron meeting or exceeding ASTM A-536 65-45-12. Valve ends shall be ANSI 125 lb flanged. Valves shall be rated for 250 psig cold water working pressure.
2. Valves shall have a ductile iron disc with stainless steel shaft and nylon reinforcement, fully encapsulated with EPDM rubber. Disc travel to closure shall not be more than 35 degrees and shall seal drop tight at pressures above 5 psig. Bronze seat rings are not allowed. Disc shall be the only allowable moving part. No O-rings, pivot pins or other bearings are allowed. Disc must be reversible such that either side will seal equally.
3. Valves shall meet or exceed the requirements of ANSI/AWWA C508. The valve body and bonnet shall be coated with fusion-bonded-epoxy coating conforming to ANSI/AWWAC550. Bonnet nuts and bolts and other hardware/plugs shall be stainless steel.
4. Valves shall be manufactured by Valmatic, American Flow Control's Series 2100 Ductile Iron Resilient Seated Check Valve, Kennedy Fig. 506, or approved equivalent.

2. Silent Check Valves or Non-Slam Check Valves:
   a. Check valves shall be furnished and installed as shown and shall be Figure 280 as manufactured by GA Industries, Valmatic series 1800 (Globe style) or approved equal.
3. Backflow Preventer: Double spring-loaded check valve assembly with automatically operating reduced pressure relief valve located in the pressure zone between the two check valves. All bronze construction with stainless steel internals, union, threaded or flanged connections, inlet and outlet shutoff valves. Test cocks on inlet, relief, and outlet pressure zones. Size, flow capacity and pressure drop as shown on the Drawings. N.S.F. and A.S.S.E. tested and approved. Provide air gap drain, plumbed to floor. 1/2 inch - 3/4 inch sizes: Watts #009, FEBCO #860, Beeco #12, or approved equivalent. 1 inch - larger: Watts #909, FEBCO #860, Beeco #6-C, or approved equivalent.
4. Pressure Reducing Valve (PRV): Watts LFU5B-Z3 or approved equal. Pressure reducing valve shall have integral stainless steel strainer. Valve shall be suitable for pressures up to 300 psi, with adjustable downstream pressure from 25-75 psi. Valve shall be set for 50 psi downstream pressure or as required by application. Valve shall have lead free cast copper silicon alloy body, replaceable stainless steel seat, reinforced EPDM diaphragm and valve disk.

D. Valve Actuators and Operators
1. Manual Operators
   a. Hand Wheel Operators: Manual hand wheel operators shall be provided for valves with a centerline less than 60 inches AFF. For valves located with a centerline greater than 60 inches, AFF, chain wheels and guides shall be provided. Where chains hang in normally traveled areas, provide "L" type tie-back anchors.

E. Valve Connections
1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Unless otherwise shown, valves shall be the same size as the adjoining pipe.
2. Thread pipe sizes 2 inches and smaller.

3. Flange pipe sizes 2-1/2 inches or larger.
4. Solder or screw to solder adaptors for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.

F. Gauge Assemblies
1. Provide gauges as shown on the drawings with the appropriate protective fittings. Gauges shall be liquid filled, 4-1/2-inch diameter aluminum casing, and the measurement range shall be compatible with the applicable working pressure.
2. A corrosion resistant diaphragm seal shall be provided to protect the gauge instrument from the applicable liquid being measured. The diaphragm seal shall meet or exceed the pressure rating of the process piping. The seal shall include a flushing screw on the liquid side of the seal and a filling screw on the instrument side of the seal.
3. Pressure snubbers, stainless steel in construction, shall be provided for all assemblies to protect the gauge instrument.
4. A ball valve shall be provided for each gauge assembly to allow the assembly to be disconnected from the process piping and serviced. Unless otherwise specified on the drawing, the ball valve shall be a minimum of 1/2-inch in diameter.

2.4 ACCESSORIES

A. All accessory items such as positioners, actuators, limit switches, solenoid pilot valves, and speed control valves shown, specified, or required, shall be factory mounted on the indicated valve and adjusted accordingly.

2.5 APPURTENANCES

A. Floor Stands and Extension Stems: When required by the installations, floor stands and extension stems shall be provided for operation of valves. Floor stands shall be of the non-rising stem, indicating type, complete with all necessary steel extension stems, couplings, hand wheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Stem guides shall be spaced so that the stem L/R ratio does not exceed 200. Provide all necessary anchor bolts in Type 304 stainless steel. Floor stands shall be cast iron base type, Figure F-5515 as manufactured by Clow Corporation, Figure A-26426 as manufactured by Mueller Company, or approved equal. All hand wheels shall turn counter clockwise to open and the valves. Where operators for quarter-turn valves are located on floor stands, extension stems shall be torque tube type properly sized for the maximum torque capacity of the valve.

B. Floor Boxes and Extension Stems: Floor boxes shall be Neenah Foundry R 7506, Clow No. F5690, or approved equal. Provide steel valve extension stems where required to locate the operating nut in the floor box. Stem guides shall be spaced so that the L/R slenderness ratio does not exceed 200. Provide all necessary anchor bolts in Type 304 stainless steel.

C. Chain Wheels and Guides: Chain wheels and guides shall be Figure F-5680 as manufactured by Clow Corporation, DeZurik Corporation, or approved equal. Chain wheels and guides shall be galvanized or cadmium-plated. Chains shall be of the size recommended by the valve manufacturer and shall extend to within 4 feet of the operating floor. Chains shall be heavily galvanized or cadmium-plated. Where chains hang in normally traveled areas, appropriate "L" type tie-back anchors shall be provided and located as directed by the Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Apply a shop coat finish of an asphalt varnish to:
   1. Interior surfaces of all valves except corrosion resistant or specially coated valves as required.
   2. Exterior surfaces of buried or submerged valves.
   3. Miscellaneous piping appurtenances.

B. Apply coats of paint filler and enamel to parts customarily finished at the shop, or other treatment customary with the manufacturer.

C. Apply a shop coat of grease or other suitable rust resistant coating to ferrous surfaces obviously not to be painted.

3.2 INSTALLATION

A. Install valves and accessories in strict accordance with manufacturer's instructions and recommendations, as shown on the Drawings and as directed by the Engineer.

B. Install valves with stems upright or horizontal, not inverted.

C. Carefully erect all valves and support them in their respective positions free from distortion and strain.

D. Independently support all valves connected to pumps and equipment, and in piping systems that cannot support valves.

E. Repair any scratches, marks and other types of surface damage etc. with original coating as supplied by the factory.

3.3 ADJUSTING

A. Check and adjust all valves and accessories for smooth operation.

END OF SECTION

SECTION 15121

PRESSURE REDUCING VALVES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install pressure reducing valves, including all necessary appurtenances, of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

B. Related Sections
   1. Section 15100 – Valves and Specialties

1.2 QUALITY ASSURANCE

A. Pressure reducing valves shall be certified to comply with NSF/ANSI 61 and 372 (lead free compliance)

B. Materials shall be from one manufacturer for each piece of equipment or fitting.

C. All valves supplied under this Section shall be from a single manufacturer.

D. Acceptable manufacturers:
   1. Cla-Val Co., Costa Mesa CA 92627-4416
   2. or approved equal.

PART 2 - PRODUCTS

2.1 PRESSURE REDUCING VALVES

A. Provide the number and size of valves shown on the Drawings.

B. Function
   1. The Pressure Reducing Valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure.

C. Main Valve
   1. The valve shall be hydraulically operated, single diaphragm-actuated, globe or angle pattern, as shown on the Drawings. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.
   2. The valve shall be equipped with a NC Solenoid valve. When the solenoid is activated the valve will open and perform the pressure reducing function.
   3. The solenoid shall be controlled manually from the RTU Panel or remotely through SCADA.
   4. Valve shall be equal to Cla-Val model 93-01.

D. Main Valve Body

1. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. Ductile Iron is standard and other materials shall be available. No fabrication or welding shall be used in the manufacturing process.
2. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.
3. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. Valve stem shall be of designed to be self-cleaning to minimize/eliminate buildup of mineral deposits which prevent the valve from operating freely. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.
4. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.
5. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 6" and smaller size valves shall be threaded into the cover and body. Valve seat in 8" and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same

material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

6. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment, provided the valve is installed and used in accordance with all applicable instructions. Electrical components shall have a one-year warranty.
7. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4" through 24" sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which show flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity, and if there will be cavitation damage.
8. Material Specifications and Product Options: As shown on the Drawings.

E. Pilot Control System
1. The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted.
2. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.
3. Material Specifications and Product Options for Pilot Control: As shown on the Drawings.
4. The Valve shall have a solenoid control to allow it to open or shut on command through SCADA.

F. Low Flow By-Pass
1. Not required.

G. Initial Pressure Settings
1. Initial pressure setting shall be 42 psi or as shown on the Drawings. Pressure settings shall be adjusted in the field to establish the desired flow rate from the high pressure zone to the main pressure zone.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Requirements:
1. Install in accordance with manufacturer’s recommendations.
2. Refer to Section 15100 “Valves and Specialties” for additional installation requirements.

B. Contractor shall measure and record actual valve centerline elevation in the field following installation.

3.2 START-UP & TRAINING

A. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments for all valves provided under this Section.

B. The Contractor shall be responsible for any additional work determined by the manufacturer's representative to be necessary for proper operation of the valve as described by these Specifications and the Drawings at no additional cost to the Owner.

C. Demonstrate to the satisfaction of the Engineer that the valve operates as described by these Specifications and the Drawings.

D. The factory representative shall provide training to operators, in the presence of the Engineer, on proper operation and maintenance of all valves provided under this Section.

3.3 OPERATION AND MAINTENANCE MANUALS

A. Provide operation and maintenance manuals in accordance with the General Conditions and Division 1 of these Specifications.

END OF SECTION

SECTION 15220

PRESSURE RELIEF VALVE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included: Furnish and install pressure reducing valves, including all necessary appurtenances, of the type(s) and size(s) and in the location(s) shown on the Drawings and as specified herein.

B. Related Sections

1. Section 15100 – Valves

1.2 QUALITY ASSURANCE

A. Materials shall be from one manufacturer for each piece of equipment or fitting.

B. All valves supplied under this Section shall be from a single manufacturer.

PART 2 – PRODUCTS

2.1 FUNCTION

A. The valve shall maintain a constant upstream pressure by bypassing or relieving excess pressure and shall maintain close pressure limits without causing surges. If upstream pressure decreases below the spring setting, the valve shall close.

B. The valve shall provide adequate Cv and flow capacity for the application. Sizing reports shall be made available by the manufacturer where desired.

2.2 MAIN VALVE

A. The valve shall be hydraulically operated, single diaphragm-actuated, globe or angle pattern as indicated in the valve schedule or shown on the Drawings. The valve shall consist of three major components: the body with seat installed, the actuator covers, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls. The flexible diaphragm shall be compatible with the operating fluid, shall not be used as the seating surface, and shall be fully supported by the body and/or cover.

B. The valve shall contain a resilient, synthetic rubber disc with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. No O-ring type discs (circular, square, or quad type) shall be permitted as the seating surface.

C. The flexible, non-wicking, FDA approved diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber

grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

D. The main valve seat and any stem bearing in the valve cover shall be removable. The valve stem, seal disc and seat shall be stainless steel, and the body and covers shall be ductile iron. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline.

E. Line and coat all Ductile Iron components, including body and covers with a NSF-61 certified coating applied by the electrostatic heat fusion process. Where applicable, the valve assembly and components shall be compliant to NSF low-lead requirements.

F. The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three years from date of shipment provided the valve is installed and used in accordance with all applicable instructions.

2.3 PILOT CONTROL SYSTEM

A. The pressure relief pilot shall be a direct-acting, adjustable, spring-loaded, diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. The pilot control is normally held closed by the force of the compression on the spring above the diaphragm and it opens when the pressure acting on the underside of the diaphragm exceeds the spring setting. Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked.

B. Pilot Control System will be provided with ball valves for isolation, closing flow control, and a Y-strainer for protection.

C. A full range of spring settings shall be available in ranges from 0-450 psi.

2.4 SIZE

A. As shown on the Drawings.

2.5 MANUFACTURER AND MODEL

A. Cla-val Model 50-01;

B. Or equal.

2.6 OPTIONS

A. Inlet pressure gauge

B. Position indicator

PART 3 - EXECUTION

3.1 INSTALLATION

A. Requirements:
   1. Install in accordance with manufacturer's recommendations.
   2. Refer to Section 15100 "Valves" for additional installation requirements.

B. Contractor shall measure and record actual valve centerline elevation in the field following installation.

3.2 START-UP & TRAINING

A. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments for all valves provided under this Section.

B. The Contractor shall be responsible for any additional work determined by the manufacturer's representative to be necessary for proper operation of the valve as described by these Specifications and the Drawings at no additional cost to the Owner.

C. Demonstrate to the satisfaction of the Engineer that the valve operates as described by these Specifications and the Drawings.

D. The factory representative shall provide training to operators, in the presence of the Engineer, on proper operation and maintenance of all valves provided under this Section.

3.3 OPERATION AND MAINTENANCE MANUALS

A. Provide operation and maintenance manuals in accordance with the General Conditions and Division 1 of these Specifications.

END OF SECTION

Scope of Work

Furnish, install and test all electrical work and appurtenant work in complete accordance with the Drawings and Specifications.

Contractor's Duties

Except as specifically noted, provide and pay for all labor, materials, equipment, tools, machinery, water, heat, other facilities and services necessary for proper execution and completion of work.

Contents of Division

Section No.	Section Title
16050	Basic Electric
16110	Raceway
16120	Wire and Cables
16130	Cabinets, Boxes, and Fittings
16140	Wiring Devices
16190	Supporting Devices
16195	Electrical Identification
16400	Service Entrance
16440	Disconnect Switches
16450	Grounding
16460	Transformers
16470	Panelboards
16481	Motor Starters
16500	Lighting Fixtures

SECTION 16050

BASIC ELECTRICAL

PART 1 - GENERAL

1.01 SCOPE

A. The CONTRACTOR shall provide the labor, tools, equipment, and materials necessary to furnish and install the complete electrical work in accordance with the plans and as specified herein. The work shall include but not be limited to the following: The CONTRACTOR shall provide:

1. Complete power distribution systems including electrical service, panelboards, variable frequency drives, motor controllers, transformers, over current devices, wiring devices, raceway, cable, wire and etc.

2. All motor wiring, safety disconnects, and motor starters unless integral with equipment.

3. Complete interior, exterior and emergency lighting system including emergency battery pack fixtures, exit signs, lamps, controls, trim and accessories.

4. Control wiring not provided by other Divisions.

5. Complete grounding and surge protection system.

6. All support material and hardware for raceway, cable tray and electrical equipment.

7. Underground system.

8. Termination of all cable and wire unless otherwise noted. This includes, but is not limited to, final termination of all control and instrumentation wiring in Process Equipment and PLC control panels and consoles.

9. Building wall, floor and roof penetrations for raceway and cable tray.

10. Fire rated sealing of all electrical penetrations.

11. Miscellaneous equipment.

12. Start up, acceptance testing test reports and instruction of systems operation to the OWNER.

B. This section also includes general construction materials and methods for application with electrical installations as follows:

1. Miscellaneous metals for support of electrical materials and equipment.

2. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

3. Concrete used for the following:
   a) Housekeeping pads.
   b) Pipe supports.

4. Temporary utilities and connections include the following:

   a) Temporary electric service.
   b) Temporary service.
   c) Temporary lighting to provide adequate illumination of work areas and security.

C. Related Work. Division 16 is responsible for installation, wiring and raceways for electrically operated equipment, cabinet, starters, controls, instrumentation and related items furnished under other divisions. Division 16 shall furnish and install disconnect switches for equipment furnished under other divisions. This shall include but not be limited to the following:

1. Process equipment control panels.

2. PLC control panels, consoles and instrumentation.

3. HVAC and mechanical equipment starters, disconnects, panels, etc.

D. Related Work Not Included:

1. Excavation and backfilling including gravel or sand bedding for underground electrical work, concrete encasement for conduit shall be performed by CONTRACTOR under other divisions of this specifications.

2. Furnishing and/or installing temperature control for mechanical trades under Division 15.

E. Examination of Site:

1. Before submitting a bid, the CONTRACTOR shall visit and carefully examine site to identify existing conditions and difficulties that may affect the Work of this Section. No extra payment will be allowed for additional work caused by unfamiliarity with site conditions.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

1.03 QUALITY ASSURANCE

A. Codes and Standards. Perform all work associated with basic electrical materials in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein. Where provisions of the pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. National Electrical Code (NEC).
2. National Fire Protection Association (NFPA).
3. Underwriters Laboratories, Inc. (UL).
4. Local and State Building Codes.
5. All electrical equipment shall be listed and labeled by UL or an approved independent nationally recognized electrical testing laboratory.

B. Inspector Certifications

1. Provide two copies of the electrical inspectors certificate of approved showing acceptability of work done under this contract.

1.04 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.

B. Follow the procedures specified in Division 1 Section “Submittals” and in addition, the CONTRACTOR shall prepare and submit a complete submittal list to the Owner’s Representative. The submittal list shall include all submittal items covered in the Division 16 specification sections.

C. Shop drawings shall be submitted to the Owner’s Representative for approval. Shop drawings shall identify the specific equipment and material being supplied; the quantity being supplied; and all accessories, dimensions, descriptions, mounting and connection details, wiring diagrams, elementary control diagrams, equipment interface diagrams and any other information necessary to determine compliance with the plans and specifications. Fabrication and installation shall be in accordance with the approved shop drawings.

D. As-built copies of all shop drawings shall be submitted to the ENGINEER. This shall include but not limited to the following:

1. Motor Control Centers.
2. Variable frequency drives.
3. Standby generators.

4. PLC and Control Panels.

E. Permits and Easements. Submit copies of reports, permits, and easements necessary for installation, use, and operation.

F. Test Reports. Submit copies of reports of tests, inspections, and meter readings as specified. Tests, inspections, and meter readings shall be performed using the CONTRACTOR's temporary power source unless otherwise specified.

1.05 RECORD DRAWINGS

A. The CONTRACTOR shall maintain a complete and separate set of prints of Contract Drawings and specifications at job site for duration of the contract. The CONTRACTOR shall record work completed and all changes from original Contract. Drawings shall clearly and accurately include work installed as a modification or as an addition to the original design.

B. At completion of work and prior to final request for payment, the CONTRACTOR shall submit a complete set of reproducible record drawings showing all systems as actually installed.

1.06 JOB CONDITIONS

A. Existing Conditions:

1. Maintain and protect existing building services, which transit the area affected by selective demolition.

2. Existing Utilities. Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.

3. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

4. Verify that the electrical installation may be made in complete accordance with all pertinent codes and regulations and the original design.

B. Coordination.

1. Coordinate the installation of electrical items with the schedules for work of other trades to prevent unnecessary delays in the total work.

2. Coordinate with all utility and telephone companies and make all installations for their services in accordance with all utility company requirements.

3. Any changes shall be done at the CONTRACTOR'S expense.

4. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, furnish and install all required supports and wiring to clean the encroachment.

5. Any work installed contrary to or without acceptance by the ENGINEER shall be subject to change as directed by the ENGINEER, and no extra compensation will be allowed to the CONTRACTOR for making these changes.

C. Accuracy of Data:

1. The Drawings are diagrammatic and functional only, and are not intended to show exact circuit layouts, number of fittings, components and place in satisfactory operational power, lighting, and other electrical systems shown. Install additional circuits, components and material wherever needed to conform to the specific requirements of the equipment whether or not indicated or specified.

2. Information and components called for in the specification but not shown on plans or vise versa, shall apply and shall be provided as though required expressly by both.

3. The locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Field measurements shall take precedence over scaled dimensions from Drawings. Exact locations shall be as accepted by ENGINEER during construction. Obtain in the field all information relevant to the placing of electrical work and, in case of any interference with other work, proceed as directed by the ENGINEER and furnish all labor and materials necessary to complete the work in an acceptable manner.

4. The Contract Drawings and the specifications are intended to comply with all pertinent codes, regulations and standards. In the event of discrepancy, the CONTRACTOR shall immediately notify the ENGINEER in writing of said discrepancies and apply for an interpretation and, unless an interpretation is offered in writing by the ENGINEER prior to the execution of the Contract, the applicable rules and regulations shall be complied with as a part of the Contract.

5. In case of difference between building codes, specifications, state laws, industry standards and the Contract Documents, the most stringent shall govern. Should the CONTRACTOR perform any work that does not comply with the requirements of the applicable building codes, state laws, and industry standards, he shall bear all cost arising in correcting these deficiencies.

6. Verify size and ratings of motors and other electrically operated devices supplied by others.

7. Check with ENGINEER before installation of work for outlets not specified as to location or for work that interferes with other trades.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protection. Use all means necessary to protect electrical system materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the ENGINEER and at no additional cost to the OWNER. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the ENGINEER, at the cost and expense of the CONTRACTOR, or shall be replaced by the CONTRACTOR at his own expense.

C. Protect the work of other trades. Restore any damage caused to other trades to the condition existing prior to damage at no additional cost to the OWNER.

D. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.

1.08 SPECIAL WARRANTY

A. Compile and assemble the warranties specified in Division 16 into a separate set of vinyl covered three ring binders, tabulated and indexed for easy reference.

B. Provide complete warranty information for each item. Information to include:
1. Product or equipment list.
2. Date of beginning of warranty or bond.
3. Duration of warranty or bond.
4. Names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.09 DEFINITIONS

A. As used in this specification, “provide” means “furnish and install”, “furnish” means “to purchase and deliver to the project site complete with every necessary appurtenance and support and to store in a secure area in accordance with manufacturers instructions”, and “install” means “to unload at the delivery point at the site or retrieve from storage, move to point of installation and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project”.

B. Finished Areas. In general, areas with carpet or tile floors, lay-in or fixed ceiling tile, special architectural ceiling treatment, or tiled, plastered, or paneled walls shall be considered finished areas.

C. Interior. For the purposes of this specification, interior is any area within the boundaries of the foundation of any building within the superstructure or other structures not classified as a building.

D. Hazardous (Classified) Areas. Hazardous (classified) areas are designated on the drawings in conformance with the National Electrical Code (NEC). All equipment and the installation shall conform to requirements for installation in the designated hazardous area as described in Articles 500, 501, and 502 of the NEC.

1.10 TEMPORARY POWER:

A. The CONTRACTOR shall furnish, install, maintain, and remove the temporary electrical power and lighting systems, including lamps, and pay for all labor, materials, and equipment required therefore. All such temporary electrical work shall meet the requirements of the National Electrical Code, the local utility company, and OSHA.

B. The CONTRACTOR shall make all necessary arrangements with the local utility company as to where the temporary electric service can be obtained.

C. The CONTRACTOR shall secure and pay for all required permits and back charges for work performed by others, and other expenses incidental to the installation of the temporary electric service.

D. The CONTRACTOR shall provide all necessary equipment including temporary standby generator to maintain the full operation of the pumping station during the construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials and equipment shall be listed by UL unless it can be demonstrated that no UL standards exist for a specific item or class of equipment.

B. All other materials, not specifically described but required for a complete and operable electrical installation, shall be new, first quality of their respective kinds, specification grade or better, and as selected by the CONTRACTOR subject to the acceptance by the ENGINEER.

2.02 INTERCHANGEABILITY

A. In all design and purchasing, interchangeability of items of equipment, subassemblies, parts, motors, starters, relays and other items is essential. All similar items shall be of the same manufacturer, type, model and dimensions.

B. For ease of maintenance and parts replacement, to the maximum extent possible, use equipment of a single manufacturer.

C. The ENGINEER reserves the right to reject any submittal which contains equipment from various manufacturers if suitable materials can be secured from fewer manufacturers and to require that source of materials be unified to the maximum extent possible.

PART 3 - EXECUTION

3.01 COORDINATION

A. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Field verify all locations and dimensions to ensure that the equipment will be properly located, readily accessible, and installed in accordance with all pertinent codes and regulations, the contract documents, and the referenced standards.

C. The work shall be carefully laid out in advance, and where cutting, drilling, etc., of floors, walls, ceilings, or other surfaces is necessary for the proper installation, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.

D. In the event any discrepancies are discovered, immediately notify the Owner's Representative in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION

A. Install all equipment and fixtures in complete accordance with the manufacturer’s recommendations and all pertinent codes and regulations.

B. Thoroughly inspect all items of equipment and any items dented, scratched, or otherwise damaged in any manner shall be replaced or repaired and painted to match original finish.

1. All items so repaired and refinished shall be brought to the attention of the ENGINEER for inspection and acceptance.

C. Coordinate the installation of required supporting devices and sleeves to be set in cast-in-place concrete or supported from or on other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring

positioning prior to closing in the building and equipment which must be placed in service before further construction can take place.

E. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

F. The final routing of raceways shall be determined by structural conditions, interferences with other trades and by terminal locations on apparatus. The ENGINEER reserves the right of a reasonable amount of shifting at no extra cost up until time of roughing in the work.

G. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.

H. In general, wiring and raceway systems for security alarm, fire alarm, telephone and intercommunications systems are not indicated on the drawings but shall be furnished and installed under this section.

I. Each lighting and each receptacle circuit shall have its own neutral, dedicated to that circuit. A common neutral for more than one signal phase circuit is not allowed.

J. Surface mounted panel boxed, junction boxes, conduits, etc., shall be supported by spacers to provide a clearance between wall and equipment.

K. Upon completion of all installation, lamping, and testing, thoroughly inspect all exposed portions of the electrical installation and completely remove all exposed labels, soils, markings and foreign material.

3.03 MARKING AND LABELING

A. All panelboards, indoor transformers, cabinets, control panels and other specified equipment shall be labeled with engraved laminated plastic plates, minimum ¾" high with 3/8" engraved letters. Punch tapes with mastic backings are not acceptable.

B. All starters, disconnect switches and other specified equipment shall be marked with engraved laminated plastic plates, minimum ½" high with ¼" engraved letters. Where individual switches are circuit breakers in power or distribution panelboards do not have cardholders, they shall be marked with ½" high labels.

C. All empty conduits shall have labels tied to the pull string at each end of each empty conduit, marked as to identification of each end. Junction boxes with circuits provided for future use shall be labeled with appropriate circuit designation.

D. All panelboards directories shall be filled out with typewritten identification of each circuit.

3.04 TESTS & SETTINGS

A. Provide the services of an independent Testing Agency to perform the specified tests for the following systems:

1. Ground resistance.

The Testing Company shall perform all testing in accordance with National Electrical Testing Association (NETA) standards and procedures. All testing results shall be submitted on NETA forms and the testing data shall be certified by the respective Agency. Test results shall indicate recommended action for a sub-par test results. Results shall list recommended test values that should be obtained for new installation.

B. Provide necessary material, equipment, labor and technical supervision to perform and complete the Electrical Acceptance Tests as required.

C. Acceptance tests as herein specified are defined as those tests and inspections required to determine that the equipment involved is acceptable as delivered to the job site, that the equipment may be energized for final operational tests and is in accordance with the Specifications.

D. Final acceptance of the equipment and/or workmanship will depend upon performance characteristics as determined by the subject tests, in addition to complete operation tests, on all electrical equipment to show that it will perform the functions for which it was designed.

E. If the test and inspection data submitted should indicate deficiencies in the operation of the electrical apparatus or in the manufacturer thereof, the CONTRACTOR shall promptly implement the necessary adjustments, corrections, modifications and/or replacements necessary to be made to meet the specified requirements.

F. Upon completion of the remedial work, the Testing Agency shall repeat all of the tests on components previously found deficient on the first test or any additional test if they be required. It shall be the responsibility and obligation of the Contractor to have all remedial work accomplished as may be required by second and/or additional tests.

3.05 CLEANING

A. General. When all work is completed and has been tested and accepted by the Owner's Representative, the CONTRACTOR shall clean all light fixtures, equipment, and exposed surfaces that have been directly affected by this work. The CONTRACTOR, insofar as the work is concerned, shall at all times keep the premises in a neat and orderly condition and at the completion of the work shall properly clean up and remove from the site any excess materials.

*** END OF SECTION ***

SECTION 16110

RACEWAY

PART 1 – GENERAL

1.01 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to install raceways in accordance with the plans and as specified herein.

B. All raceway systems shall be complete with fittings, boxes, and necessary connections as required.

C. Types of raceways in this section include the following:
   1. Intermediate metal conduit (IMC).
   2. Liquid tight flexible conduit.
   3. Rigid galvanized steel conduit (RGS).
   4. Rigid nonmetallic conduit (PVC).
   5. Wireways.
   6. Underground ducts.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections. The following sections contain requirements that relate to this section:
   1. Division 16 section "Basic Electrical Requirements."
   2. Division 16 section "Wire, Cables and Connectors" for other wiring methods.
   3. Division 16 section "Supporting Devices" for raceway supports.
   4. Division 16 section "Cabinets, Boxes and Fittings" for boxes used with conduit and tubing systems.

1.03 QUALITY ASSURANCE

A. Reference Standards:
   1. National Fire Protection Association (NFPA) 70 "National Electrical Code" (NEC).
   2. National Electrical Manufacturers Association (NEMA) Compliance.
   3. Underwriter's Laboratories, Inc. (UL) Compliance and Labeling. Provide raceway products and components listed and labeled by UL, Electrical Testing Laboratories (ETL), or Canadian Standards Association (CSA).

1.04 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.
B. Submit in accordance with Conditions of Contract and Division 1 specification sections:

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Conduit and Tubing

1. Provide rigid steel conduit conforming to ANSI C80.1.
2. Provide intermediate steel conduit conforming to UL 1242.
3. Provide liquid tight flexible metal conduit and fittings conforming to UL 360.

B. Nonmetallic Conduit

1. Rigid Nonmetallic Conduit. PVC, Schedule 40 or 80, 90° C, conforming to NEMA TC-2, UL 651, and MEC Article 347.

C. Fittings and Couplings:

1. Threaded for rigid and IMC.
2. Compression for EMT.
3. Solvent weld for PVC, NEMA TC3.
4. Ferrous fittings shall be cadmium or zinc-coated, UL 614B.
5. Fittings for use in hazardous locations, UL 886.
6. Conduit Bodies

D. Wireways

1. General Purpose Wireways. NEMA 1 steel, front accessible, totally enclosed with bolted covers. Finish with rust-inhibiting coating and gray baked enamel finish.

2. Oiltight Wireways. NEMA 12, oiltight and dusttight steel with hinged gasketed cover, external latches, and flanged gasketed joints. Finished with gray enamel paint inside and outside.

3. Watertight Wireways. NEMA 4X, watertight, corrosion resistant stainless steel with hinged gasketed cover, screw clamps, and flanged gasketed joints.

2.02 ACCEPTABLE MANUFACTURERS

A. Conduit.

1. General Electric.
2. National.
3. Allied Tube and Conduit.
4. Carlon.
5. Electri-Flex Company.
6. Republic.
7. Perma-Cote Industries.
8. Robroy Industries, Inc.
9. Triangle PWC, Inc.
10. VAW of America, Inc.
11. Wheatland Tube Co.

B. Conduit Fittings and Accessories.
1. Pyle-National.
2. American Electric.
3. Appleton Electric Co.
4. Carlon.
5. Crouse-Hinds Division, Cooper Industries, Inc.
6. Thomas & Betts.
7. Killark Electric Mfg. Co.
8. Kraloy Products Co.
9. O-Z/Gedney.
10. Perma-Cote Industries
11. Raco
12. Robroy Industries.
13. Unistrut Corp.

C. Wireways
1. American Electric
2. B-Line Systems, Inc.
3. Circle AW Products.
4. GS Metals Corp.
5. Hoffman Engineering Co.
6. Square D Company.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Uses Permitted

1. Use liquidtight flexible metal conduit for the final 24 inches of connections to motors or control items subject to movement or vibration.
2. Use RGS or IMC for all exterior aboveground installations unless otherwise noted.

3. Use Schedule 40 PVC conduit for exterior direct buried installations unless otherwise noted.
4. Use Schedule 40 PVC conduit for exterior concrete encased installations. The transition from concrete encasement to riser shall be rigid steel conduit.
5. Use RGS or IMC for all other interior installations not exposed to severe moisture or corrosive conditions such as chemical feed area.
6. Use PVC coated RGS for all wiring in classified area. UL listed Aluminum rigid metal conduit approved for use in classified area shall be acceptable in lieu of PVC coated RGS conduit.

B. Routing

1. Install exposed conduits, parallel or perpendicular to walls, ceilings, or structural members. Do not run through structural members. Avoid horizontal runs within partitions or side walls. Avoid ceiling inserts, lights, or ventilation ducts or outlets. Do not run conduits across pipe shafts or ventilation duct openings and keep conduits a minimum of 6 inches from parallel runs of flues, hot water pipes, or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.
2. Conduits installed in new construction shall be concealed in walls or slabs. New conduits installed in existing areas shall be concealed where practical.
3. Conduits installed in other interior areas shall not be embedded in waterproofed or water bearing walls. Where possible, conduits to motors or equipment more than 3 feet from walls shall be run in or under the slab and stubbed up to the junction box. For all other interior applications, conduits shall be installed, exposed, or concealed as indicated on the plans.
4. For conduits installed in exterior areas:
   a) Do not run conduits exposed on the exterior surface of buildings.
5. Conduits penetrating exterior walls below grade, at grade floors, or below grade floors shall be sealed to prevent moisture migration. The exterior of the conduit shall be sealed with a mechanical pipe seal. The interior conduit seal shall be a gland type sealing bushing or RTV closed cell silicone foam. Ensure that conduits do not retain water against these seals.
6. Conduits shall penetrate roofs only where specifically shown on the plans. Provide all required flashing.
7. Raceways penetrating fire rated walls, floors, and partitions shall be sealed with a fire rated sealant as described in Division 16 specification section "Basic Electrical Materials and Methods."
8. All conduits must be supported with materials specifically made for this purpose. Do not use wire hangers. Do not attach any parts of the raceway system to ventilation ducts. Conduit supports shall be attached to the building. Support conduits on each side of bends and on a spacing not to exceed the following: 6 feet for conduits smaller than 1 1/4 inches and 8 feet for conduits 1 1/4 inches and larger. Support riser conduits at each floor level with clamp hangers. All underground conduits shall

be securely anchored to prevent movement during placement of concrete or backfill. Use precast separators and heavy gauge wire ties or other approved fasteners.

9. Install accessible pull boxes in runs over 100 feet or with more than three 90° bends or equivalent.
10. All empty conduits shall have #14 galvanized steel pull wire and terminate in accessible junction boxes or have accessible capped ends for future use.
11. Use E.Y.S. seal fittings for all conduits leaving hazardous areas and chemical rooms.

C. Conduit Embedded In Slab

1. Electrical conduit may be embedded in concrete according to the provisions of Article 6.3 of ACI 318 "Building Code Requirements for Reinforced Concrete", provided the following conditions are met:

   a) Outside diameter of conduit shall not exceed 1/3 of overall concrete thickness. Maximum conduit outside diameter shall not exceed 3 inches when embedded in slab.
   b) Conduit shall not be placed closer than three diameters on center. Route conduit to minimize crossing of different conduit runs.
   c) Conduit shall not be embedded in structural concrete slabs less than four inches thick.
   d) A 1 1/2 inch minimum concrete cover shall be provided for conduits in structural concrete slabs.
   e) Conduit shall be located between the bottom and top of reinforcing steel. Conduit, crossing in the slab, must be reviewed by the ENGINEER for proper cover.
   f) Conduit is generally not permitted in beams or girders.
   g) Only two conduits may cross at any point. The sum of the outside diameters of the crossing conduits shall not exceed 1/3 of the concrete thickness.
   h) Provide additional reinforcement around all groups of conduits which stub up through the slabs.
   i) Except where there are only isolated runs of conduit in slab, a plan showing conduit detail and the proposed routing of the conduits in slab shall be submitted, for the ENGINEERS approval prior to installation.

D. Underground Conduits

1. When installed in concrete or underground, apply two coats of approved asphaltum paint to metallic conduits. Provide protection for conduit in areas subject to vehicle traffic.
2. Where conduits are installed in concrete slabs, on the ground, underground, or exposed to the weather, make all joints liquid tight and gas tight.
3. Bury all underground conduit, except under concrete slabs placed on fill, to a depth of at least two feet below finished grade unless otherwise indicated on the Drawings.

4. Slope ducts to drain away from buildings into manholes and/or handholes. Adjust final slopes to coordinate with existing site utilities.
5. Install on undisturbed soil where possible. Concrete encase conduits as shown on Drawings. Use pit run gravel and sand, placed 8 in. lifts and compacted for backfill.
6. After installation, clean and swab ducts.
7. Install galvanized steel pull wires in spare ducts. Cap spare ducts.

*** END OF SECTION ***

SECTION 16120
WIRE AND CABLES

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to install wires, cables, and connectors in accordance with the plans and as specified herein.

B. This section includes wires, cables, and connectors for power, lighting, signal, control, and related systems rated 600 volts and less.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections:

1. "Basic Electrical Requirements."
2. "Electrical Identification."

1.3 QUALITY ASSURANCE

A. Reference Standards:

1. National Fire Protection Association (NFPA) 70 "National Electrical Code (NEC)."

2. Underwriter's Laboratories, Inc. (UL) Compliance.

   a. UL Standard 83 Thermoplastic Insulated Wires and Cables.
   b. UL Standard 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   c. UL Standard 854 Service Entrance Cable.

3. National Electrical Manufacturers Association (NEMA) Compliance.

   a. WC-5 Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical nergy.
   b. WC-7 Cross Linked Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

c. WC-8 Ethylene Propylene Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

4. Institute of Electrical and Electronic Engineers (IEEE) Compliance.

a. Standard 82 Test Procedure for Impulse Voltage Tests on Insulated Conductors.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.

B. Submit the following in accordance with Conditions of Contract and Division 1 specification sections:

1. Product data for electrical wires, cables, and connectors.
2. Product data for Megger insulation testing instrument.
3. Report sheets for Megger testing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cable properly packaged in factory fabricated type containers, or wound on NEMA specified type wire and cable reels.

B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris, and traffic.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General

1. Provide factory fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by Installer to comply with project's installation requirements, NEC and NEMA standards. Select from the following UL types those wires with construction features which fulfill project requirements:

2. Provide color coding for phase identification in accordance with requirements in Division 16 section "Electrical Identification."

3. Provide factory applied nylon or polyvinyl chloride (PVC) external jackets on wires and cables for pulls in raceways over 100 feet in length, for pulls in raceways with more than three equivalent 90

degree bends, for pulls in conduits underground or under slabs on grade, and where indicated.

B. Service Wiring:

1. 98 percent conductivity copper.
2. 600 volt insulation, type RHW-RHH.
3. U.L. listed for underground use in wet locations at 75° C.

C. Building Wiring:

1. 98 percent conductivity copper.
2. 600 volt insulation, type THWN-THHN.
3. Solid conductor: #10 AWG and smaller.
4. Stranded conductor: #8 AWG and larger.
5. Minimum branch circuit: #12 AWG.
6. Minimum control wiring: #14 AWG, unless otherwise indicated.

D. Instrumentation

1. Instrumentation wiring for remote monitoring of equipment shall be #14 AWG, copper stranded.

2. Instrumentation wiring for transmitting 4-20mA DC signals shall be shielded, 2-conductor, minimum #18 AWG, equal to Belden No. 8179.

E. Splices:

1. No. 10 and smaller with 600 volt pressure type insulated connector of wire-nut type, or equal; soldered and crimped type not allowed. Ideal type “wire nut” Buchanan type “B-Cap” and Minnesota Mining (3M) type “Scotchiok”.

2. No. 8 and larger with solderless lugs or solderless connectors of Lock-tite or similar type properly taped with plastic insulating tape, Minnesota Mining Co. #33, or equal, then two half-lap servings of friction tape, Manson, or equal.’

3. Wire connector systems for use with underground conductors shall be UL listed specifically for such use.

4. Service entrance conductors shall be installed without splices. Electrical equipment feeders shall be spliced only where shown or specifically approved. Control and metering conductors shall be installed without splices.

5. All splices shall be made only by specific permission of the Engineer and then only in manholes or pull boxes and shall be sealed watertight with a heat shrunk insulation.

6. Tighten electrical connectors and terminals in accordance with manufacturer's published torque tightening values. Where manufacture's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and 486B.

7. Use UL listed splice for all underground wires, ducts buried, in conduit and in ducts. Connectors and splices shall be waterproof.

2.2 ACCEPTABLE MANUFACTURERS

A. Wire and Cable.

1. American Insulated Wire Corp.
2. Brintec Corp.
3. Carol Cable Co., Inc.
4. Pirell.
5. General Cable.
6. Rome.
7. Triangle.

B. Connectors and Terminals for Wires and Cable Conductors.

1. AMP.
2. Burndy Corporation.
3. Ideal Industries, Inc.
4. 3M Company
5. O-Z/Gedney Co.
6. Raychem.
7. Thomas and Betts Corp.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION

A. All wire and cables shall be installed in conduit of size and type indicated on the drawing and specifications.

B. Install electrical cables, wires, and connectors in compliance with NEC.

C. Coordinate cable installation with other work.

D. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary

E. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.

F. Conceal all cable in finished spaces.

G. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible.

H. Power conductors shall be No. 12 AWG minimum. Control conductors may be No. 14 AWG where circuit amperes and the NEC allow and when length does not pose a voltage drop problem.

I. Conductors shall be sized such that voltage drop does not exceed 3 percent for branch circuits or 5 percent for feeder/branch circuit combination.

J. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

K. All feeder and branch circuit wiring shall be color coded at all termination and splice locations. System neutrals shall be designated in addition to phase conductors. Equipment grounds shall be green.

L. The number of conductors shown on the Drawings is not necessarily the correct number required. As many conductors as are required in each case shall be installed. Grounding conductors are not scheduled.

3.2 FIELD QUALITY CONTROL

A. The Contractor shall test each electrical circuit after permanent cables are in place with terminators installed, but before cable or wire is connected to equipment or devices to demonstrate that each circuit is free from improper grounds and short circuits.

B. The Contractor shall test by Megger Test, the insulation resistance between phases and from each phase to ground for each of the following feeder and motor branch circuits:

1. Panelboards.
2. Motors.
3. Motor Control Centers.

C. The Megger Testing shall be witnessed by the Engineer/Architect. The Engineer/Architect shall be notified at least 48 hours in advance of testing.

D. Measure the insulation resistance at 100 volts dc with a hand cranked or motor driven "Megger" insulation testing instrument for period of one minute. Battery operated test instruments are not permitted. All test instruments are to be provided by the Contractor

E. If any insulation resistance measures less than 50 megohms, the cable shall be considered faulty with the cable failing the insulation test. In moist environments, bag the ends of the cable to prevent a faulty Megger test.

F. Any cable which fails the insulation tests or which fails when tested under full load conditions shall be replaced with new cable for the full length and retested at no additional cost to Owner.

G. The below grade service or feeder splice shall be water immersion Megger tested in the presence of the Engineer. Each splice shall be immersed in a grounded water immersion bath for 24 continuous hours prior to and during the test. Criteria for failure shall be as described for cable above.

END OF SECTION

SECTION 16130

CABINETS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install cabinets, boxes, and fittings in accordance with the plans and as specified herein.

B. This section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this section include:

1. Outlet and device boxes.
2. Pull and junction boxes.
3. Boxes and fittings for hazardous locations.
4. Hinged door enclosures.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections:

1. "Basic Electrical Requirements."
2. “Raceways."

1.3 QUALITY ASSURANCE

A. Reference Standards.

1. Underwriter's Laboratories, Inc. (UL) Listing and Labeling. Items provided under this section shall be listed and labeled by UL.
2. National Electrical Code (NEC) Compliance.
3. National Electrical Manufacturers Association (NEMA) Compliance.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and material certifications as required.

B. Submit the following in accordance with Conditions of Contract and Division 1 specification sections:

1. Product data for cabinets and enclosures with classification higher than NEMA 1.
2. Shop drawings for floor boxes and boxes, enclosures and cabinets that are to be shop fabricated (nonstock items).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cabinets, Boxes, and Fittings, General

1. Electrical cabinets, boxes, and fittings of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations and provide air sealing gaskets for units mounted in exterior walls.

B. Materials and Finishes

1. Provide fasteners for general use which are corrosion resistant screws and hardware including cadmium and zinc plated items.
2. Provide fasteners for damp or wet locations which are stainless steel screws and hardware.
3. Provide cast metal for boxes, enclosures, and covers which is copper-free aluminum except as otherwise specified.
4. Provide exterior finish which is gray baked enamel for items exposed in finished locations except as otherwise indicated.
5. Provide fittings for boxes, cabinets, and enclosures which conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings, and box connectors.

C. Metal Outlet Boxes

1. Conform to UL 514A, "Metallic Outlet Boxes," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.
2. Provide cast iron boxes of iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

D. Pull and Junction Boxes

1. Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted

on covers of material same as box and shall be of size and shape to suit application cover shall be gasketed.

2. Provide hot-dipped galvanized steel boxes constructed of sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.

E. Nonmetallic Outlet, Device, and Wiring Boxes

1. Conform to NEMA OS 2, "Nonmetallic Outlet Boxes, Device Boxes, Covers, and box Supports," and UL 514C, "Nonmetallic Outlet Boxes, Flush Device Boxes and Covers." Boxes shall be molded polyvinyl chloride (PVC) units of type, shape, size, and depth to suit location and application.
2. Boxes shall be equipped with threaded screw holes for device and cover plate mounting. Each box shall have a molded cover of matching PVC material suitable for the application.

2.2 ACCEPTABLE MANUFACTURERS

A. American Electric

B. Appleton

C. Carlon

D. Crouse Hinds

E. Hoffman Engineering Co.

F. Killark Electric Mfg. Co.

G. O.Z. Gedney

H. Parker Electrical Mfg. Co.

I. Raco/Bell Division Harvey Hubbell

J. Spring City Electrical Mfg. Co.

K. Square D Co.

L. Steel City/Thomas & Betts

PART 3 - EXECUTION

3.1 INSTALLATION

A. General

1. Install items where indicated and where required to suit code requirements and installation conditions.
2. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
3. Support and fasten items securely in accordance with Division 16 section "Supporting Devices." Boxes shall be securely mounted to the building structure, independent of the raceway entering or leaving.
4. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
5. Remove sharp edges where they may come in contact with wiring or personnel.

B. Uses Permitted

1. Outlet Boxes.

a. Use nonmetallic boxes in corrosive areas such as chemical feed and storage or as designated on the plans.
b. Use explosionproof boxes in hazardous areas as designated on the plans.
c. Use cast metal boxes in all other locations. Each box with associated covers and fittings shall have a NEMA rating suitable for each location installed or as designated on the plans.

2. Pull and Junction Boxes.

a. Use general purpose boxes (NEMA 1) in finished areas with framed construction.
b. Use dusttight and oiltight boxes (NEMA 12) in other dry interior areas.
c. Use explosionproof boxes (NEMA 7) in hazardous areas as designated on the plans.
d. Use watertight boxes (NEMA 4X), stainless steel construction for interior damp/wet location, interior below grade and in exterior and wet locations on outdoor structure where moisture is present.

3. Cabinets

a. Install enclosures and associated materials and NEMA types suitable for each location and in conformance with the drawings.

C. Installation of Outlet Boxes

1. Surface mount outlet boxes for exposed conduit runs.
2. Adjust position of outlets in finished masonry walls to suit masonry course lines.
3. Coordinate cutting of masonry walls to achieve neat openings for boxes. Use rotary cutting equipment to cut masonry work for installation of electrical fittings.
4. Locate boxes in masonry walls so that only a corner need be cut from masonry units.
5. Do not use sectional or handy boxes unless specifically requested.
6. Adjust outlet mounting height to agree with required location for equipment served.
7. Wall boxes in block construction shall be masonry boxes with inside ears and shall be concrete tight.
8. Outlet boxes shall be installed at all lighting fixtures.
9. Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles either vertically or horizontally, but consistently either way. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.
10. For concrete boxes use extra deep boxes to permit side conduit entrance without interfacing with reinforcing, but do not use such boxes with over 6 inch depth.
11. For existing outlet boxes where extension rings are required to be installed, drill new mounting holes in the rings to align with the mounting holes on the existing boxes where existing holes are not aligned.

D. Installation of Pull and Junction Boxes

1. For boxes in main feeder conduit runs, use sizes not smaller than 8 inches square by 4 inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed those required by NEC.
2. Install clamps, grips, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inches inside boxes.
3. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.

4. Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated.
5. Steel enclosed wireways and auxiliary gutter may be used at grouped equipment locations and at other locations where multiple circuits are run, when such use is accepted by the ENGINEER.

3.2 GROUNDING

A. Electrically ground metallic cabinets, boxes, and enclosures. .

END OF SECTION

16140-1

WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install wiring devices in accordance with the plans and as specified herein.

B. This section includes the following:
   1. Receptacles.
   2. Ground Fault Circuit Interrupter Receptacles.
   3. Snap Switches.
   4. Wall Plates.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections:
   1. “Basic Electrical Requirements.”
   2. “Disconnect Switches.”
   3. “Electrical Identification.”

1.3 QUALITY ASSURANCE

A. Reference Standards.
   1. National Fire Protection Association (NFPA) 70 "National Electrical Code (NEC)."
   2. Underwriter's Laboratories, Inc. (UL) and National Electrical Manufacturers Association (NEMA) Compliance.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.

B. Submit the following in accordance with Conditions of Contract and Division 1 specifications sections:
   1. Product data for each type of product specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers
1. Wiring Devices.
a. Bryant Electric Co.
b. General Electric Co.
c. Hubbell, Inc.
d. Slater Electric Co.
e. Leviton.
f. Pass & Seymour/Legrand.

B. Wiring Devices
1. Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA standards. Provide ivory color devices and wall plates except as otherwise indicated. Verify color selections with Owner's Representative.
2. Receptacles.
a. Receptacles, Industrial Heavy Duty 2-pole, 3-wire grounding rated 20 amperes, 125 volts, back wiring, metal plaster ears, NEMA type 5-20R unless otherwise noted. Provide pin and sleeve design receptacles conforming to UL 498.
b. Ground Fault Interrupter (GFI) Receptacles. Provide 20 ampere, "feed through" type ground fault circuit interrupter, with integral heavy duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 2 3/4 inch deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 94.3.
c. Special purpose outlets: NEMA heavy duty class, grounding type with matching plug.
3. Switches.
a. Snap Switches. Quiet type alternating current (ac) switches, NEMA heavy duty class, rated at 20 ampere, 120/277 v. Provide matching two pole, 3-way or 4-way switches. Comply with UL 20 and NEMA Standards.

C. Wiring Device Accessories
   1. Cover plates. Single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide plate color to match wiring devices except as otherwise indicated.
   2. Interior finished areas: Stainless steel, type 302 satin finish, minimum 0.032-inch thick; accurately die cut and beveled; smooth rolled outer edge for flush mounted boxes, edge smoothed to fit surface mounted boxes; with screws to match plate cover finish. Cover plates to be oversized.
   3. Interior equipment areas: Galvanized steel, smooth rolled outer edge. Nonmetallic construction for chemical feed and storage area.
   4. Exterior and interior wet locations: Die-cast aluminum, satin finished; weatherproof; individual spring loaded gasketed lift lids for devices; corrosion resistant screws to match plate cover finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC. The location of all devices shall be subject to the acceptance of the Engineer. The drawings show approximate locations only.
B. Coordinate with other work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other work.
C. Mount all wall switches at 4'-0" above finished floor and all receptacles at 1’- 6" above the finished floor unless otherwise noted.
D. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.
E. Install galvanized steel wall plates in unfinished spaces.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install supporting devices in accordance with the plans and as specified herein.

B. This section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

B. Related Sections:

1. "Basic Electrical Requirements."

1.3 QUALITY ASSURANCE

A. Reference Standards.

1. National Electrical Code (NEC) Compliance.
2. Underwriter's Laboratories, Inc. (UL), Electrical Testing Laboratories, Inc. (ETL), or Canadian Standards Association (CSA).

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.

B. Submit the following in accordance with Conditions of Contract and Division 1 specification sections:

1. Product data for each type of product specified.
2. Hanger and support schedule showing manufacturer's figure, number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Supports, support hardware, and fasteners within corrosive areas shall be stainless steel or FRP unless approved by Engineer.

B. Coatings

1. Supports, support hardware, and fasteners in non-corrosive spaces shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot dip galvanized unless material is inherently corrosion resistant or as called out on the Drawings.

C. Conduit Supports:

1. Single run hangers: Galvanized steel conduit straps or clamps, or cast metal beam clamps. Perforated straps and spring steel clips and clamsp will not be permitted.
2. Group run hangers: Minimum 12-gauge galvanized performed U-channel rack with conduit fittings; 25 percent spare capacity.
3. Hanger rods: Threaded steel, 3/8-inch diameter.
4. Vertical run supports: Minimum 12-gauge galvanized performed U-channel struts with conduit fittings.

D. Equipment and lighting supports:

1. U-channel: 12-gauge galvanized performed U-channel struts with fixture and conduit fittings, as applicable.
2. Loose angles, channels, plates and tubing: As specified in Section 05500.

E. Anchors:

1. Hollow masonry: Stainless steel toggle bolts.
2. Solid masonry: Lead expansion anchors or preset inserts.
3. Metal surfaces: Machine screws, bolts, or steel clamps as required for application.
4. Wood surfaces: Wood screws.

F. Conduit Seals. Provide factory fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Provide a cast-in-place water stop wall sleeve with a mechanical pipe seal between the conduit and the sleeve. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

2.2 ACCEPTABLE MANUFACTURERS

A. Metal Angle and U-Channel Systems.

1. Allied Tube and Conduit Corp.
2. American Electric.
3. B-Line Systems, Inc.
4. GS Metals Corp.
5. Kin-Line, Inc.
6. Unistrut Diversified Products.

B. Conduit Sealing Bushings.

1. Cooper Industries, Inc.
2. GS Metals Corp.
3. Killark Electric Mfg. Co.
4. OZ/Gedney.
5. Product Electric Corp.
6. Raco, Inc.
7. Spring City Electrical Mfg. Co.
8. Thomas & Betts Corp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installations.

C. Conform to manufacturer's recommendations for selection and installation of supports.

D. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

E. Support parallel runs of horizontal raceways together on trapeze type hangers.

F. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1 1/2 inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use

1/4 inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

G. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

H. Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

I. Install sleeves in concrete slabs and walls and all other fire rated floors and walls for raceways and cable installations. For sleeves through fire rated wall or floor construction, apply UL listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

J. Install conduit seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal. Provide seals for the interior of conduits which penetrate exterior or water bearing walls, consisting of gland type sealing bushings or RTV closed cell silicone foam. Provide explosionproof conduit seal fittings with appropriate potting material where conduits enter or leave a Class 1, Division 1 or 2 environment or a Class 2, Division 1 or 2 environment.

END OF SECTION

SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to perform the work in accordance with the plans and as specified herein.

B. This section includes requirements for electrical identification components including, but not limited to, the following:
   1. Identification labeling for cables and conductors.
   2. Operational instruction signs.
   3. Warning and caution signs.
   4. Equipment labels and signs.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections.
   1. "Basic Electrical Requirements".
   2. "Wires, Cables, and Connectors".

1.3 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA) 70 "National Electrical Code (NEC)."

B. American National Standards Institute (ANSI) Compliance.

1.4 SUBMITTALS

A. Submit manufacturer's technical product data sheets for each type of product specified.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Name Plates & Signs
   1. Laminated Plastic Signs and Labels. Engraving stock melamine plastic laminate, 1/16 inch minimum thick for signs up to 20

square inches, or 8 inches in length; 1/8 inch thick for larger sizes; punched for mechanical fasteners.

2. Exterior Warning and Caution Signs. Weather resistant, nonfading, preprinted cellulose acetate butyrate signs with 20 gauge, galvanized steel backing, with colors, legend, and size appropriate to the location.
3. Interior Warning and Caution Signs. Aluminum signs with preprinted baked enamel finish and punched for fasteners. Colors, legend, and size appropriate to location.

B. Wire and Cable Markers

1. Underground Line Marking Tape. Permanent, bright colored, continuous printed, metal backed, plastic tape compounded for direct burial service not less than 6 inches wide. Printed legend indicative of general type of underground line below.
2. Wire Labels. Wires small than No. 4. Vinyl or vinyl cloth, self-adhesive, wraparound, wire markers with preprinted numbers and letters. Wire sizes No. 4 and larger and multi conductor cables shall be marked with one-piece, nylon locking marker ties equal to Panduit PLM Series.

2.2 Acceptable Manufacturers.

A. American Labelmark Co.
B. Almetek.
C. Brady.
D. Emed Co., Inc.
E. Ideal Industries, Inc.
F. Kraftbilt.
G. LEM Products, Inc.
H. Markal Corp.
I. Panduit Corp.
J. Seton Name Plate Co.
K. Standard Signs, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

3.2 INSTALLATION

A. Warning Signs. Install warning or caution signs where required by NEC, where indicated, or where reasonably required to ensure safe operation

and maintenance of electrical systems and of the items to which they connect.

B. Equipment Name Plates

1. Install engraved plastic laminate identification labels on each major unit of electrical, communication and signaling equipment. Black lettering on a white field to match terminology and numbering on the Contract Documents and shop drawings.
2. Provide labels with 1/2 inch high lettering on 1 1/2 inch high label (2 inches high where two lines are required) for each unit of the following categories of equipment.
   a. Panelboards, electrical cabinets, and enclosures.
   b. Access doors and panels for concealed electrical items.
   c. Motor starters.
   d. Power transfer equipment.
   e. Contactors.
   f. Transformers.
   g. Control stations.
   h. Frequency converters.
   i. Power generating units.
   j. Enclosed circuit breakers.
   k. Disconnect switches.
   l. Control panels.
   m. Motor control centers.
3. Provide a framed, typed circuit schedule for each panelboard.

C. Junction and Pullbox . Where required by codes, install pressure sensitive, self-adhesive labels on box cover to indicate system voltage. Black on orange background.

D. Underground Electrical Line. Install continuous underground plastic line markers, directly above all underground lines and conduits at 6 to 8 inches below finished grade.

E. Wire and Cable Markers

1. Tag control circuit conductors at both ends and at junction box splices using wire and cable markers with identification numbers as designated on equipment wiring diagrams. Provide typed listing to identify conductors by number and use.
2. Identify spare conductors, individually, at both ends and at junction box splices with number between 1 and 999. Do not duplicate numbers.
3. Identify wire numbers on terminal block marking strips.
4. Provide permanent plastic name tag indicating load for each feeder for all junction boxes, handholes and manholes. Label all process motor wires to yard equipment in handholes and manholes.

Black	A	Brown
Red	B	Orange*
Blue	C	Yellow
White	Neutral	White
Green	Ground	Green

*Where not permitted by inspecting authority, use purple.

END OF SECTION

SECTION 16400

SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to provide service entrance work in accordance with the plans and as specified herein.

1. Extent of service entrance work at each site is indicated by drawings and schedules.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections.

1. "Basic Electrical Requirements".

1.3 QUALITY ASSURANCE

A. Reference Standards.

1. National Electrical Code (NEC), including Articles 230, 250, and 338.

2. National Electrical Manufacturers Association (NEMA) Compliance.

3. Underwriters' Laboratories, Inc. (UL) Compliance.

a. UL 50 Electrical Cabinets and Boxes.
b. UL 854 Service Entrance Cables.
c. UL 869 Electrical Service Equipment.

4. Institute of Electrical and Electronic Engineers (IEEE) Compliance.

5. American National Standards Institute (ANSI) Compliance.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certification as required.

B. Submit the following in accordance with Conditions of Contract and Division 1 specification sections:

1. Product Data. Submit manufacturer's data on service entrance equipment and accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General. Provide service entrance equipment and accessories; of types, sizes, ratings and electrical characteristics indicated, which comply with utility and manufacturer's standard materials, design and construction.

B. Meter Sockets. Provide meter sockets which comply with requirements of local utility company supplying electrical power to service entrance equipment of building project.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and install required conduit wire, pullboxes, and accessory items to accomplish the work involved in providing the electrical service as shown on the Drawings. Service shall be 480Y/277 volts, 3 phase, 4 wire, 60 Hertz as shown on the drawings.

B. Coordinate service work with the OWNER and utility company.

C. Obtain all permits, pay all fees and provide all materials and labor necessary for interfacing with utility equipment to install electric service.

D. Furnish and install all electrical conduit for low voltage cables and low voltage wire and accessory items necessary to accomplish the work detailed herein or in the Drawings.

E. Furnish and install metering conduit, wiring and meter base.

3.2 ALLOWANCE.

A. The contractor shall include an allowance of $15,000 in his/her base bid to cover the utility’s charges for the new service at the designated sites as shown on the drawings (utility charges associated with the utility transformers and terminations only. All other electrical secondary service work and the temporary electrical service work shall be carried in the electrical contractor’s base bid). If the utility’s charge, when determined,

is more or less than the stated allowance, the contract sum shall be adjusted accordingly by change order. The balance of the work to complete the entire electric service for the project will be the responsibility of the contractor. An official copy of the utility company's invoice to the contractor describing the work performed shall be submitted to engineer for approval.

END OF SECTION

SECTION 16440
DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and material necessary to install circuit and motor disconnects in accordance with the plans and as specified herein.

B. Extent of circuit and motor disconnect switch work is indicated by drawings and schedules.

C. Types of circuit and motor disconnect switches in this section include the following:

1. Equipment disconnects.
2. Motor circuit disconnects.
3. Service switch.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections.

1. "Basic Electrical Requirements."
2. "Raceway."
3. "Wires, Cables, and Connectors."
4. "Cabinets, Boxes, and Fittings."
5. "Overcurrent Protective Devices."

1.3 QUALITY ASSURANCE

A. Reference Standards.

1. National Electrical Code (NEC) Compliance.
2. Underwriters' Laboratories, Inc. (UL) Compliance. Comply with requirements of UL 98 "Enclosed and Dead Front Switches."
3. National Electrical Manufacturers Association (NEMA) Compliance. Comply with applicable requirements of NEMA Standards. KS-1 "Enclosed Switches".

1.4 SUBMITTALS

A. General. Submit manufacturer's product data, test reports, and material certifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Heavy Duty Safety Switches. Provide surface mounted, heavy duty type, sheet steel enclosed safety switches, of types, sizes, and electrical characteristics as indicated on the drawings. Provide switches incorporating quick make, quick break type switches, so that switch blades are visible in OFF position with door open. Interlocked cover to prevent opening in “ON” positions except by means of special interlock release mechanism. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable and is padlockable in OFF position. Construct current carrying parts of high conductivity copper with silver tungsten type switch contacts; and positive pressure type reinforced fuse clips where fusible switches are specified or required by code. Provide NEMA Type enclosures as shown on plans.

B. Fuses. Provide fuses for safety switches, confirming to UL 198E as noted on plan, fuses shall be Class RK 1 unless otherwise noted.

2.2 ACCEPTABLE MANUFACTURERS

A. Siemens.

B. Cutler-Hammer, Inc.

C. General Electric Co.

D. Square D Company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, and NEMA.

B. Install disconnect switches for use with motor driven equipment, motors, and controllers within sight of the motor position unless otherwise indicated.

C. Provide a suitable means for mounting all disconnect switches.

3.2 GROUNDING

A. Provide equipment grounding connections, tightened to ensure a permanent and effective ground, for all electrical disconnect switches.

END OF SECTION

SECTION 16450
GROUNDING

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install grounding materials in accordance with the plans and as specified herein.

B. Grounding. This section includes solid grounding of electrical systems and equipment.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections:

1. "Basic Electrical Requirements."

C. Related Sections. The following sections contain requirements that relate to this section:

1. Division 16 section "Wires, Cables, and Connectors."

1.3 QUALITY ASSURANCE

A. Reference Standards.

1. "National Electrical Code" (NEC), as applicable to electrical grounding and bonding, Art. 250. Use of conduit system for ground conductor shall not be allowed.
2. Underwriters' Laboratories, Inc. (UL). UL 467 "Electrical Grounding and Bonding Equipment."
3. Institute of Electrical and Electronic Engineers (IEEE) IEEE 81 and 142.
    a. 80-1986, "IEEE Guide for Safety in AC Substation Grounding."
    b. 81-1983, "IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounded System (Part 1)."
    c. 141-1993, "IEEE Recommended Practice for Electric Power Distribution for Industrial Plants."
    d. 142-1991, "IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems."

1.4 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 1 specification sections:

1. Product data for each type of product specified.

PART 2 - EXECUTION

2.1 MATERIALS

A. Provide each electrical grounding system with assembly of materials required for complete installation including wires/cables, connec-tors, lugs, clamps, ground rods, bonding jumpers and accessories.

B. Provide electrical grounding conductors for grounding connections matched to power supply wiring materials and sized according to N.E.C.

C. Provide electrical connectors, lugs, clamps, boding jumpers and accessories as recommended by the respective manufacturer for the particular application, unless other indicated.

D. Ground rods; Solid copper, 5/8-inch diameter by 10 feet long.

E. Insulated conductors: Green in color.

F. Ground Bus. Bare annealed copper bars of rectangular cross section, 1/4" x 3" x length as required, with 98 percent conductivity, rigidly attached to structure.

G. Bonding Strap Conductor/Connectors. Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

H. Pressure Connectors. High conductivity plated units.

I. Bolted Clamps. Heavy duty units listed for the application.

J. Exothermic Welded Connections. Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

2.2 ACCEPTABLE MANUFACTURERS

A. Burndy Corporation.

B. A.B. Chance Co.

C. Dossert Corp.

D. Erico Products, Inc.

E. GB Electrical, Inc.

F. Joslyn Manufacturing Co.

G. Kearney-National.

H. O-Z/Gedney Co.

I. Quazite Corporation.

J. Raco, Inc.

K. Thomas and Betts.

PART 3- EXECUTION

3.1 GROUNDING AND BONDING

A. Ground main service entrance distribution panel ground bus or lug to neutral of incoming service, to enclosure, to building steel and to main cold water pipe. Install grounding bushings or service conduits.

B. Provide equipment grounding conductors in all conduits containing power, control, or instrumentation conductors on the load side of the service equipment or on the load side of a separately derived system.

C. Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except that larger sizes indicated or shown on the Contract Documents shall take precedence. Use of metallic conduit systems for equipment grounding as recognized by the NEC shall not be permitted under this specification.

D. Separately derived systems required by NEC to be grounded shall be grounded in accordance with NEC 250-26.

1. In addition, bond the grounded conductor of the separately derived system to the nearest available point on the interior metal water piping system, per NEC 250-80(a), or if no water piping extend to main service disconnect ground.

E. Install grounding bushings on conduits at both primary and secondary entrances to transformers. Ground transformer enclosures to bushings.

F. Install bonding jumper for flexible metal conduit unless fittings are approved for grounding or otherwise comply with N.E.C.

1. Size jumper to match over-current device.
2. Green insulation.
3. Connect to grounding bushing at each end.

G. Ground each metal lighting pole or standard with a common bare copper equipment grounding conductor run with the circuit conductors.

H. Ensure that entire electrical system is electrically continuous and permanently and effectively grounded, including all electrical equipment and motors.

I. Locate ground rods with a minimum of one rod length from each other and at least the same distance from any other grounding electrode. Connect ground conductors to ground rods by means of exothermic welds except at test wells and as otherwise indicated. Drive rods until tops are 24 inches below finished floor or final grade except as otherwise indicated.

J. Route grounding electrode conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

1. Ensure that grounding electrode conductor connections to interior piping, structural members, and the like are accessible for periodic inspection during the life of the structure.

3.2 BONDING FOR OTHER TRADES

A. Signal raceways, water piping, heating piping and metallic air ducts shall be bonded together and to the grounding conductor with No. 8 soft drawn bare solid conductors. Connections to pipes shall be made with cast clamps of like material as the pipes to which attached, to ducting terminated in a secure manner by best practical means, bonding across any flexible or insulated connections.

B. All bonding conductors shall be installed in a neat and workmanlike manner, properly shaped for contour of surface involved and properly supported. At locations remote from the switch gear, bond to the larges raceway nearby.

3.3 FIELD QUALITY CONTROL

A. Independent Testing Organization. Arrange and pay for the services of a qualified independent electrical testing organization to perform tests described below.

B. Measure ground resistance without the soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the three point fall of potential method in accordance with Section 9.03 of IEEE 81. Simple moisture addition is not acceptable.

C. Ground/resistance maximum values shall be as follows:

1. Equipment rated 500 kva and less. 10 ohms.
2. Equipment rated 500 kVA to 1000 kVA. 5 ohms.
3. Equipment rated over 1000 kVA. 3 ohms.
4. Unfenced substations and pad mounted equipment. 5 ohms.
5. Fence Grounds. 10 ohms.

D. Where ground resistances exceed specified values, and if directed, modify the grounding system to reduce resistance values. Where measures are directed that exceed those indicated under the provisions of the Contract, covering change orders will be provided.

END OF SECTION

SECTION 16460

TRANSFORMERS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install transformers in accordance with the plans and as specified herein.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections:

1. "Basic Electrical Requirements."
2. "Electrical Identification".

1.3 QUALITY ASSURANCE

A. Reference Standards.
1. National Fire Protection Association (NFPA) 70 "National Electrical Code (NEC)."
2. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) Compliance.
3. Underwriters' Laboratories, Inc. (UL) Compliance, UL 506 Standard.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.

B. Product Test Reports. Certified copies of manufacturer's design and routine factory tests required by the referenced standards.

PART 2 - PRODUCTS

2.1 TRANSFORMERS, GENERAL

A. Factory assembled and tested, air cooled, dry type units of size specified, having characteristics and ratings as indicated. Units shall be designed for 60 Hertz (Hz) service.

B. Comply with NEMA Standard ST 20 "Dry Type Transformers for General Applications" and TP1 standards.

C. Windings. Two winding type, copper. Three phase transformers shall use one coil per phase in primary and secondary.

D. Sound Level. Minimum of 3 decibels (dB) less than NEMA ST 20 standard sound levels for transformer type and size indicated when factory tested in accordance with that standard.

E. Enclosures. Unless otherwise noted on the drawings enclosures shall be indoor, ventilated.

F. Insulation Class. 185 degrees Celsius (o C.) or 220o C. class for transformers 15 kilovolt amperes (kVa) or smaller; 220o C. class for transformers larger than 15 kVa.

G. Insulation Temperature Rise. 80o C. maximum rise above 40o C.

H. Taps. For transformers 3 kVa and larger, full capacity taps in high voltage winding as follows:

1. 3 kVa through 25 kVa. Two 5 percent taps below rated high voltage.
2. 3 kVa through 10 kVa. Two 5 percent taps below rated high voltage.
3. 15 kVa through 500 kVa. Six 2 1/2 percent taps, two above and four below rated high voltage.

I. Accessories. The following accessory items are required where indicated:

1. Wall Mounting Brackets. Manufacturers standard brackets for transformers sized up to 75 kVa where wall mounting is indicated.

2.2 ACCEPTABLE MANUFACTURERS

A. Acme Electric Corp.

B. General Electric Co.

C. Siemens Energy & Automation, Inc.

D. Square D Co.

E. Westinghouse Electric Corp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Arrange equipment to provide adequate spacing for cooling air circulation.

B. Install units on vibration mounts as shown; comply with manufacturer's indicated installation method, if any. Outdoor installations shall be on a housekeeping pad unless pole mounted. Indoor installations over 30 kVa shall be set on a welded steel channel box on top of a housekeeping pad. Indoor installations 30 kVa and under shall be wall mounted using steel angle frame unless otherwise noted.

3.2 GROUNDING

A. Ground transformers per NEC Art. 250.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to install panelboards and enclosures in accordance with the plans and as specified herein.

B. This section includes lighting and power panelboards and associated auxiliary equipment rated 600 volts or less.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

B. Related Sections:

1. "Basic Electrical Requirements."

1.3 QUALITY ASSURANCE

A. Reference Standards.
B. National Fire Protection Association (NFPA) 70, NEC, compliance.
C. National Electrical Manufacturers Association (NEMA) Standard. NEMA PB1, "Panelboards."
D. Underwriters' Laboratories, Inc. (UL) Standards. Comply with UL 61 "Panelboards", UL 50 "Cabinets and Boxes" and ULB69 "service entrance equpment".

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.

B. Submit the following in accordance with Conditions of Contract and Division 1 specification sections.

1. Product data for each type panelboard, accessory item, and component specified.
2. Shop drawings from manufacturers of panelboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, voltage rating and AIC ratings. Include the following

3. Panel schedules for installation in panelboards. Submit final versions after load balancing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Panelboards shall be of a dead-front safety type, equipped with thermal-magnetic molded case circuit breakers as indicated on the Drawings. All panels shall be of same manufacture, complying with UL61.

B. Circuit breakers shall be thermal-magnetic type with quick-make, quick-break, trip-free mechanism, per Fed. Spec. W-C-375B.

C. Furnish molded case circuit breakers in panel boards as indicated on Drawing. Series rated breakers shall not be acceptable.

D. Panelboards shall have fully capacity neutral bus, ground bus and bolt-on circuit breakers. All bus construction shall be copper.

E. Panelboards for use as service disconnecting means shall additionally conform to UL 869.

F. Accessories. Provide a transient voltage surge suppression device for panelboards as indicated on the drawings. The units shall be 3 phase and shall be mounted in a metal enclosure suitable for attachment to the panelboard enclosure. The units shall meet UL standard 1449 and have a UL label. Provide Leviton TVSS devices or equal.

2.2 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Square D. Co.
2. Cutler-Hammer Products
3. Siemens Energy and Automation, Inc.
4. General Electric Co.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessory items in accordance with NEMA PB 1.1,"General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less" and manufacturers' written installation instructions.

B. Mounting Heights. Top of trim 6'-2" above finished floor, except as indicated.

C. Circuit Directory. Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing. Number branch circuit devices accordingly to correspond to circuit directory.

3.2 GROUNDING

A. Make equipment grounding connections for panelboards as indicated.

B. Provide ground continuity to main electrical ground bus indicated.

C. Electrical Tests. Include the following items performed in accordance with manufacturer's instructions:

1. Ground resistance test on system and equipment ground connections.
2. Test main and subfeed overcurrent protective devices.

D. Cleaning

1. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

E. Commissioning

1. Balancing Loads. After substantial completion, conduct load balancing measurements and circuit changes as follows:

a. Perform measurements during period of normal working load as advised by the Owner.
b. Tolerance. Difference between phase loads exceeding 20 percent at any one panelboard is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

END OF SECTION

SECTION16481

MOTOR STARTERS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install motor starters in accordance with the plans and as specified herein.

B. Types of motor starters specified in this section include the following:
   1. Manual.
   2. Combination.
   3. Variable frequency drive.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

B. Related Sections.
   1. “Basic Electrical Requirements”.

1.3 QUALITY ASSURANCE

A. Reference Standards.
   1. National Electrical Code (NEC) Articles 220, 250, and 430.
   2. Underwriters' Laboratories, Inc. (UL) Compliance. UL 486A and B, and UL 508. Provide starters and components which are UL listed and labeled.
   3. Institute of Electrical and Electronic Engineers (IEEE) Compliance.
   4. National Electrical Manufacturers Association (NEMA) Compliance. NEMA Standard ICS 2.

B. Qualifications
   1. Firms regularly engaged in manufacture of motor starters and drives of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

C. Factory Test
   1. Variable Frequency Drives
      a. All control printed circuit boards shall be dynamically tested for a minimum of 22 hours while heat cycled 1 hour at each temperature setting from 32 degrees Fahrenheit (32^{o} F.) to 140^{o} F.
      b. All controllers shall be subjected to Run-In Test with a properly sized motor and operated under cycling load conditions on a dynamometer.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.

B. Submit the following in accordance with conditions of contract and Division 1 specification sections:

1. Product Data. Submit manufacturer's data and installation instructions on motor starters and drives.

2. Wiring Diagrams. Submit power and control wiring diagrams for motor controllers showing connections to electrical power panels, feeders, and equipment. Differentiate between portions of wiring which are manufacturer installed and portions which are field installed.

3. Motor Overloads. Submit for approval motor overload sizes for each new motor starter furnished or existing motor starter modified. Overload size shall be based on actual motor nameplate data and power factor correction size; where applicable. Include thermal overload compensation sizing information where motor(s) are operated at temperatures different than the motor starters.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Except as otherwise indicated, provide motor starters, drives and auxiliary components which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation.

B. Fractional HP Manual Starters. Provide single phase fractional HP manual motor controllers, of sizes and ratings indicated. Equip with manually operated quick make, quick break toggle mechanisms; and with one piece melting alloy type thermal units. Provide starters with double break silver alloy contacts, visible from both sides of controller; green pilot lights, and switch capable of being padlocked OFF.

C. Variable Frequency Drives:

1. Variable frequency controllers shall be listed by Underwriters Laboratories (UL).

2. Construct the drives with three major sections: a full wave, 3 phase diode rectifier section to convert from alternating current (ac) to direct current (dc), a dc filter section to smooth the dc voltage, and a pulse width modulated 3 phase inverter section to provide a variable voltage, variable frequency output at a constant voltage to frequency ration. The output frequency range shall be a minimum of 6 to 120 hertz (Hz). The drives shall be provided with passive harmonic filters housed inside the drive enclosure as required.

3. General:

a. Pump applications, constant torque.

b. Motor type – standard NEMA design B.
c. The controller shall not require an isolation transformer, even if motors are located in a damp area.
d. All components shall include original manufacturer's identification and part number.
e. High power factor input with minimal line distortion, notching or harmonics.
f. Basic drive design shall be pulse width modulated with carrier frequency adjustable to 10 KHZ.
g. The controller shall comply with Federal Communications Commission requirements under Part 15 Rules for Radio Frequency Interference and IEEE 519 for 5% maximum harmonics.
h. All controllers shall be subjected to a 22-hour burn-in test.

4. Environmental:
   a. Ambient operating temperature range – 10 to 40° C.
   b. Humidity: 5 to 95%, noncondensing.
   c. Altitude: 0 to 3300 feet above sea level.
5. Electrical:
   a. Input line voltage: 480 volts, 3-phase, 60 Hz, +/- 10% fluctuations.
   b. Motor nameplate voltage: 460 volts, 3-phase, 60 Hz.
   c. Output frequency range: 0 to 120 Hz.
   d. Minimum drive efficiency: 95% at 100% speed.
   e. Current rating: 115% of connected motor full load ampere (output rated current) continuous at full speed, 150% for one minute.
   f. Power loss ride through: 16 mx.
   g. Input line fuses.
   h. External control circuit voltage: 120 V AC, maximum.
6. The controller shall include the following protective features with status indictors:
   a. Overvoltage.
   b. Undervoltage.
   c. Overcurrent.
   d. Ground fault.
   e. Overtemperature.
   f. Phase loss/blown fuse.
   g. Running overload protection.
   h. Common alarm contact for external user.
   i. Line circuit breaker.
   j. In-line 5% reactor.
7. The power circuit design shall be such that the following conditions will not damage the drive:

a. Single or three-phase fault from line-to-line or line-to-ground.
b. Opening of all three phases during operation by disconnect switch at motor location.

8. Indicator light safety feature shall indicate when DC bus is energized and capacitors are charged.
9. Internal calibration adjustments:
   a. Minimum speed.
   b. Maximum speed.
   c. DC boost.
   d. Acceleration/deceleration rates.
   e. Stop mode (ramp or coast).
   f. Automatic restart after fault trip with lockout after five attempts to restart.
   g. Anti-windmilling adjustable brake time.
   h. Adjustable volts/Hertz.
10. Unit mounted operator controls:
   a. Hand-Off-Auto switch.
   b. Speed adjust potentiometer.
   c. Indicating speed meter.
   d. Power ON light.
   e. Alarm reset, lights and additional devices as shown on the drawings.
   f. All indicating lights shall be push-to-test type.
   g. VFD-Bypass selector switch, where shown on the one-line diagrams.
   h. VFD and Bypass indicating lights, where hown on the one-line diagrams.
11. Provision for remote external controls:
   a. Two wire ON-OFF control.
   b. Speed adjust, analog input (4-20 MADC).
   c. Remote Forward-Reverse switch input where shown on the drawings.
12. Provide control interlocks and alarms as shown on the drawings. The drives shall disable the operation of the equipment after a preset time delay when any of the connected alarm signal is activated. Provide time delay relays as required. The drives must be manually reset prior to restart.

D. Combination Starters. Provide combination starters consisting of a starter as described above with thermal magnetic molded case circuit breaker mounted in a common enclosure. Provide external operator handles for the switches or breakers. Design of the handle with an up-down motion and with the down position indicating OFF. Construct the handles to permit locking in the OFF position with up to three padlocks. The starters shall be NEMA rated but in no case less than NEMA size I. The starters shall include HOA selector switches, ON/OFF pilot lights, control power

transformer, electronic overload relays, three phase power monitor to protect against low voltage, loss of phase and phase reversal with auto reset, two sets of auxiliary contacts, alarm lights, timers, relays, etc. as shown on the drawings.

E. Harmonic Requirements:
   1. Under normal operation conditions when minimum of two VFD's of each set of pumps are operating, the line harmonics introduced into the power system from the VFD controller shall be within the distortion limits as defined in IEEE 519, latest edition.
   2. Total harmonic distortion (THD) for both voltage and current shall not exceed 5 percent, when measured at the point of common coupling (PCC).
   3. An independent testing company shall perform the harmonic analysis after all systems have been in place and fully operational.

F. Enclosures. Starters and drives shall be mounted as shown on the drawings. Units shown as weatherproof (WP) shall be mounted in NEMA Type 4 enclosures. NEMA 1 enclosures shall be provided for stand-alone starters and drives respectively in dry area. Coat the enclosures with the manufacturer's standard color finish.

2.2 EXTRA MATERIALS

A. Maintenance Stock, Fuses. For types and ratings required, furnish additional fuses, amounting to one unit for every installed unit.

2.3 ACCEPTABLE MANUFACTURERS

A. Variable Frequency Drives:
   1. Allen-Bradley Only.

B. Starters:
   1. Allen-Bradley Only.

PART 3- EXECUTION

3.1 INSTALLATION

A. Examine areas and conditions under which motor starters and drives are to be installed, and notify the Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

B. Install motor starters and drives where indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards, to insure that products fulfill requirements.

C. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply

with tightening torques specified in UL Standards 486A and B, and the NEC.

D. Install fuses, of sizes indicated, in each fusible disconnect switch.

E. Wall mount the enclosures using spacers or standoffs (1/4 inch minimum).

3.2 FIELD TRAINING

A. Retain "the manufacturer's" services to provide two 8-hour days of start—up supervision and operator training for variable frequency drives.

3.3 FIELD QUALITY CONTROL

A. Prior to energization of motor controller equipment, check with ground resistance tester, phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

B. Prior to energization, check circuitry for electrical continuity, and for short circuits.

C. The manufacturer's representative shall provide on-site training for the owner's representative upon completion of acceptance testing.

END OF SECTION

SECTION 16500
LIGHTING FIXTURES

PART 1 – GENERAL

1.1 SCOPE

A. The Contractor shall provide the labor, tools, equipment, and materials necessary to furnish and install lighting fixtures in accordance with the plans and schedules as specified herein.

B. Types of lighting fixtures in this section include the following:
   1. LED.

1.2 RELATED DOCUMENTS

A. General. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

B. Division 16 Section 16050, "Basic Electrical Materials and Methods," sections apply to work specified in this section.

C. Related Sections. The following Division 16 sections contain requirements that relate to this section:
   1. Section 16120, "Wires, Cables, and Connectors," for wiring used in tandem wired fixtures.

1.3 QUALITY ASSURANCE

A. Reference Standards.
   1. National Electrical Code (NEC) compliance.
   2. National Electrical Manufacturers Association (NEMA) Compliance. NEMA Standard LE 1 and LE 2.
   3. Underwriters' Laboratories, Inc. (UL) Compliance. UL 486A and B, standards.
   4. National Fire Protection Association (NFPA) Compliance. NFPA 78, NFPA 101,.

1.4 SUBMITTALS

A. Furnish manufacturer's product data, test reports, and materials certifications as required.
B. Submit the following in accordance with Conditions of Contract and Division 1 specification sections:
   1. Submit manufacturer's product data and installation instructions on each type lighting fixture and component including lamp data.
   2. Provide isofootcandle (isolux) plot diagram of footcandles on horizontal pavement surface which shows composite values of illuminance projected from the arrangement of light sources from indicated fixture locations and heights in outdoor applications.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Provide lighting fixtures, of sizes, types and ratings as indicated on the drawings, complete with, but not limited to, housings, lamps, reflectors and wiring. Ship fixtures factory assembled, with those components required for a complete installation.

2.2 SPARE PARTS

A. Provide a quantity equal to 10 percent of installed units of the following component type:
   1. Lamps. Ten lamps for each 100 of each type and rating installed. Furnish at least one of each type.
   2. Diffusers and Lenses. One for each 100 of each type and rating installed. Furnish at least one of each type.
   3. Globes and Guards. One for each 20 of each type and rating installed. Furnish at least one of each type.
   4. Photocell. One for each type and rating integral to lighting fixtures. Furnish at least one of each type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine areas and conditions under which lighting fixtures are to be installed. Examine substrate/substrata for supporting lighting fixtures. Notify the Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to the Engineer.

B. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, National Electrical Contractors Association's (NECA) "Standard of Installation," NEMA standards.

C. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by the Engineer.

D. Support fixtures in lay-in type grid ceilings by hangers or wire anchors from the structural ceiling, not from the lay-in grid.

1. Exception. For recessed cans, the cans shall be equipped with bar hangers with integral slots for mounting directly to the T bar grid. In addition, all four corners of the T bar grid shall be supported from the structural ceiling by hangers or wire anchors.

E. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.

F. Fasten fixtures securely to indicated structural supports. Ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than 2 feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one inch vertical adjustment. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row.

3.2 GROUNDING. Provide ground to all lighting fixtures. Provide equipment grounding connections for exterior lighting fixtures as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

3.3 FIELD QUALITY CONTROL

A. At Date of Substantial Completion, clean luminaries and replace lamps in lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by the Engineer.

END OF SECTION

APPENDIX A

GEOTECHNICAL INFORMATION

Geotechnical Report dated May 28, 2021 by R.W. Gillespie & Associates, Inc.

R.W. Gillespie & Associates, Inc.
Geotechnical Engineering • Environmental Consulting • Materials Testing Services

28 May 2021

Jeffrey Clifton, P.E., Project Manager
Underwood Engineers, Inc.
25 Vaughan Mall
Portsmouth, NH 03801

Subject: Geotechnical Engineering Evaluation
Proposed Water Tank – Webb Place
Dover, New Hampshire
RWG&A Project No. 0515-191

Dear Mr. Clifton:

R.W. Gillespie & Associates, Inc. (RWG&A), is pleased to present the results of the geotechnical engineering evaluation for the proposed water tank to be constructed on Webb Place in Dover, New Hampshire. This evaluation was performed in general accordance with the Underwood Engineers, Inc. (UE) subconsultant agreement dated 15 March 2021. The purpose of the services was to obtain information regarding subsurface conditions on which to base recommendations about the geotechnical aspects of design and construction of foundations and seismic considerations. The attached report presents the results of RWG&A's subsurface explorations, laboratory testing, engineering evaluations, and provides geotechnical design recommendations.

RWG&A has enjoyed working with Underwood Engineers, Inc., on this project. If you have any questions, or if we may be of further service, please contact us.

Sincerely,
R. W. GILLESPIE & ASSOCIATES, INC.

Marc R. Grenier, P.E.
Senior Geotechnical Engineer

MRG:md

G:\PROJECTS\0500\0515\0515-191\Report\2021-05-28 GI Report 0515-191.docx

R.W. Gillespie & Associates, Inc.

Report
of

GEOTECHNICAL ENGINEERING EVALUATION

for

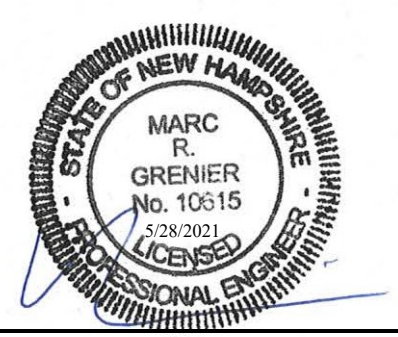
PROPOSED WATER TANK – WEBB PLACE
DOVER, NEW HAMPSHIRE

Prepared
for

UNDERWOOD ENGINEERS, INC.
PORTSMOUTH, NEW HAMPSHIRE

Prepared
by

R. W. GILLESPIE & ASSOCIATES, INC.
NEWINGTON, NEW HAMPSHIRE



Marc R. Grenier, P.E.
State of New Hampshire License No. 10615

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.01 Background 1
1.02 Scope of Services 1

2.0 SUBSURFACE EXPLORATION 2

3.0 LABORATORY TESTING 2

4.0 SUBSURFACE CONDITIONS 3

4.01 Subsurface Soils 3
4.02 Groundwater 3

5.0 EVALUATION OF GEOTECHNICAL DATA 3

5.01 General 3
5.02 Proposed Construction 3
5.03 Foundations 4
5.04 Construction Considerations 4

6.0 RECOMMENDATIONS 4

6.01 Site Preparation 4
6.02 Site Filling 5
6.03 Foundations 6
6.04 Temporary Excavations 7
6.05 Geotechnical Observation 7

7.0 CLOSURE 8

FIGURES:

Figure 1. Locus Map
Figure 2. Exploration Location Plan

APPENDICES:

Appendix A. Limitations
Appendix B. Exploration Logs
Appendix C. Laboratory Test Results

1.0 INTRODUCTION

1.01 Background

The proposed construction consists of an elevated water tank located on Webb Place in Dover, New Hampshire as shown on Figure 1, *Locus Map*. The planned construction area is undeveloped and is mostly wooded. The ground surface at the water tank area is relatively level.

R.W. Gillespie & Associates, Inc.'s (RWG&A's) understanding of the site and proposed construction is based on communications with Underwood Engineers, Inc. (UE) including a site visit, results of the soil explorations and laboratory tests, information received in emails from UE on 11 November 2020 which included Figure 2, *Proposed Water Storage Tank*, dated November 2020, prepared by UE and the Technical Bulletin titled *Geotechnical Investigation Specification for Composite Elevated Water Storage Tanks*, dated August 9, 2017 and prepared by Landmark.

1.02 Scope of Services

This evaluation was performed to develop site-specific soil and laboratory data, and to make geotechnical evaluations for the proposed construction. The services were performed in accordance with UE Subconsultant Agreement dated 15 March 2021. Refer to Appendix A for limitations and use of this report. As performed, RWG&A's scope of services included the following items:

1. Reviewed project information, readily available published subsurface information and geologic mapping, and visited the site to observe surface conditions.

2. Prepared a geotechnical subsurface exploration and sampling program to obtain subsurface information for use in geotechnical evaluations.

3. Marked the boring locations in the field. Contacted DigSafe to verify planned boring locations were clear of utilities.

4. Arranged to have the soil borings performed by a local drilling company as a subcontractor to RWG&A. Provided technical monitoring of exploration activities so that depths, locations, and sampling methods could be modified in response to the subsurface conditions encountered. Observed, logged, and sampled the explorations.

5. Performed laboratory tests on selected soil samples recovered from the subsurface explorations to aid in soil description and for determination of engineering properties needed for foundation design.

6. Conducted engineering evaluations of the geotechnical aspects of the proposed project. Emphasis was placed on foundation type, allowable foundation loads, lateral load resistance, seismic site class, and excavations.

7. Prepared this report presenting the findings, conclusions, and recommendations of the geotechnical evaluation.

2.0 SUBSURFACE EXPLORATION

The subsurface exploration program consisted of four test borings designated B-1 through B-4. The explorations were advanced to depths ranging from 27 to 42 feet below local ground surface and were drilled on 07 April 2021 by Northern Test Boring, Inc. of Gorham, Maine using a track-mounted drill rig. Split-barrel sampling with standard penetration testing (*ASTM D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*) was generally performed at about 5-foot intervals in the soil borings. The borings were advanced using hollow-stem augers.

Exploration activities were coordinated and monitored by RWG&A personnel who prepared the exploration logs. The soils were described in general accordance with *ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. Logs of the explorations are included in Appendix B. Stratification lines shown on the exploration logs represent the estimated boundaries between the different soil types encountered and approximate refusal depths; the actual transitions will be more gradual and vary over short distances. Subsurface information should only be considered representative of subsurface conditions encountered within the vertical reach of the explorations on the date the explorations were made.

Figure 2, *Exploration Location Plan*, shows the approximate exploration locations. Boring locations were selected and marked by UE using tape survey prior to drilling and were based on the technical bulletin from Landmark. Elevations were interpolated from the plans provided. Locations and elevations should be considered accurate only to the degree implied by the methodology used to determine them.

3.0 LABORATORY TESTING

Laboratory testing was performed to assist in description and estimation of engineering properties of the soils. The laboratory testing program consisted of two grain-size distribution tests and natural moisture content determinations. The tests were performed in general accordance with the following methods and procedures:

- *ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass*.

- *ASTM D6913/6913M – 17, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.*

Moisture content test results are presented on the exploration logs. Results of other tests are presented in Appendix C, *Laboratory Test Results*. Tests were conducted at the RWG&A soil and materials testing laboratory in Biddeford, Maine, which is accredited by the American Association of State Highway and Transportation Officials (AASHTO) for the tests performed.

4.0 SUBSURFACE CONDITIONS

4.01 Subsurface Soils

In summary, the subsurface conditions consisted of topsoil over naturally deposited silty sand over sand with varying amounts of silt and gravel. The topsoil thickness generally ranged from about 3 to 6 inches. The naturally deposited soils generally consisted of loose silty sand over medium dense sand with varying amounts of silt and gravel. Please refer to the exploration logs in Appendix B for descriptions of subsurface conditions encountered at specific locations.

4.02 Groundwater

Free water was not observed in the borings upon completion. Borings were backfilled upon completion of the borehole. Free water levels observed during the subsurface exploration program were influenced by the exploration methods (e.g., slow groundwater response due to low soil permeability) and are not considered representative of stabilized groundwater levels. The absence of free water data on certain exploration logs implies no groundwater data is available but does not necessarily mean that groundwater will not be encountered at these locations within the vertical reaches of the explorations in the future. Groundwater levels at the site will fluctuate due to season, temperature, rainfall, and construction activity in the area; therefore, water levels during and following construction will vary from those observed in the explorations.

5.0 EVALUATION OF GEOTECHNICAL DATA

5.01 General

Engineering evaluations for this project are based on the subsurface explorations, laboratory testing data, and the design information currently available to RWG&A. This report addresses geotechnical issues with site layout as shown on Figure 2, *Proposed Water Storage Tank*, dated November 2020, prepared by UE. The engineering evaluations that follow should be reviewed by RWG&A to confirm their continued applicability after proposed site grading has been prepared. It is recommended foundation design and construction be in compliance with the requirements of applicable ordinances, regulations, and codes. When this report was prepared, the applicable building code in Dover was the New Hampshire State Building Code which adopts *2015 International Building Code*® by reference.

5.02 Proposed Construction

The planned water tank would be a pedestal-type 1 MG tank. The overall tank height is 110 feet, and the 67-foot diameter tank would be supported by a 38-foot diameter pedestal. The finished grades are anticipated to be near the existing ground surface and no below grade spaces are planned. Foundation loads, settlement tolerances, and special design and construction features (such as below-grade spaces, pits, etc.), were not available when this report was prepared. The evaluations that follow are based on structural loads of up to about 5 kips per foot of wall and

tolerable settlement of 3 inches total and tilting of less than 1/800 in accordance with the Landmark technical bulletin.

5.03 Foundations

With proper site preparation, the proposed water tank may be supported by shallow foundations consisting of spread and/or continuous footings bearing on naturally deposited inorganic soil or compacted structural fill.

5.04 Construction Considerations

Construction Dewatering: The on-site naturally deposited soils are moderately sensitive to disturbance when wet. To reduce disturbance of exposed subgrade soils, it will be important to divert runoff, provide positive grading to shed seepage and runoff from flat areas, and compact exposed soils to reduce rutting, ponding, and surface water infiltration. RWG&A anticipates that if groundwater is encountered during construction, then groundwater control can be accomplished through the use of ditches, sumps, and open pumping.

Use of On-site Soils: It is anticipated the surficial topsoil will be stripped and be either incorporated into proposed landscaped areas, where practicable, or hauled off-site. Topsoil and organic materials are considered unsuitable for use as common fill.

The subsurface soils from foundation and site work excavations will generally consist of naturally deposited sand with silt and gravel. The naturally deposited soils are moderately moisture sensitive. Moisture-density relationships should be established during construction to provide guidance on appropriate working moisture contents. Working moisture content for moisture sensitive soils generally ranges from about minus three to plus one of optimum moisture content.

Laboratory tests indicate the naturally deposited soils would be unsuitable for reuse as structural fill. If on-site soils are proposed for use other than common fill, the soil should be stockpiled separately and tested to determine if it meets specification requirements for its intended use.

6.0 RECOMMENDATIONS

The recommendations presented below are provided for use in design of the proposed water tank foundations and site improvements. Foundation design and site work construction will be greatly influenced by subsurface conditions at the project site.

6.01 Site Preparation

1. All topsoil, fill, organic material, debris, rubbish, frozen soils, muck, loose, or disturbed soils and other unsuitable materials should be removed from areas of proposed construction. Unsuitable materials include uncontrolled fills (i.e., fills placed without systematic densification and moisture control to an acceptable percent compaction) and deleterious substances.

2. Surface grading should provide positive drainage away from constructed facilities both during and after construction.

3. Dewatering requirements will vary across the site based on groundwater levels encountered during construction and soil types. In general, it should be practical to accomplish construction dewatering from within excavations using open pumping methods to a depth of one to two feet below groundwater surface. Surface runoff and infiltration of groundwater should be controlled so that excavation, filling, and foundation construction can be completed in-the-dry.

4. After topsoil is removed from the tank foundation area, exposed subgrades should be compacted with a minimum of four passes of a 5-ton roller under the observation of the geotechnical engineer to improve the density of suitable soils. Areas of the subgrade where soft and/or loose soils are encountered or where it exhibits weaving, pumping, or other signs of instability, should be excavated and replaced with compacted structural fill.

6.02 Site Filling

5. Common fill may be placed in landscaped areas. Common fill should consist of inorganic mineral soil free of ice, loam, organic, or other unsuitable materials. Common fill may contain cobbles up to 2/3 of the lift thicknesses used to place and compact it; recommended maximum lift thickness for common fill before compaction is 12 inches.

6. The on-site inorganic soils are unsuitable for use as structural fill but may be used as common fill. In addition, the on-site inorganic soils are generally frost susceptible. The moisture content will need to be tightly controlled for placement and compaction to the required density without excessive weaving, pumping, or other types of instability.

7. Only structural fill should be used as fill below foundations and as backfill within 2 feet of foundations. Structural fill should be a well-graded sand and gravel mixture free of roots, topsoil, loam, organic material, and any other deleterious materials, as well as clods of silt or clay, and meet the following gradation requirements:

Screen or Sieve Size	Percent Passing
6 inches	100
3 inches	70 – 100
No. 4	35-70
No. 40	5-35
No. 200	0-5

(Note: Maximum particle size should be limited to 3 inches within 2 feet of foundations.)

On-site excavated soils represented by the particle-size distribution reports in Appendix B (Lab Nos. 16475-01 & -02) are unsuitable for reuse as structural fill. Imported fill should meet recommended gradations. On-site soil proposed for reuse should be stockpiled separately and tested to determine if they meet specification requirements for their intended use.

Alternatively, material meeting requirements of New Hampshire Department of Transportation Standard Specification Item 304.2, *Gravel*, 304.3, *Crushed Gravel*, or 304.4, *Crushed Stone (Fine)* may be used as structural fill.

8. In open areas, structural fill should be placed in level, uniform lifts not exceeding 12 inches in uncompacted thickness and be compacted with self-propelled compaction equipment. In confined areas, structural fill should be placed in lifts not exceeding 6 inches in uncompacted thickness and be compacted with hand-operated compaction equipment. All fill placed for foundation support should be structural fill compacted to at least 95 percent of the maximum dry density as determined by *ASTM Standard D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))*.

6.03 Foundations

9. The proposed water tank should be designed to withstand lateral, uplift, and overturning forces due to earthquakes. The in-place soils encountered in the explorations are not considered susceptible to liquefaction. In accordance with the *2015 International Building Code®*, the site is classified as Site Class D.

10. The proposed water tank may be supported on spread and/or continuous footings bearing on the naturally deposited soils or compacted structural fill. The footings should be proportioned for an allowable contact pressure of 3,000 pounds per square foot. Total settlements of less than 1 inch and differential settlements of less than 1/2 inch over a distance of 40 feet should be expected. Minimum footing width should be in accordance with concrete design and building code requirements, and no less than 2 feet. For footings having a least lateral dimension less than 3 feet, the above allowable pressure should be taken as 1/3 of the above value times the least dimension in feet.

11. Excavation of foundation bearing surfaces in soil or fill should be performed by earthwork equipment fitted with smooth-edged buckets. Final subgrade preparation should include compaction of fill or naturally deposited soil subgrades with hand-guided, vibratory compaction equipment. Following compaction and prior to placement of concrete, care should be taken to limit disturbance of the bearing surfaces. Any loose, softened, or disturbed material due to construction traffic should be removed prior to placement of concrete and backfilled with compacted structural fill.

12. It is recommended that design bottom of footing level for exterior footings bearing on structural fill or naturally deposited soil be a minimum of 4 feet below lowest adjacent ground surface exposed to freezing temperatures.

13. The integrity of natural soils and structural fill must be maintained during cold weather conditions. Foundation subgrades should not be allowed to freeze. The naturally deposited soils are considered moderately frost susceptible. Freezing of subgrade soils beneath foundations might result in heaving and post-construction settlement. The Contractor should make every effort to prevent freezing of subgrade soils. In the event frost penetration occurs, all frozen and previously frozen soils should be removed and

replaced with compacted structural fill. At no time should frozen material be placed as fill.

14. Lateral loads from wind and earthquake may be resisted by friction between the bottoms of footings and supporting subgrades, and by passive earth pressures against the sides of the foundation. A friction coefficient of 0.25 and an equivalent fluid pressure of 150 pcf against sides of footings should be used in design of footings.

6.04 Temporary Excavations

15. Soils at this site, encountered below surficial topsoil, consist of silty sand and sand with varying amounts of silt and gravel. We anticipate that foundation and utility excavations can be accomplished using sloped, open-cut techniques. It is also anticipated that dewatering can be accomplished using sumps and open pumping methods.

    The Contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

    As a safety measure, it is recommended all vehicles and spoil piles be kept a minimum lateral distance from the top of excavations equal to no less than 100 percent of the slope height. Exposed slope faces should be protected against the elements.

6.05 Geotechnical Observation

The geotechnical recommendations provided as the basis for design of this project were developed using limited numbers of observations and tests. The Owner should be sensitive to the potential need for adjustment in the field. We recommend that the Owner retain RWG&A to observe geotechnical construction aspects of the project. These services should include observing general compliance with the design concepts, specifications and recommendations, and assisting in development of design changes should subsurface conditions differ from those anticipated prior to the start of construction. Observation improves the likelihood that the design intent will be carried out during construction. In addition, it allows RWG&A to confirm its design recommendations. For this project, geotechnical observation of the following aspects is recommended:

- Site stripping and subgrade compaction
- Structural fill placement and compaction
- Preparation of foundation subgrades

In addition to geotechnical observation, RWG&A can also provide full-service construction inspection and materials testing. This would include soils, portland cement and asphaltic

concrete, structural steel and welding inspections, destructive and non-destructive testing, and special inspection services in fulfillment of building code requirements.

7.0 CLOSURE

This report has been prepared for specific application for the Water Tank to be constructed on Webb Place in Dover, New Hampshire, for the exclusive use of Underwood Engineers. This work has been completed in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. In the event any changes are made in the nature, design, or location of the proposed construction, the conclusions and recommendations of this report should be reviewed by RWG&A.

The recommendations presented are based on the results of widely spaced explorations. The nature of variations between the explorations may not become evident until construction has begun. If variations are encountered, it will be necessary for RWG&A to re-evaluate the recommendations presented in this report. RWG&A requests an opportunity for a general review of the final design and specifications in order to determine that earthwork and foundation recommendations have been interpreted in the manner in which they are intended.



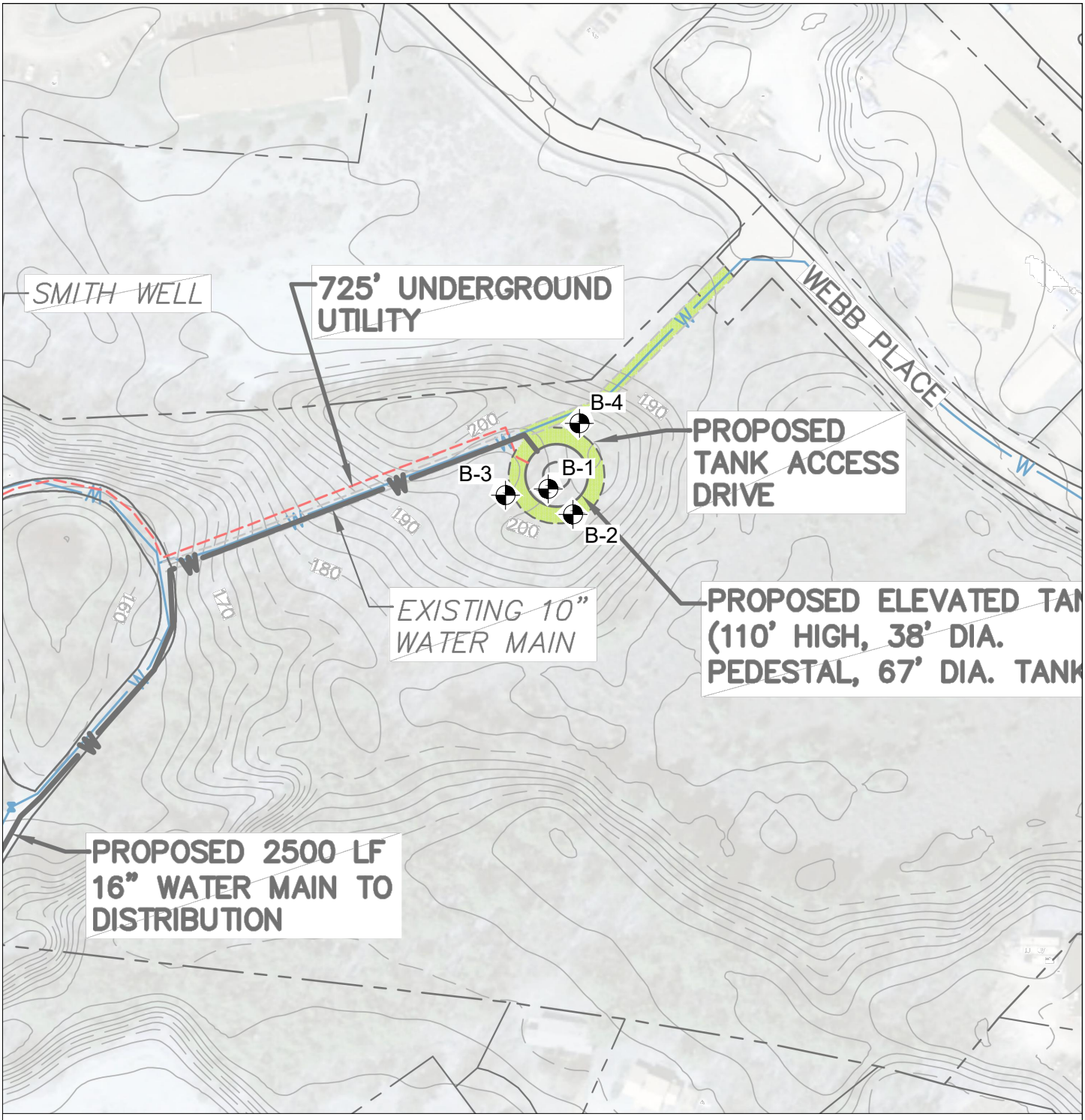
FIGURE 1
LOCUS MAP
GEOTECHNICAL EVALUATION
PROPOSED WATER TANK
DOVER, NEW HAMPSHIRE

MAY 2021 PROJECT NO. 0515-191

SOURCE:
USGS 7.5-MINUTE TOPOGRAPHIC QUADRANGLE OF
DOVER WEST, NH, & DOVER EAST, NH, BOTH DATED 2018.

R.W. Gillespie & Associates
Geotechnical Engineering ● Materials Testing Services
Environmental Consulting ● www.rwgillespie.com

G:\PROJECTS\0500\0515\0515-191\AutoCAD\FIG 1, LOCUS MAP 0515-191.dwg, 04/07/2021 4:30:09 PM



LEGEND:

B-1 APPROXIMATE LOCATION OF SOIL BORING DRILLED 07 APRIL 2021.

N

0 150 225 300

SCALE, FEET

SOURCE:
DRAWING NO. 2, TITLED "PROPOSED WATER STORAGE TANK", PREPARED BY UNDERWOOD ENGINEERS, DATED NOV 2020.

FIGURE 2
EXPLORATION LOCATION PLAN
GEOTECHNICAL EVALUATION
PROPOSED WATER TANK - WEBB PLACE
DOVER, NEW HAMPSHIRE

MAY 2021 PROJECT NO. 0515-191

R.W. Gillespie & Associates
Geotechnical Engineering ● Materials Testing Services
Environmental Consulting ● www.rwgillespie.com

G:\PROJECTS\0500\0515\0515-191\AutoCAD\FIG 2, ELP 0515-191.dwg, 05/27/2021 5:10:49 PM, 1. DWG To PDF.pc3

APPENDIX A

LIMITATIONS

Geotechnical Evaluation
Proposed Water Tank – Webb Place
Dover, New Hampshire

LIMITATIONS

This evaluation has been limited to consideration of the geotechnical aspects of the Water Tank to be constructed on Webb Place in Dover, New Hampshire. The purpose of the evaluation was to obtain information regarding subsurface conditions on which to base recommendations about the geotechnical aspects of design and construction of foundations and seismic considerations.

This geotechnical evaluation might also aid Contractors responsible for construction of the planned water tank. However, the recommendations and comments provided hereinafter are not intended to be instructions or directives to the project Contractors. The project Contractors must evaluate construction issues encountered in the work on the basis of their experience with similar projects taking in to account their own methods and procedures.

RWG&A has not considered the construction from a worker safety perspective. Construction safety is the responsibility of the project Contractor, who is also solely responsible for the means, methods, and sequencing of construction operations. RWG&A is providing this information as a service to Underwood Engineers, Inc. Under no circumstances should this information be interpreted to mean that RWG&A, Underwood Engineers, Inc., and/or the Owner are assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

RWG&A's services exclude an environmental site assessment relative to oil and hazardous materials or evidence of a potential release or threat of oil or hazardous materials on, below, or around the site. (Note: any statement in this report, or on the exploration logs, regarding odors or unusual or suspicious conditions is for informational purposes only and is not intended to constitute an environmental assessment.) Also exclude any service to investigate or detect the presence of mold or other biological contaminants, or any service that was designed or intended to prevent or lower the risk of the occurrence of an infestation of mold or other biological contaminants (MOBC infestation).

APPENDIX B

EXPLORATION LOGS

Geotechnical Evaluation
Proposed Water Tank – Webb Place
Dover, New Hampshire

RWG&A, Inc. soil descriptions are based on the following criteria. Descriptive terminology is used to denote the grain size and percentage of each component. The soil descriptions are based on visual-manual classification procedures, Standard Penetration Test results, and the results of laboratory testing on selected soil samples, where available. The Unified Soil Classification Group Symbol will be indicated in capital letters.

COMPONENT DEFINITIONS BY GRADATION SIEVE LIMITS

Materials	Definitions	Fractions	Upper	Lower
Boulders	Material too large to pass through an opening 12 in. square.			
Cobbles	Material passing through a 12 in. opening and retained on the 3 in. sieve.			
Gravel	Material passing the 3 in. sieve and retained on 1/4" (No. 4 sieve).	Coarse Fine	3 in. 3/4 in.	3/4 in. 1/4 in.
Sand	Material passing the No. 4 sieve and retained on the No. 200 sieve.	Coarse Medium Fine	No. 4 (1/4") No. 10 (1/8") No. 40 (1/32")	No. 10 (1/8") No. 40 (1/32") No. 200
Silt	Material passing the No. 200 sieve which is usually non-plastic in character and exhibits little or no strength when air dried.		No. 200	
Clay	Material passing the No. 200 sieve which can also be made to exhibit plasticity within a certain range of moisture contents and which exhibits considerable strength when air dried.		No. 200	

SOIL DESCRIPTION

General

Soils are described as to the Unified Soil Classification Systems Group Symbol, density or consistency, color, grain size distribution and other pertinent properties such as plasticity and dry strength. The RWG&A order of descriptors is as follows:

1. USCS Group Name and Symbol, or Fill
2. Density or Consistency
3. Moisture
4. Grain Size & Constituent percentages
5. Other pertinent descriptors
6. Color

DESCRIPTIVE TERMINOLOGY DENOTING COMPONENT PROPORTIONS

Descriptive Terms	Range of Proportions
Noun (major component)	∃50%
Adjective (secondary component)	20 - 50%
Some (third component)	25 - 45%
Little (second or third component)	15 - 25%
Few (second or third component)	5 - 15%
Trace	0 - 5%
With	Amount of component not determined. Used as a conjunction only. Does not indicate component percentile

OTHER DESCRIPTIVE TERMS

Where appropriate, geological classifications are also used (Glacial Till, etc.)

TYPICAL DESCRIPTIONS

SAND WITH SILT (SP-SM): Medium dense, moist, coarse to medium sand, few silt, brown.
FILL; Loose, dry, fine sand, some gravel and silt, with brick and concrete fragments, dark brown.
SILTY CLAY (CL); Very stiff, moist, silty clay, olive-brown.

DENSITY OR CONSISTENCY OF SOILS

COHESIVE SOILS

Consistency of Cohesive Soils	Standard Penetration Test (Blows Per Foot) (N)	Undrained Shear Strength (TSF)
Very Soft	0 - 2	Below 0.13 (250 psf)
Soft	2 - 4	0.13 to 0.25 (to 500 psf)
Medium	4 - 8	0.25 to 0.5 (to 1,000 psf)
Stiff	8 - 15	0.5 to 1.0 (to 2,000 psf)
Very Stiff	15 - 30	1.0 to 2.0 (to 4,000 psf)
Hard	Over 30	over 2.0 (over 4,000 psf)

Consistency of cohesive soils is based upon field vane shear, torvane, or pocket penetrometer, or laboratory vane shear or Unconsolidated-Undrained Triaxial Compression tests. Consistency of cohesive soils is based upon the Standard Penetration test when no other data is available.

COHESIONLESS SOILS

Density of Cohesionless Soils	Standard Penetration Test (Blows per Foot) (in)
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	over 50

PENETRATION RESISTANCE

STANDARD PENETRATION TEST (ASTM D1586) - a 2.0-inch diameter, 1-3/8 inch inside diameter split barrel sample is driven into soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The total number of blows required for penetration from 6 to 18 inches is the Standard Penetration Resistance (N).

COBBLES AND BOULDERS

The percentage of cobbles and boulders is estimated visually where possible.

Descriptive Term	Estimated Percentage
Very Few	0 - 10%
Few	10 - 25%
Common	25 - 40%
Numerous	40 - 50%

If the percentage cannot be determined, as in a typical test boring, then use “with” to indicate the presence of cobbles and/or boulders. (i.e., gravelly sand with cobbles and boulders).

FILLS

The following terminology is used to denote size range of man-made materials within fill deposits:

Size Range	Comparative Soil Terms
<No. 200 Sieve	Silt - size
No. 200 to 1/4 in.	Sand - size
1/4 in. to 3 in.	Gravel - size
3 in. to 12 in.	Cobble - size
>12 in.	Boulder - size

SUPPLEMENTAL SOIL DESCRIPTION TERMINOLOGY

Term	Example	
Seam	Typically 1/16 to 1/2 inch thick	1/4 inch sand seams
Layer	Greater than 1/2 inch thick	2-inch sand layers
Occasional	One or less per foot of thickness	
Frequent	More than one per foot of thickness	
Interbedded	Alternating soil layers of different composition	
Varved	Alternating thin seams of silt and clay	
Mottled	Variations in color	

© R. W. Gillespie & Associates, Inc. 2008-12-17

R.W. Gillespie & Associates

- Geotechnical Engineering
- Environmental Consulting
- Materials Testing Services

Boring Log: B-1

Total Depth (ft): 42

Sheet 1 of 2

Project Name: Proposed Water Tank
RWG&A Project No. 0515-191
Location: Dover, New Hampshire
Client: Underwood Engineers, Inc.
RWG&A Representative: Anthony Stohlberg
Boring Location: See Exploration Location Plan
Boring Abandonment Method: Auger cuttings
Observed Water Depth: Not Obs.

Drilling Co.: Northern Test Boring
Drill Rig: Diedrich D-50
Driller Rep.: Mike Nadeau
Date Started: 04/07/2021
Date Completed: 04/07/2021
Surface Elevation: 198 feet
Drilling Method: 2 1/4" HSA
Casing Type: N/A

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0			S-1	TOPSOIL AND ORGANIC MATERIAL (3 inches). SILTY SAND (SM); Loose, medium to fine sand, little silt, brown.	7	1 1 1 2	2		
5			S-2	SAND WITH GRAVEL AND SILT (SP-SM); Dense, medium to fine sand, few silt, few gravel.	16	8 12 19 12	31		
10			S-3		12	12 12 14 14	26	3.3	GS NM
15			S-4	Less gravel by drilling pressure.	11	12 14 19 12	33		
20			S-5		10	7 8 14 11	22		
25			S-6		20	9 8 11 10	21		
30									

Notes:

R.W. Gillespie & Associates

- Geotechnical Engineering
- Environmental Consulting
- Materials Testing Services

Boring Log: B-1

Total Depth: 42

Sheet 2 of 2

Project Name: Proposed Water Tank
Location: Dover New Hampshire
Client: Underwood Engineers, Inc.
Observed Water Depth: Not Obs.

RWG&A Project No. 0515-191
Surface Elevation: 198 feet
Casing Type: N/A

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
30			S-7		15	5 6 7 7	13		
35			S-8		14	9 7 7 9	14		
40			S-9		16	10 10 11 19	21		
				Bottom of Exploration at 42'; Not refusal.					
45									
50									
55									
60									

Notes:

R.W. Gillespie & Associates

- Geotechnical Engineering
- Environmental Consulting
- Materials Testing Services

Boring Log: B-2

Total Depth (ft): 27

Sheet 1 of 1

Project Name: Proposed Water Tank
RWG&A Project No. 0515-191
Location: Dover, New Hampshire
Client: Underwood Engineers, Inc.
RWG&A Representative: Anthony Stohlberg
Boring Location: See Exploration Location Plan
Boring Abandonment Method: Auger cuttings
Observed Water Depth: Not Obs.

Drilling Co.: Northern Test Boring
Drill Rig: Diedrich D-50
Driller Rep.: Mike Nadeau
Date Started: 04/07/2021
Date Completed: 04/07/2021
Surface Elevation: 198 feet
Drilling Method: 2 1/4" HSA
Casing Type: N/A

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0			S-1	TOPSOIL AND ORGANIC MATERIAL (4 inches). SILTY SAND (SM); Loose, medium to fine sand, little silt, few gravel, brown-tan.	8	3 2 3 6	5		
5			S-2	SAND WITH SILT AND GRAVEL (SP-SM); Medium dense, coarse to fine sand, few silt, little gravel, brown-tan-gray.	15	9 9 11 9	20		
10			S-3		10	13 7 9 8	16		
15			S-4		15	8 6 7 6	13	2.5	GS NM
20			S-5		15	6 7 7 8	14		
25			S-6			6 7 8 9	15		
30				Bottom of Exploration at 27'; Not refusal.					

Notes:

R.W. Gillespie & Associates

- Geotechnical Engineering
- Environmental Consulting
- Materials Testing Services

Boring Log: B-3

Total Depth (ft): 22

Sheet 1 of 1

Project Name: Proposed Water Tank
RWG&A Project No. 0515-191
Location: Dover, New Hampshire
Client: Underwood Engineers, Inc.
RWG&A Representative: Anthony Stohlberg
Boring Location: See Exploration Location Plan
Boring Abandonment Method: Auger cuttings
Observed Water Depth: Not Obs.

Drilling Co.: Northern Test Boring
Drill Rig: Diedrich D-50
Driller Rep.: Mike Nadeau
Date Started: 04/07/2021
Date Completed: 04/07/2021
Surface Elevation: 196 feet
Drilling Method: 2 1/4" HSA
Casing Type: N/A

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0			S-1	TOPSOIL AND ORGANIC MATERIAL (3 inches). SAND WITH SILT (SP-SM); Loose, fine sand, few silt, trace gravel, tan and brown.	19	1 1 1 1	2		
5			S-2	SAND WITH GRAVEL AND SILT (SP-SM); Medium dense, coarse to fine sand, few gravel, few silt.	12	5 6 5 6	11		
10			S-3		10	23 14 12 14	26		
15			S-4		12	8 11 9 11	20		
20			S-5		12	12 9 10 11	19		
25				Bottom of Exploration at 22'; Not refusal.					
30									

Notes:

R.W. Gillespie & Associates

- Geotechnical Engineering
- Environmental Consulting
- Materials Testing Services

Boring Log: B-4

Total Depth (ft): 27

Sheet 1 of 1

Project Name: Proposed Water Tank
RWG&A Project No. 0515-191
Location: Dover, New Hampshire
Client: Underwood Engineers, Inc.
RWG&A Representative: Anthony Stohlberg
Boring Location: See Exploration Location Plan
Boring Abandonment Method: Auger cuttings
Observed Water Depth: Not Obs.

Drilling Co.: Northern Test Boring
Drill Rig: Diedrich D-50
Driller Rep.: Mike Nadeau
Date Started: 04/07/2021
Date Completed: 04/07/2021
Surface Elevation: 198 feet
Drilling Method: 2 1/4" HSA
Casing Type: N/A

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0			S-1	TOPSOIL AND ORGANIC MATERIAL (6 inches). SAND WITH SILT AND GRAVEL (SP-SM); Medium dense, medium to fine sand, few silt, few gravel.	8	4 4 8 8	12		
5			S-2		12	6 6 4 5	10		
10			S-3		18	11 12 14 18	26		
15			S-4		6	11 4 4 4	8		
20			S-5		15	8 8 12 9	20		
25			S-6		0	8 8 10 8	18		
30				Bottom of Exploration at 27'; Not refusal.					

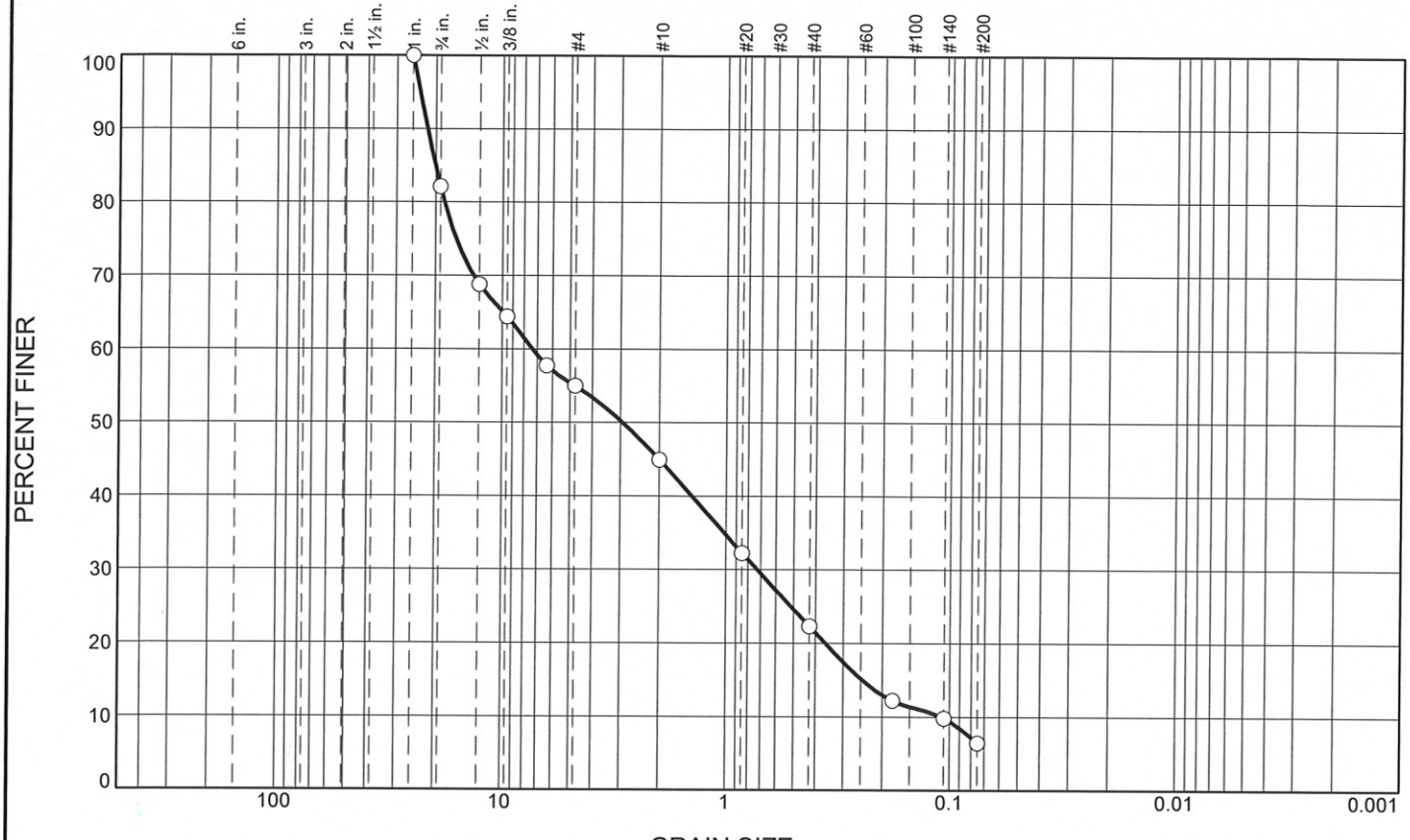
Notes:

APPENDIX C

LABORATORY TEST RESULTS

Geotechnical Evaluation
Proposed Water Tank – Webb Place
Dover, New Hampshire

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	17.9	27.1	10.0	22.7	15.8	6.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	82.1		
1/2"	68.8		
3/8"	64.4		
1/4"	57.7		
#4	55.0		
#10	45.0		
#20	32.3		
#40	22.3		
#80	12.2		
#140	9.8		
#200	6.5		

* (no specification provided)

Soil Description

poorly graded sand with silt and gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 21.8302 D_{85}= 20.0882 D_{60}= 7.3613
D_{50}= 2.9397 D_{30}= 0.7276 D_{15}= 0.2465
D_{10}= 0.1088 C_u= 67.64 C_c= 0.66

Classification

USCS= SP-SM AASHTO= A-1-a

Remarks

Moisture Content: 3.3%

Location: B-1
Sample Number: S-3 **Depth:** 10-12'

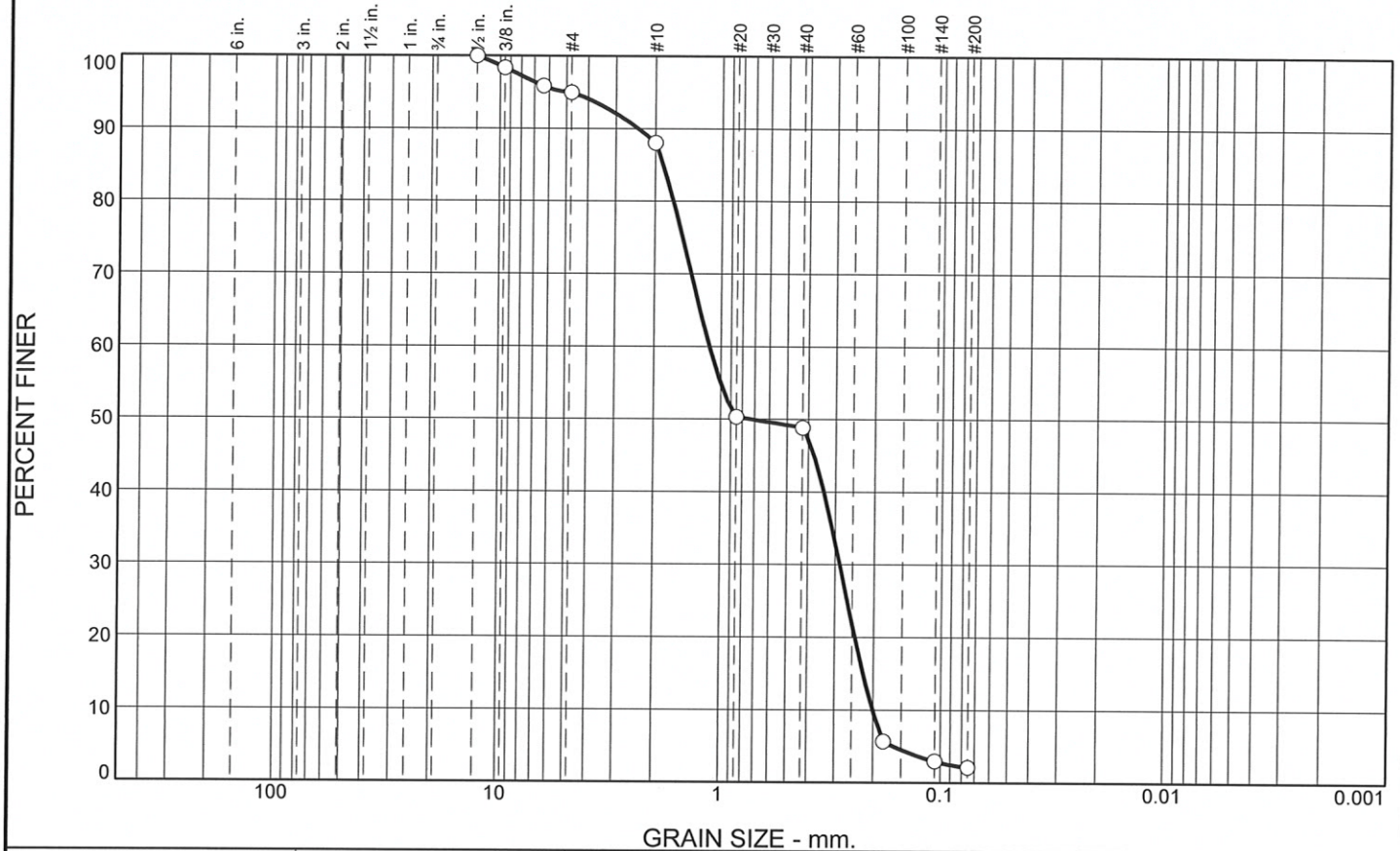
Date: 04-13-2021

R.W. Gillespie & Associates, Inc.
Biddeford, Maine

Client: Underwood Engineers, Inc
Project: Proposed Water Tank
Dover, NH
Project No: 0515-191 **Lab No.** 16475-01

Tested By: BB **Checked By:** MTG MTG

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.0	6.9	39.2	46.8	2.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	98.4		
1/4"	95.9		
#4	95.0		
#10	88.1		
#20	50.3		
#40	48.9		
#80	5.7		
#140	3.0		
#200	2.1		

* (no specification provided)

Soil Description

poorly graded sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.3892 D_{85}= 1.8478 D_{60}= 1.1299
D_{50}= 0.7331 D_{30}= 0.2865 D_{15}= 0.2231
D_{10}= 0.2019 C_u= 5.60 C_c= 0.36

Classification

USCS= SP AASHTO= A-1-b

Remarks

Moisture Content: 2.5%

Location: B-2
Sample Number: S-4 **Depth:** 15-17'

Date: 04-13-2021

R.W. Gillespie & Associates, Inc.
Biddeford, Maine

Client: Underwood Engineers, Inc
Project: Proposed Water Tank
Dover, NH
Project No: 0515-191 **Lab No.** 16475-02

Tested By: BB **Checked By:** MTG MTG

APPENDIX B

CITY OF DOVER
TRENCH RULES AND REGULATIONS

TRENCH RULES AND REGULATIONS
FOR THE CITY OF DOVER, NEW HAMPSHIRE

72 HOURS PRIOR TO ANY CONSTRUCTION
DIG SAFE MUST BE CONTACTED AT 1-888-344-7233.

All rules and regulations shall be strictly adhered to. Any deviation from these rules and regulations may subject the contractor to revoked digging privileges or fines as specified in City of Dover, NH Ordinance, Streets and Sidewalks, Chapter 152. (See attached)

1. The Applicant must obtain a digging permit from the City Engineer's Office at least **24 hours prior to digging in any City owned street or right-of-way**. The Dig Safe number must be brought in at this time. This permit and all required permits must be in the Contractor's possession at all times.

2. At the time of obtaining the digging permit the Applicant will be required to post the following for each trench:
   - a deposit in the form of a Treasurer's Check, personal check or cash in the amount of five dollars ($5.00) per square foot of area to be disturbed - a minimum deposit of two hundred dollars ($200.00) is required.
   - a one-time, non-refundable inspection fee of $70.00

3. The Applicant shall be responsible for the excavation for one (1) year from the date of completion. If at any time during the one-year period the excavation requires any additional work (i.e.: repair of settlement, loaming, seeding, etc.), the Applicant will be responsible to complete this work in a timely manner or forfeit the digging deposit and possible future digging privileges in the City of Dover. The City of Dover reserves the right to repair any trench at the expense of the permit holder if necessity or public safety dictates or due to failure of permit holder to repair. If, however, at the end of the one-year period, the excavation is deemed acceptable, the digging deposit will be refunded to the Applicant.

4. Digging will **NOT** be allowed in City owned streets or rights-of-way between the dates of November 15 and April 15.

5. Digging will **NOT** be allowed on Fridays in main artery streets without written approval from the City Engineer's office.

6. Digging will **NOT** be allowed in City owned streets or rights-of-way on weekends or City designated holidays.

7. TRAFFIC CONTROL (See attached sheet)
   - It shall be the responsibility of the Contractor to provide all necessary cones, barricades, flashing lights, signs, flagmen and traffic officers.
   - Any Contractor negligent in utilizing the necessary sign packages(s) may be required to stop all work, or may be supplied the necessary item(s), and all or a portion of their digging deposit may be utilized in order to offset the cost of the sign package.
   - All work on main artery streets shall have a traffic safety plan submitted to the City Engineer's Office at time of application for a digging permit. This plan must be approved prior to the beginning of work.

8. Safe trench construction shall be provided for all personnel. Trench shoring shall be per OSHA standards. City personnel will not enter an unsafe trench.

9. Safety equipment (i.e.: safety vests, hardhats, etc.) shall be used on all jobs as required or the permit may be revoked.

10. All trench edges shall be saw cut in a neat line a minimum of one foot (1') larger than the width and length of the proposed excavation.

11. All excavations shall be backfilled with existing material except as follows:
    a. Backfill shall be compacted in a maximum of one foot lifts.
    b. The top 18 inches of base material under roadways shall consist of 6 inches of crushed gravel laid over 12 inches of bank run gravel.
    c. Specifications for gravel are as follows:

BANK RUN		CRUSH	
Sieve	**Percent Passing**	**Sieve**	**Percent Passing**
6"	100	1-1/2"	100
#4	25 – 70	#4	< 55
#200	<12% of passing #4	S200	<12% of passing #4

12. The applicant will be responsible for delivering to the Dover Engineering Office the following:
    - Gradation test of gravel, backfill, crushed gravel and/or bankrun gravel.
    - Current lab proctor of gravel performed to AASHTO test.
    - Field densities of the top 18 inches of roadway base material after construction of each individual excavation or per 100 linear feet of trench, whichever is greater. Acceptable compaction will be 95% optimum density using the Modified Proctor method.

13. Trenches shall be patched immediately – not left overnight without special permission from the City Engineer's Office.

14. Pavement thickness shall be the larger of the existing pavement thickness or 4 inches. Pavement shall be type "E", ½" aggregate, with a minimum of 6% liquid.
    - Minimum base course shall be 2 inches thick.
    - Minimum wear course shall be 2 inches thick.

15. If concrete is found under the pavement, it shall be replaced to full thickness with hot top.

16. The edges of the trench patch shall have a tack coat of bitumen before each pavement course and upon completion of the patch.

17. Upon completion of the work and prior to release of the deposit, all above paperwork shall be on file. In the case of those applicants regularly doing business and keeping a continuous letter of credit, please be aware that future permit approval will be subject to previous acceptable performance.

18. UTILITY PROTECTION (See attached detail sheet)

19. The cost of repair to any existing utility shall be the responsibility of the Applicant. In the event of any damage to existing utilities, the Dover Utility Division must be contacted at 516-6450 or 516-6459, 7am to 4pm. After 4pm, the Dover Police Department must be contacted at 742-4646.

20. Streets, driveways, sidewalks or other private property disturbed in the course of the work, shall be restored in an approved manner satisfactory to the City at the expense of the Applicant.

21. All debris shall be cleaned up and removed in a timely manner.

TELEPHONE NUMBERS:

POLICE DISPATCH ..... 742-4646 (for emergencies)

ENGINEERING OFFICE 516-6450

UTILITIES RIVER STREET OFFICE..... 516-6459

COMMUNITY SERVICES ADMIN 516-6070

LAIDLAW TRANSPORTATION 692-4406

TRAFFIC CONTROL AND CONSTRUCTION SIGNS

1. Proper maintenance of traffic shall be the Contractor's responsibility.

2. This Work shall consist of furnishing, erecting and maintaining temporary construction signs, barricades, channeling devices, flagmen, lights or other warning devices to provide safe travel for the public.

3. A traffic control plan shall be submitted to the Engineer for approval at time of applying for a digging permit. No work shall begin without an approved plan in place.

4. All work is to be done in accordance with the provisions of the "Manual On Uniform Traffic Control Devices" 1988 edition, including Revisions 1 and 2; the NHDOT "Standard Specifications for Road and Bridge Construction", State of New Hampshire, 1990, sections 615 and 618; and the State of new Hampshire Traffic Control Handbook.

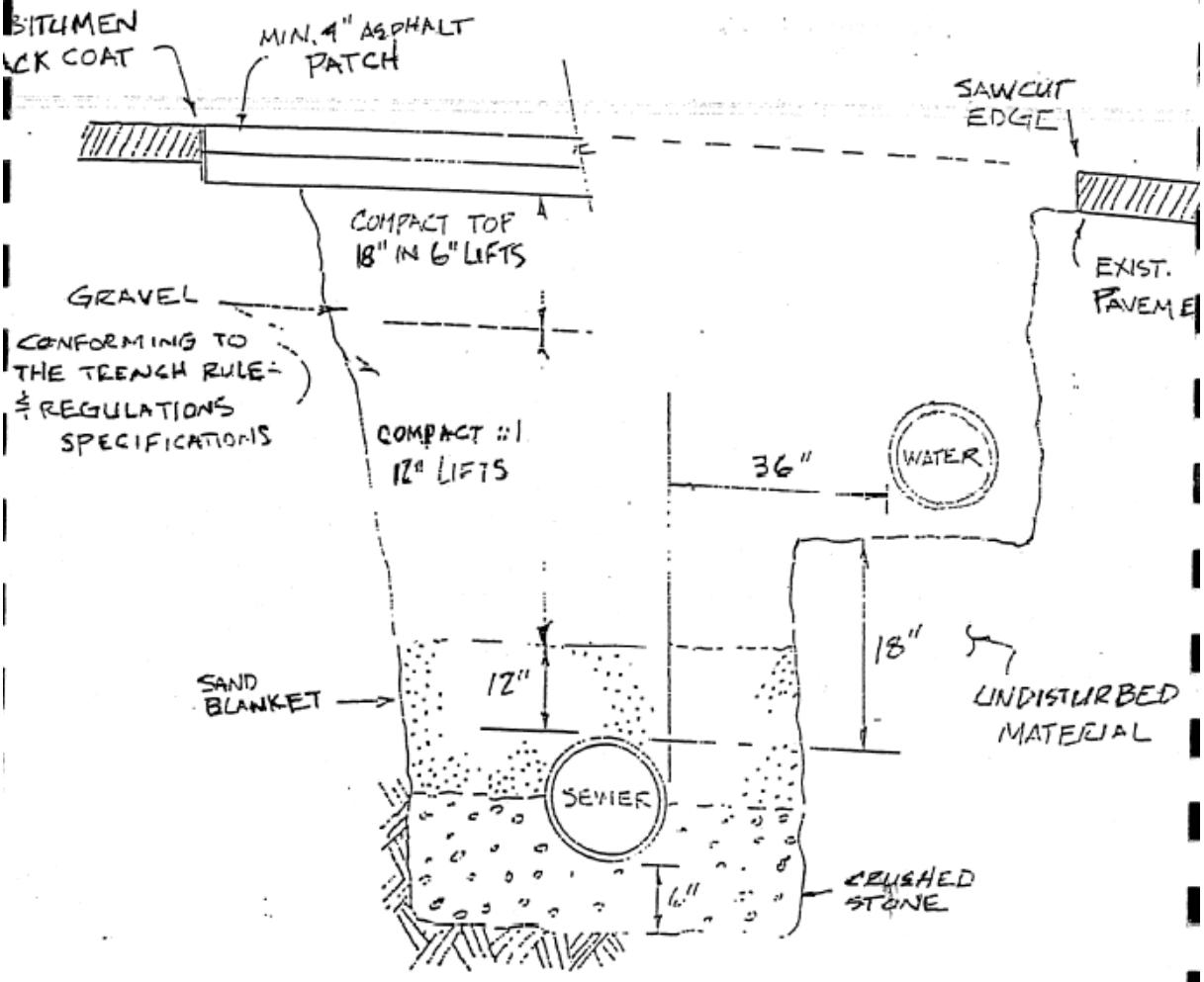
5. Maintenance of traffic shall be accomplished by the use of flagmen or qualified uniformed police officers wherever construction severely restricts the flow of traffic in frequently traveled roads, or as required to direct traffic through or around the work or as ordered.

6. Construction signs will be placed at each approach of the work to adequately warn traffic. If flaggers are used, additional warning signs will be placed.

7. If acceptable traffic control is not maintained, as determined by the Engineer, the Contractor may be required to suspend work that interferes with traffic.

TYPICAL TRENCH DETAIL

COMPACT TO 95% OPTIMUM DENSITY



TRAFFIC CONTROL

Traffic control minimum requirements as described in previous sections must be adhered to . This includes placement of signs at all work areas for advanced warning to vehicular and pedestrian traffic. This is to be done at all times regardless if work area includes City Right of Way.

Some standard signs required:
signs must meet MUTCD requirements;



W20-7b



W20-11



W20-10



W20-7a

CITY OF DOVER

PLANNING BOARD - STAFF MEMO FILE #P22-06

Application Type:	Conditional Use Permit
Applicant(s):	American Durafilm Co, Inc.
Owner(s):	AD Dover, LLC
Location:	Innovation Way (Tax Map D, Lot 11-1)
Meeting Date:	February 22, 2022

INTENT: To request a Conditional Use Permit to allow 7,972 s.f. of wetland buffer impacts

LOTS/UNITS PROPOSED: N/A

AGENDA ITEM #: 4-B

ACREAGE: 3.30 acres

ZONING DISTRICT: IT/R-40

EXISTING LAND USE: Vacant

PROPOSED LAND USE: Light Manufacturing

SURROUNDING LAND USE: Residential and vacant and Industrial

ZBA ACTION: None

ATTACHMENTS: Application materials, CC minutes

DECLARE REGIONAL IMPACT: No

APPLICATION IS COMPLETE: Yes

NOTICES SENT: Abutter notices were sent by certified mail to all abutters for this meeting

PERMITS REQUIRED:
CUP

WAIVER(S) REQUESTED:
N/A for this case

Summary of Request and Background
The Board conditionally approved a CUP and Site Plan for American Durafilm at their September 28, 2021 meeting. The applicant and their engineer have discovered that an additional 553 square feet of wetland buffer impact is necessary thus increasing the wetland buffer impact from 7,419 s.f. as approved to 7,972 s.f. as requested. The applicant is looking to increase the amount of fill to improve the foundation support. This is part of the site plan for a new manufacturing building and associated parking and drainage facilities. Since it was an increase to the amount of wetland buffer impacted, Conservation Commission reviewed and endorsed the new CUP application at their February 14, 2022 meeting (minutes attached).

Consistency with Land Use Regulations – Conditional Use Permit
The Wetlands Protection District ordinance provides for Conditional Use Permits to allow impacts to wetlands and wetland buffers if standards related to demonstration that no practicable alternative exists, impact avoidance was considered, impacts were minimized, and mitigation has been sought.

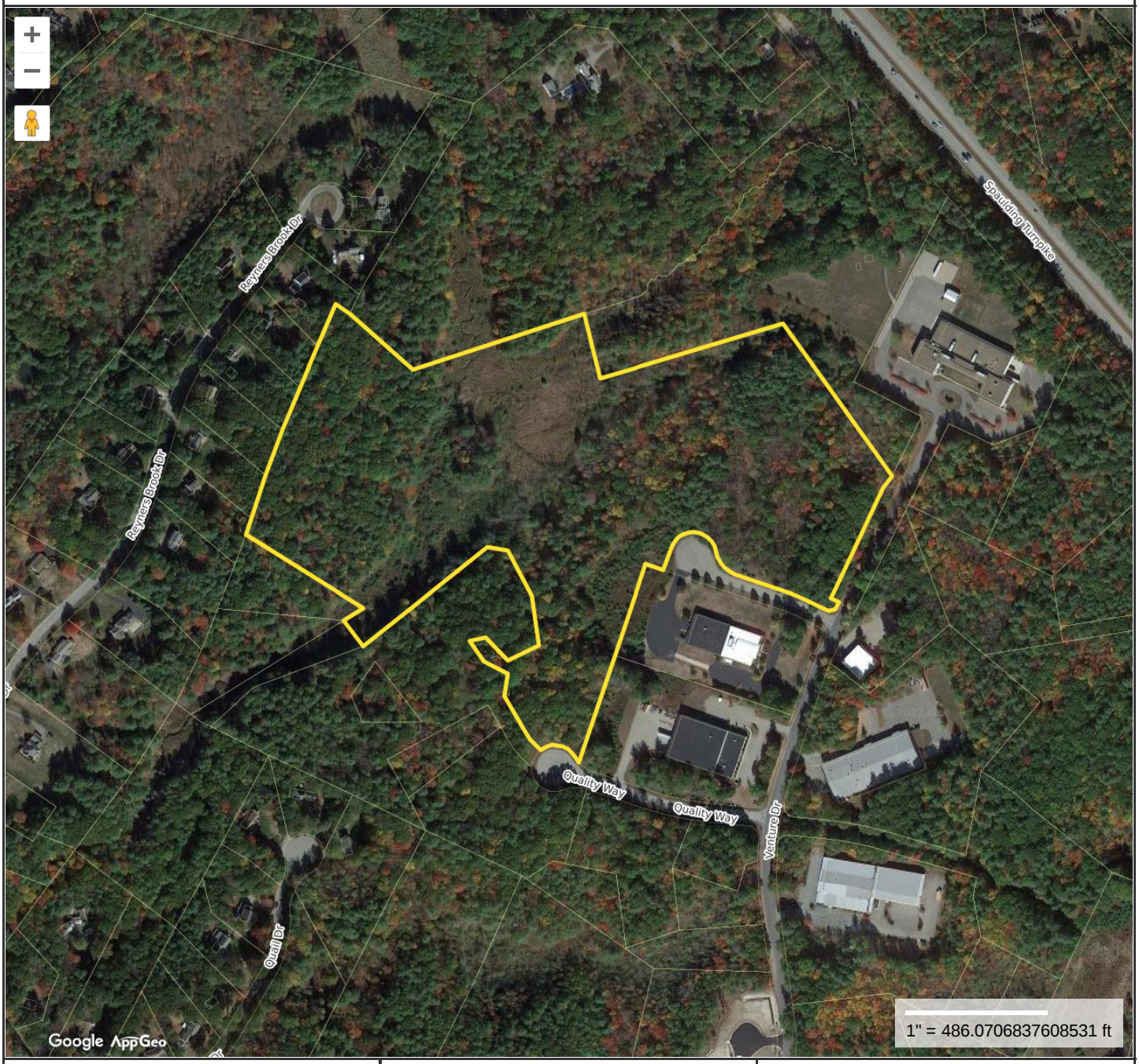
Staff feels that the applicant considered the criteria when designing the plan by placing the building as close to Innovation Way as possible, that wetland impacts have been avoided and that the wetland buffer with the primary impacts is an isolated wetland that is not connected to the larger wetlands to the northwest. The building placement is the only practicable alternative and the impacts were minimized such that no building or parking is in the buffer. Staff believes this proposal is consistent with the standards.

STAFF RECOMMENDATION:
The Planning Department recommends the Planning Board to accept the application, open the public hearing, and vote to grant the Conditional Use Permit with the following condition:

Condition to be Met Prior to the Issuance of the Conditional Use Permit:

1. The applicant shall provide the Planning Department with:
   a. Electronic copy of the revised impact plan including in PDF and DWG formats
   b. Four full size copies of the plan.

Innovation Way & Venture Drive



Property Information

Property ID	D0011-001000
Location	9 VENTURE DR
Owner	DOVER BUSINESS & IND DEV AUTHORITY
Land Use	903

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

City of Dover, NH makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated 5/3/2021
Data updated Daily

Print map scale is approximate. Critical layout or measurement activities should not be done using this resource.

City of Dover, New Hampshire
CONDITIONAL USE PERMIT APPLICATION

[Revision Date: October 19, 2020]

Office Use Only	Project #:		Date Received:	
	Amount Paid:		Time Received:	

APPLICANT AND OWNER INFORMATION

Name of Applicant: American Durafilm Co., Inc. Telephone # 508-429-8000

Address of Applicant: 55 Boynton Road Holliston, MA 01746

E-Mail Address: mhendrick@americandurafilm.com

Name of Property Owner (if different from applicant): AD Dover, LLC Telephone # 508-429-8000

Address of Property Owner: P.O. Box 794 Dover, NH 03821

PROPERTY INFORMATION

Assessor's Map # D Lot(s) # 11-10

Address of Property: Innovation Way (Venture Drive)

Zoning District(s) IT Overlay District(s) NONE

Existing Use of Property: Vacant

CONDITIONAL USE PERMIT INFORMATION

Type of Conditional Use Permit (Check All That Apply):

☐ Conservation District	☐ RCM Use Overlay District	☐ Gateway District
☐ Groundwater Protection	☐ Off-Street Parking and Loading	☐ Alternative Treatment Center
☒ Wetland Protection District	☐ Central Business District	☐ Heritage Residential District

Describe Proposed Use or Activity That Requires Conditional Use Permit and Describe Any Impacts:

This application is to request an amendment to the previously approved Condition Use Permit to allow an additional 553 s.f. of impact to the wetland buffer, increasing the approved impact area of 7,419 s.f. to 7,972 s.f. There will continue to be no direct impact to the wetlands.

List Any Associated State or Federal Permits That Have Been or Will Be Applied For and Indicate Their Status: NONE

Name of Professional That Prepared Plans: Stephen J. Haight, P.E. - Civilworks New England

Address PO Box 1166 Dover, NH 03821 Telephone #: 603-749-0443

Professional License #: NH Civil Engineer #7978 E-mail address: shaight@civilworksne.com

SIGNATURES

I/We hereby submit this application to the City of Dover Planning Board and attest that to the best of my knowledge all of the information on this application form and in the accompanying application materials and documentation is true and accurate. As applicant or as agent, I attest that I am duly authorized to act in this capacity.

x Signature of Property Owner: _____ Date: 1/17/22

x Signature of Applicant (if different from owner): _____ Date: 1/17/22

Signature of Agent: _____ Date: _____

AUTHORIZATION TO ENTER SUBJECT PROPERTY

I, and my successors, hereby authorize members of the Dover Planning Board, Planning Department and other pertinent City Departments and boards to enter my property for the purpose of evaluating this application, including performing inspections during the application phase, post-approval phase, construction phase and occupancy phase. It is understood that these individuals must use all reasonable care, courtesy, and diligence when on the property.

x Signature of Property Owner: _____ Date: 1/17/22

CITY OF DOVER CONDITIONAL USE
LIST OF ABUTTERS

Pursuant to RSA 676:4, the State Law of New Hampshire, the City of Dover is required to notify the applicant, abutters (including holders of conservation easements), and any professional whose seal is on the plan, of the public hearing by certified mail, return receipt requested. Staff will provide the abutter information, while the applicant must provide accurate contact information for the owner, applicant and professional agents representing the project.

Owner:

TAX MAP	LOT #	PROPERTY OWNER	MAILING ADDRESS
D	11-10	AD Dover, LLC	P.O. Box 794 Dover, NH 03821

Applicant (if different from owner):

APPLICANT NAME	APPLICANT COMPANY	MAILING ADDRESS
Mack Hendrick	American Durafilm Co., Inc.	55 Boynton Road Holliston, MA 01746

Surveyor and/or Engineer/Professional Agent:

NAME	COMPANY	MAILING ADDRESS
Stephen J. Haight, P.E.	Civilworks New England	PO Box 1166 Dover, NH 03821
Kevin M. McEneaney, LLS	McEneaney Survey Associates	24 Chestnut Street Dover, NH 03820

Conservation Easement Holder: N/A

TAX MAP	LOT #	NAME OF EASEMENT HOLDER	MAILING ADDRESS

PLANNING BOARD FEE SCHEDULE/INVOICE

(Revised July 1, 2021)

Below are the fees associated with plan review and are subject to a nonrefundable application fee to cover administrative expenses. Please complete the information below and provide payment with your application submittal. **Plan Review Fees shall be paid prior to technical review committee (TRC) being scheduled.** For plans not requiring TRC review, **fees are due 21 days prior** to the Planning Board meeting. Staff will coordinate abutter/notice fees, which will be invoiced and must be paid 28 hours before the Planning Board meeting for an application to be heard. Fees shall be paid by cash or check made payable to "City of Dover".

A. Plan Review Fees

1. Application fee for the following (SELECT ALL THAT APPLY):

- ☐ SUBDIVISION Application fee $200.00 + $150.00 x # _____ new lots created = $_____
- ☐ LOT LINE ADJUSTMENT Application fee $200.00 + $100.00 X # ___ of lots involved = $_____
- ☐ TRANSFER OF DEVELOPMENT RIGHTS Application fee $200.00 = $_____
- ☐ SITE REVIEW – RESIDENTIAL Application fee $200.00+ $100.00 x # __ per dwelling unit =$_____
- ☐ SITE REVIEW – NON-RESIDENTIAL Application fee $200.00 + (not to exceed $10,000)
  - New construction $.15 sq. ft. x # _____ sq. ft.= $_____
  - Additions (new floor space) $.10 per sq. ft. x # _____sq. ft.= $_____
- ☐ MOTEL/HOTEL $35.00 x # ___ per lodging unit= $_____
- ☐ CHANGE OF USE Application fee $200.00 + (not to exceed $5,000)
  - Existing floor spaces $.10 per sq. ft. x # _____ sq. ft. = $_____
- ☒ CONDITIONAL USE PERMIT Application fee $200.00 x # __1__ per Application = $ 200.00
- ☐ GRAVEL PIT/ EXCAVATIONS
  - Application fee $50.00= $_____
  - Permit fee $75.00= $_____
- ☐ EXTENSIONS/AMENDMENTS/WAIVERS FOR AN APPROVED PLAN Application fee $200.00 = $_____
- ☐ REQUEST FOR REZONING Application fee $200.00 = $_____
- ☐ DRIVEWAY WAIVER Application fee $200.00 = $_____

2. TOTAL IMPERVIOUS PAVED AREA (for new development, roadways or additions to existing parking lots, (not to exceed $10,000)) Application fee of $200.00 is N/A if it is part of a Site Review or Subdivision Plan. $200.00 + $.07 per sq. ft. x # _____ sq. ft. = $_____

SUBTOTAL PLAN REVIEW FEE (A) = $ 200.00

AND

B. Abutter Notification/Mailing Labels - this office will create and print the abutter list and provide labels in triplicate for each abutter. The applicant/owner will review the list for accuracy and provide to us the engineer, architect, licensed land surveyor (LLS), licensed landscape architect (LLA) and/or soil scientist whose professional seal appears on the plan with names and addresses for notices.

- ☐ Applicant & Owner, engineer, architect, LLS, LLA and/or soil scientist
  - Certified letters fee # _____ of x $8.00= $_____
- ☐ Certified letters fee: # of abutters _____ X $8.00= $_____
- ☐ First Class Mail fee (for individual owner of units within a condominium or other collective form of ownership): # of abutters _____ X $1.00= $_____
- ☐ Creating/Printing Abutter Labels in triplicate per sheet _____ x $10.00= $_____

C. Foster's newspaper public notice fee $100.00 x # _____ applications = $_____

SUBTOTAL NOTICE FEE (B & C) = $_____

TOTAL INVOICE AMOUNT (A, B & C) = $_____

PLAN REVIEW FEE COLLECTED/PAID = $ _____

BALANCE DUE = $ _____

The balance due must be paid 28 hours prior to the Planning Board Meeting, to be heard.

PROJECT NARRATIVE

for

Amended Conditional Use Permit

AMERICAN DURAFILM CO., INC.
Innovation Way (&Venture Drive)
Tax Map D, Lot 11-10

JANUARY 2022

PROJECT OVERVIEW & SITE CHARACTERISTICS

The project parcel is shown on Tax Map D as Lot 11-10, is located within the IT District and consists of +/- 3.3 acres, and is currently being developed. The Site Plan P21-49 and the Conditional Use permit P21-50 were approved by the Planning Board on September 28, 2021.

Based on the final foundation design, additional fill is required to provide structural support for the foundation. This proposal requests an amendment to the previously approved Conditional Use permit to allow an additional 553 s.f. of impact to the wetland buffer: Increasing the approved impact of 7,419 s.f. to 7,972 s.f. There are no proposed impacts to any wetlands.

The project site consists of the following general improvements:

- Construction of +/- 15,000 SF professional/light manufacturing facility with associated parking and truck access.
- Construction of on-site stormwater detention and treatment system, grading, and other drainage requirements.
- On site utility construction.
- Construction of (2) new entrances on Innovation Way.
- Stabilize remaining areas with loam and seed.

DRIVEWAY AND PARKING LOT

There are no changes proposed to the approved site plan with the exception of the additional grading.

WETLAND SETBACK IMPACT TYPE

The project work requires an amendment to Conditional Use permit P21-50 from the City of Dover to allow an additional 553 s.f. of wetland buffer impact. Thereby increasing the approved impact of 7,419 s.f. +/- to 7,972 s.f.. The project does not impact bogs, marshes, sand dunes, tidal wetlands, cedar swamps, undisturbed tidal buffer zone, or involve any work within 50 feet of a salt marsh. The project is not located within 100 feet of prime wetlands.

DRAINAGE

There are no changes proposed to the approved site plan with the exception of the additional grading.

UTILITIES

There are no changes proposed to the approved site plan with the exception of the additional grading.

P22-06 **9 Venture Drive**

Property ID	Location	Owner 1	Owner 2	Owner Address 1	City	State	Zip
A0047-014000	19 REYNERS BROOK DR	YORK JENNIFER L TRUSTEE	YORK JENNIFER L REVOCABLE LIVING TRUST	19 REYNERS BROOK	DOVER	NH	03820
A0047-016000	21 REYNERS BROOK DR	ATORO TEMITAYO M &	ATORO KATHRYN E	21 REYNERS BROOK DR	DOVER	NH	03820
A0047-018000	23 REYNERS BROOK DR	ENOS DON A & LINDA M CO-TRUSTEES	ENOS FAMILY REVOCABLE TRUST	23 REYNERS BROOK	DOVER	NH	03820
A0047-020000	25 REYNERS BROOK DR	COVERT JOSEPH & CATHERINE TRUSTEES	COVERTJOSEPH AND CATHERINE REVOCABLE TRU	25 REYNERS BROOK	DOVER	NH	03820
A0047-022000	27 REYNERS BROOK DR	CLAPPER YVONNE &	CLAPPER WAYNE	27 REYNERS BROOK	DOVER	NH	03820
A0047-024000	29 REYNERS BROOK DR	POOLE PETER W & KATHLEEN E	POOLE FAMILY REV TRUST	29 REYNERS BROOK	DOVER	NH	03820
A0047-026000	31 REYNERS BROOK DR	HODGES CRAIG B & CAROLYN TRUSTEES	HODGES CRAIG AND CAROLYN REVOCABLE TRUST	31 REYNERS BROOK DR	DOVER	NH	03820
A0047-028000	33 REYNERS BROOK DR	LEFOLEY THOMAS & CAROL		33 REYNERS BROOK	DOVER	NH	03820
A0052-000001	51 SANDY LN	KIPP LIZA KALIWODA		49 SANDY LN	DOVER	NH	03820
D0009-A00000	150 VENTURE DR	INDEX PACKAGING INC		1055 WHITE MOUNTAIN HIGHWAY	MILTON	NH	03851
D0009-A00SND	VENTURE DR	INDEX PACKAGING INC		1055 WHITE MOUNTAIN HIGHWAY	MILTON	NH	03851
D0009-A01SND	VENTURE DR	INDEX PACKAGING INC		1055 WHITE MOUNTAIN HIGHWAY	MILTON	NH	03851
D0011-000000	127 VENTURE DR	APW PROPERTIES LLC		127 VENTURE DR	DOVER	NH	03820
D0011-003000	111 VENTURE DR	MERCHANDISE CENTRAL LLC		111 VENTURE DR	DOVER	NH	03820
D0011-004000	110 VENTURE DR	QUALITY WAY LLC		55 MAIN ST UNIT 407	NEWMARKET	NH	03857
D0011-006000	QUALITY WY	DOVER BUSINESS & IND DEV AUTHORITY	F/K/A DOVER IND DEV AUTHORITY	288 CENTRAL AV	DOVER	NH	03820
D0011-007000	QUALITY WY	DOVER BUSINESS & IND DEV AUTHORITY	F/K/A DOVER IND DEV AUTHORITY	288 CENTRAL AV	DOVER	NH	03820
D0011-007SN2	QUALITY WY	DOVER BUSINESS & IND DEV AUTHORITY	F/K/A DOVER IND DEV AUTHORITY	288 CENTRAL AV	DOVER	NH	03820
D0011-008000	QUALITY WY	DOVER BUSINESS & IND DEV AUTHORITY	F/K/A DOVER IND DEV AUTHORITY	288 CENTRAL AV	DOVER	NH	03820
D0011-008SN1	QUALITY WY	DOVER BUSINESS & IND DEV AUTHORITY	F/K/A DOVER IND DEV AUTHORITY	288 CENTRAL AV	DOVER	NH	03820
D0011-008SN2	QUALITY WY	DOVER BUSINESS & IND DEV AUTHORITY	F/K/A DOVER IND DEV AUTHORITY	288 CENTRAL AV	DOVER	NH	03820
D0011-008SN3	QUALITY WY	DOVER BUSINESS & IND DEV AUTHORITY	F/K/A DOVER IND DEV AUTHORITY	288 CENTRAL AV	DOVER	NH	03820
D0011-009000	10 INNOVATION WY	HEINE USA		10 INNOVATION WAY	DOVER	NH	03820
D0011-009SND	INNOVATION WY	HEINE USA		10 INNOVATION WAY	DOVER	NH	03820
D0011-A00000	SANDY LN	150 VENTURE DRIVE LLC		192 DOVER POINT RD	DOVER	NH	03820
D0011-001000	9 VENTURE DR	DOVER BUSINESS & IND DEV AUTHORITY		288 CENTRAL AVE	DOVER	NH	03820
		AMERICAN DURAFILM CO., INC.	MACK HENDRICK	55 BOYNTON ROAD	HOLLISTON	MA	01746
		AD DOVER LLC		P.O. BOX 794	DOVER	NH	03821
		CIVILWORKS NEW ENGLAND	STEPHEN J HAIGHT, PE	P.O BOX 1166	DOVER	NH	03821
		MCENEANEY SURVEY ASSOCIATES	KEVIN M MCENEANEY LLS	24 CHESTNUT STREET	DOVER	NH	03820

J. Aube: Are float stops going to be used for this project?

M. Cardin: Float stops are not necessary.

J. Aube: What is the total length?

M. Cardin: A bit less then 200 ft.

J. Aube: Is there any eelgrass at this location?

M. Cardin: No, none is this specific area.

A. Kramer-Perry: How does the dock length compare to the surrounding area?

M. Cardin: A bit hard to tell from the aerial photos but is longer than the abutting docks, one of which is in poor condition.

A. Lyon: Can you describe the section where the dock meets the shoreland?

M. Cardin: The area upland is grassy and rocky. There are also old timbers there which would need to be removed.

A. Kramer-Perry: Will the salt marsh migrate?

M. Cardin: It's likely that it will but it could take a number of years.

K. Murphy: Is there a need to remove some of the vegetation?

M. Cardin: Yes, a small swath.

J. Aube moved to endorse the application, A. Kramer-Perry seconded. Vote: 7 yes

B. City of Dover Conditional Use Permit for American Durafilm Co., Inc. (Owner: AD Dover, LLC.) (Agent: Civilworks New England), Assessor's Map D, Lot 11-10, zoned IT, located on Innovation Way and Venture Drive. Proposal is to increase the amount of fill to improve the foundation support, creating an additional 553 square feet of impact to the wetland buffer increasing the previously approved impact of 7,419 square feet to 7,972 square feet.

Jase Gregiore from Civilworks New England introduced the project.

J. Aube: What is the current condition?

J. Gregiore: Currently vegetated.

J. Aube: What would the impact to the project be of not doing this?

J. Gregiore: 2:1 side slope due to the cost of the fill.

J. Aube: Could the buffer be enhanced elsewhere so that there is no net loss?

J. Gregiore: No opportunity was identified to enhance the buffer onsite.

S. Fellows: Approximately how long and wide is the expanded impact area?

J. Gregiore: The area is between 100 – 150 feet long by 3-4 feet wide.

A. Lyon: Will trees remain in the current vegetated area?

J. Gregiore: Yes, they will.

K. Murphy moved to endorse the application, A. Lyon seconded. Vote: 7 yes.

C. City of Dover Conditional Use Permit for Todd Diggins and Krystin Ward (Agent: Jones & Beach Engineers, Inc.), Assessor's Map 8, Lot 32, zoned R-20, located at 3 Wentworth Terrace. Proposal is to construct a 975 square foot addition to include an accessory dwelling unit, creating, 966 square feet of disturbance to the Conservation District.

Barry Gier from Jones and Beach Engineers, Inc. introduced the project.

K. Murphy: Question about note #3 on the plans, should that be there?

B. Gier: Typo and will be corrected.

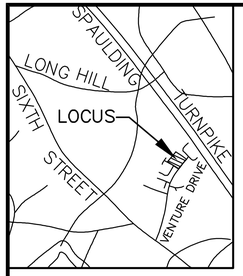
J. Aube: What is the increase to the impervious surface?

B. Gier: Actually, the impervious surface decreases due to the removal of a portion of the driveway and addition of porous pavers.

A. Lyon: Porous pavers are great but they must be maintained to function properly. There should be a maintenance plan in place.

A. Lyon conditionally moved to endorse the application with the addition of a porous paver maintenance plan before Planning Board review, K. Murphy seconded. Vote: 7 yes.

DRAFT



PIPE CHART:

P1
15" HDPE
L=13.0'
S=0.0192

P2
12" HDPE
L=8.0'
S=0.0100

P3
12" HDPE
L=38.0'
S=0.0058

P4
12" HDPE
L=64.0'
S=0.0050

P5
12" HDPE
L=137.0'
S=0.0047

P6
15" HDPE
L=20.0'
S=0.0300

P7
12" HDPE
L=20.0'
S=0.0050

PUD
4" HDPE
L=60.0'
S=0.0000

RD1
12" HDPE
L=114.0'
S=0.0053

DRAINAGE CHART:

PCB1
RIM=183.70
INV.IN=179.70
INV.OUT=179.00

PCB2
RIM=186.65
INV.IN=182.10
INV.OUT=182.00

PCB3
RIM=184.85
INV.IN=181.85
INV.OUT=181.75

PCB4 (5' DIAMETER)
RIM=186.00
INV.IN=181.45
INV.OUT=181.35

PCB5
RIM=186.10
INV.OUT=182.10

D / 11-1

TOTAL PARCEL AREA
1,576,425 S.F.
36.19 Ac.
PROPOSED LOT AREA
143,577 S.F.
3.30 Ac

S71°54'43"E
295.33'

N18°05'17"E
192.58'

STABILIZE SLOPE WITH SC150BN (TYP)

BUFFER IMPACT C
2,812 S.F.

PROPOSED SILTSOXX
12" SINGLE ROW

PREFORMED SCOUR HOLE

ADDITIONAL BUFFER IMPACT B
553 S.F.

PROPOSED OUTLET PROTECTION (SEE DETAIL)

FES-1
INV.:172.4

BUFFER IMPACT B
701 S.F.

PROPOSED SILTSOXX
12" SINGLE ROW

PROPOSED FUTURE
5,000 S.F.
BUILDING ADDITION

BIO-RETENTION POND 1 (BIO1)

BUFFER IMPACT A
3,906 S.F.

STABILIZE SLOPE WITH SC150BN (TYP)

PROPOSED
15,000 S.F.
BUILDING
F.F.=189.5

TC 188.6
BC 188.1

PCB5

TS1
L=160.0'
S=0.005
D=2.0'

FES-2
INV.:178.75

P1

RD1

PCB1

INV.:180.3

FES-3
INV.:180.75

PCB4

P6

P5

P4

P2

P3

PCB2

PCB3

PROPOSED CONSTRUCTION ENTRANCE

10' WIDE UTILITY EASEMENT

INV.IN:
182.20

EOP

SGC

ASPHALT SIDEWALK

INNOVATION WAY

VENTURE DRIVE

NOTES:

1. TOAL AREA OF WETLAND BUFFER IMPACT = 7,972 S.F.

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)

NOT FOR CONSTRUCTION FOR PERMIT USE ONLY

PLANNING FILE NO.: P21-49

NO.	REVISION	APP'D	DATE
3	GRADING UPDATE FOR FND	SJH	1-10-21
2	PER PB COMMENTS	SJH	11-12-21
1	PER TRC COMMENTS	SJH	9-2-21

DATE: 8-6-21
SCALE: 1"=20'
DRAWN BY: SRD
DESIGN BY: JRG
APPROVED BY:SJH
PROJECT NO:21041
FILE: SITE

CIVILWORKS NEW ENGLAND
CIVIL & WATERFRONT ENGINEERING
181 Watson Road, PO Box 1166
Dover, New Hampshire 03821
603.749.0443

GRADING, DRAINAGE & EROSION CONTROL PLAN

MANUFACTURING/COMMERICAL BUILDING
INNOVATION WAY
DOVER, NH

AMERICAN DURAFILM CO. INC.
55 BOYNTON ROAD
P.O. BOX 6770
HOLLISTON, MA 01746

8

CITY OF DOVER	CITY OF DOVER - ORDINANCE
	Posted: February XX, 2022
	Ordinance Title: Site Review Regulations Amendments Chapter: 153

1. Chapter 153 of the Code of the City of Dover, entitled Site Plan Review, is hereby amended by revising Section 6, "Application requirements: Technical Review Committee."

"153-6. Application requirements; Technical Review Committee.
[Amended 8-26-2008; 3-23-2010; 1-24-2012]

A. "Prior to the formal submission of an application for site review, the applicant shall meet with the Technical Review Committee. Said meeting(s) shall serve to assist the applicant in preparing a development proposal that is technically conforming to the regulations contained herein. The Technical Review Committee shall be comprised of the Planning Board Chair, the Conservation Commission Chair, City Engineer, Fire and Rescue Chief, Police Chief, Zoning Administrator, Economic Development Director and Director of Planning and Community Development, who shall serve as Chair. All Committee members shall have a designated alternate available in their absence.

B. A completed application sufficient to invoke jurisdiction of the Planning Board shall include the following elements:
   (1) A completed application form, available at the Department of Planning and Community Development office.
   (2) A completed site review checkoff list.
   (3) A written narrative description of the proposed project, addressing its purpose, scope of operation, and impact on the immediate area of influence and the City in general (traffic, schools, utilities, land use compatibility, aesthetics, land and water resources, etc.).
   (4) Ground/aerial photographs of the site and immediate area.
   (5) Fifteen copies of the site development plan as more fully described in Article IV of this chapter. Transmit a pdf of the site development plan via e-mail to dover-planning@dover.nh.gov. (Note: Only ~~six~~ eight copies of the preliminary plan need to be submitted initially for review by the Technical Review Committee. However, ~~15~~ the applicant shall check with the Planning Department about number of copies ~~will be~~ required for submission of the complete application to the Planning Board.) [Amended 5-24-2016]
   (6) A list of owners, applicants, and professionals involved in the application. Additionally a fee for the City to create a list of abutting property owners that lie within 200 feet of the subject parcel. ~~Information shall include name, mailing address, and Dover Tax Map and lot numbers for the applicant to review.~~ The City will prepare verified mailings. [Amended 1-14-2020; 7-27-2021]
   (7) A fee of an amount to be determined in accordance with the fee schedule contained in § 153-18 of this chapter.

C. The applicant shall file the application with the Planning Board office at least 21 days prior to the Planning Board meeting, at which time the application will be accepted and a public hearing held.
[Amended 1-14-2020]
(1) The applicant and abutters shall be notified of said public hearing by verified mail, with return receipt requested, stating the time, date and place of such hearing. Notice will be mailed at least 10 days prior to the date of the meeting by the City.
(2) Such public hearing shall be advertised in a newspaper of general distribution not less than 10 days prior to the said meeting."

2. Chapter 153 of the Code of the City of Dover, entitled Site Plan Review, is hereby amended by revising Section 13, "Site development plan" to read as follows:

"153-13. Site development plan. [Amended 5-25-1999; 8-26-2008; 3-23-2010; 1-24-2012]
A. A site development plan shall be drawn to an appropriate scale, not less than one inch equals 50 feet, and shall show the following information:
(1) A small-scale location map delineating the project site and its relation to the surrounding area at an appropriate scale.
[Amended 5-24-2016]
(2) Name or identifying title of the proposed project as well as planning file number, once assigned.
(3) Date and approximate true North.
(4) Exact locations and dimensions or property lines and names of current abutters.
(5) Location of all existing and proposed buildings and structures on the site. Any details on detail sheets shall be numbered or lettered.
[Amended 5-24-2016]
(6) Delineate existing zoning and special district boundaries.
(7) Specify proposed finished floor elevations of buildings so to assure positive surface drainage and proper elevation relationship to adjacent property.
(8) Existing and proposed grade contours (two-foot intervals) so to certify the adequate disposal of on-site water. Upon request, contours delineating existing surface shall be extended 100 feet beyond the limits of the project site and shall be related to the United States Geographical Survey.
(9) Location, dimension and material of all existing and proposed utilities and identify all on-site waste disposal systems and wells.
(10) Location of test borings, groundwater elevation and soil profiles shall be provided upon request.
(11) Parking layout that delineates the number of parking spaces and parking arrangement.
(12) A landscape plan that delineates the arrangement, species and dimensions of all existing and proposed landscaping materials. The landscape plan, in sufficient detail to indicate compliance with these regulations, shall be prepared by a professional

landscape architect who is licensed by the State of New Hampshire. The licensed landscape architect shall sign the plan. The landscape plan shall be certified by the licensed landscape architect and include his/her State of New Hampshire license number.

(13) Where multifamily development is proposed, those areas supporting slopes in excess of 20%, the federal floodway and floodplain, and the surface areas of water bodies and wetlands shall be clearly depicted on the site plan and quantified.

(14) Where change in use is being proposed, the following additional items are required:

(a) A table showing the expected amount of change in demand for parking, water and sewer use, and traffic.

(b) A floor plan showing the proposed use and square footage in each use.

(15) A colored architectural plan showing all sides of new buildings, as prepared by a registered engineer or architect, who shall sign the plan and place his/her seal upon it. The plan shall conform to the guidelines contained in § 153-14L.

(16) A neighborhood plan on an aerial photograph, showing all property lines within a distance determined by the Director of Planning and Community Development during initial consultations, and how the project relates to abutting uses. This sheet should show the proposed impervious surfaces and zoning boundaries.

[Amended 5-24-2016]

(17) A colored rendering of the streetscape that will be created along the existing public right-of-way. This sheet shall include a perspective of both sides of any existing roadway, any street or sidewalk improvements, proposed plantings and structures, as prepared by a registered engineer or architect, who shall sign the plan and place his/her seal upon it, as required.[1]

[1] Editor's Note: Original § 149-13A(18) of the 2013 Code, which immediately followed this subsection, was repealed 6-12-2018.

(18) A stormwater management and erosion control plan shall be developed in accordance with the requirements of § 153-14A if it is determined to be necessary by the Technical Review Committee during its review process, as outlined in § 153-6A. Site plans shall provide for the proper management of stormwater and erosion and sedimentation control.

(19) Traffic impact assessment and analysis. All development projects that require site plan review shall prepare a traffic impact assessment and analysis that complies with the standards contained in Chapter 157, Land Subdivision Regulations, § 157-10D, as amended.

(20) A detailed landscape operations and maintenance plan, developed in accordance with the requirements of § 153-14G. Site plans shall provide for the proper management of landscaping, ensuring that landscaping is not unintentionally damaged as a result of snow removal or general traffic flow, pedestrian or otherwise.

[Added 6-12-2018]

(21) For site plans requiring Alteration of Terrain (AoT) permits, the applicant shall submit the results of their Natural Heritage Bureau DataCheck Tool search including

any rare species or critical habitat impacts with the TRC application materials. Should the results indicate further studies are necessary, those studies would be required as part of the Planning Board application materials submitted during Technical Review Committee review.

~~4.~~3. Chapter 153 of the Code of the City of Dover, entitled Site Plan Review, is hereby amended by revising Section 13, "Parking", Subsection D, Subsection (c) as follows:

In the Parking Regulation Table, the first row be changed to read "Residential[3] (non-CBD-G or TOD)" and a new row shall be added to become the third row to state "Residential[3] (CBD-TOD)" for 1 space per unit.

4. Chapter 153 of the Code of the City of Dover, entitled Site Plan Review, is hereby amended by revising Section 6 entitled "Application Requirements, Technical Review Committee" subsection A subsection 6, to read as follows:

A. "Prior to the formal submission of an application for site review, the applicant shall meet with the Technical Review Committee. Said meeting(s) shall serve to assist the applicant in preparing a development proposal that is technically conforming to the regulations contained herein. The Technical Review Committee shall be comprised of the Planning Board Chair, the Conservation Commission Chair, City Engineer, Fire and Rescue Chief, Police Chief, Zoning Administrator, Economic Development Director and Director of Planning and Community Development, who shall serve as Chair. All Committee members shall have a designated alternate available in their absence.

For projects under the threshold described in Section 153-4.A but meeting the threshold of 153-4.B (1) through (5) may be approved by the majority vote of Technical Review Committee per RSA 676:43 provided no waivers or Conditional Use Permits are necessary to meet regulations."

AND

Chapter 153 of the Code of the City of Dover, entitled Site Plan Review, is hereby amended by revising Section 4 entitled "Applicability" subsection E to read as follows:

"E. Notwithstanding the above criteria, the Technical Review Committee, per RSA 676:43, by majority vote may approve minor site plans. It also may require any project that the Committee has determined has a significant projected impact on traffic, health, welfare, environmental quality, and safety issues to appear before the Planning Board for site review. Any project requiring waivers or a Conditional Use Permit to meet regulations, shall be forwarded to the Planning Board for review."

Formatted: List Paragraph, Indent: Left: 0.25", Hanging: 0.5", Space After: 12 pt

Formatted: List Paragraph, Left, Indent: Left: 0.25", Hanging: 0.5", Space After: 12 pt

CITY OF DOVER - ORDINANCE

Posted: February XX, 2022

CITY OF DOVER

Ordinance Title: Land Subdivision Regulations Amendments
Chapter: 157

1. Chapter 157 of the Code of the City of Dover, entitled Land Subdivision Regulations, is hereby amended by revising Section 10, "Application submittal and review", Subsection B to read as follows.

   [Amended 1-14-2020]

   B. "Included with the application shall be the names and mailing addresses of all ~~abutters~~ owners, applicants, and professionals. ~~as indicated in City records.~~ The Planning Department, for a fee outlined in the Fee Schedule, will create a list of names and addresses of all abutters obtained from City records or the Stafford County Registry of Deeds not more than five calendar days before the date of filing for the applicants review."~~The names of all abutters shall be obtained from City records not more than five calendar days before the date of filing. In addition to the abutters list, three duplicate sets of adhesive mailing labels for all abutters shall be submitted for use by staff in preparing verified mailings."~~

2. Chapter 157 of the Code of the City of Dover, entitled Land Subdivision Regulations, is hereby amended by revising Section 16, "Application submittal and review", Subsection B to read as follows.

   [Amended 1-14-2020]

   B. "Included with the application shall be the names and mailing addresses of all owners, applicants, and professionals assisting with the application. The Planning Department, for a fee, outlined in the Fee Schedule, will create a list of the names and addresses of all abutters obtained from City records or the Strafford County Registry of Deeds not more than five calendar days before the date of filing for the applicants to review."

   [Amended 1-14-2020; 7-27-2021]

~~5.~~3. Chapter 157 of the Code of the City of Dover, entitled Land Subdivision Regulations, is hereby amended by revising Section 17, "Application submittal and review for minor lot line adjustments and boundary agreements", Subsection B to read as follows.

   B. "Included with the application shall be the names and mailing addresses of all owners, applicants, and professionals assisting with the application. The Planning Department, for a fee, outlined in the Fee Schedule will create a list of the names and addresses of all abutters obtained from City records or the Strafford County Registry of Deeds not more than five calendar days before the date of filing for the applicants to review.~~abutters as indicated in City records. The names of all abutters shall be obtained~~

~~from City records or the Strafford County Registry of Deeds not more than five calendar days before the date of filing. In addition to the abutters list, three duplicate sets of adhesive mailing labels for all abutters shall be submitted for use by staff in preparing verified mailings~~."

[Amended 1-14-2020]

~~6.~~4. Chapter 157 of the Code of the City of Dover, entitled Site Plan Review, is hereby amended by revising Section 10, "Application submittal and review", subsection A, to read as follows:

A. To be considered complete an application shall:

(1) Be made on forms available at the Planning Board office.

(2) Include one electronic copy and 15 copies of the preliminary plat layout and the plat construction detail sheets as more fully described in §§ 157-27 and 157-29, respectively, in this chapter. Transmit a pdf of the subdivision plat via e-mail to dover-planning@dover.nh.gov. (Note: Only eight copies of the preliminary plat need to be submitted initially for review by the Technical Review Committee. However, 15 copies are required for submission of the complete application to the Planning Board.)

[Amended 5-24-2016; 2-26-2019]

(3) Include a fee in an amount to be determined in accordance with the fee schedule outlined in § 157-53 of this chapter.

(4) Comply in all respects with Article VIII of this chapter, except where a waiver may be specifically authorized by the Planning Board.

(5) Be filed with the Director of Planning and Community Development at least 21 calendar days prior to a regularly scheduled meeting of the Board.

[Amended 1-14-2020]

(6) Be reviewed and evaluated by the Technical Review Committee as to the completeness of the information submitted by the applicant. Particular attention will be given to the arrangement, location and width of streets; topography and soil data; method of sewage disposal; water provision; on-site drainage; preservation of on-site vegetal elements; lot size and arrangement; the present and future development of adjoining lands; and conformity with the Master Plan and other relevant City ordinances. This review by the Technical Review Committee may be eliminated if, in the judgment of the Director of Planning and Community Development, such a review is not warranted. The Director shall provide a written explanation to the Planning Board for said elimination of this review.

(7) For subdivision plans requiring Alteration of Terrain (AoT) permits, the applicant shall submit the results of their Natural Heritage Bureau DataCheck Tool search including any rare species or critical habitat impacts with the TRC application materials. Should the results indicate further studies are necessary, those studies

would be required as part of the Planning Board application materials submitted during Technical Review Committee review.

(~~8~~7) Include special investigative studies, review of documents and other matters, if required for particular applications. Reasonable fees to cover the cost of such studies or reviews shall be charged to the applicant [RSA 676:4, I(g)].