ATTACHMENT 2

MEMPHIS REGIONAL MEGASITE

HAYWOOD COUNTY, TENNESSEE

MEMPHIS REGIONAL MEGASITE
WATER TREATMENT PLANT

ENGINEERING REPORT

REVISED
AUGUST 2022

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8/1/22

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Appendix

Engineering Report:
The following is an Engineering Report addressing the Memphis Regional Megasite (MRM) Water Treatment Plant. This report specifically addresses the following:

- MRM water wells located along the north edge of the site with feed to the water treatment plant.
- The MRM water treatment plant and clearwells.
- MRM Water Distribution System

Megasite Area:
There have been a number of past studies performed on the Megasite in anticipation of the construction of a large industrial facility at this location. Studies have included:

- Phase I Environmental Site Assessment, Wetlands Investigation, and Threatened and Endangered Species Report – Dated April 21, 2005.
- Archaeological Investigations of the Haywood County Industrial Megasite Project Area, Haywood County, Tennessee – Dated June 2007.

Reference these studies for more specific information on environmental resources present.

This report is based on the Engineering Report Checklist, Appendix I-D-2, of the Design Criteria for Review of Sewage Works Construction Plans and Documents Manual, Effective November 1, 2017, as recommended in review meeting with Tennessee Department of Environment & Conservation (TDEC). Note that the paragraphs below are organized as prescribed with paragraphs indicated as not applicable (N/A) to this project.

A. Basis Of Flow Characterization

Present design flow rate for the potable water supply at the Memphis Regional Megasite (MRM) is 7.0 MGD (million gallons per day) based upon review with STREAM to provide water for the planned tenants.
The system capacity of 7.0 MGD is based upon information from the September 2021 commitment of Ford as the primary tenant for the MRM, and a future tenant on the east side. Ford provided a design flow of 4.3 MGD at the time of full buildout. Concurrently, the State is collaborating with a potential tenant on the East side of the MRM (currently using a code name of Handy). The data Handy provided indicated they would have a total water requirement of 2.0 MGD, resulting in a maximum tenant demand of 6.3 MGD.

Combining these required flows of 4.3 MGD for Ford and 2.0 for Handy, we have set the design capacity with Stream at 7.0 MGD. Water from the treatment system will not be supplied to any user off site, only to tenants at the Memphis Regional Megasite. In addition to the two tenants, the MRM distribution system will normally supply domestic water needs to the water treatment building, the wastewater treatment building, and in future, the EMS station along the southeast area of the site, all expected to be a minimal addition to the system loads. In an emergency, the MRM distribution system will also feed the fire hydrants located at the wastewater treatment building. The EMS station will also require occasional firetruck filling off this system. These emergency loads are not anticipated to hinder the tenants' water usage.

Therefore, our basis for design for the water treatment plant is 7.0 MGD.

B. Characterization of Flow

The water treatment plant is developed to provide potable quality water to the tenants that will be located at the Memphis Regional Megasite. No other users will be provided water from the treatment system.

Our water source for the process is groundwater from the Memphis Sand Aquifer. Lane Hydro completed the initial study in 2012 to review potential well field site and report findings related to the drawdown capacity and well placement. The provided report denotes the ability to draw flow rate of 8.0 MGD from the aquifer with proper placement of wells with acceptable drawdown levels. *The Preliminary Design Investigation, provided by Layne Hydro, is provided in Appendix B.*

The demand for water at the Memphis Regional Megasite will begin with Ford in Phase 1 with startup of the initial process lines and quickly expand to full potential of 4.3 MGD as startup is completed. This time frame is expected to be less than one year. With the inclusion of the future tentative East Tenant (Handy) is added, nominal flow usage is noted to be 6.3 MGD for Phase 2 in the future.

The production of water from the wells through treatment can produce varied flows to provide potable water to meet tenant needs. This design reviewed with STREAM, is based upon a constant flow rate. Normal flow through the water treatment plant will be at a rate of 7.0 MGD. We have included within the design the ability to provide added flow to tenants allowing for filling of firewater tanks within their design complying with fire code to fill a tank within 8 hours. We have included basis of flow noting filling a 500,000 gallon tank at an added flow rate of 1041 GPM. This flow combined with planned flow rate of 6.3 MGD (4375 GPM) results in a flow rate of 5400 GPM for peak instantaneous flow rates, drawing water from the two (2) one million-gallon elevated water towers, and the two (2) clearwells for a period of 8 hours. No allowance for direct fire water pump connection has been included in the design. This stance agrees with discussions with the Memphis Regional Megasite Authority and the State of Tennessee with respect to water plant design development.

Initial Build and Design (Phase 1)

The initial build and design shown on the plans and specifications includes consideration for the Initial tenant, Ford Motor Company and their design flow needs, as well as water for the water treatment plant and wastewater facilities. The initial installed MRM distribution system will include the followings:

- Design and installation of seven (7) wells with submersible pumps and water supply header to the treatment plant.
- Design and installation of the water treatment plant and associated equipment with a treatment capacity of 7.0 MGD.
- Two elevated water towers, each with a capacity of 1.0 million gallons.
- A 16” supply header routed from the treatment plant to the north tower, along the north edge of the site

- A 24" supply header routed to the south water tower (north/south).
- Four 16" branches with valve and flow meters for extension by Ford off the 24" N/S line
- One 16 inch header with block valve for future connection or header to east tenant off the 24" N/S line.
- 8" water line to the on-site wastewater treatment plant located to the far west edge of the Memphis regional Megasite.
- 2" water connection to the water treatment plant.

Future addition Phase 2 not shown in detail on the design drawings, when the East Tenant is added, the MRM distribution system will add the following:

- An extension of a 16" line from the west 24" supply header to the east sides of the site near the middle of the site from 12" valve installed in initial build out.
- An extension of the 16" line from the north tower south to form a loop from the water treatment facility.
- two (2) connections for a future tenant (Handy) on the east side of the loop with block valves and flow meters.
- a possible branch off the east side of the loop to a future EMS station to the south.

Water quality sampling was completed from the aquifer through testing in 2012 and 2019, along with additional testing, recently completed, to comply with TDEC's requirement request. The analysis for incoming water stream from the aquifer has noted pH levels variation from 5.2 to 6.0, levels of CO2 that will be addressed through treatment, and low level of turbidity, below 1.0 NTU.

The water analysis results that have been completed to date are included within the report in Appendix C and have also been provide to TDEC by Ron Dow of EnSafe who completed the analysis.

C. Unit Process Design Parameters

a. Overview
    i. The unit processes incorporated into the new water treatment plant will include:
        1. Aeration of incoming water stream for reduction of CO_2 levels.
        2. Chemical feed for pH adjustment and mixing chamber, with 10-minute hydraulic retention.
        3. Disinfection using sodium hypochlorite solution, with chorine contact chamber. Dual feeders shall be used.
        4. Phosphate addition (Aquamag)
        5. Two 583,000-gallon clearwells providing a two-hour hydraulic detention each.
        6. Eight (8) 1276 GPM high service pumps to direct water to the water towers for distribution, four in each clearwell.
    ii. Disposal of waste from the treatment plant operations including sanitary and laboratory wastes will be directed to an on-site pump tank which will be pumped out as needed and transferred to the on-site wastewater treatment

facility. An engineering report for pump statin SLS-1 has been submitted to TDEC Engineering Services, Mr. Tim Hill for review.

    iii. During the initial design of the Megasite water Plant in 2013, Brownsville Environmental Authority (BEA) assisted in review of the water plant design development. Due to the low turbidity levels of water from the Memphis Sand Aquifer, it was recommended that the filtration step be removed from the design of the facility. This is consistent with other water plants in the Brownsville and Stanton TN area that draw water from the same aquifer.

b. Well Pumps
    i. Seven well pumps are provided to draw water from the Memphis Sand Aquifer, each with a nominal capacity of 1111 GPM. To maintain capacity of 7.0 MGD, five pumps will be in operation based upon operating points, leaving two (2) pumps for redundancy. The pumps are provided with VFD's and flow meters in the discharge to control the flow rates. Wells are spaced at a minimum of 1000-foot separation in accordance with the recommendations within the Preliminary Design Investigation performed by Layne Hydro in 2012 (located in Appendix B).
    ii. Pump design data and curves are located in Appendix F.

c. Aerators
    i. Aerators are provided in the treatment system for the reduction of CO2 levels in the incoming water stream through oxidation. Reduction of CO2 will also result in raising the pH level. Test results provided indication of free CO2 levels variation from a low of 44 mg/L to a high of 81 mg/L in six collected samples for an average of 61 mg/L. The pH level in these samples varied from 5.66 to 6.22. It is noted in the Community Public Water Systems Design Criteria that CO2 levels are to be reduced to a level between 10 to 15 mg/L.
    ii. Maximum design loading rate for a unit is to be 20 GPM/ft2 of tray area, with sufficient trays to reduce CO2 levels to 10 to 15 mg/L. CO_2 reduction based upon oxidation through the selected aeration units average 90%.
    iii. Aerator Design Criteria:
        1. Aerator type: Induced draft
        2. Inlet CO2 level: 65 mg/L (average)
        3. Outlet CO2 level: 10 to 15 mg/L
        4. Design Flow rate (Max) 6000 GPM
        5. Design flow (Max) per aerator unit: 2000 GPM
        6. Normal design flow per Aerator: 1620 GPM
        7. Aerator area: 100 SF each.
        8. Model #: WesTech AWI31C, Induced Draft Aerator, or approved equal
        9. Blower Capacity: 7,500 CFM
        10. Inlet: 14-inch
        11. Outlet: 18-inch
        12. Power:
            a. Normal power source: 480Volt, 3-phase, four wire 60-hertz, alternating current.

        b. Alternate power source: emergency power from the WTP emergency generator.

    iv. The design data for the induced draft aerator is included in Appendix H

d. Flash Mix Chamber
    i. Flash Mix Chamber for pH adjustment and chlorine contact will receive water from the aerator outlet connection for the addition of chemicals into the water stream. The structure will include a single vertical top entry mixer within the structure to prevent short circuiting. Sodium hydroxide, sodium hypochlorite and AquaMag (phosphate) will be added into the chamber. The mixer will operate at any time that a well pump is in operation and continue operating for a period of time after flow stops. After the flash mix, the waters will flow through the 30 inch outlet line to the baffled clearwell structures to ensure proper contact and mixing occur. The flash mix structure will be constructed using reinforced concrete and be of adequate size to allow proper mixing of the treatment chemicals.
    ii. The flash mix chamber is 6’0 wide by 18’-0 long and has a depth of 14’-0 to ensure proper mixing of chemicals within the chamber. The flash mix chamber includes a top entry mixer.

e. Clearwell
    i. The clearwells receive treated water and store water for distribution to the site. There are two clearwells included in the design to allow one unit to be taken out of service for cleaning when necessary to provide redundancy. Each clearwell is constructed of reinforced concrete and is set into the ground above the water table and extends 3 foot above grade.
    ii. The clearwell design includes two (2) baffled chambers with a common center wall to extend contact time and minimize stagnation. The pump well at the south end of the clearwells is lowered and provides ability for the four (4) pumps to distribute water from the clearwells. The inclusion of two separate clearwells will allow one unit to be shut down for inspection or repair and not impact the operation of the plant. The structure will be constructed using reinforced concrete and be of adequate size to allow a minimum of two (2) hours hydraulic detention for the treated water per clearwell. Water volume for the clearwell is 583,350 gallons for each side, or total of 1,166,700 gallons. The concrete tanks will receive coating to comply with requirements of AWWA and NSF/ANSI Standard 61.
    iii. Further data for the clearwells is included in Appendix I

f. Drawings for the flash mix chamber and the clearwells are included in the issued Drawings in the SBC Project No. 529/000-02-2010-04, Water Treatment Plant (700 series).

g. Elevated Water Storage Tanks

   i. Two (2) one-million gallons of elevated storage volume will be provided at the elevation necessary to yield a minimum of 60 PSI static pressure at the Mega-site. One existing south tower is in place on the site. A second tank will be installed at the north side of the facility. The total elevated storage will be provided by the two-steel elevated water storage tanks is 2,000,000 gallons. Tanks shall follow the current AWWA standards wherever applicable. In order to provide 60 PSI station pressure, each tank will have a ground-to-overflow height of approximately 168-feet, at an elevation of 524.0’. At low water level the water pressure may reach 60 psi. Based on the preliminary geotechnical investigation, the tanks will be constructed on deep pile foundations.

   ii. The tank is being provided as part of a design build contract. This effort will include the design of the tower foundations noted above. The Geotechnical report for the North Tower area is provided for reference in Appendix E.

   iii. The foundation shall be designed by the Composite Elevated Water Storage Tank Contractor to safely support the structure based on the foundation recommendations within the geotechnical consultant’s soil report (See also 1.7.2). Foundations shall be sized in accordance with load combinations defined by AWWA D-107, Sec. 4... No work will proceed on the North Tower until the final design for the north tower submitted to TDEC and approved.

   iv. Pressures and volumes required for the fire water supply can be higher and will need to be supplied by pumps and tanks in a separate system and has not been identified by the State of Tennessee as an item within the scope of this project. Water from the potable system will be utilized to fill separate fire water tanks to be provided by tenants. The required volumes of firewater for tenants on this site will need to be stored separate. This is consistent with the philosophy that was agree to in development in 2012 for 3.0 MGD plant.

   - The drawings for location of the elevated north tower and the existing south tower are located on the Site Piping package SBC Project 529/000-02-2010-04, Site Water Piping (600 series) and The North Elevated Water Tower is located within the North Water Tower design package. 529/000-02-2010-04 (800 series drawings).
   - Tower data is located in Appendix L and Geotech report for the tower is located in Appendix E

D. Pump Hydraulics

a. Well pumps

   i. The system head curves for the well pumps are based on operation of well pumps to produce 7.0 million gallons per day of water to the treatment plant, including standby pumps for redundancy. The proposed system alignment is shown in Appendix F of this document. The pumping concept consists of using five (5) vertical turbine pumps to direct nominal 7.0 MGD water from the wells to the water treatment plant. The well pumps are located along the north side of the Memphis Regional Megasite

    ii. *Seven (7) well pumps are provided to draw water from the Memphis Sand Aquifer, each with a nominal capacity of 1111 GPM each at the initial design point. Pumps are provided with VFD's and flow will be controlled through use of flow meters in the pump discharge. Operating points on the curves are based upon pump calculations. Actual flow will vary by pump dependent upon demand and flow determined through PLC for each pump. Individual pumps will not exceed the maximum flow rate of 1111 GPM. Each of the operating pumps operate individually and are tied to a header, routed to the aerators at the water treatment plant. To maintain capacity of 7.0 MGD, five pumps will be in operation, leaving two (2) pumps for redundancy. The well pump total flow rates are monitored by the flow meter at the inlet of the aerators*. Wells are spaced at minimum of 1000 foot separation in accordance with the recommendations within the Preliminary Design Investigation performed by Layne Hydro in 2012.

    iii. The pumps for the MRM wells:
        1. Type: Submersible turbine
        2. *Design Capacity: 1111 GPM at 260 Ft*
        3. Number of Pumps: 7 submersible turbine pumps
        4. *Pump Model: Wilo model SP1 10.1200-3, 3 Stage, 3450 RPM with Impeller Dia.: Rated 3C, 8 inch discharge.*
        5. *Motor drives: VFD rated at 100 HP, synchronous*
        6. Normal Power Source: 480Volt, 3 -phase, four wire 60 hertz, alternating current.
        7. Alternate Power source: Emergency power from the Water Treatment Plant emergency generator.

    iv. Pump design Data and curves are located in Appendix F.

b. High Service Pumps

    i. The system head curves for the high service pumps are based upon operation of a series of pumps to provide required flow from the clearwells to fill the two (2) elevated water storage towers and distribution to the users at the Memphis Regional Megasite. The design flow of 7.0 MGD is the basis for sizing of the pumps with an allowance for peak flows for each tenant. Criteria for the operation includes the normal use of two (2) pumps in each clearwell to meet normal flow demands. Each pump is rated for a nominal 1276 GPM capacity. A total of four pumps are included in each clearwell to allow the system to provide the rated capacity of 7.0 MGD in case one clearwell may be out of service for cleaning or repair. Many different scenarios were reviewed to ensure the pumps were able to supply water demand to the users as described above. The high service pumps operate on VFD's and also flow to the system can be controlled to bring added pumps on line or reduce flows based upon demand and tower levels. The critical design scenarios are described in the Appendix G.

    ii. Design criteria for the pumps and system hydraulics are included in Appendix G.

E. Chemical Feed Pump Selection Data

a. Chemical Feed Pumps
    i. The chemicals used include 12.5% sodium hypochlorite, 50% solution sodium hydroxide, and phosphate (AquaMag) to inhibit corrosion.
    ii. Each set of chemical feed pumps is based upon one unit in operation and the second pump being redundant. Section is pulled from the storage tanks to the pump skid. The chemical feed pumps will start upon signal from the plant PLC noting that there is flow into the plant. Pumps are flow paced upon the inlet water flow rate to the treatment plant as indicated on the incoming meter through the PLC. When flow to the plant stops, chemical feed pumps will stop.
    iii. Chemical feed pumps selected are Blue-White peristaltic type pumps. Two pumps are placed upon each skid, completely pre-piped and wired for use with each chemical. Each pump is capable of providing design flow for the chemicals.
    iv. The chemical feed pump calculations and data are located in Appendix K.

F. Chemical Storage Volumes and Environments to Meet Safety and Compatibility Requirements

a. Chemical Tanks
    i. Chemical storage tanks are provided for the three chemical s that are used in the water treatment process. The chemicals used include 12.5% sodium hypochlorite, 50% solution sodium hydroxide, and phosphate (AquaMag). A set of SDS sheets are included in the **Appendix J** for reference.
    ii. Chemical storage tanks are provided of materials impervious to the chemicals stored. Two (2) tanks are provided for chemicals to provide back up for each system. The tanks are sized to hold a nominal 30 days of storage for each chemical. Chemical tanks are vented outside of the building. Filling of the tanks can be completed from totes or from chemical truck. Truck unloading containment area is provided with spill containment.
    iii. Each chemical is contained separate within the chemical area. Each area includes a sump within the curb for the collection of spills and an individual level alarm will indicate a spill in the specific containment area. The sodium hypochlorite area sump will include an added alarm to advise operators that the area is unsafe to enter if there is a spill.
    iv. Containment volumes for each set of tanks includes total volume of largest tank and allows for accommodation of sprinkler water.
b. Chemical storage tanks are included for the storage of chemicals on site and include secondary containment with separation for each chemical.
c. Information for the chemical tanks, containment and chemicals is Appendix J

G. Reliability Levels for Equipment and Power Supplies

a. In an effort to provide greater reliability for the supply of potable water to the tenants, redundant equipment has been included for treatment operations and for the electrical power feed, an emergency generator has been included with the design to provide back up for all equipment on the site of the water plant including wells, treatment equipment and distribution pumps.

H. Energy Saving Solutions Considered

a. Energy for the water plant process system includes the use of soft start for the well pumps and variable speed drives for the high service pumps at the clearwells. The system will also start/stop appropriate number of pumps based upon the water flow requirements for the site tenants.

I. Odor Control Consideration – N/A

J. Corrosion Control Consideration

a. Additional Corrosion Control considerations have not been provided in the design of the Water Treatment Plant or the water supply main line with exception to providing special coatings to materials where corrosion is most likely to occur within the chemical storage area. The water supply headers will be made of a highly corrosion resistant material, ductile iron.

b. Soils do not suggest a need for external protective coatings.

K. Velocities In Gravity Sewers and Mitigation – N/A

L. Calculations For Nutrient and Hydraulic Loading for Land Application Areas - N/A

M. Flow Data - N/A

N. Justification For Rehabilitation Methodology - N/A

O. Potential Reuse Sales - N/A

P. Status And Coverage of All Required / Anticipated Permits

a. Below is a list of permits associated with this project.

i.	NPDES:	Permit No.: TNR 122613
ii.	ARAP:	Permit No.: In Progress
iii.	SWPPP	Permit No.: In Progress

Q. Tables Demonstrating Unit Process Conformance to The Appropriate Design Criteria - N/A

R. Cut Sheets for Equipment and Instrumentation

a. See appropriate Appendix.

APPENDIX A

1. GENERAL PROJECT INFORMATION

- **Applicant Name:** State of Tennessee
- **Address:** 312 Rosa L. Parks Avenue, 24th Floor
- **Point of Contact:** John M. Hull – Deputy Commissioner, STREAM Capital Projects
    - o **Phone Number:** 615-741-1265
    - o **Email:** John.Hull@Tn.Gov

(As the Megasite Authority is being worked out, this contact may change to Mr. Clay Bright as follows:

Clay Bright
Megasite Authority of West Tennessee
James K Polk Building, Suite 700
505 Deaderick Street
Nashville, TN 37243
p. 615-430-0538

Engineer of Record

- **Firm:** SSOE Group
- **Name:** James B. Whitehead
- **Address:** 320 Seven Springs Way, Suite 350, Brentwood, Tennessee 37027
    - o **Phone Number:** 615-661-7585
    - o **Email:** jwhitehead@SSOE.com

2. PROJECT SPECIFIC INFORMATION

- **Project Name:**

    Memphis Regional Megasite: Water Treatment Plant
    State of Tennessee
    Portion of
    Record Book 71, Page 306 & Page 310
    Tax Map 137, Parcel 2.00
- **Associated WWTP:** Memphis Regional Megasite Wastewater Treatment Plant
- **Permit Numbers**
    - o **NPDES:** TNR 122613
    - ~~o~~ **ARAP:** In progress
    - ~~o~~ **SWPPP** In progress
- **Lat/Long of Project Site:** LAT: 36°26’20.53” N LONG: -89°25’35.89” W

- **State/Federal Funding Agency:** State of Tennessee STREAM Capital Projects
- **Estimated Project Construction Cost:** $45,000,000
- **Purpose Of the Project:**

  The purpose of this water treatment plant project is to provide support for the for the tenants at the Memphis Regional Megasite with potable water. The project includes a series of seven (7) wells located along the north side of the Memphis Regional Megasite, approximately a mile of water supply piping to the water treatment plant also located along the north side of the Memphis Regional Megasite and two (2) elevated 1,000,000 gallon water storage towers, one located at the northeast corner of the site and a second unit located in the south developed area of the site along with 36,000 LF of water piping including 14” through 20” water supply lines from the series of wells to the treatment plant and 16 inch water supply main from the water plant to the north tower and 24 inch water supply main from the water plant to the south tower.

3. WATER TREATMENT PLANT INFORMATION / DESIGN DATA

MRM Water Wells

- **Station Type:** Seven (7) individual well casings located at spacing of 1000 feet Identical submersible Turbine Pumps
- **Design Capacity:** **MAX** 5555 GPM **At 2**60’ TDH, normal flow 4875 GPM
- **Number Of Pumps:** Seven (7) Submersible Turbine Pumps each at capacity of 1111 GPM spaced at 1000 feet.
- **Normal Operation:** five (5) pumps will operate to produce 7.0 MDG (million gallons per day) water to the treatment plant.
- **Model Of Pumps:** *Wilo model SP1 10.1200-3, 3 Stage, 3450 RPM with Impeller DIA 3C*
- **Motor Drives:** Variable Speed at 100 HP, synchronous motors.
- **Power**
  - **Normal Power Source:**
    - Motor and Drives will be 480 Volts, 3-Phase, four wire, 60 Hertz alternating current. *Starters will be variable speed*. Electric Power Provided for controls will be 120 volts, single phase, 60 Hertz alternating current.
  - **Alternate Power Source:** Emergency Power from the MRM WTP Generator

Water Treatment Plant

- **Station Name:** Memphis Regional Megasite Water Treatment Plant
- **Design Firm Capacity:** Normal capacity 4875 GPM (7.0 MGD)
- **Design Peak Capacity:** 5500 GPM (gallon per minute) short term.
- Treatment process incudes the use of aeration for reduction of carbon dioxide levels, chemical addition for pH adjustment, chlorination, and addition of phosphate (Aquamag). All chemicals are flow paced based upon inlet water flow to the treatment plant. The system includes two clearwells each with a nominal capacity of 580,000 gallons including with four (4) high service pumps to provide potable water to the water towers and users on site. The supply water line is metered and includes turbidity and residual chlorine measurement.
- **Power**
    - **Normal Power Source:**
        - Water Treatment Plant Main Switchgear
            - 3200 AMPS
            - 480/277 Volt, 3 Phase, 60 Hz. Sec.
    - **Standby Or Emergency Power Source:**
        - Emergency Generator at the Water Treatment Plant
            - Rating: 2500kW/ 3125 kVA
            - 480/277 Volt, 3 Phase, 60 Hz. Sec.
- **Associated Plan Package/Sheets:**
        - All are provided as one complete package 529/000-02-2010-04. The Water treatment system is located within the Water Treatment Plant design.

4. WATER MAIN INFORMATION / DESIGN DATA

- Basis Of Design
    - The 16”, through 24” DIP in, water supply main is designed to adequately handle a design water supply of 7.0 MGD at a velocity range of approximately 3.5 to 5.5 ft/sec. The supply headers are sized for allowance of future expansion on site. The headers include air release, and block valves every 2500 feet along the supply main. An 8” water supply header is routed to the Memphis regional Megasite WWTP located to the west side of the site*, and a connection to the water treatment plant.*

- **Associated Plan Package/Sheets:**
- Drawings for the water mains are located in the following package:
  - Site Piping Packages: _529/000-02-2010-04

5. ELEVATED WATER TOWER INFORMATION / DESIGN DATA

- **Design basis:**
- Two water towers are provided to aid in supply of potable water to the Memphis regional Megasite. One tower is located at the south side of the site and a second unit is located at the northeast corner of the Megasite. The towers received water from the high service pumps located at the clearwells in the water treatment plant. Each tower includes an altitude valve to maintain level in the tower. Each water tower includes a security fence, lighting and secured lower level.
- The North tower will be supplied similar to the existing south tower. The north tower and foundations are being design by the tower supplier.
-
- **Existing South Water Tower:**
- **Basis of Design:** Elevated Water Tower
- **Design capacity:** 1,000,000 gallons
- **Overflow elevation:** Elev. 524.0’
- **North Water Tower:**
- **Basis of Design:** Elevated Water Tower
- **Design capacity:** 1,000,000 gallons
- **Overflow elevation:** Elev. 524.0’
- **Associated Plan Package/Sheets:**
  - All are provided as one complete package 529/000-02-2010-04. The North Elevated Water Tower package is located within the North Water Tower design package. 529/000-02-2010-04 (800 series drawings).
  - Refer to the Geotechnical report included in Appendix E.
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APPENDIX B

PRELIMINARY DESIGN INVESTIGATION

ANALYSIS OF A POTENTIAL WELL FIELD SITE FOR AN INDUSTRIAL FACILITY NEAR STANTON, TENNESSEE

PREPARED FOR:
SSOE

August 27, 2012

Prepared by
Layne Hydro
a division of Layne Christensen Company
Bloomington, Indiana

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FIGURES

TABLES

APPENDICES

1. INTRODUCTION

This report summarizes our assessment of site conditions and discusses the feasibility of locating a well field for water supply at a proposed 3,800 acre industrial site (Megasite) in Haywood County, Tennessee (Figure 1). The study identifies potential well locations and spacing guidelines for two possible well field configurations:

1. Target production of 3 million gallons per day (mgd) achieved with 2 wells, each operating at 1,050 gallons per minute (gpm), with a third well available as backup
2. Target production of 8 mgd using 5 wells, each operating at 1,111 gpm

For the first part of the study we assembled and synthesized available information to evaluate the aquifer systems in the area and estimate hydraulic properties of the local aquifer. The data reviewed included the following:

- Driller's logs for area water wells
- Groundwater elevation and groundwater flow data
- Previous Layne work in the area
- Previous federal, state, and consultant reports on local and regional hydrogeologic conditions

This data was used to develop a groundwater flow model of the site. The groundwater flow model estimated the pumping-induced, water-level drawdown at the wells and estimated the well-to-well pumping interference. The output of the model validated the feasibility of locating a well field at the site and recommended well spacing guidelines.

2. REGIONAL GEOLOGY

Groundwater supplies in most of western Tennessee are obtained from various sand units of a regional aquifer system referred to as the Mississippi Embayment (Embayment). The Embayment is a large aquifer system that spans seven states, and is generally comprised of a series of sand, silt, and clay-rich sediments that trend along the Mississippi River (Figure 2). These sediments are thickest near the River and become thinner to the east and west. The sediments of the Embayment are discretized into units that are either water bearing aquifers or confining units between the aquifers. The primary aquifers of the Embayment in western Tennessee include, in descending order from the ground surface: the Cockfield Formation, the Memphis Sand, and the Fort Pillow Sand Formation (Figure 3).

The Cockfield Formation is primarily used for domestic and farm water supplies. It consists of interbedded sand, silt, clay, and lignite of fluvial origin. Wells in the Cockfield Aquifer range from 90 to 350 feet deep (Parks, 1990a). Clay beds of the Cook Mountain Formation lie beneath the Cockfield Aquifer and retard the downward movement of groundwater to the underlying Memphis Sand Aquifer.

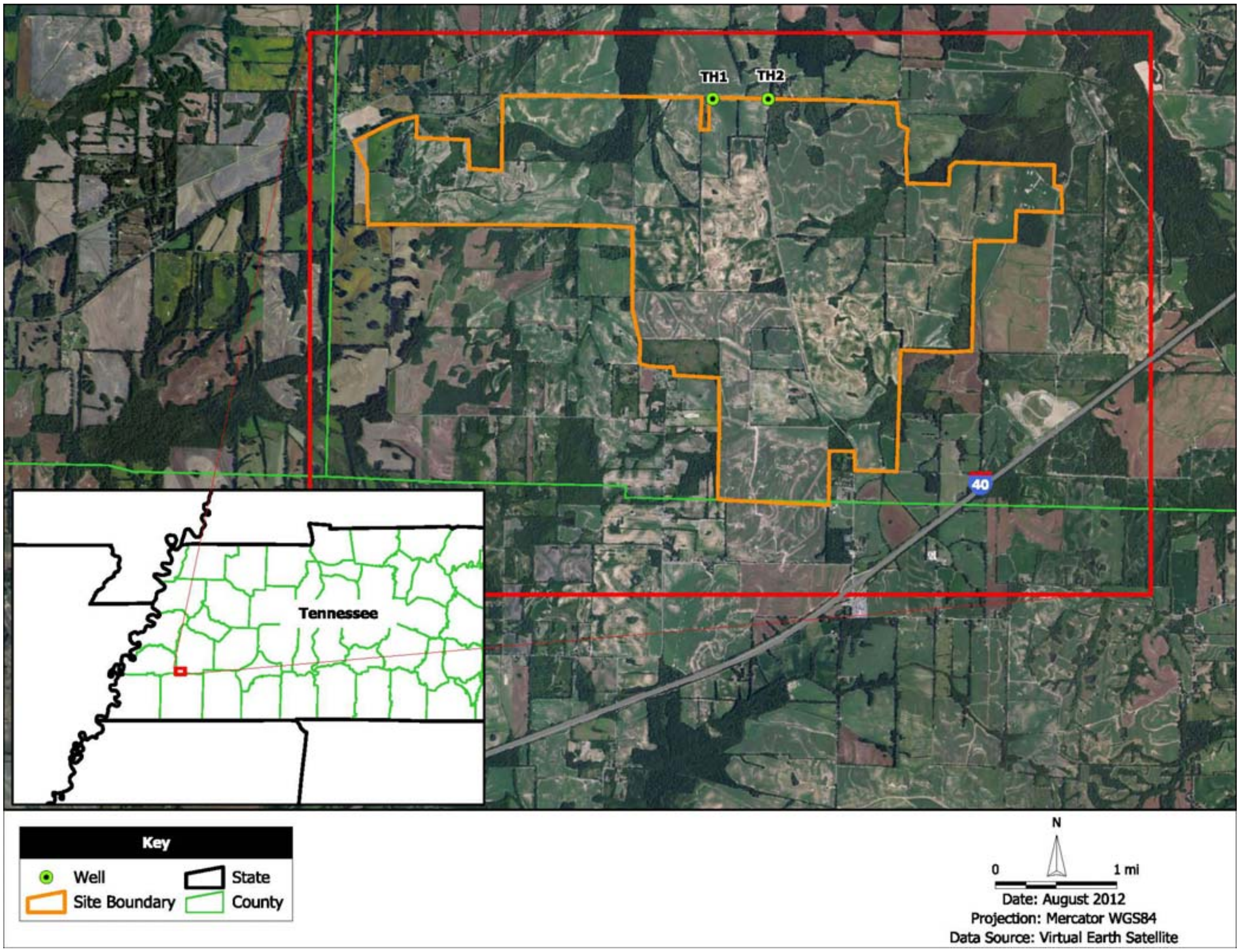

Figure 1. Location of site and two test borings.

The Memphis Sand primarily consists of massive beds of fine to coarse sand with relatively few interbedded silt, clay, and lignite layers. The Formation ranges up to 900 feet in thickness in down-dip areas in the western part of the region and is thinnest along the eastern outcrop area (Figure 2). The Memphis Sand Aquifer is a major source of public and industrial water in western Tennessee. It is the source of water for the municipalities surrounding the project area, including Brownsville and Stanton. The Flour Island Formation is the lower confining unit for the Memphis Sand Aquifer, separating it from the underlying Fort Pillow Aquifer (Parks, 1990b).

The Fort Pillow Formation is present throughout Haywood County and most of western Tennessee (Parks, 1989). It provides water to several industrial and public wellfields but it is not heavily used because of the availability of water at shallower depths.

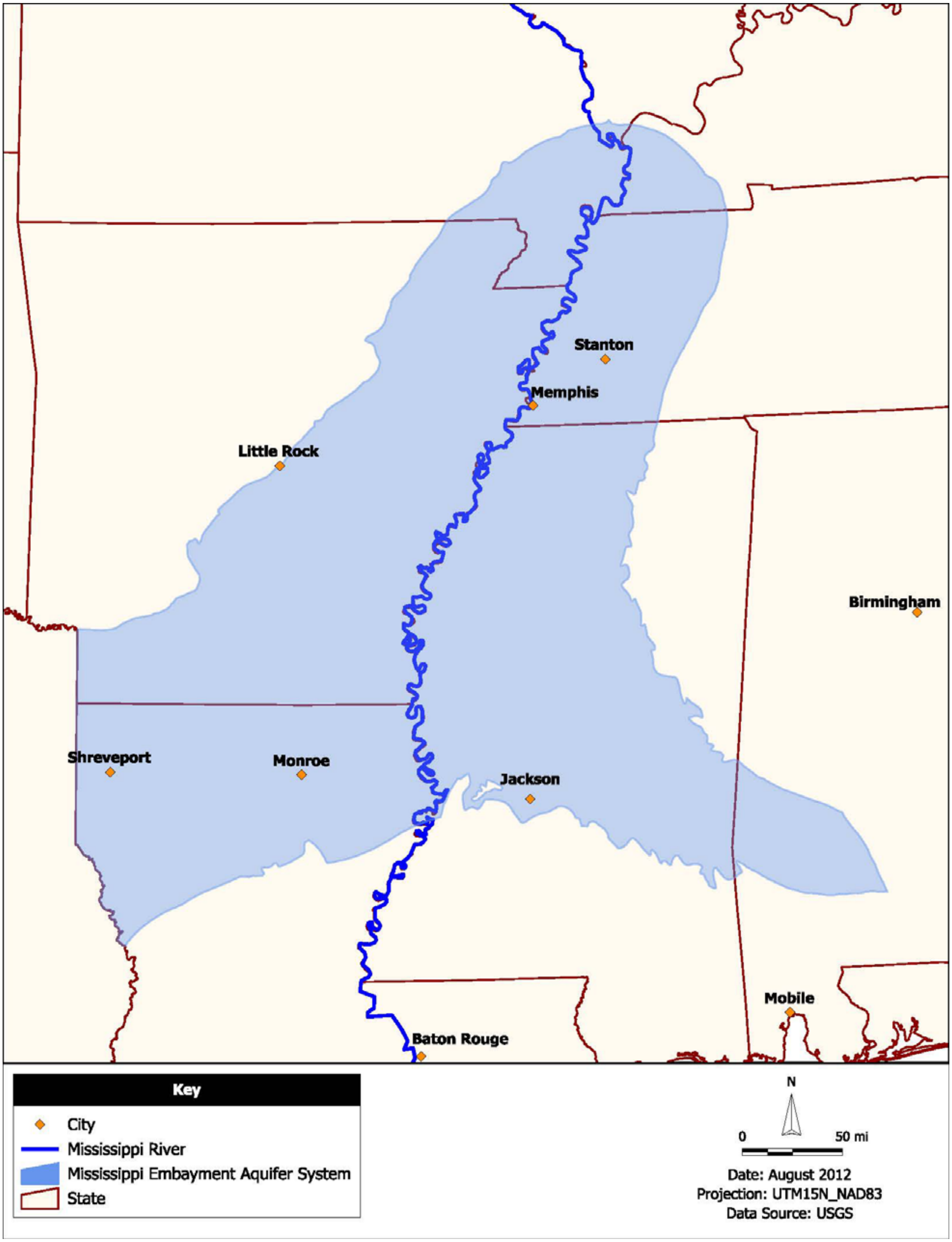

Figure 2. Extent of the Mississippi Embayment Aquifer System.

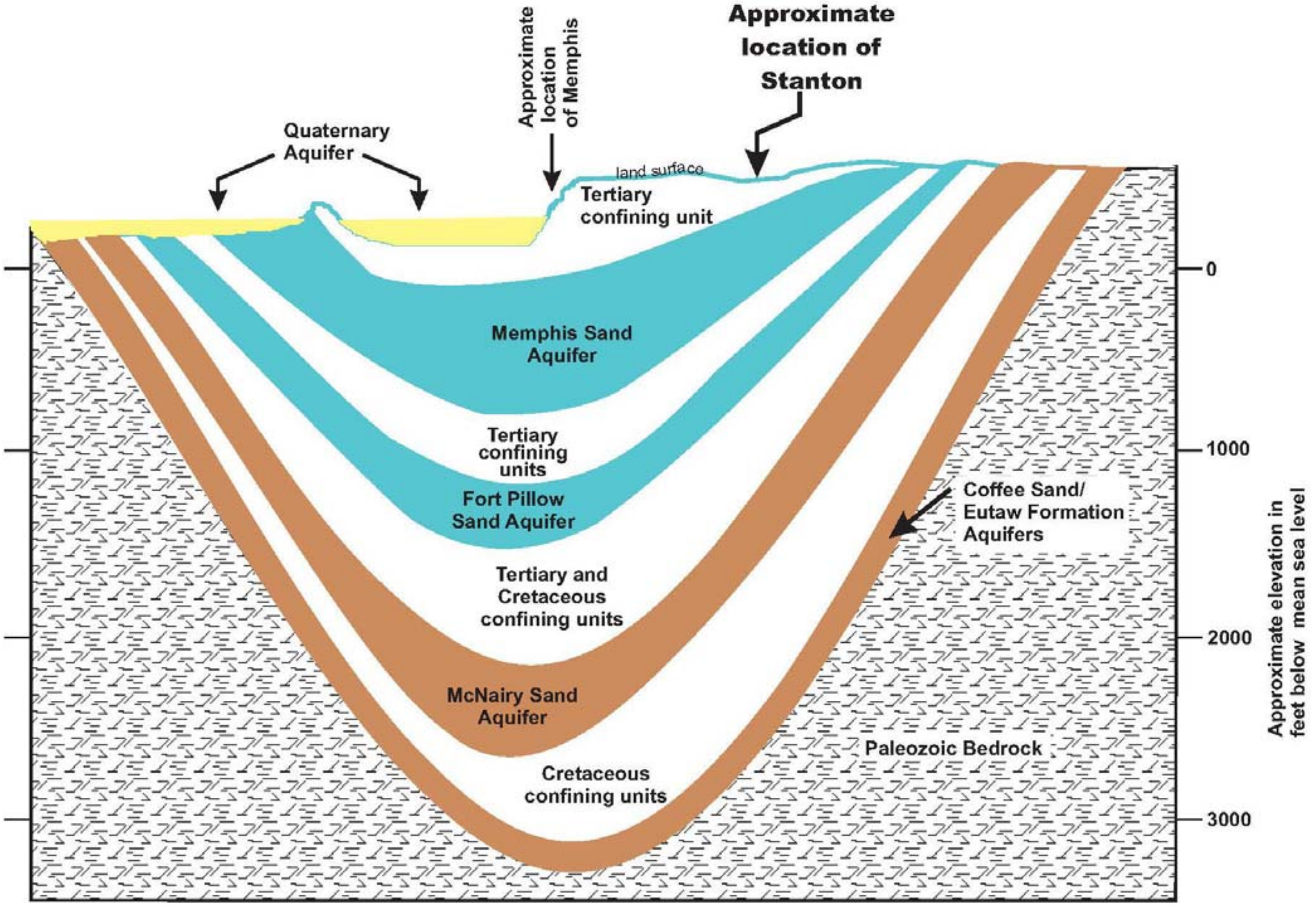

Figure 3. Cross-sectional drawing of the Mississippi Embayment Aquifer System (from Brahana, 1987).

3. LOCAL AQUIFER PROPERTIES

The primary aquifer properties that are used to design a well field are the aquifer transmissivity, storage coefficient, and the amount of water that is recharged into the aquifer. The aquifer transmissivity represents an aquifer's overall ability to move water and equals the hydraulic conductivity multiplied by the aquifer thickness. The hydraulic conductivity of the aquifer describes the ease with which water can move through pore spaces in the aquifer material. In an unconsolidated aquifer like the Memphis Sand, it is function of the composition of the sediments that comprise the aquifer. The storage coefficient represents the volume of water released from storage due to water-level declines in the aquifer.

3.1. AQUIFER THICKNESS

The USGS mapped the aquifers and confining units of the Mississippi Embayment using available boring logs, electric logs, and other geologic data and made this available through an online tool that can be used to query a specific location (Jackson, 2012). While this mapping is broad in scale and may not precisely represent conditions at a specific location, it is useful for average conditions over an area of interest. Using this tool to evaluate the geology at the site shows the Cockfield Formation is not present but identifies an unnamed alluvial unit from the surface to about 60 feet below ground surface (ft bgs). The unnamed alluvial unit overlies a 9 ft clay layer, which overlies the Memphis Sand Aquifer. The Memphis Sand is shown to extend to 590 ft bgs before encountering what appears to be the Flour Island confining unit (Figure 4).

In addition to the USGS study information, two test holes were drilled on-site to gather site-specific information (Figure 1). Interpretation of Resistivity/Gamma logs of these two test holes are generally consistent with the information from the USGS map (Figure 4). In TH-2 the Memphis sand appears to extend from approximately 85 feet to 620 feet. In TH-2 the Memphis sand appears to start at 100 feet and continues at least to its total depth (360 feet).

In both TH-1 and TH-2 there is a 40 to 50 feet section of lower permeable material at around 150 and 230 ft bgs, respectively. A layer of impermeable material this thick will retard vertical water flow and locally isolate the lower section of the aquifer. Therefore, for the purpose of estimating the water drawdown, we based the aquifer thickness on the lower section between 270 ft and 615 ft bgs, for a total thickness of 345 feet.

3.2. HYDRAULIC CONDUCTIVITY AND STORAGE COEFFICIENT

The USGS used local pumping test data to estimate the transmissivity and hydraulic conductivities for different locations in the Memphis Sand Aquifer. The results from 76 aquifer tests made in the Memphis area and western Tennessee indicate that transmissivities range from 2,700 to 53,500 ft^2/day (Parks, 1990b). This data set estimated the storage coefficient to range from 0.0001 to 0.003. The closest test performed near the site was in a well near Stanton, Tennessee. These test results produced an estimated aquifer transmissivity of 27,000 ft^2/day (Brahana, 2001). Using transmissivity and an aquifer thickness from the lower section of the TH-2 boring of 345 feet, the resultant hydraulic conductivity would be 78 ft/day.

Layne performed a series of aquifer tests on wells at the TVA Lagoon Creek Power plant located approximately 15 miles north of the site. These wells are completed in the Memphis Sand Aquifer. The estimated hydraulic conductivity from these tests ranged from 69 to 88 ft/day (Schroeder, 2010).

3.3. RECHARGE

Recharge to the Memphis Aquifer comes from leakage from upper units and at outcrops located at the edges of the Aquifer. The USGS estimated the areal recharge rate into upper units of the Mississippi Embayment Aquifer to be in the range of 0.32 to 0.99 in/year in the area of the Megasite (Clark, 2009). However, clay layers between the ground surface and the aquifer retards the downward flow into the Memphis Sand Aquifer, and a smaller, unknown, portion of this recharge reaches the Memphis Sand. The other source of recharge to the Memphis Aquifer is from precipitation where the aquifer outcrops. The aquifer outcrop is defined as were there are no confining units above the Memphis Sand. This area starts about 6 miles east of the site and continues to where the aquifer terminates about 34 miles to the east (Parks, 1990b).

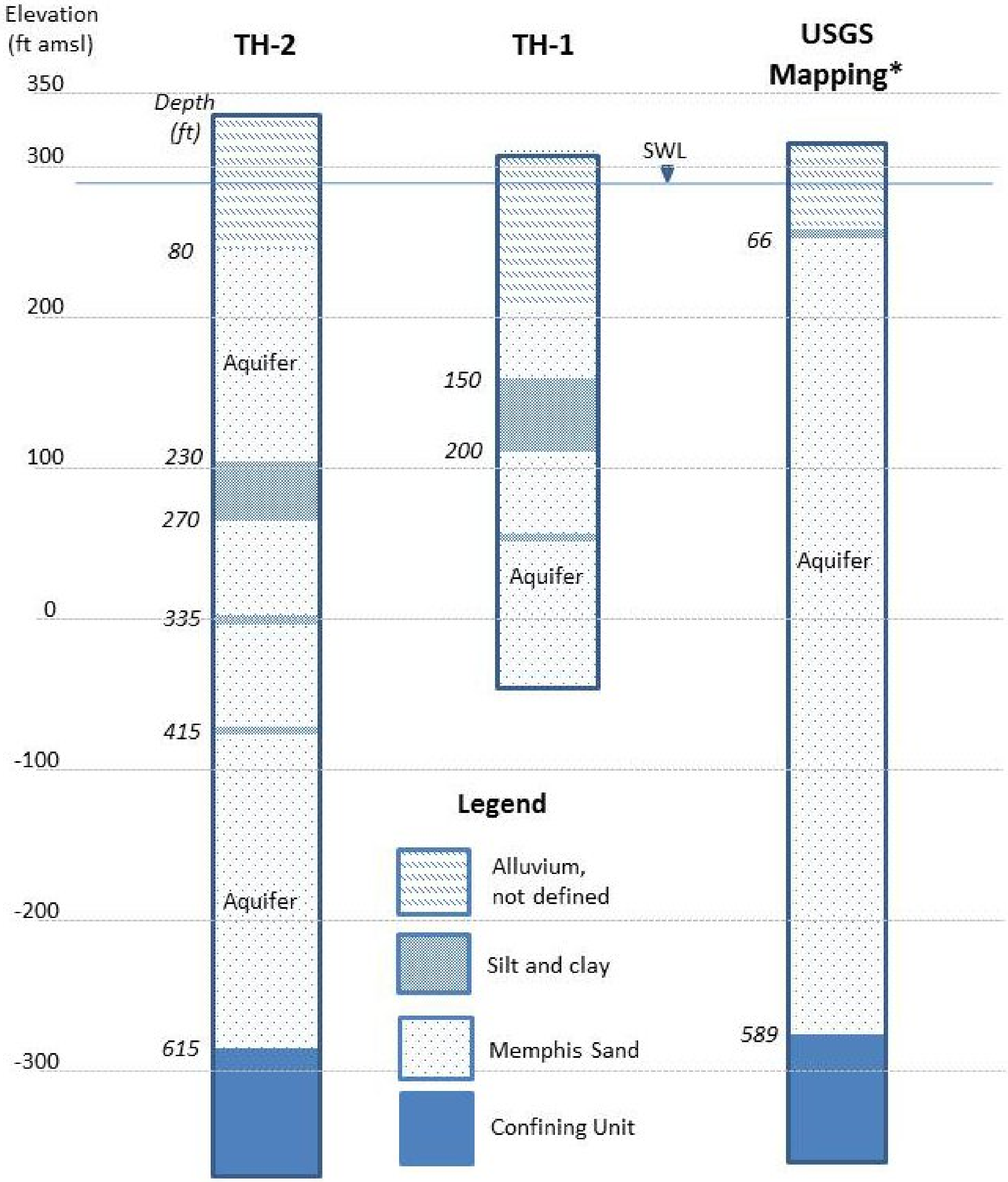

Figure 4. Aquifer configuration and thickness of three data points at the Megasite (*Jackson, 2012).

3.4. GROUNDWATER MOVEMENT AND BOUNDARIES

A USGS groundwater level contour map shows the water generally flows toward, then parallel to the Mississippi River towards the south, except where influenced by large pumping centers (Schrader, 2007). The contour map shows no nearby features that may act as head-specified boundary conditions for groundwater flow. As a result, time-varying water levels in the area owing to the proposed development are determined by the initial water levels in the aquifer, the recharge rate, and the locations and rates of groundwater withdrawals. Water pumped by wells, therefore, comes from releases in aquifer storage and from recharge over the area of interest. The aquifer is bounded around its extents where the formation terminates.

4. GROUNDWATER FLOW MODEL

A groundwater flow model was used to estimate the pumping water level in the aquifer, to estimate the interference between wells, and to establish recommended well spacing guidelines. The groundwater flow model was constructed using data from the borings taken at the site, other local borings, and USGS regional aquifer studies.

The transient analytic element code TTim (Bakker, 2010) was used to model the aquifer. This code allows the evaluation of pumping drawdown over time. Based on a particular layout of production wells and an accompanying pumping schedule, the groundwater model predicted the long-term water level drawdown in the aquifer from pumping proposed wells at the Megasite. Water levels were evaluated after 30 years of continuous pumping.

The model dimensions and properties were based on local boring logs and aquifer test data. The perimeter of the mapped aquifer system lies many miles from the project site, and furthermore, the aquifer appears to receive a substantial rate of recharge; thus we assumed that the aquifer was of infinite lateral extent. The aquifer was modeled as a single layer located below the 40 ft clay layer observed between 230 to 270 ft bgs in the TH-2 boring; therefore, the thickness was assumed to be 345 ft. By making this assumption we ignore the contribution of the portion 150 ft section above the clay layer. However, over long-term pumping (30 years) this 150 ft section will contribute water to the well and ignoring its contribution is a conservative assumption. An aquifer hydraulic conductivity of 78 ft/day was used in the model, which ties back to the aquifer transmissivity measured in the nearby Stanton well (Table 1).

No recharge due to vertical leakage through confining clay layers, or infiltration at distant outcrops, was used in the model. Hydrolgeologic boundaries on the aquifer are so distant from the site that no boundaries are included in the groundwater flow model. This modeling approach is conservative as it assumes that all water pumped from the aquifer comes from storage.

Table 1. Aquifer properties used in the groundwater flow model.

Property	Units	Value
Aquifer thickness	ft	345
Hydraulic conductivity (K)	ft/day	78
Storativity	--	1e-4

4.1. WELL SPACING AND INTERFERENCE

Our recommendations for well spacing are primarily based on a maximum allowable interference between the wells. Well interference is the drop in static water level of a well due to one or more nearby wells operating. The maximum allowable interference used was 10% of the available drawdown in the pumping well after 30 years of continuous pumping. For this study we define the available drawdown as the distance from the static water level to the top of the well screen. Assuming a static water level of 30 ft bgs, and the top of the well screen set at top of the lower aquifer section 270 ft bgs (TH-2), the available drawdown is 240 ft and 10% of this amount is 24 ft.

Another factor we consider when estimating well spacing is that it is generally preferrable to keep the pumping water above the primary confining unit of a confined aquifer. In this case, the primary confining unit is the upper layer that extends to approximately 50 ft below the static water level. This establishes the total maximum drawdown in the aquifer to be 50 ft.

4.2. PREDICTIVE MODELING

Separate predictive modeling runs were performed for the 3 mgd and 8 mgd well field configurations. The 3 mgd well field was built with 2 wells each producing 1.5 mgd (1,050 gpm). The 8 mgd wellfield was built with 5 wells each operating at 1,111 gpm. The baseline well spacing was 1,000 ft apart. Two criterea were used to evaluate well spacing. The first criteria was the drawdown interference at the well location can not be greater than 24 ft. The second criteria was the total maximum drawdown in the aquifer can not be greater than 50 ft. The greatest drawdown point was measured at the outsite of the well gravel pack in the middle of the well field. The aquifer drawdown was evaluated after 30 years of continuous pumping.

3 mgd Well Field

A single well pumping 1,050 gpm, generated an estimated drawdown in the aquifer at the well of 16.9 ft (Table 2). The drawdown 1,000 ft away at the 2nd well location is 5.9 ft. Since the total aquifer drawdown is less than 10% of the available drawdown, there are no theoretical restrictions on the placement of a second well based on this criteria. With both wells operating, the maximum drawdown in the aquifer is 22.8 ft.

Table 2. Relative well locations and drawdown for 3 mgd well field with 1,000 ft well spacing.

			Well Interference		Total Aquifer Drawdown	
Well	X	Y	Rate (gpm)	Drawdown* (ft)	Rate (gpm)	Drawdown* (ft)
W1	0	0	1,050	16.9	1,050	**22.8**
W2	1,000	0	0	**5.9**	1,050	**22.8**
W3	2,000	0	0	5.1	0	11.0
Total					2,100	

*Drawdown in the aquifer at the well

The 3 mgd well field was also evaluated using a 700 ft spacing between wells. In this configuration the drawdown in a well located 700 ft from the pumping well is 6.3 ft (Table 3). The maximum drawdown in the aquifer with both wells operating is 23.2 ft. This shows closer spacing than 1,000 is possible within the 3 mgd well field

Since the total aquifer drawdown is less than 10% of the available drawdown at the single pumping well, there are no theoretical restrictions on the placement of a second well based on this criteria. However, there are other considerations that can drive well spacing, including total aquifer drawdown and limitations on the ability to expand the well field in the future. If the final spacing is to be less than 700 ft, a site specific test and analysis should be completed to determine the drawdown interference.

Table 3. Relative well locations and drawdown for 3 mgd well field with 700 ft well spacing.

			Well Interference		Total Aquifer Drawdown	
Well	X	Y	Rate (gpm)	Drawdown* (ft)	Rate (gpm)	Drawdown* (ft)
W1	0	0	1,050	16.9	1,050	**23.2**
W2	700	0	0	**6.3**	1,050	**23.2**
W3	1,400	0	0	5.4	0	11.6
Total					2,100	

*Drawdown in the aquifer at the well

8 mgd Well Field

The configuration for the 8 mgd well field is 5 wells located in a line, with a 1,000 spacing between wells (Figure 5). A single well pumping 1,111 gpm, generated an estimated drawdown in the aquifer at the well of 17.8 ft. The drawdown 1,000 ft away at the 2nd well location is 6.3 ft. The worst case interference will occur in the middle well location (Well 3) with two wells pumping on either side . In this scenario, the interference in Well 3 is 23.2 ft (Table 4). This is less than the 24 ft criteria. The maximum drawdown in the aquifer when all five wells are running is 41.1 ft.

The maximum estimated interference is close to the established maximum critiera. We do *not* recommend placing the wells any closer together than 1,000 ft for the 8 mgd well field.

Date: August 2012
Projection: Mercator WGS84
Data Source: Virtual Earth Satellite

Figure 5. Possible well locations for 8 mgd well field.

Table 4. Relative well locations and drawdown for 8 mgd well field.

Well	X	Y	Well Interference		Total Aquifer Drawdown	
			Rate (gpm)	Drawdown* (ft)	Rate (gpm)	Drawdown* (ft)
W1	0	0	1,111	33.5	1,111	38.8
W2	1,000	0	1,111	34.3	1,111	40.6
W3	2,000	0	0	**23.2**	1,111	**41.1**
W4	3,000	0	1,111	34.3	1,111	40.6
W5	4,000	0	1,111	33.5	1,111	38.8
Total					5,555	

*Drawdown in the aquifer at the well

5. CONCLUSION AND RECOMMENDATIONS

The Megasite overlies the Memphis Sand Aquifer, which is a productive sand and gravel unit that can sustain the pumping requirements for either a 3 or 8 mgd well field. For these well fields we recommend:

- minimum well spacing of 700 ft between wells for the 3 mgd scenario
- minimum well spacing of 1,000 ft between wells for the 8 mgd scenario.

This analysis is based soley on published docoments and local boring logs. We recommend performing a pumping test on the first production well and analyzing this site-specific data to estimate aquifer properties and determine well performance. This data should be used to confirm the final well field design and the design of individual wells.

6. REFERENCES

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Parks, W.S., and Carmichael, J.K., 1990b, Geology and ground-water resources of the Memphis Sand in western Tennessee: U.S. Geological Survey Water-Resources Investigations Report 88–4182, 30 p

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Schrader, T.P., 2007, Sparta-Memphis aquifer—SHEET 1 of 1 Potentiometric surface in the Sparta-Memphis aquifer of the Mississippi Embayment, spring 2007 *U.S.G.S.* Scientific Investigations Report Map 3014

Schroeder, B. 2010. Memo to James Crouch, Layne Central, RE: TVA Lagoon Creek, Well T-3MS.

APPENDIX 1 – Electric logs of test borings at the site

U. S. Geological Survey

Tennessee District

Well Number HA:A-013

Site-Id Number 352623089254200

County Haywood

Date April 6, 2011

Latitude 352622.8

Longitude 892541.6

Land Surface Elevation 310' (T)

Logging MP LSD

Casing none

Log Type Sp, SPR, down hole

Borehole Fluid Drilling mud

Depth, Logger ~358' SP/SPR; ~355' Gamma

Sp. Conductance

Temperature

Depth, Driller 360'

Logging Crew J. Carmichael

Logging Speed ~20'/m

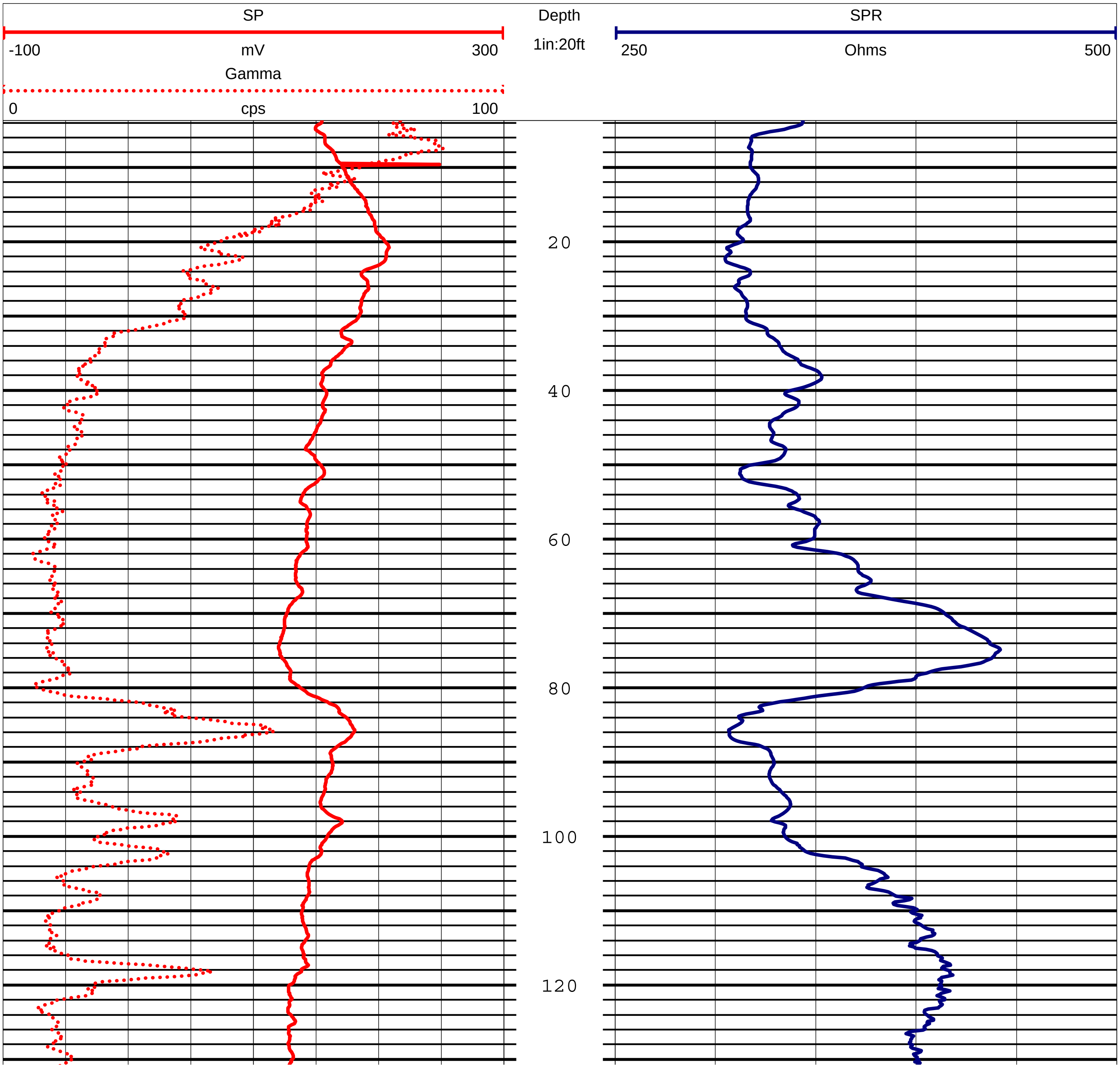
Logging Direction SP/SPR down; gamma up

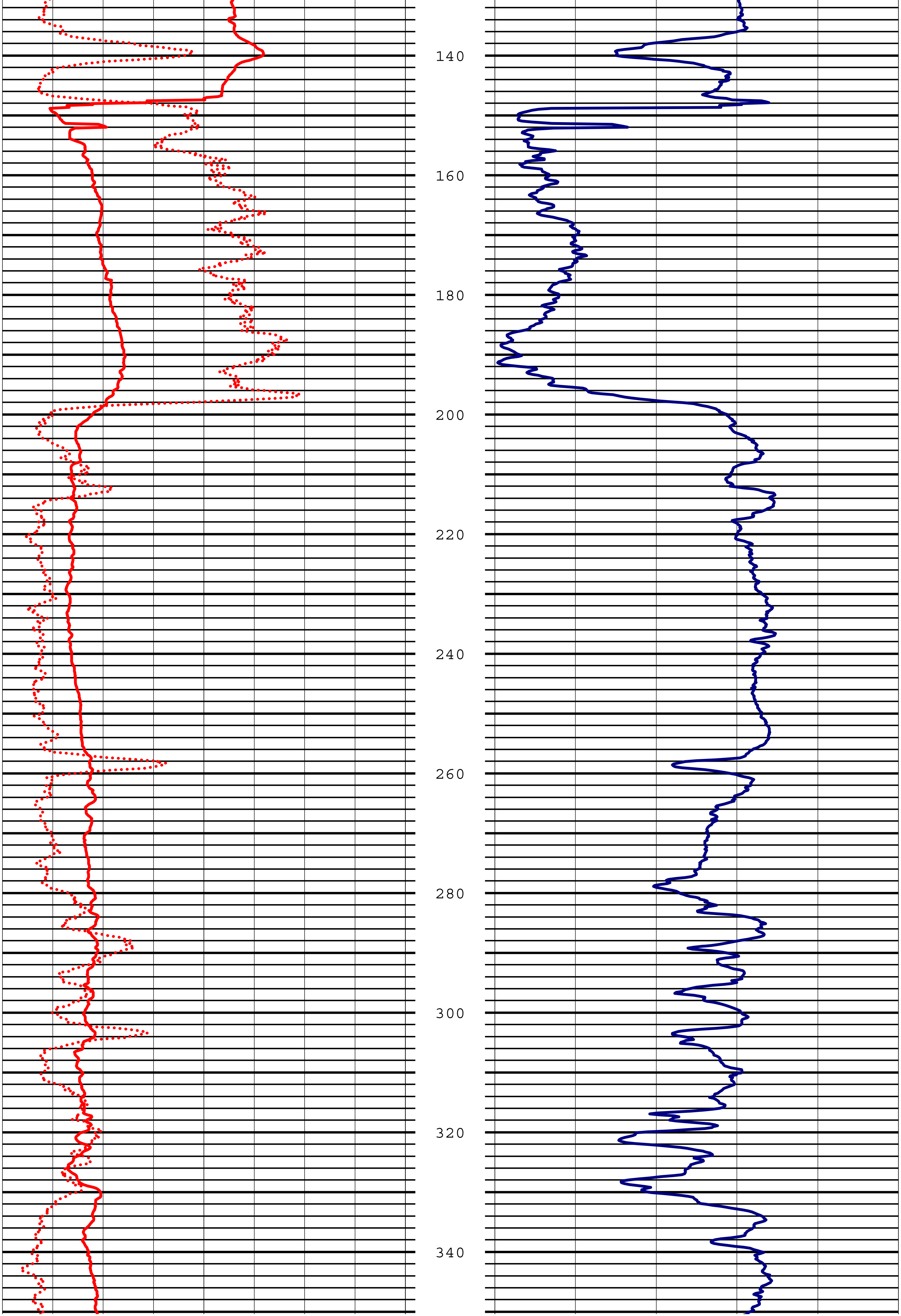
Log System Mt Sopris

Probe 1851

Probe offset

Remarks Megasite TH#1; 8" hole drilled by Russell Basham, Wilson Well Inc.; TD logger: ~358' SP/SPR; ~355" Gamma; will make 4" PVC weel in TH w/ 20' screen from ~220-240'; SP shifted below ~148' after probe hung on clay on way down and cable was raised and lowered so probe could descend.

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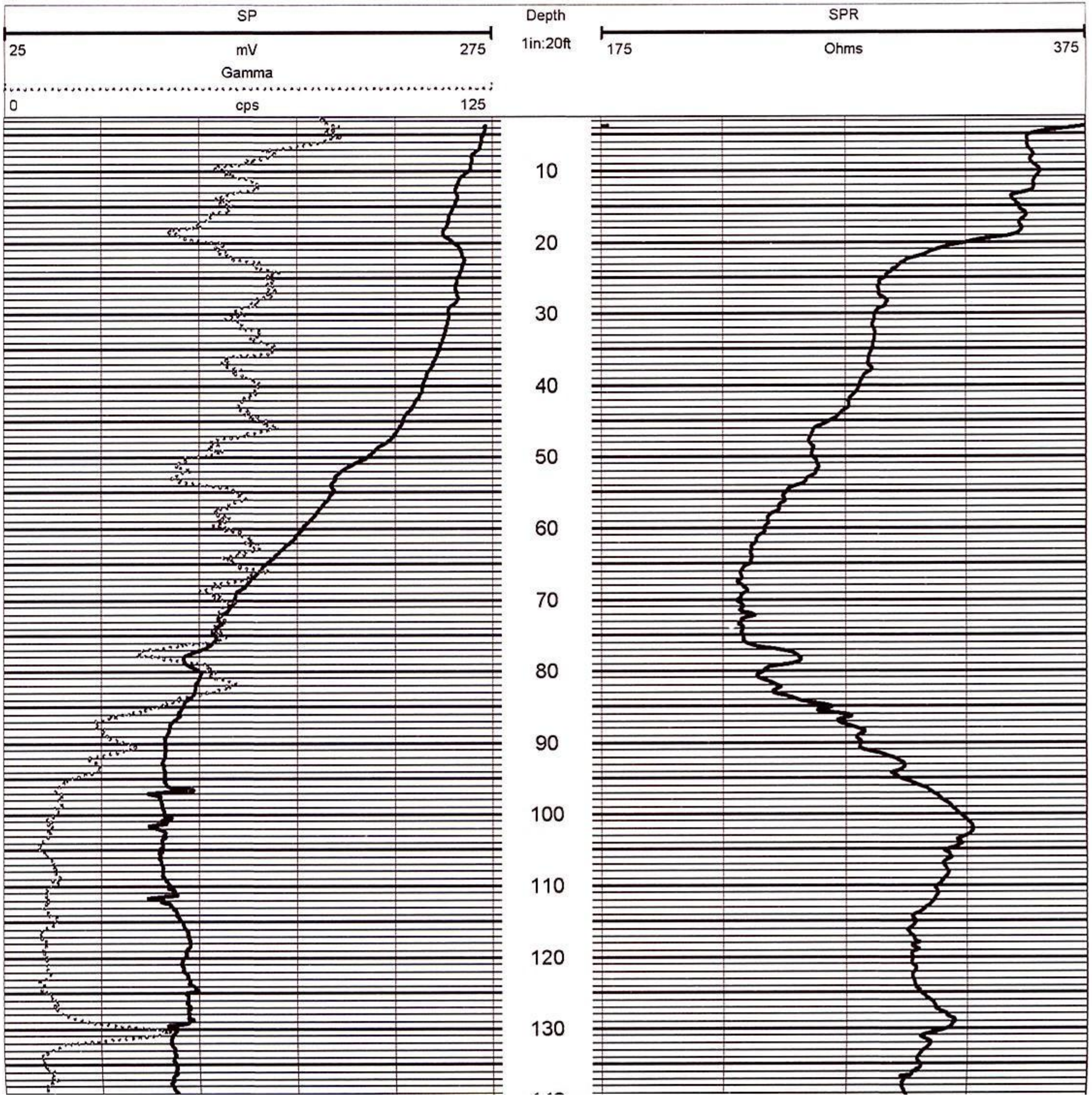
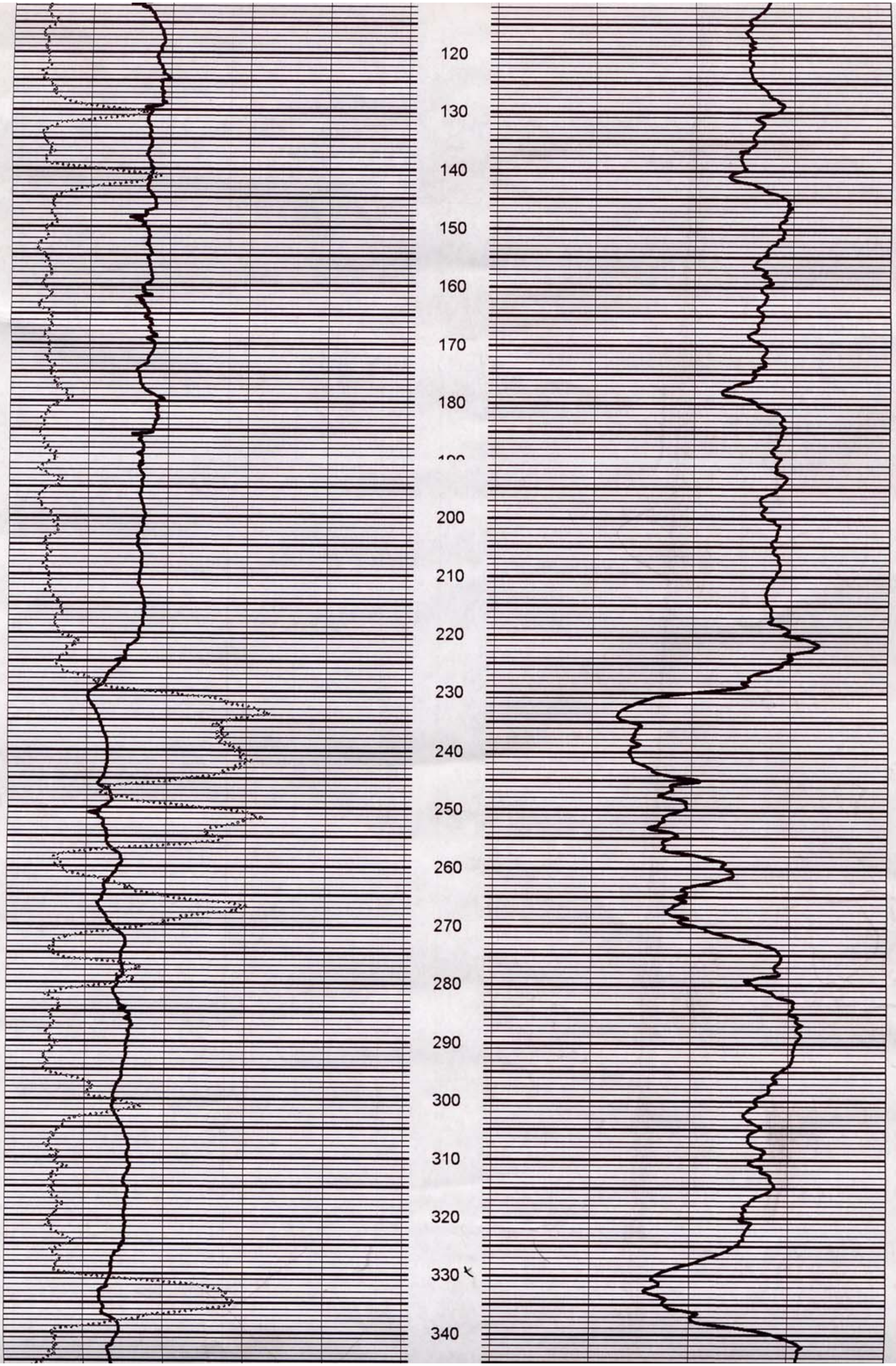
U. S. Geological Survey
Tennessee District

Well Number HA:A-012
Site-Id Number 352623089251800
County Haywood
Date April 20, 2011

Latitude 352622.7
Longitude 892517.8
Land Surface Elevation 337' (T)
Logging MP LSD
Casing none

Log Type SP/SPR, down
Borehole Fluid Drilling mud
Depth, Logger ~695'
Sp. Conductance
Temperature
Depth, Driller 700'
Logging Crew J. Carmichael
Logging Speed ~20'/m
Logging Direction SP/SPR, down; NG, up
Log System Mt Sopris
Probe 1851
Probe offset
Remarks Megasite TH#2

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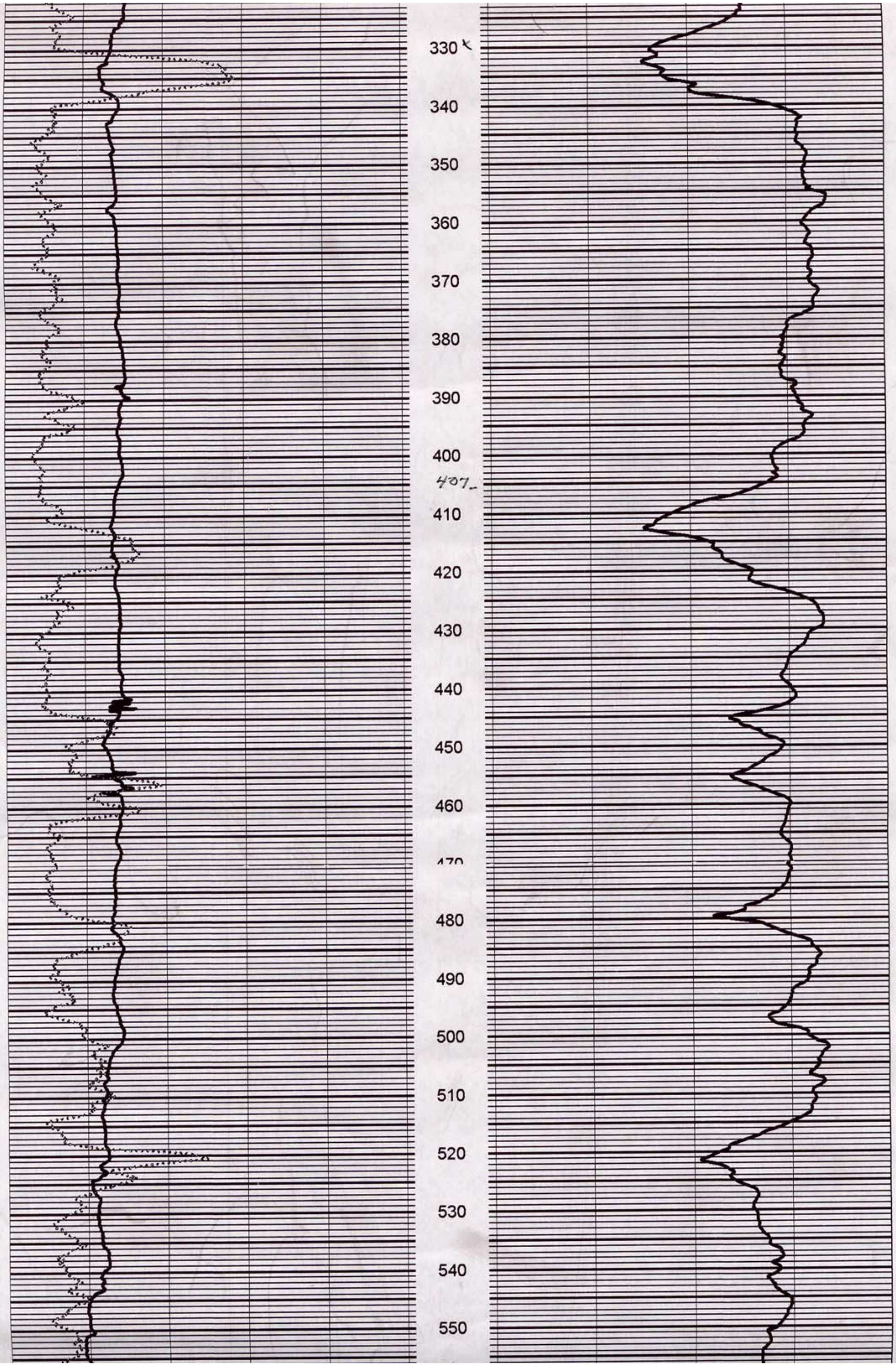
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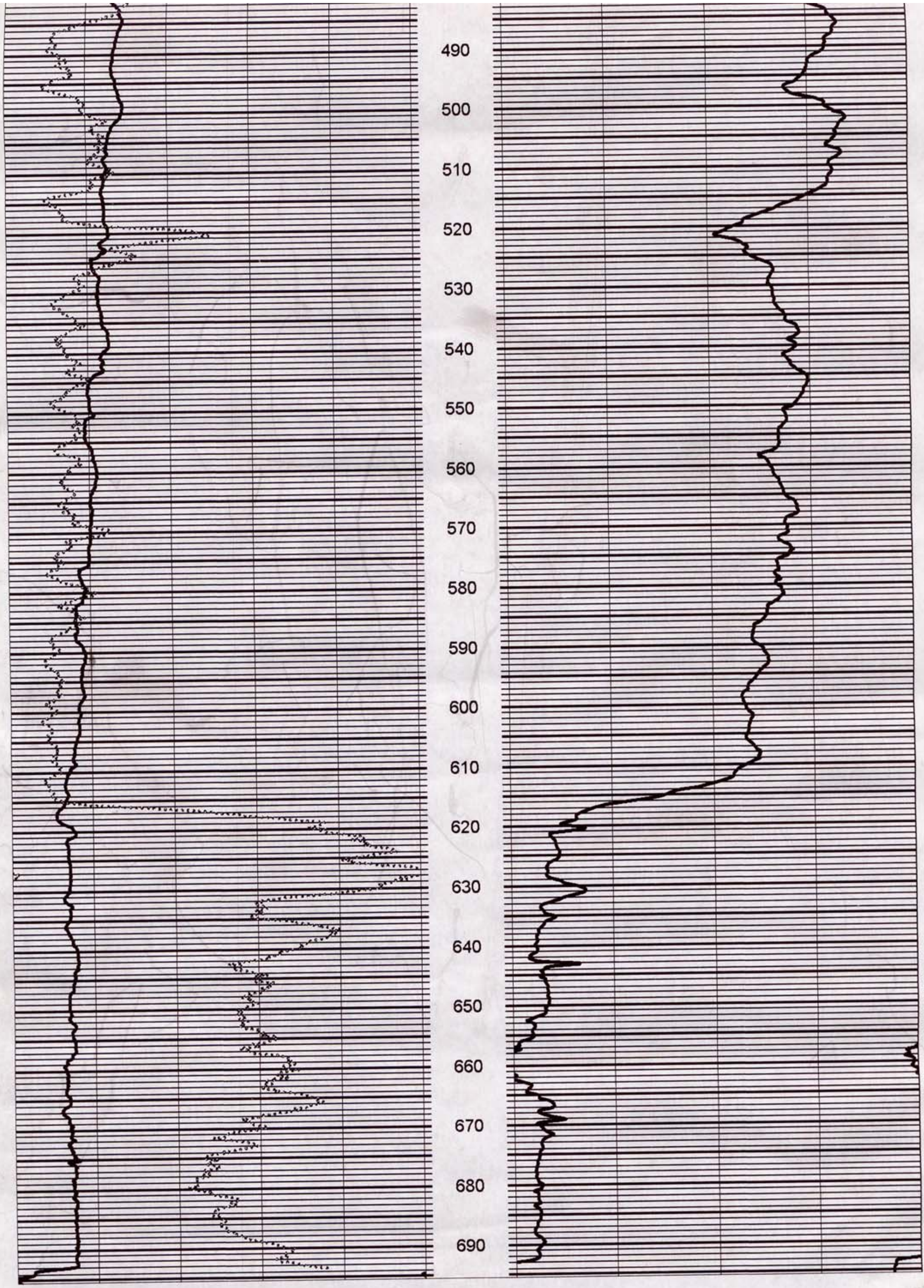
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APPENDIX C

Appendix C Contains:

Results of laboratory testing from the existing East and West Wells at the Mempis Regional Megasite. These results have also been provided to TDEC by EnSafe Ron Dow.

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

May 03, 2013

Russell Wilson
Wilson Well
8050 Whiteville Newcastle Road
Whiteville, TN 38075
TEL: (731) 415-6550
FAX

RE: Brownsville Megasite Order No.: 1304323

Dear Russell Wilson:

TEC Environmental Laboratories, INC received 2 sample(s) on 4/23/2013 for the analyses presented in the following report.

There were no problems with the analytical events associated with this report unless noted in the Case Narrative. Analytical results designated with a "J" qualifier are estimated and represent a detection above the Method Detection Limit (MDL) and less than the Reporting Limit (PQL).

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

As always we appreciate your business and are pleased to be of service to you.

If you have any questions, please feel free to call or email.

Sincerely,

Billie J. Haynes

Billie Haynes
Laboratory Manager
2269 Dr. F.E. Wright Drive
Jackson, TN 38305

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

Analytical Report

WO#: **1304323**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/23/2013 10:45:00 AM
Project: Brownsville Megasite
Lab ID: 1304323-001
Matrix: AQUEOUS
Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
ICP METALS IN DRINKING WATER					**E200.7**		Analyst: **rh**
Aluminum	ND	0.020			mg/L	0.4	4/30/2013 9:55:33 AM
Arsenic	ND	0.004			mg/L	0.4	4/30/2013 9:55:33 AM
Copper	ND	0.008	1.00		mg/L	0.4	4/30/2013 9:55:33 AM
Iron	0.145	0.020			mg/L	0.4	4/30/2013 9:55:33 AM
Lead	ND	0.001	0.015		mg/L	0.4	4/30/2013 9:55:33 AM
Manganese	ND	0.004			mg/L	0.4	4/30/2013 9:55:33 AM
Silver	ND	0.020			mg/L	0.4	4/30/2013 9:55:33 AM
Sodium	5.10	0.020			mg/L	0.4	4/30/2013 9:55:33 AM
Zinc	ND	0.020			mg/L	0.4	4/30/2013 9:55:33 AM
HARDNESS TOTAL					**E130.2**		Analyst: **rh**
Hardness (As CaCO3)	9.50	0.200			mg/L CaCO	1	4/30/2013 4:15:00 PM
MERCURY					**E245.1**		Analyst: **rh**
Mercury	ND	0.000200			mg/L	1	4/29/2013 1:45:00 PM
TOTAL DISSOLVED SOLIDS					**2540-C**		Analyst: **ps**
TDS	26.0	25.0			mg/L	1	4/25/2013 9:00:00 AM
TOTAL SUSPENDED SOLIDS					**2540-D**		Analyst: **ps**
Suspended Solids (Residue, Non-Filterable)	6.00	2.00			mg/L	1	4/26/2013 2:00:00 PM
PH					**A4500-H+B**		Analyst: **bfc**
pH	6.16				SI	1	4/23/2013 10:45:00 AM

Qualifiers:				
	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

Analytical Report

WO#: **1304323**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/23/2013 10:45:00 AM
Project: Brownsville Megasite
Lab ID: 1304323-001
Matrix: AQUEOUS
Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
CONDUCTANCE				**2510-B**			Analyst: **bfc**
Conductivity Specific	53	0			µmhos/cm	1	4/23/2013 10:45:00 AM
DISSOLVED OXYGEN				**E360.1**			Analyst: **bfc**
Oxygen, Dissolved	6.73	0.100			mg/L	1	4/23/2013 10:45:00 AM
TEMPERATURE				**2550_B**			Analyst: **bfc**
Temperature	16.2				°C	1	4/23/2013 10:45:00 AM
TURBIDITY				**SM2130-B**			Analyst: **bfc**
Turbidity	0.28	0.0500			NTU	1	4/23/2013 10:45:00 AM
SURFACTANTS				**M5540-C**			Analyst: **SUB**
Surfactants	ND	0.0500	0.500		mg/L	1	4/24/2013 4:58:00 PM
ALKALINITY				**M2320 B**			Analyst: **kh**
Alkalinity, Total (As CaCO3)	ND	20.0			mg/L CaCO	2	4/29/2013 2:34:00 PM
CHLORIDE				**E325.2**			Analyst: **hh**
Chloride	1.93	0.500			mg/L	1	4/26/2013 3:00:00 PM
TOTAL CYANIDE				**E335.4**			Analyst: **hh**
Cyanide	ND	0.00500			mg/L	1	4/24/2013 10:17:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

Analytical Report

WO#: **1304323**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/23/2013 10:45:00 AM
Project: Brownsville Megasite
Lab ID: 1304323-001
Matrix: AQUEOUS
Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
FREE CARBON DIOXIDE				**M4500-CO2 D**			Analyst: **hh**
Bicarbonate	18	1.0			mg/L	1	4/29/2013 3:00:00 PM
Free Carbon Dioxide	52	1.0			mg/L	1	4/29/2013 3:00:00 PM
COLOR - COLORIMETRIC, PLATINUM-COBALT				**E110.3**			Analyst: **SUB**
Color	ND	5.00			PtCo	1	4/24/2013 5:45:00 PM
FLUORIDE				**E340.2**			Analyst: **hh**
Fluoride	0.0630	0.0500		J	mg/L	1	5/2/2013 3:20:00 PM
NITRITE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrite	ND	0.200			mg/L	1	4/23/2013 3:30:00 PM
NITRATE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrate (As N)	ND	0.200			mg/L	1	4/23/2013 3:30:00 PM
TOTAL PHOSPHORUS				**E365.1**			Analyst: **hh**
Phosphorus, Total (As P)	0.183	0.100		J	mg/L	1	4/26/2013 9:12:00 AM
SULFATE				**E375.4**			Analyst: **hh**
Sulfate	ND	5.00			mg/L	1	5/2/2013 9:55:00 AM

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

Analytical Report

WO#: **1304323**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/23/2013 11:00:00 AM
Project: Brownsville Megasite
Lab ID: 1304323-002
Matrix: AQUEOUS
Client Sample ID East Well #2

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
ICP METALS IN DRINKING WATER				**E200.7**			Analyst: **rh**
Aluminum	ND	0.020			mg/L	0.4	4/30/2013 10:01:54 AM
Arsenic	ND	0.004			mg/L	0.4	4/30/2013 10:01:54 AM
Copper	ND	0.008	1.00		mg/L	0.4	4/30/2013 10:01:54 AM
Iron	0.081	0.020			mg/L	0.4	4/30/2013 10:01:54 AM
Lead	ND	0.001	0.015		mg/L	0.4	4/30/2013 10:01:54 AM
Manganese	0.011	0.004			mg/L	0.4	4/30/2013 10:01:54 AM
Silver	ND	0.020			mg/L	0.4	4/30/2013 10:01:54 AM
Sodium	3.10	0.020			mg/L	0.4	4/30/2013 10:01:54 AM
Zinc	ND	0.020			mg/L	0.4	4/30/2013 10:01:54 AM
HARDNESS TOTAL				**E130.2**			Analyst: **rh**
Hardness (As CaCO3)	10.2	0.200			mg/L CaCO	1	4/30/2013 4:15:00 PM
MERCURY				**E245.1**			Analyst: **rh**
Mercury	ND	0.000200			mg/L	1	4/29/2013 1:45:00 PM
TOTAL DISSOLVED SOLIDS				**2540-C**			Analyst: **ps**
TDS	ND	25.0			mg/L	1	4/25/2013 9:00:00 AM
TOTAL SUSPENDED SOLIDS				**2540-D**			Analyst: **ps**
Suspended Solids (Residue, Non-Filterable)	3.00	2.00			mg/L	1	4/26/2013 2:00:00 PM
PH				**A4500-H+B**			Analyst: **bfc**
pH	6.22				SI	1	4/23/2013 11:00:00 AM

Qualifiers:				
	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

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Analytical Report

WO#: **1304323**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Project: Brownsville Megasite
Lab ID: 1304323-002
Client Sample ID East Well #2

Collection Date: 4/23/2013 11:00:00 AM
Matrix: AQUEOUS

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
CONDUCTANCE				**2510-B**			Analyst: **bfc**
Conductivity Specific	42	0			µmhos/cm	1	4/23/2013 11:00:00 AM
DISSOLVED OXYGEN				**E360.1**			Analyst: **bfc**
Oxygen, Dissolved	3.61	0.100			mg/L	1	4/23/2013 11:00:00 AM
TEMPERATURE				**2550_B**			Analyst: **bfc**
Temperature	16.6				°C	1	4/23/2013 11:00:00 AM
TURBIDITY				**SM2130-B**			Analyst: **bfc**
Turbidity	0.47	0.0500			NTU	1	4/23/2013 11:00:00 AM
SURFACTANTS				**M5540-C**			Analyst: **SUB**
Surfactants	ND	0.0500	0.500		mg/L	1	4/24/2013 4:58:00 PM
ALKALINITY				**M2320 B**			Analyst: **kh**
Alkalinity, Total (As CaCO3)	ND	20.0			mg/L CaCO	2	4/29/2013 2:34:00 PM
CHLORIDE				**E325.2**			Analyst: **hh**
Chloride	1.26	0.500			mg/L	1	4/26/2013 3:00:00 PM
TOTAL CYANIDE				**E335.4**			Analyst: **hh**
Cyanide	ND	0.00500			mg/L	1	4/24/2013 10:17:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

Analytical Report

WO#: **1304323**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/23/2013 11:00:00 AM
Project: Brownsville Megasite
Lab ID: 1304323-002
Matrix: AQUEOUS
Client Sample ID East Well #2

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
FREE CARBON DIOXIDE				**M4500-CO2 D**			Analyst: **hh**
Bicarbonate	16	1.0			mg/L	1	4/29/2013 3:00:00 PM
Free Carbon Dioxide	53	1.0			mg/L	1	4/29/2013 3:00:00 PM
COLOR - COLORIMETRIC, PLATINUM-COBALT				**E110.3**			Analyst: **SUB**
Color	ND	5.00			PtCo	1	4/24/2013 5:45:00 PM
FLUORIDE				**E340.2**			Analyst: **hh**
Fluoride	0.0601	0.0500		J	mg/L	1	5/2/2013 3:20:00 PM
NITRITE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrite	ND	0.200			mg/L	1	4/23/2013 3:30:00 PM
NITRATE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrate (As N)	ND	0.200			mg/L	1	4/23/2013 3:30:00 PM
TOTAL PHOSPHORUS				**E365.1**			Analyst: **hh**
Phosphorus, Total (As P)	0.139	0.100		J	mg/L	1	4/26/2013 9:12:00 AM
SULFATE				**E375.4**			Analyst: **hh**
Sulfate	ND	5.00			mg/L	1	5/2/2013 9:55:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

May 03, 2013

Russell Wilson
Wilson Well
8050 Whiteville Newcastle Road
Whiteville, TN 38075
TEL: (731) 415-6550
FAX

RE: Brownsville Megasite Order No.: 1304342

Dear Russell Wilson:

TEC Environmental Laboratories, INC received 2 sample(s) on 4/24/2013 for the analyses presented in the following report.

There were no problems with the analytical events associated with this report unless noted in the Case Narrative. Analytical results designated with a “J” qualifier are estimated and represent a detection above the Method Detection Limit (MDL) and less than the Reporting Limit (PQL).

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

As always we appreciate your business and are pleased to be of service to you.

If you have any questions, please feel free to call or email.

Sincerely,

Billie J. Haynes

Billie Haynes
Laboratory Manager
2269 Dr. F.E. Wright Drive
Jackson, TN 38305

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

Analytical Report

WO#: **1304342**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/24/2013 10:36:00 AM
Project: Brownsville Megasite
Lab ID: 1304342-001
Matrix: AQUEOUS
Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
ICP METALS IN DRINKING WATER				**E200.7**			Analyst: **rh**
Aluminum	ND	0.020			mg/L	0.4	4/30/2013 10:05:07 AM
Arsenic	ND	0.004			mg/L	0.4	4/30/2013 10:05:07 AM
Copper	ND	0.008	1.00		mg/L	0.4	4/30/2013 10:05:07 AM
Iron	0.027	0.020			mg/L	0.4	4/30/2013 10:05:07 AM
Lead	ND	0.001	0.015		mg/L	0.4	4/30/2013 10:05:07 AM
Manganese	0.022	0.004			mg/L	0.4	4/30/2013 10:05:07 AM
Silver	ND	0.020			mg/L	0.4	4/30/2013 10:05:07 AM
Sodium	5.04	0.020			mg/L	0.4	4/30/2013 10:05:07 AM
Zinc	ND	0.020			mg/L	0.4	4/30/2013 10:05:07 AM
HARDNESS TOTAL				**E130.2**			Analyst: **rh**
Hardness (As CaCO3)	9.52	0.200			mg/L CaCO	1	4/30/2013 4:15:00 PM
MERCURY				**E245.1**			Analyst: **rh**
Mercury	ND	0.000200			mg/L	1	4/29/2013 1:45:00 PM
TOTAL DISSOLVED SOLIDS				**2540-C**			Analyst: **ps**
TDS	38.0	25.0			mg/L	1	4/25/2013 9:00:00 AM
TOTAL SUSPENDED SOLIDS				**2540-D**			Analyst: **ps**
Suspended Solids (Residue, Non-Filterable)	ND	2.00			mg/L	1	4/26/2013 2:00:00 PM
PH				**A4500-H+B**			Analyst: **bfc**
pH	5.66				SI	1	4/24/2013 10:36:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

Analytical Report

WO#: **1304342**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/24/2013 10:36:00 AM
Project: Brownsville Megasite
Lab ID: 1304342-001
Matrix: AQUEOUS
Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
CONDUCTANCE					**2510-B**		Analyst: **bfc**
Conductivity Specific	48	0			µmhos/cm	1	4/24/2013 10:36:00 AM
DISSOLVED OXYGEN					**E360.1**		Analyst: **bfc**
Oxygen, Dissolved	7.25	0.100			mg/L	1	4/24/2013 10:36:00 AM
TEMPERATURE					**2550_B**		Analyst: **bfc**
Temperature	15.8				°C	1	4/24/2013 10:36:00 AM
TURBIDITY					**SM2130-B**		Analyst: **bfc**
Turbidity	0.33	0.0500			NTU	1	4/24/2013 10:36:00 AM
SURFACTANTS					**M5540-C**		Analyst: **SUB**
Surfactants	ND	0.0500	0.500		mg/L	1	4/25/2013 6:02:00 PM
ALKALINITY					**M2320 B**		Analyst: **kh**
Alkalinity, Total (As CaCO3)	ND	20.0			mg/L CaCO	2	4/29/2013 2:34:00 PM
CHLORIDE					**E325.2**		Analyst: **hh**
Chloride	1.97	0.500			mg/L	1	4/26/2013 3:00:00 PM
TOTAL CYANIDE					**E335.4**		Analyst: **hh**
Cyanide	ND	0.00500			mg/L	1	5/2/2013 11:50:00 AM

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

Analytical Report

WO#: **1304342**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/24/2013 10:36:00 AM
Project: Brownsville Megasite
Lab ID: 1304342-001
Matrix: AQUEOUS
Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
FREE CARBON DIOXIDE				**M4500-CO2 D**			Analyst: **hh**
Bicarbonate	18	1.0			mg/L	1	4/29/2013 3:00:00 PM
Free Carbon Dioxide	79	1.0			mg/L	1	4/29/2013 3:00:00 PM
COLOR - COLORIMETRIC, PLATINUM-COBALT				**E110.3**			Analyst: **SUB**
Color	ND	5.00			PtCo	1	4/25/2013 6:00:00 PM
FLUORIDE				**E340.2**			Analyst: **hh**
Fluoride	0.146	0.0500		J	mg/L	1	5/2/2013 3:20:00 PM
NITRITE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrite	ND	0.200			mg/L	1	4/25/2013 4:00:00 PM
NITRATE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrate (As N)	ND	0.200			mg/L	1	4/25/2013 4:00:00 PM
TOTAL PHOSPHORUS				**E365.1**			Analyst: **hh**
Phosphorus, Total (As P)	0.185	0.100		J	mg/L	1	4/26/2013 9:12:00 AM
SULFATE				**E375.4**			Analyst: **hh**
Sulfate	ND	5.00			mg/L	1	5/2/2013 9:55:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

Analytical Report

WO#: **1304342**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/24/2013 10:50:00 AM
Project: Brownsville Megasite
Lab ID: 1304342-002
Matrix: AQUEOUS
Client Sample ID East Well #2

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
ICP METALS IN DRINKING WATER				**E200.7**			Analyst: **rh**
Aluminum	ND	0.020			mg/L	0.4	4/30/2013 10:08:17 AM
Arsenic	ND	0.004			mg/L	0.4	4/30/2013 10:08:17 AM
Copper	ND	0.008	1.00		mg/L	0.4	4/30/2013 10:08:17 AM
Iron	0.043	0.020			mg/L	0.4	4/30/2013 10:08:17 AM
Lead	ND	0.001	0.015		mg/L	0.4	4/30/2013 10:08:17 AM
Manganese	0.009	0.004			mg/L	0.4	4/30/2013 10:08:17 AM
Silver	ND	0.020			mg/L	0.4	4/30/2013 10:08:17 AM
Sodium	3.07	0.020			mg/L	0.4	4/30/2013 10:08:17 AM
Zinc	ND	0.020			mg/L	0.4	4/30/2013 10:08:17 AM
HARDNESS TOTAL				**E130.2**			Analyst: **rh**
Hardness (As CaCO3)	9.82	0.200			mg/L CaCO	1	4/30/2013 4:15:00 PM
MERCURY				**E245.1**			Analyst: **rh**
Mercury	ND	0.000200			mg/L	1	4/29/2013 1:45:00 PM
TOTAL DISSOLVED SOLIDS				**2540-C**			Analyst: **ps**
TDS	30.0	25.0			mg/L	1	4/25/2013 9:00:00 AM
TOTAL SUSPENDED SOLIDS				**2540-D**			Analyst: **ps**
Suspended Solids (Residue, Non-Filterable)	ND	2.00			mg/L	1	4/26/2013 2:00:00 PM
PH				**A4500-H+B**			Analyst: **bfc**
pH	5.73				SI	1	4/24/2013 10:50:00 AM

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

Analytical Report

WO#: **1304342**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Project: Brownsville Megasite
Lab ID: 1304342-002
Client Sample ID East Well #2
Collection Date: 4/24/2013 10:50:00 AM
Matrix: AQUEOUS

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
CONDUCTANCE				**2510-B**			Analyst: **bfc**
Conductivity Specific	38	0			µmhos/cm	1	4/24/2013 10:50:00 AM
DISSOLVED OXYGEN				**E360.1**			Analyst: **bfc**
Oxygen, Dissolved	3.48	0.100			mg/L	1	4/24/2013 10:50:00 AM
TEMPERATURE				**2550_B**			Analyst: **bfc**
Temperature	16.4				°C	1	4/24/2013 10:50:00 AM
TURBIDITY				**SM2130-B**			Analyst: **bfc**
Turbidity	0.38	0.0500			NTU	1	4/24/2013 10:50:00 AM
SURFACTANTS				**M5540-C**			Analyst: **SUB**
Surfactants	ND	0.0500	0.500		mg/L	1	4/25/2013 6:02:00 PM
ALKALINITY				**M2320 B**			Analyst: **kh**
Alkalinity, Total (As CaCO3)	ND	20.0			mg/L CaCO	2	4/29/2013 2:34:00 PM
CHLORIDE				**E325.2**			Analyst: **hh**
Chloride	1.30	0.500			mg/L	1	4/26/2013 3:00:00 PM
TOTAL CYANIDE				**E335.4**			Analyst: **hh**
Cyanide	ND	0.00500			mg/L	1	5/2/2013 11:50:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
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TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

Analytical Report

WO#: **1304342**
Date Reported: **5/3/2013**

CLIENT:	Wilson Well	**Collection Date:**	4/24/2013 10:50:00 AM
Project:	Brownsville Megasite		
Lab ID:	1304342-002	**Matrix:**	AQUEOUS
Client Sample ID	East Well #2		

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
FREE CARBON DIOXIDE				**M4500-CO2 D**			Analyst: **hh**
Bicarbonate	16	1.0			mg/L	1	4/29/2013 3:00:00 PM
Free Carbon Dioxide	60	1.0			mg/L	1	4/29/2013 3:00:00 PM
COLOR - COLORIMETRIC, PLATINUM-COBALT				**E110.3**			Analyst: **SUB**
Color	ND	5.00			PtCo	1	4/25/2013 6:00:00 PM
FLUORIDE				**E340.2**			Analyst: **hh**
Fluoride	0.0918	0.0500		J	mg/L	1	5/2/2013 3:20:00 PM
NITRITE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrite	ND	0.200			mg/L	1	4/25/2013 4:00:00 PM
NITRATE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrate (As N)	ND	0.200			mg/L	1	4/25/2013 4:00:00 PM
TOTAL PHOSPHORUS				**E365.1**			Analyst: **hh**
Phosphorus, Total (As P)	0.165	0.100		J	mg/L	1	4/26/2013 9:12:00 AM
SULFATE				**E375.4**			Analyst: **hh**
Sulfate	ND	5.00			mg/L	1	5/2/2013 9:55:00 AM

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

May 03, 2013

Russell Wilson
Wilson Well
8050 Whiteville Newcastle Road
Whiteville, TN 38075
TEL: (731) 415-6550
FAX

RE: Brownsville Megasite Order No.: 1304306

Dear Russell Wilson:

TEC Environmental Laboratories, INC received 2 sample(s) on 4/22/2013 for the analyses presented in the following report.

There were no problems with the analytical events associated with this report unless noted in the Case Narrative. Analytical results designated with a “J” qualifier are estimated and represent a detection above the Method Detection Limit (MDL) and less than the Reporting Limit (PQL).

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

As always we appreciate your business and are pleased to be of service to you.

If you have any questions, please feel free to call or email.

Sincerely,

Billie J. Haynes

Billie Haynes
Laboratory Manager
2269 Dr. F.E. Wright Drive
Jackson, TN 38305

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

Analytical Report

WO#: **1304306**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/22/2013 11:20:00 AM
Project: Brownsville Megasite
Lab ID: 1304306-001
Matrix: AQUEOUS
Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
ICP METALS IN DRINKING WATER				**E200.7**			Analyst: **rh**
Aluminum	ND	0.020			mg/L	0.4	4/30/2013 9:49:11 AM
Arsenic	ND	0.004			mg/L	0.4	4/30/2013 9:49:11 AM
Copper	ND	0.008	1.00		mg/L	0.4	4/30/2013 9:49:11 AM
Iron	0.034	0.020			mg/L	0.4	4/30/2013 9:49:11 AM
Lead	ND	0.001	0.015		mg/L	0.4	4/30/2013 9:49:11 AM
Manganese	ND	0.004			mg/L	0.4	4/30/2013 9:49:11 AM
Silver	ND	0.020			mg/L	0.4	4/30/2013 9:49:11 AM
Sodium	4.96	0.020			mg/L	0.4	4/30/2013 9:49:11 AM
Zinc	ND	0.020			mg/L	0.4	4/30/2013 9:49:11 AM
HARDNESS TOTAL				**E130.2**			Analyst: **rh**
Hardness (As CaCO3)	9.68	0.200			mg/L CaCO	1	4/30/2013 4:15:00 PM
MERCURY				**E245.1**			Analyst: **rh**
Mercury	ND	0.000200			mg/L	1	4/23/2013 1:20:00 PM
TOTAL DISSOLVED SOLIDS				**2540-C**			Analyst: **ps**
TDS	50.0	25.0			mg/L	1	4/25/2013 9:00:00 AM
TOTAL SUSPENDED SOLIDS				**2540-D**			Analyst: **ps**
Suspended Solids (Residue, Non-Filterable)	ND	2.00			mg/L	1	4/26/2013 2:00:00 PM
PH				**A4500-H+B**			Analyst: **bfc**
pH	5.66				SI	1	4/22/2013 11:20:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

CLIENT: Wilson Well
Collection Date: 4/22/2013 11:20:00 AM
Project: Brownsville Megasite
Lab ID: 1304306-001
Matrix: AQUEOUS
Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
CONDUCTANCE					**2510-B**		Analyst: **bfc**
Conductivity Specific	49	0			µmhos/cm	1	4/26/2013 11:47:27 AM
DISSOLVED OXYGEN					**E360.1**		Analyst: **bfc**
Oxygen, Dissolved	7.08	0.100			mg/L	1	4/22/2013 11:20:00 AM
TEMPERATURE					**2550_B**		Analyst: **bfc**
Temperature	16.7				°C	1	4/22/2013 11:20:00 AM
TURBIDITY					**SM2130-B**		Analyst: **rh**
Turbidity	0.170	0.0500			NTU	1	4/22/2013 2:30:00 PM
SURFACTANTS					**M5540-C**		Analyst: **SUB**
Surfactants	ND	0.0500	0.500		mg/L	1	4/23/2013 7:52:00 PM
ALKALINITY					**M2320 B**		Analyst: **kh**
Alkalinity, Total (As CaCO3)	ND	20.0			mg/L CaCO	2	4/22/2013 1:45:00 PM
CHLORIDE					**E325.2**		Analyst: **hh**
Chloride	1.92	0.500			mg/L	1	4/26/2013 3:00:00 PM
TOTAL CYANIDE					**E335.4**		Analyst: **hh**
Cyanide	ND	0.00500			mg/L	1	4/24/2013 10:17:00 AM

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

Analytical Report

WO#: **1304306**
Date Reported: **5/3/2013**

CLIENT: Wilson Well

Collection Date: 4/22/2013 11:20:00 AM

Project: Brownsville Megasite

Lab ID: 1304306-001

Matrix: AQUEOUS

Client Sample ID West Well #1

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
FREE CARBON DIOXIDE				**M4500-CO2 D**			Analyst: **hh**
Bicarbonate	10	1.0			mg/L	1	4/29/2013 3:00:00 PM
Free Carbon Dioxide	44	1.0			mg/L	1	4/29/2013 3:00:00 PM
COLOR - COLORIMETRIC, PLATINUM-COBALT				**E110.3**			Analyst: **SUB**
Color	ND	5.00			PtCo	1	4/23/2013 5:45:00 PM
FLUORIDE				**E340.2**			Analyst: **hh**
Fluoride	0.150	0.0500		J	mg/L	1	5/2/2013 3:20:00 PM
NITRITE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrite	ND	0.200			mg/L	1	4/23/2013 3:30:00 PM
NITRATE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrate (As N)	ND	0.200			mg/L	1	4/23/2013 3:30:00 PM
TOTAL PHOSPHORUS				**E365.1**			Analyst: **hh**
Phosphorus, Total (As P)	0.175	0.100		J	mg/L	1	4/26/2013 9:12:00 AM
SULFATE				**E375.4**			Analyst: **hh**
Sulfate	ND	5.00			mg/L	1	5/2/2013 9:55:00 AM

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

TEC Environmental Laboratories, INC
2269 Dr. F.E. Wright Drive
Jackson, TN 38305
TEL: 731-423-5330 FAX: 731-423-5326
Website: www.tecenvirolabs.com

Analytical Report

WO#: **1304306**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/22/2013 11:35:00 AM
Project: Brownsville Megasite
Lab ID: 1304306-002
Matrix: AQUEOUS
Client Sample ID East Well #2

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
ICP METALS IN DRINKING WATER				**E200.7**			Analyst: **rh**
Aluminum	ND	0.020			mg/L	0.4	4/30/2013 9:52:22 AM
Arsenic	ND	0.004			mg/L	0.4	4/30/2013 9:52:22 AM
Copper	ND	0.008	1.00		mg/L	0.4	4/30/2013 9:52:22 AM
Iron	0.051	0.020			mg/L	0.4	4/30/2013 9:52:22 AM
Lead	ND	0.001	0.015		mg/L	0.4	4/30/2013 9:52:22 AM
Manganese	0.012	0.004			mg/L	0.4	4/30/2013 9:52:22 AM
Silver	ND	0.020			mg/L	0.4	4/30/2013 9:52:22 AM
Sodium	3.09	0.020			mg/L	0.4	4/30/2013 9:52:22 AM
Zinc	ND	0.020			mg/L	0.4	4/30/2013 9:52:22 AM
HARDNESS TOTAL				**E130.2**			Analyst: **rh**
Hardness (As CaCO3)	9.95	0.200			mg/L CaCO	1	4/30/2013 4:15:00 PM
MERCURY				**E245.1**			Analyst: **rh**
Mercury	ND	0.000200			mg/L	1	4/23/2013 1:20:00 PM
TOTAL DISSOLVED SOLIDS				**2540-C**			Analyst: **ps**
TDS	30.0	25.0			mg/L	1	4/25/2013 9:00:00 AM
TOTAL SUSPENDED SOLIDS				**2540-D**			Analyst: **ps**
Suspended Solids (Residue, Non-Filterable)	ND	2.00			mg/L	1	4/26/2013 2:00:00 PM
PH				**A4500-H+B**			Analyst: **bfc**
pH	5.81				SI	1	4/22/2013 11:35:00 AM

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
	J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
	ND	Not Detected at the Reporting Limit	PL	Permit Limit
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

Analytical Report

WO#: **1304306**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Project: Brownsville Megasite
Lab ID: 1304306-002
Client Sample ID East Well #2
Collection Date: 4/22/2013 11:35:00 AM
Matrix: AQUEOUS

Analyses	**Result**	**MDL**	**MCL**	**Qual**	**Units**	**DF**	**Date Analyzed**
CONDUCTANCE				**2510-B**			Analyst: **bfc**
Conductivity Specific	36	0			µmhos/cm	1	4/22/2013 11:35:00 AM
DISSOLVED OXYGEN				**E360.1**			Analyst: **bfc**
Oxygen, Dissolved	3.37	0.100			mg/L	1	4/22/2013 11:35:00 AM
TEMPERATURE				**2550_B**			Analyst: **bfc**
Temperature	16.8				°C	1	4/22/2013 11:35:00 AM
TURBIDITY				**SM2130-B**			Analyst: **rh**
Turbidity	0.360	0.0500			NTU	1	4/22/2013 2:30:00 PM
SURFACTANTS				**M5540-C**			Analyst: **SUB**
Surfactants	ND	0.0500	0.500		mg/L	1	4/23/2013 7:52:00 PM
ALKALINITY				**M2320 B**			Analyst: **kh**
Alkalinity, Total (As CaCO3)	26.0	20.0			mg/L CaCO	2	4/22/2013 1:45:00 PM
CHLORIDE				**E325.2**			Analyst: **hh**
Chloride	1.24	0.500			mg/L	1	4/26/2013 3:00:00 PM
TOTAL CYANIDE				**E335.4**			Analyst: **hh**
Cyanide	ND	0.00500			mg/L	1	4/24/2013 10:17:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

Analytical Report

WO#: **1304306**
Date Reported: **5/3/2013**

CLIENT: Wilson Well
Collection Date: 4/22/2013 11:35:00 AM
Project: Brownsville Megasite
Lab ID: 1304306-002
Matrix: AQUEOUS
Client Sample ID East Well #2

Analyses	Result	MDL	MCL	Qual	Units	DF	Date Analyzed
FREE CARBON DIOXIDE				**M4500-CO2 D**			Analyst: **hh**
Bicarbonate	26	1.0			mg/L	1	4/29/2013 3:00:00 PM
Free Carbon Dioxide	81	1.0			mg/L	1	4/29/2013 3:00:00 PM
COLOR - COLORIMETRIC, PLATINUM-COBALT				**E110.3**			Analyst: **SUB**
Color	ND	5.00			PtCo	1	4/23/2013 5:45:00 PM
FLUORIDE				**E340.2**			Analyst: **hh**
Fluoride	0.128	0.0500		J	mg/L	1	5/2/2013 3:20:00 PM
NITRITE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrite	ND	0.200			mg/L	1	4/23/2013 3:30:00 PM
NITRATE AS N				**E353.2**			Analyst: **hh**
Nitrogen, Nitrate (As N)	ND	0.200			mg/L	1	4/23/2013 3:30:00 PM
TOTAL PHOSPHORUS				**E365.1**			Analyst: **hh**
Phosphorus, Total (As P)	0.214	0.100			mg/L	1	4/26/2013 9:12:00 AM
SULFATE				**E375.4**			Analyst: **hh**
Sulfate	ND	5.00			mg/L	1	5/2/2013 9:55:00 AM

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	M	Manual Integration used to determine area response
ND	Not Detected at the Reporting Limit	PL	Permit Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

ENSAFE
creative thinking. custom solutions.®

June 10, 2019

Jimmy West
Tennessee Department of Economic and Community Development
312 Rosa L. Parks Avenue,
27th Floor
Nashville, Tennessee 37243

Re: Groundwater Sampling and Analytical Results
Memphis Regional Megasite

Dear Mr. West:

Following up with our June 7, 2019 communications, please find attached the laboratory analytical results for two groundwater samples collected on June 3, 2019 at the Memphis Regional Megasite.

As you know, two wells were installed in April 2011 by Wilson Well Co. Incorporated and have historically been identified as the East Well and the West Well. Well locations are shown in Attachment A. Well driller reports are shown in Attachment B and include formation logs, well construction details, locations, and supporting information. The producing interval of the East Well is approximately 320 to 360 feet below ground surface. The producing interval of the West Well is approximately 200 to 240 feet below ground surface.

Pursuant to our conversations, these two wells were flushed and groundwater samples were collected on June 3, 2019. Due to the wells having been stagnate for long periods of time, flushing was performed to obtain samples considered more representative of formation water. An estimated 1,132 gallons of groundwater was purged from the East Well, and an estimated 660 gallons of groundwater was purged from the West Well. Following purging, groundwater samples were collected from each well and analyzed by Waypoint Analytical for parameters requested by a third party. The laboratory analytical reports showing the analyzed parameters, analytical methods, and results are shown in Attachment C for review by the third party.

If you have any questions, comments, or would like any additional information, please do not hesitate to call me at 615-255-9300.

Sincerely,

EnSafe Inc.

Ronald T. Dow, P.G.
Project Manager

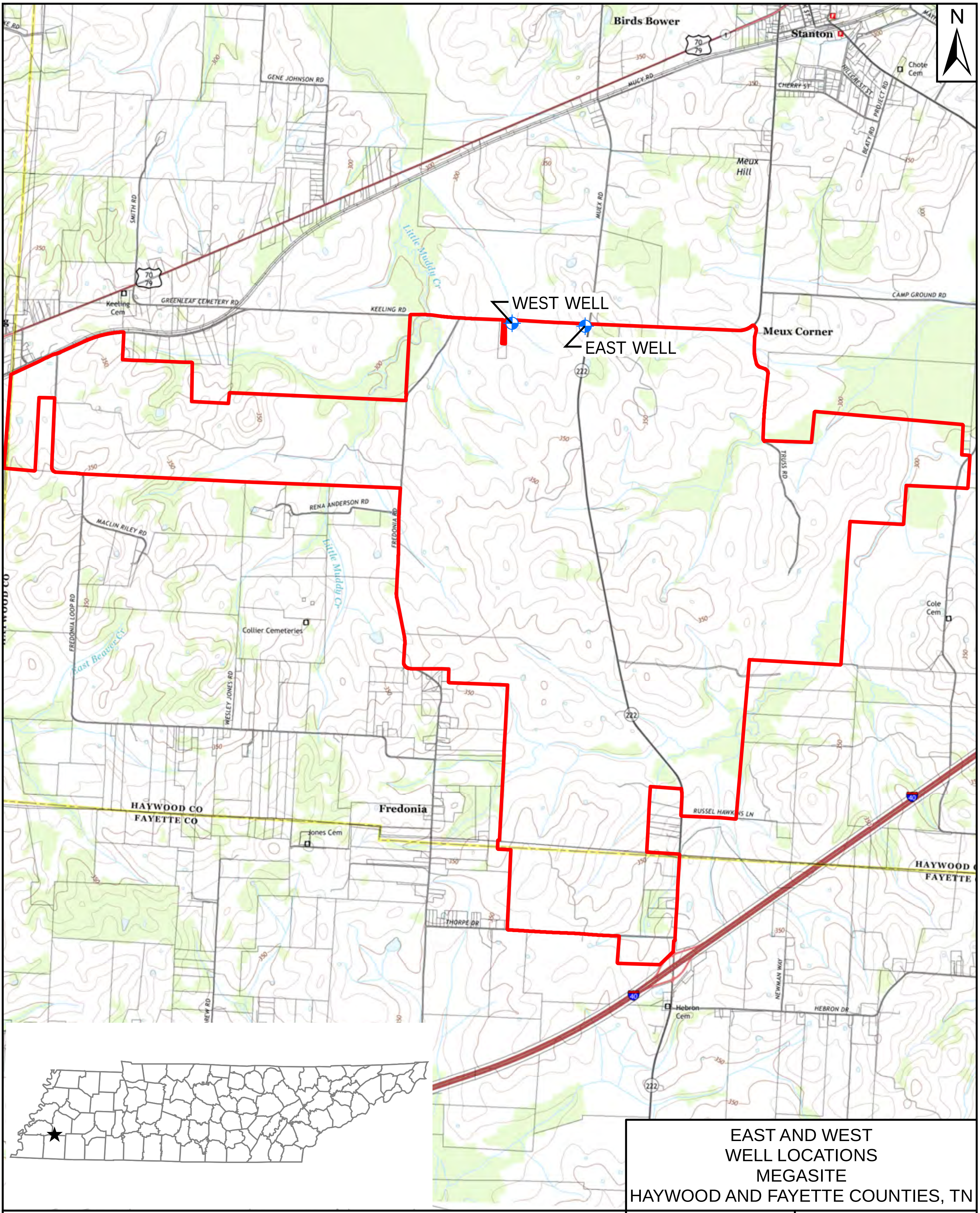
Attachments:

Attachment A	East and West Well Locations Figure
Attachment B	Well Driller Reports
Attachment C	Laboratory Analytical Reports

cc: Laura Waynick, TN DGS

ATTACHMENT A

EAST AND WEST WELL LOCATIONS FIGURE



EAST AND WEST WELL LOCATIONS MEGASITE HAYWOOD AND FAYETTE COUNTIES, TN

REQUESTED BY: R. Dow

DRAWN BY: K. Burnum

DATE: 6/10/2019

PROJECT NO: 08888817147

PITTS NO:

ENSAFE

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Legend

⊕ WELL LOCATION

🟥 APPROXIMATE SITE BOUNDARY

☐ APPROXIMATE PARCEL BOUNDARIES

0 3,500 7,000 Feet

Data Sources: U.S. Geological Survey. Maryville quadrangle, Tennessee. Photorevised 2016. 1:24,000. 7.5 Minute Series.

X:\DGS\Megasite\Site_Vicinity_WellLocations.mxd

ATTACHMENT B

WELL DRILLER REPORTS

TENNESSEE WATER WELL DRILLERS REPORT
DEPARTMENT OF ENVIRONMENT & CONSERVATION

THIS REPORT TO BE SUBMITTED BY DRILLER WITHIN 30 DAYS
AFTER COMPLETION OF DRILLING WATER WELL WITH REQUIRED FEE
TO: DIRECTOR, DIVISION OF WATER SUPPLY, 401 CHURCH ST.
L & C TOWER 6TH FLOOR, NASHVILLE, TENNESSEE 37243-1549

OFFICE USE ONLY
Well No.:
Date Rec'd:
Check#:
Amount Rec'd:
Receipt# Cd#

PLEASE PRINT

(1) WELL CONTRACTOR

Firm Name Wilson Well Co. Inc Lic. No. 565
Rig. Operator Russell Basford
Driller Tag# D#0093108 "West Well"

(2) WELL LOCATION

County Haywood County
Driller Map No. 5 (NUMBER) A (LETTER) (W) (X) (Y) ☒
or
Latitude: 35 (DEG) 26 (MIN) 22.8 (SEC) Longitude 89 (DEG) 25 (MIN) 41.6 (SEC)
Well Address: Keeling Rd. (ROAD OR STREET)
City: Stanton Zip 38069
1/2 Miles (N) (E) (S) [✓ (W)] of Hwy 222 & Keeling Rd (LANDMARK)

(3) TYPE OF WORK

Date drill rig left site: 4 / 7 / 2011
New Well ☒ Deepen ☐ Rework ☐
Backfill And Abandon ☐

(4) WELL COMPLETION DATA

Date Completed 4 / 7 / 2011 Static Level 25.6 Ft.
Total Depth 240 Ft. Estimated Yield 100 GPM
Depth to bedrock - NA - Ft.

(5) WATER-BEARING ZONES

DEPTH IN FT.	GPM	WATER QUALITY
220-240	100gpm	Good/Fair

(6) WELL TEST

Tested By: Pumping ☒ Blowing ☒ Bailing ☐
Static Level 25.6 Ft. Pumping Level 53' Est. Ft. After 8 Hr.
0 Min. At 80 GPM
Development Time Prior to Test 2 hrs Hr. 0 min Min.

(7) FORMATION LOG

DEPTH IN FT. FROM	TO	DESCRIPTION (DENOTE ROCK COLOR & TYPE & CAVES)
0	30	Brown Clay
30 -	40	White Clay
40	140	Med Brown Sand
140	155	Coarse Brwn Sand
155	200	Clay Gray
200	260	Med Brwn Sand
260	340	Med Brwn Sand / Some Strippy Clay
340	365	Med Uniform Sand "good"

(If additional space is needed, use back of form or use comments section)

(8) COMMENTS

5 H.p. - 80 gpm 10EC Reel Jacket Pump
5 H.p. 1 phase Franklin Motor
5 H.p. - Standard Control Box
Pump Setting - 120 Feet
↳ on 120' - 2" Certa-lok Drop
1 - 4" x 2" Simmons Well Seal
Test Bore" - Drilled to 365 ft / Electric + Gamma Logged
Logged By USGS

(9) WELL OWNER

Name S. S. O. E. (FIRST) (LAST)
or Company S.S.O.E, Inc.
Address 1001 Madison Ave.
City Toledo State OH Zip 43604
Phone # (419) 255 - 4241

(10) PROPOSED USE OF WELL

Residential ☐ Commercial ☐ Industrial ☐ Monitor ☐ Test ☒
Farm ☐ Irrigation ☐ Heat Pump ☐ Municipal ☐ Other ☐
(Specify) 4" Test Well for H_2O Quality

(11) PRIMARY CASING

Diameter 4 Inches Top Set 6" Above In Ground
From Land Surface to 220 ft. Ft. below ground
Type: Plastic ☒ Steel ☐ Galvanized ☐
Concrete ☐ Other ☐ None ☐
Wall Thickness Sch. 80 or SDR# 26+

(12) WELL FINISH

Open Hole ☐ Screen ☐ Slotted or Perf. Pipe ☒
From 220 Ft. To 240 Ft.
If Screen, Plastic ☒ Metal ☐ Slot Size .010 In.
Gravel Pack From: 200' Ft. to 240' Ft.

(13) BACK FILL MATERIAL

Bentonite ☒ Cement ☐ From 3 Ft. to 10 Ft.

	From	To		From	To
Cuttings			Sand		
Bentonite			Cement		
Other (Specify) Bent. Chips	200	Grd. level			

(14) LINER CASING Yes ☐ No ☐

N/A

Type: Plastic ☐ Steel ☐ Diameter In.
From: — Ft. to — Ft.
Packers Installed? Yes ☐ No ☐
Location: Ft. and Ft.

(15) ANTICIPATED WATER QUALITY

Clear ☒ Cloudy ☐ Dingy ☐ Muddy ☐
Good ☒ Fair ☐ Bad ☐ Iron ☐ Sulfur ☐
Gas ☐ Oil ☐ Salt ☐
Other ☐ (specify) H_2O Quality Looks to be good.

(16) GENERAL INFORMATION

Well Disinfected: Yes ☒ No ☐
Well Capped: Yes ☐ No ☒
Well located greater than fifty feet from septic tank & field line: Yes ☒ No ☐ No Septic
From information provided by:
☒ Property owner (provide written statement by owner)
☒ Driller determination
☐ Health Department permit
Drilling process water obtained from:
Well ☒ Springbox ☐ Public Supply ☐ Surface Supply ☐
Pump Installed by Driller: Yes ☒ No ☐

I certify that the above information is true and accurate to the best of my knowledge. Signed Russell G. Basford #906 Licensed Driller

CN-0825 (Rev. 10-98) **Distribution:** White - Central Office Canary - Driller Pink - Homeowner

RDA 1520

TENNESSEE WATER WELL DRILLERS REPORT
DEPARTMENT OF ENVIRONMENT & CONSERVATION

THIS REPORT TO BE SUBMITTED BY DRILLER WITHIN 30 DAYS
AFTER COMPLETION OF DRILLING WATER WELL WITH REQUIRED FEE
TO: DIRECTOR, DIVISION OF WATER SUPPLY, 401 CHURCH ST.
L & C TOWER 6TH FLOOR, NASHVILLE, TENNESSEE 37243-1549

OFFICE USE ONLY
Well No.:
Date Rec'd:
Check#:
Amount Rec'd:
Receipt# Cd#

PLEASE PRINT

(1) WELL CONTRACTOR
Firm Name: Wilson Well Co. Inc Lic. No. 565
Rig. Operator: Russell G. Basford #906
Driller Tag# D#0093109 "EAST WELL"

(2) WELL LOCATION
County: Haywood County
Driller Map No.: 5 (NUMBER) A (LETTER) (W) (X) (Y) [✓ (Z)]
or Latitude: 35 DEG 26 MIN 22.7 SEC Longitude 89 DEG 25 MIN 17.8 SEC
Well Address: Hwy 222 (ROAD OR STREET)
City: Stanton Zip
0.0 Miles (N) (E) (S) [✓ (W)] of Intersection Hwy 222 + Keeling Rd (LANDMARK)

(3) TYPE OF WORK
Date drill rig left site: 4 / 19 / 11
New Well ☒ Deepen ☐ Rework ☐
Backfill And Abandon ☐

(4) WELL COMPLETION DATA
Date Completed 4 / 19 / 11 Static Level 47' Ft.
Total Depth 360 Ft. Ft. Estimated Yield 100 GPM
Depth to bedrock -NA- Ft.

(5) WATER-BEARING ZONES

DEPTH IN FT.	GPM	WATER QUALITY
330'-360'	100gpm	Good/Fair

(6) WELL TEST
Tested By: Pumping ☒ Blowing ☒ Bailing ☐
Static Level 47 Ft. Pumping Level +,- 56' Ft. After 8 Hr.
0 Min. At 80 GPM
Development Time Prior to Test 2 Hr. 0 Min.

(7) FORMATION LOG

DEPTH IN FT. FROM	TO	DESCRIPTION (DENOTE ROCK COLOR & TYPE & CAVES)
0	5	Topsoil
5	60	Clay
60	90	Strippy Clay
90	140	Med Brwn Sand
140	280	Sand
280	340	Sand w/Occasional Strips
330	415	Med/Crs Sand
415	540	Sand/Strippy Clay
540	615	Med Sand
615	700	Clay / Rock Strips

(If additional space is needed, use back of form or use comments section)

(8) COMMENTS
Hit Rock @ 642' & Again @ 668 ft/Rock
Just Test Well was Drilled & Electric/Gamma logged down to 700'
Pump - 80gpm 10EC Red Jacket
Mtr 5h.p. Franklin Motor
Standard 5hp. Control Box
Pump Set @ 160' - 2" Certa-lok Drop Pipe
1 - 4"x2" Well Seal
→ Over

(9) WELL OWNER
Name: S.S.O.E. Inc. (FIRST / LAST)
or Company: S.S.O.E Inc.
Address: 1001 Madison Ave.
City: Toledo State OH Zip 43604
Phone # (419) 255-4241

(10) PROPOSED USE OF WELL
Residential ☐ Commercial ☐ Industrial ☐ Monitor ☐ Test ☒
Farm ☐ Irrigation ☐ Heat Pump ☐ Municipal ☐ Other ☐
(Specify) WEST TEST WELL

(11) PRIMARY CASING
Diameter 4" Inches Top Set 6" Above In Ground
From Land Surface to 340 Ft. Ft. below ground
Type: Plastic ☒ Steel ☐ Galvanized ☐
Concrete ☐ Other ☐ None ☐
Wall Thickness Sch 80 Certa-lok or SDR# 26 +

(12) WELL FINISH
Open Hole ☐ Screen ☐ Slotted or Perf. Pipe ☒
From 340' Ft. To 360' Ft.
If Screen, Plastic ☒ Metal ☐ Slot Size .010 In.
Gravel Pack From: 320' Ft. to 360' Ft.

(13) BACK FILL MATERIAL
Bentonite ☒ Cement ☐ From 3 Ft. to 10 Ft.
From To From To
Cuttings Sand
Bentonite Cement
Other (Specify) Bent. Chips 300 G. Level

(14) LINER CASING Yes ☐ No ☐
Type: Plastic ☐ Steel ☐ Diameter In.
From: Ft. to Ft.
Packers Installed? Yes ☐ No ☐
Location: Ft. and Ft.

(15) ANTICIPATED WATER QUALITY
Clear ☒ Cloudy ☐ Dingy ☐ Muddy ☐
Good ☒ Fair ☒ Bad ☐ Iron ☐ Sulfur ☐
Gas ☐ Oil ☐ Salt ☐
Other ☐ (specify) TEC LABS TESTED H_2O

(16) GENERAL INFORMATION
Well Disinfected: Yes ☒ No ☐
Well Capped: Yes ☐ No ☒
Well located greater than fifty feet from septic tank & field line: Yes ☒ No ☐
From information provided by:
☒ Property owner (provide written statement by owner)
☒ Driller determination
☐ Health Department permit
Drilling process water obtained from:
Well ☒ Springbox ☐ Public Supply ☐ Surface Supply ☐
Pump Installed by Driller: Yes ☒ No ☐

I certify that the above information is true and accurate to the best of my knowledge. Signed Russell G. Basford #906 TN. Lic# Licensed Driller

Distribution: White - Central Office Canary - Driller Pink - Homeowner

CN-0825 (Rev. 10-98) RDA 1520

ATTACHMENT C

LABORATORY ANALYTICAL REPORTS

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

6/10/2019

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 19-154-0225
Client Project Description: Silent Noise II
Haywood County, TN
FID #Megasite/Haywood Co
Project #0888821780

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 6/3/2019 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule August 2017) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Alabama	#40750	Louisiana	#04015	VA NELAP	#460181	Texas	#T104704180	Arkansas	#88-0650
Mississippi		California	#2904	NC	#415	Oklahoma	#9311	SC	#84002
Kentucky	#90047	Tennessee	#TN02027	EPA	#TN00012	Kentucky UST	#80215	PA DEP	#68-03195

Sample Summary Table

Report Number: **19-154-0225**

Client Project Description:
Silent Noise II
Haywood County, TN
FID #Megasite/Haywood Co
Project #0888821780

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
92428	East H6319	Aqueous	06/03/2019 09:40	06/03/2019
92430	West G6319	Aqueous	06/03/2019 10:25	06/03/2019

Client: EnSafe, Inc.
Project: Silent Noise II
Lab Report Number: 19-154-0225
Date: 6/7/2019

CASE NARRATIVE

Total Metals Method EPA-200.7

Sample 92428 (East H6319)
Analyte: Zinc
QC Batch No: L439593/L439425
Target analyte(s) was identified in the method blank associated with this project. Per laboratory protocol any associated affected sample result is flagged "B" to indicate that it was detected in the method blank.

Sample 92430 (West G6319)
Analyte: Zinc
QC Batch No: L439593/L439425
Target analyte(s) was identified in the method blank associated with this project. Per laboratory protocol any associated affected sample result is flagged "B" to indicate that it was detected in the method blank.

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project Information : Silent Noise II
Haywood County, TN
FID #Megasite/Haywood Co

Report Date : 06/10/2019
Received : 06/03/2019

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **19-154-0225**

REPORT OF ANALYSIS

Lab No : **92428**
Sample ID : **East H6319**

Matrix: **Aqueous**
Sampled: **6/3/2019 9:40**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Alkalinity (as CaCO3)	**6**	mg/L	1	1	1	06/04/19 09:56	CJH	2320B-2011
Bicarbonate	**6**	mg/L	1	1	1	06/04/19 09:56	CJH	2320B-2011
Carbonate	<2	mg/L	2	2	1	06/04/19 09:56	CJH	2320B-2011
Ammonia Nitrogen	<0.030	mg/L	0.030	0.100	1	06/04/19 13:25	EWB	4500NH3D-2011
Fecal Coliform	<2	MPN/100mL	2	2	1	06/03/19 12:54	IEW	Colilert-18
Chloride	**1.16**	mg/L	0.052	0.400	1	06/03/19 12:53	CCR	EPA-300.0
Conductivity	**31.5**	µS/cm	0.010	0.010	1	06/06/19 12:24	IEW	2510B-2011
Nitrate (NO3-N)	**0.034 J**	mg/L	0.017	0.100	1	06/03/19 12:53	CCR	EPA-300.0
pH	**6.0**	s.u.			1	06/03/19 15:20	TSP	4500H+B-2011
Total Dissolved Solids	<50.5	mg/L	50.5	50.5	1	06/03/19 17:09	CxC	2540C-2011
Total Suspended Solids	**9**	mg/L	2	2	1	06/05/19 09:59	ADM	2540D-2011
Phosphorus	**0.371 J**	mg/L	0.123	0.500	1	06/05/19 14:29	CLP	365.4
TOC	<0.500	mg/L	0.500	1.00	1	06/04/19 22:59	TJS	5310C-2011
Calcium	**2.82**	mg/L	0.290	0.500	1	06/05/19 14:20	BKN	EPA-200.7
Copper	<0.0020	mg/L	0.0020	0.0050	1	06/05/19 03:59	KKM	EPA-200.7
Hardness as CaCO3(SM-2340B)	**10.5**	mg/L	0.0318	0.100	1	06/05/19 03:59		EPA-200.7
Iron	**0.276**	mg/L	0.0806	0.100	1	06/05/19 03:59	KKM	EPA-200.7
Magnesium	**0.830**	mg/L	0.0318	0.100	1	06/05/19 03:59	KKM	EPA-200.7
Manganese	<0.0062	mg/L	0.0062	0.0100	1	06/05/19 03:59	KKM	EPA-200.7
Silicon	**5.17**	mg/L	0.0400	0.0500	1	06/05/19 03:59	KKM	EPA-200.7
Silicon as SiO2	**11.1**	mg/L	0.040	0.050	1	06/05/19 03:59		CALCULATION~
Sodium	**3.02**	mg/L	0.200	0.500	1	06/05/19 03:59	KKM	EPA-200.7
Zinc	**0.0581 B**	mg/L	0.0089	0.0100	1	06/07/19 11:22	BKN	EPA-200.7

Qualifiers/ Definitions

B	Analyte detected in blank	DF	Dilution Factor
J	Estimated value	MQL	Method Quantitation Limit

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Project Information : Silent Noise II
Haywood County, TN
FID #Megasite/Haywood Co

Report Date : 06/10/2019
Received : 06/03/2019

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **19-154-0225**

REPORT OF ANALYSIS

Lab No : **92428**
Sample ID : **East H6319**

Matrix: **Aqueous**
Sampled: **6/3/2019 9:40**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Sulfate	**1.31**	mg/L	0.118	1.00	1	06/03/19 12:53	CCR	EPA-300.0

Qualifiers/ Definitions				
	B	Analyte detected in blank	DF	Dilution Factor
	J	Estimated value	MQL	Method Quantitation Limit

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EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project Information : Silent Noise II
Haywood County, TN
FID #Megasite/Haywood Co

Report Date : 06/10/2019
Received : 06/03/2019

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **19-154-0225**

REPORT OF ANALYSIS

Lab No : **92430**
Sample ID : **West G6319**

Matrix: **Aqueous**
Sampled: **6/3/2019 10:25**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Alkalinity (as CaCO3)	**8**	mg/L	1	1	1	06/04/19 09:56	CJH	2320B-2011
Bicarbonate	**8**	mg/L	1	1	1	06/04/19 09:56	CJH	2320B-2011
Carbonate	<2	mg/L	2	2	1	06/04/19 09:56	CJH	2320B-2011
Ammonia Nitrogen	<0.030	mg/L	0.030	0.100	1	06/04/19 13:25	EWB	4500NH3D-2011
Fecal Coliform	<1	MPN/100mL	1	1	1	06/03/19 12:54	IEW	Colilert-18
Chloride	**1.91**	mg/L	0.052	0.400	1	06/03/19 13:26	CCR	EPA-300.0
Conductivity	**39.0**	µS/cm	0.010	0.010	1	06/06/19 12:24	IEW	2510B-2011
Nitrate (NO3-N)	**0.042 J**	mg/L	0.017	0.100	1	06/03/19 13:26	CCR	EPA-300.0
pH	**6.2**	s.u.			1	06/03/19 15:20	TSP	4500H+B-2011
Total Dissolved Solids	<50.0	mg/L	50.0	50.0	1	06/03/19 17:09	CxC	2540C-2011
Total Suspended Solids	<2	mg/L	2	2	1	06/05/19 09:59	ADM	2540D-2011
Phosphorus	**0.357 J**	mg/L	0.123	0.500	1	06/05/19 14:31	CLP	365.4
TOC	<0.500	mg/L	0.500	1.00	1	06/04/19 23:32	TJS	5310C-2011
Calcium	**2.82**	mg/L	0.290	0.500	1	06/05/19 14:25	BKN	EPA-200.7
Copper	<0.0020	mg/L	0.0020	0.0050	1	06/05/19 04:04	KKM	EPA-200.7
Hardness as CaCO3(SM-2340B)	**10.8**	mg/L	0.0318	0.100	1	06/05/19 04:04		EPA-200.7
Iron	<0.0806	mg/L	0.0806	0.100	1	06/05/19 04:04	KKM	EPA-200.7
Magnesium	**0.916**	mg/L	0.0318	0.100	1	06/05/19 04:04	KKM	EPA-200.7
Manganese	<0.0062	mg/L	0.0062	0.0100	1	06/05/19 04:04	KKM	EPA-200.7
Silicon	**6.75**	mg/L	0.0400	0.0500	1	06/05/19 04:04	KKM	EPA-200.7
Silicon as SiO2	**14.4**	mg/L	0.040	0.050	1	06/05/19 04:04		CALCULATION~
Sodium	**5.22**	mg/L	0.200	0.500	1	06/05/19 04:04	KKM	EPA-200.7
Zinc	**0.0522 B**	mg/L	0.0089	0.0100	1	06/07/19 11:28	BKN	EPA-200.7

Qualifiers/ Definitions

B	Analyte detected in blank	DF	Dilution Factor
J	Estimated value	MQL	Method Quantitation Limit

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Project Information : Silent Noise II
Haywood County, TN
FID #Megasite/Haywood Co

Report Date : 06/10/2019
Received : 06/03/2019

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **19-154-0225**

REPORT OF ANALYSIS

Lab No : **92430**
Sample ID : **West G6319**

Matrix: **Aqueous**
Sampled: **6/3/2019 10:25**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Sulfate	**0.631 J**	mg/L	0.118	1.00	1	06/03/19 13:26	CCR	EPA-300.0

Qualifiers/ Definitions

B	Analyte detected in blank	DF	Dilution Factor
J	Estimated value	MQL	Method Quantitation Limit

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **Silent Noise II**
Report No: **19-154-0225**

QC Analytical Batch: L438790
Analysis Method: 2320B-2011
Analysis Description: Alkalinity

Laboratory Control Sample LCS

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Alkalinity (as CaCO3)	mg/L	472	452	95.7	90-110

Duplicate L 99112-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Alkalinity (as CaCO3)	mg/L	35	37	5.5	10	06/04/19 09:56
Bicarbonate	mg/L	35	37	5.5	10	06/04/19 09:56
Carbonate	mg/L	< 2	<2	0.0	10	06/04/19 09:56

Quality Control Data

Client ID: **EnSafe, Inc.**

Project Description: **Silent Noise II**

Report No: **19-154-0225**

QC Analytical Batch: L439135
Analysis Method: 2510B-2011
Analysis Description: Conductivity/Resistivity

Duplicate L 89327-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Conductivity	µS/cm	214	216	0.9	10.0	06/06/19 12:24

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **Silent Noise II**
Report No: **19-154-0225**

QC Analytical Batch: L438952
Analysis Method: 2540C-2011
Analysis Description: Total Dissolved Solids

Laboratory Control Sample LCS

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Total Dissolved Solids	mg/L	250	248	99.2	90-110

Duplicate L 91985-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Total Dissolved Solids	mg/L	534	546	2.2	10.0	06/03/19 17:09

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **Silent Noise II**
Report No: **19-154-0225**

QC Analytical Batch: L439025
Analysis Method: 2540D-2011
Analysis Description: Total Suspended Solids

Lab Reagent Blank LRB Matrix: AQU
Associated Lab Samples: 92428, 92430

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Total Suspended Solids	mg/L	<2	2	2	06/05/19 09:59

Duplicate L 89364-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Total Suspended Solids	mg/L	3	3	0.0	10	06/05/19 09:59

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **Silent Noise II**
Report No: **19-154-0225**

QC Prep: L439056
QC Prep Batch Method: TKN/TKP Digestion
QC Analytical Batch(es): L439105
Analysis Method: 365.4
Analysis Description: Total Phosphorus

Lab Reagent Blank LRB-L439056 Matrix: AQU
Associated Lab Samples: 92428, 92430

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Phosphorus	mg/L	<0.123	0.123	0.500	06/05/19 14:23

Laboratory Control Sample LCS-L439056

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Phosphorus	mg/L	4.00	4.02	101	80-120

Duplicate L 91516-DUP-L439056

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Phosphorus	mg/L	2.27	2.28	0.4	20.0	06/05/19 14:27

Matrix Spike L 91516-MS-L439056

Parameter	Units	Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS %Rec	%Rec Limits	Max RPD
Phosphorus	mg/L	2.27	4.00		6.44		104	70-130	

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **Silent Noise II**
Report No: **19-154-0225**

QC Analytical Batch: L438805
Analysis Method: 4500NH3D-2011
Analysis Description: Ammonia Nitrogen (ISE)

Lab Reagent Blank LRB Matrix: AQU
Associated Lab Samples: 92428, 92430

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Ammonia Nitrogen	mg/L	<0.030	0.030	0.100	06/04/19 13:25

Laboratory Control Sample LCS

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Ammonia Nitrogen	mg/L	5.00	5.04	101	91-115

Matrix Spike & Matrix Spike Duplicate L 90934-MS L 90934-MSD

Parameter	Units	Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS %Rec	MSD %Rec	%Rec Limits	RPD	Max RPD
Ammonia Nitrogen	mg/L	207	200	200	404	401	98.5	97.0	70-130	0.7	20.0

Quality Control Data

Client ID:	**EnSafe, Inc.**
Project Description:	**Silent Noise II**
Report No:	**19-154-0225**

QC Prep:	L439049	**QC Analytical Batch(es):**	L439076
QC Prep Batch Method:	5310C-2011	**Analysis Method:**	5310C-2011
		Analysis Description:	Total Organic Carbon

Lab Reagent Blank LRB-L439049 Matrix: AQU

Associated Lab Samples: 92428, 92430

Parameter	Units	Blank Result	MDL	MQL	Analyzed
TOC	mg/L	<0.500	0.500	1.00	06/04/19 13:39

Laboratory Control Sample LCS-L439049

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
TOC	mg/L	5.00	5.11	102	85-115

Matrix Spike & Matrix Spike Duplicate L 92373-MS-L439049 L 92373-MSD-L439049

Parameter	Units	Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS %Rec	MSD %Rec	%Rec Limits	RPD	Max RPD
TOC	mg/L	< 0.526	5.26	5.26	6.02	5.97	114	113	70-130	0.8	20.0

Quality Control Data

Client ID:	**EnSafe, Inc.**
Project Description:	**Silent Noise II**
Report No:	**19-154-0225**

QC Prep:	L438759	**QC Analytical Batch(es):**	L438996,L439273
QC Prep Batch Method:	EPA-200.7 (PREP)	**Analysis Method:**	EPA-200.7
		Analysis Description:	Total Metals

Lab Reagent Blank LRB-L438759 Matrix: AQU

Associated Lab Samples: 92428, 92430

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Calcium	mg/L	<0.290	0.290	0.500	06/05/19 14:15
Copper	mg/L	<0.0020	0.0020	0.0050	06/05/19 03:18
Iron	mg/L	<0.0806	0.0806	0.100	06/05/19 03:18
Magnesium	mg/L	<0.0318	0.0318	0.100	06/05/19 03:18
Manganese	mg/L	<0.0062	0.0062	0.0100	06/05/19 03:18
Silicon	mg/L	<0.0400	0.0400	0.0500	06/05/19 03:18
Sodium	mg/L	<0.200	0.200	0.500	06/05/19 03:18

Laboratory Control Sample LCS-L438759

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Calcium	mg/L	10.0	10.4	104	85-115
Copper	mg/L	1.00	0.963	96.3	85-115
Iron	mg/L	10.0	9.69	96.9	85-115
Magnesium	mg/L	10.0	9.62	96.2	85-115
Manganese	mg/L	1.00	1.03	103	85-115
Silicon	mg/L	1.00	0.950	95.0	85-115
Sodium	mg/L	10.0	9.99	99.9	85-115

Matrix Spike & Matrix Spike Duplicate L 91932-MS-L438759 L 91932-MSD-L438759

Parameter	Units	Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS %Rec	MSD %Rec	%Rec Limits	RPD	Max RPD
Calcium	mg/L	7.89	10.0	10.0	18.1	17.6	102	97.1	70-130	2.8	20.0
Copper	mg/L	0.0073	1.00	1.00	0.996	0.967	98.8	95.9	70-130	2.9	20.0
Iron	mg/L	0.197	10.0	10.0	10.1	9.83	99.0	96.3	70-130	2.7	20.0
Magnesium	mg/L	0.629	10.0	10.0	10.5	10.3	98.7	96.7	70-130	1.9	20.0

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **Silent Noise II**
Report No: **19-154-0225**

QC Prep: L438759
QC Prep Batch Method: EPA-200.7 (PREP)

QC Analytical Batch(es): L438996
Analysis Method: EPA-200.7
Analysis Description: Total Metals

Matrix Spike & Matrix Spike Duplicate L 91932-MS-L438759 L 91932-MSD-L438759

Parameter	Units	Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS %Rec	MSD %Rec	%Rec Limits	RPD	Max RPD
Manganese	mg/L	0.0312	1.00	1.00	1.08	1.05	105	102	70-130	2.8	20.0
Silicon	mg/L	1.03	1.00	1.00	2.07	2.01	104	98.0	70-130	2.9	20.0
Sodium	mg/L	1.87	10.0	10.0	11.9	11.7	100	98.3	70-130	1.6	20.0

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **Silent Noise II**
Report No: **19-154-0225**

QC Prep: L439425
QC Prep Batch Method: EPA-200.7 (PREP)

QC Analytical Batch(es): L439593
Analysis Method: EPA-200.7
Analysis Description: Total Metals

Lab Reagent Blank LRB-L439425 Matrix: AQU
Associated Lab Samples: 92428, 92430

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Zinc	mg/L	0.0095	0.0089	0.0100	06/07/19 13:02

Laboratory Control Sample LCS-L439425

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Zinc	mg/L	1.00	0.994	99.4	85-115

Matrix Spike & Matrix Spike Duplicate L 94356-MS-L439425 L 94356-MSD-L439425

Parameter	Units	Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS %Rec	MSD %Rec	%Rec Limits	RPD	Max RPD
Zinc	mg/L	0.243	1.00	1.00	1.18	1.15	93.7	90.7	70-130	2.5	20.0

Quality Control Data

Client ID:	**EnSafe, Inc.**
Project Description:	**Silent Noise II**
Report No:	**19-154-0225**

QC Prep: L438791
QC Prep Batch Method: EPA-300.0 (PREP)

QC Analytical Batch(es): L439085
Analysis Method: EPA-300.0
Analysis Description: Anions by Ion Chromatography

Lab Reagent Blank LRB-L438791 Matrix: AQU
Associated Lab Samples: 92428, 92430

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Chloride	mg/L	<0.052	0.052	0.400	06/03/19 10:51
Nitrate (NO3-N)	mg/L	<0.017	0.017	0.100	06/03/19 10:51
Sulfate	mg/L	<0.118	0.118	1.00	06/03/19 10:51

Laboratory Control Sample LCS-L438791

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Chloride	mg/L	55.6	57.7	104	90-110
Nitrate (NO3-N)	mg/L	12.5	12.6	100	90-110
Sulfate	mg/L	69.4	69.9	101	90-110

Matrix Spike & Matrix Spike Duplicate L 92428-MS-L438791 L 92428-MSD-L438791

Parameter	Units	Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS %Rec	MSD %Rec	%Rec Limits	RPD	Max RPD
Chloride	mg/L	1.16	26.3	26.3	28.3	28.6	103	104	80-120	1.0	20.0
Nitrate (NO3-N)	mg/L	0.034	5.94	5.94	6.13	6.21	103	105	80-120	1.2	20.0
Sulfate	mg/L	1.31	32.9	32.9	34.3	34.6	100	101	80-120	0.8	20.0

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Cooler Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **19-154-0225**

Shipping Method

○ Fed Ex ○ US Postal ○ Lab ○ Other :
○ UPS ● Client ○ Courier Thermometer ID: t45

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Required
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Required
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	○ Yes	● No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr) ☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d) ☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments: Per Ron Dow, do not analyze sample East G6319.

Signature: Carleen Qualls Date & Time: 06/03/2019 11:38:26

Waypoint ANALYTICAL

19-154-0226
05627
06-03-2019
12:37:46
EnSafe, Inc.
Silent Noise II

Kit ID:	0000118162
Initiated By:	Rebekah Barger Ross
Initiated Date:	5/31/2019
Project Comment	

CHAIN-OF-CUSTODY

19-154-0225
05627
06-03-2019
11:37:37
EnSafe, Inc.
Silent Noise II

Company Name EnSafe, Inc.	**Company Number** 05627	**Client Project Manager/Contact** Mr. Ron Dow	**Purchase Order Number** 27735
Site Name Silent Noise II - Haywood County, TN	**Project Number** 0888821780	☐ RUSH – Additional charges apply ☐ Special Detection Limits(s) Date Results Needed	**Method of Shipment** ☐ Fed Ex ☐ UPS ☐ USPS ☐ Courier ☑ Client Drop Off Other
LIMS Project ID Ensafe - Silent Noise II	**Project Manager Phone #** (615) 252-2834	**Project Manager Email** rdow@ensafe.com	**Site/Facility ID #** Megasite / Haywood Co

Date	Time	Sample ID	Matrix	Grab/ Comp	# of Cont	Container Type	Preservation	Analyses
6/3/19	0935	EAST G6319	Aqueous	G	1	Plastic - Quart	NONE	TDS, TSS, Alkalinity, Sulfate, Chloride, Nitrate, Conductivity, pH
		EAST G6319	Aqueous	G	1	Plastic - Quart	NONE	BOD
		EAST G6319	Aqueous	G	1	Plastic - Pint	HNO3 - Nitric Acid	Fe, Mn, Cu, Zn, Na, Hardness, Silica as SiO2
		EAST G6319	Aqueous	G	1	Plastic - 100ml Micro	Na2S2O3 - Sodium Thiosulfate	Fecal Coliform
		EAST G6319	Aqueous	G	1	Plastic - Pint	H2SO4 - Sulfuric Acid	Ammonia, Phosphorus
	↓	EAST G6319	Aqueous	G	3	Glass Vial Clear - 40ml	H3PO4 - Phosphoric Acid	TOC
↓	0940	EAST H6319	Aqueous	G	1	Plastic - Quart	NONE	TDS, TSS, Alkalinity, Sulfate, Chloride, Nitrate, Conductivity, pH

For Laboratory Use Only

Ice	Custody Seals	Lab Comments
[✓ Y]/N	Y/[✓ N]	

Blank/Cooler Temp CW
T45 4.1°C

Sampled by (Name - Print) Ben Brantley

Client Remarks/Comments

Relinquished by: (SIGNATURE)	Date	Time	Received by: (SIGNATURE)	Date	Time
Ben Brantley	6/3/19	1130			
			J. Smith	6.3.19	11:50

Waypoint ANALYTICAL

19-154-0226
05627
06-03-2019
12:37:46
EnSafe, Inc.
Silent Noise II

CHAIN-OF-CUSTODY

19-154-0225
05627
06-03-2019
11:37:37
EnSafe, Inc.
Silent Noise II

Kit ID:	0000118162
Initiated By:	Rebekah Barger Ross
Initiated Date:	5/31/2019
Project Comment	

Company Name EnSafe, Inc.	**Company Number** 05627	**Client Project Manager/Contact** Mr. Ron Dow	**Purchase Order Number** 27735
Site Name Silent Noise II - Haywood County, TN	**Project Number** 0888821780	☐ RUSH – Additional charges apply ☐ Special Detection Limits(s) Date Results Needed	**Method of Shipment** ☐ Fed Ex ☐ UPS ☐ USPS ☐ Courier ☑ Client Drop Off Other
LIMS Project ID Ensafe - Silent Noise II	**Project Manager Phone #** (615) 252-2834	**Project Manager Email** rdow@ensafe.com	**Site/Facility ID #** Megasite / Haywood Co

Date	Time	Sample ID	Matrix	Grab/ Comp	# of Cont	Container Type	Preservation	Analyses
6/3/19	0940	EAST HG 3/19	Aqueous		1	Plastic - Quart	NONE	BOD
		EAST H6 3/19	Aqueous		1	Plastic - Pint	HNO3 - Nitric Acid	Fe, Mn, Cu, Zn, Na, Hardness, Silica as SiO2
		EAST H6 3/19	Aqueous		1	Plastic - 100ml Micro	Na2S2O3 - Sodium Thiosulfate	Fecal Coliform
		EAST H6 3/19	Aqueous		1	Plastic - Pint	H2SO4 - Sulfuric Acid	Ammonia, Phosphorus
		EAST H6 3/19	Aqueous		3	Glass Vial Clear - 40ml	H3PO4 - Phosphoric Acid	TOC
		WEST G6 3/19	Aqueous		1	Plastic - Quart	NONE	TDS, TSS, Alkalinity, Sulfate, Chloride, Nitrate, Conductivity, pH
		WEST G6 3/19	Aqueous		1	Plastic - Quart	NONE	BOD
	1025	WEST G6 3/19	Aqueous		1	Plastic - Pint	HNO3 - Nitric Acid	Fe, Mn, Cu, Zn, Na, Hardness, Silica as SiO2

For Laboratory Use Only			**Sampled by (Name - Print)** Ben Brantley	**Client Remarks/Comments**		
Ice [✓ Y]/N	**Custody Seals** Y/[✓ N]	**Lab Comments**	**Relinquished by: (SIGNATURE)** Ben Brantley	**Date Time** 6-3-19 1130	**Received by: (SIGNATURE)**	**Date Time**
			Relinquished by: (SIGNATURE)	**Date Time**	**Received by: (SIGNATURE)**	**Date Time**
Blank/Cooler Temp T45 4.1°C CW			**Relinquished by: (SIGNATURE)**	**Date Time**	**Received by: (SIGNATURE)** J Smith	**Date Time** 6.3.19 1130

Waypoint ANALYTICAL

27

EnSafe, Inc.
Silent Noise II
19-154-0226
05627
06-03-2019
12:37:46

EnSafe, Inc.
Silent Noise II
19-154-0225
05627
06-03-2019
11:37:37

Kit ID:	0000118162
Initiated By:	Rebekah Barger Ross
Initiated Date:	5/31/2019
Project Comment	

CHAIN-OF-CUSTODY

Company Name EnSafe, Inc.	**Company Number** 05627	**Client Project Manager/Contact** Mr. Ron Dow	**Purchase Order Number** 27735
Site Name Silent Noise II - Haywood County, TN	**Project Number** 0888821780	☐ RUSH – Additional charges apply ☐ Special Detection Limits(s) Date Results Needed	**Method of Shipment** ☐ Fed Ex ☐ UPS ☐ USPS ☐ Courier ☑ Client Drop Off Other
LIMS Project ID Ensafe - Silent Noise II	**Project Manager Phone #** (615) 252-2834	**Project Manager Email** rdow@ensafe.com	**Site/Facility ID #**

Date	Time	Sample ID	Matrix	Grab/ Comp	# of Cont	Container Type	Preservation	Analyses
6/3/19	1025	WESTG6319	Aqueous		1	Plastic - 100ml Micro	Na2S2O3 - Sodium Thiosulfate	Fecal Coliform
↓	1025	WESTG6319	Aqueous		1	Plastic - Pint	H2SO4 - Sulfuric Acid	Ammonia, Phosphorus
	1025	WESTG6319	Aqueous		3	Glass Vial Clear - 40ml	H3PO4 - Phosphoric Acid	TOC

For Laboratory Use Only			**Sampled by (Name - Print)** Ben Brantley	**Client Remarks/Comments**			
Ice [✓ Y]/N	**Custody Seals** Y/[✓ N]	**Lab Comments**	**Relinquished by: (SIGNATURE)**	**Date Time** 6-3-19 1130	**Received by: (SIGNATURE)**	**Date Time**	
			Relinquished by: (SIGNATURE)	**Date Time**	**Received by: (SIGNATURE)**	**Date Time**	
Blank/Cooler Temp T45 4.1°C			**Relinquished by: (SIGNATURE)**	**Date Time**	**Received by: (SIGNATURE)** J. Smith	**Date Time** 6.3.19 1130	

Rebekah Ross - Please Hold EASTG6319 Sample - Haywood County Megasite

From: Ron Dow <rdow@Ensafe.com>
To: Rebekah Ross <rross@waypointanalytical.com>
Date: 6/4/2019 9:41 AM
Subject: Please Hold EASTG6319 Sample - Haywood County Megasite

Hi Rebekah,

Following up with our conversation, please hold sample EASTG6319 that was delivered yesterday.

Thank you again for the consideration,
Ron

Ronald T. Dow P.G.
EnSafe
220 Athens Way
Suite 410
Nashville, TN 37228
rdow@ensafe.com
Office: 615-252-2834
Cell: 615-887-3287

19-154-0225
05627
06-03-2019
11:37:37
EnSafe, Inc.
Silent Noise II

19-154-0226
05627
06-03-2019
12:37:46
EnSafe, Inc.
Silent Noise II

19-154-0370
05627
06-05-2019
14:03:37
EnSafe, Inc.
Silent Noise II

Waypoint
ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

6/10/2019

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 19-154-0226
Client Project Description: Silent Noise II
Haywood County, TN
Project #0888821780

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 6/3/2019 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule August 2017) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

Alabama	#40750	Louisiana	#04015	VA NELAP	#460181	Texas	#T104704180	Arkansas	#88-0650
Mississippi		California	#2904	NC	#415	Oklahoma	#9311	SC	#84002
Kentucky	#90047	Tennessee	#TN02027	EPA	#TN00012	Kentucky UST	#80215	PA DEP	#68-03195

Sample Summary Table

Report Number: **19-154-0226**

Client Project Description: **Silent Noise II**
Haywood County, TN
Project #0888821780

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
92429	East H6319	Aqueous	06/03/2019 09:40	06/03/2019
92431	West G6319	Aqueous	06/03/2019 10:25	06/03/2019

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project Information : Silent Noise II
Haywood County, TN
Project #0888821780

Report Date : 06/10/2019
Received : 06/03/2019

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **19-154-0226**

REPORT OF ANALYSIS

Lab No : **92429**
Sample ID : **East H6319**

Matrix: **Aqueous**
Sampled: **6/3/2019 9:40**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Biochemical Oxygen Demand (5-day)	<5	mg/L	5	5	1	06/03/19 12:30	KEW	5210B-2011

Qualifiers/ Definitions		
DF	Dilution Factor	
MQL	Method Quantitation Limit	

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project Information : Silent Noise II
Haywood County, TN
Project #0888821780

Report Date : 06/10/2019
Received : 06/03/2019

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **19-154-0226**

REPORT OF ANALYSIS

Lab No : **92431**
Sample ID : **West G6319**

Matrix: **Aqueous**
Sampled: **6/3/2019 10:25**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Biochemical Oxygen Demand (5-day)	<5	mg/L	5	5	1	06/03/19 12:30	KEW	5210B-2011

Qualifiers/ Definitions	DF	Dilution Factor	MQL	Method Quantitation Limit

Waypoint ANALYTICAL
2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **Silent Noise II**
Report No: **19-154-0226**

QC Analytical Batch: L438872
Analysis Method: 5210B-2011
Analysis Description: Biochemical Oxygen Demand (BOD)

Glucose-Glutamic Acid GGA

Parameter	Units	Result	Range	Analyzed
Biochemical Oxygen Demand (5-day)	mg/L	193	167.5-228.5	06/03/19 12:30

Duplicate L 92290-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Biochemical Oxygen Demand (5-day)	mg/L	1280	1190	7.2	30	06/03/19 12:30

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Cooler Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **19-154-0226**

Shipping Method

○ Fed Ex ○ US Postal ○ Lab ○ Other :
○ UPS ● Client ○ Courier Thermometer ID: t45

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Required
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Required
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr) ☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d) ☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments: Per Ron Dow, do not analyze sample East G6319.

Signature: Carleen Qualls Date & Time: 06/03/2019 12:38:59

Waypoint ANALYTICAL

EnSafe, Inc.
Silent Noise II
19-154-0226
05627
06-03-2019
12:37:46

EnSafe, Inc.
Silent Noise II
19-154-0225
05627
06-03-2019
11:37:37

CHAIN-OF-CUSTODY

Kit ID:	0000118162
Initiated By:	Rebekah Barger Ross
Initiated Date:	5/31/2019
Project Comment	

Company Name EnSafe, Inc.	**Company Number** 05627	**Client Project Manager/Contact** Mr. Ron Dow	**Purchase Order Number** 27735
Site Name Silent Noise II - Haywood County, TN	**Project Number** 0888821780	☐ RUSH – Additional charges apply ☐ Special Detection Limits(s) Date Results Needed	**Method of Shipment** ☐ Fed Ex ☐ UPS ☐ USPS ☐ Courier ☑ Client Drop Off Other
LIMS Project ID Ensafe - Silent Noise II	**Project Manager Phone #** (615) 252-2834	**Project Manager Email** rdow@ensafe.com	**Site/Facility ID #** Megasite / Haywood Co

Date	Time	Sample ID	Matrix	Grab/ Comp	# of Cont	Container Type	Preservation	Analyses
6/3/19	0935	EAST G6319	Aqueous	G	1	Plastic - Quart	NONE	TDS, TSS, Alkalinity, Sulfate, Chloride, Nitrate, Conductivity, pH
		EAST G6319	Aqueous	G	1	Plastic - Quart	NONE	BOD
		EAST G6319	Aqueous	G	1	Plastic - Pint	HNO3 - Nitric Acid	Fe, Mn, Cu, Zn, Na, Hardness, Silica as SiO2
		EAST G6319	Aqueous	G	1	Plastic - 100ml Micro	Na2S2O3 - Sodium Thiosulfate	Fecal Coliform
		EAST G6319	Aqueous	G	1	Plastic - Pint	H2SO4 - Sulfuric Acid	Ammonia, Phosphorus
		EAST G6319	Aqueous	G	3	Glass Vial Clear - 40ml	H3PO4 - Phosphoric Acid	TOC
	0940	EAST H6319	Aqueous	G	1	Plastic - Quart	NONE	TDS, TSS, Alkalinity, Sulfate, Chloride, Nitrate, Conductivity, pH

For Laboratory Use Only

Ice	Custody Seals	Lab Comments
[✓ Y] / N	Y / [✓ N]	
Blank/Cooler Temp T45 4.1°C		

CW

Sampled by (Name - Print) Ben Brantley	**Client Remarks/Comments**			
Relinquished by: (SIGNATURE) Ben Brantley	**Date** 6/3/19 **Time** 1130	**Received by: (SIGNATURE)**	**Date**	**Time**
Relinquished by: (SIGNATURE)	**Date** **Time**	**Received by: (SIGNATURE)**	**Date**	**Time**
Relinquished by: (SIGNATURE)	**Date** **Time**	**Received by: (SIGNATURE)** J. Smith	**Date** 6.3.19	**Time** 11:50

Waypoint ANALYTICAL

19-154-0226
05627
06-03-2019
12:37:46
EnSafe, Inc.
Silent Noise II

CHAIN-OF-CUSTODY

Kit ID:	0000118162
Initiated By:	Rebekah Barger Ross
Initiated Date:	5/31/2019
Project Comment	

19-154-0225
05627
06-03-2019
11:37:37
EnSafe, Inc.
Silent Noise II

Company Name EnSafe, Inc.	**Company Number** 05627	**Client Project Manager/Contact** Mr. Ron Dow	**Purchase Order Number** 27735
Site Name Silent Noise II - Haywood County, TN	**Project Number** 0888821780	☐ RUSH – Additional charges apply ☐ Special Detection Limits(s) Date Results Needed	**Method of Shipment** ☐ Fed Ex ☐ UPS ☐ USPS ☐ Courier ☑ Client Drop Off Other
LIMS Project ID Ensafe - Silent Noise II	**Project Manager Phone #** (615) 252-2834	**Project Manager Email** rdow@ensafe.com	**Site/Facility ID #** Megasite / Haywood Co

Date	Time	Sample ID	Matrix	Grab/ Comp	# of Cont	Container Type	Preservation	Analyses
6/3/19	0940	EAST HG 319	Aqueous		1	Plastic - Quart	NONE	BOD
		EAST H6 319	Aqueous		1	Plastic - Pint	HNO3 - Nitric Acid	Fe, Mn, Cu, Zn, Na, Hardness, Silica as SiO2
		EAST H6 319	Aqueous		1	Plastic - 100ml Micro	Na2S2O3 - Sodium Thiosulfate	Fecal Coliform
		EAST H6 319	Aqueous		1	Plastic - Pint	H2SO4 - Sulfuric Acid	Ammonia, Phosphorus
		EAST H6 319	Aqueous		3	Glass Vial Clear - 40ml	H3PO4 - Phosphoric Acid	TOC
		WEST G6 319	Aqueous		1	Plastic - Quart	NONE	TDS, TSS, Alkalinity, Sulfate, Chloride, Nitrate, Conductivity, pH
		WEST G6 319	Aqueous		1	Plastic - Quart	NONE	BOD
	1025	WEST G6 319	Aqueous		1	Plastic - Pint	HNO3 - Nitric Acid	Fe, Mn, Cu, Zn, Na, Hardness, Silica as SiO2

For Laboratory Use Only

Ice	Custody Seals	Lab Comments
[✓ Y]/N	Y/[✓ N]	
Blank/[✓ Cooler] Temp T45 4.1°C		

Sampled by (Name - Print) Ben Brantley

Client Remarks/Comments

Relinquished by: (SIGNATURE)	Date Time	Received by: (SIGNATURE)	Date Time
Ben Brantley	6-3-19 1130		
		J Smith	6.3.19 1130

Waypoint ANALYTICAL

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19-154-0226
05627
06-03-2019
12:37:46
EnSafe, Inc.
Silent Noise II

CHAIN-OF-CUSTODY

19-154-0225
05627
06-03-2019
11:37:37
EnSafe, Inc.
Silent Noise II

Kit ID:	0000118162
Initiated By:	Rebekah Barger Ross
Initiated Date:	5/31/2019
Project Comment	

Company Name EnSafe, Inc.	**Company Number** 05627	**Client Project Manager/Contact** Mr. Ron Dow	**Purchase Order Number** 27735
Site Name Silent Noise II - Haywood County, TN	**Project Number** 0888821780	☐ RUSH – Additional charges apply ☐ Special Detection Limits(s) Date Results Needed	**Method of Shipment** ☐ Fed Ex ☐ UPS ☐ USPS ☐ Courier ☑ Client Drop Off Other
LIMS Project ID Ensafe - Silent Noise II	**Project Manager Phone #** (615) 252-2834	**Project Manager Email** rdow@ensafe.com	**Site/Facility ID #**

Date	Time	Sample ID	Matrix	Grab/ Comp	# of Cont	Container Type	Preservation	Analyses
6/3/19	1025	WESTGG319	Aqueous		1	Plastic - 100ml Micro	Na2S2O3 - Sodium Thiosulfate	Fecal Coliform
↓	1025	WESTG6319	Aqueous		1	Plastic - Pint	H2SO4 - Sulfuric Acid	Ammonia, Phosphorus
	1025	WESTG6319	Aqueous		3	Glass Vial Clear - 40ml	H3PO4 - Phosphoric Acid	TOC

For Laboratory Use Only			**Sampled by (Name - Print)** Ben Brantley	**Client Remarks/Comments**	
Ice [✓ Y]/N	**Custody Seals** Y/[✓ N]	**Lab Comments**	**Relinquished by: (SIGNATURE)** Ben Brantley	**Date Time** 6-3-19 1130	**Received by: (SIGNATURE)**
			Relinquished by: (SIGNATURE)	**Date Time**	**Received by: (SIGNATURE)**
Blank/Cooler Temp T45 4.1°C			**Relinquished by: (SIGNATURE)**	**Date Time**	**Received by: (SIGNATURE)** J Smith 6.3.19 1130

Rebekah Ross - Please Hold EASTG6319 Sample - Haywood County Megasite

From: Ron Dow <rdow@Ensafe.com>
To: Rebekah Ross <rross@waypointanalytical.com>
Date: 6/4/2019 9:41 AM
Subject: Please Hold EASTG6319 Sample - Haywood County Megasite

Hi Rebekah,

Following up with our conversation, please hold sample EASTG6319 that was delivered yesterday.

Thank you again for the consideration,
Ron

Ronald T. Dow P.G.
EnSafe
220 Athens Way
Suite 410
Nashville, TN 37228
rdow@ensafe.com
Office: 615-252-2834
Cell: 615-887-3287

19-154-0225
05627
06-03-2019
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EnSafe, Inc.
Silent Noise II

19-154-0226
05627
06-03-2019
12:37:46
EnSafe, Inc.
Silent Noise II

19-154-0370
05627
06-05-2019
14:03:37
EnSafe, Inc.
Silent Noise II

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

4/19/2022

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 22-108-0045
Client Project Description: MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 088882945

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 4/17/2022 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method. Where the laboratory was not responsible for the sampling stage (refer to the chain of custody) results apply to the sample as received.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule May 2021) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Certification Summary

Laboratory ID: WP MTN: Waypoint Analytical, LLC., Memphis, TN

State	Program	Lab ID	Expiration Date
Alabama	State Program	40750	02/28/2023
Arkansas	State Program	88-0650	02/07/2023
California	State Program	2904	06/30/2022
Florida	State Program - NELAP	E871157	06/30/2022
Georgia	State Program	C044	02/18/2023
Georgia	State Program	04015	06/30/2022
Illinois	State Program - NELAP	200078	10/10/2022
Kentucky	State Program	80215	06/30/2022
Kentucky	State Program	KY90047	12/31/2022
Louisiana	State Program - NELAP	LA037	12/31/2022
Louisiana	State Program - NELAP	04015	06/30/2022
Mississippi	State Program	MS	02/11/2023
North Carolina	State Program	415	12/31/2022
Pennsylvania	State Program - NELAP	68-03195	05/31/2022
South Carolina	State Program	84002	06/30/2022
South Carolina	State Program	84002	06/30/2022
Tennessee	State Program	02027	02/11/2023
Texas	State Program - NELAP	T104704180	09/30/2022
Virginia	State Program	00106	06/30/2022
Virginia	State Program - NELAP	460181	09/14/2022

Sample Summary Table

Report Number: **22-108-0045**

Client Project Description: **MegaSite Drinking Water**
Source Assessment
Stanton, TN
Project No. 088882945

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
94187	EASTWELL041722	Aqueous	04/17/2022 09:20	04/17/2022
94188	WESTWELL041722	Aqueous	04/17/2022 10:05	04/17/2022

Waypoint ANALYTICAL

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www.waypointanalytical.com

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/19/2022
Received : 04/17/2022

Rebekah Ross
Project Manager

Report Number : **22-108-0045**

REPORT OF ANALYSIS

Lab No : **94187**
Sample ID : **EASTWELL041722**

Matrix: **Aqueous**
Sampled: **4/17/2022 9:20**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	**0.4 J**	NTU	0.3	1.0	1	04/18/22 10:00	TKM	2130B-2011
Total Coliform	<1	MPN/100mL	1	1	1	04/17/22 10:48	SBA	9223B-2016

Qualifiers/ Definitions

DF	Dilution Factor	J	Estimated value
MQL	Method Quantitation Limit		

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/19/2022
Received : 04/17/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-108-0045**

REPORT OF ANALYSIS

Lab No : **94188**
Sample ID : **WESTWELL041722**

Matrix: **Aqueous**
Sampled: **4/17/2022 10:05**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	**0.3 J**	NTU	0.3	1.0	1	04/18/22 10:00	TKM	2130B-2011
Total Coliform	<1	MPN/100mL	1	1	1	04/17/22 10:48	SBA	9223B-2016

Qualifiers/ Definitions

DF Dilution Factor
MQL Method Quantitation Limit
J Estimated value

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **MegaSite Drinking Water**
Report No: **22-108-0045**

QC Analytical Batch: L611313
Analysis Method: 2130B-2011
Analysis Description: Turbidity

Lab Reagent Blank LRB Matrix: AQU
Associated Lab Samples: 94187, 94188

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Turbidity	NTU	<0.3	0.3	1.0	04/18/22 10:00

Laboratory Control Sample LCS

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Turbidity	NTU	40	42	105	90-110

Duplicate L 94188-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Turbidity	NTU	< 1.0	<1.0	0.0	20	04/18/22 10:00

Waypoint ANALYTICAL

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www.waypointanalytical.com

Shipment Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **22-108-0045**

Shipping Method

○ Fed Ex	○ US Postal	○ Lab	○ Other :	
○ UPS	● Client	○ Courier	Thermometer ID:	T124

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers/boxes received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Present
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Present
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr)
☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d)
☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments:

Signature: Emily M. Peterson

Date & Time: 04/18/2022 09:38:17

ENSAFE

EnSafe Inc.
800-588-7962

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

COC No.

Page 1 of 1

Project Name: Mega Site

PO No. 5627

Project No. 0888829845 Phase 001

Site Location: Stanton, TN

Send Results To: Ben Brantley bbrantley@ensafe.com

Sampler/Site Phone# Ben Brantley / 901 896-8457

Lab Name: Waypoint Analytical

Turnaround Time(specify): Stand.

Sample Analysis Requested (*Enter number of containers for each test*)

								(3)→	ST											
Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	(mm/dd/yy)	Time (Military) (hhmm)	Matrix Code (1)	Sample Type (2)	Field Filtered (Y/N)	Total No. of Containers	Total Coli. E.coli	Turbidity									Extra Volume for MS/MSD	HOLD
	EAST WELL041722	EAST Well	04/17/22	0920	WG	N	N	2	X	X										
	Westwell041722	WEST Well	04/17/22	1005	WG	N	N	2	X	X										

22-108-0045
05627
04-18-2022
09:37:27
EnSafe, Inc.
MegaSite Drinking Water

Field **Comments:**

Lab **Comments:**

Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time
1 Ben Brantley	04/17/22		1	4/17/22	1043
2			2	5.3C	T124
3			3		

Sample Shipment and Delivery Details

Number of coolers in shipment:

Samples Iced?(check) Yes_____ No_____

Method of Shipment:

Airbill No:

Date Shipped:

(1) Matrix Code: **AA**=Air, **AQ**=Air QC Matrix, **CK**=Caulk, **GS**=Soil Gas, **LF**=Free Product, **LH**=Liquid Waste, **MS**=Mastic, **Oil**=Oil, **PT**=Paint, **SC**=Cement/Concrete, **SE**=Sediment, **SF**=Filter Sandpack, **SL**=Sludge, **SN**=Miscellaneous Solid/Building Materials, **SO**=Soil, **SQ**=Soil/Solid QC Matrix, **ST**=Solid Waste, **SW**=Swab/Wipe, **TA**=Animal Tissue, **TP**=Plant Tissue, **WG**=Ground Water, **WL**=Leachate, **WO**=Ocean Water, **WP**=Drinking Water, **WQ**=Water QC Matrix, **WS**=Surface Water, **SU**=Storm Water, **WW**=Waste Water

(2) Sample Type: AB=Ambient Blank, **EB**=Equipment Blank, **FB**=Field Blank, **FD**=Field Duplicate Sample, **FR**=Field Replicate, **MB**=Material Blank, **N**=Normal Environmental Sample, **RB**=Material Rinse Blank, **TB**=Trip Blank

(3) Preservative added: **HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Rev. 12/12

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

4/20/2022

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 22-105-0009
Client Project Description: MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 0888829845

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 4/14/2022 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method. Where the laboratory was not responsible for the sampling stage (refer to the chain of custody) results apply to the sample as received.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule May 2021) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

NELAP ACCREDITED TNI LABORATORY

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 º Fax 901.213.2440
www.waypointanalytical.com

Certification Summary

Laboratory ID: WP MTN: Waypoint Analytical, LLC., Memphis, TN

State	Program	Lab ID	Expiration Date
Alabama	State Program	40750	02/28/2023
Arkansas	State Program	88-0650	02/07/2023
California	State Program	2904	06/30/2022
Florida	State Program - NELAP	E871157	06/30/2022
Georgia	State Program	C044	02/18/2023
Georgia	State Program	04015	06/30/2022
Illinois	State Program - NELAP	200078	10/10/2022
Kentucky	State Program	80215	06/30/2022
Kentucky	State Program	KY90047	12/31/2022
Louisiana	State Program - NELAP	LA037	12/31/2022
Louisiana	State Program - NELAP	04015	06/30/2022
Mississippi	State Program	MS	02/11/2023
North Carolina	State Program	415	12/31/2022
Pennsylvania	State Program - NELAP	68-03195	05/31/2022
South Carolina	State Program	84002	06/30/2022
South Carolina	State Program	84002	06/30/2022
Tennessee	State Program	02027	02/11/2023
Texas	State Program - NELAP	T104704180	09/30/2022
Virginia	State Program	00106	06/30/2022
Virginia	State Program - NELAP	460181	09/14/2022

Sample Summary Table

Report Number: **22-105-0009**

Client Project Description: **MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 0888829845**

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
98101	EastWell041422	Aqueous	04/14/2022 17:05	04/14/2022

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/20/2022
Received : 04/14/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-105-0009**

REPORT OF ANALYSIS

Lab No : **98101**
Sample ID : **EastWell041422**

Matrix: **Aqueous**
Sampled: **4/14/2022 17:05**

Test	**Results**	**Units**	**MDL**	**MQL**	**DF**	**Date / Time Analyzed**	**By**	**Analytical Method**
Turbidity	<0.3	NTU	0.3	1.0	1	04/15/22 16:00	FMM	2130B-2011
Total Coliform	<1	MPN/100mL		1	1	04/14/22 17:48	SBA	9223B-2016

Qualifiers/ Definitions				
	DF	Dilution Factor	MQL	Method Quantitation Limit

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Shipment Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **22-105-0009**

Shipping Method

○ Fed Ex ○ US Postal ○ Lab ○ Other :
○ UPS ● Client ○ Courier
Thermometer ID: T124

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers/boxes received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Present
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Present
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr) ☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d) ☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments:

Signature: Hannah R. Brown Date & Time: 04/15/2022 10:06:05

ENSAFE

EnSafe Inc.
800-588-7962

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

COC No.
Page 1 of 1

Project Name: Mega Site
PO No. 5627
Project No. 0888829845 Phase 01

Site Location: Stanton, IN

Send Results To: bbrantley@ensafe.com

Sampler/Site Phone# Ben Brantley / 901 896 8457

Lab Name: Waypoint Analytical
Turnaround Time(specify): Standard

Sample Analysis Requested (*Enter number of containers for each test*)

Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	(mm/dd/yy)	Time (Military) (hhmm)	Matrix Code **(1)**	Sample Type **(2)**	Field Filtered (Y/N)	**(3)→** Total No. of Containers	ST Total Coli + E.coli	Turbidity									Extra Volume for MS/MSD	HOLD
	EASTWell041422	EASTWELL	04/14/22	1705	WG	N	N	2	X	X										

22-105-0009
05627
04-15-2022
10:05:26
EnSafe, Inc.
MegaSite Drinking Water Source Assessment

Field **Comments:**

Lab **Comments:**

Sample Shipment and Delivery Details
Number of coolers in shipment: 1
Samples Iced?(check) Yes X No____
Method of Shipment: hand deliv.
Airbill No:
Date Shipped:

Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time
1 Ben Brantley	04/14/22	1740	1	4/14/22	1743
2			2	5.5°C	T124
3			3		

(1) Matrix Code: **AA**=Air, **AQ**=Air QC Matrix, **CK**=Caulk, **GS**=Soil Gas, **LF**=Free Product, **LH**=Liquid Waste, **MS**=Mastic, **Oil**=Oil, **PT**=Paint, **SC**=Cement/Concrete, **SE**=Sediment, **SF**=Filter Sandpack, **SL**=Sludge, **SN**=Miscellaneous Solid/Building Materials, **SO**=Soil, **SQ**=Soil/Solid QC Matrix, **ST**=Solid Waste, **SW**=Swab/Wipe, **TA**=Animal Tissue, **TP**=Plant Tissue, **WG**=Ground Water, **WL**=Leachate, **WO**=Ocean Water, **WP**=Drinking Water, **WQ**=Water QC Matrix, **WS**=Surface Water, **SU**=Storm Water, **WW**=Waste Water

(2) Sample Type: **AB**=Ambient Blank, **EB**=Equipment Blank, **FB**=Field Blank, **FD**=Field Duplicate Sample, **FR**=Field Replicate, **MB**=Material Blank, **N**=Normal Environmental Sample, **RB**=Material Rinse Blank, **TB**=Trip Blank

(3) Preservative added: **HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Rev. 12/12

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

4/20/2022

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 22-105-0008
Client Project Description: MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 0888829845

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 4/15/2022 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method. Where the laboratory was not responsible for the sampling stage (refer to the chain of custody) results apply to the sample as received.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule May 2021) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 º Fax 901.213.2440
www.waypointanalytical.com

Certification Summary

Laboratory ID: WP MTN: Waypoint Analytical, LLC., Memphis, TN

State	Program	Lab ID	Expiration Date
Alabama	State Program	40750	02/28/2023
Arkansas	State Program	88-0650	02/07/2023
California	State Program	2904	06/30/2022
Florida	State Program - NELAP	E871157	06/30/2022
Georgia	State Program	C044	02/18/2023
Georgia	State Program	04015	06/30/2022
Illinois	State Program - NELAP	200078	10/10/2022
Kentucky	State Program	80215	06/30/2022
Kentucky	State Program	KY90047	12/31/2022
Louisiana	State Program - NELAP	LA037	12/31/2022
Louisiana	State Program - NELAP	04015	06/30/2022
Mississippi	State Program	MS	02/11/2023
North Carolina	State Program	415	12/31/2022
Pennsylvania	State Program - NELAP	68-03195	05/31/2022
South Carolina	State Program	84002	06/30/2022
South Carolina	State Program	84002	06/30/2022
Tennessee	State Program	02027	02/11/2023
Texas	State Program - NELAP	T104704180	09/30/2022
Virginia	State Program	00106	06/30/2022
Virginia	State Program - NELAP	460181	09/14/2022

Sample Summary Table

Report Number: **22-105-0008**

Client Project Description: **MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 0888829845**

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
98112	EastWell041522	Aqueous	04/15/2022 08:30	04/15/2022

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/20/2022
Received : 04/15/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-105-0008**

REPORT OF ANALYSIS

Lab No : **98112**
Sample ID : **EastWell041522**

Matrix: **Aqueous**
Sampled: **4/15/2022 8:30**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	<0.3	NTU	0.3	1.0	1	04/15/22 16:00	FMM	2130B-2011
Total Coliform	**2**	MPN/100mL		1	1	04/15/22 12:15	IEM	9223B-2016

Qualifiers/ Definitions	DF	Dilution Factor	MQL	Method Quantitation Limit

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Shipment Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **22-105-0008**

Shipping Method

○ Fed Ex	○ US Postal	○ Lab	○ Other :	
○ UPS	● Client	○ Courier	Thermometer ID:	T137

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers/boxes received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Present
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Present
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr)	☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d)	☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments:

Signature: Hannah R. Brown

Date & Time: 04/15/2022 10:25:03

ENSAFE

EnSafe Inc.
800-588-7962

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

COC No.
Page 1 of 1

Project Name: Mega Site
Site Location: Stanton, TN
Send Results To: Ben Brantley bbrantley@ensafe.com
PO No. 5627
Project No. 08888 29845 Phase 001
Sampler/Site Phone# Ben B. + Griffin H. / 901 896-8457
Lab Name:
Turnaround Time(specify):

Sample Analysis Requested (*Enter number of containers for each test*)

Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	(mm/dd/yy)	Time (Military) (hhmm)	Matrix Code (1)	Sample Type (2)	Field Filtered (Y/N)	Total No. of Containers	ST Total Coliforms E. col.	Turbidity									Extra Volume for MS/MSD	HOLD
	EASTWELL041522	EASTWell	04/15/22	0830	WG	N	N	2	X	X										

EnSafe, Inc.
MegaSite Drinking Water Source Assessment
22-105-0008
05627
04-15-2022
10:22:26

Field **Comments:** Note Short Hold time

Lab **Comments:** cooler temp: 0.2°c T137

Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time
1 Ben Brantley	4/15/22	0955	1		
2			2		
3			3 Emily Peterson	4/15/22	0955

Sample Shipment and Delivery Details
Number of coolers in shipment:
Samples Iced?(check) Yes X No____
Method of Shipment: Hand delivery
Airbill No:
Date Shipped:

(1) Matrix Code: **AA**=Air, **AQ**=Air QC Matrix, **CK**=Caulk, **GS**=Soil Gas, **LF**=Free Product, **LH**=Liquid Waste, **MS**=Mastic, **Oil**=Oil, **PT**=Paint, **SC**=Cement/Concrete, **SE**=Sediment, **SF**=Filter Sandpack, **SL**=Sludge, **SN**=Miscellaneous Solid/Building Materials, **SO**=Soil, **SQ**=Soil/Solid QC Matrix, **ST**=Solid Waste, **SW**=Swab/Wipe, **TA**=Animal Tissue, **TP**=Plant Tissue, **WG**=Ground Water, **WL**=Leachate, **WO**=Ocean Water, **WP**=Drinking Water, **WQ**=Water QC Matrix, **WS**=Surface Water, **SU**=Storm Water, **WW**=Waste Water
(2) Sample Type: **AB**=Ambient Blank, **EB**=Equipment Blank, **FB**=Field Blank, **FD**=Field Duplicate Sample, **FR**=Field Replicate, **MB**=Material Blank, **N**=Normal Environmental Sample, **RB**=Material Rinse Blank, **TB**=Trip Blank
(3) Preservative added: **HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Rev. 12/12

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

4/19/2022

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 22-106-0006
Client Project Description: MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 088882945

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 4/15/2022 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method. Where the laboratory was not responsible for the sampling stage (refer to the chain of custody) results apply to the sample as received.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule May 2021) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Certification Summary

Laboratory ID: WP MTN: Waypoint Analytical, LLC., Memphis, TN

State	Program	Lab ID	Expiration Date
Alabama	State Program	40750	02/28/2023
Arkansas	State Program	88-0650	02/07/2023
California	State Program	2904	06/30/2022
Florida	State Program - NELAP	E871157	06/30/2022
Georgia	State Program	C044	02/18/2023
Georgia	State Program	04015	06/30/2022
Illinois	State Program - NELAP	200078	10/10/2022
Kentucky	State Program	80215	06/30/2022
Kentucky	State Program	KY90047	12/31/2022
Louisiana	State Program - NELAP	LA037	12/31/2022
Louisiana	State Program - NELAP	04015	06/30/2022
Mississippi	State Program	MS	02/11/2023
North Carolina	State Program	415	12/31/2022
Pennsylvania	State Program - NELAP	68-03195	05/31/2022
South Carolina	State Program	84002	06/30/2022
South Carolina	State Program	84002	06/30/2022
Tennessee	State Program	02027	02/11/2023
Texas	State Program - NELAP	T104704180	09/30/2022
Virginia	State Program	00106	06/30/2022
Virginia	State Program - NELAP	460181	09/14/2022

Sample Summary Table

Report Number: **22-106-0006**

Client Project Description:
MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 088882945

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
93971	WESTWELL041522	Aqueous	04/15/2022 16:47	04/15/2022

Waypoint ANALYTICAL

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www.waypointanalytical.com

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project Information : MegaSite Drinking Water
Source Assessment
Stanton, TN

Report Date : 04/19/2022
Received : 04/15/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-106-0006**

REPORT OF ANALYSIS

Lab No : **93971**
Sample ID : **WESTWELL041522**

Matrix: **Aqueous**
Sampled: **4/15/2022 16:47**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	<0.3	NTU	0.3	1.0	1	04/16/22 12:00	TKM	2130B-2011
Total Coliform	<1	MPN/100mL	1	1	1	04/15/22 17:32	SBA	9223B-2016

Qualifiers/ Definitions

DF Dilution Factor

MQL Method Quantitation Limit

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **MegaSite Drinking Water**
Report No: **22-106-0006**

QC Analytical Batch: L611314
Analysis Method: 2130B-2011
Analysis Description: Turbidity

Lab Reagent Blank LRB Matrix: AQU
Associated Lab Samples: 93971

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Turbidity	NTU	<0.3	0.3	1.0	04/16/22 12:00

Laboratory Control Sample LCS

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Turbidity	NTU	40	42	105	90-110

Duplicate L 93981-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Turbidity	NTU	< 1.0	<1.0	0.0	20	04/16/22 12:00

Waypoint ANALYTICAL

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Shipment Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **22-106-0006**

Shipping Method

○ Fed Ex ○ US Postal ○ Lab ○ Other :
○ UPS ● Client ○ Courier Thermometer ID: T124

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers/boxes received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Present
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Present
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr) ☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d) ☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments:

Signature: Hannah R. Brown Date & Time: 04/16/2022 11:18:59

ENSAFE

EnSafe Inc.
800-588-7962

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

COC No.

Page 1 of 1

Project Name: MegaSite

PO No. 5627

Project No. 0888829845 Phase 001

Site Location: Stanton, TN

Send Results To: Griffin Heard, Gheard@ensafe.com

Sampler/Site Phone# Griffin Heard / 901 483-0920

Lab Name: WayPoint Analytical

Turnaround Time(specify): Stand.

Sample Analysis Requested (*Enter number of containers for each test*)

Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	(mm/dd/yy)	Time (Military) (hhmm)	Matrix Code **(1)**	Sample Type **(2)**	Field Filtered (Y/N)	Total No. of Containers	Total Coliform E.coli	Turbidity									Extra Volume for MS/MSD	HOLD
								(3)→	ST											
	WESTWE1104 1522	WESTwell	04/15/22	0647	WG	N	N	2	X	X										

GH

EnSafe, Inc.
MegaSite Drinking Water
22-106-0006
05627
04-16-2022
11:15:44

Field **Comments:**

Lab **Comments:**

Sample Shipment and Delivery Details

Number of coolers in shipment: 1

Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time
1	4/15/22	1729	1	04/16/2022	1729
2			2	4.9°C	
3			3	T124	

Samples Iced?(check) Yes ✓ No____

Method of Shipment:

Airbill No:

Date Shipped:

(1) Matrix Code: **AA**=Air, **AQ**=Air QC Matrix, **CK**=Caulk, **GS**=Soil Gas, **LF**=Free Product, **LH**=Liquid Waste, **MS**=Mastic, **Oil**=Oil, **PT**=Paint, **SC**=Cement/Concrete, **SE**=Sediment, **SF**=Filter Sandpack, **SL**=Sludge, **SN**=Miscellaneous Solid/Building Materials, **SO**=Soil, **SQ**=Soil/Solid QC Matrix, **ST**=Solid Waste, **SW**=Swab/Wipe, **TA**=Animal Tissue, **TP**=Plant Tissue, **WG**=Ground Water, **WL**=Leachate, **WO**=Ocean Water, **WP**=Drinking Water, **WQ**=Water QC Matrix, **WS**=Surface Water, **SU**=Storm Water, **WW**=Waste Water

(2) Sample Type: **AB**=Ambient Blank, **EB**=Equipment Blank, **FB**=Field Blank, **FD**=Field Duplicate Sample, **FR**=Field Replicate, **MB**=Material Blank, **N**=Normal Environmental Sample, **RB**=Material Rinse Blank, **TB**=Trip Blank

(3) Preservative added: **HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Rev. 12/12

Waypoint ANALYTICAL

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www.waypointanalytical.com

4/19/2022

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 22-106-0009
Client Project Description: MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 088882945

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 4/16/2022 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method. Where the laboratory was not responsible for the sampling stage (refer to the chain of custody) results apply to the sample as received.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule May 2021) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Certification Summary

Laboratory ID: WP MTN: Waypoint Analytical, LLC., Memphis, TN

State	Program	Lab ID	Expiration Date
Alabama	State Program	40750	02/28/2023
Arkansas	State Program	88-0650	02/07/2023
California	State Program	2904	06/30/2022
Florida	State Program - NELAP	E871157	06/30/2022
Georgia	State Program	C044	02/18/2023
Georgia	State Program	04015	06/30/2022
Illinois	State Program - NELAP	200078	10/10/2022
Kentucky	State Program	80215	06/30/2022
Kentucky	State Program	KY90047	12/31/2022
Louisiana	State Program - NELAP	LA037	12/31/2022
Louisiana	State Program - NELAP	04015	06/30/2022
Mississippi	State Program	MS	02/11/2023
North Carolina	State Program	415	12/31/2022
Pennsylvania	State Program - NELAP	68-03195	05/31/2022
South Carolina	State Program	84002	06/30/2022
South Carolina	State Program	84002	06/30/2022
Tennessee	State Program	02027	02/11/2023
Texas	State Program - NELAP	T104704180	09/30/2022
Virginia	State Program	00106	06/30/2022
Virginia	State Program - NELAP	460181	09/14/2022

Sample Summary Table

Report Number: **22-106-0009**

Client Project Description:
MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 088882945

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
93980	EASTWell041622	Aqueous	04/16/2022 10:47	04/16/2022
93981	WESTWell041622	Aqueous	04/16/2022 11:25	04/16/2022

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/19/2022
Received : 04/16/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-106-0009**

REPORT OF ANALYSIS

Lab No : **93980**
Sample ID : **EASTWell041622**

Matrix: **Aqueous**
Sampled: **4/16/2022 10:47**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	**0.8 J**	NTU	0.3	1.0	1	04/16/22 12:00	TKM	2130B-2011
Total Coliform	<1	MPN/100mL	1	1	1	04/16/22 12:05	SBA	9223B-2016

Qualifiers/ Definitions	DF	Dilution Factor	J	Estimated value
	MQL	Method Quantitation Limit		

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/19/2022
Received : 04/16/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-106-0009**

REPORT OF ANALYSIS

Lab No : **93981**
Sample ID : **WESTWell041622**

Matrix: **Aqueous**
Sampled: **4/16/2022 11:25**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	**0.4 J**	NTU	0.3	1.0	1	04/16/22 12:00	TKM	2130B-2011
Total Coliform	<1	MPN/100mL	1	1	1	04/16/22 12:05	SBA	9223B-2016

Qualifiers/ Definitions

DF	Dilution Factor	J	Estimated value
MQL	Method Quantitation Limit		

Quality Control Data

Client ID: **EnSafe, Inc.**

Project Description: **MegaSite Drinking Water**

Report No: **22-106-0009**

QC Analytical Batch: L611314
Analysis Method: 2130B-2011
Analysis Description: Turbidity

Lab Reagent Blank LRB Matrix: AQU

Associated Lab Samples: 93980, 93981

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Turbidity	NTU	<0.3	0.3	1.0	04/16/22 12:00

Laboratory Control Sample LCS

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Turbidity	NTU	40	42	105	90-110

Duplicate L 93981-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Turbidity	NTU	< 1.0	<1.0	0.0	20	04/16/22 12:00

Waypoint ANALYTICAL

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Shipment Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **22-106-0009**

Shipping Method

○ Fed Ex	○ US Postal	○ Lab	○ Other :	
○ UPS	● Client	○ Courier	Thermometer ID:	T137

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers/boxes received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Present
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Present
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr)
☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d)
☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments:

Signature: Hannah R. Brown

Date & Time: 04/16/2022 12:05:24

ENSAFE

EnSafe Inc.
800-588-7962

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

COC No.

Page 1 of 1

Project Name: Megasite

PO No. 5627

Project No. 0888829845 Phase 001

Site Location: Stanton, TN

Send Results To: bbrantley@ensafe.com

Sampler/Site Phone# Ben Brantley

Lab Name: Waypoint Analytical

Turnaround Time(specify): Standard

Sample Analysis Requested (*Enter number of containers for each test*)

Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	(mm/dd/yy)	Time (Military) (hhmm)	Matrix Code (1)	Sample Type (2)	Field Filtered (Y/N)	Total No. of Containers	(3)→ ST Ecoli: + Total Coliform	Turbidity	Volume for MS/MSD
	EASTWell041622	EASTWell	04/16/22	1847 ~~0455~~	WG	N	N	2	X	X	
	WESTWell041622	WESTWell	04/16/22	1125	WP	N	N	2	X	X	

22-106-0009
05627
04-16-2022
11:50:47
EnSafe, Inc.
MegaSite Drinking Water

Field **Comments:**

	Relinquished by (signature)	Date	Time
1	Ben Bran	4/16/22	1158
2			
3			

Lab **Comments:**

cooler temp: 2.2°C TB7 J03

	Received by (signature)	Date	Time
1		1159	4/16/22
2			
3			

Sample Shipment and Delivery Details

Number of coolers in shipment:

Samples Iced?(check) Yes ✓ No____

Method of Shipment:

Airbill No:

Date Shipped:

(1) Matrix Code: **AA**=Air, **AQ**=Air QC Matrix, **CK**=Caulk, **GS**=Soil Gas, **LF**=Free Product, **LH**=Liquid Waste, **MS**=Mastic, **Oil**=Oil, **PT**=Paint, **SC**=Cement/Concrete, **SE**=Sediment, **SF**=Filter Sandpack, **SL**=Sludge, **SN**=Miscellaneous Solid/Building Materials, **SO**=Soil, **SQ**=Soil/Solid QC Matrix, **ST**=Solid Waste, **SW**=Swab/Wipe, **TA**=Animal Tissue, **TP**=Plant Tissue, **WG**=Ground Water, **WL**=Leachate, **WO**=Ocean Water, **WP**=Drinking Water, **WQ**=Water QC Matrix, **WS**=Surface Water, **SU**=Storm Water, **WW**=Waste Water

(2) Sample Type: AB=Ambient Blank, **EB**=Equipment Blank, **FB**=Field Blank, **FD**=Field Duplicate Sample, **FR**=Field Replicate, **MB**=Material Blank, **N**=Normal Environmental Sample, **RB**=Material Rinse Blank, **TB**=Trip Blank

(3) Preservative added: **HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Rev. 12/12

Waypoint ANALYTICAL

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Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

4/21/2022

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 22-108-0063
Client Project Description: MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 0888829845

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 4/18/2022 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method. Where the laboratory was not responsible for the sampling stage (refer to the chain of custody) results apply to the sample as received.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule May 2021) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

NELAP ACCREDITED TNI LABORATORY

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Certification Summary

Laboratory ID: WP MTN: Waypoint Analytical, LLC., Memphis, TN

State	Program	Lab ID	Expiration Date
Alabama	State Program	40750	02/28/2023
Arkansas	State Program	88-0650	02/07/2023
California	State Program	2904	06/30/2022
Florida	State Program - NELAP	E871157	06/30/2022
Georgia	State Program	C044	02/18/2023
Georgia	State Program	04015	06/30/2022
Illinois	State Program - NELAP	200078	10/10/2022
Kentucky	State Program	80215	06/30/2022
Kentucky	State Program	KY90047	12/31/2022
Louisiana	State Program - NELAP	LA037	12/31/2022
Louisiana	State Program - NELAP	04015	06/30/2022
Mississippi	State Program	MS	02/11/2023
North Carolina	State Program	415	12/31/2022
Pennsylvania	State Program - NELAP	68-03195	05/31/2022
South Carolina	State Program	84002	06/30/2022
South Carolina	State Program	84002	06/30/2022
Tennessee	State Program	02027	02/11/2023
Texas	State Program - NELAP	T104704180	09/30/2022
Virginia	State Program	00106	06/30/2022
Virginia	State Program - NELAP	460181	09/14/2022

Sample Summary Table

Report Number: **22-108-0063**

Client Project Description: **MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 0888829845**

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
94260	EASTWELL041822	Aqueous	04/18/2022 10:20	04/18/2022
94261	WESTWELL041822	Aqueous	04/18/2022 10:55	04/18/2022

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/21/2022
Received : 04/18/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-108-0063**

REPORT OF ANALYSIS

Lab No : **94260**
Sample ID : **EASTWELL041822**

Matrix: **Aqueous**
Sampled: **4/18/2022 10:20**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	**0.6 J**	NTU	0.3	1.0	1	04/19/22 16:39	FMM	2130B-2011
Total Coliform	**2**	MPN/100mL		1	1	04/18/22 15:25	IEM	9223B-2016

Qualifiers/ Definitions

DF	Dilution Factor	J	Estimated value
MQL	Method Quantitation Limit		

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/21/2022
Received : 04/18/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-108-0063**

REPORT OF ANALYSIS

Lab No : **94261**
Sample ID : **WESTWELL041822**

Matrix: **Aqueous**
Sampled: **4/18/2022 10:55**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	**0.4 J**	NTU	0.3	1.0	1	04/19/22 16:39	FMM	2130B-2011
Total Coliform	<1	MPN/100mL		1	1	04/18/22 15:25	IEM	9223B-2016

Qualifiers/ Definitions				
	DF	Dilution Factor	J	Estimated value
	MQL	Method Quantitation Limit		

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **MegaSite Drinking Water**
Report No: **22-108-0063**

QC Analytical Batch: L611680
Analysis Method: 2130B-2011
Analysis Description: Turbidity

Lab Reagent Blank LRB Matrix: AQU

Associated Lab Samples: 94260, 94261

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Turbidity	NTU	<0.3	0.3	1.0	04/19/22 16:39

Laboratory Control Sample LCS

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Turbidity	NTU	40	44	110	90-110

Duplicate L 94260-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Turbidity	NTU	< 1.0	<1.0	0.0	20	04/19/22 16:39

Waypoint ANALYTICAL

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Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Shipment Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **22-108-0063**

Shipping Method

○ Fed Ex	○ US Postal	○ Lab	○ Other :	
○ UPS	● Client	○ Courier	Thermometer ID:	T135

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers/boxes received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Present
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Present
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr) ☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d) ☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments:

Signature: Emily M. Peterson Date & Time: 04/18/2022 11:40:13

ENSAFE

EnSafe Inc.
800-588-7962

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

Project Name: Mega Site
Site Location: Stanton, TN
Send Results To: bbrantley@ensafe.com
Sampler/Site Phone# Griffin Heard | 9014830920
Lab Name: Way Point
Turnaround Time(specify): Std

COC No.
Page of
PO No. 5627
Project No. 0888829845 Phase 001

Sample Analysis Requested (*Enter number of containers for each test*)

Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	(mm/dd/yy)	Time (Military) (hhmm)	Matrix Code (1)	Sample Type (2)	Field Filtered (Y/N)	Total No. of Containers (3)→	Total coli: E coli	Turbidity	Extra Volume for MS/MSD	HOLD
	EASTWELL041822	EAST WELL	4/18/22	1020	WG	N	N	2	X	X		
	WESTWELL041822	WEST WELL	4/18/22	1055	WG	N	N	2	X	X		

22-108-0063
05627
04-18-2022
11:39:39
EnSafe, Inc.
MegaSite Drinking Water

Field **Comments:**

Lab **Comments:** 1.5°c T135 EP

Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time
1	4/18/22	1135	1		
2			2		
3			3 Emily Peterson	4/18/22	1135

Sample Shipment and Delivery Details
Number of coolers in shipment: 1
Samples Iced?(check) Yes ✓ No____
Method of Shipment:
Airbill No:
Date Shipped:

(1) Matrix Code: **AA**=Air, **AQ**=Air QC Matrix, **CK**=Caulk, **GS**=Soil Gas, **LF**=Free Product, **LH**=Liquid Waste, **MS**=Mastic, **Oil**=Oil, **PT**=Paint, **SC**=Cement/Concrete, **SE**=Sediment, **SF**=Filter Sandpack, **SL**=Sludge, **SN**=Miscellaneous Solid/Building Materials, **SO**=Soil, **SQ**=Soil/Solid QC Matrix, **ST**=Solid Waste, **SW**=Swab/Wipe, **TA**=Animal Tissue, **TP**=Plant Tissue, **WG**=Ground Water, **WL**=Leachate, **WO**=Ocean Water, **WP**=Drinking Water, **WQ**=Water QC Matrix, **WS**=Surface Water, **SU**=Storm Water, **WW**=Waste Water
(2) Sample Type: **AB**=Ambient Blank, **EB**=Equipment Blank, **FB**=Field Blank, **FD**=Field Duplicate Sample, **FR**=Field Replicate, **MB**=Material Blank, **N**=Normal Environmental Sample, **RB**=Material Rinse Blank, **TB**=Trip Blank
(3) Preservative added: **HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Rev. 12/12

Waypoint
ANALYTICAL

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www.waypointanalytical.com

4/21/2022

EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville, TN, 37228

Ref: Analytical Testing
Lab Report Number: 22-109-0061
Client Project Description: MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 0888829845

Dear Mr. Ron Dow:
Waypoint Analytical, LLC. received sample(s) on 4/19/2022 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. The analyses were performed in accordance with the applicable analytical method. Where the laboratory was not responsible for the sampling stage (refer to the chain of custody) results apply to the sample as received.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule May 2021) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

The results are shown on the attached Report of Analysis(s). Results for solid matrices are reported on an as-received basis unless otherwise indicated. This report shall not be reproduced except in full and relates only to the samples included in this report.

Please do not hesitate to contact me or client services if you have any questions or need additional information.

Sincerely,

Rebekah Ross

Rebekah Ross
Project Manager

Certification Summary

Laboratory ID: WP MTN: Waypoint Analytical, LLC., Memphis, TN

State	Program	Lab ID	Expiration Date
Alabama	State Program	40750	02/28/2023
Arkansas	State Program	88-0650	02/07/2023
California	State Program	2904	06/30/2022
Florida	State Program - NELAP	E871157	06/30/2022
Georgia	State Program	C044	02/18/2023
Georgia	State Program	04015	06/30/2022
Illinois	State Program - NELAP	200078	10/10/2022
Kentucky	State Program	80215	06/30/2022
Kentucky	State Program	KY90047	12/31/2022
Louisiana	State Program - NELAP	LA037	12/31/2022
Louisiana	State Program - NELAP	04015	06/30/2022
Mississippi	State Program	MS	02/11/2023
North Carolina	State Program	415	12/31/2022
Pennsylvania	State Program - NELAP	68-03195	05/31/2022
South Carolina	State Program	84002	06/30/2022
South Carolina	State Program	84002	06/30/2022
Tennessee	State Program	02027	02/11/2023
Texas	State Program - NELAP	T104704180	09/30/2022
Virginia	State Program	00106	06/30/2022
Virginia	State Program - NELAP	460181	09/14/2022

Sample Summary Table

Report Number: **22-109-0061**

Client Project Description:
MegaSite Drinking Water
Source Assessment
Stanton, TN
Project No. 0888829845

Lab No	Client Sample ID	Matrix	Date Collected	Date Received
94537	EASTWELL041922	Aqueous	04/19/2022 09:37	04/19/2022
94538	WESTWELL041922	Aqueous	04/19/2022 10:20	04/19/2022

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/21/2022
Received : 04/19/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-109-0061**

REPORT OF ANALYSIS

Lab No : **94537**
Sample ID : **EASTWELL041922**

Matrix: **Aqueous**
Sampled: **4/19/2022 9:37**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	**0.9 J**	NTU	0.3	1.0	1	04/19/22 16:39	FMM	2130B-2011
Total Coliform	<1	MPN/100mL		1	1	04/19/22 15:15	CMF	9223B-2016

Qualifiers/ Definitions

DF	Dilution Factor	J	Estimated value
MQL	Method Quantitation Limit		

05627
EnSafe, Inc.
Mr. Ron Dow
220 Athens Way Suite 410
Nashville , TN 37228

Project MegaSite Drinking Water

Information : Source Assessment
Stanton, TN

Report Date : 04/21/2022
Received : 04/19/2022

Rebekah Ross

Rebekah Ross
Project Manager

Report Number : **22-109-0061**

REPORT OF ANALYSIS

Lab No : **94538**
Sample ID : **WESTWELL041922**

Matrix: **Aqueous**
Sampled: **4/19/2022 10:20**

Test	Results	Units	MDL	MQL	DF	Date / Time Analyzed	By	Analytical Method
Turbidity	**0.5 J**	NTU	0.3	1.0	1	04/19/22 16:39	FMM	2130B-2011
Total Coliform	<1	MPN/100mL		1	1	04/19/22 15:15	CMF	9223B-2016

Qualifiers/ Definitions

DF	Dilution Factor	J	Estimated value
MQL	Method Quantitation Limit		

Quality Control Data

Client ID: **EnSafe, Inc.**
Project Description: **MegaSite Drinking Water**
Report No: **22-109-0061**

QC Analytical Batch: L611680
Analysis Method: 2130B-2011
Analysis Description: Turbidity

Lab Reagent Blank LRB Matrix: AQU
Associated Lab Samples: 94537, 94538

Parameter	Units	Blank Result	MDL	MQL	Analyzed
Turbidity	NTU	<0.3	0.3	1.0	04/19/22 16:39

Laboratory Control Sample LCS

Parameter	Units	Spike Conc.	LCS Result	LCS %Rec	% Rec Limits
Turbidity	NTU	40	44	110	90-110

Duplicate L 94260-DUP

Parameter	Units	Result	DUP Result	RPD	Max RPD	Analyzed
Turbidity	NTU	< 1.0	<1.0	0.0	20	04/19/22 16:39

Waypoint ANALYTICAL

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Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Shipment Receipt Form

Customer Number: **05627**
Customer Name: **EnSafe, Inc.**
Report Number: **22-109-0061**

Shipping Method

○ Fed Ex ○ US Postal ○ Lab ○ Other :
○ UPS ● Client ○ Courier Thermometer ID: T102

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers/boxes received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Present
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Present
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr) ☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d) ☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included? ○ Yes ● No

Comments:

Signature: Makayla Weaver Date & Time: 04/19/2022 11:55:08

ENSAFE

EnSafe Inc.
800-588-7962

CHAIN OF CUSTODY AND ANALYTICAL REQUEST RECORD

COC No.

Page 1 of 1

Project Name: Mega Site

PO No. 5627

Project No. 0888829845

Phase 001

Site Location: Stanton, TN

Send Results To: bbrantley@ensafe.com

Sampler/Site Phone# G. Heard - 901-483-0920

Lab Name: Way Point

Turnaround Time(specify): Std.

Sample Analysis Requested (*Enter number of containers for each test*)

Lab ID	Sample ID (sys_samp_code)	Location ID (sys_loc_code)	(mm/dd/yy)	Time (Military) (hhmm)	Matrix Code **(1)**	Sample Type **(2)**	Field Filtered (Y/N)	Total No. of Containers	Total Colif. E.coli	Turbidity									Extra Volume for MS/MSD	HOLD
								(3)→												
	EASTWELL041922	EASTWELL	4/19/22	0937	WG	N	N	2	X	X										
	WESTWELL041922	WESTWELL	4/19/22	1020	WG	N	N	2	X	X										

GH

22-109-0061
05627
04-19-2022
11:54:11

EnSafe. Inc.
MegaSite Drinking Water

Field **Comments:**

Lab **Comments:** 4.4 T10RMW

	Relinquished by (signature)	Date	Time	Received by (signature)	Date	Time
1		4/19/22	1057			
2						
3					04/19/2022	1057

Sample Shipment and Delivery Details

Number of coolers in shipment: 1

Samples Iced?(check) Yes ✓ No____

Method of Shipment: drop off

Airbill No:

Date Shipped:

(1) Matrix Code: **AA**=Air, **AQ**=Air QC Matrix, **CK**=Caulk, **GS**=Soil Gas, **LF**=Free Product, **LH**=Liquid Waste, **MS**=Mastic, **Oil**=Oil, **PT**=Paint, **SC**=Cement/Concrete, **SE**=Sediment, **SF**=Filter Sandpack, **SL**=Sludge, **SN**=Miscellaneous Solid/Building Materials, **SO**=Soil, **SQ**=Soil/Solid QC Matrix, **ST**=Solid Waste, **SW**=Swab/Wipe, **TA**=Animal Tissue, **TP**=Plant Tissue, **WG**=Ground Water, **WL**=Leachate, **WO**=Ocean Water, **WP**=Drinking Water, **WQ**=Water QC Matrix, **WS**=Surface Water, **SU**=Storm Water, **WW**=Waste Water

(2) Sample Type: AB=Ambient Blank, **EB**=Equipment Blank, **FB**=Field Blank, **FD**=Field Duplicate Sample, **FR**=Field Replicate, **MB**=Material Blank, **N**=Normal Environmental Sample, **RB**=Material Rinse Blank, **TB**=Trip Blank

(3) Preservative added: **HA**=Hydrochloric Acid, **NI**=Nitric Acid, **SH**=Sodium Hydroxide, **SA**=Sulfuric Acid, **AA**=Ascorbic Acid, **HX**=Hexane, **ME**=Methanol, **SB**=sodium bisulfate, **ST**=Sodium Thiosulfate, If **NO preservative** added leave blank

Rev. 12/12

eurofins | Environment Testing America

ANALYTICAL REPORT

Eurofins Eaton South Bend
110 S Hill Street
South Bend, IN 46617
Tel: (574)233-4777

Laboratory Job ID: 810-19498-1
Client Project/Site: MegaSite Drinking Water Source Assessmen

For:
EnSafe, Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134

Attn: Ms. Sandra Ross

Authorized for release by:
4/19/2022 1:54:21 PM

Caleb Hunsberger, Project Manager
(574)233-4777
Anthony.Hunsberger@et.eurofinsus.com

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Table of Contents

Definitions/Glossary

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Dioxin

Qualifier	Qualifier Description
I	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
TNTC	Too Numerous To Count

Case Narrative

Client: EnSafe, Inc.
Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Job ID: 810-19498-1

Laboratory: Eurofins Eaton South Bend

Narrative

Job Narrative
810-19498-1

Comments
No additional comments.

Receipt
The samples were received on 4/1/2022 8:45 AM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was -1.0º C.

Receipt Exceptions

Methods SM 9223B, Subcontract: The following samples were received outside of holding time: WestWell03312022 (810-19498-1), LTB 03-28-2022 (810-19498-2) and LTB 03-28-2022 (810-19498-3).

GC/MS VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC/MS Semi VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

HPLC/IC
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC Semi VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Dioxin
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry
Method SM 2550B: This analysis is normally performed in the field and has a method-defined holding time of 15 minutes. The following sample has been qualified with the "HF" flag to indicate analysis was performed in the laboratory outside the 15 minute timeframe: WestWell03312022 (810-19498-1).

Method 150.1: This analysis is normally performed in the field and has a method-defined holding time of 15 minutes. The following sample has been qualified with the "HF" flag to indicate analysis was performed in the laboratory outside the 15 minute timeframe: WestWell03312022 (810-19498-1).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Dioxin Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client Sample ID: WestWell03312022 Lab Sample ID: 810-19498-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Chloroform	0.70		0.50		ug/L	1		524.2	Total/NA
Bromide	30		10		ug/L	1		300.0	Total/NA
Calcium	2.6		0.10		mg/L	1		200.7	Total Recoverable
Iron	0.051		0.020		mg/L	1		200.7	Total Recoverable
Magnesium	0.93		0.10		mg/L	1		200.7	Total Recoverable
Sodium	5.4		0.10		mg/L	1		200.7	Total Recoverable
Aluminum	100		2.0		ug/L	1		200.8	Total Recoverable
Barium	8.7		2.0		ug/L	1		200.8	Total Recoverable
Hardness as calcium carbonate	10		0.66		mg/L	1		SM 2340B	Total Recoverable
Calcium hardness as calcium carbonate	6.4		0.25		mg/L	1		SM 2340B	Total Recoverable
Magnesium hardness as calcium carbonate	3.8		0.41		mg/L	1		SM 2340B	Total Recoverable
pH	5.8	HF	0.1		SU	1		150.1	Total/NA
Turbidity	5.7		0.10		NTU	1		180.1	Total/NA
Nitrate Nitrite as N	3.3		0.10		mg/L	1		353.2	Total/NA
Nitrate as N	3.3		0.10		mg/L	1		Nitrate by calc	Total/NA
Alkalinity, Total	18		1.0		mg/L	1		SM 2320B	Total/NA
Langelier Index	-3.8				LangSU	1		SM 2330B	Total/NA
Total Dissolved Solids	47		10		mg/L	1		SM 2540C	Total/NA
Temperature	20	H			Degrees C	1		SM 2550B	Total/NA

Client Sample ID: LTB 03-28-2022 Lab Sample ID: 810-19498-3

No Detections.

This Detection Summary does not include radiochemical test results.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Client Sample ID: WestWell03312022

Lab Sample ID: 810-19498-1

Date Collected: 03/31/22 12:30

Matrix: Drinking Water

Date Received: 04/01/22 08:45

Method: 524.2 - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	<0.50		0.50		ug/L			04/07/22 01:41	1
1,1,1-Trichloroethane	<0.50		0.50		ug/L			04/07/22 01:41	1
1,1,2,2-Tetrachloroethane	<0.50		0.50		ug/L			04/07/22 01:41	1
1,1,2-Trichloroethane	<0.50		0.50		ug/L			04/07/22 01:41	1
1,1-Dichloroethane	<0.50		0.50		ug/L			04/07/22 01:41	1
1,1-Dichloroethene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,1-Dichloropropene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,2,3-Trichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,2,3-Trichloropropane	<0.50		0.50		ug/L			04/07/22 01:41	1
1,2,4-Trichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,2,4-Trimethylbenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,2-Dibromo-3-Chloropropane	<0.20		0.20		ug/L			04/07/22 01:41	1
1,2-Dibromoethane (EDB)	<0.20		0.20		ug/L			04/07/22 01:41	1
1,2-Dichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,2-Dichloroethane	<0.50		0.50		ug/L			04/07/22 01:41	1
1,2-Dichloropropane	<0.25		0.25		ug/L			04/07/22 01:41	1
o-Xylene	<0.50		0.50		ug/L			04/07/22 01:41	1
m-Xylene & p-Xylene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,3,5-Trimethylbenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,3-Dichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
1,3-Dichloropropane	<0.50		0.50		ug/L			04/07/22 01:41	1
1,4-Dichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
2,2-Dichloropropane	<0.50		0.50		ug/L			04/07/22 01:41	1
2-Chlorotoluene	<0.50		0.50		ug/L			04/07/22 01:41	1
4-Chlorotoluene	<0.50		0.50		ug/L			04/07/22 01:41	1
Benzene	<0.50		0.50		ug/L			04/07/22 01:41	1
4-Isopropyltoluene	<0.50		0.50		ug/L			04/07/22 01:41	1
Bromobenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
Bromochloromethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Bromodichloromethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Bromoform	<0.50		0.50		ug/L			04/07/22 01:41	1
Bromomethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Carbon tetrachloride	<0.50		0.50		ug/L			04/07/22 01:41	1
Chloroethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Chlorobenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
Chloromethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Chloroform	**0.70**		0.50		ug/L			04/07/22 01:41	1
Dibromomethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Dichlorodifluoromethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Dichloromethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Dibromochloromethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Ethylbenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
Hexachlorobutadiene	<0.25		0.25		ug/L			04/07/22 01:41	1
Isopropylbenzene	<0.25		0.25		ug/L			04/07/22 01:41	1
Naphthalene	<0.50		0.50		ug/L			04/07/22 01:41	1
Methyl-tert-butyl Ether (MTBE)	<0.50		0.50		ug/L			04/07/22 01:41	1
Styrene	<0.50		0.50		ug/L			04/07/22 01:41	1
Tetrachloroethene	<0.50		0.50		ug/L			04/07/22 01:41	1
Toluene	<0.50		0.50		ug/L			04/07/22 01:41	1

Client Sample ID: WestWell03312022 **Lab Sample ID: 810-19498-1**
Date Collected: 03/31/22 12:30 **Matrix: Drinking Water**
Date Received: 04/01/22 08:45

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethylene	<0.50		0.50		ug/L			04/07/22 01:41	1
Trichlorofluoromethane	<0.50		0.50		ug/L			04/07/22 01:41	1
Vinyl chloride	<0.20		0.20		ug/L			04/07/22 01:41	1
tert-Butylbenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
cis-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/07/22 01:41	1
cis-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/07/22 01:41	1
n-Butylbenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
N-Propylbenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
sec-Butylbenzene	<0.50		0.50		ug/L			04/07/22 01:41	1
trans-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/07/22 01:41	1
trans-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/07/22 01:41	1
Xylenes, Total	<0.50		0.50		ug/L			04/07/22 01:41	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*102*		*70 - 130*		*04/07/22 01:41*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*		*04/07/22 01:41*	*1*
4-Bromofluorobenzene (Surr)	*87*		*70 - 130*		*04/07/22 01:41*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*85*		*70 - 130*		*04/07/22 01:41*	*1*

Method: 525.2 - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Heptachlor epoxide	<0.020		0.020		ug/L		04/07/22 08:06	04/08/22 11:03	1
Di(2-ethylhexyl)adipate	<0.59		0.59		ug/L		04/07/22 08:06	04/08/22 11:03	1
Di (2-ethylhexyl)phthalate	<0.59		0.59		ug/L		04/07/22 08:06	04/08/22 11:03	1
Hexachlorobenzene	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Simazine	<0.068		0.068		ug/L		04/07/22 08:06	04/08/22 11:03	1
Alachlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Atrazine	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Propachlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Metribuzin	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Butachlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Aldrin	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Benzo[a]pyrene	<0.020		0.020		ug/L		04/07/22 08:06	04/08/22 11:03	1
Metolachlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
gamma-BHC (Lindane)	<0.020		0.020		ug/L		04/07/22 08:06	04/08/22 11:03	1
Dieldrin	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Endrin	<0.0098		0.0098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Methoxychlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1
Heptachlor	<0.039		0.039		ug/L		04/07/22 08:06	04/08/22 11:03	1
Hexachlorocyclopentadiene	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 11:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Nitro-m-xylene	*102*		*70 - 130*	*04/07/22 08:06*	*04/08/22 11:03*	*1*
Perylene-d12	*99*		*70 - 130*	*04/07/22 08:06*	*04/08/22 11:03*	*1*
Triphenylphosphate	*104*		*70 - 130*	*04/07/22 08:06*	*04/08/22 11:03*	*1*

Method: 548.1 - Endothall (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Endothall	<5.0		5.0		ug/L		04/04/22 08:24	04/05/22 15:32	1

Client Sample Results

Client: EnSafe, Inc.
Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Client Sample ID: WestWell03312022

Lab Sample ID: 810-19498-1

Date Collected: 03/31/22 12:30

Matrix: Drinking Water

Date Received: 04/01/22 08:45

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenoxyacetic acid (Surr)	*90*		*70 - 130*	*04/04/22 08:24*	*04/05/22 15:32*	*1*

Method: 504.1 - EDB, DBCP and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	<0.010		0.010	ug/L		04/08/22 14:33	04/08/22 23:55	1
1,2-Dibromo-3-Chloropropane	<0.010		0.010	ug/L		04/08/22 14:33	04/08/22 23:55	1

Method: 505 - Organochlorine Pesticides/PCBs (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	<0.080		0.080	ug/L		04/07/22 10:35	04/07/22 19:30	1
PCB-1221	<0.19		0.19	ug/L		04/07/22 10:35	04/07/22 19:30	1
PCB-1232	<0.23		0.23	ug/L		04/07/22 10:35	04/07/22 19:30	1
PCB-1242	<0.26		0.26	ug/L		04/07/22 10:35	04/07/22 19:30	1
PCB-1248	<0.10		0.10	ug/L		04/07/22 10:35	04/07/22 19:30	1
PCB-1254	<0.10		0.10	ug/L		04/07/22 10:35	04/07/22 19:30	1
PCB-1260	<0.20		0.20	ug/L		04/07/22 10:35	04/07/22 19:30	1
Chlordane (technical)	<0.10		0.10	ug/L		04/07/22 10:35	04/07/22 19:30	1
Toxaphene	<1.0		1.0	ug/L		04/07/22 10:35	04/07/22 19:30	1
Total PCBs as DCB (Qualitative)	<0.50		0.50	ug/L		04/07/22 10:35	04/07/22 19:30	1

Method: 515.3 - Herbicides (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-TP (Silvex)	<0.10		0.10	ug/L		04/05/22 07:38	04/14/22 11:06	1
Dalapon	<1.0		1.0	ug/L		04/05/22 07:38	04/14/22 11:06	1
Dicamba	<0.10		0.10	ug/L		04/05/22 07:38	04/14/22 11:06	1
Dinoseb	<0.10		0.10	ug/L		04/05/22 07:38	04/14/22 11:06	1
Pentachlorophenol	<0.040		0.040	ug/L		04/05/22 07:38	04/14/22 11:06	1
Picloram	<0.10		0.10	ug/L		04/05/22 07:38	04/14/22 11:06	1
2,4-D	<0.10		0.10	ug/L		04/05/22 07:38	04/14/22 11:06	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*74*		*70 - 130*	*04/05/22 07:38*	*04/14/22 11:06*	*1*

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**30**		10	ug/L			04/01/22 22:06	1
Chloride	<2.0		2.0	mg/L			04/01/22 23:39	1
Sulfate	<5.0		5.0	mg/L			04/01/22 23:39	1

Method: 531.2 - Carbamate Pesticides (HPLC) - Dissolved

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1-Naphthol	<1.0		1.0	ug/L			04/08/22 12:04	1
3-Hydroxycarbofuran	<0.50		0.50	ug/L			04/08/22 12:04	1
Aldicarb	<0.50		0.50	ug/L			04/08/22 12:04	1
Aldicarb sulfone	<0.70		0.70	ug/L			04/08/22 12:04	1
Aldicarb sulfoxide	<0.50		0.50	ug/L			04/08/22 12:04	1
Carbaryl	<0.50		0.50	ug/L			04/08/22 12:04	1
Carbofuran	<0.90		0.90	ug/L			04/08/22 12:04	1
Methomyl	<0.50		0.50	ug/L			04/08/22 12:04	1
Oxamyl	<1.0		1.0	ug/L			04/08/22 12:04	1

Client Sample ID: WestWell03312022

Date Collected: 03/31/22 12:30
Date Received: 04/01/22 08:45

Lab Sample ID: 810-19498-1
Matrix: Drinking Water

Method: 547 - Glyphosate (DAI HPLC) - Dissolved

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Glyphosate	<6.0		6.0	ug/L			04/05/22 09:05	1

Method: 549.2 - Diquat and Paraquat (HPLC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Diquat	<0.40		0.40	ug/L		04/05/22 08:05	04/08/22 17:09	1

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water

Analyte	Result	Qualifier	RL	EDL	Unit	D	Prepared	Analyzed	Dil Fac
2,3,7,8-TCDD	<4.0		4.0		pg/L		04/08/22 09:19	04/09/22 00:57	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C-2,3,7,8-TCDD	*99*		*25 - 164*	*04/08/22 09:19*	*04/09/22 00:57*	*1*

Method: 200.7 - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	**2.6**		0.10	mg/L		04/05/22 11:25	04/06/22 13:47	1
Iron	**0.051**		0.020	mg/L		04/05/22 11:25	04/06/22 13:47	1
Magnesium	**0.93**		0.10	mg/L		04/05/22 11:25	04/06/22 13:47	1
Sodium	**5.4**		0.10	mg/L		04/05/22 11:25	04/06/22 13:47	1

Method: 200.8 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Uranium	<1.0		1.0	ug/L			04/06/22 12:48	1

Method: 200.8 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**100**		2.0	ug/L			04/06/22 12:48	1
Antimony	<1.0		1.0	ug/L			04/06/22 12:48	1
Arsenic	<1.0		1.0	ug/L			04/06/22 12:48	1
Barium	**8.7**		2.0	ug/L			04/06/22 12:48	1
Beryllium	<0.30		0.30	ug/L			04/06/22 12:48	1
Cadmium	<0.50		0.50	ug/L			04/06/22 12:48	1
Chromium	<0.90		0.90	ug/L			04/06/22 12:48	1
Copper	<1.0		1.0	ug/L			04/06/22 12:48	1
Lead	<0.50		0.50	ug/L			04/06/22 12:48	1
Manganese	<2.0		2.0	ug/L			04/06/22 12:48	1
Nickel	<1.0		1.0	ug/L			04/06/22 12:48	1
Selenium	<2.0		2.0	ug/L			04/06/22 12:48	1
Silver	<0.50		0.50	ug/L			04/06/22 12:48	1
Thallium	<0.30		0.30	ug/L			04/06/22 12:48	1
Zinc	<5.0		5.0	ug/L			04/06/22 12:48	1

Method: 245.1 - Mercury (CVAA)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.10		0.10	ug/L		04/08/22 12:11	04/08/22 16:20	1

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	**10**		0.66	mg/L			04/07/22 19:36	1
Calcium hardness as calcium carbonate	**6.4**		0.25	mg/L			04/07/22 19:36	1

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16

Client Sample ID: WestWell03312022

Lab Sample ID: 810-19498-1

Date Collected: 03/31/22 12:30

Matrix: Drinking Water

Date Received: 04/01/22 08:45

Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Magnesium hardness as calcium carbonate	**3.8**		0.41		mg/L			04/07/22 19:36	1

General Chemistry

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
pH	**5.8**	**HF**	0.1		SU			04/01/22 14:51	1
Turbidity	**5.7**		0.10		NTU			04/01/22 14:11	1
Cyanide, Total	<0.0050		0.0050		mg/L		04/07/22 09:36	04/07/22 11:26	1
Nitrite as N	<0.010		0.010		mg/L			04/01/22 13:22	1
Nitrate Nitrite as N	**3.3**		0.10		mg/L			04/01/22 12:12	1
Nitrate as N	**3.3**		0.10		mg/L			04/05/22 14:10	1
Color, True	<3.0		3.0		Color Units			04/01/22 13:39	1
Odor	<1.0		1.0		T.O.N.			04/01/22 13:06	1
Alkalinity, Total	**18**		1.0		mg/L			04/05/22 11:58	1
Langelier Index	**-3.8**				LangSU			04/12/22 15:37	1
Total Dissolved Solids	**47**		10		mg/L			04/04/22 14:06	1
Temperature	**20**	**H**			Degrees C			04/01/22 14:44	1
Fluoride	<0.050		0.050		mg/L			04/07/22 10:41	1

Client Sample ID: LTB 03-28-2022

Lab Sample ID: 810-19498-3

Date Collected: 03/31/22 00:00

Matrix: Drinking Water

Date Received: 04/01/22 08:45

Method: 524.2 - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	<0.50		0.50		ug/L			04/07/22 01:18	1
1,1,1-Trichloroethane	<0.50		0.50		ug/L			04/07/22 01:18	1
1,1,2,2-Tetrachloroethane	<0.50		0.50		ug/L			04/07/22 01:18	1
1,1,2-Trichloroethane	<0.50		0.50		ug/L			04/07/22 01:18	1
1,1-Dichloroethane	<0.50		0.50		ug/L			04/07/22 01:18	1
1,1-Dichloroethene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,1-Dichloropropene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,2,3-Trichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,2,3-Trichloropropane	<0.50		0.50		ug/L			04/07/22 01:18	1
1,2,4-Trichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,2,4-Trimethylbenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,2-Dibromo-3-Chloropropane	<0.20		0.20		ug/L			04/07/22 01:18	1
1,2-Dibromoethane (EDB)	<0.20		0.20		ug/L			04/07/22 01:18	1
1,2-Dichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,2-Dichloroethane	<0.50		0.50		ug/L			04/07/22 01:18	1
1,2-Dichloropropane	<0.25		0.25		ug/L			04/07/22 01:18	1
o-Xylene	<0.50		0.50		ug/L			04/07/22 01:18	1
m-Xylene & p-Xylene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,3,5-Trimethylbenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,3-Dichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
1,3-Dichloropropane	<0.50		0.50		ug/L			04/07/22 01:18	1
1,4-Dichlorobenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
2,2-Dichloropropane	<0.50		0.50		ug/L			04/07/22 01:18	1
2-Chlorotoluene	<0.50		0.50		ug/L			04/07/22 01:18	1
4-Chlorotoluene	<0.50		0.50		ug/L			04/07/22 01:18	1

Client Sample Results

Client: EnSafe, Inc. Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Client Sample ID: LTB 03-28-2022 **Lab Sample ID: 810-19498-3**
Date Collected: 03/31/22 00:00 **Matrix: Drinking Water**
Date Received: 04/01/22 08:45

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.50		0.50		ug/L			04/07/22 01:18	1
4-Isopropyltoluene	<0.50		0.50		ug/L			04/07/22 01:18	1
Bromobenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
Bromochloromethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Bromodichloromethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Bromoform	<0.50		0.50		ug/L			04/07/22 01:18	1
Bromomethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Carbon tetrachloride	<0.50		0.50		ug/L			04/07/22 01:18	1
Chloroethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Chlorobenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
Chloromethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Chloroform	<0.50		0.50		ug/L			04/07/22 01:18	1
Dibromomethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Dichlorodifluoromethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Dichloromethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Dibromochloromethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Ethylbenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
Hexachlorobutadiene	<0.25		0.25		ug/L			04/07/22 01:18	1
Isopropylbenzene	<0.25		0.25		ug/L			04/07/22 01:18	1
Naphthalene	<0.50		0.50		ug/L			04/07/22 01:18	1
Methyl-tert-butyl Ether (MTBE)	<0.50		0.50		ug/L			04/07/22 01:18	1
Styrene	<0.50		0.50		ug/L			04/07/22 01:18	1
Tetrachloroethene	<0.50		0.50		ug/L			04/07/22 01:18	1
Toluene	<0.50		0.50		ug/L			04/07/22 01:18	1
Trichloroethylene	<0.50		0.50		ug/L			04/07/22 01:18	1
Trichlorofluoromethane	<0.50		0.50		ug/L			04/07/22 01:18	1
Vinyl chloride	<0.20		0.20		ug/L			04/07/22 01:18	1
tert-Butylbenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
cis-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/07/22 01:18	1
cis-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/07/22 01:18	1
n-Butylbenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
N-Propylbenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
sec-Butylbenzene	<0.50		0.50		ug/L			04/07/22 01:18	1
trans-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/07/22 01:18	1
trans-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/07/22 01:18	1
Xylenes, Total	<0.50		0.50		ug/L			04/07/22 01:18	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*103*		*70 - 130*		*04/07/22 01:18*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*04/07/22 01:18*	*1*
4-Bromofluorobenzene (Surr)	*88*		*70 - 130*		*04/07/22 01:18*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*89*		*70 - 130*		*04/07/22 01:18*	*1*

Surrogate Summary

Client: EnSafe, Inc.
Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method: 524.2 - Volatile Organic Compounds (GC/MS)

Matrix: Drinking Water
Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCA (70-130)	TOL (70-130)	BFB (70-130)	DCZ (70-130)
810-19498-1	WestWell03312022	102	98	87	85
810-19498-3	LTB 03-28-2022	103	100	88	89
MB 810-16353/5	Method Blank	103	100	91	86

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
DCZ = 1,2-Dichlorobenzene-d4 (Surr)

Method: 525.2 - Semivolatile Organic Compounds (GC/MS)

Matrix: Drinking Water
Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	2NMX (70-130)	PRY (70-130)	TPP (70-130)
810-19498-1	WestWell03312022	102	99	104
LCS 810-16374/2-A	Lab Control Sample	102	97	106
LLCS 810-16374/4-A	Lab Control Sample	102	97	102
MB 810-16374/1-A	Method Blank	100	94	105

Surrogate Legend

2NMX = 2-Nitro-m-xylene
PRY = Perylene-d12
TPP = Triphenylphosphate

Method: 548.1 - Endothall (GC/MS)

Matrix: Drinking Water
Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	24D (70-130)
810-19498-1	WestWell03312022	90
LCS 810-16117/2-A	Lab Control Sample	93
LLCS 810-16117/3-A	Lab Control Sample	101
MB 810-16117/1-A	Method Blank	99

Surrogate Legend

24D = 2,4-Dichlorophenoxyacetic acid (Surr)

Method: 515.3 - Herbicides (GC)

Matrix: Drinking Water
Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCPAA1 (70-130)
810-19498-1	WestWell03312022	74
LLCS 810-15931/2-B	Lab Control Sample	92
MB 810-16186/1-B	Method Blank	92

Surrogate Legend

DCPAA = 2,4-Dichlorophenylacetic acid

Isotope Dilution Summary

Client: EnSafe, Inc. Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water

Matrix: Drinking Water **Prep Type: Total/NA**

Percent Isotope Dilution Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	TCDD (25-164)
810-19498-1	WestWell03312022	99
MB 410-242496/1-A	Method Blank	97

Surrogate Legend

TCDD = 13C-2,3,7,8-TCDD

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water

Matrix: Drinking Water **Prep Type: Total/NA**

Percent Isotope Dilution Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	TCDD (20-175)
LCS 410-242496/2-A	Lab Control Sample	112

Surrogate Legend

TCDD = 13C-2,3,7,8-TCDD

QC Sample Results

Method: 524.2 - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 810-16353/5
Matrix: Drinking Water
Analysis Batch: 16353

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	<0.50		0.50		ug/L			04/06/22 21:02	1
1,1,1-Trichloroethane	<0.50		0.50		ug/L			04/06/22 21:02	1
1,1,2,2-Tetrachloroethane	<0.50		0.50		ug/L			04/06/22 21:02	1
1,1,2-Trichloroethane	<0.50		0.50		ug/L			04/06/22 21:02	1
1,1-Dichloroethane	<0.50		0.50		ug/L			04/06/22 21:02	1
1,1-Dichloroethene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,1-Dichloropropene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,2,3-Trichlorobenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,2,3-Trichloropropane	<0.50		0.50		ug/L			04/06/22 21:02	1
1,2,4-Trichlorobenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,2,4-Trimethylbenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,2-Dibromo-3-Chloropropane	<0.20		0.20		ug/L			04/06/22 21:02	1
1,2-Dibromoethane (EDB)	<0.20		0.20		ug/L			04/06/22 21:02	1
1,2-Dichlorobenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,2-Dichloroethane	<0.50		0.50		ug/L			04/06/22 21:02	1
1,2-Dichloropropane	<0.25		0.25		ug/L			04/06/22 21:02	1
o-Xylene	<0.50		0.50		ug/L			04/06/22 21:02	1
m-Xylene & p-Xylene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,3,5-Trimethylbenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,3-Dichlorobenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
1,3-Dichloropropane	<0.50		0.50		ug/L			04/06/22 21:02	1
1,4-Dichlorobenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
2,2-Dichloropropane	<0.50		0.50		ug/L			04/06/22 21:02	1
2-Chlorotoluene	<0.50		0.50		ug/L			04/06/22 21:02	1
4-Chlorotoluene	<0.50		0.50		ug/L			04/06/22 21:02	1
Benzene	<0.50		0.50		ug/L			04/06/22 21:02	1
4-Isopropyltoluene	<0.50		0.50		ug/L			04/06/22 21:02	1
Bromobenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
Bromochloromethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Bromodichloromethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Bromoform	<0.50		0.50		ug/L			04/06/22 21:02	1
Bromomethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Carbon tetrachloride	<0.50		0.50		ug/L			04/06/22 21:02	1
Chloroethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Chlorobenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
Chloromethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Chloroform	<0.50		0.50		ug/L			04/06/22 21:02	1
Dibromomethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Dichlorodifluoromethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Dichloromethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Dibromochloromethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Ethylbenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
Hexachlorobutadiene	<0.25		0.25		ug/L			04/06/22 21:02	1
Isopropylbenzene	<0.25		0.25		ug/L			04/06/22 21:02	1
Naphthalene	<0.50		0.50		ug/L			04/06/22 21:02	1
Methyl-tert-butyl Ether (MTBE)	<0.50		0.50		ug/L			04/06/22 21:02	1
Styrene	<0.50		0.50		ug/L			04/06/22 21:02	1
Tetrachloroethene	<0.50		0.50		ug/L			04/06/22 21:02	1

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 810-16353/5
Matrix: Drinking Water
Analysis Batch: 16353

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Toluene	<0.50		0.50		ug/L			04/06/22 21:02	1
Trichloroethylene	<0.50		0.50		ug/L			04/06/22 21:02	1
Trichlorofluoromethane	<0.50		0.50		ug/L			04/06/22 21:02	1
Vinyl chloride	<0.20		0.20		ug/L			04/06/22 21:02	1
tert-Butylbenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
cis-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/06/22 21:02	1
cis-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/06/22 21:02	1
n-Butylbenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
N-Propylbenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
sec-Butylbenzene	<0.50		0.50		ug/L			04/06/22 21:02	1
trans-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/06/22 21:02	1
trans-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/06/22 21:02	1
Xylenes, Total	<0.50		0.50		ug/L			04/06/22 21:02	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*103*		*70 - 130*		*04/06/22 21:02*	*1*
Toluene-d8 (Surr)	*100*		*70 - 130*		*04/06/22 21:02*	*1*
4-Bromofluorobenzene (Surr)	*91*		*70 - 130*		*04/06/22 21:02*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*86*		*70 - 130*		*04/06/22 21:02*	*1*

Method: 525.2 - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 810-16374/1-A
Matrix: Drinking Water
Analysis Batch: 16434

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16374

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Heptachlor epoxide	<0.020		0.020		ug/L		04/07/22 08:06	04/07/22 22:08	1
Di(2-ethylhexyl)adipate	<0.60		0.60		ug/L		04/07/22 08:06	04/07/22 22:08	1
Di (2-ethylhexyl)phthalate	<0.60		0.60		ug/L		04/07/22 08:06	04/07/22 22:08	1
Hexachlorobenzene	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Simazine	<0.070		0.070		ug/L		04/07/22 08:06	04/07/22 22:08	1
Alachlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Atrazine	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Propachlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Metribuzin	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Butachlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Aldrin	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Benzo[a]pyrene	<0.020		0.020		ug/L		04/07/22 08:06	04/07/22 22:08	1
Metolachlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
gamma-BHC (Lindane)	<0.020		0.020		ug/L		04/07/22 08:06	04/07/22 22:08	1
Dieldrin	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Endrin	<0.010		0.010		ug/L		04/07/22 08:06	04/07/22 22:08	1
Methoxychlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Heptachlor	<0.040		0.040		ug/L		04/07/22 08:06	04/07/22 22:08	1
Hexachlorocyclopentadiene	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Method: 525.2 - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 810-16374/1-A
Matrix: Drinking Water
Analysis Batch: 16434

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16374

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Nitro-m-xylene	*100*		*70 - 130*	*04/07/22 08:06*	*04/07/22 22:08*	*1*
Perylene-d12	*94*		*70 - 130*	*04/07/22 08:06*	*04/07/22 22:08*	*1*
Triphenylphosphate	*105*		*70 - 130*	*04/07/22 08:06*	*04/07/22 22:08*	*1*

Lab Sample ID: LCS 810-16374/2-A
Matrix: Drinking Water
Analysis Batch: 16434

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16374

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Heptachlor epoxide	1.98	1.99		ug/L		100	70 - 130
Di(2-ethylhexyl)adipate	1.98	2.07		ug/L		105	70 - 130
Di (2-ethylhexyl)phthalate	1.98	2.05		ug/L		103	70 - 130
Hexachlorobenzene	1.98	1.97		ug/L		99	70 - 130
Simazine	1.98	2.06		ug/L		104	70 - 130
Propachlor	1.98	2.04		ug/L		103	70 - 130
Metribuzin	1.98	2.30		ug/L		116	70 - 130
Butachlor	1.98	1.97		ug/L		99	70 - 130
Aldrin	1.98	1.84		ug/L		93	70 - 130
Metolachlor	1.98	1.99		ug/L		100	70 - 130
gamma-BHC (Lindane)	1.98	1.99		ug/L		100	70 - 130
Dieldrin	1.98	1.98		ug/L		100	70 - 130
Endrin	1.98	2.22		ug/L		112	70 - 130
Methoxychlor	1.98	2.11		ug/L		106	70 - 130
Heptachlor	1.98	1.97		ug/L		99	70 - 130
Hexachlorocyclopentadiene	1.98	1.77		ug/L		89	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Nitro-m-xylene	*102*		*70 - 130*
Perylene-d12	*97*		*70 - 130*
Triphenylphosphate	*106*		*70 - 130*

Lab Sample ID: LLCS 810-16374/4-A
Matrix: Drinking Water
Analysis Batch: 16434

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16374

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Heptachlor epoxide	0.00993	<0.020		ug/L		92	50 - 150
Di(2-ethylhexyl)adipate	0.596	0.517	J	ug/L		87	50 - 150
Di (2-ethylhexyl)phthalate	0.596	0.536	J	ug/L		90	50 - 150
Hexachlorobenzene	0.0993	0.0872	J	ug/L		88	50 - 150
Simazine	0.0695	0.0653	J	ug/L		94	50 - 150
Propachlor	0.0993	0.0883	J	ug/L		89	50 - 150
Metribuzin	0.0993	0.0928	J	ug/L		93	50 - 150
Butachlor	0.0993	0.0751	J	ug/L		76	50 - 150
Aldrin	0.0695	0.0543	J	ug/L		78	50 - 150
Metolachlor	0.0993	0.0846	J	ug/L		85	50 - 150
gamma-BHC (Lindane)	0.0199	0.0185	J	ug/L		93	50 - 150
Dieldrin	0.0199	<0.020		ug/L		81	50 - 150

Method: 525.2 - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LLCS 810-16374/4-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16434 **Prep Batch: 16374**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Endrin	0.00993	0.0109		ug/L		110	50 - 150
Methoxychlor	0.0993	0.0809	J	ug/L		81	50 - 150
Heptachlor	0.00993	0.0107	J	ug/L		108	50 - 150
Hexachlorocyclopentadiene	0.0993	0.0916	J	ug/L		92	50 - 150

Surrogate	*LLCS %Recovery*	*LLCS Qualifier*	*Limits*
2-Nitro-m-xylene	*102*		*70 - 130*
Perylene-d12	*97*		*70 - 130*
Triphenylphosphate	*102*		*70 - 130*

Method: 548.1 - Endothall (GC/MS)

Lab Sample ID: MB 810-16117/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16195 **Prep Batch: 16117**

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Endothall	<5.0		5.0	ug/L		04/04/22 08:24	04/05/22 10:30	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenoxyacetic acid (Surr)	*99*		*70 - 130*	*04/04/22 08:24*	*04/05/22 10:30*	*1*

Lab Sample ID: LCS 810-16117/2-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16195 **Prep Batch: 16117**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Endothall	100	119		ug/L		119	69 - 136

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenoxyacetic acid (Surr)	*93*		*70 - 130*

Lab Sample ID: LLCS 810-16117/3-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16195 **Prep Batch: 16117**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Endothall	9.00	12.6		ug/L		140	50 - 150

Surrogate	*LLCS %Recovery*	*LLCS Qualifier*	*Limits*
2,4-Dichlorophenoxyacetic acid (Surr)	*101*		*70 - 130*

QC Sample Results

Client: EnSafe, Inc.
Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method: 504.1 - EDB, DBCP and 1,2,3-TCP (GC)

Lab Sample ID: MB 810-16527/1-A
Client Sample ID: Method Blank
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16541
Prep Batch: 16527

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	<0.010		0.010		ug/L		04/08/22 14:33	04/08/22 23:04	1
1,2-Dibromo-3-Chloropropane	<0.010		0.010		ug/L		04/08/22 14:33	04/08/22 23:04	1

Lab Sample ID: LCS 810-16527/2-A
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16541
Prep Batch: 16527

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
1,2-Dibromoethane (EDB)			0.250	0.222		ug/L		89	70 - 130		
1,2-Dibromo-3-Chloropropane			0.250	0.234		ug/L		94	70 - 130		

Lab Sample ID: LCS 810-16527/3-A
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16541
Prep Batch: 16527

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
1,2-Dibromoethane (EDB)			0.250	0.294		ug/L		117	70 - 130		
1,2-Dibromo-3-Chloropropane			0.250	0.265		ug/L		106	70 - 130		

Lab Sample ID: LLCS 810-16527/6-A
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16541
Prep Batch: 16527

Analyte			Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits		
1,2-Dibromoethane (EDB)			0.0100	0.0135		ug/L		135	50 - 150		
1,2-Dibromo-3-Chloropropane			0.0100	0.0110		ug/L		110	50 - 150		

Method: 505 - Organochlorine Pesticides/PCBs (GC)

Lab Sample ID: MB 810-16398/1-A
Client Sample ID: Method Blank
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16426
Prep Batch: 16398

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	<0.080		0.080		ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1221	<0.19		0.19		ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1232	<0.23		0.23		ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1242	<0.26		0.26		ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1248	<0.10		0.10		ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1254	<0.10		0.10		ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1260	<0.20		0.20		ug/L		04/07/22 10:35	04/07/22 16:22	1
Chlordane (technical)	<0.10		0.10		ug/L		04/07/22 10:35	04/07/22 16:22	1
Toxaphene	<1.0		1.0		ug/L		04/07/22 10:35	04/07/22 16:22	1
Total PCBs as DCB (Qualitative)	<0.50		0.50		ug/L		04/07/22 10:35	04/07/22 16:22	1

Method: 505 - Organochlorine Pesticides/PCBs (GC) (Continued)

Lab Sample ID: LLCS 810-16398/2-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16426 **Prep Batch: 16398**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Chlordane (technical)	0.100	0.118		ug/L		118	50 - 150

Lab Sample ID: LLCS 810-16398/3-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16426 **Prep Batch: 16398**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Toxaphene	1.00	1.09		ug/L		109	50 - 150

Method: 515.3 - Herbicides (GC)

Lab Sample ID: LLCS 810-15931/2-B **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16797 **Prep Batch: 15931**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
2,4,5-TP (Silvex)	0.100	0.0811	J	ug/L		81	48 - 148
Dicamba	0.200	0.141		ug/L		70	
Dinoseb	0.200	0.148		ug/L		74	39 - 141
Pentachlorophenol	0.0400	0.0320	J	ug/L		80	30 - 171
Picloram	0.100	0.0750	J	ug/L		75	24 - 150
2,4-D	0.200	0.103		ug/L		51	24 - 138

Surrogate	*LLCS %Recovery*	*LLCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*92*		*70 - 130*

Lab Sample ID: MB 810-16186/1-B **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16797 **Prep Batch: 16186**

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-TP (Silvex)	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1
Dalapon	<1.0		1.0		ug/L		04/05/22 07:38	04/13/22 22:16	1
Dicamba	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1
Dinoseb	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1
Pentachlorophenol	<0.040		0.040		ug/L		04/05/22 07:38	04/13/22 22:16	1
Picloram	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1
2,4-D	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*92*		*70 - 130*	*04/05/22 07:38*	*04/13/22 22:16*	*1*

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 810-16076/4 **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16076

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<2.0		2.0		mg/L			04/01/22 16:33	1
Sulfate	<5.0		5.0		mg/L			04/01/22 16:33	1

Lab Sample ID: LCS 810-16076/5 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16076

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Chloride			10.0	9.64		mg/L		96	90 - 110		
Sulfate			25.0	24.9		mg/L		100	90 - 110		

Lab Sample ID: MB 810-16096/4 **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16096

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Bromide	<10		10		ug/L			04/01/22 16:17	1

Lab Sample ID: LCS 810-16096/5 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16096

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Bromide			250	252		ug/L		101	90 - 110		

Method: 531.2 - Carbamate Pesticides (HPLC)

Lab Sample ID: MBL 810-16371/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Dissolved**
Analysis Batch: 16425

Analyte	MBL Result	MBL Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1-Naphthol	<0.20		1.0		ug/L			04/08/22 01:10	1
3-Hydroxycarbofuran	<0.20		0.50		ug/L			04/08/22 01:10	1
Aldicarb	<0.20		0.50		ug/L			04/08/22 01:10	1
Aldicarb sulfone	<0.20		0.70		ug/L			04/08/22 01:10	1
Aldicarb sulfoxide	<0.20		0.50		ug/L			04/08/22 01:10	1
Carbaryl	<0.20		0.50		ug/L			04/08/22 01:10	1
Carbofuran	<0.20		0.90		ug/L			04/08/22 01:10	1
Methomyl	<0.20		0.50		ug/L			04/08/22 01:10	1
Oxamyl	<0.20		1.0		ug/L			04/08/22 01:10	1

Method: 547 - Glyphosate (DAI HPLC)

Lab Sample ID: MB 810-16138/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Dissolved**
Analysis Batch: 16161

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Glyphosate	<6.0		6.0		ug/L			04/05/22 05:30	1

QC Sample Results

Method: 547 - Glyphosate (DAI HPLC) (Continued)

Lab Sample ID: LCS 810-16138/3-A
Matrix: Drinking Water
Analysis Batch: 16161

Client Sample ID: Lab Control Sample
Prep Type: Dissolved

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Glyphosate	50.0	50.6		ug/L		101	73 - 122

Lab Sample ID: LLCS 810-16138/2-A
Matrix: Drinking Water
Analysis Batch: 16161

Client Sample ID: Lab Control Sample
Prep Type: Dissolved

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Glyphosate	6.00	6.08		ug/L		101	42 - 160

Lab Sample ID: 810-19498-1 DU
Matrix: Drinking Water
Analysis Batch: 16161

Client Sample ID: WestWell03312022
Prep Type: Dissolved

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Glyphosate	<6.0		<6.0		ug/L		NC	19

Method: 549.2 - Diquat and Paraquat (HPLC)

Lab Sample ID: MB 810-16188/1-A
Matrix: Drinking Water
Analysis Batch: 16530

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16188

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Diquat	<0.40		0.40	ug/L		04/05/22 08:05	04/08/22 15:39	1

Lab Sample ID: LCS 810-16188/2-A
Matrix: Drinking Water
Analysis Batch: 16530

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16188

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Diquat	5.00	4.81		ug/L		96	70 - 130

Lab Sample ID: LLCS 810-16188/3-A
Matrix: Drinking Water
Analysis Batch: 16530

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16188

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Diquat	0.400	0.493		ug/L		123	21 - 161

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water

Lab Sample ID: MB 410-242496/1-A
Matrix: Drinking Water
Analysis Batch: 242588

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 242496

Analyte	MB Result	MB Qualifier	RL	EDL	Unit	D	Prepared	Analyzed	Dil Fac
2,3,7,8-TCDD	<4.0		4.0		pg/L		04/08/22 09:19	04/08/22 17:58	1

Isotope Dilution	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C-2,3,7,8-TCDD	*97*		*25 - 164*	*04/08/22 09:19*	*04/08/22 17:58*	*1*

QC Sample Results

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water (Continued)

Lab Sample ID: LCS 410-242496/2-A
Matrix: Drinking Water
Analysis Batch: 242588

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 242496

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
2,3,7,8-TCDD	2.00	3.10	J I	pg/L		155	67 - 158

Isotope Dilution	*LCS %Recovery*	*LCS Qualifier*	*Limits*
13C-2,3,7,8-TCDD	*112*		*20 - 175*

Method: 200.7 - Metals (ICP)

Lab Sample ID: MB 810-16216/1-A
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	<0.10		0.10	mg/L		04/05/22 11:25	04/06/22 13:00	1
Iron	<0.020		0.020	mg/L		04/05/22 11:25	04/06/22 13:00	1
Magnesium	<0.10		0.10	mg/L		04/05/22 11:25	04/06/22 13:00	1
Sodium	<0.10		0.10	mg/L		04/05/22 11:25	04/06/22 13:00	1

Lab Sample ID: LCS 810-16216/4-A
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Calcium	5.00	4.89		mg/L		98	85 - 115
Iron	5.00	4.84		mg/L		97	85 - 115
Magnesium	5.00	4.89		mg/L		98	85 - 115
Sodium	5.00	4.86		mg/L		97	85 - 115

Lab Sample ID: LLCS 810-16216/2-A
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Iron	0.0100	0.0128	J	mg/L		128	50 - 150
Magnesium	0.0100	0.0101	J	mg/L		101	50 - 150
Sodium	0.0100	<0.022		mg/L		88	50 - 150

Lab Sample ID: LLCS 810-16216/3-A
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Calcium	0.100	0.0976	J	mg/L		98	50 - 150
Magnesium	0.100	0.0954	J	mg/L		95	50 - 150
Sodium	0.100	0.0957	J	mg/L		96	50 - 150

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Method: 200.8 - Metals (ICP/MS)

Lab Sample ID: MB 810-16218/1-A
Matrix: Drinking Water
Analysis Batch: 16329

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 16218

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	<2.0		2.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Antimony	<1.0		1.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Arsenic	<1.0		1.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Barium	<2.0		2.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Beryllium	<0.30		0.30		ug/L		04/05/22 11:25	04/06/22 11:56	1
Cadmium	<0.50		0.50		ug/L		04/05/22 11:25	04/06/22 11:56	1
Chromium	<0.90		0.90		ug/L		04/05/22 11:25	04/06/22 11:56	1
Lead	<0.50		0.50		ug/L		04/05/22 11:25	04/06/22 11:56	1
Manganese	<2.0		2.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Nickel	<1.0		1.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Selenium	<2.0		2.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Silver	<0.50		0.50		ug/L		04/05/22 11:25	04/06/22 11:56	1
Thallium	<0.30		0.30		ug/L		04/05/22 11:25	04/06/22 11:56	1
Zinc	<5.0		5.0		ug/L		04/05/22 11:25	04/06/22 11:56	1

Lab Sample ID: LCS 810-16218/6-A
Matrix: Drinking Water
Analysis Batch: 16329

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16218

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Aluminum	50.0	49.6		ug/L		99	85 - 115
Antimony	50.0	52.4		ug/L		105	85 - 115
Arsenic	50.0	48.4		ug/L		97	85 - 115
Barium	50.0	48.1		ug/L		96	85 - 115
Beryllium	50.0	48.9		ug/L		98	85 - 115
Cadmium	50.0	48.5		ug/L		97	85 - 115
Chromium	50.0	49.0		ug/L		98	85 - 115
Copper	50.0	49.3		ug/L		99	85 - 115
Lead	50.0	50.7		ug/L		101	85 - 115
Manganese	50.0	48.3		ug/L		97	85 - 115
Nickel	50.0	47.9		ug/L		96	85 - 115
Selenium	50.0	48.1		ug/L		96	85 - 115
Silver	50.0	44.2		ug/L		88	85 - 115
Thallium	50.0	48.7		ug/L		97	85 - 115
Zinc	50.0	48.6		ug/L		97	85 - 115

Lab Sample ID: LLCS 810-16218/2-A
Matrix: Drinking Water
Analysis Batch: 16329

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16218

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Antimony	0.300	0.328	J	ug/L		109	50 - 150
Arsenic	0.300	<0.89		ug/L		64	50 - 150
Barium	0.300	0.308	J	ug/L		103	50 - 150
Beryllium	0.300	0.290	J	ug/L		97	50 - 150
Cadmium	0.300	0.351	J	ug/L		117	50 - 150
Chromium	0.300	<0.31		ug/L		100	50 - 150
Copper	0.300	<0.55		ug/L		88	50 - 150
Lead	0.300	0.298	J	ug/L		99	50 - 150

Method: 200.8 - Metals (ICP/MS) (Continued)

Lab Sample ID: LLCS 810-16218/2-A
Matrix: Drinking Water
Analysis Batch: 16329

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16218

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Manganese	0.300	0.310	J	ug/L		103	50 - 150
Nickel	0.300	0.292	J	ug/L		97	50 - 150
Selenium	0.300	<1.6		ug/L		138	50 - 150
Silver	0.300	0.179	J	ug/L		60	50 - 150
Thallium	0.300	0.282	J	ug/L		94	50 - 150
Zinc	0.300	<2.3		ug/L		116	50 - 150

Lab Sample ID: LLCS 810-16218/3-A
Matrix: Drinking Water
Analysis Batch: 16329

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16218

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Antimony	1.00	1.08		ug/L		108	50 - 150
Arsenic	1.00	0.974	J	ug/L		97	50 - 150
Barium	1.00	1.08	J	ug/L		108	50 - 150
Copper	1.00	0.951	J	ug/L		95	50 - 150
Manganese	1.00	1.00	J	ug/L		100	50 - 150
Nickel	1.00	0.977	J	ug/L		98	50 - 150
Selenium	1.00	<1.6		ug/L		109	50 - 150
Zinc	1.00	<2.3		ug/L		103	50 - 150

Lab Sample ID: LLCS 810-16218/4-A
Matrix: Drinking Water
Analysis Batch: 16329

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16218

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Aluminum	2.00	2.92		ug/L		146	50 - 150
Barium	2.00	1.92	J	ug/L		96	50 - 150
Manganese	2.00	1.97	J	ug/L		98	50 - 150
Selenium	2.00	1.98	J	ug/L		99	50 - 150
Zinc	2.00	<2.3		ug/L		98	50 - 150

Lab Sample ID: LLCS 810-16218/5-A
Matrix: Drinking Water
Analysis Batch: 16329

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16218

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Zinc	5.00	4.88	J	ug/L		98	50 - 150

Method: 245.1 - Mercury (CVAA)

Lab Sample ID: MB 810-16509/1-A
Matrix: Drinking Water
Analysis Batch: 16546

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16509

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.10		0.10	ug/L		04/08/22 12:11	04/08/22 15:51	1

QC Sample Results

Client: EnSafe, Inc.
Project/Site: MegaSite Drinking Water Source Assessmen

Job ID: 810-19498-1

Method: 245.1 - Mercury (CVAA) (Continued)

Lab Sample ID: LCS 810-16509/3-A
Matrix: Drinking Water
Analysis Batch: 16546

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16509

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	1.00	0.993		ug/L		99	85 - 115

Lab Sample ID: LLCS 810-16509/2-A
Matrix: Drinking Water
Analysis Batch: 16546

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16509

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	0.100	0.0731	J	ug/L		73	50 - 150

Method: 150.1 - pH (Electrometric)

Lab Sample ID: LCSSRM 810-16070/4
Matrix: Drinking Water
Analysis Batch: 16070

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec Limits
pH	9.00	9.1		SU		101.0	98.9 - 101.1

Lab Sample ID: LCSSRM 810-16070/9
Matrix: Drinking Water
Analysis Batch: 16070

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec Limits
pH	9.00	9.0		SU		100.3	98.9 - 101.1

Method: 180.1 - Turbidity, Nephelometric

Lab Sample ID: MB 810-16061/4
Matrix: Drinking Water
Analysis Batch: 16061

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Turbidity	<0.10		0.10	NTU			04/01/22 14:00	1

Lab Sample ID: LLCS 810-16061/3
Matrix: Drinking Water
Analysis Batch: 16061

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Turbidity	0.116	0.10		NTU		95	50 - 150

Method: 335.4 - Cyanide, Total

Lab Sample ID: MBL 810-16381/4-A
Matrix: Drinking Water
Analysis Batch: 16413

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16381

Analyte	MBL Result	MBL Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Cyanide, Total	<0.0028		0.0050	mg/L		04/07/22 08:45	04/07/22 11:17	1

Method: 335.4 - Cyanide, Total (Continued)

Lab Sample ID: LCS 810-16381/2-A
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16413
Prep Batch: 16381

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Cyanide, Total	0.100	0.0986		mg/L		99	90 - 110

Lab Sample ID: LLCS 810-16381/3-A
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16413
Prep Batch: 16381

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Cyanide, Total	0.00500	0.00510		mg/L		102	80 - 120

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 810-16053/20
Client Sample ID: Method Blank
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16053

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	<0.10		0.10	mg/L			04/01/22 12:03	1

Lab Sample ID: LCS 810-16053/16
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16053

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Nitrate Nitrite as N	4.00	4.07		mg/L		102	90 - 110

Lab Sample ID: LLCS 810-16053/19
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16053

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Nitrate Nitrite as N	0.100	0.0889	J	mg/L		89	50 - 150

Lab Sample ID: MBL 810-16059/19
Client Sample ID: Method Blank
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16059

Analyte	MBL Result	MBL Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrite as N	<0.0026		0.010	mg/L			04/01/22 13:13	1

Lab Sample ID: LCS 810-16059/15
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16059

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Nitrite as N	0.200	0.198		mg/L		99	90 - 110

Method: 353.2 - Nitrogen, Nitrate-Nitrite (Continued)

Lab Sample ID: LLCS 810-16059/18 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16059

Analyte			Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits		
Nitrite as N			0.0100	0.00930	J	mg/L		93	50 - 150		

Method: SM 2120B - Color, True, Colorimetric

Lab Sample ID: MB 810-16056/12 **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16056

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Color, True	<3.0		3.0		Color Units			04/01/22 13:31	1

Method: SM 2150B - Odor

Lab Sample ID: MB 810-16141/1 **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16141

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Odor	<1.0		1.0		T.O.N.			04/01/22 12:56	1

Method: SM 2320B - Alkalinity

Lab Sample ID: MBL 810-16269/6 **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16269

Analyte	MBL Result	MBL Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity, Total	<1.0		1.0		mg/L			04/05/22 10:12	1

Lab Sample ID: LCS 810-16269/4 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16269

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Alkalinity, Total			100	91.8		mg/L		92	78 - 114		

Lab Sample ID: LLCS 810-16269/5 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16269

Analyte			Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits		
Alkalinity, Total			1.00	<1.0		mg/L		92	50 - 150		

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 810-16155/1 **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16155

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<10		10		mg/L			04/04/22 12:45	1

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: LCS 810-16155/2 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16155

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Total Dissolved Solids	1000	1000		mg/L		100	85 - 115

Method: SM 4500 F C - Fluoride

Lab Sample ID: MBL 810-16421/6 **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16421

Analyte	MBL Result	MBL Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.028		0.050	mg/L			04/07/22 10:06	1

Lab Sample ID: LCS 810-16421/4 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16421

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	2.00	2.02		mg/L		101	90 - 110

Lab Sample ID: LLCS 810-16421/5 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16421

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.0500	0.0500		mg/L		100	50 - 150

QC Association Summary

Client: EnSafe, Inc.
Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

GC/MS VOA

Analysis Batch: 16353

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	524.2	
810-19498-3	LTB 03-28-2022	Total/NA	Drinking Water	524.2	
MB 810-16353/5	Method Blank	Total/NA	Drinking Water	524.2	

GC/MS Semi VOA

Prep Batch: 16117

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	548.1	
MB 810-16117/1-A	Method Blank	Total/NA	Drinking Water	548.1	
LCS 810-16117/2-A	Lab Control Sample	Total/NA	Drinking Water	548.1	
LLCS 810-16117/3-A	Lab Control Sample	Total/NA	Drinking Water	548.1	

Analysis Batch: 16195

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	548.1	16117
MB 810-16117/1-A	Method Blank	Total/NA	Drinking Water	548.1	16117
LCS 810-16117/2-A	Lab Control Sample	Total/NA	Drinking Water	548.1	16117
LLCS 810-16117/3-A	Lab Control Sample	Total/NA	Drinking Water	548.1	16117

Prep Batch: 16374

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	525.2	
MB 810-16374/1-A	Method Blank	Total/NA	Drinking Water	525.2	
LCS 810-16374/2-A	Lab Control Sample	Total/NA	Drinking Water	525.2	
LLCS 810-16374/4-A	Lab Control Sample	Total/NA	Drinking Water	525.2	

Analysis Batch: 16434

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	525.2	16374
MB 810-16374/1-A	Method Blank	Total/NA	Drinking Water	525.2	16374
LCS 810-16374/2-A	Lab Control Sample	Total/NA	Drinking Water	525.2	16374
LLCS 810-16374/4-A	Lab Control Sample	Total/NA	Drinking Water	525.2	16374

GC Semi VOA

Prep Batch: 15931

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LLCS 810-15931/2-B	Lab Control Sample	Total/NA	Drinking Water	515.3	

Cleanup Batch: 15997

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LLCS 810-15931/2-B	Lab Control Sample	Total/NA	Drinking Water	Aliquot	15931

Prep Batch: 16186

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	515.3	
MB 810-16186/1-B	Method Blank	Total/NA	Drinking Water	515.3	

Cleanup Batch: 16215

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	Aliquot	16186

GC Semi VOA (Continued)

Cleanup Batch: 16215 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 810-16186/1-B	Method Blank	Total/NA	Drinking Water	Aliquot	16186

Prep Batch: 16398

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	505	
MB 810-16398/1-A	Method Blank	Total/NA	Drinking Water	505	
LLCS 810-16398/2-A	Lab Control Sample	Total/NA	Drinking Water	505	
LLCS 810-16398/3-A	Lab Control Sample	Total/NA	Drinking Water	505	

Analysis Batch: 16426

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	505	16398
MB 810-16398/1-A	Method Blank	Total/NA	Drinking Water	505	16398
LLCS 810-16398/2-A	Lab Control Sample	Total/NA	Drinking Water	505	16398
LLCS 810-16398/3-A	Lab Control Sample	Total/NA	Drinking Water	505	16398

Prep Batch: 16527

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	504.1	
MB 810-16527/1-A	Method Blank	Total/NA	Drinking Water	504.1	
LCS 810-16527/2-A	Lab Control Sample	Total/NA	Drinking Water	504.1	
LCS 810-16527/3-A	Lab Control Sample	Total/NA	Drinking Water	504.1	
LLCS 810-16527/6-A	Lab Control Sample	Total/NA	Drinking Water	504.1	

Analysis Batch: 16541

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	504.1	16527
MB 810-16527/1-A	Method Blank	Total/NA	Drinking Water	504.1	16527
LCS 810-16527/2-A	Lab Control Sample	Total/NA	Drinking Water	504.1	16527
LCS 810-16527/3-A	Lab Control Sample	Total/NA	Drinking Water	504.1	16527
LLCS 810-16527/6-A	Lab Control Sample	Total/NA	Drinking Water	504.1	16527

Analysis Batch: 16797

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	515.3	16215
MB 810-16186/1-B	Method Blank	Total/NA	Drinking Water	515.3	16215
LLCS 810-15931/2-B	Lab Control Sample	Total/NA	Drinking Water	515.3	15997

HPLC/IC

Analysis Batch: 16076

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	300.0	
MB 810-16076/4	Method Blank	Total/NA	Drinking Water	300.0	
LCS 810-16076/5	Lab Control Sample	Total/NA	Drinking Water	300.0	

Analysis Batch: 16096

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	300.0	
MB 810-16096/4	Method Blank	Total/NA	Drinking Water	300.0	
LCS 810-16096/5	Lab Control Sample	Total/NA	Drinking Water	300.0	

HPLC/IC

Filtration Batch: 16138

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Dissolved	Drinking Water	Filtration	
MB 810-16138/1-A	Method Blank	Dissolved	Drinking Water	Filtration	
LCS 810-16138/3-A	Lab Control Sample	Dissolved	Drinking Water	Filtration	
LLCS 810-16138/2-A	Lab Control Sample	Dissolved	Drinking Water	Filtration	
810-19498-1 DU	WestWell03312022	Dissolved	Drinking Water	Filtration	

Analysis Batch: 16161

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Dissolved	Drinking Water	547	16138
MB 810-16138/1-A	Method Blank	Dissolved	Drinking Water	547	16138
LCS 810-16138/3-A	Lab Control Sample	Dissolved	Drinking Water	547	16138
LLCS 810-16138/2-A	Lab Control Sample	Dissolved	Drinking Water	547	16138
810-19498-1 DU	WestWell03312022	Dissolved	Drinking Water	547	16138

Prep Batch: 16188

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	549.2	
MB 810-16188/1-A	Method Blank	Total/NA	Drinking Water	549.2	
LCS 810-16188/2-A	Lab Control Sample	Total/NA	Drinking Water	549.2	
LLCS 810-16188/3-A	Lab Control Sample	Total/NA	Drinking Water	549.2	

Filtration Batch: 16371

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Dissolved	Drinking Water	Filtration	
MBL 810-16371/1-A	Method Blank	Dissolved	Drinking Water	Filtration	

Analysis Batch: 16425

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Dissolved	Drinking Water	531.2	16371
MBL 810-16371/1-A	Method Blank	Dissolved	Drinking Water	531.2	16371

Analysis Batch: 16530

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	549.2	16188
MB 810-16188/1-A	Method Blank	Total/NA	Drinking Water	549.2	16188
LCS 810-16188/2-A	Lab Control Sample	Total/NA	Drinking Water	549.2	16188
LLCS 810-16188/3-A	Lab Control Sample	Total/NA	Drinking Water	549.2	16188

Specialty Organics

Prep Batch: 242496

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	1613B	
MB 410-242496/1-A	Method Blank	Total/NA	Drinking Water	1613B	
LCS 410-242496/2-A	Lab Control Sample	Total/NA	Drinking Water	1613B	

Analysis Batch: 242588

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 410-242496/1-A	Method Blank	Total/NA	Drinking Water	1613B	242496
LCS 410-242496/2-A	Lab Control Sample	Total/NA	Drinking Water	1613B	242496

Specialty Organics

Analysis Batch: 242674

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	1613B	242496

Metals

Prep Batch: 16216

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total Recoverable	Drinking Water	200.2	
MB 810-16216/1-A	Method Blank	Total Recoverable	Drinking Water	200.2	
LCS 810-16216/4-A	Lab Control Sample	Total Recoverable	Drinking Water	200.2	
LLCS 810-16216/2-A	Lab Control Sample	Total Recoverable	Drinking Water	200.2	
LLCS 810-16216/3-A	Lab Control Sample	Total Recoverable	Drinking Water	200.2	

Prep Batch: 16218

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 810-16218/1-A	Method Blank	Total Recoverable	Drinking Water	200.8	
LCS 810-16218/6-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	
LLCS 810-16218/2-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	
LLCS 810-16218/3-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	
LLCS 810-16218/4-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	
LLCS 810-16218/5-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	

Analysis Batch: 16329

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total Recoverable	Drinking Water	200.8	
810-19498-1	WestWell03312022	Total/NA	Drinking Water	200.8	
MB 810-16218/1-A	Method Blank	Total Recoverable	Drinking Water	200.8	16218
LCS 810-16218/6-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218
LLCS 810-16218/2-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218
LLCS 810-16218/3-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218
LLCS 810-16218/4-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218
LLCS 810-16218/5-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218

Analysis Batch: 16336

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total Recoverable	Drinking Water	200.7	16216
MB 810-16216/1-A	Method Blank	Total Recoverable	Drinking Water	200.7	16216
LCS 810-16216/4-A	Lab Control Sample	Total Recoverable	Drinking Water	200.7	16216
LLCS 810-16216/2-A	Lab Control Sample	Total Recoverable	Drinking Water	200.7	16216
LLCS 810-16216/3-A	Lab Control Sample	Total Recoverable	Drinking Water	200.7	16216

Analysis Batch: 16458

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total Recoverable	Drinking Water	SM 2340B	

Prep Batch: 16509

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	245.1	
MB 810-16509/1-A	Method Blank	Total/NA	Drinking Water	245.1	
LCS 810-16509/3-A	Lab Control Sample	Total/NA	Drinking Water	245.1	
LLCS 810-16509/2-A	Lab Control Sample	Total/NA	Drinking Water	245.1	

Metals

Analysis Batch: 16546

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	245.1	16509
MB 810-16509/1-A	Method Blank	Total/NA	Drinking Water	245.1	16509
LCS 810-16509/3-A	Lab Control Sample	Total/NA	Drinking Water	245.1	16509
LLCS 810-16509/2-A	Lab Control Sample	Total/NA	Drinking Water	245.1	16509

General Chemistry

Analysis Batch: 16053

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	353.2	
MB 810-16053/20	Method Blank	Total/NA	Drinking Water	353.2	
LCS 810-16053/16	Lab Control Sample	Total/NA	Drinking Water	353.2	
LLCS 810-16053/19	Lab Control Sample	Total/NA	Drinking Water	353.2	

Analysis Batch: 16056

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	SM 2120B	
MB 810-16056/12	Method Blank	Total/NA	Drinking Water	SM 2120B	
LCSSRM 810-16056/13	Lab Control Sample	Total/NA	Drinking Water	SM 2120B	

Analysis Batch: 16059

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	353.2	
MBL 810-16059/19	Method Blank	Total/NA	Drinking Water	353.2	
LCS 810-16059/15	Lab Control Sample	Total/NA	Drinking Water	353.2	
LLCS 810-16059/18	Lab Control Sample	Total/NA	Drinking Water	353.2	

Analysis Batch: 16061

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	180.1	
MB 810-16061/4	Method Blank	Total/NA	Drinking Water	180.1	
LLCS 810-16061/3	Lab Control Sample	Total/NA	Drinking Water	180.1	

Analysis Batch: 16070

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	150.1	
LCSSRM 810-16070/4	Lab Control Sample	Total/NA	Drinking Water	150.1	
LCSSRM 810-16070/9	Lab Control Sample	Total/NA	Drinking Water	150.1	

Analysis Batch: 16073

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	SM 2550B	

Analysis Batch: 16141

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	SM 2150B	
MB 810-16141/1	Method Blank	Total/NA	Drinking Water	SM 2150B	

Analysis Batch: 16155

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	SM 2540C	

General Chemistry (Continued)

Analysis Batch: 16155 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 810-16155/1	Method Blank	Total/NA	Drinking Water	SM 2540C	
LCS 810-16155/2	Lab Control Sample	Total/NA	Drinking Water	SM 2540C	

Analysis Batch: 16244

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	Nitrate by calc	

Analysis Batch: 16269

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	SM 2320B	
MBL 810-16269/6	Method Blank	Total/NA	Drinking Water	SM 2320B	
LCS 810-16269/4	Lab Control Sample	Total/NA	Drinking Water	SM 2320B	
LLCS 810-16269/5	Lab Control Sample	Total/NA	Drinking Water	SM 2320B	

Prep Batch: 16381

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	Distill/CN	
MBL 810-16381/4-A	Method Blank	Total/NA	Drinking Water	Distill/CN	
LCS 810-16381/2-A	Lab Control Sample	Total/NA	Drinking Water	Distill/CN	
LLCS 810-16381/3-A	Lab Control Sample	Total/NA	Drinking Water	Distill/CN	

Analysis Batch: 16413

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	335.4	16381
MBL 810-16381/4-A	Method Blank	Total/NA	Drinking Water	335.4	16381
LCS 810-16381/2-A	Lab Control Sample	Total/NA	Drinking Water	335.4	16381
LLCS 810-16381/3-A	Lab Control Sample	Total/NA	Drinking Water	335.4	16381

Analysis Batch: 16421

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	SM 4500 F C	
MBL 810-16421/6	Method Blank	Total/NA	Drinking Water	SM 4500 F C	
LCS 810-16421/4	Lab Control Sample	Total/NA	Drinking Water	SM 4500 F C	
LLCS 810-16421/5	Lab Control Sample	Total/NA	Drinking Water	SM 4500 F C	

Analysis Batch: 16708

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19498-1	WestWell03312022	Total/NA	Drinking Water	SM 2330B	

Lab Chronicle

Client Sample ID: WestWell03312022

Lab Sample ID: 810-19498-1

Date Collected: 03/31/22 12:30

Matrix: Drinking Water

Date Received: 04/01/22 08:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	524.2		1	16353	04/07/22 01:41	DC	EA SB
Total/NA	Prep	525.2			16374	04/07/22 08:06	HB	EA SB
Total/NA	Analysis	525.2		1	16434	04/08/22 11:03	CG	EA SB
Total/NA	Prep	548.1			16117	04/04/22 08:24	JH	EA SB
Total/NA	Analysis	548.1		1	16195	04/05/22 15:32	TL	EA SB
Total/NA	Prep	504.1			16527	04/08/22 14:33	SS	EA SB
Total/NA	Analysis	504.1		1	16541	04/08/22 23:55	JV	EA SB
Total/NA	Prep	505			16398	04/07/22 10:35	AM	EA SB
Total/NA	Analysis	505		1	16426	04/07/22 19:30	JB	EA SB
Total/NA	Prep	515.3			16186	04/05/22 07:38	AM	EA SB
Total/NA	Cleanup	Aliquot			16215	04/05/22 11:40	AM	EA SB
Total/NA	Analysis	515.3		1	16797	04/14/22 11:06	TL	EA SB
Total/NA	Analysis	300.0		1	16076	04/01/22 23:39	JL	EA SB
Total/NA	Analysis	300.0		1	16096	04/01/22 22:06	JL	EA SB
Dissolved	Filtration	Filtration			16371	04/07/22 06:43	AM	EA SB
Dissolved	Analysis	531.2		1	16425	04/08/22 12:04	TL	EA SB
Dissolved	Filtration	Filtration			16138	04/04/22 10:13	MP	EA SB
Dissolved	Analysis	547		1	16161	04/05/22 09:05	RS	EA SB
Total/NA	Prep	549.2			16188	04/05/22 08:05	SS	EA SB
Total/NA	Analysis	549.2		1	16530	04/08/22 17:09	DL	EA SB
Total/NA	Prep	1613B			242496	04/08/22 09:19	TJK2	ELLE
Total/NA	Analysis	1613B		1	242674	04/09/22 00:57	UA2A	ELLE
Total Recoverable	Prep	200.2			16216	04/05/22 11:25	NB	EA SB
Total Recoverable	Analysis	200.7		1	16336	04/06/22 13:47	AC	EA SB
Total Recoverable	Analysis	200.8		1	16329	04/06/22 12:48	NB	EA SB
Total/NA	Analysis	200.8		1	16329	04/06/22 12:48	NB	EA SB
Total/NA	Prep	245.1			16509	04/08/22 12:11	AC	EA SB
Total/NA	Analysis	245.1		1	16546	04/08/22 16:20	AC	EA SB
Total Recoverable	Analysis	SM 2340B		1	16458	04/07/22 19:36	AC	EA SB
Total/NA	Analysis	150.1		1	16070	04/01/22 14:51	JA	EA SB
Total/NA	Analysis	180.1		1	16061	04/01/22 14:11	JA	EA SB
Total/NA	Prep	Distill/CN			16381	04/07/22 09:36	KH	EA SB
Total/NA	Analysis	335.4		1	16413	04/07/22 11:26	KH	EA SB
Total/NA	Analysis	353.2		1	16053	04/01/22 12:12	KH	EA SB
Total/NA	Analysis	353.2		1	16059	04/01/22 13:22	KH	EA SB
Total/NA	Analysis	Nitrate by calc		1	16244	04/05/22 14:10	KH	EA SB
Total/NA	Analysis	SM 2120B		1	16056	04/01/22 13:39	JA	EA SB
Total/NA	Analysis	SM 2150B		1	16141	04/01/22 13:06	JA	EA SB
Total/NA	Analysis	SM 2320B		1	16269	04/05/22 11:58	KH	EA SB
Total/NA	Analysis	SM 2330B		1	16708	04/12/22 15:37	KH	EA SB
Total/NA	Analysis	SM 2540C		1	16155	04/04/22 14:06	JA	EA SB
Total/NA	Analysis	SM 2550B		1	16073	04/01/22 14:44	KH	EA SB

Lab Chronicle

Client: EnSafe, Inc. Job ID: 810-19498-1

Project/Site: MegaSite Drinking Water Source Assessmen

Client Sample ID: WestWell03312022 **Lab Sample ID: 810-19498-1**

Date Collected: 03/31/22 12:30 **Matrix: Drinking Water**

Date Received: 04/01/22 08:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	SM 4500 F C		1	16421	04/07/22 10:41	KH	EA SB

Client Sample ID: LTB 03-28-2022 **Lab Sample ID: 810-19498-3**

Date Collected: 03/31/22 00:00 **Matrix: Drinking Water**

Date Received: 04/01/22 08:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	524.2		1	16353	04/07/22 01:18	DC	EA SB

Laboratory References:

EA SB = Eurofins Eaton South Bend, 110 S Hill Street, South Bend, IN 46617, TEL (574)233-4777

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Laboratory: Eurofins Eaton South Bend

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Tennessee	State	TN02973	06-30-22

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
505	505	Drinking Water	Total PCBs as DCB (Qualitative)
515.3	515.3	Drinking Water	Dicamba
524.2		Drinking Water	1,1,1,2-Tetrachloroethane
524.2		Drinking Water	1,1,2,2-Tetrachloroethane
524.2		Drinking Water	1,1-Dichloroethane
524.2		Drinking Water	1,1-Dichloropropene
524.2		Drinking Water	1,2,3-Trichlorobenzene
524.2		Drinking Water	1,2,3-Trichloropropane
524.2		Drinking Water	1,2,4-Trimethylbenzene
524.2		Drinking Water	1,2-Dibromo-3-Chloropropane
524.2		Drinking Water	1,2-Dibromoethane (EDB)
524.2		Drinking Water	1,3,5-Trimethylbenzene
524.2		Drinking Water	1,3-Dichlorobenzene
524.2		Drinking Water	1,3-Dichloropropane
524.2		Drinking Water	2,2-Dichloropropane
524.2		Drinking Water	2-Chlorotoluene
524.2		Drinking Water	4-Chlorotoluene
524.2		Drinking Water	4-Isopropyltoluene
524.2		Drinking Water	Bromobenzene
524.2		Drinking Water	Bromochloromethane
524.2		Drinking Water	Bromomethane
524.2		Drinking Water	Chloroethane
524.2		Drinking Water	Chloromethane
524.2		Drinking Water	cis-1,3-Dichloropropylene
524.2		Drinking Water	Dibromomethane
524.2		Drinking Water	Dichlorodifluoromethane
524.2		Drinking Water	Hexachlorobutadiene
524.2		Drinking Water	Isopropylbenzene
524.2		Drinking Water	Methyl-tert-butyl Ether (MTBE)
524.2		Drinking Water	m-Xylene & p-Xylene
524.2		Drinking Water	Naphthalene
524.2		Drinking Water	n-Butylbenzene
524.2		Drinking Water	N-Propylbenzene
524.2		Drinking Water	o-Xylene
524.2		Drinking Water	sec-Butylbenzene
524.2		Drinking Water	tert-Butylbenzene
524.2		Drinking Water	trans-1,3-Dichloropropylene
524.2		Drinking Water	Trichlorofluoromethane
525.2	525.2	Drinking Water	Aldrin
525.2	525.2	Drinking Water	Butachlor
525.2	525.2	Drinking Water	Dieldrin
525.2	525.2	Drinking Water	Metolachlor
525.2	525.2	Drinking Water	Metribuzin
525.2	525.2	Drinking Water	Propachlor
531.2		Drinking Water	1-Naphthol

Accreditation/Certification Summary

Laboratory: Eurofins Eaton South Bend (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
531.2		Drinking Water	3-Hydroxycarbofuran
531.2		Drinking Water	Carbaryl
531.2		Drinking Water	Methomyl
SM 2150B		Drinking Water	Odor
SM 2330B		Drinking Water	Langelier Index
SM 2340B		Drinking Water	Calcium hardness as calcium carbonate
SM 2340B		Drinking Water	Magnesium hardness as calcium carbonate
SM 2550B		Drinking Water	Temperature

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	1.01	11-30-22
A2LA	ISO/IEC 17025	0001.01	11-30-22
Alaska	State	PA00009	06-30-22
Alaska (UST)	State	17-027	02-28-23
Arizona	State	AZ0780	03-12-23
Arkansas DEQ	State	88-0660	08-10-22
California	State	2792	02-02-22 *
Colorado	State	PA00009	06-30-22
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-23
Delaware (DW)	State	N/A	01-31-23
Florida	NELAP	E87997	06-30-22
Georgia (DW)	State	C048	01-31-22 *
Hawaii	State	N/A	01-31-23
Illinois	NELAP	200027	01-31-23
Iowa	State	361	03-02-22 *
Kansas	NELAP	E-10151	10-31-22
Kentucky (DW)	State	KY90088	12-31-22
Kentucky (UST)	State	1.01	11-30-22
Kentucky (WW)	State	KY90088	01-01-23
Louisiana	NELAP	02055	06-30-22
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-22
Massachusetts	State	M-PA009	06-30-22
Michigan	State	9930	01-31-23
Minnesota	NELAP	042-999-487	12-31-22
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-23
Montana (UST)	State	<cert No.>	02-01-23
Nebraska	State	NE-OS-32-17	01-31-23
New Hampshire	NELAP	2730	01-10-23
New Jersey	NELAP	PA011	06-30-22
New York	NELAP	10670	04-01-23

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Accreditation/Certification Summary

Client: EnSafe, Inc.
Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
North Carolina (DW)	State	42705	07-31-22
North Carolina (WW/SW)	State	521	12-31-22
North Dakota	State	R-205	01-31-23
Oklahoma	NELAP	R-205	08-31-22
Oregon	NELAP	PA200001	09-11-22
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-23
Rhode Island	State	LAO00338	12-30-22
South Carolina	State	89002	01-31-23
Tennessee	State	02838	01-31-23
Texas	NELAP	T104704194-21-40	08-31-22
USDA	US Federal Programs	P330-19-00197	07-03-22
Vermont	State	VT - 36037	10-28-22
Virginia	NELAP	460182	06-14-22
Washington	State	C457	04-12-22
West Virginia (DW)	State	9906 C	12-31-22
West Virginia DEP	State	055	04-12-22
Wyoming	State	8TMS-L	01-31-23
Wyoming (UST)	A2LA	1.01	11-30-22

Method Summary

Client: EnSafe, Inc.
Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method	Method Description	Protocol	Laboratory
524.2	Volatile Organic Compounds (GC/MS)	EPA-DW	EA SB
525.2	Semivolatile Organic Compounds (GC/MS)	EPA	EA SB
548.1	Endothall (GC/MS)	EPA	EA SB
504.1	EDB, DBCP and 1,2,3-TCP (GC)	EPA-DW	EA SB
505	Organochlorine Pesticides/PCBs (GC)	EPA	EA SB
515.3	Herbicides (GC)	EPA	EA SB
300.0	Anions, Ion Chromatography	EPA	EA SB
531.2	Carbamate Pesticides (HPLC)	EPA	EA SB
547	Glyphosate (DAI HPLC)	EPA	EA SB
549.2	Diquat and Paraquat (HPLC)	EPA	EA SB
1613B	Tetra Chlorinated Dioxin in Drinking Water	EPA	ELLE
200.7	Metals (ICP)	EPA	EA SB
200.8	Metals (ICP/MS)	EPA	EA SB
245.1	Mercury (CVAA)	EPA	EA SB
SM 2340B	Total Hardness (as CaCO3) by calculation	SM	EA SB
150.1	pH (Electrometric)	MCAWW	EA SB
180.1	Turbidity, Nephelometric	MCAWW	EA SB
335.4	Cyanide, Total	MCAWW	EA SB
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	EA SB
Nitrate by calc	Nitrogen, Nitrate-Nitrite	SM	EA SB
SM 2120B	Color, True, Colorimetric	SM	EA SB
SM 2150B	Odor	SM	EA SB
SM 2320B	Alkalinity	SM	EA SB
SM 2330B	Corrosivity, LSI Calculation	SM	EA SB
SM 2540C	Solids, Total Dissolved (TDS)	SM	EA SB
SM 2550B	Temperature	SM	EA SB
SM 4500 F C	Fluoride	SM	EA SB
1613B	Separatory Funnel (Liquid-Liquid) Extraction	EPA	ELLE
200.2	Preparation, Total Recoverable Metals	EPA	EA SB
200.8	Preparation, Metals	EPA	EA SB
200.8	Preparation, Total Recoverable Metals	EPA	EA SB
245.1	Preparation, Mercury	EPA	EA SB
504.1	Microextraction	EPA-DW	EA SB
505	Extraction, Organochlorine Pesticides/PCBs	EPA	EA SB
515.3	Extraction of Chlorinated Acids	EPA-DW	EA SB
525.2	Extraction of Semivolatile Compounds	EPA	EA SB
548.1	Extraction of Endothall	EPA-DW	EA SB
549.2	Extraction of Diquat and Paraquat	EPA	EA SB
Aliquot	Preparation, Extract aliquot	None	EA SB
Distill/CN	Distillation, Cyanide	None	EA SB
Filtration	Sample Filtration	None	EA SB

Protocol References:

EPA = US Environmental Protection Agency
EPA-DW = "Methods For The Determination Of Organic Compounds In Drinking Water", EPA/600/4-88/039, December 1988 And Its Supplements.
MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.
None = None
SM = "Standard Methods For The Examination Of Water And Wastewater"

Laboratory References:

EA SB = Eurofins Eaton South Bend, 110 S Hill Street, South Bend, IN 46617, TEL (574)233-4777
ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Client: EnSafe, Inc.
Job ID: 810-19498-1
Project/Site: MegaSite Drinking Water Source Assessmen

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
810-19498-1	WestWell03312022	Drinking Water	03/31/22 12:30	04/01/22 08:45
810-19498-3	LTB 03-28-2022	Drinking Water	03/31/22 00:00	04/01/22 08:45

810-19498 Chain of Custody

Chain of Custody Record

eurofins Environment Testing America

Client Contact: Ms. Sandra Ross
Company: EnSafe, Inc.
Address: 5724 Summer Trees Drive
City: Memphis
State, Zip: TN, 38134
Phone: 901-372-7962(Tel)
Email: sross@ensafe.com
Project Name: MegaSite Drinking Water Source Assessmen
Site: Mega Site - East+ West Wells

Sampler: Norm K. / Ben B
Phone:
PWSID:
Due Date Requested:
TAT Requested (days): Standard
Compliance Project: Δ Yes Δ No
PO #: 0000032853
WO #:
Project #: 81002259
SSOW#:

Lab PM: Hunsberger, Caleb
E-Mail: anthony.hunsberger@eurofinset.com

Carrier Tracking No(s): 974546495952
State of Origin: TN

COC No: 810-10215-2984.1
Page: Page 1 of 3
Job #: 08882 29845

Preservation Codes:
A - HCL M - Hexane
B - NaOH N - None
C - Zn Acetate O - AsNaO2
D - Nitric Acid P - Na2O4S
E - NaHSO4 Q - Na2SO3
F - MeOH R - Na2S2O3
G - Amchlor S - H2SO4
H - Ascorbic Acid T - TSP Dodecahydrate
I - Ice U - Acetone
J - DI Water V - MCAA
K - EDTA W - pH 4-5
L - EDA Z - other (specify)
Other:

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	1613B_DW - 2,3,7,8-TCDD	524.2_Pres_PREC - Phase I,II & V Regulated & Unregulated V	548.1_PREC - Endothall	2540C_Calcd - Total Dissolved Solids (TDS)	9223B_CIPA18_DW - Local Method	200.7_SDWA, 200.8_SDWA, 245.1_SDWA *	300_OF_14D_B - Bromide	531.2_PREC - Phase II & V	SUBCONTRACT - Asbestos	SM2150_Odor_B - Local Method	2120B_True - True Color	525.2_PREC - Phase II & V 525	335.4 - Total Cyanide	Total Number of containers	Special Instructions/Note:
				Preservation Code:	☒	☒	N	HA	R	N	R	D	L		N	N	N			☒	
WestWell03312022	3.31.22	1230	G	Drinking Water	N	N	X	X	✓	X	X	X	X	X	X	X	X	X	X		
Trip Blank	3.31.22			Drinking Water				X													
03/28/22 ppw 04/01/22				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by: Date: Time: Method of Shipment: FedEx

Relinquished by: Ben Brantl 1500	Date/Time: 3-31-2022	Company: EnSafe	Received by:	Date/Time: 04/01/22 0845	Company: EEA
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: [✓ Δ Yes] Δ No
Custody Seal No.:
* pH Acceptable
Cooler Temperature(s) °C and Other Remarks: -1.0 Wet

Ver: 06/08/2021

South Bend, IN
110 S Hill Street
South Bend, IN 46617
Phone: 574-233-4777 Fax: 574-233-8207

Chain of Custody Record

eurofins | Environment Testing America

Client Information	Sampler: Noah K. / Ben B.	Lab PM: Hunsberger, Caleb	Carrier Tracking No(s):	COC No: 810-10215-2984.2
Client Contact: Ms. Sandra Ross	Phone: 901 896 8457	E-Mail: anthony.hunsberger@eurofinset.com	State of Origin:	Page: Page 2 of 3
Company: EnSafe, Inc.	PWSID:			Job #:

Address: 5724 Summer Trees Drive
City: Memphis
State, Zip: TN, 38134
Phone: 901-372-7962(Tel)
Email: sross@ensafe.com
Project Name: MegaSite Drinking Water Source Assessmen
Site: Mega Site East + West wells

Due Date Requested:
TAT Requested (days): Standard
Compliance Project: ∆ Yes ∆ No
PO #: 0000032853
WO #:
Project #: 81002259
SSOW#:

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	504.1_PREC, 505_PREC, 547_PREC	549.2_PREC - Diquat *	150.1, 180.1, 353.2	4500_F_C - Fluoride	2320B - Total Alkalinity Only	300_OF_28D_PREC - (MOD) Chloride, Fluoride, Sulfate	515.3_PREC - Chlorinated Acids - Phase II & V by 515.	200.8_U - Uranium *	SM7500_Rn_B - Radon	SM7110B, SM7500_Ra_B, SM7500_Ra_D *	906.0 - Tritium	504.1_PREC - Full List	~~SUBCONTRACT - Phenols to Monrovia~~	Total Number of containers	Special Instructions/Note:
				Preservation Code:	☒	☒	R		N	N	N	N	Q	D	N	D	N	R	S	☒	
westwell 0331 2022	3.31.22	1230	G	Drinking Water	N	N	X	X	X	X	X	X	X	X	X	X	X	X			
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	
				Drinking Water																	

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by: Ben B	Date/Time: 3.31.2022	Company: EnSafe	Received by: Penny Pehling Wright	Date/Time: 04/01/22 0845	Company: EEA
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time	Company:

Custody Seals Intact: ∆ [✓ Yes] ∆ No
Custody Seal No.:

*pH Acceptable

Cooler Temperature(s) °C and Other Remarks: -1.0 Wet

Ver: 06/08/2021

South Bend, IN
110 S Hill Street
South Bend, IN 46617
Phone: 574-233-4777 Fax: 574-233-8207

Chain of Custody Record

eurofins | Environment Testing America

Client Information	Sampler: Norm K./Ben B.	Lab PM: Hunsberger, Caleb	Carrier Tracking No(s):	COC No: 810-10215-2984.3
Client Contact: Ms. Sandra Ross	Phone:	E-Mail: anthony.hunsberger@eurofinset.com	State of Origin:	Page: Page 3 of 3
Company: EnSafe, Inc.	PWSID:	**Analysis Requested**		Job #:

Address: 5724 Summer Trees Drive	**Due Date Requested:**
City: Memphis	**TAT Requested (days):**
State, Zip: TN, 38134	**Compliance Project:** Δ Yes Δ No
Phone: 901-372-7962(Tel)	PO #: 0000032853
Email: sross@ensafe.com	WO #:
Project Name: MegaSite Drinking Water Source Assessmen	Project #: 81002259
Site:	SSOW#:

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUBCONTRACT - MBAS	Total Number of containers	Special Instructions/Note:
				Preservation Code:			N		
West Well03312022	3.31.2022	1230	G	Drinking Wate	N	N	X		
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					

Possible Hazard Identification
☒ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment: FED EX

Relinquished by:	Date/Time: 3.31.2022	Company: EnSafe	Received by:	Date/Time: 04/01/22 0845	Company: EEA
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ [✓ Yes] Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: -1.0 Wet

Ver: 06/08/2021

West wall

South Bend, IN
110 S Hill Street
South Bend, IN 46617
Phone: 574-233-4777 Fax: 574-233-8207

Chain of Custody Record

eurofins | Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Hunsberger, Caleb	Carrier Tracking No(s):	COC No: 810-2742.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: anthony.hunsberger@eurofinset.com	State of Origin: Tennessee	Page: Page 1 of 1
Company: Eurofins Lancaster Laboratories Env, LLC		Accreditations Required (See note): State - Tennessee		Job #: 810-19498-1

Address: 2425 New Holland Pike, ,
City: Lancaster
State, Zip: PA, 17601
Phone: 717-656-2300(Tel)
Email:
Project Name: MegaSite Drinking Water Source Assessmen
Site:

Due Date Requested: 5/3/2022
TAT Requested (days):
PO #:
WO #:
Project #: 81002259
SSOW#:

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	1613B_DW/1613B_P_Sep 2,3,7,8-TCDD	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
✓ WestWell03312022 (810-19498-1)	3/31/22	12:30 Central		Drinking Wate			X	2	

Note: Since laboratory accreditations are subject to change, Eurofins Eaton Analytical, LLC places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins Eaton Analytical, LLC laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins Eaton Analytical, LLC attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to Eurofins Eaton Analytical, LLC.

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2
Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time: 4-4-22 1600	Company: EEA	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time: 4/5/22 1050	Company: ELLE

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks: 1.8

Ver: 06/08/2021

Login Sample Receipt Checklist

Client: EnSafe, Inc.

Job Number: 810-19498-1

Login Number: 19498
List Number: 1
Creator: Pehling-Wright, Penny

List Source: Eurofins Eaton South Bend

Question	Answer	Comment
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Samples do not require splitting or compositing.	True	
Container provided by EEA	True	

Login Sample Receipt Checklist

Client: EnSafe, Inc.

Job Number: 810-19498-1

Login Number: 19498
List Number: 2
Creator: McCaskey, Jonathan

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC
List Creation: 04/05/22 12:14 PM

Question	**Answer**	**Comment**
The cooler's custody seal is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	False	Received project as a subcontract.
Sample custody seals are intact.	N/A	

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ANALYTICAL REPORT

Eurofins Eaton South Bend
110 S Hill Street
South Bend, IN 46617
Tel: (574)233-4777

Laboratory Job ID: 810-19492-1
Client Project/Site: MegaSite Drinking Water Source Assessmen

For:
EnSafe, Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134

Attn: Ms. Sandra Ross

Caleb Hunsberger

Authorized for release by:
4/19/2022 1:52:19 PM

Caleb Hunsberger, Project Manager
(574)233-4777
Anthony.Hunsberger@et.eurofinsus.com

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Table of Contents

Definitions/Glossary

Client: EnSafe, Inc.
Project/Site: MegaSite Drinking Water Source Assessmen

Job ID: 810-19492-1

Qualifiers

GC/MS Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Dioxin

Qualifier	Qualifier Description
I	Value is EMPC (estimated maximum possible concentration).
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Metals

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
HF	Field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
TNTC	Too Numerous To Count

Job ID: 810-19492-1

Laboratory: Eurofins Eaton South Bend

Narrative

Job Narrative
810-19492-1

Comments
No additional comments.

Receipt
The samples were received on 4/1/2022 8:45 AM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 0.0º C.

Receipt Exceptions

Methods SM 9223B, Subcontract: The following samples were received outside of holding time: EastWell03312022 (810-19492-1), LTB 03-28-2022 (810-19492-2) and LTB 03-28-2022 (810-19492-3).

GC/MS VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC/MS Semi VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

HPLC/IC
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

GC Semi VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Dioxin
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Metals
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

General Chemistry
Method SM 2550B: This analysis is normally performed in the field and has a method-defined holding time of 15 minutes. The following sample has been qualified with the "HF" flag to indicate analysis was performed in the laboratory outside the 15 minute timeframe: EastWell03312022 (810-19492-1).

Method 150.1: This analysis is normally performed in the field and has a method-defined holding time of 15 minutes. The following sample has been qualified with the "HF" flag to indicate analysis was performed in the laboratory outside the 15 minute timeframe: EastWell03312022 (810-19492-1).

Method SM 2150B: The following sample(s) was received with less than 2 days remaining on the holding time or less than one shift (8 hours) remaining on a test with a holding time of 48 hours or less. As such, the laboratory had insufficient time remaining to perform the analysis within holding time: EastWell03312022 (810-19492-1).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Dioxin Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Detection Summary

Client Sample ID: EastWell03312022

Lab Sample ID: 810-19492-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Chloroform	34		0.50		ug/L	1		524.2	Total/NA
Toluene	5.1		0.50		ug/L	1		524.2	Total/NA
Bromide	13		10		ug/L	1		300.0	Total/NA
Chloride	2.6		2.0		mg/L	1		300.0	Total/NA
Calcium	3.3		0.10		mg/L	1		200.7	Total Recoverable
Iron	0.10		0.020		mg/L	1		200.7	Total Recoverable
Magnesium	0.87		0.10		mg/L	1		200.7	Total Recoverable
Sodium	3.4		0.10		mg/L	1		200.7	Total Recoverable
Aluminum	61		2.0		ug/L	1		200.8	Total Recoverable
Barium	7.6		2.0		ug/L	1		200.8	Total Recoverable
Chromium	2.3		0.90		ug/L	1		200.8	Total Recoverable
Copper	3.2		1.0		ug/L	1		200.8	Total Recoverable
Hardness as calcium carbonate	12		0.66		mg/L	1		SM 2340B	Total Recoverable
Calcium hardness as calcium carbonate	8.2		0.25		mg/L	1		SM 2340B	Total Recoverable
Magnesium hardness as calcium carbonate	3.6		0.41		mg/L	1		SM 2340B	Total Recoverable
pH	6.1	HF	0.1		SU	1		150.1	Total/NA
Turbidity	2.6		0.10		NTU	1		180.1	Total/NA
Alkalinity, Total	12		1.0		mg/L	1		SM 2320B	Total/NA
Langelier Index	-3.6				LangSU	1		SM 2330B	Total/NA
Total Dissolved Solids	38		10		mg/L	1		SM 2540C	Total/NA
Temperature	20	H			Degrees C	1		SM 2550B	Total/NA

Client Sample ID: LTB 03-28-2022

Lab Sample ID: 810-19492-3

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: EastWell03312022

Lab Sample ID: 810-19492-1

Date Collected: 03/31/22 11:10
Matrix: Drinking Water
Date Received: 04/01/22 08:45

Method: 524.2 - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	<0.50		0.50		ug/L			04/04/22 12:23	1
1,1,1-Trichloroethane	<0.50		0.50		ug/L			04/04/22 12:23	1
1,1,2,2-Tetrachloroethane	<0.50		0.50		ug/L			04/04/22 12:23	1
1,1,2-Trichloroethane	<0.50		0.50		ug/L			04/04/22 12:23	1
1,1-Dichloroethane	<0.50		0.50		ug/L			04/04/22 12:23	1
1,1-Dichloroethene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,1-Dichloropropene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,2,3-Trichlorobenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,2,3-Trichloropropane	<0.50		0.50		ug/L			04/04/22 12:23	1
1,2,4-Trichlorobenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,2,4-Trimethylbenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,2-Dibromo-3-Chloropropane	<0.20		0.20		ug/L			04/04/22 12:23	1
1,2-Dibromoethane (EDB)	<0.20		0.20		ug/L			04/04/22 12:23	1
1,2-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,2-Dichloroethane	<0.50		0.50		ug/L			04/04/22 12:23	1
1,2-Dichloropropane	<0.25		0.25		ug/L			04/04/22 12:23	1
o-Xylene	<0.50		0.50		ug/L			04/04/22 12:23	1
m-Xylene & p-Xylene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,3,5-Trimethylbenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,3-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
1,3-Dichloropropane	<0.50		0.50		ug/L			04/04/22 12:23	1
1,4-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
2,2-Dichloropropane	<0.50		0.50		ug/L			04/04/22 12:23	1
2-Chlorotoluene	<0.50		0.50		ug/L			04/04/22 12:23	1
4-Chlorotoluene	<0.50		0.50		ug/L			04/04/22 12:23	1
Benzene	<0.50		0.50		ug/L			04/04/22 12:23	1
4-Isopropyltoluene	<0.50		0.50		ug/L			04/04/22 12:23	1
Bromobenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
Bromochloromethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Bromodichloromethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Bromoform	<0.50		0.50		ug/L			04/04/22 12:23	1
Bromomethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Carbon tetrachloride	<0.50		0.50		ug/L			04/04/22 12:23	1
Chloroethane	<0.50		0.50		ug/L			04/05/22 15:45	1
Chlorobenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
Chloromethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Chloroform	**34**		0.50		ug/L			04/04/22 12:23	1
Dibromomethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Dichlorodifluoromethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Dichloromethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Dibromochloromethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Ethylbenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
Hexachlorobutadiene	<0.25		0.25		ug/L			04/04/22 12:23	1
Isopropylbenzene	<0.25		0.25		ug/L			04/04/22 12:23	1
Naphthalene	<0.50		0.50		ug/L			04/04/22 12:23	1
Methyl-tert-butyl Ether (MTBE)	<0.50		0.50		ug/L			04/04/22 12:23	1
Styrene	<0.50		0.50		ug/L			04/04/22 12:23	1
Tetrachloroethene	<0.50		0.50		ug/L			04/04/22 12:23	1
Toluene	**5.1**		0.50		ug/L			04/04/22 12:23	1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Client Sample ID: EastWell03312022 **Lab Sample ID: 810-19492-1**
Date Collected: 03/31/22 11:10 **Matrix: Drinking Water**
Date Received: 04/01/22 08:45

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Trichloroethylene	<0.50		0.50		ug/L			04/04/22 12:23	1
Trichlorofluoromethane	<0.50		0.50		ug/L			04/04/22 12:23	1
Vinyl chloride	<0.20		0.20		ug/L			04/04/22 12:23	1
tert-Butylbenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
cis-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/04/22 12:23	1
cis-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/04/22 12:23	1
n-Butylbenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
N-Propylbenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
sec-Butylbenzene	<0.50		0.50		ug/L			04/04/22 12:23	1
trans-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/04/22 12:23	1
trans-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/04/22 12:23	1
Xylenes, Total	<0.50		0.50		ug/L			04/04/22 12:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*105*		*70 - 130*		*04/04/22 12:23*	*1*
1,2-Dichloroethane-d4 (Surr)	*107*		*70 - 130*		*04/05/22 15:45*	*1*
Toluene-d8 (Surr)	*96*		*70 - 130*		*04/04/22 12:23*	*1*
Toluene-d8 (Surr)	*96*		*70 - 130*		*04/05/22 15:45*	*1*
4-Bromofluorobenzene (Surr)	*86*		*70 - 130*		*04/04/22 12:23*	*1*
4-Bromofluorobenzene (Surr)	*90*		*70 - 130*		*04/05/22 15:45*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*83*		*70 - 130*		*04/04/22 12:23*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*93*		*70 - 130*		*04/05/22 15:45*	*1*

Method: 525.2 - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Heptachlor epoxide	<0.020		0.020		ug/L		04/07/22 08:06	04/08/22 10:20	1
Di(2-ethylhexyl)adipate	<0.59		0.59		ug/L		04/07/22 08:06	04/08/22 10:20	1
Di (2-ethylhexyl)phthalate	<0.59		0.59		ug/L		04/07/22 08:06	04/08/22 10:20	1
Hexachlorobenzene	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Simazine	<0.069		0.069		ug/L		04/07/22 08:06	04/08/22 10:20	1
Alachlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Atrazine	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Propachlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Metribuzin	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Butachlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Aldrin	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Benzo[a]pyrene	<0.020		0.020		ug/L		04/07/22 08:06	04/08/22 10:20	1
Metolachlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
gamma-BHC (Lindane)	<0.020		0.020		ug/L		04/07/22 08:06	04/08/22 10:20	1
Dieldrin	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Endrin	<0.0098		0.0098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Methoxychlor	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1
Heptachlor	<0.039		0.039		ug/L		04/07/22 08:06	04/08/22 10:20	1
Hexachlorocyclopentadiene	<0.098		0.098		ug/L		04/07/22 08:06	04/08/22 10:20	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Nitro-m-xylene	*103*		*70 - 130*	*04/07/22 08:06*	*04/08/22 10:20*	*1*
Perylene-d12	*96*		*70 - 130*	*04/07/22 08:06*	*04/08/22 10:20*	*1*
Triphenylphosphate	*103*		*70 - 130*	*04/07/22 08:06*	*04/08/22 10:20*	*1*

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Client Sample ID: EastWell03312022

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Date Collected: 03/31/22 11:10

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Method: 548.1 - Endothall (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Endothall	<5.0		5.0		ug/L		04/04/22 08:24	04/05/22 15:16	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenoxyacetic acid (Surr)	*77*		*70 - 130*	*04/04/22 08:24*	*04/05/22 15:16*	*1*

Method: 504.1 - EDB, DBCP and 1,2,3-TCP (GC)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	<0.010		0.010		ug/L		04/08/22 14:33	04/08/22 23:29	1
1,2-Dibromo-3-Chloropropane	<0.010		0.010		ug/L		04/08/22 14:33	04/08/22 23:29	1

Method: 505 - Organochlorine Pesticides/PCBs (GC)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	<0.080		0.080		ug/L		04/07/22 10:35	04/07/22 18:50	1
PCB-1221	<0.19		0.19		ug/L		04/07/22 10:35	04/07/22 18:50	1
PCB-1232	<0.23		0.23		ug/L		04/07/22 10:35	04/07/22 18:50	1
PCB-1242	<0.26		0.26		ug/L		04/07/22 10:35	04/07/22 18:50	1
PCB-1248	<0.10		0.10		ug/L		04/07/22 10:35	04/07/22 18:50	1
PCB-1254	<0.10		0.10		ug/L		04/07/22 10:35	04/07/22 18:50	1
PCB-1260	<0.20		0.20		ug/L		04/07/22 10:35	04/07/22 18:50	1
Chlordane (technical)	<0.10		0.10		ug/L		04/07/22 10:35	04/07/22 18:50	1
Toxaphene	<1.0		1.0		ug/L		04/07/22 10:35	04/07/22 18:50	1
Total PCBs as DCB (Qualitative)	<0.50		0.50		ug/L		04/07/22 10:35	04/07/22 18:50	1

Method: 515.3 - Herbicides (GC)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-TP (Silvex)	<0.10		0.10		ug/L		04/05/22 07:38	04/14/22 09:30	1
Dalapon	<1.0		1.0		ug/L		04/05/22 07:38	04/14/22 09:30	1
Dicamba	<0.10		0.10		ug/L		04/05/22 07:38	04/14/22 09:30	1
Dinoseb	<0.10		0.10		ug/L		04/05/22 07:38	04/14/22 09:30	1
Pentachlorophenol	<0.040		0.040		ug/L		04/05/22 07:38	04/14/22 09:30	1
Picloram	<0.10		0.10		ug/L		04/05/22 07:38	04/14/22 09:30	1
2,4-D	<0.10		0.10		ug/L		04/05/22 07:38	04/14/22 09:30	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*76*		*70 - 130*	*04/05/22 07:38*	*04/14/22 09:30*	*1*

Method: 300.0 - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Bromide	**13**		10		ug/L			04/01/22 21:37	1
Chloride	**2.6**		2.0		mg/L			04/01/22 23:19	1
Sulfate	<5.0		5.0		mg/L			04/01/22 23:19	1

Method: 531.2 - Carbamate Pesticides (HPLC) - Dissolved

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1-Naphthol	<1.0		1.0		ug/L			04/11/22 21:05	1
3-Hydroxycarbofuran	<0.50		0.50		ug/L			04/11/22 21:05	1
Aldicarb	<0.50		0.50		ug/L			04/11/22 21:05	1
Aldicarb sulfone	<0.70		0.70		ug/L			04/11/22 21:05	1
Aldicarb sulfoxide	<0.50		0.50		ug/L			04/11/22 21:05	1
Carbaryl	<0.50		0.50		ug/L			04/11/22 21:05	1

Client Sample Results

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Date Collected: 03/31/22 11:10

Matrix: Drinking Water

Date Received: 04/01/22 08:45

Method: 531.2 - Carbamate Pesticides (HPLC) - Dissolved (Continued)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Carbofuran	<0.90		0.90	ug/L			04/11/22 21:05	1
Methomyl	<0.50		0.50	ug/L			04/11/22 21:05	1
Oxamyl	<1.0		1.0	ug/L			04/11/22 21:05	1

Method: 547 - Glyphosate (DAI HPLC) - Dissolved

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Glyphosate	<6.0		6.0	ug/L			04/05/22 08:47	1

Method: 549.2 - Diquat and Paraquat (HPLC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Diquat	<0.40		0.40	ug/L		04/05/22 08:05	04/08/22 17:00	1

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water

Analyte	Result	Qualifier	RL	EDL	Unit	D	Prepared	Analyzed	Dil Fac
2,3,7,8-TCDD	<3.8		3.8		pg/L		04/08/22 09:19	04/09/22 00:07	1

Isotope Dilution	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C-2,3,7,8-TCDD	*79*		*25 - 164*	*04/08/22 09:19*	*04/09/22 00:07*	*1*

Method: 200.7 - Metals (ICP) - Total Recoverable

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	**3.3**		0.10	mg/L		04/05/22 11:25	04/06/22 13:40	1
Iron	**0.10**		0.020	mg/L		04/05/22 11:25	04/06/22 13:40	1
Magnesium	**0.87**		0.10	mg/L		04/05/22 11:25	04/06/22 13:40	1
Sodium	**3.4**		0.10	mg/L		04/05/22 11:25	04/06/22 13:40	1

Method: 200.8 - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Uranium	<1.0		1.0	ug/L			04/06/22 12:46	1

Method: 200.8 - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**61**		2.0	ug/L			04/06/22 12:46	1
Antimony	<1.0		1.0	ug/L			04/06/22 12:46	1
Arsenic	<1.0		1.0	ug/L			04/06/22 12:46	1
Barium	**7.6**		2.0	ug/L			04/06/22 12:46	1
Beryllium	<0.30		0.30	ug/L			04/06/22 12:46	1
Cadmium	<0.50		0.50	ug/L			04/06/22 12:46	1
Chromium	**2.3**		0.90	ug/L			04/06/22 12:46	1
Copper	**3.2**		1.0	ug/L			04/06/22 12:46	1
Lead	<0.50		0.50	ug/L			04/06/22 12:46	1
Manganese	<2.0		2.0	ug/L			04/06/22 12:46	1
Nickel	<1.0		1.0	ug/L			04/06/22 12:46	1
Selenium	<2.0		2.0	ug/L			04/06/22 12:46	1
Silver	<0.50		0.50	ug/L			04/06/22 12:46	1
Thallium	<0.30		0.30	ug/L			04/06/22 12:46	1
Zinc	<5.0		5.0	ug/L			04/06/22 12:46	1

Method: 245.1 - Mercury (CVAA)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.10		0.10	ug/L		04/08/22 12:11	04/08/22 16:18	1

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Method: SM 2340B - Total Hardness (as CaCO3) by calculation - Total Recoverable

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Hardness as calcium carbonate	**12**		0.66		mg/L			04/07/22 19:36	1
Calcium hardness as calcium carbonate	**8.2**		0.25		mg/L			04/07/22 19:36	1
Magnesium hardness as calcium carbonate	**3.6**		0.41		mg/L			04/07/22 19:36	1

General Chemistry

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.1**	**HF**	0.1		SU			04/01/22 14:48	1
Turbidity	**2.6**		0.10		NTU			04/01/22 14:14	1
Cyanide, Total	<0.0050		0.0050		mg/L		04/07/22 09:24	04/07/22 11:24	1
Nitrite as N	<0.010		0.010		mg/L			04/01/22 13:23	1
Nitrate Nitrite as N	<0.10		0.10		mg/L			04/01/22 12:13	1
Nitrate as N	<0.10		0.10		mg/L			04/05/22 14:10	1
Color, True	<3.0		3.0		Color Units			04/01/22 13:40	1
Odor	<1.0	H	1.0		T.O.N.			04/01/22 13:03	1
Alkalinity, Total	**12**		1.0		mg/L			04/05/22 11:15	1
Langelier Index	**-3.6**				LangSU			04/12/22 15:37	1
Total Dissolved Solids	**38**		10		mg/L			04/04/22 14:12	1
Temperature	**20**	**H**			Degrees C			04/01/22 14:44	1
Fluoride	<0.050		0.050		mg/L			04/07/22 10:28	1

Client Sample ID: LTB 03-28-2022

Lab Sample ID: 810-19492-3
Date Collected: 03/31/22 00:00
Matrix: Drinking Water
Date Received: 04/01/22 08:45

Method: 524.2 - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	<0.50		0.50		ug/L			04/04/22 11:49	1
1,1,1-Trichloroethane	<0.50		0.50		ug/L			04/04/22 11:49	1
1,1,2,2-Tetrachloroethane	<0.50		0.50		ug/L			04/04/22 11:49	1
1,1,2-Trichloroethane	<0.50		0.50		ug/L			04/04/22 11:49	1
1,1-Dichloroethane	<0.50		0.50		ug/L			04/04/22 11:49	1
1,1-Dichloroethene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,1-Dichloropropene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,2,3-Trichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,2,3-Trichloropropane	<0.50		0.50		ug/L			04/04/22 11:49	1
1,2,4-Trichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,2,4-Trimethylbenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,2-Dibromo-3-Chloropropane	<0.20		0.20		ug/L			04/04/22 11:49	1
1,2-Dibromoethane (EDB)	<0.20		0.20		ug/L			04/04/22 11:49	1
1,2-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,2-Dichloroethane	<0.50		0.50		ug/L			04/04/22 11:49	1
1,2-Dichloropropane	<0.25		0.25		ug/L			04/04/22 11:49	1
o-Xylene	<0.50		0.50		ug/L			04/04/22 11:49	1
m-Xylene & p-Xylene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,3,5-Trimethylbenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,3-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
1,3-Dichloropropane	<0.50		0.50		ug/L			04/04/22 11:49	1
1,4-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
2,2-Dichloropropane	<0.50		0.50		ug/L			04/04/22 11:49	1

Client Sample Results

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Lab Sample ID: 810-19492-3

Date Collected: 03/31/22 00:00

Matrix: Drinking Water

Date Received: 04/01/22 08:45

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
2-Chlorotoluene	<0.50		0.50		ug/L			04/04/22 11:49	1
4-Chlorotoluene	<0.50		0.50		ug/L			04/04/22 11:49	1
Benzene	<0.50		0.50		ug/L			04/04/22 11:49	1
4-Isopropyltoluene	<0.50		0.50		ug/L			04/04/22 11:49	1
Bromobenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
Bromochloromethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Bromodichloromethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Bromoform	<0.50		0.50		ug/L			04/04/22 11:49	1
Bromomethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Carbon tetrachloride	<0.50		0.50		ug/L			04/04/22 11:49	1
Chloroethane	<0.50		0.50		ug/L			04/05/22 15:22	1
Chlorobenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
Chloromethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Chloroform	<0.50		0.50		ug/L			04/04/22 11:49	1
Dibromomethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Dichlorodifluoromethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Dichloromethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Dibromochloromethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Ethylbenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
Hexachlorobutadiene	<0.25		0.25		ug/L			04/04/22 11:49	1
Isopropylbenzene	<0.25		0.25		ug/L			04/04/22 11:49	1
Naphthalene	<0.50		0.50		ug/L			04/04/22 11:49	1
Methyl-tert-butyl Ether (MTBE)	<0.50		0.50		ug/L			04/04/22 11:49	1
Styrene	<0.50		0.50		ug/L			04/04/22 11:49	1
Tetrachloroethene	<0.50		0.50		ug/L			04/04/22 11:49	1
Toluene	<0.50		0.50		ug/L			04/04/22 11:49	1
Trichloroethylene	<0.50		0.50		ug/L			04/04/22 11:49	1
Trichlorofluoromethane	<0.50		0.50		ug/L			04/04/22 11:49	1
Vinyl chloride	<0.20		0.20		ug/L			04/04/22 11:49	1
tert-Butylbenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
cis-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/04/22 11:49	1
cis-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/04/22 11:49	1
n-Butylbenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
N-Propylbenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
sec-Butylbenzene	<0.50		0.50		ug/L			04/04/22 11:49	1
trans-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/04/22 11:49	1
trans-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/04/22 11:49	1
Xylenes, Total	<0.50		0.50		ug/L			04/04/22 11:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*99*		*70 - 130*		*04/04/22 11:49*	*1*
1,2-Dichloroethane-d4 (Surr)	*111*		*70 - 130*		*04/05/22 15:22*	*1*
Toluene-d8 (Surr)	*96*		*70 - 130*		*04/04/22 11:49*	*1*
Toluene-d8 (Surr)	*99*		*70 - 130*		*04/05/22 15:22*	*1*
4-Bromofluorobenzene (Surr)	*83*		*70 - 130*		*04/04/22 11:49*	*1*
4-Bromofluorobenzene (Surr)	*87*		*70 - 130*		*04/05/22 15:22*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*85*		*70 - 130*		*04/04/22 11:49*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*90*		*70 - 130*		*04/05/22 15:22*	*1*

Surrogate Summary

Client: EnSafe, Inc.
Job ID: 810-19492-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method: 524.2 - Volatile Organic Compounds (GC/MS)

Matrix: Drinking Water

Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCA (70-130)	TOL (70-130)	BFB (70-130)	DCZ (70-130)
810-19492-1	EastWell03312022	105	96	86	83
810-19492-1	EastWell03312022	107	96	90	93
810-19492-1 DU	EastWell03312022	101	96	87	82
810-19492-3	LTB 03-28-2022	99	96	83	85
810-19492-3	LTB 03-28-2022	111	99	87	90
MB 810-16112/6	Method Blank	100	90	82	81
MB 810-16197/5	Method Blank	108	98	90	95

Surrogate Legend

DCA = 1,2-Dichloroethane-d4 (Surr)
TOL = Toluene-d8 (Surr)
BFB = 4-Bromofluorobenzene (Surr)
DCZ = 1,2-Dichlorobenzene-d4 (Surr)

Method: 525.2 - Semivolatile Organic Compounds (GC/MS)

Matrix: Drinking Water

Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	2NMX (70-130)	PRY (70-130)	TPP (70-130)
810-19492-1	EastWell03312022	103	96	103
LCS 810-16374/2-A	Lab Control Sample	102	97	106
LLCS 810-16374/4-A	Lab Control Sample	102	97	102
MB 810-16374/1-A	Method Blank	100	94	105

Surrogate Legend

2NMX = 2-Nitro-m-xylene
PRY = Perylene-d12
TPP = Triphenylphosphate

Method: 548.1 - Endothall (GC/MS)

Matrix: Drinking Water

Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	24D (70-130)
810-19492-1	EastWell03312022	77
LCS 810-16117/2-A	Lab Control Sample	93
LLCS 810-16117/3-A	Lab Control Sample	101
MB 810-16117/1-A	Method Blank	99

Surrogate Legend

24D = 2,4-Dichlorophenoxyacetic acid (Surr)

Method: 515.3 - Herbicides (GC)

Matrix: Drinking Water

Prep Type: Total/NA

Percent Surrogate Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	DCPAA1 (70-130)
810-19492-1	EastWell03312022	76
LLCS 810-15931/2-B	Lab Control Sample	92

Surrogate Summary

Client: EnSafe, Inc. Job ID: 810-19492-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method: 515.3 - Herbicides (GC) (Continued)

Matrix: Drinking Water **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
Lab Sample ID	**Client Sample ID**	**DCPAA1 (70-130)**
MB 810-16186/1-B	Method Blank	92

Surrogate Legend

DCPAA = 2,4-Dichlorophenylacetic acid

Isotope Dilution Summary

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water

Matrix: Drinking Water **Prep Type: Total/NA**

Percent Isotope Dilution Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	TCDD (25-164)
810-19492-1	EastWell03312022	79
MB 410-242496/1-A	Method Blank	97

Surrogate Legend

TCDD = 13C-2,3,7,8-TCDD

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water

Matrix: Drinking Water **Prep Type: Total/NA**

Percent Isotope Dilution Recovery (Acceptance Limits)

Lab Sample ID	Client Sample ID	TCDD (20-175)
LCS 410-242496/2-A	Lab Control Sample	112

Surrogate Legend

TCDD = 13C-2,3,7,8-TCDD

QC Sample Results

Client: EnSafe, Inc.
Job ID: 810-19492-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method: 524.2 - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 810-16112/6
Client Sample ID: Method Blank
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16112

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	<0.50		0.50		ug/L			04/04/22 11:16	1
1,1,1-Trichloroethane	<0.50		0.50		ug/L			04/04/22 11:16	1
1,1,2,2-Tetrachloroethane	<0.50		0.50		ug/L			04/04/22 11:16	1
1,1,2-Trichloroethane	<0.50		0.50		ug/L			04/04/22 11:16	1
1,1-Dichloroethane	<0.50		0.50		ug/L			04/04/22 11:16	1
1,1-Dichloroethene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,1-Dichloropropene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,2,3-Trichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,2,3-Trichloropropane	<0.50		0.50		ug/L			04/04/22 11:16	1
1,2,4-Trichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,2,4-Trimethylbenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,2-Dibromo-3-Chloropropane	<0.20		0.20		ug/L			04/04/22 11:16	1
1,2-Dibromoethane (EDB)	<0.20		0.20		ug/L			04/04/22 11:16	1
1,2-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,2-Dichloroethane	<0.50		0.50		ug/L			04/04/22 11:16	1
1,2-Dichloropropane	<0.25		0.25		ug/L			04/04/22 11:16	1
o-Xylene	<0.50		0.50		ug/L			04/04/22 11:16	1
m-Xylene & p-Xylene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,3,5-Trimethylbenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,3-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
1,3-Dichloropropane	<0.50		0.50		ug/L			04/04/22 11:16	1
1,4-Dichlorobenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
2,2-Dichloropropane	<0.50		0.50		ug/L			04/04/22 11:16	1
2-Chlorotoluene	<0.50		0.50		ug/L			04/04/22 11:16	1
4-Chlorotoluene	<0.50		0.50		ug/L			04/04/22 11:16	1
Benzene	<0.50		0.50		ug/L			04/04/22 11:16	1
4-Isopropyltoluene	<0.50		0.50		ug/L			04/04/22 11:16	1
Bromobenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
Bromochloromethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Bromodichloromethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Bromoform	<0.50		0.50		ug/L			04/04/22 11:16	1
Bromomethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Carbon tetrachloride	<0.50		0.50		ug/L			04/04/22 11:16	1
Chloroethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Chlorobenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
Chloromethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Chloroform	<0.50		0.50		ug/L			04/04/22 11:16	1
Dibromomethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Dichlorodifluoromethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Dichloromethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Dibromochloromethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Ethylbenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
Hexachlorobutadiene	<0.25		0.25		ug/L			04/04/22 11:16	1
Isopropylbenzene	<0.25		0.25		ug/L			04/04/22 11:16	1
Naphthalene	<0.50		0.50		ug/L			04/04/22 11:16	1
Methyl-tert-butyl Ether (MTBE)	<0.50		0.50		ug/L			04/04/22 11:16	1
Styrene	<0.50		0.50		ug/L			04/04/22 11:16	1
Tetrachloroethene	<0.50		0.50		ug/L			04/04/22 11:16	1

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 810-16112/6
Matrix: Drinking Water
Analysis Batch: 16112

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Toluene	<0.50		0.50		ug/L			04/04/22 11:16	1
Trichloroethylene	<0.50		0.50		ug/L			04/04/22 11:16	1
Trichlorofluoromethane	<0.50		0.50		ug/L			04/04/22 11:16	1
Vinyl chloride	<0.20		0.20		ug/L			04/04/22 11:16	1
tert-Butylbenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
cis-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/04/22 11:16	1
cis-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/04/22 11:16	1
n-Butylbenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
N-Propylbenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
sec-Butylbenzene	<0.50		0.50		ug/L			04/04/22 11:16	1
trans-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/04/22 11:16	1
trans-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/04/22 11:16	1
Xylenes, Total	<0.50		0.50		ug/L			04/04/22 11:16	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*100*		*70 - 130*		*04/04/22 11:16*	*1*
Toluene-d8 (Surr)	*90*		*70 - 130*		*04/04/22 11:16*	*1*
4-Bromofluorobenzene (Surr)	*82*		*70 - 130*		*04/04/22 11:16*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*81*		*70 - 130*		*04/04/22 11:16*	*1*

Lab Sample ID: 810-19492-1 DU
Matrix: Drinking Water
Analysis Batch: 16112

Client Sample ID: EastWell03312022
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
1,1,1,2-Tetrachloroethane	<0.50			<0.50		ug/L				NC	20
1,1,1-Trichloroethane	<0.50			<0.50		ug/L				NC	20
1,1,2,2-Tetrachloroethane	<0.50			<0.50		ug/L				NC	20
1,1,2-Trichloroethane	<0.50			<0.50		ug/L				NC	20
1,1-Dichloroethane	<0.50			<0.50		ug/L				NC	20
1,1-Dichloroethene	<0.50			<0.50		ug/L				NC	20
1,1-Dichloropropene	<0.50			<0.50		ug/L				NC	20
1,2,3-Trichlorobenzene	<0.50			<0.50		ug/L				NC	20
1,2,3-Trichloropropane	<0.50			<0.50		ug/L				NC	20
1,2,4-Trichlorobenzene	<0.50			<0.50		ug/L				NC	20
1,2,4-Trimethylbenzene	<0.50			<0.50		ug/L				NC	20
1,2-Dibromo-3-Chloropropane	<0.20			<0.20		ug/L				NC	20
1,2-Dibromoethane (EDB)	<0.20			<0.20		ug/L				NC	20
1,2-Dichlorobenzene	<0.50			<0.50		ug/L				NC	20
1,2-Dichloroethane	<0.50			<0.50		ug/L				NC	20
1,2-Dichloropropane	<0.25			<0.25		ug/L				NC	20
o-Xylene	<0.50			<0.50		ug/L				NC	20
m-Xylene & p-Xylene	<0.50			<0.50		ug/L				NC	20
1,3,5-Trimethylbenzene	<0.50			<0.50		ug/L				NC	20
1,3-Dichlorobenzene	<0.50			<0.50		ug/L				NC	20
1,3-Dichloropropane	<0.50			<0.50		ug/L				NC	20
1,4-Dichlorobenzene	<0.50			<0.50		ug/L				NC	20
2,2-Dichloropropane	<0.50			<0.50		ug/L				NC	20

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 810-19492-1 DU
Matrix: Drinking Water
Analysis Batch: 16112

Client Sample ID: EastWell03312022
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
2-Chlorotoluene	<0.50		<0.50		ug/L		NC	20
4-Chlorotoluene	<0.50		<0.50		ug/L		NC	20
Benzene	<0.50		<0.50		ug/L		NC	20
4-Isopropyltoluene	<0.50		<0.50		ug/L		NC	20
Bromobenzene	<0.50		<0.50		ug/L		NC	20
Bromochloromethane	<0.50		<0.50		ug/L		NC	20
Bromodichloromethane	<0.50		<0.50		ug/L		NC	20
Bromoform	<0.50		<0.50		ug/L		NC	20
Bromomethane	<0.50		<0.50		ug/L		NC	20
Carbon tetrachloride	<0.50		<0.50		ug/L		NC	20
Chlorobenzene	<0.50		<0.50		ug/L		NC	20
Chloromethane	<0.50		<0.50		ug/L		NC	20
Chloroform	34		34.1		ug/L		1	20
Dibromomethane	<0.50		<0.50		ug/L		NC	20
Dichlorodifluoromethane	<0.50		<0.50		ug/L		NC	20
Dichloromethane	<0.50		<0.50		ug/L		NC	20
Dibromochloromethane	<0.50		<0.50		ug/L		NC	20
Ethylbenzene	<0.50		<0.50		ug/L		NC	20
Hexachlorobutadiene	<0.25		<0.25		ug/L		NC	20
Isopropylbenzene	<0.25		<0.25		ug/L		NC	20
Naphthalene	<0.50		<0.50		ug/L		NC	20
Methyl-tert-butyl Ether (MTBE)	<0.50		<0.50		ug/L		NC	20
Styrene	<0.50		<0.50		ug/L		NC	20
Tetrachloroethene	<0.50		<0.50		ug/L		NC	20
Toluene	5.1		4.96		ug/L		2	20
Trichloroethylene	<0.50		<0.50		ug/L		NC	20
Trichlorofluoromethane	<0.50		<0.50		ug/L		NC	20
Vinyl chloride	<0.20		<0.20		ug/L		NC	20
tert-Butylbenzene	<0.50		<0.50		ug/L		NC	20
cis-1,2-Dichloroethylene	<0.50		<0.50		ug/L		NC	20
cis-1,3-Dichloropropylene	<0.50		<0.50		ug/L		NC	20
n-Butylbenzene	<0.50		<0.50		ug/L		NC	20
N-Propylbenzene	<0.50		<0.50		ug/L		NC	20
sec-Butylbenzene	<0.50		<0.50		ug/L		NC	20
trans-1,2-Dichloroethylene	<0.50		<0.50		ug/L		NC	20
trans-1,3-Dichloropropylene	<0.50		<0.50		ug/L		NC	20
Xylenes, Total	<0.50		<0.50		ug/L		NC	20

Surrogate	*DU %Recovery*	*DU Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*101*		*70 - 130*
Toluene-d8 (Surr)	*96*		*70 - 130*
4-Bromofluorobenzene (Surr)	*87*		*70 - 130*
1,2-Dichlorobenzene-d4 (Surr)	*82*		*70 - 130*

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 810-16197/5 **Client Sample ID: Method Blank**

Matrix: Drinking Water **Prep Type: Total/NA**

Analysis Batch: 16197

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	<0.50		0.50		ug/L			04/05/22 14:59	1
1,1,1-Trichloroethane	<0.50		0.50		ug/L			04/05/22 14:59	1
1,1,2,2-Tetrachloroethane	<0.50		0.50		ug/L			04/05/22 14:59	1
1,1,2-Trichloroethane	<0.50		0.50		ug/L			04/05/22 14:59	1
1,1-Dichloroethane	<0.50		0.50		ug/L			04/05/22 14:59	1
1,1-Dichloroethene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,1-Dichloropropene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,2,3-Trichlorobenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,2,3-Trichloropropane	<0.50		0.50		ug/L			04/05/22 14:59	1
1,2,4-Trichlorobenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,2,4-Trimethylbenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,2-Dibromo-3-Chloropropane	<0.20		0.20		ug/L			04/05/22 14:59	1
1,2-Dibromoethane (EDB)	<0.20		0.20		ug/L			04/05/22 14:59	1
1,2-Dichlorobenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,2-Dichloroethane	<0.50		0.50		ug/L			04/05/22 14:59	1
1,2-Dichloropropane	<0.25		0.25		ug/L			04/05/22 14:59	1
o-Xylene	<0.50		0.50		ug/L			04/05/22 14:59	1
m-Xylene & p-Xylene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,3,5-Trimethylbenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,3-Dichlorobenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
1,3-Dichloropropane	<0.50		0.50		ug/L			04/05/22 14:59	1
1,4-Dichlorobenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
2,2-Dichloropropane	<0.50		0.50		ug/L			04/05/22 14:59	1
2-Chlorotoluene	<0.50		0.50		ug/L			04/05/22 14:59	1
4-Chlorotoluene	<0.50		0.50		ug/L			04/05/22 14:59	1
Benzene	<0.50		0.50		ug/L			04/05/22 14:59	1
4-Isopropyltoluene	<0.50		0.50		ug/L			04/05/22 14:59	1
Bromobenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
Bromochloromethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Bromodichloromethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Bromoform	<0.50		0.50		ug/L			04/05/22 14:59	1
Bromomethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Carbon tetrachloride	<0.50		0.50		ug/L			04/05/22 14:59	1
Chloroethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Chlorobenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
Chloromethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Chloroform	<0.50		0.50		ug/L			04/05/22 14:59	1
Dibromomethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Dichlorodifluoromethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Dichloromethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Dibromochloromethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Ethylbenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
Hexachlorobutadiene	<0.25		0.25		ug/L			04/05/22 14:59	1
Isopropylbenzene	<0.25		0.25		ug/L			04/05/22 14:59	1
Naphthalene	<0.50		0.50		ug/L			04/05/22 14:59	1
Methyl-tert-butyl Ether (MTBE)	<0.50		0.50		ug/L			04/05/22 14:59	1
Styrene	<0.50		0.50		ug/L			04/05/22 14:59	1
Tetrachloroethene	<0.50		0.50		ug/L			04/05/22 14:59	1

Method: 524.2 - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 810-16197/5
Matrix: Drinking Water
Analysis Batch: 16197

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Toluene	<0.50		0.50		ug/L			04/05/22 14:59	1
Trichloroethylene	<0.50		0.50		ug/L			04/05/22 14:59	1
Trichlorofluoromethane	<0.50		0.50		ug/L			04/05/22 14:59	1
Vinyl chloride	<0.20		0.20		ug/L			04/05/22 14:59	1
tert-Butylbenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
cis-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/05/22 14:59	1
cis-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/05/22 14:59	1
n-Butylbenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
N-Propylbenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
sec-Butylbenzene	<0.50		0.50		ug/L			04/05/22 14:59	1
trans-1,2-Dichloroethylene	<0.50		0.50		ug/L			04/05/22 14:59	1
trans-1,3-Dichloropropylene	<0.50		0.50		ug/L			04/05/22 14:59	1
Xylenes, Total	<0.50		0.50		ug/L			04/05/22 14:59	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*108*		*70 - 130*		*04/05/22 14:59*	*1*
Toluene-d8 (Surr)	*98*		*70 - 130*		*04/05/22 14:59*	*1*
4-Bromofluorobenzene (Surr)	*90*		*70 - 130*		*04/05/22 14:59*	*1*
1,2-Dichlorobenzene-d4 (Surr)	*95*		*70 - 130*		*04/05/22 14:59*	*1*

Method: 525.2 - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 810-16374/1-A
Matrix: Drinking Water
Analysis Batch: 16434

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16374

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Heptachlor epoxide	<0.020		0.020		ug/L		04/07/22 08:06	04/07/22 22:08	1
Di(2-ethylhexyl)adipate	<0.60		0.60		ug/L		04/07/22 08:06	04/07/22 22:08	1
Di (2-ethylhexyl)phthalate	<0.60		0.60		ug/L		04/07/22 08:06	04/07/22 22:08	1
Hexachlorobenzene	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Simazine	<0.070		0.070		ug/L		04/07/22 08:06	04/07/22 22:08	1
Alachlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Atrazine	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Propachlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Metribuzin	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Butachlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Aldrin	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Benzo[a]pyrene	<0.020		0.020		ug/L		04/07/22 08:06	04/07/22 22:08	1
Metolachlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
gamma-BHC (Lindane)	<0.020		0.020		ug/L		04/07/22 08:06	04/07/22 22:08	1
Dieldrin	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Endrin	<0.010		0.010		ug/L		04/07/22 08:06	04/07/22 22:08	1
Methoxychlor	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1
Heptachlor	<0.040		0.040		ug/L		04/07/22 08:06	04/07/22 22:08	1
Hexachlorocyclopentadiene	<0.10		0.10		ug/L		04/07/22 08:06	04/07/22 22:08	1

QC Sample Results

Client: EnSafe, Inc. Job ID: 810-19492-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method: 525.2 - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 810-16374/1-A
Matrix: Drinking Water
Analysis Batch: 16434

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16374

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Nitro-m-xylene	*100*		*70 - 130*	*04/07/22 08:06*	*04/07/22 22:08*	*1*
Perylene-d12	*94*		*70 - 130*	*04/07/22 08:06*	*04/07/22 22:08*	*1*
Triphenylphosphate	*105*		*70 - 130*	*04/07/22 08:06*	*04/07/22 22:08*	*1*

Lab Sample ID: LCS 810-16374/2-A
Matrix: Drinking Water
Analysis Batch: 16434

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16374

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Heptachlor epoxide	1.98	1.99		ug/L		100	70 - 130
Di(2-ethylhexyl)adipate	1.98	2.07		ug/L		105	70 - 130
Di (2-ethylhexyl)phthalate	1.98	2.05		ug/L		103	70 - 130
Hexachlorobenzene	1.98	1.97		ug/L		99	70 - 130
Simazine	1.98	2.06		ug/L		104	70 - 130
Propachlor	1.98	2.04		ug/L		103	70 - 130
Metribuzin	1.98	2.30		ug/L		116	70 - 130
Butachlor	1.98	1.97		ug/L		99	70 - 130
Aldrin	1.98	1.84		ug/L		93	70 - 130
Metolachlor	1.98	1.99		ug/L		100	70 - 130
gamma-BHC (Lindane)	1.98	1.99		ug/L		100	70 - 130
Dieldrin	1.98	1.98		ug/L		100	70 - 130
Endrin	1.98	2.22		ug/L		112	70 - 130
Methoxychlor	1.98	2.11		ug/L		106	70 - 130
Heptachlor	1.98	1.97		ug/L		99	70 - 130
Hexachlorocyclopentadiene	1.98	1.77		ug/L		89	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Nitro-m-xylene	*102*		*70 - 130*
Perylene-d12	*97*		*70 - 130*
Triphenylphosphate	*106*		*70 - 130*

Lab Sample ID: LLCS 810-16374/4-A
Matrix: Drinking Water
Analysis Batch: 16434

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16374

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Heptachlor epoxide	0.00993	<0.020		ug/L		92	50 - 150
Di(2-ethylhexyl)adipate	0.596	0.517	J	ug/L		87	50 - 150
Di (2-ethylhexyl)phthalate	0.596	0.536	J	ug/L		90	50 - 150
Hexachlorobenzene	0.0993	0.0872	J	ug/L		88	50 - 150
Simazine	0.0695	0.0653	J	ug/L		94	50 - 150
Propachlor	0.0993	0.0883	J	ug/L		89	50 - 150
Metribuzin	0.0993	0.0928	J	ug/L		93	50 - 150
Butachlor	0.0993	0.0751	J	ug/L		76	50 - 150
Aldrin	0.0695	0.0543	J	ug/L		78	50 - 150
Metolachlor	0.0993	0.0846	J	ug/L		85	50 - 150
gamma-BHC (Lindane)	0.0199	0.0185	J	ug/L		93	50 - 150
Dieldrin	0.0199	<0.020		ug/L		81	50 - 150

Method: 525.2 - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LLCS 810-16374/4-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16434 **Prep Batch: 16374**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Endrin	0.00993	0.0109		ug/L		110	50 - 150
Methoxychlor	0.0993	0.0809	J	ug/L		81	50 - 150
Heptachlor	0.00993	0.0107	J	ug/L		108	50 - 150
Hexachlorocyclopentadiene	0.0993	0.0916	J	ug/L		92	50 - 150

Surrogate	*LLCS %Recovery*	*LLCS Qualifier*	*Limits*
2-Nitro-m-xylene	*102*		*70 - 130*
Perylene-d12	*97*		*70 - 130*
Triphenylphosphate	*102*		*70 - 130*

Method: 548.1 - Endothall (GC/MS)

Lab Sample ID: MB 810-16117/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16195 **Prep Batch: 16117**

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Endothall	<5.0		5.0	ug/L		04/04/22 08:24	04/05/22 10:30	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenoxyacetic acid (Surr)	*99*		*70 - 130*	*04/04/22 08:24*	*04/05/22 10:30*	*1*

Lab Sample ID: LCS 810-16117/2-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16195 **Prep Batch: 16117**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Endothall	100	119		ug/L		119	69 - 136

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenoxyacetic acid (Surr)	*93*		*70 - 130*

Lab Sample ID: LLCS 810-16117/3-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16195 **Prep Batch: 16117**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Endothall	9.00	12.6		ug/L		140	50 - 150

Surrogate	*LLCS %Recovery*	*LLCS Qualifier*	*Limits*
2,4-Dichlorophenoxyacetic acid (Surr)	*101*		*70 - 130*

Method: 504.1 - EDB, DBCP and 1,2,3-TCP (GC)

Lab Sample ID: MB 810-16527/1-A
Matrix: Drinking Water
Analysis Batch: 16541

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16527

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	<0.010		0.010	ug/L		04/08/22 14:33	04/08/22 23:04	1
1,2-Dibromo-3-Chloropropane	<0.010		0.010	ug/L		04/08/22 14:33	04/08/22 23:04	1

Lab Sample ID: LCS 810-16527/2-A
Matrix: Drinking Water
Analysis Batch: 16541

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16527

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,2-Dibromoethane (EDB)	0.250	0.222		ug/L		89	70 - 130
1,2-Dibromo-3-Chloropropane	0.250	0.234		ug/L		94	70 - 130

Lab Sample ID: LCS 810-16527/3-A
Matrix: Drinking Water
Analysis Batch: 16541

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16527

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
1,2-Dibromoethane (EDB)	0.250	0.294		ug/L		117	70 - 130
1,2-Dibromo-3-Chloropropane	0.250	0.265		ug/L		106	70 - 130

Lab Sample ID: LLCS 810-16527/6-A
Matrix: Drinking Water
Analysis Batch: 16541

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16527

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
1,2-Dibromoethane (EDB)	0.0100	0.0135		ug/L		135	50 - 150
1,2-Dibromo-3-Chloropropane	0.0100	0.0110		ug/L		110	50 - 150

Method: 505 - Organochlorine Pesticides/PCBs (GC)

Lab Sample ID: MB 810-16398/1-A
Matrix: Drinking Water
Analysis Batch: 16426

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16398

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	<0.080		0.080	ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1221	<0.19		0.19	ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1232	<0.23		0.23	ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1242	<0.26		0.26	ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1248	<0.10		0.10	ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1254	<0.10		0.10	ug/L		04/07/22 10:35	04/07/22 16:22	1
PCB-1260	<0.20		0.20	ug/L		04/07/22 10:35	04/07/22 16:22	1
Chlordane (technical)	<0.10		0.10	ug/L		04/07/22 10:35	04/07/22 16:22	1
Toxaphene	<1.0		1.0	ug/L		04/07/22 10:35	04/07/22 16:22	1
Total PCBs as DCB (Qualitative)	<0.50		0.50	ug/L		04/07/22 10:35	04/07/22 16:22	1

QC Sample Results

Method: 505 - Organochlorine Pesticides/PCBs (GC) (Continued)

Lab Sample ID: LLCS 810-16398/2-A
Matrix: Drinking Water
Analysis Batch: 16426

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16398

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Chlordane (technical)	0.100	0.118		ug/L		118	50 - 150

Lab Sample ID: LLCS 810-16398/3-A
Matrix: Drinking Water
Analysis Batch: 16426

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16398

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Toxaphene	1.00	1.09		ug/L		109	50 - 150

Lab Sample ID: 810-19492-1 DU
Matrix: Drinking Water
Analysis Batch: 16426

Client Sample ID: EastWell03312022
Prep Type: Total/NA
Prep Batch: 16398

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
PCB-1016	<0.080		<0.080		ug/L		NC	30
PCB-1221	<0.19		<0.19		ug/L		NC	30
PCB-1232	<0.23		<0.23		ug/L		NC	30
PCB-1242	<0.26		<0.26		ug/L		NC	30
PCB-1248	<0.10		<0.10		ug/L		NC	30
PCB-1254	<0.10		<0.10		ug/L		NC	30
PCB-1260	<0.20		<0.20		ug/L		NC	30
Chlordane (technical)	<0.10		<0.10		ug/L		NC	30
Toxaphene	<1.0		<1.0		ug/L		NC	30
Total PCBs as DCB (Qualitative)	<0.50		<0.50		ug/L		NC	

Method: 515.3 - Herbicides (GC)

Lab Sample ID: LLCS 810-15931/2-B
Matrix: Drinking Water
Analysis Batch: 16797

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 15931

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
2,4,5-TP (Silvex)	0.100	0.0811	J	ug/L		81	48 - 148
Dicamba	0.200	0.141		ug/L		70	
Dinoseb	0.200	0.148		ug/L		74	39 - 141
Pentachlorophenol	0.0400	0.0320	J	ug/L		80	30 - 171
Picloram	0.100	0.0750	J	ug/L		75	24 - 150
2,4-D	0.200	0.103		ug/L		51	24 - 138

Surrogate	*LLCS %Recovery*	*LLCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*92*		*70 - 130*

Lab Sample ID: MB 810-16186/1-B
Matrix: Drinking Water
Analysis Batch: 16797

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 16186

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-TP (Silvex)	<0.10		0.10	ug/L		04/05/22 07:38	04/13/22 22:16	1
Dalapon	<1.0		1.0	ug/L		04/05/22 07:38	04/13/22 22:16	1

Method: 515.3 - Herbicides (GC) (Continued)

Lab Sample ID: MB 810-16186/1-B **Client Sample ID: Method Blank**

Matrix: Drinking Water **Prep Type: Total/NA**

Analysis Batch: 16797 **Prep Batch: 16186**

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Dicamba	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1
Dinoseb	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1
Pentachlorophenol	<0.040		0.040		ug/L		04/05/22 07:38	04/13/22 22:16	1
Picloram	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1
2,4-D	<0.10		0.10		ug/L		04/05/22 07:38	04/13/22 22:16	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*92*		*70 - 130*	*04/05/22 07:38*	*04/13/22 22:16*	*1*

Method: 300.0 - Anions, Ion Chromatography

Lab Sample ID: MB 810-16076/4 **Client Sample ID: Method Blank**

Matrix: Drinking Water **Prep Type: Total/NA**

Analysis Batch: 16076

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Chloride	<2.0		2.0		mg/L			04/01/22 16:33	1
Sulfate	<5.0		5.0		mg/L			04/01/22 16:33	1

Lab Sample ID: LCS 810-16076/5 **Client Sample ID: Lab Control Sample**

Matrix: Drinking Water **Prep Type: Total/NA**

Analysis Batch: 16076

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Chloride			10.0	9.64		mg/L		96	90 - 110		
Sulfate			25.0	24.9		mg/L		100	90 - 110		

Lab Sample ID: MB 810-16096/4 **Client Sample ID: Method Blank**

Matrix: Drinking Water **Prep Type: Total/NA**

Analysis Batch: 16096

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Bromide	<10		10		ug/L			04/01/22 16:17	1

Lab Sample ID: LCS 810-16096/5 **Client Sample ID: Lab Control Sample**

Matrix: Drinking Water **Prep Type: Total/NA**

Analysis Batch: 16096

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Bromide			250	252		ug/L		101	90 - 110		

Method: 531.2 - Carbamate Pesticides (HPLC)

Lab Sample ID: MBL 810-16611/1-A **Client Sample ID: Method Blank**

Matrix: Drinking Water **Prep Type: Dissolved**

Analysis Batch: 16630

Analyte	MBL Result	MBL Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
1-Naphthol	<0.20		1.0		ug/L			04/11/22 18:29	1
3-Hydroxycarbofuran	<0.20		0.50		ug/L			04/11/22 18:29	1

Method: 531.2 - Carbamate Pesticides (HPLC) (Continued)

Lab Sample ID: MBL 810-16611/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Dissolved**
Analysis Batch: 16630

Analyte	MBL Result	MBL Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Aldicarb	<0.20		0.50		ug/L			04/11/22 18:29	1
Aldicarb sulfone	<0.20		0.70		ug/L			04/11/22 18:29	1
Aldicarb sulfoxide	<0.20		0.50		ug/L			04/11/22 18:29	1
Carbaryl	<0.20		0.50		ug/L			04/11/22 18:29	1
Carbofuran	<0.20		0.90		ug/L			04/11/22 18:29	1
Methomyl	<0.20		0.50		ug/L			04/11/22 18:29	1
Oxamyl	<0.20		1.0		ug/L			04/11/22 18:29	1

Method: 547 - Glyphosate (DAI HPLC)

Lab Sample ID: MB 810-16138/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Dissolved**
Analysis Batch: 16161

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Glyphosate	<6.0		6.0		ug/L			04/05/22 05:30	1

Lab Sample ID: LCS 810-16138/3-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Dissolved**
Analysis Batch: 16161

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Glyphosate			50.0	50.6		ug/L		101	73 - 122		

Lab Sample ID: LLCS 810-16138/2-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Dissolved**
Analysis Batch: 16161

Analyte			Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits		
Glyphosate			6.00	6.08		ug/L		101	42 - 160		

Method: 549.2 - Diquat and Paraquat (HPLC)

Lab Sample ID: MB 810-16188/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16530 **Prep Batch: 16188**

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Diquat	<0.40		0.40		ug/L		04/05/22 08:05	04/08/22 15:39	1

Lab Sample ID: LCS 810-16188/2-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16530 **Prep Batch: 16188**

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Diquat			5.00	4.81		ug/L		96	70 - 130		

Method: 549.2 - Diquat and Paraquat (HPLC) (Continued)

Lab Sample ID: LLCS 810-16188/3-A
Matrix: Drinking Water
Analysis Batch: 16530

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 16188

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Diquat	0.400	0.493		ug/L		123	21 - 161

Method: 1613B - Tetra Chlorinated Dioxin in Drinking Water

Lab Sample ID: MB 410-242496/1-A
Matrix: Drinking Water
Analysis Batch: 242588

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 242496

Analyte	MB Result	MB Qualifier	RL	EDL	Unit	D	Prepared	Analyzed	Dil Fac
2,3,7,8-TCDD	<4.0		4.0		pg/L		04/08/22 09:19	04/08/22 17:58	1

Isotope Dilution	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
13C-2,3,7,8-TCDD	*97*		*25 - 164*	*04/08/22 09:19*	*04/08/22 17:58*	*1*

Lab Sample ID: LCS 410-242496/2-A
Matrix: Drinking Water
Analysis Batch: 242588

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 242496

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
2,3,7,8-TCDD	2.00	3.10	J I	pg/L		155	67 - 158

Isotope Dilution	*LCS %Recovery*	*LCS Qualifier*	*Limits*
13C-2,3,7,8-TCDD	*112*		*20 - 175*

Method: 200.7 - Metals (ICP)

Lab Sample ID: MB 810-16216/1-A
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Calcium	<0.10		0.10	mg/L		04/05/22 11:25	04/06/22 13:00	1
Iron	<0.020		0.020	mg/L		04/05/22 11:25	04/06/22 13:00	1
Magnesium	<0.10		0.10	mg/L		04/05/22 11:25	04/06/22 13:00	1
Sodium	<0.10		0.10	mg/L		04/05/22 11:25	04/06/22 13:00	1

Lab Sample ID: LCS 810-16216/4-A
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Calcium	5.00	4.89		mg/L		98	85 - 115
Iron	5.00	4.84		mg/L		97	85 - 115
Magnesium	5.00	4.89		mg/L		98	85 - 115
Sodium	5.00	4.86		mg/L		97	85 - 115

QC Sample Results

Method: 200.7 - Metals (ICP) (Continued)

Lab Sample ID: LLCS 810-16216/2-A
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte			Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits		
Iron			0.0100	0.0128	J	mg/L		128	50 - 150		
Magnesium			0.0100	0.0101	J	mg/L		101	50 - 150		
Sodium			0.0100	<0.022		mg/L		88	50 - 150		

Lab Sample ID: LLCS 810-16216/3-A
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: Lab Control Sample
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte			Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits		
Calcium			0.100	0.0976	J	mg/L		98	50 - 150		
Magnesium			0.100	0.0954	J	mg/L		95	50 - 150		
Sodium			0.100	0.0957	J	mg/L		96	50 - 150		

Lab Sample ID: 810-19492-1 MS
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: EastWell03312022
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec Limits		
Calcium	3.3		5.00	8.21		mg/L		98	70 - 130		
Iron	0.10		5.00	5.07		mg/L		99	70 - 130		
Magnesium	0.87		5.00	5.90		mg/L		101	70 - 130		
Sodium	3.4		5.00	8.44		mg/L		101	70 - 130		

Lab Sample ID: 810-19492-1 MSD
Matrix: Drinking Water
Analysis Batch: 16336

Client Sample ID: EastWell03312022
Prep Type: Total Recoverable
Prep Batch: 16216

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec Limits	RPD	RPD Limit
Calcium	3.3		5.00	8.18		mg/L		98	70 - 130	0	20
Iron	0.10		5.00	5.06		mg/L		99	70 - 130	0	20
Magnesium	0.87		5.00	5.87		mg/L		100	70 - 130	0	20
Sodium	3.4		5.00	8.40		mg/L		100	70 - 130	0	20

Method: 200.8 - Metals (ICP/MS)

Lab Sample ID: MB 810-16218/1-A
Matrix: Drinking Water
Analysis Batch: 16329

Client Sample ID: Method Blank
Prep Type: Total Recoverable
Prep Batch: 16218

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	<2.0		2.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Antimony	<1.0		1.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Arsenic	<1.0		1.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Barium	<2.0		2.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Beryllium	<0.30		0.30		ug/L		04/05/22 11:25	04/06/22 11:56	1
Cadmium	<0.50		0.50		ug/L		04/05/22 11:25	04/06/22 11:56	1
Chromium	<0.90		0.90		ug/L		04/05/22 11:25	04/06/22 11:56	1
Lead	<0.50		0.50		ug/L		04/05/22 11:25	04/06/22 11:56	1
Manganese	<2.0		2.0		ug/L		04/05/22 11:25	04/06/22 11:56	1
Nickel	<1.0		1.0		ug/L		04/05/22 11:25	04/06/22 11:56	1

QC Sample Results

Client: EnSafe, Inc. Job ID: 810-19492-1
Project/Site: MegaSite Drinking Water Source Assessmen

Method: 200.8 - Metals (ICP/MS) (Continued)

Lab Sample ID: MB 810-16218/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total Recoverable**
Analysis Batch: 16329 **Prep Batch: 16218**

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	<2.0		2.0	ug/L		04/05/22 11:25	04/06/22 11:56	1
Silver	<0.50		0.50	ug/L		04/05/22 11:25	04/06/22 11:56	1
Thallium	<0.30		0.30	ug/L		04/05/22 11:25	04/06/22 11:56	1
Zinc	<5.0		5.0	ug/L		04/05/22 11:25	04/06/22 11:56	1

Lab Sample ID: LCS 810-16218/6-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total Recoverable**
Analysis Batch: 16329 **Prep Batch: 16218**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Aluminum	50.0	49.6		ug/L		99	85 - 115
Antimony	50.0	52.4		ug/L		105	85 - 115
Arsenic	50.0	48.4		ug/L		97	85 - 115
Barium	50.0	48.1		ug/L		96	85 - 115
Beryllium	50.0	48.9		ug/L		98	85 - 115
Cadmium	50.0	48.5		ug/L		97	85 - 115
Chromium	50.0	49.0		ug/L		98	85 - 115
Copper	50.0	49.3		ug/L		99	85 - 115
Lead	50.0	50.7		ug/L		101	85 - 115
Manganese	50.0	48.3		ug/L		97	85 - 115
Nickel	50.0	47.9		ug/L		96	85 - 115
Selenium	50.0	48.1		ug/L		96	85 - 115
Silver	50.0	44.2		ug/L		88	85 - 115
Thallium	50.0	48.7		ug/L		97	85 - 115
Zinc	50.0	48.6		ug/L		97	85 - 115

Lab Sample ID: LLCS 810-16218/2-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total Recoverable**
Analysis Batch: 16329 **Prep Batch: 16218**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Antimony	0.300	0.328	J	ug/L		109	50 - 150
Arsenic	0.300	<0.89		ug/L		64	50 - 150
Barium	0.300	0.308	J	ug/L		103	50 - 150
Beryllium	0.300	0.290	J	ug/L		97	50 - 150
Cadmium	0.300	0.351	J	ug/L		117	50 - 150
Chromium	0.300	<0.31		ug/L		100	50 - 150
Copper	0.300	<0.55		ug/L		88	50 - 150
Lead	0.300	0.298	J	ug/L		99	50 - 150
Manganese	0.300	0.310	J	ug/L		103	50 - 150
Nickel	0.300	0.292	J	ug/L		97	50 - 150
Selenium	0.300	<1.6		ug/L		138	50 - 150
Silver	0.300	0.179	J	ug/L		60	50 - 150
Thallium	0.300	0.282	J	ug/L		94	50 - 150
Zinc	0.300	<2.3		ug/L		116	50 - 150

QC Sample Results

Method: 200.8 - Metals (ICP/MS) (Continued)

Lab Sample ID: LLCS 810-16218/3-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total Recoverable**
Analysis Batch: 16329 **Prep Batch: 16218**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Antimony	1.00	1.08		ug/L		108	50 - 150
Arsenic	1.00	0.974	J	ug/L		97	50 - 150
Barium	1.00	1.08	J	ug/L		108	50 - 150
Copper	1.00	0.951	J	ug/L		95	50 - 150
Manganese	1.00	1.00	J	ug/L		100	50 - 150
Nickel	1.00	0.977	J	ug/L		98	50 - 150
Selenium	1.00	<1.6		ug/L		109	50 - 150
Zinc	1.00	<2.3		ug/L		103	50 - 150

Lab Sample ID: LLCS 810-16218/4-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total Recoverable**
Analysis Batch: 16329 **Prep Batch: 16218**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Aluminum	2.00	2.92		ug/L		146	50 - 150
Barium	2.00	1.92	J	ug/L		96	50 - 150
Manganese	2.00	1.97	J	ug/L		98	50 - 150
Selenium	2.00	1.98	J	ug/L		99	50 - 150
Zinc	2.00	<2.3		ug/L		98	50 - 150

Lab Sample ID: LLCS 810-16218/5-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total Recoverable**
Analysis Batch: 16329 **Prep Batch: 16218**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Zinc	5.00	4.88	J	ug/L		98	50 - 150

Method: 245.1 - Mercury (CVAA)

Lab Sample ID: MB 810-16509/1-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16546 **Prep Batch: 16509**

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.10		0.10	ug/L		04/08/22 12:11	04/08/22 15:51	1

Lab Sample ID: LCS 810-16509/3-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16546 **Prep Batch: 16509**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	1.00	0.993		ug/L		99	85 - 115

Lab Sample ID: LLCS 810-16509/2-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16546 **Prep Batch: 16509**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Mercury	0.100	0.0731	J	ug/L		73	50 - 150

Method: 150.1 - pH (Electrometric)

Lab Sample ID: LCSSRM 810-16070/4 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16070

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec Limits
pH	9.00	9.1		SU		101.0	98.9 - 101.1

Lab Sample ID: LCSSRM 810-16070/9 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16070

Analyte	Spike Added	LCSSRM Result	LCSSRM Qualifier	Unit	D	%Rec	%Rec Limits
pH	9.00	9.0		SU		100.3	98.9 - 101.1

Method: 180.1 - Turbidity, Nephelometric

Lab Sample ID: MB 810-16061/4 **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16061

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Turbidity	<0.10		0.10	NTU			04/01/22 14:00	1

Lab Sample ID: LLCS 810-16061/3 **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16061

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Turbidity	0.116	0.10		NTU		95	50 - 150

Method: 335.4 - Cyanide, Total

Lab Sample ID: MBL 810-16381/4-A **Client Sample ID: Method Blank**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16413 **Prep Batch: 16381**

Analyte	MBL Result	MBL Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Cyanide, Total	<0.0028		0.0050	mg/L		04/07/22 08:45	04/07/22 11:17	1

Lab Sample ID: LCS 810-16381/2-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16413 **Prep Batch: 16381**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Cyanide, Total	0.100	0.0986		mg/L		99	90 - 110

Lab Sample ID: LLCS 810-16381/3-A **Client Sample ID: Lab Control Sample**
Matrix: Drinking Water **Prep Type: Total/NA**
Analysis Batch: 16413 **Prep Batch: 16381**

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Cyanide, Total	0.00500	0.00510		mg/L		102	80 - 120

QC Sample Results

Method: 353.2 - Nitrogen, Nitrate-Nitrite

Lab Sample ID: MB 810-16053/20
Client Sample ID: Method Blank
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16053

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	<0.10		0.10		mg/L			04/01/22 12:03	1

Lab Sample ID: LCS 810-16053/16
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16053

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Nitrate Nitrite as N			4.00	4.07		mg/L		102	90 - 110		

Lab Sample ID: LLCS 810-16053/19
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16053

Analyte			Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits		
Nitrate Nitrite as N			0.100	0.0889	J	mg/L		89	50 - 150		

Lab Sample ID: MBL 810-16059/19
Client Sample ID: Method Blank
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16059

Analyte	MBL Result	MBL Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Nitrite as N	<0.0026		0.010		mg/L			04/01/22 13:13	1

Lab Sample ID: LCS 810-16059/15
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16059

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits		
Nitrite as N			0.200	0.198		mg/L		99	90 - 110		

Lab Sample ID: LLCS 810-16059/18
Client Sample ID: Lab Control Sample
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16059

Analyte			Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits		
Nitrite as N			0.0100	0.00930	J	mg/L		93	50 - 150		

Method: SM 2120B - Color, True, Colorimetric

Lab Sample ID: MB 810-16056/12
Client Sample ID: Method Blank
Matrix: Drinking Water
Prep Type: Total/NA
Analysis Batch: 16056

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Color, True	<3.0		3.0		Color Units			04/01/22 13:31	1

QC Sample Results

Method: SM 2150B - Odor

Lab Sample ID: MB 810-16141/1
Matrix: Drinking Water
Analysis Batch: 16141

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Odor	<1.0		1.0	T.O.N.			04/01/22 12:56	1

Method: SM 2320B - Alkalinity

Lab Sample ID: MBL 810-16269/6
Matrix: Drinking Water
Analysis Batch: 16269

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MBL Result	MBL Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity, Total	<1.0		1.0	mg/L			04/05/22 10:12	1

Lab Sample ID: LCS 810-16269/4
Matrix: Drinking Water
Analysis Batch: 16269

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Alkalinity, Total	100	91.8		mg/L		92	78 - 114

Lab Sample ID: LLCS 810-16269/5
Matrix: Drinking Water
Analysis Batch: 16269

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Alkalinity, Total	1.00	<1.0		mg/L		92	50 - 150

Method: SM 2540C - Solids, Total Dissolved (TDS)

Lab Sample ID: MB 810-16155/1
Matrix: Drinking Water
Analysis Batch: 16155

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Total Dissolved Solids	<10		10	mg/L			04/04/22 12:45	1

Lab Sample ID: LCS 810-16155/2
Matrix: Drinking Water
Analysis Batch: 16155

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Total Dissolved Solids	1000	1000		mg/L		100	85 - 115

Method: SM 4500 F C - Fluoride

Lab Sample ID: MBL 810-16421/6
Matrix: Drinking Water
Analysis Batch: 16421

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MBL Result	MBL Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Fluoride	<0.028		0.050	mg/L			04/07/22 10:06	1

Method: SM 4500 F C - Fluoride (Continued)

Lab Sample ID: LCS 810-16421/4 **Client Sample ID: Lab Control Sample**

Matrix: Drinking Water **Prep Type: Total/NA**

Analysis Batch: 16421

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	2.00	2.02		mg/L		101	90 - 110

Lab Sample ID: LLCS 810-16421/5 **Client Sample ID: Lab Control Sample**

Matrix: Drinking Water **Prep Type: Total/NA**

Analysis Batch: 16421

Analyte	Spike Added	LLCS Result	LLCS Qualifier	Unit	D	%Rec	%Rec Limits
Fluoride	0.0500	0.0500		mg/L		100	50 - 150

GC/MS VOA

Analysis Batch: 16112

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	524.2	
810-19492-3	LTB 03-28-2022	Total/NA	Drinking Water	524.2	
MB 810-16112/6	Method Blank	Total/NA	Drinking Water	524.2	
810-19492-1 DU	EastWell03312022	Total/NA	Drinking Water	524.2	

Analysis Batch: 16197

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	524.2	
810-19492-3	LTB 03-28-2022	Total/NA	Drinking Water	524.2	
MB 810-16197/5	Method Blank	Total/NA	Drinking Water	524.2	

GC/MS Semi VOA

Prep Batch: 16117

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	548.1	
MB 810-16117/1-A	Method Blank	Total/NA	Drinking Water	548.1	
LCS 810-16117/2-A	Lab Control Sample	Total/NA	Drinking Water	548.1	
LLCS 810-16117/3-A	Lab Control Sample	Total/NA	Drinking Water	548.1	

Analysis Batch: 16195

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	548.1	16117
MB 810-16117/1-A	Method Blank	Total/NA	Drinking Water	548.1	16117
LCS 810-16117/2-A	Lab Control Sample	Total/NA	Drinking Water	548.1	16117
LLCS 810-16117/3-A	Lab Control Sample	Total/NA	Drinking Water	548.1	16117

Prep Batch: 16374

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	525.2	
MB 810-16374/1-A	Method Blank	Total/NA	Drinking Water	525.2	
LCS 810-16374/2-A	Lab Control Sample	Total/NA	Drinking Water	525.2	
LLCS 810-16374/4-A	Lab Control Sample	Total/NA	Drinking Water	525.2	

Analysis Batch: 16434

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	525.2	16374
MB 810-16374/1-A	Method Blank	Total/NA	Drinking Water	525.2	16374
LCS 810-16374/2-A	Lab Control Sample	Total/NA	Drinking Water	525.2	16374
LLCS 810-16374/4-A	Lab Control Sample	Total/NA	Drinking Water	525.2	16374

GC Semi VOA

Prep Batch: 15931

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LLCS 810-15931/2-B	Lab Control Sample	Total/NA	Drinking Water	515.3	

Cleanup Batch: 15997

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LLCS 810-15931/2-B	Lab Control Sample	Total/NA	Drinking Water	Aliquot	15931

GC Semi VOA

Prep Batch: 16186

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	515.3	
MB 810-16186/1-B	Method Blank	Total/NA	Drinking Water	515.3	

Cleanup Batch: 16215

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	Aliquot	16186
MB 810-16186/1-B	Method Blank	Total/NA	Drinking Water	Aliquot	16186

Prep Batch: 16398

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	505	
MB 810-16398/1-A	Method Blank	Total/NA	Drinking Water	505	
LLCS 810-16398/2-A	Lab Control Sample	Total/NA	Drinking Water	505	
LLCS 810-16398/3-A	Lab Control Sample	Total/NA	Drinking Water	505	
810-19492-1 DU	EastWell03312022	Total/NA	Drinking Water	505	

Analysis Batch: 16426

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	505	16398
MB 810-16398/1-A	Method Blank	Total/NA	Drinking Water	505	16398
LLCS 810-16398/2-A	Lab Control Sample	Total/NA	Drinking Water	505	16398
LLCS 810-16398/3-A	Lab Control Sample	Total/NA	Drinking Water	505	16398
810-19492-1 DU	EastWell03312022	Total/NA	Drinking Water	505	16398

Prep Batch: 16527

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	504.1	
MB 810-16527/1-A	Method Blank	Total/NA	Drinking Water	504.1	
LCS 810-16527/2-A	Lab Control Sample	Total/NA	Drinking Water	504.1	
LCS 810-16527/3-A	Lab Control Sample	Total/NA	Drinking Water	504.1	
LLCS 810-16527/6-A	Lab Control Sample	Total/NA	Drinking Water	504.1	

Analysis Batch: 16541

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	504.1	16527
MB 810-16527/1-A	Method Blank	Total/NA	Drinking Water	504.1	16527
LCS 810-16527/2-A	Lab Control Sample	Total/NA	Drinking Water	504.1	16527
LCS 810-16527/3-A	Lab Control Sample	Total/NA	Drinking Water	504.1	16527
LLCS 810-16527/6-A	Lab Control Sample	Total/NA	Drinking Water	504.1	16527

Analysis Batch: 16797

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	515.3	16215
MB 810-16186/1-B	Method Blank	Total/NA	Drinking Water	515.3	16215
LLCS 810-15931/2-B	Lab Control Sample	Total/NA	Drinking Water	515.3	15997

HPLC/IC

Analysis Batch: 16076

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	300.0	

HPLC/IC (Continued)

Analysis Batch: 16076 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 810-16076/4	Method Blank	Total/NA	Drinking Water	300.0	
LCS 810-16076/5	Lab Control Sample	Total/NA	Drinking Water	300.0	

Analysis Batch: 16096

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	300.0	
MB 810-16096/4	Method Blank	Total/NA	Drinking Water	300.0	
LCS 810-16096/5	Lab Control Sample	Total/NA	Drinking Water	300.0	

Filtration Batch: 16138

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Dissolved	Drinking Water	Filtration	
MB 810-16138/1-A	Method Blank	Dissolved	Drinking Water	Filtration	
LCS 810-16138/3-A	Lab Control Sample	Dissolved	Drinking Water	Filtration	
LLCS 810-16138/2-A	Lab Control Sample	Dissolved	Drinking Water	Filtration	

Analysis Batch: 16161

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Dissolved	Drinking Water	547	16138
MB 810-16138/1-A	Method Blank	Dissolved	Drinking Water	547	16138
LCS 810-16138/3-A	Lab Control Sample	Dissolved	Drinking Water	547	16138
LLCS 810-16138/2-A	Lab Control Sample	Dissolved	Drinking Water	547	16138

Prep Batch: 16188

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	549.2	
MB 810-16188/1-A	Method Blank	Total/NA	Drinking Water	549.2	
LCS 810-16188/2-A	Lab Control Sample	Total/NA	Drinking Water	549.2	
LLCS 810-16188/3-A	Lab Control Sample	Total/NA	Drinking Water	549.2	

Analysis Batch: 16530

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	549.2	16188
MB 810-16188/1-A	Method Blank	Total/NA	Drinking Water	549.2	16188
LCS 810-16188/2-A	Lab Control Sample	Total/NA	Drinking Water	549.2	16188
LLCS 810-16188/3-A	Lab Control Sample	Total/NA	Drinking Water	549.2	16188

Filtration Batch: 16611

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Dissolved	Drinking Water	Filtration	
MBL 810-16611/1-A	Method Blank	Dissolved	Drinking Water	Filtration	

Analysis Batch: 16630

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Dissolved	Drinking Water	531.2	16611
MBL 810-16611/1-A	Method Blank	Dissolved	Drinking Water	531.2	16611

QC Association Summary

Client: EnSafe, Inc.
Job ID: 810-19492-1
Project/Site: MegaSite Drinking Water Source Assessmen

Specialty Organics

Prep Batch: 242496

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	1613B	
MB 410-242496/1-A	Method Blank	Total/NA	Drinking Water	1613B	
LCS 410-242496/2-A	Lab Control Sample	Total/NA	Drinking Water	1613B	

Analysis Batch: 242588

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 410-242496/1-A	Method Blank	Total/NA	Drinking Water	1613B	242496
LCS 410-242496/2-A	Lab Control Sample	Total/NA	Drinking Water	1613B	242496

Analysis Batch: 242674

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	1613B	242496

Metals

Prep Batch: 16216

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total Recoverable	Drinking Water	200.2	
MB 810-16216/1-A	Method Blank	Total Recoverable	Drinking Water	200.2	
LCS 810-16216/4-A	Lab Control Sample	Total Recoverable	Drinking Water	200.2	
LLCS 810-16216/2-A	Lab Control Sample	Total Recoverable	Drinking Water	200.2	
LLCS 810-16216/3-A	Lab Control Sample	Total Recoverable	Drinking Water	200.2	
810-19492-1 MS	EastWell03312022	Total Recoverable	Drinking Water	200.2	
810-19492-1 MSD	EastWell03312022	Total Recoverable	Drinking Water	200.2	

Prep Batch: 16218

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 810-16218/1-A	Method Blank	Total Recoverable	Drinking Water	200.8	
LCS 810-16218/6-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	
LLCS 810-16218/2-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	
LLCS 810-16218/3-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	
LLCS 810-16218/4-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	
LLCS 810-16218/5-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	

Analysis Batch: 16329

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total Recoverable	Drinking Water	200.8	
810-19492-1	EastWell03312022	Total/NA	Drinking Water	200.8	
MB 810-16218/1-A	Method Blank	Total Recoverable	Drinking Water	200.8	16218
LCS 810-16218/6-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218
LLCS 810-16218/2-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218
LLCS 810-16218/3-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218
LLCS 810-16218/4-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218
LLCS 810-16218/5-A	Lab Control Sample	Total Recoverable	Drinking Water	200.8	16218

Analysis Batch: 16336

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total Recoverable	Drinking Water	200.7	16216
MB 810-16216/1-A	Method Blank	Total Recoverable	Drinking Water	200.7	16216
LCS 810-16216/4-A	Lab Control Sample	Total Recoverable	Drinking Water	200.7	16216
LLCS 810-16216/2-A	Lab Control Sample	Total Recoverable	Drinking Water	200.7	16216

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Metals (Continued)

Analysis Batch: 16336 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LLCS 810-16216/3-A	Lab Control Sample	Total Recoverable	Drinking Water	200.7	16216
810-19492-1 MS	EastWell03312022	Total Recoverable	Drinking Water	200.7	16216
810-19492-1 MSD	EastWell03312022	Total Recoverable	Drinking Water	200.7	16216

Analysis Batch: 16458

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total Recoverable	Drinking Water	SM 2340B	

Prep Batch: 16509

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	245.1	
MB 810-16509/1-A	Method Blank	Total/NA	Drinking Water	245.1	
LCS 810-16509/3-A	Lab Control Sample	Total/NA	Drinking Water	245.1	
LLCS 810-16509/2-A	Lab Control Sample	Total/NA	Drinking Water	245.1	

Analysis Batch: 16546

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	245.1	16509
MB 810-16509/1-A	Method Blank	Total/NA	Drinking Water	245.1	16509
LCS 810-16509/3-A	Lab Control Sample	Total/NA	Drinking Water	245.1	16509
LLCS 810-16509/2-A	Lab Control Sample	Total/NA	Drinking Water	245.1	16509

General Chemistry

Analysis Batch: 16053

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	353.2	
MB 810-16053/20	Method Blank	Total/NA	Drinking Water	353.2	
LCS 810-16053/16	Lab Control Sample	Total/NA	Drinking Water	353.2	
LLCS 810-16053/19	Lab Control Sample	Total/NA	Drinking Water	353.2	

Analysis Batch: 16056

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	SM 2120B	
MB 810-16056/12	Method Blank	Total/NA	Drinking Water	SM 2120B	
LCSSRM 810-16056/13	Lab Control Sample	Total/NA	Drinking Water	SM 2120B	

Analysis Batch: 16059

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	353.2	
MBL 810-16059/19	Method Blank	Total/NA	Drinking Water	353.2	
LCS 810-16059/15	Lab Control Sample	Total/NA	Drinking Water	353.2	
LLCS 810-16059/18	Lab Control Sample	Total/NA	Drinking Water	353.2	

Analysis Batch: 16061

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	180.1	
MB 810-16061/4	Method Blank	Total/NA	Drinking Water	180.1	
LLCS 810-16061/3	Lab Control Sample	Total/NA	Drinking Water	180.1	

General Chemistry

Analysis Batch: 16070

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	150.1	
LCSSRM 810-16070/4	Lab Control Sample	Total/NA	Drinking Water	150.1	
LCSSRM 810-16070/9	Lab Control Sample	Total/NA	Drinking Water	150.1	

Analysis Batch: 16073

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	SM 2550B	

Analysis Batch: 16141

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	SM 2150B	
MB 810-16141/1	Method Blank	Total/NA	Drinking Water	SM 2150B	

Analysis Batch: 16155

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	SM 2540C	
MB 810-16155/1	Method Blank	Total/NA	Drinking Water	SM 2540C	
LCS 810-16155/2	Lab Control Sample	Total/NA	Drinking Water	SM 2540C	

Analysis Batch: 16244

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	Nitrate by calc	

Analysis Batch: 16269

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	SM 2320B	
MBL 810-16269/6	Method Blank	Total/NA	Drinking Water	SM 2320B	
LCS 810-16269/4	Lab Control Sample	Total/NA	Drinking Water	SM 2320B	
LLCS 810-16269/5	Lab Control Sample	Total/NA	Drinking Water	SM 2320B	

Prep Batch: 16381

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	Distill/CN	
MBL 810-16381/4-A	Method Blank	Total/NA	Drinking Water	Distill/CN	
LCS 810-16381/2-A	Lab Control Sample	Total/NA	Drinking Water	Distill/CN	
LLCS 810-16381/3-A	Lab Control Sample	Total/NA	Drinking Water	Distill/CN	

Analysis Batch: 16413

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	335.4	16381
MBL 810-16381/4-A	Method Blank	Total/NA	Drinking Water	335.4	16381
LCS 810-16381/2-A	Lab Control Sample	Total/NA	Drinking Water	335.4	16381
LLCS 810-16381/3-A	Lab Control Sample	Total/NA	Drinking Water	335.4	16381

Analysis Batch: 16421

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	SM 4500 F C	
MBL 810-16421/6	Method Blank	Total/NA	Drinking Water	SM 4500 F C	
LCS 810-16421/4	Lab Control Sample	Total/NA	Drinking Water	SM 4500 F C	
LLCS 810-16421/5	Lab Control Sample	Total/NA	Drinking Water	SM 4500 F C	

QC Association Summary

General Chemistry

Analysis Batch: 16708

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
810-19492-1	EastWell03312022	Total/NA	Drinking Water	SM 2330B	

Lab Chronicle

Client Sample ID: EastWell03312022
Lab Sample ID: 810-19492-1
Date Collected: 03/31/22 11:10
Matrix: Drinking Water
Date Received: 04/01/22 08:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	524.2		1	16112	04/04/22 12:23	CM	EA SB
Total/NA	Analysis	524.2		1	16197	04/05/22 15:45	DC	EA SB
Total/NA	Prep	525.2			16374	04/07/22 08:06	HB	EA SB
Total/NA	Analysis	525.2		1	16434	04/08/22 10:20	CG	EA SB
Total/NA	Prep	548.1			16117	04/04/22 08:24	JH	EA SB
Total/NA	Analysis	548.1		1	16195	04/05/22 15:16	TL	EA SB
Total/NA	Prep	504.1			16527	04/08/22 14:33	SS	EA SB
Total/NA	Analysis	504.1		1	16541	04/08/22 23:29	JV	EA SB
Total/NA	Prep	505			16398	04/07/22 10:35	AM	EA SB
Total/NA	Analysis	505		1	16426	04/07/22 18:50	JB	EA SB
Total/NA	Prep	515.3			16186	04/05/22 07:38	AM	EA SB
Total/NA	Cleanup	Aliquot			16215	04/05/22 11:40	AM	EA SB
Total/NA	Analysis	515.3		1	16797	04/14/22 09:30	TL	EA SB
Total/NA	Analysis	300.0		1	16076	04/01/22 23:19	JL	EA SB
Total/NA	Analysis	300.0		1	16096	04/01/22 21:37	JL	EA SB
Dissolved	Filtration	Filtration			16611	04/11/22 11:30	HB	EA SB
Dissolved	Analysis	531.2		1	16630	04/11/22 21:05	RS	EA SB
Dissolved	Filtration	Filtration			16138	04/04/22 10:13	MP	EA SB
Dissolved	Analysis	547		1	16161	04/05/22 08:47	RS	EA SB
Total/NA	Prep	549.2			16188	04/05/22 08:05	SS	EA SB
Total/NA	Analysis	549.2		1	16530	04/08/22 17:00	DL	EA SB
Total/NA	Prep	1613B			242496	04/08/22 09:19	TJK2	ELLE
Total/NA	Analysis	1613B		1	242674	04/09/22 00:07	UA2A	ELLE
Total Recoverable	Prep	200.2			16216	04/05/22 11:25	NB	EA SB
Total Recoverable	Analysis	200.7		1	16336	04/06/22 13:40	AC	EA SB
Total Recoverable	Analysis	200.8		1	16329	04/06/22 12:46	NB	EA SB
Total/NA	Analysis	200.8		1	16329	04/06/22 12:46	NB	EA SB
Total/NA	Prep	245.1			16509	04/08/22 12:11	AC	EA SB
Total/NA	Analysis	245.1		1	16546	04/08/22 16:18	AC	EA SB
Total Recoverable	Analysis	SM 2340B		1	16458	04/07/22 19:36	AC	EA SB
Total/NA	Analysis	150.1		1	16070	04/01/22 14:48	JA	EA SB
Total/NA	Analysis	180.1		1	16061	04/01/22 14:14	JA	EA SB
Total/NA	Prep	Distill/CN			16381	04/07/22 09:24	KH	EA SB
Total/NA	Analysis	335.4		1	16413	04/07/22 11:24	KH	EA SB
Total/NA	Analysis	353.2		1	16053	04/01/22 12:13	KH	EA SB
Total/NA	Analysis	353.2		1	16059	04/01/22 13:23	KH	EA SB
Total/NA	Analysis	Nitrate by calc		1	16244	04/05/22 14:10	KH	EA SB
Total/NA	Analysis	SM 2120B		1	16056	04/01/22 13:40	JA	EA SB
Total/NA	Analysis	SM 2150B		1	16141	04/01/22 13:03	JA	EA SB
Total/NA	Analysis	SM 2320B		1	16269	04/05/22 11:15	KH	EA SB
Total/NA	Analysis	SM 2330B		1	16708	04/12/22 15:37	KH	EA SB
Total/NA	Analysis	SM 2540C		1	16155	04/04/22 14:12	JA	EA SB

Client Sample ID: EastWell03312022 Lab Sample ID: 810-19492-1

Date Collected: 03/31/22 11:10 **Matrix: Drinking Water**

Date Received: 04/01/22 08:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	SM 2550B		1	16073	04/01/22 14:44	KH	EA SB
Total/NA	Analysis	SM 4500 F C		1	16421	04/07/22 10:28	KH	EA SB

Client Sample ID: LTB 03-28-2022 Lab Sample ID: 810-19492-3

Date Collected: 03/31/22 00:00 **Matrix: Drinking Water**

Date Received: 04/01/22 08:45

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	524.2		1	16112	04/04/22 11:49	CM	EA SB
Total/NA	Analysis	524.2		1	16197	04/05/22 15:22	DC	EA SB

Laboratory References:

EA SB = Eurofins Eaton South Bend, 110 S Hill Street, South Bend, IN 46617, TEL (574)233-4777

ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Accreditation/Certification Summary

Client: EnSafe, Inc. Job ID: 810-19492-1
Project/Site: MegaSite Drinking Water Source Assessmen

Laboratory: Eurofins Eaton South Bend

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
Tennessee	State	TN02973	06-30-22

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
505	505	Drinking Water	Total PCBs as DCB (Qualitative)
515.3	515.3	Drinking Water	Dicamba
524.2		Drinking Water	1,1,1,2-Tetrachloroethane
524.2		Drinking Water	1,1,2,2-Tetrachloroethane
524.2		Drinking Water	1,1-Dichloroethane
524.2		Drinking Water	1,1-Dichloropropene
524.2		Drinking Water	1,2,3-Trichlorobenzene
524.2		Drinking Water	1,2,3-Trichloropropane
524.2		Drinking Water	1,2,4-Trimethylbenzene
524.2		Drinking Water	1,2-Dibromo-3-Chloropropane
524.2		Drinking Water	1,2-Dibromoethane (EDB)
524.2		Drinking Water	1,3,5-Trimethylbenzene
524.2		Drinking Water	1,3-Dichlorobenzene
524.2		Drinking Water	1,3-Dichloropropane
524.2		Drinking Water	2,2-Dichloropropane
524.2		Drinking Water	2-Chlorotoluene
524.2		Drinking Water	4-Chlorotoluene
524.2		Drinking Water	4-Isopropyltoluene
524.2		Drinking Water	Bromobenzene
524.2		Drinking Water	Bromochloromethane
524.2		Drinking Water	Bromomethane
524.2		Drinking Water	Chloroethane
524.2		Drinking Water	Chloromethane
524.2		Drinking Water	cis-1,3-Dichloropropylene
524.2		Drinking Water	Dibromomethane
524.2		Drinking Water	Dichlorodifluoromethane
524.2		Drinking Water	Hexachlorobutadiene
524.2		Drinking Water	Isopropylbenzene
524.2		Drinking Water	Methyl-tert-butyl Ether (MTBE)
524.2		Drinking Water	m-Xylene & p-Xylene
524.2		Drinking Water	Naphthalene
524.2		Drinking Water	n-Butylbenzene
524.2		Drinking Water	N-Propylbenzene
524.2		Drinking Water	o-Xylene
524.2		Drinking Water	sec-Butylbenzene
524.2		Drinking Water	tert-Butylbenzene
524.2		Drinking Water	trans-1,3-Dichloropropylene
524.2		Drinking Water	Trichlorofluoromethane
525.2	525.2	Drinking Water	Aldrin
525.2	525.2	Drinking Water	Butachlor
525.2	525.2	Drinking Water	Dieldrin
525.2	525.2	Drinking Water	Metolachlor
525.2	525.2	Drinking Water	Metribuzin
525.2	525.2	Drinking Water	Propachlor
531.2		Drinking Water	1-Naphthol

Accreditation/Certification Summary

Laboratory: Eurofins Eaton South Bend (Continued)

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
531.2		Drinking Water	3-Hydroxycarbofuran
531.2		Drinking Water	Carbaryl
531.2		Drinking Water	Methomyl
SM 2150B		Drinking Water	Odor
SM 2330B		Drinking Water	Langelier Index
SM 2340B		Drinking Water	Calcium hardness as calcium carbonate
SM 2340B		Drinking Water	Magnesium hardness as calcium carbonate
SM 2550B		Drinking Water	Temperature

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
A2LA	Dept. of Defense ELAP	1.01	11-30-22
A2LA	ISO/IEC 17025	0001.01	11-30-22
Alaska	State	PA00009	06-30-22
Alaska (UST)	State	17-027	02-28-23
Arizona	State	AZ0780	03-12-23
Arkansas DEQ	State	88-0660	08-10-22
California	State	2792	02-02-22 *
Colorado	State	PA00009	06-30-22
Connecticut	State	PH-0746	06-30-23
DE Haz. Subst. Cleanup Act (HSCA)	State	019-006 (PA cert)	01-31-23
Delaware (DW)	State	N/A	01-31-23
Florida	NELAP	E87997	06-30-22
Georgia (DW)	State	C048	01-31-22 *
Hawaii	State	N/A	01-31-23
Illinois	NELAP	200027	01-31-23
Iowa	State	361	03-02-22 *
Kansas	NELAP	E-10151	10-31-22
Kentucky (DW)	State	KY90088	12-31-22
Kentucky (UST)	State	1.01	11-30-22
Kentucky (WW)	State	KY90088	01-01-23
Louisiana	NELAP	02055	06-30-22
Maine	State	2019012	03-12-23
Maryland	State	100	06-30-22
Massachusetts	State	M-PA009	06-30-22
Michigan	State	9930	01-31-23
Minnesota	NELAP	042-999-487	12-31-22
Missouri	State	450	01-31-25
Montana (DW)	State	0098	01-01-23
Montana (UST)	State	<cert No.>	02-01-23
Nebraska	State	NE-OS-32-17	01-31-23
New Hampshire	NELAP	2730	01-10-23
New Jersey	NELAP	PA011	06-30-22
New York	NELAP	10670	04-01-23

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Laboratory: Eurofins Lancaster Laboratories Environment Testing, LLC (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
North Carolina (DW)	State	42705	07-31-22
North Carolina (WW/SW)	State	521	12-31-22
North Dakota	State	R-205	01-31-23
Oklahoma	NELAP	R-205	08-31-22
Oregon	NELAP	PA200001	09-11-22
PALA	Canada	1978	09-16-24
Pennsylvania	NELAP	36-00037	01-31-23
Rhode Island	State	LAO00338	12-30-22
South Carolina	State	89002	01-31-23
Tennessee	State	02838	01-31-23
Texas	NELAP	T104704194-21-40	08-31-22
USDA	US Federal Programs	P330-19-00197	07-03-22
Vermont	State	VT - 36037	10-28-22
Virginia	NELAP	460182	06-14-22
Washington	State	C457	04-12-22
West Virginia (DW)	State	9906 C	12-31-22
West Virginia DEP	State	055	04-12-22
Wyoming	State	8TMS-L	01-31-23
Wyoming (UST)	A2LA	1.01	11-30-22

Method Summary

Client: EnSafe, Inc.
Project/Site: MegaSite Drinking Water Source Assessmen

Job ID: 810-19492-1

Method	Method Description	Protocol	Laboratory
524.2	Volatile Organic Compounds (GC/MS)	EPA-DW	EA SB
525.2	Semivolatile Organic Compounds (GC/MS)	EPA	EA SB
548.1	Endothall (GC/MS)	EPA	EA SB
504.1	EDB, DBCP and 1,2,3-TCP (GC)	EPA-DW	EA SB
505	Organochlorine Pesticides/PCBs (GC)	EPA	EA SB
515.3	Herbicides (GC)	EPA	EA SB
300.0	Anions, Ion Chromatography	EPA	EA SB
531.2	Carbamate Pesticides (HPLC)	EPA	EA SB
547	Glyphosate (DAI HPLC)	EPA	EA SB
549.2	Diquat and Paraquat (HPLC)	EPA	EA SB
1613B	Tetra Chlorinated Dioxin in Drinking Water	EPA	ELLE
200.7	Metals (ICP)	EPA	EA SB
200.8	Metals (ICP/MS)	EPA	EA SB
245.1	Mercury (CVAA)	EPA	EA SB
SM 2340B	Total Hardness (as CaCO3) by calculation	SM	EA SB
150.1	pH (Electrometric)	MCAWW	EA SB
180.1	Turbidity, Nephelometric	MCAWW	EA SB
335.4	Cyanide, Total	MCAWW	EA SB
353.2	Nitrogen, Nitrate-Nitrite	MCAWW	EA SB
Nitrate by calc	Nitrogen, Nitrate-Nitrite	SM	EA SB
SM 2120B	Color, True, Colorimetric	SM	EA SB
SM 2150B	Odor	SM	EA SB
SM 2320B	Alkalinity	SM	EA SB
SM 2330B	Corrosivity, LSI Calculation	SM	EA SB
SM 2540C	Solids, Total Dissolved (TDS)	SM	EA SB
SM 2550B	Temperature	SM	EA SB
SM 4500 F C	Fluoride	SM	EA SB
1613B	Separatory Funnel (Liquid-Liquid) Extraction	EPA	ELLE
200.2	Preparation, Total Recoverable Metals	EPA	EA SB
200.8	Preparation, Metals	EPA	EA SB
200.8	Preparation, Total Recoverable Metals	EPA	EA SB
245.1	Preparation, Mercury	EPA	EA SB
504.1	Microextraction	EPA-DW	EA SB
505	Extraction, Organochlorine Pesticides/PCBs	EPA	EA SB
515.3	Extraction of Chlorinated Acids	EPA-DW	EA SB
525.2	Extraction of Semivolatile Compounds	EPA	EA SB
548.1	Extraction of Endothall	EPA-DW	EA SB
549.2	Extraction of Diquat and Paraquat	EPA	EA SB
Aliquot	Preparation, Extract aliquot	None	EA SB
Distill/CN	Distillation, Cyanide	None	EA SB
Filtration	Sample Filtration	None	EA SB

Protocol References:

EPA = US Environmental Protection Agency
EPA-DW = "Methods For The Determination Of Organic Compounds In Drinking Water", EPA/600/4-88/039, December 1988 And Its Supplements.
MCAWW = "Methods For Chemical Analysis Of Water And Wastes", EPA-600/4-79-020, March 1983 And Subsequent Revisions.
None = None
SM = "Standard Methods For The Examination Of Water And Wastewater"

Laboratory References:

EA SB = Eurofins Eaton South Bend, 110 S Hill Street, South Bend, IN 46617, TEL (574)233-4777
ELLE = Eurofins Lancaster Laboratories Environment Testing, LLC, 2425 New Holland Pike, Lancaster, PA 17601, TEL (717)656-2300

Sample Summary

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
810-19492-1	EastWell03312022	Drinking Water	03/31/22 11:10	04/01/22 08:45
810-19492-3	LTB 03-28-2022	Drinking Water	03/31/22 00:00	04/01/22 08:45

810-19492 Chain of Custody

Chain of Custody Record

eurofins Environment Testing America

Client Information: Ms. Sandra Ross	Sampler: Norm K. / Ben B.	Lab PM: Hunsberger, Caleb	Carrier Tracking No(s): 774548495941	COC No: 810-10215-2984.1
	Phone:	E-Mail: anthony.hunsberger@eurofinset.com	State of Origin: TN	Page: Page 1 of 3

Company: EnSafe, Inc.
PWSID:
Job #: 088882984 5
Address: 5724 Summer Trees Drive
Due Date Requested:
City: Memphis
TAT Requested (days): Standard
State, Zip: TN, 38134
Compliance Project: [✓ Yes] ∆ No
Phone: 901-372-7962(Tel)
PO #: 0000032853
Email: sross@ensafe.com
WO #:
Project Name: MegaSite Drinking Water Source Assessmen
Project #: 81002259
Site: MegaSite - East + West Wells
SSOW#:

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	1613B_DW - 2,3,7,8-TCDD ✓	524.2_Pres_PREC - Phase I,II & V Regulated & Unregulated V ✓	548.1_PREC - Endothall ✓	2540C_Calcd - Total Dissolved Solids (TDS) ✓	9223B_CIPA18_DW - Local Method ✓	200.7_SDWA, 200.8_SDWA, 245.1_SDWA *	300_OF_14D_B - Bromide ✓	531.2_PREC - Phase II & V	SUBCONTRACT - Asbestos ✓ ①	SM2150_Odor_B - Local Method ✓	2120B_True - True Color ✓	525.2_PREC - Phase II & V 525 ✓	335.4 - Total Cyanide ✓	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	HA	R	N	R	D	L		N	N	N				
EAST Well 03312022	3·31·22	1110	G	Drinking Wate	N	N	X	X	X	X	X	X	X	X	X	X	X	X	X		① Reozonate to
EastWell 03312022 Trip Blank	3-31-22	1110	G	Drinking Wate				X													restart hold time
03/28/22 ppw 04/01/22				Drinking Wate																	ppw 04/01/22
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
~~C - Zn Acetate~~	~~O - AsNaO2~~
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment: Fed EX

Relinquished by: Ben Brantley	Date/Time: 3·31·2022 1500	Company: EnSafe	Received by: Penny Petway Wright	Date/Time: 04/01/22 0845	Company: EEA
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: [✓ Yes] ∆ No
Custody Seal No.:

* pH Acceptable

Cooler Temperature(s) °C and Other Remarks: 0.0 Wet

Ver: 06/08/2021

South Bend, IN
110 S Hill Street
South Bend, IN 46617
Phone: 574-233-4777 Fax: 574-233-8207

Cross Offs on COC by Client

Chain of Custody Record

eurofins Environment Testing America

Client Information	Sampler: Norm K. / Ben B.	Lab PM: Hunsberger, Caleb	Carrier Tracking No(s):	COC No: 810-10215-2984.2
Client Contact: Ms. Sandra Ross	Phone:	E-Mail: anthony.hunsberger@eurofinset.com	State of Origin: TN	Page: Page 2 of 3
Company: EnSafe, Inc.	PWSID:			Job #: 0888829845
Address: 5724 Summer Trees Drive	Due Date Requested:			
City: Memphis	TAT Requested (days): Standard			
State, Zip: TN, 38134	Compliance Project: [✓ Δ Yes] Δ No			
Phone: 901-372-7962(Tel)	PO #: 0000032853			
Email: sross@ensafe.com	WO #:			
Project Name: MegaSite Drinking Water Source Assessmen	Project #: 81002259			
Site: Mega Site - East+West wells	SSOW#:			

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS[redacted] (Yes or No)	504.1_PREC, 505_PREC, 547_PREC ✓	549.2_PREC - Diquat *	150.1, 180.1, 353.2 ✓	4500_F_C - Fluoride ✓	2320B - Total Alkalinity Only ✓	300_OF_28D_PREC - (MOD) Chloride, Fluoride, Sulfate ✓	515.3_PREC - Chlorinated Acids - Phase II & V by 515. ✓	200.8_U - Uranium *	SM7500_Rn_B - Radon ✓	SM7110B, SM7500_Ra_B, SM7500_Ra_D *	906.0 - Tritium ✓	504.1_PREC - Full List	~~SUBCONTRACT - Phenols to Monrovia~~	Total Number of containers	Special Instructions/Note:
				Preservation Code:			R		N	N	N	N	Q	D	N	D	N	R	S		
EastWell033122022	3.31.22	1110	G	Drinking Water	N	N	X	X	X	X	X	X	X	X	X	X	X	X			
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	
				Drinking Wate																	

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Possible Hazard Identification
☒ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Deliverable Requested: I, II, III, IV, Other (specify)

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*

Special Instructions/QC Requirements:

Empty Kit Relinquished by: | Date: | Time: | Method of Shipment:

Relinquished by: Ben Brantley	Date/Time: 3.31.2022	Company: EnSafe	Received by: Penny Rebling Wright	Date/Time: 04/01/22 0845	Company: EETA
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: [✓ Δ Yes] Δ No | Custody Seal No.: | Cooler Temperature(s) °C and Other Remarks: 0.0 Wet

*pH Acceptable

Ver: 06/08/2021

South Bend, IN
110 S Hill Street
South Bend, IN 46617
Phone: 574-233-4777 Fax: 574-233-8207

Chain of Custody Record

eurofins Environment Testing America

Sampler: Norm K. / Ben B.
Phone:
Lab PM: Hunsberger, Caleb
E-Mail: anthony.hunsberger@eurofinset.com
Carrier Tracking No(s):
State of Origin: TN
COC No: 810-10215-2984.3
Page: Page 3 of 3
Job #: 0888 & 29845

Client Information

Client Contact: Ms. Sandra Ross
Company: EnSafe, Inc.
PWSID:
Address: 5724 Summer Trees Drive
City: Memphis
State, Zip: TN, 38134
Phone: 901-372-7962(Tel)
Email: sross@ensafe.com
Project Name: MegaSite Drinking Water Source Assessmen
Site: Mega-Site East + Wat Well
Due Date Requested:
TAT Requested (days): Standard
Compliance Project: [✓ Δ Yes] Δ No
PO #: 0000032853
WO #:
Project #: 81002259
SSOW#:

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	SUBCONTRACT - MBAS	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N		
EastWell03312022	3.31.22	1110	G	Drinking Wate	N	N	X		
				Drinking Wate					~~Recd Asbestos~~
				Drinking Wate					ppw 04/01/22
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					
				Drinking Wate					

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Possible Hazard Identification
☒ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by:
Date:
Time: 1500
Method of Shipment: FedEx

Relinquished by: Ben Brantley	Date/Time: 3.31.2022 1500	Company: EnSafe	Received by: Penny Ashling Wright	Date/Time: 04/01/22 0845	Company: EEA
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: [✓ Δ Yes] Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks: 0.0 Wet

Ver: 06/08/2021

South Bend, IN
110 S Hill Street
South Bend, IN 46617
Phone: 574-233-4777 Fax: 574-233-8207

Chain of Custody Record

eurofins Environment Testing America

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Hunsberger, Caleb	Carrier Tracking No(s):	COC No: 810-2742.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: anthony.hunsberger@eurofinset.com	State of Origin: Tennessee	Page: Page 1 of 1
Company: Eurofins Lancaster Laboratories Env, LLC		Accreditations Required (See note): State - Tennessee		Job #: 810-19492-1

Address: 2425 New Holland Pike, ,
City: Lancaster
State, Zip: PA, 17601
Phone: 717-656-2300(Tel)
Email:
Project Name: MegaSite Drinking Water Source Assessmen
Site:

Due Date Requested: 5/3/2022
TAT Requested (days):
PO #:
WO #:
Project #: 81002259
SSOW#:

Analysis Requested

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	1613B_DW/1613B_P_Sep 2,3,7,8-TCDD	Total Number of containers	Special Instructions/Note:
				Preservation Code:	☒	☒		☒	
✓ EastWell03312022 (810-19492-1)	3/31/22	11:10 Central		Drinking Wate			X	2	

Note: Since laboratory accreditations are subject to change, Eurofins Eaton Analytical, LLC places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the Eurofins Eaton Analytical, LLC laboratory or other instructions will be provided. Any changes to accreditation status should be brought to Eurofins Eaton Analytical, LLC attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to Eurofins Eaton Analytical, LLC.

Possible Hazard Identification
Unconfirmed

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ______ *Months*

Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2

Special Instructions/QC Requirements:

Empty Kit Relinquished by:		Date:	Time:		Method of Shipment:	
Relinquished by:	Date/Time: 4-4-22 1600	Company: EEA	Received by:	Date/Time:	Company:	
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:	
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time: 4/5/22 10:56	Company: ELLE	

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks: 1.8

Ver: 06/08/2021

Login Sample Receipt Checklist

Client: EnSafe, Inc.

Job Number: 810-19492-1

Login Number: 19492
List Number: 1
Creator: Pehling-Wright, Penny

List Source: Eurofins Eaton South Bend

Question	Answer	Comment
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Samples do not require splitting or compositing.	True	
Container provided by EEA	True	

Login Sample Receipt Checklist

Client: EnSafe, Inc.

Job Number: 810-19492-1

Login Number: 19492
List Number: 2
Creator: McCaskey, Jonathan

List Source: Eurofins Lancaster Laboratories Environment Testing, LLC
List Creation: 04/05/22 12:14 PM

Question	Answer	Comment
The cooler's custody seal is intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable (</=6C, not frozen).	True	
Cooler Temperature is recorded.	True	
WV: Container Temperature is acceptable (</=6C, not frozen).	N/A	
WV: Container Temperature is recorded.	N/A	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the containers received and the COC.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses.	True	
Is the Field Sampler's name present on COC?	False	Received project as a subcontract.
Sample custody seals are intact.	N/A	

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 373 ft. Lat: 35.4518° N Lon: -89.2457° W
Station: **STANTON 8.8 E, TN US US1TNHW0004**

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Generated on 04/19/2022

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Observation Time Temperature: Unknown Observation Time Precipitation: Unknown

Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
			24 Hrs. Ending at Observation Time		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2022	03	01				0.00		0.0										
2022	03	02				0.00		0.0										
2022	03	03				0.00		0.0										
2022	03	04				0.00		0.0										
2022	03	05				0.00		0.0										
2022	03	06				0.00		0.0										
2022	03	07				0.52												
2022	03	08																
2022	03	09				0.25												
2022	03	10				0.00		0.0										
2022	03	11				0.00		0.0										
2022	03	12				0.21												
2022	03	13				0.00		0.0										
2022	03	14				0.00		0.0										
2022	03	15				0.00		0.0										
2022	03	16				0.15												
2022	03	17				0.00		0.0										
2022	03	18				0.47												
2022	03	19				0.00		0.0										
2022	03	20																
2022	03	21				0.00		0.0										
2022	03	22				0.48												
2022	03	23				1.65												
2022	03	24				0.00		0.0										
2022	03	25				0.00		0.0										
2022	03	26				0.00		0.0										
2022	03	27				0.00		0.0										
2022	03	28				0.00		0.0										
2022	03	29				0.00		0.0										
2022	03	30				0.00		0.0										
2022	03	31				1.08												
Summary						4.81		0.0										

NMA Meeting Date

Empty, or blank, cells indicate that a data observation was not reported.

*Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

"s" This data value failed one of NCDC's quality control tests. "At Obs." = Temperature at time of observation

"T" values in the Precipitation or Snow category above indicate a "trace" value was recorded.

"A" values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.

Generated on 04/19/2022

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 373 ft. Lat: 35.4518° N Lon: -89.2457° W

Station: **STANTON 8.8 E, TN US US1TNHW0004**

Observation Time Temperature: Unknown Observation Time Precipitation: Unknown

Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
			24 Hrs. Ending at Observation Time		At Obs.	24 Hour Amounts Ending at Observation Time				At Obs. Time	24 Hour Wind Movement (mi)	Amount of Evap. (in)	4 in. Depth			8 in. Depth		
			Max.	Min.		Rain, Melted Snow, Etc. (in)	Flag	Snow, Ice Pellets, Hail (in)	Flag	Snow, Ice Pellets, Hail, Ice on Ground (in)			Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
2022	04	01				0.05												
2022	04	02				0.00		0.0										
2022	04	03				0.00		0.0										
2022	04	04				0.00		0.0										
2022	04	05				0.21												
2022	04	06				0.12												
2022	04	07				0.03												
2022	04	08				0.00		0.0										
2022	04	09				0.00		0.0										
2022	04	10				0.00		0.0										
2022	04	11				0.00		0.0										
2022	04	12				0.50												
2022	04	13				0.80												
2022	04	14				1.30												
2022	04	15				0.00		0.0										
2022	04	16				1.53												
2022	04	17																
2022	04	18																
2022	04	19																
2022	04	20																
2022	04	21																
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2022	04	25																
2022	04	26																
2022	04	27																
2022	04	28																
2022	04	29																
2022	04	30																
Summary						4.54		0.0										

Empty, or blank, cells indicate that a data observation was not reported.

*Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown

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"A" values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.

Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

MEGASITE INITIAL DRINKING WATER SOURCE RESULTS

DATE	WEST WELL		EAST WELL	
	Total Coliform	**Turbidity**	**Total Coliform**	**Turbidity**
4/14/2022	<1 MPN/100ml	<0.3 NTU	NS	NS
4/15/2022	<1 MPN/100ml	<0.3 NTU	2 MPN/100ml	<0.3 NTU
4/16/2022	<1 MPN/100ml	<0.4 J NTU	<1 MPN/100ml	0.8 J NTU
4/17/2022	<1 MPN/100ml	0.3 J NTU	<1 MPN/100ml	0.4 J NTU
4/18/2022	<1 MPN/100ml	0.4 J NTU	2 MPN/100ml	0.6 J NTU
4/19/2022	<1 MPN/100ml	0.5 J NTU	<1 MPN/100ml	0.9 J NTU

NTU - Nephelometric Turbidity Unit

MPN - Most Probable Number

J - Estimated concentration between method detection limit and method quantification limit

NS - Not Sampled

APPENDIX D

ECS Southeast, LLP

Geotechnical Engineering Report

MRM – Stanton, TN Geotechnical Exploration

Keeling Road
Stanton, Tennessee

ECS Project No. 26:5272

March 21, 2022

ECS SOUTHEAST, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities

March 21, 2022

Mr. Dwain Hibdon
SSOE Group
320 Seven Springs Way
Brentwood, TN 37027

ECS Project No. 26:5272

Reference: Geotechnical Engineering Report
MRM – Stanton, TN
Keeling Road
Stanton, Tennessee

Dear Mr. Hibdon:

ECS Southeast, LLP (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to SSOE Group during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southeast, LLP

MARK D. LUSKIN
No. 111668

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https://ecslimited365.sharepoint.com/sites/26Nashville/26 Geotechnical/D3 Projects/5200-5299/26-5272 MRM - Stanton TN Geotechnical Exploration/Report/26-5272 MRM - Stanton TN Geotechnical Exploration.docx

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- Shear Wave Velocity Plots

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- Liquid and Plastic Limits Test Report
- Laboratory Test Results Summary

Appendix D – Supplemental Report Documents and Calculations
- Important Information

EXECUTIVE SUMMARY

ECS Southeast, LLP (ECS) has completed the subsurface exploration for the proposed construction of a new wastewater treatment plant with associated parking/drive lanes at Keeling Road in Stanton, Tennessee. The project information summarized below is based exclusively on the information made available to us by the client at the time of this report and the results of our subsurface exploration. Our findings, conclusions, and recommendations are summarized below.

PROJECT INFORMATION:

- Site Location : Keeling Road, Stanton, Tennessee
- Building Scope: Water Treatment Plant
- Assumed Loads: Max. column loads = 100 kips, Max. wall loads = 3 to 5 klf
- Earthwork: Unknown at this time
- Sitework: Parking lot, drive lanes, and underground utilities

SUBSURFACE CONDITIONS:

- Field Exploration: 20 SPT borings in the proposed construction area
- Native Material: Lean CLAY, trace sand
- Refusal Materials: Not encountered in our boring locations
- Groundwater: Not encountered in our boring locations

GEOTECHNICAL CONCERNS:

- Presence of agriculturally disturbed soils
- Presence of soft soils

DESIGN & CONSTRUCTION RECOMMENDATIONS:

- Foundations: 2,500 psf on native soils/structural fill
- Slabs-on-Grade: Modulus of Subgrade Reaction, k = 110 pci
- Seismic Design: Seismic Site Class “C”

This summary should not be considered apart from the entire text of the report with all the qualifications and considerations mentioned herein. Details of our conclusions and recommendations are discussed in the report text.

1.0 INTRODUCTION

Our services were provided in accordance with our Proposal No. 26:9095, dated December 15, 2021, as authorized by SSOE Group on December 22, 2021, which includes our Terms and Conditions of Service.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- Observations from our site reconnaissance including current site conditions, surface drainage features, and surface topographic conditions.
- A subsurface characterization and a description of the field exploration and laboratory tests were performed. Groundwater concerns relative to the planned construction are summarized. Expected geological or seismic hazards are also addressed.
- Final logs of the soil borings and records of the field exploration prepared in accordance with the standard practice for geotechnical engineering. A boring location plan is included, and the results of the laboratory tests were plotted on the final boring logs and included on a separate test report sheet. Existing approximate elevation were recorded for each top of boring, based on interpolation of approximate locations and contour information.
- Recommendations for allowable bearing pressures for conventional shallow foundation systems and estimates of predicted total and differential foundation settlement. This includes specific project information and design loads provided by the project structural engineer, if available.
- Recommendations for floor slab construction, including recommendations for subgrade modulus, subgrade improvements and underslab subdrainage recommendations, as necessary.
- Recommendations for lateral earth pressures for below grade walls.
- Evaluation of the on-site soil characteristics encountered in the soil borings. Specifically, we discuss the on-site materials for re-use as engineered fill to support slabs and pavements. We also included compaction requirements and material guidelines.
- Recommended seismic site class in accordance with IBC 2018, based on ReMi Testing, PSHA analysis, and our knowledge of the site geology.
- Recommended flexible asphalt and rigid concrete pavement sections (light duty and heavy duty) based on assumed loading conditions and estimated CBR values.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE

The project site is located on Keeling Road in Stanton, Tennessee. The site is surrounded by a residential home to the east, Keeling Road to the north, and agricultural farmland to the west and south. Based on elevations obtained from Google Earth, the site appears to undergo approximately 10 feet of topographic relief from 314 to 324 feet MSL. The existing site use is for agriculture.

Figure 2.1.1. Site Location Shown Outlined in Red

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including proposed buildings and related infrastructure.

Table 2.2.1 Design Information

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Development Footprint	Unknown
# of Stories	1 above grade; Below grade areas possible
Usage	Water Treatment Plant
Assumed Column Loads	100 kips (Full Dead and Factored Live)
Assumed Wall Loads	3 to 5 kips per linear foot (klf) maximum
Lowest Finish Floor Elevation	Not known at this time

3.0 FIELD EXPLORATION AND LABORATORY TESTING

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms to assist in developing geotechnical recommendations for the project.

3.1.1 Test Borings

The subsurface conditions were explored by drilling twenty (20) soil test borings within the proposed building area. A track-mounted drill rig was utilized to drill the soil test borings. Borings were advanced to a total depth of 10 to 25 feet below the ground surface (the approximate proposed boring termination depth).

Boring locations were identified in the field by drilling personnel at the time of the mobilization of our drilling equipment. The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A. Ground surface elevations noted on our boring logs were obtained from Google Earth and should be considered approximate.

Standard penetration tests (SPT's) were conducted in the borings at regular intervals in general accordance with ASTM D 1586. Small representative samples were obtained during these tests and were used to classify the soils encountered. The standard penetration resistances obtained provide a general indication of soil shear strength and compressibility.

3.1.2 Refraction Microtremor (ReMi)

Chapter 16 of the International Building Codes (IBC) is utilized by structural engineers to calculate the acceleration response spectra from earthquake motions in the design of the lateral force resistant members of structures. The IBC recommends that site-specific soil data be gathered for every site and permits the use of a refraction microtremor (ReMi) shear wave velocity testing and analysis to determine the Seismic Site Class. Two (2) ReMi surveys were performed at the subject site.

For the ReMi fieldwork, approximately 220-feet of cable (traverse) was laid out on the ground surface. Geophones were typically placed at 20-foot intervals and connected to the cable that is connected to a Seismic Source Co.™ 12-channel exploration seismograph. For this study, 12 channels were used. Ambient vibrations, or microtremors, were recorded at each traverse location. The field data recorded was processed using SeisOpt® ReMi™ software to determine a one-dimensional average shear-wave (S-wave) velocity image for each traverse.

3.1.3 Laboratory Testing Program

A geotechnical engineer classified each soil sample on the basis of texture and plasticity in general accordance with the Unified Soil Classification System (USCS, ASTM D 2487). The group symbols for each soil type are indicated in parentheses following the soil descriptions on each boring log. A brief explanation of the USCS is included in the Appendix. The engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between materials on the exploration records should be considered approximate; in situ, the transitions may be gradual.

Representative soil samples were selected and tested in our laboratory to check field classifications and to determine pertinent index properties. The laboratory testing program included:

- Natural moisture content determinations (ASTM D 2216)
- Atterberg Limits tests (ASTM D 4318)

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded unless other instructions are received as to their disposition. The results of the laboratory testing are included in Appendix C.

3.2 REGIONAL/SITE GEOLOGY

The USGS Geologic Map of the West Sheet of the Geologic Map of Tennessee (1966) indicates this particular site is underlain by Loess Deposits. Loess can generally be described as a combination of clay, sand and silt that was deposited as wind-blown glacial materials. These materials are typically gray to brown, with a maximum thickness of 100 feet along the Mississippi River thinning to depths of 5 feet as you move east away from the river.

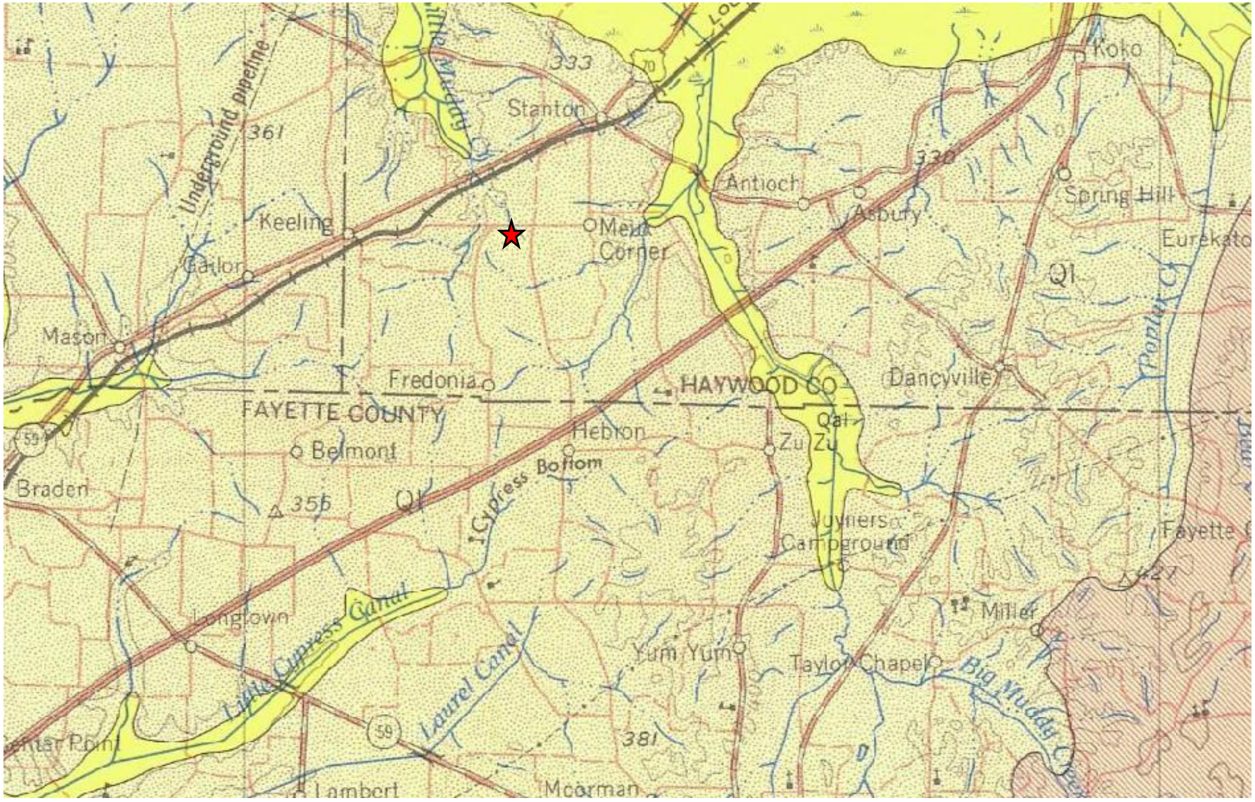


Figure 3.1.1 - USGS Geologic Map of the West Sheet of the Geologic Map of Tennessee (approximate site location shown by red star)

3.3 SUBSURFACE CHARACTERIZATION

The site subsurface conditions were evaluated with twenty (20) SPT borings at the approximate locations shown on the Boring Location Diagram in the Appendix. The quantity of borings, boring locations, and drilling depths were discussed with the project team prior to completing this subsurface exploration.

The following tables provides generalized characterizations of the soil strata encountered during our subsurface exploration.

Table 3.3.1 - Summary of Subsurface Stratums

Approximate Depth (ft)	Stratum	Description[(1)]
0 – 3	I	Lean CLAY (CL) with varying amounts of sand, agriculturally disturbed soils
2 - 25+	II	Lean CLAY (CL) with varying amounts of sand

Notes: (1) This summary is generalized and does not describe the actual conditions encountered in the borings. These stratums may not occur at each location. Depths are approximate. Detailed descriptions of the encountered materials are listed on the Borings Logs in the Appendix.

The subsurface conditions presented in Table 3.3.1 and shown on the Boring Logs should be considered approximate, based on interpretation of the exploration data using normally accepted geotechnical engineering judgments. It should be noted that transitions between different soil strata are typically less distinct than that shown on the exploration records. Subsurface conditions between the actual boring locations will vary. In addition, surficial material depths may also vary significantly across the site from those we encountered.

3.5 LABORATORY TEST RESULTS

Laboratory index test results indicate the in-situ moisture contents of the tested samples ranged from approximately 14 to 30 percent.

Atterberg Limits test performed on select soil samples from Borings B-1 and B-19 indicated low plasticity LEAN CLAY (CL). The Liquid Limits of the samples were 38 and 42 and Plasticity Indices were 16 and 20, respectively. These results have been included on the boring logs and Laboratory Testing Summary in Appendix C.

3.6 GROUNDWATER OBSERVATIONS

During drilling operations, groundwater was not encountered. It should be noted that it is possible for perched water to exist within the depths explored during other times of the year depending upon climatic and rainfall conditions.

Variations in the location of the long-term water table may occur as a result of change in precipitation, evaporation, surface water runoff, and other factors not immediately apparent at the time of this exploration.

4.0 DESIGN RECOMMENDATIONS

4.1 GENERAL

The primary purpose of this geotechnical exploration was to help identify and evaluate the general subsurface conditions relative to the proposed construction. Our recommendations have been developed on the basis of the previously described project information and subsurface conditions identified during this study.

4.1.1 Agriculturally Disturbed Soils: Based on the results of our SPT borings, the upper 1 to 3 feet of the soils at the site appears to be agriculturally disturbed, which would be expected since this site appears to have been an active farmland for many years. Agriculturally disturbed materials are typically adequate to be utilized as engineered fill; however, they are very sensitive to moisture changes. If these materials are attempted to be utilized during wetter and colder periods, chemical stabilization and/or careful moisture conditioning will be required.

4.1.2 Soft Soils: Based on the results of SPT borings, soft soils (material with a N-Value less than or equal to 5 bpf) were encountered in the upper 3 feet in Borings B-1, B-2, B-5, B-6, B-7, B-9, B-19, and B-20. Based on our experience in the area, soils with blow counts less than or equal to 5 bpf typically are not able to pass a proofroll and additional undercutting or ground improvement techniques will likely be required.

4.1.3 Construction Monitoring: ECS should be on-site full-time during earthwork and foundation construction activities to document that our recommendations are followed and to provide recommendations for remedial activities, where necessary.

4.2 SUBGRADE PREPARATION

The following sections describe our general recommendations for preparing the site subgrade prior to fill placement operations.

4.2.1 Stripping and Grubbing

The subgrade preparation should consist of stripping the vegetation, rootmat, topsoil, and soft or inadequate materials from the 10-foot expanded building and 5-foot expanded pavement limits, and 5 feet beyond the toe of structural fills.

4.2.2 Excavation Considerations

The materials encountered within the borings should generally be excavatable with conventional earth moving equipment such as pans/scrapers, loaders, bulldozers, rubber-tired backhoes, etc. Areas of mass excavation, trenches and pits should meet the requirements of the most current Occupational Safety and Health Administration (OSHA) 29 CFR Part 1926, “Occupational Safety and Health Standards-Excavations”. Site excavation safety should be solely the responsibility of the contractor and his subcontractors.

4.2.3 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be thoroughly proofrolled with construction equipment having a minimum axle load of 10 tons [e.g. fully loaded tandem-axle dump truck]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying localized yielding materials.

Where proofrolling identifies areas that are soft or "pumping" subgrade those areas should be repaired prior to the placement of subsequent structural fill or other construction materials. Undercut areas may be backfilled with compacted shotrock fill, engineered fill, compacted dense-grade aggregate base, or flowable fill once adequate subgrade soils have been encountered. If adequate subgrade soils are not encountered after the initial 3 to 4 feet of undercut in pavement or slab-on-grade areas, the backfill recommendations in Table 4.2.3.1 may be utilized.

Table 4.2.3.1 – Maximum Undercut Remediation Recommendations

Maximum Undercut Depth	Backfill Requirements
No Undercut	Cement treat upper 12 inches of subgrade
3 feet	Layer of Tensar TX 140 grid or equivalent and 3 feet of granular stone or shotrock fill
6 feet	2 foot bridge layer of soil then placed and compacted engineered fill

4.3 EARTHWORK OPERATIONS

4.3.1 Structural Fill

Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications. The fill should exhibit a maximum dry density of at least 90 pounds per cubic foot, as determined by a Standard Proctor compaction test (ASTM D 698). Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

Structural Fill Materials: Materials for use as structural fill should consist of inorganic soils with the following engineering properties and compaction requirements.

Table 4.3.1.1 – Structural Fill Recommendations

Material Type	Subject	Property
Soil Fill	Building and Pavement Areas	LL < 45, PI<25
	Building and Pavement Areas Below upper 2 feet	LL < 60, PI<35
	Max. Particle Size	4 inches
	Max. organic content	5% by dry weight
Shotrock Fill	Max. Amount of Fines (Pass No. 4 sieve)	20% by weight
	Max. Particle Size	18 inch

Table 4.3.1.2 – Structural Fill Compaction Recommendations

Subject	Requirement
Compaction Standard	Standard Proctor, ASTM D698
Required Compaction	95% of Max. Dry Density
Moisture Content	-2 to +3 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction (18-inch for shotrock fill)

Fill Compaction Control: The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for buildings, pavements, and slopes, etc., at the time of fill placement. Grade controls should be maintained throughout the filling operations. Filling operations should be observed on a full-time basis by ECS to document that the minimum compaction requirements are being achieved. Field density testing of fills should be performed at the frequencies shown in Table 4.3.1.3, but not less than 2 tests per lift.

Table 4.3.1.3 Frequency of Compaction Tests in Fill Areas

Location	Frequency of Tests
Expanded Building Limits	1 test per 2,500 sq. ft. per lift
Pavement Areas	1 test per 10,000 sq. ft. per lift
Utility Trenches	1 test per 200 linear ft. per lift

Fill Placement: Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of structural fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

At the end of each work day, fill areas should be graded to facilitate drainage of precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils.

Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage should be maintained during the earthwork phases of construction to reduce the likelihood of water ponding which has a tendency to degrade subgrade soils.

Where fill materials will be placed to widen existing embankment fills, or placed up against sloping ground, the soil subgrade should be scarified and the new fill benched or keyed into the existing material. Fill material should be placed in horizontal lifts. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 inches to 4 inches may be required to achieve specified degrees of compaction.

We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of higher plasticity soils is difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

4.4 FOUNDATIONS

Provided subgrades and structural fills are prepared as recommended in this report, the proposed structure can be supported by shallow foundations bearing on structural fill or native soils. ECS recommends proofrolling and/or utilizing a Dynamic Cone Penetrometer (DCP) to verify the adequacy of the existing fill. We recommend the foundation design use the following parameters.

Table 4.4.1 Foundation Recommendations

Design Parameter	Column and Wall Footing	Matt or Wall Footing	Matt or Wall Footing
Foundation Type	Shallow Footings	Shallow Footings	Shallow Footings
Assumed Maximum Loads	Column: 150 Kips Continuous: 3 KLF	Continuous: 10 KLF	Continuous: 10 KLF
Net Allowable Bearing Pressure$^{(1)}$	2,500 psf – Native Soils or Structural Fill	2,500 psf – Native Soils or Structural Fill	2,500 psf – Native Soils or Structural Fill
Minimum Width	24 inches	24 inches	24 inches
Minimum Exterior Frost Depth (below final exterior grade)	18 inches	18 inches	18 inches
Sliding Friction Coefficient	0.3	0.3	0.3
Coefficient of Passive Soil Resistance	295	295	295
Estimated Total Settlement $^{(2)}$	Less than 1- inch	Less than 2- inches$^{(4)}$	Less than 2- inches$^{(4)}$
Estimated Differential Settlement $^{(3)}$	Less than ¾ inches between columns	Less than 1- inch$^{(4)}$	Less than 1- inch$^{(4)}$

Notes:

(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.

(2) Based on assumed structural loads. If final loads are different, ECS must be contacted to review foundation recommendations and settlement calculations.

(3) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

(4) If this settlement is not acceptable, aggregate piers may be utilized.

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick "mud mat" of "lean" concrete should be placed on the bearing soils before the placement of reinforcing steel.

Footing Subgrade Observations: The existing native soils at the foundation bearing elevation are anticipated to be adequate for support of the proposed structures. It will be important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are capable of supporting the design bearing pressures. If soft or poor soils are observed at the footing bearing elevations, the inadequate soils should be undercut and removed. Undercuts should be backfilled with lean concrete ($f'_c \geq 1{,}000$ psi at 28 days) or dense graded aggregate fill up to the original design bottom of footing elevation; the original footing should be constructed on top of the hardened lean concrete or aggregate fill.

4.5 SLABS ON GRADE

We anticipate the lowest level slab-on-grade will bear on the Lean CLAY (CL), which is an adequate bearing material. The following graphic depicts our soil-supported slab recommendations:

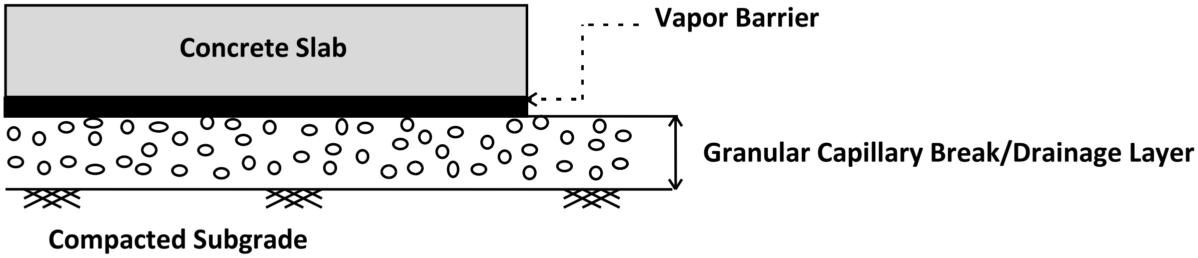


Figure 4.5.1

1. Drainage Layer Thickness: 4 inches
2. Drainage Layer Material: GRAVEL (GP, GW), SAND (SP, SW)

Slab Subgrade Verification: Prior to placement of a drainage layer, the subgrade should be proofrolled as discussed in Section 4.2.3.

Subgrade Modulus: Provided the slab will bear on native material or engineered fill, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 110 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. When a vapor barrier is used, special attention should be given to surface curing of the slab to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

Slab Isolation: Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration does not allow the use of a free-floating slab such as in a drop down footing/monolithic slab configuration, the slab should be designed with adequate reinforcement and load transfer devices to avoid overstressing of the slab.

4.6 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The Chapter 16 of the International Building Codes (IBC) is utilized by structural engineers to calculate the acceleration response spectra from earthquake motions in the design of the lateral force resistant members of structures. The IBC recommends that site-specific soil data be gathered for every site and permits the use of a refraction microtremor (ReMi) shear wave velocity testing and analysis to determine the Seismic Site Class. Two (2) ReMi survey was performed at the subject site.

For the ReMi fieldwork, approximately 220-feet of cable (traverse) was laid out on the ground surface. Geophones were typically placed at 20-foot intervals and connected to the cable that is connected to a Seismic Source Co.™ 12-channel exploration seismograph. For this study, 12 channels were used. Ambient vibrations, or microtremors, were recorded at each traverse location. The field data recorded was processed using SeisOpt® ReMi™ software to determine a one-dimensional average shear-wave (S-wave) velocity image for each traverse.

After processing the data from the ReMi field testing locations, the average shear wave velocity values that we determined at the survey location for the upper 100 feet of this site was approximately 1,205 feet/second and 1,210 feet/second. A diagram of the ReMi survey alignment and the plots of the average shear wave velocity value that was measured for this site has been attached to this letter.

The seismic site class definitions based on the average of shear wave velocity in the upper 100 feet of the soil profile are presented in Table 1613.5.2 of the Code and are summarized below.

Site Class	Soil Profile Name	Average Soil Shear Wave Velocity (Vs-bar) in the Top 100 feet (per IBC 1613.5.5)
A	Hard Rock	V_s-bar > 5,000 ft/sec
B	Rock	2,500 ft/sec < V_s-bar ≤ 5,000 ft/sec
C	Very Dense Soil and Soft Rock	1,200 ft/sec < V_s-bar ≤ 2,500 ft/sec
D	Stiff Soil Profile	600 ft/sec ≤ V_s-bar ≤ 1,200 ft/sec
E	Soft Soil Profile	V_s-bar < 600 ft/sec

Based upon the average of the ReMi testing results, and our interpretation of the IBC 2018 - Chapter 16, it is our opinion that a **Seismic Site Class "C"** is appropriate for this site.

Probabilistic Seismic Hazard Analysis (PSHA): The earthquake risk was estimated for a maximum considered earthquake ground motion having a 2-percent probability of exceedance within a 50-year period (2,475 year return period). The proprietary software program EZ-FRISK V7.62 was utilized to perform this analysis. This program incorporates earthquake return interval probability and peak ground and special accelerations on Site Class "B" conditions at a specific site location.

In the analysis, seismotectonic sources within the program are used for estimating site risk. EZ-FRISK includes a background seismotectonic source for the Central and Eastern United States (CEUS). This source is a variable seismicity source depending on location and is based on 2018 data from the United States Geological Survey (USGS). In addition to background seismicity, fault sources within the program are used to model areas historically known for large earthquakes. For the CEUS region of the United States, large historical earthquakes occurred in New Madrid, Missouri in 1812 (estimated magnitude of 7.8) and in Charleston, South Carolina in 1886 (estimated magnitude of 7.3). These areas are the most significant contributors to site risk within the region and are modeled within EZ-FRISK as fault sources. The combination of background seismicity and regional fault sources are the basis of the spectral parameters derived for this project site.

Earthquake motions generated by the seismotectonic sources were then attenuated to the site using attenuation relationships and methodology within EZ-FRISK. The attenuation relationships used in this analysis included Atkinson-Boore (1995), Campbell (2003), Frankel (1996), Somerville et al (2001), Toro (1997) and Abrahamson-Silva (1997). These relationships were developed specifically to model earthquake attenuation in the CEUS. The average of the appropriate spectral accelerations from these relationships was utilized in the determination of the design values.

The spectral accelerations determined by this PSHA are intended to be compared with those provided in ASCE 7-10. The ASCE 7-10 and PSHA spectral acceleration values for rock (Site Class "B") are provided in Table 4.6.1.

Table 4.6.1 - Summary of Parameters (Site Class "B")

Parameter	PSHA	IBC 2012
Spectral Accelerations at 0.2 sec S_s (g)	0.678	0.945
Spectral Acceleration at 1.0 sec S_1 (g)	0.222	0.327

The design values for structures at the ground surface must be calculated based on the appropriate site class determined from the characteristics of the subsurface profile. Based on the results of the ReMi conducted during our previous investigation, a seismic Site Class "C" is appropriate for this site. The IBC and the PSHA determined seismic parameters for a Site Class "C" are calculated in Table 4.6.2.

Table 4.6.2 - Summary of Seismic Parameters (Calculated for Site Class "C")

Parameter	PSHA	IBC 2012
F_a	1.129	1.022
F_v	1.578	1.473
S_{MS} (g) [S_s (g) x F_a]	0.765	0.966
S_{M1} (g) [S_1 (g) x F_v]	0.350	0.482

The IBC 2012 allows the use of site-specific procedures to determine the ground motion accelerations. When site-specific procedures (PSHA) are used to determine ground motions, the results are limited to 80% of the ground motions determined by the general spectral response acceleration determined by using IBC Code Section 1613. Table 4.6.3 summarizes the spectral parameters for the ground surface at the site based on the results in Table 4.6.2 for a seismic Site Class "C" and presents recommended values for design.

Table 4.6.3 - Parameters for Design (Site Class "C")

Parameter	PSHA	IBC 2012	PSHA/IBC	Recommended Design Values
S_{DS} (g) [S_{MS} (g) x 2/3]	0.510	0.644	79.2%	**0.515***
S_{D1} (g) [S_{M1} (g) x 2/3]	0.234	0.321	72.2%	**0.257***

*Design parameter limited to 80% of IBC value

4.7 SLOPE STABILITY

In general, compacted soil fill embankments on stiff undisturbed soils should be constructed no steeper than a ratio of 3.0 horizontal (H) to 1.0 vertical (V). We recommend cut slopes not be steeper than a ratio of 3.0 (H) to 1.0 (V).

Surface water runoff should be directed from flowing over the slope face. For cut slopes, the area above the slope crest should be constructed with a reverse slope to reduce the likelihood of surface water runoff from flowing over the slope face. Additionally, we recommend a drainage swale or other provisions be constructed near the crest of each cut slope to divert water away from the cut face.

Material should not be stockpiled within 10 feet of the crest of cut or fill slopes. In addition, both cut and fill slope faces should be protected from erosion using a vegetative cover. Seed and mulch, or erosion matting with embedded seed, are options for developing a vegetative cover.

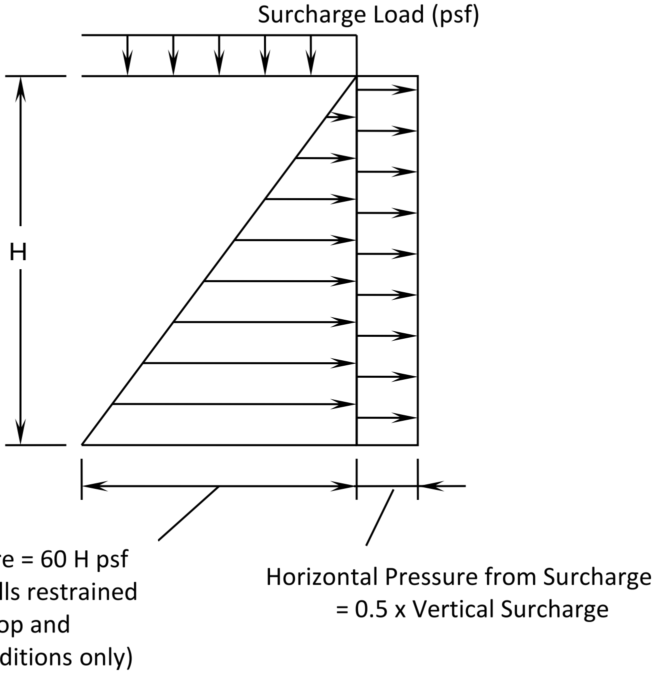
Special consideration must also be given to the stability to cut surfaces in natural soil excavations. The evaluation of slope stability aspects of this site and the proposed development is beyond the scope of this exploration. Relatively detailed grading plans will have to be developed before meaningful evaluation of slope stability can be accomplished. Slope stability evaluation should be performed by qualified geotechnical engineering personnel prior to the initiation of significant grading activities at the site.

4.8 BELOW GRADE WALLS

We recommend that below grade walls be designed to withstand at-rest lateral earth pressures and surcharge loads from adjacent building foundations, and/or streets. It is also our understanding that these walls will NOT be designed in a drained condition but instead will be designed to withstand hydrostatic pressures.

We recommend that walls that are restrained from movement at the top be designed for a linearly increasing lateral earth pressure. The following Figure depicts our recommended at-rest lateral earth pressure condition with restrained wall top:

This diagram is not suitable for the design of Support of Excavation or temporary shoring systems.



Lateral Earth Pressure = 60 H psf (For below grade walls restrained from movement at top and bottom, drained conditions only)

Horizontal Pressure from Surcharge = 0.5 x Vertical Surcharge

Figure 4.8.1

Surcharge loads imposed within a 45 degree slope from the base of the restrained wall should be considered in the below grade wall design. These surcharge loads should be based on an at-rest pressure coefficient, k_0, of 0.5. Care should be used to avoid the operation of heavy equipment to compact the wall backfill since it may overload and damage the wall; in addition, such loads are not typically considered in the design of below grade walls.

Lateral Earth Pressures: Below grade walls should be designed to withstand the lateral earth pressures exerted by the backfill. The pressure diagram is triangular. For design of below grade retaining wall structures, the following soil parameters can be utilized. These parameters assume that Lean CLAY (CL) or granular soils meeting the requirements recommended herein for retaining wall backfill will comprise the backfill in the critical zone. The critical zone is defined as the area between the back of the retaining wall structure and an imaginary line projected upward and rearward from the bottom back edge of the wall footing at a 45-degree angle.

Table 4.8.1 Retaining Wall Backfill in the Critical Zone

Soil Parameter	Estimated value (Lean Clay (CL))	Estimated value (Sand (SP))	Estimated value Select Granular Fill	Estimated value 57 or 67 Stone
Coefficient of Earth Pressure at Rest (K_o)	0.52	0.47	0.47	0.35
Coefficient of Active Earth Pressure (K_a)	0.35	0.31	0.31	0.22
Coefficient of Passive Earth Pressure (K_p)	2.88	3.25	3.25	4.6
Retained Soil Moist Unit Weight (γ)	125 pcf	125 pcf	130 pcf	105 pcf
Cohesion (C)	0 psf	0 psf	0 psf	0 psf
Angle of Internal Friction (ϕ)	29°	32°	32°	40°
Friction Coefficient [Concrete on Soil] (μ)	0.30	0.30	0.30	0.30
At-rest Equivalent Fluid Pressure	95H (psf)	92H (psf)	94H (psf)	78H (psf)
Active Equivalent Fluid Pressure	84H (psf)	82H (psf)	83H (psf)	72H (psf)
Passive Equivalent Fluid Pressure	245H (psf)	266H (psf)	285H (psf)	258H (psf)

4.9 PAVEMENTS

Subgrade Characteristics: Based on the results of our borings, it appears that the pavement subgrades in cuts will consist mainly of Lean CLAY (CL. California Bearing Ratio (CBR) testing was not performed as part of this study. Therefore, we have estimated a CBR value of 3 for preliminary design purposes.

We were not provided traffic loading information so we have assumed loadings typical of this type of project in the following table assuming a 20 year design life and 90% reliability:

Table 4.9.1: Pavement Loading Assumptions

Vehicle Description	Light Duty (15,000 ESAL)		Heavy Duty (50,000 ESAL)	
	Number of Trips per Day	Days Per Week	Number of Trips	Days Per Week
Passenger Car	500	7	500	7
Package Delivery Truck	2	5	2	5
Garbage Truck	1	2	1	2
Semi-tractor trailer (Loaded)	0	0	2	5

The preliminary pavement sections below are guidelines that may or may not comply with local jurisdictional minimums.

Table 4.9.2: Proposed Pavement Sections

MATERIAL	FLEXIBLE PAVEMENT		RIGID PAVEMENT	
	Heavy Duty	Light Duty	Heavy Duty	Light Duty
Portland Cement Concrete (f'$_c$ = 4000 psi)	-	-	6 in.	5 in.
Asphaltic Surface Course	1 in	2 in	-	-
Asphaltic Binder Course	2 in	-	-	-
Crushed Stone Base[1]	8 in	8 in	4 in	4 in

In general, heavy duty sections are areas that will be subjected to trucks, buses, or other similar vehicles including main drive lanes of the development. Light duty sections are appropriate for vehicular traffic and parking areas.

Large, front loading trash dumpsters frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of a 6-inch thick, 4,000 psi, reinforced concrete slab over 6-inches of dense graded aggregate. When traffic loading becomes available ECS or the Civil Engineer can design the pavements.

Pavement Maintenance: Regular maintenance and occasional repairs should be implemented to keep pavements in a serviceable condition. In addition, to help reduce water infiltration to the pavement section and within the base course layer resulting in softening of the subgrade and deterioration of the pavement, we recommend the timely sealing of joints and cracks using proper sealants. We recommend exterior pavements be reviewed for distress/cracks twice a year, once in the spring and once in the fall.

Sound maintenance programs should help maintain and enhance the performance of pavements and attain the design service life. A preventative maintenance program should be implemented early in the pavement life to be effective. The "standard in the industry" supported by research indicates that preventative maintenance should begin within 2 to 5 years of the pavement construction. Failure to perform preventative maintenance will reduce the service life of the pavement and increase the costs for both corrective maintenance and full pavement rehabilitation.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally adequate for support of utility pipes. The pipe subgrades should be observed and probed for adequacy by ECS. Loose or inadequate materials encountered should be removed and replaced with adequately compacted structural fill, or pipe stone bedding material.

Utility Backfilling: The granular bedding material (often #57 stone) should be at least 4 inches thick, but not less than that specified by the civil engineer's project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for structural fill and fill placement.

5.2 GENERAL CONSTRUCTION CONSIDERATIONS

Moisture Conditioning: During the cooler and wetter periods of the year, delays and additional costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives, such as lime or cement, in order to lower moisture contents to levels appropriate for compaction. Alternatively, during the drier times of the year, such as the summer months, moisture may need to be added to the soil to provide adequate moisture for successful compaction according to the project requirements.

Subgrade Protection: Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas, including structural and pavement areas. It would be advisable to designate a haul road and construction staging area to limit the areas of disturbance and to reduce construction traffic from excessively degrading sensitive subgrade soils and existing pavement areas. Haul roads and construction staging areas could be covered with excess depths of aggregate to protect those subgrades. The aggregate can later be removed and used in pavement areas.

Surface Drainage: Surface drainage conditions should be properly maintained. Surface water should be directed away from the construction area, and the work area should be sloped away from the construction area at a gradient of 1 percent or greater to reduce the potential of ponding water and the subsequent saturation of the surface soils. At the end of each work day, the subgrade soils should be sealed by rolling the surface with a smooth drum roller to reduce the likelihood of the infiltration of surface water.

Excavation Safety: Cuts or excavations associated with utility excavations may require forming or bracing, slope flattening, or other physical measures to control sloughing and/or reduce slope failures. Contractors should be familiar with applicable OSHA codes to ensure that adequate protection of the excavations and trench walls is provided.

Erosion Control: The surface soils may be erodible. Therefore, the Contractor should provide and maintain good site drainage during earthwork operations to maintain the integrity of the surface soils. Erosion and sedimentation controls should be in accordance with sound engineering practices and local requirements.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by SSOE Group. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

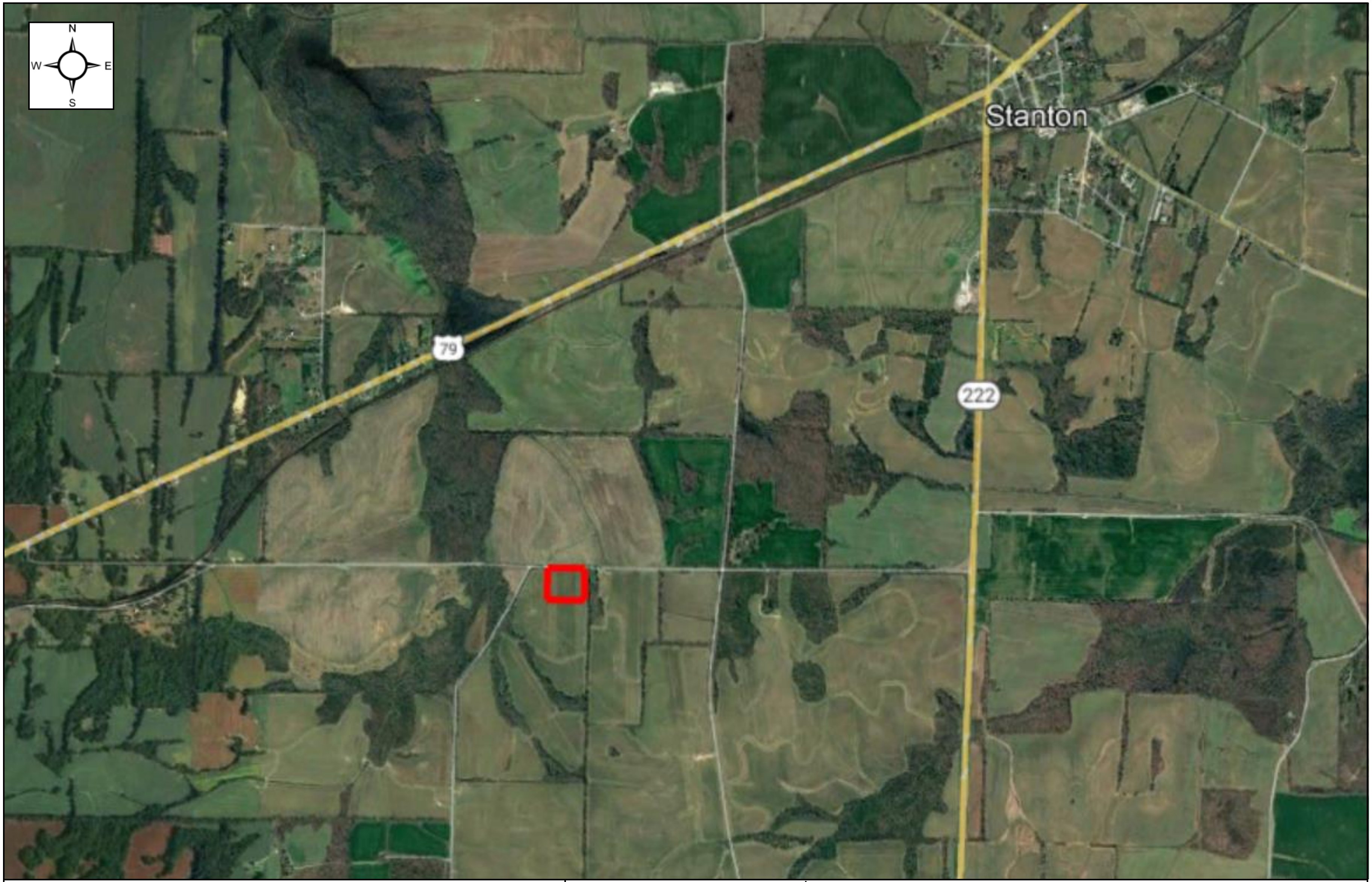
We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A – Diagrams & Reports

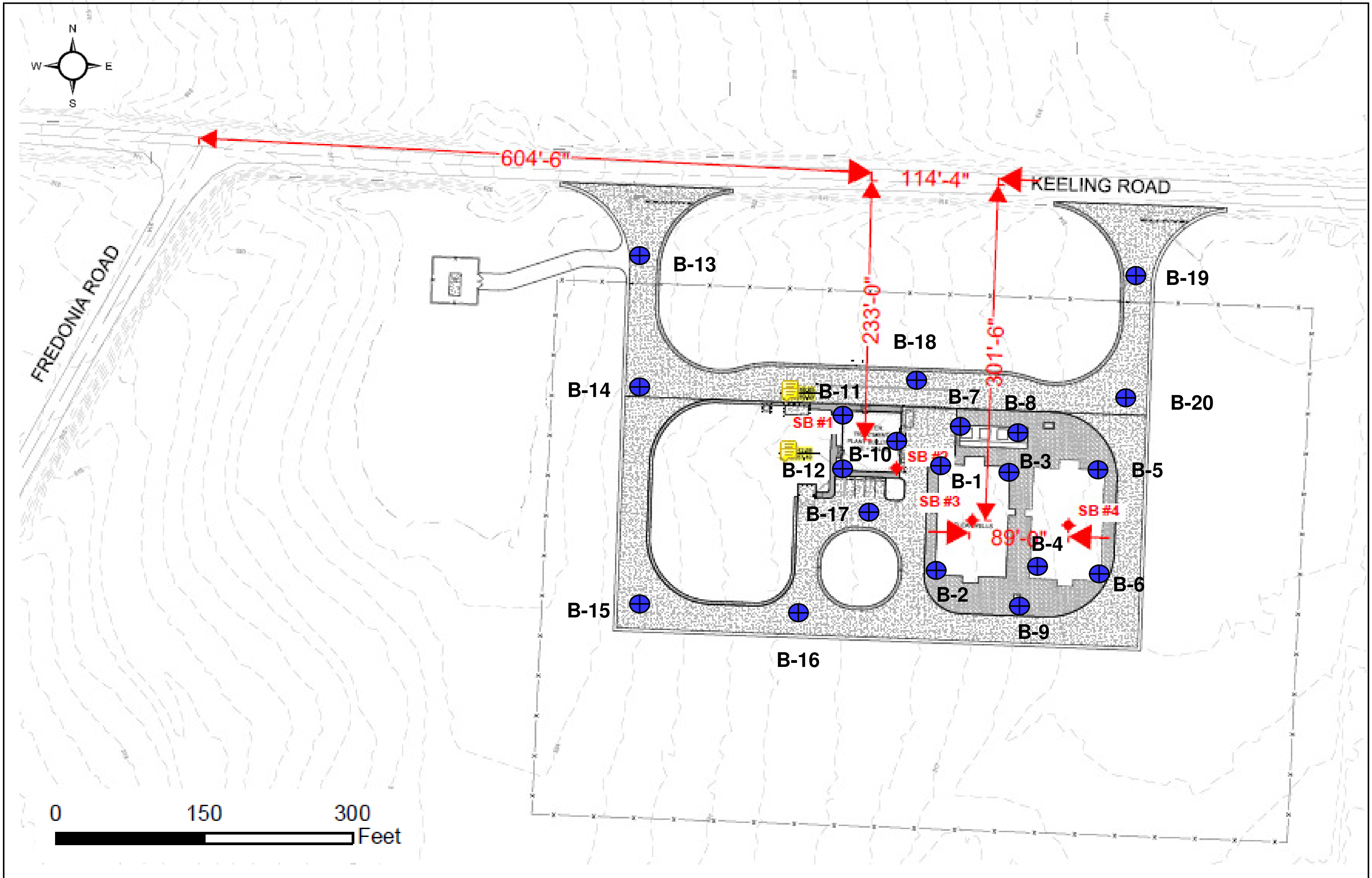
Site Location Diagram
Boring Location Diagram
Subsurface Cross-Sections



Megasite Water Treatment

Keeling Road
Stanton, Tennessee
ECS Project No. 26:5272

Site Location Diagram
(approximate site location outlined in red)



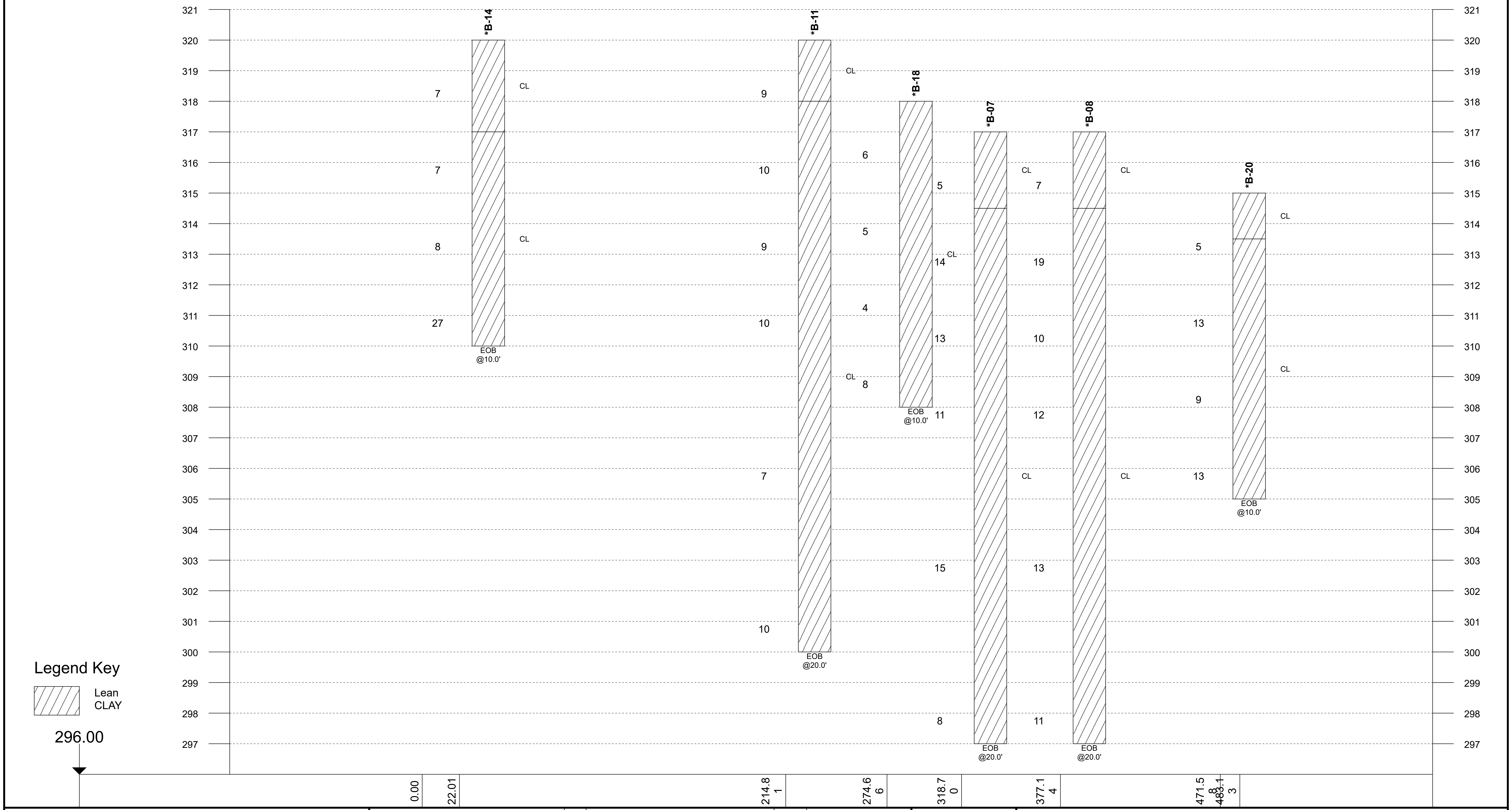
Megasite Water Treatment

Keeling Road
Stanton, Tennessee
ECS Project No. 26:5272

ECS

Boring Location Diagram

⊕ Approximate Boring Locations



Notes:
1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit X———●———△	▽	WL (First Encountered)	🟥	Fill
[FINES CONTENT%]	▼	WL (Completion)	🟪	Possible Fill
◀ BOTTOM OF CASING	▼	WL (Seasonal High Water)	▨	Probable Fill
LOSS OF CIRCULATION	▽	WL (Stabilized)	🟩	Rock

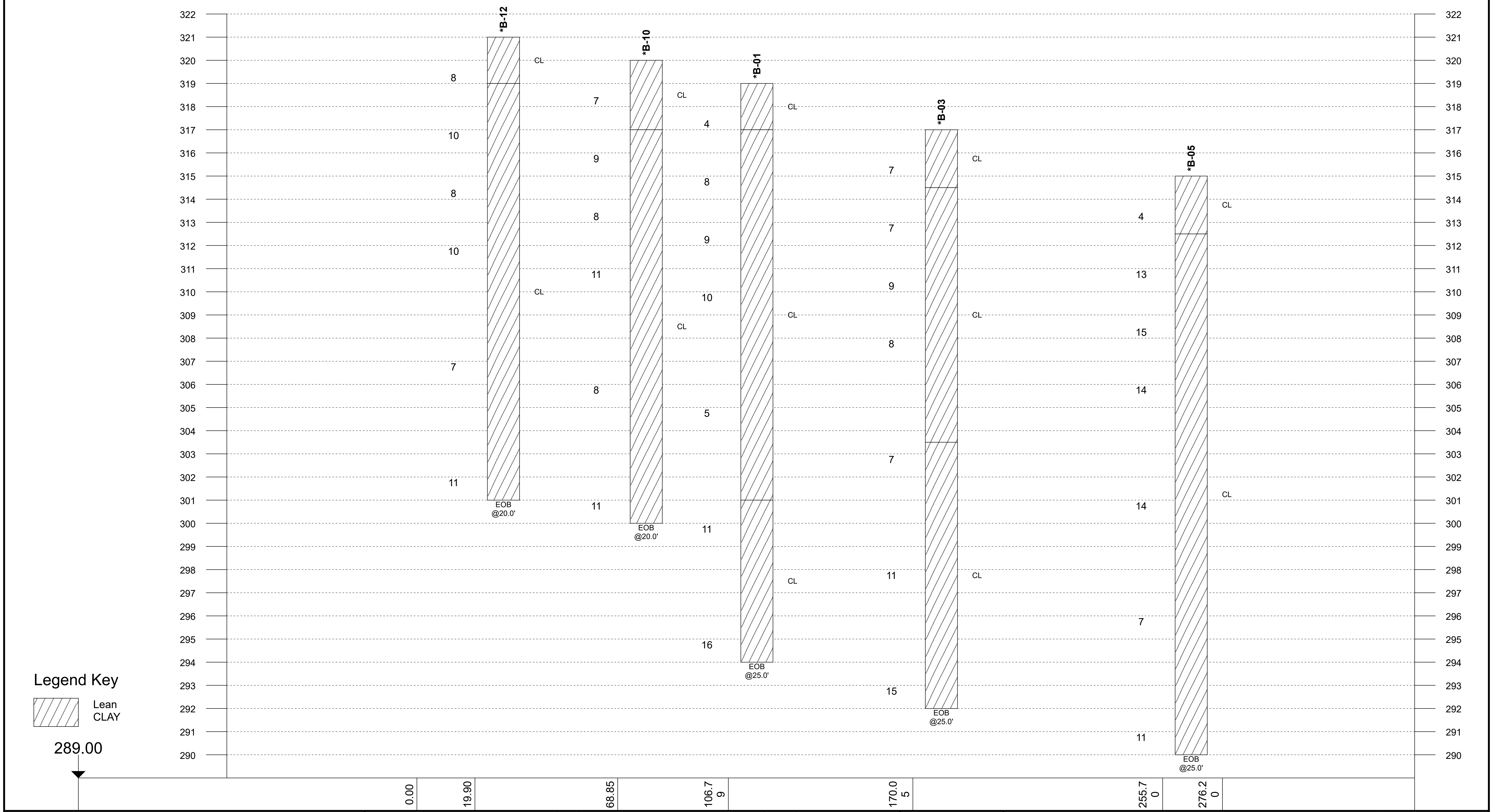
GENERALIZED SUBSURFACE SOIL PROFILE Section line A

MRM - Stanton TN Geotechnical Exploration

SSOE Group

Keeling Road, Stanton, Tennessee 38069

Project No: 26:5272
Date: 03/17/2022



Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.

2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.

3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.

4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit
X———●———△

[FINES CONTENT%]

BOTTOM OF CASING

LOSS OF CIRCULATION

▽ WL (First Encountered)
▼ WL (Completion)
▽ WL (Seasonal High Water)
▽ WL (Stabilized)

🟥 Fill
🟪 Possible Fill
▨ Probable Fill
🟩 Rock

ECS

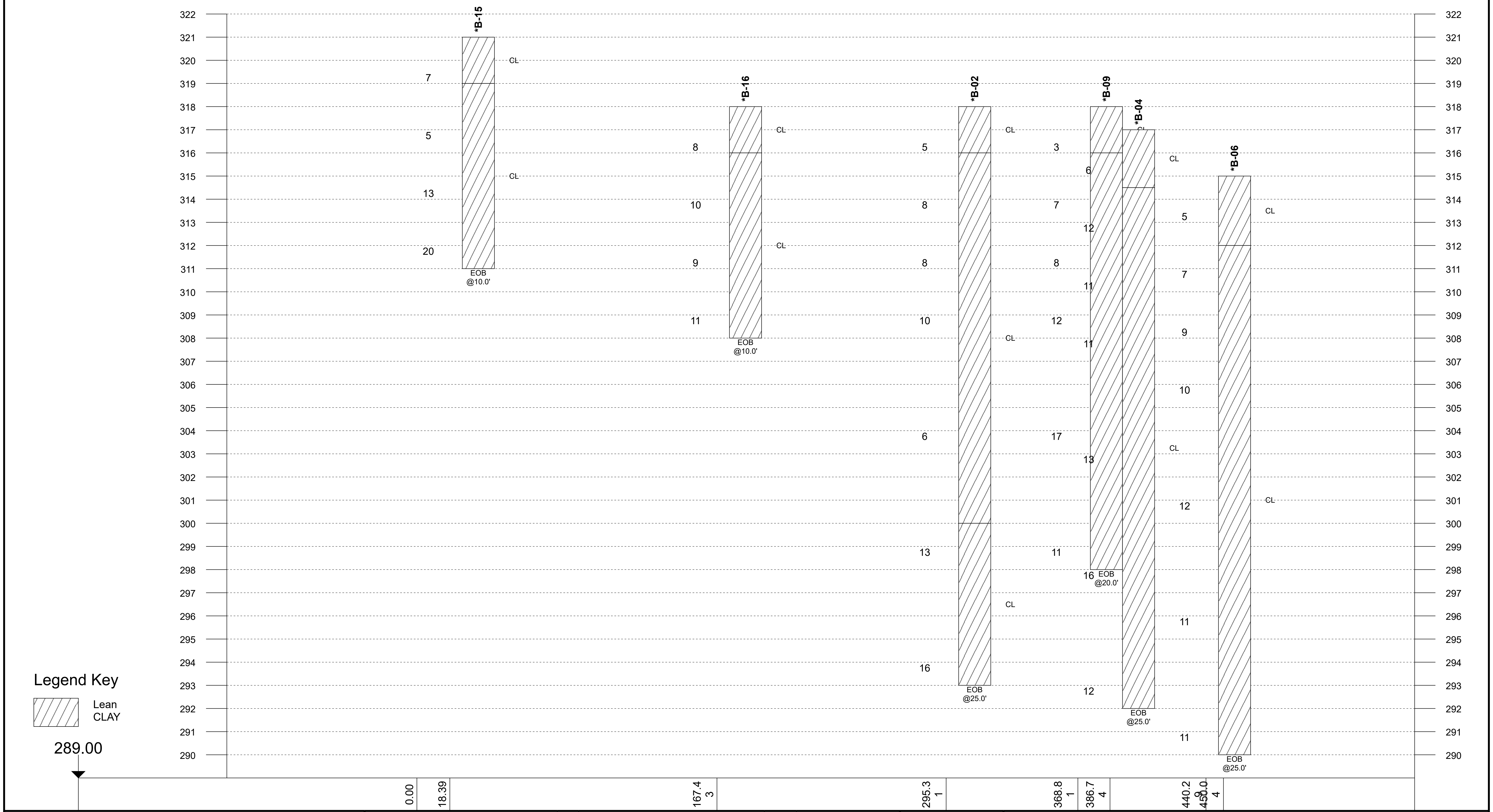
GENERALIZED SUBSURFACE SOIL PROFILE Section line B

MRM - Stanton TN Geotechnical Exploration

SSOE Group

Keeling Road, Stanton, Tennessee 38069

Project No: 26:5272 Date: 03/17/2022



Notes:
1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit X———●———△	▽ WL (First Encountered)	🟥	Fill
[FINES CONTENT%]	▼ WL (Completion)	🟪	Possible Fill
◀ BOTTOM OF CASING	▽ WL (Seasonal High Water)	■	Probable Fill
100% LOSS OF CIRCULATION	▽ WL (Stabilized)	🟩	Rock

GENERALIZED SUBSURFACE SOIL PROFILE Section line C

MRM - Stanton TN Geotechnical Exploration

SSOE Group

Keeling Road, Stanton, Tennessee 38069

Project No: 26:5272 Date: 03/17/2022

APPENDIX B – Field Operations

Reference Notes for Boring Logs
Boring Logs B-1 through B-20
Shear Wave Velocity Plots

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

■		**ASPHALT**
⁘		**CONCRETE**
⁙		**GRAVEL**
▨		**TOPSOIL**
□		**VOID**
▦		**BRICK**
○		**AGGREGATE BASE COURSE**
●	**GW**	**WELL-GRADED GRAVEL** **gravel-sand mixtures, little or no fines**
○	**GP**	**POORLY-GRADED GRAVEL** **gravel-sand mixtures, little or no fines**
▥	**GM**	**SILTY GRAVEL** **gravel-sand-silt mixtures**
▧	**GC**	**CLAYEY GRAVEL** **gravel-sand-clay mixtures**
▲	**SW**	**WELL-GRADED SAND** **gravelly sand, little or no fines**
⁚	**SP**	**POORLY-GRADED SAND** **gravelly sand, little or no fines**
⁞	**SM**	**SILTY SAND** **sand-silt mixtures**
▧	**SC**	**CLAYEY SAND** **sand-clay mixtures**
▥	**ML**	**SILT** **non-plastic to medium plasticity**
▥	**MH**	**ELASTIC SILT** **high plasticity**
▨	**CL**	**LEAN CLAY** **low to medium plasticity**
▨	**CH**	**FAT CLAY** **high plasticity**
≀	**OL**	**ORGANIC SILT or CLAY** **non-plastic to low plasticity**
≀	**OH**	**ORGANIC SILT or CLAY** **high plasticity**
⩛	**PT**	**PEAT** **highly organic soils**

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS[6]

▽	WL (First Encountered)
▼	WL (Completion)
▽	WL (Seasonal High Water)
▽	WL (Stabilized)

FILL AND ROCK

🟥	🟪	⬜	🟩
FILL	**POSSIBLE FILL**	**PROBABLE FILL**	**ROCK**

---

[1] Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2] To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3] Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4] Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5] Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6] The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7] Minor deviation from ASTM D 2488-17 Note 14.

[8] Percentages are estimated to the nearest 5% per ASTM D 2488-17.

CLIENT: **SSOE Group**

PROJECT NO.: **26:5272**

BORING NO.: **B-01**

SHEET: **1 of 1**

PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**

DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**

SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**

NORTHING: **420426.2**

EASTING: **946759.8**

STATION:

SURFACE ELEVATION: **316**

LOSS OF CIRCULATION

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

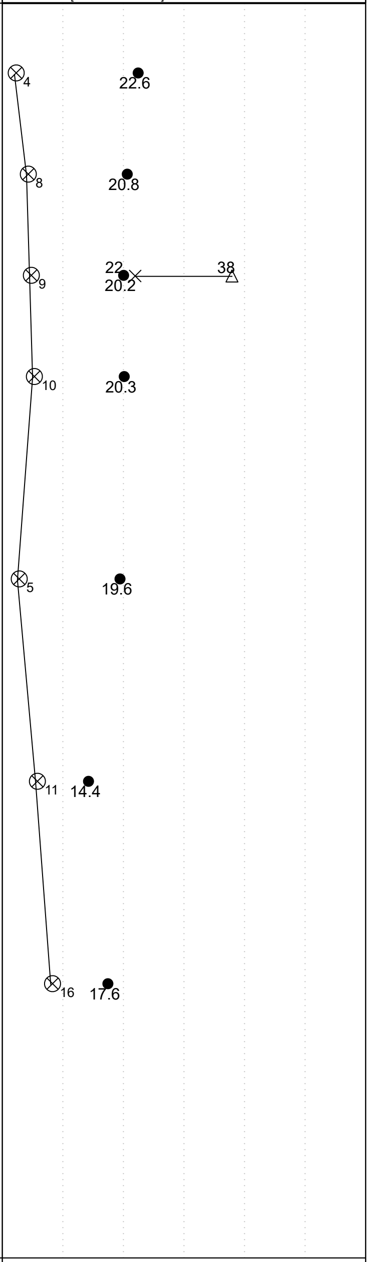
RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	8	(CL) LEAN CLAY, trace sand, trace gravel, light brown, moist, agriculturally disturbed			3-2-2 (4)
	S-2	SS	18	10	(CL) LEAN CLAY, trace sand, trace gravel, brown, moist, firm to stiff			2-4-4 (8)
5							314	
	S-3	SS	18	12				3-4-5 (9)
	S-4	SS	18	10				3-5-5 (10)
10							309	
	S-5	SS	18	8				3-3-2 (5)
15							304	
	S-6	SS	18	12	(CL) LEAN CLAY, trace gravel, brown, moist, stiff			5-6-5 (11)
20							299	
	S-7	SS	18	12				5-7-9 (16)
25					END OF BORING AT 25 FT		294	
30							289	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

WL (Seasonal High Water)

WL (Stabilized)

BORING STARTED: **Feb 14 2022**

BORING COMPLETED: **Feb 14 2022**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

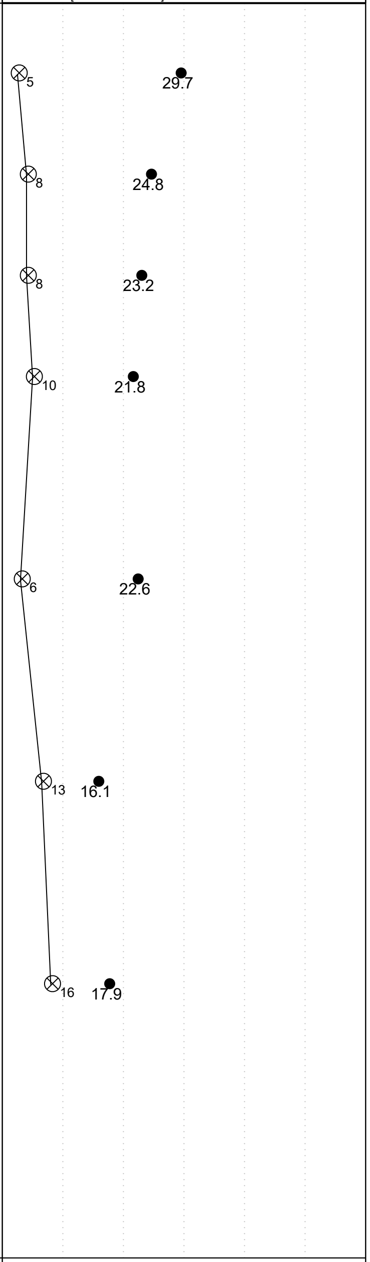
CLIENT: **SSOE Group**
PROJECT NO.: **26:5272**
BORING NO.: **B-02**
SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**
DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**
NORTHING: **420323.2**
EASTING: **946758.6**
STATION:
SURFACE ELEVATION: **318**

LOSS OF CIRCULATION 100%
BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ **STANDARD PENETRATION BLOWS/FT**
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
○ **CALIBRATED PENETROMETER TON/SF**
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	8	(CL) LEAN CLAY, trace sand, trace gravel, light brown, moist, agriculturally disturbed			2-2-3 (5)
	S-2	SS	18	10	(CL) LEAN CLAY, trace sand, trace gravel, brown, moist, firm to stiff			2-3-5 (8)
5							313	
	S-3	SS	18	16				3-4-4 (8)
	S-4	SS	18	10				2-4-6 (10)
10							308	
	S-5	SS	18	18				2-3-3 (6)
15							303	
	S-6	SS	18	12	(CL) LEAN CLAY, trace gravel, brown, moist, stiff to very stiff			4-6-7 (13)
20							298	
	S-7	SS	18	12				6-6-10 (16)
25					**END OF BORING AT 25 FT**		293	
30							288	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)
▼ WL (Completion) **Dry**
▼ WL (Seasonal High Water)
▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**
BORING COMPLETED: **Feb 14 2022**
EQUIPMENT: **ATV**
LOGGED BY:
CAVE IN DEPTH:
HAMMER TYPE: **Auto**
DRILLING METHOD: **HSA/SPT**

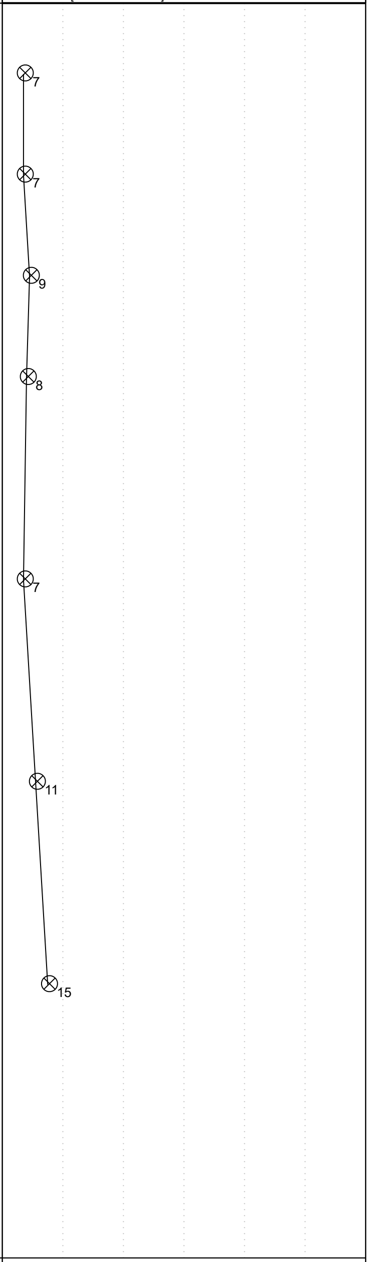
GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**
PROJECT NO.: **26:5272**
BORING NO.: **B-03**
SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**
DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**
NORTHING: **420416.7**
EASTING: **946823.0**
STATION:
SURFACE ELEVATION: **317**

LOSS OF CIRCULATION
BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	16	(CL) LEAN CLAY, trace sand, brown, moist, agriculturally disturbed			2-3-4 (7)
	S-2	SS	18	18	(CL) LEAN CLAY, trace sand, light brown, moist, firm to stiff			3-3-4 (7)
5							312	
	S-3	SS	18	16				2-4-5 (9)
	S-4	SS	18	18				2-4-4 (8)
10							307	
	S-5	SS	18	8	(CL) LEAN CLAY WITH SAND, light brown, moist, stiff			2-3-4 (7)
15							302	
	S-6	SS	18	12				4-6-5 (11)
20							297	
	S-7	SS	18	10				6-6-9 (15)
25					**END OF BORING AT 25 FT**		292	
30							287	

Plastic Limit Water Content Liquid Limit
X———●———△
⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
🟥 RQD
— REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)
▼ WL (Completion) **Dry**
▼ WL (Seasonal High Water)
▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**
BORING COMPLETED: **Feb 14 2022**
EQUIPMENT: **ATV**
LOGGED BY:
CAVE IN DEPTH:
HAMMER TYPE: **Auto**
DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**

PROJECT NO.: **26:5272**

BORING NO.: **B-04**

SHEET: **1 of 1**

PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**

DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**

SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**

LOSS OF CIRCULATION

BOTTOM OF CASING

NORTHING: **420324.7**

EASTING: **946850.2**

STATION:

SURFACE ELEVATION: **316**

Plastic Limit X Water Content ● Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

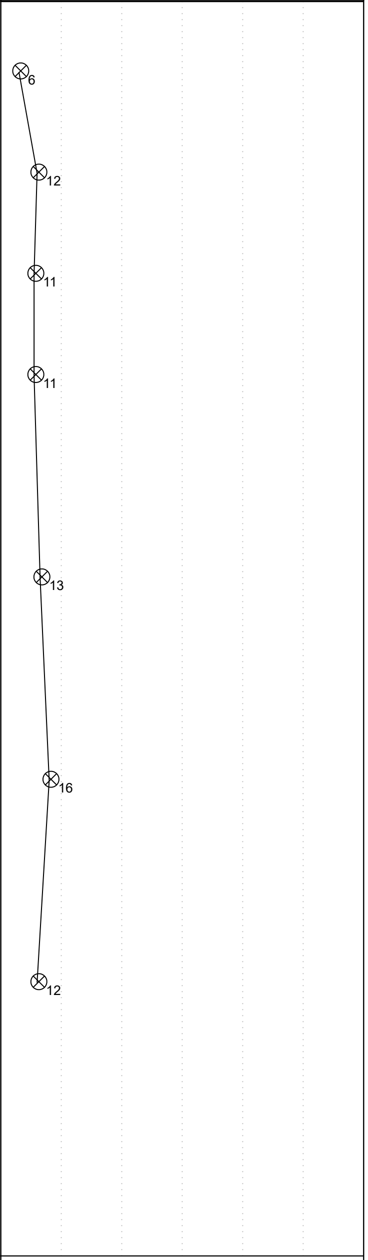
RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	13	(CL) LEAN CLAY, trace sand, trace gravel, light brown, moist, agriculturally disturbed			2-3-3 (6)
	S-2	SS	18	11	(CL) LEAN CLAY, trace sand, light brown, moist, stiff to very stiff			4-5-7 (12)
5							312	
	S-3	SS	18	10				3-5-6 (11)
	S-4	SS	18	18				4-5-6 (11)
10							307	
	S-5	SS	18	8				4-8-5 (13)
15							302	
	S-6	SS	18	8				4-7-9 (16)
20							297	
	S-7	SS	18	12				5-5-7 (12)
25					**END OF BORING AT 25 FT**		292	
30							287	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**

CAVE IN DEPTH:

BORING COMPLETED: **Feb 14 2022**

HAMMER TYPE: **Auto**

EQUIPMENT: **ATV**

LOGGED BY:

DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**	PROJECT NO.: **26:5272**	BORING NO.: **B-05**	SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**	DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**		
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**			
NORTHING: **420421.4**	EASTING: **946908.7**	STATION:	SURFACE ELEVATION: **316**

LOSS OF CIRCULATION ⟩100%⟩

BOTTOM OF CASING ➤

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

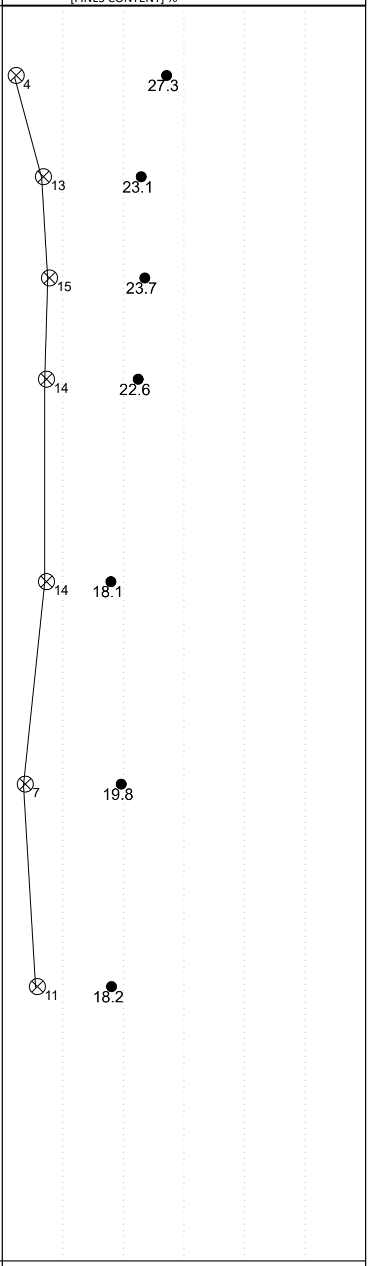
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(CL) LEAN CLAY, trace gravel, brown, moist, agriculturally disturbed			2-2-2 (4)
	S-2	SS	18	16	(CL) LEAN CLAY, trace sand, brown, moist, stiff			3-5-8 (13)
5							310	
	S-3	SS	18	16				2-7-8 (15)
	S-4	SS	18	16				4-6-8 (14)
10							305	
	S-5	SS	18	14				6-6-8 (14)
15							300	
	S-6	SS	18	16				3-3-4 (7)
20							295	
	S-7	SS	18	18				3-6-5 (11)
25					**END OF BORING AT 25 FT**		290	
30							285	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Feb 14 2022**		CAVE IN DEPTH:
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Feb 14 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:	DRILLING METHOD: **HSA/SPT**
▽ WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**	PROJECT NO.: **26:5272**	BORING NO.: **B-06**	SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**	DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**		
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**			
NORTHING: **420319.5**	EASTING: **946904.2**	STATION:	SURFACE ELEVATION: **317**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ **STANDARD PENETRATION BLOWS/FT**

ROCK QUALITY DESIGNATION & RECOVERY

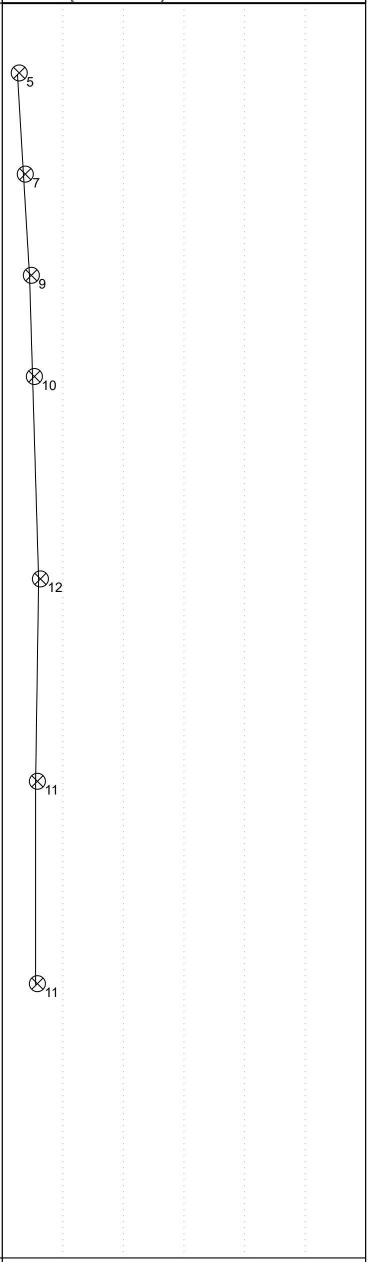
RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace sand, trace gravel, light brown, moist			
	S-1	SS	18	14				2-2-3 (5)
					(CL) LEAN CLAY, trace sand, brown, moist, firm to stiff			
	S-2	SS	18	18				3-3-4 (7)
5							310	
	S-3	SS	18	10				3-4-5 (9)
	S-4	SS	18	18				4-5-5 (10)
10							305	
	S-5	SS	18	8				4-4-8 (12)
15							300	
	S-6	SS	18	10				3-5-6 (11)
20							295	
	S-7	SS	18	8				4-5-6 (11)
25					**END OF BORING AT 25 FT**		290	
30							285	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Feb 14 2022**	CAVE IN DEPTH:
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Feb 14 2022**	HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV** / LOGGED BY:	DRILLING METHOD: **HSA/SPT**
▽ WL (Stabilized)			

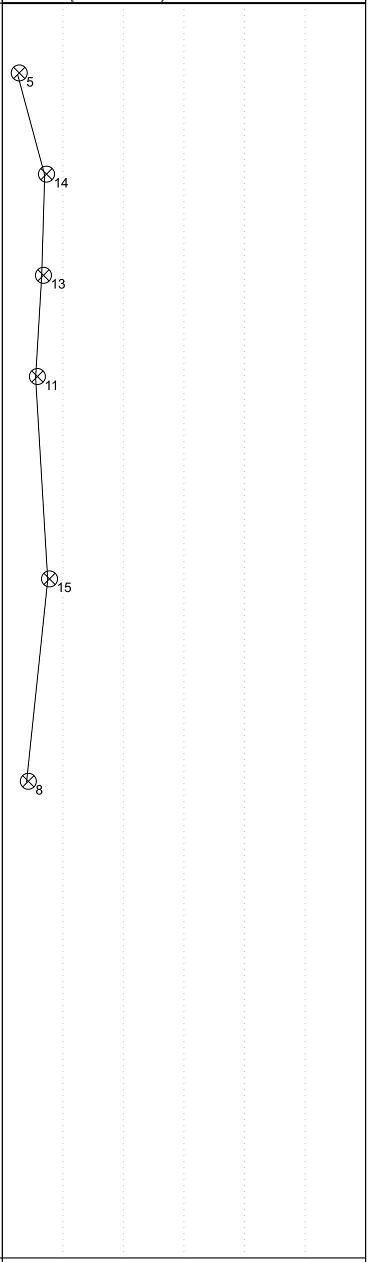
GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**	PROJECT NO.: **26:5272**	BORING NO.: **B-07**	SHEET: **1 of 1**	
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**	DRIVER/CONTRACTOR: **Tri-State Drilling, LLC**			
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**				LOSS OF CIRCULATION ⟩100%⟩
NORTHING: **420461.7**	EASTING: **946777.2**	STATION:	SURFACE ELEVATION: **318**	BOTTOM OF CASING ➡

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	8	(CL) LEAN CLAY, trace sand, trace gravel, light grayish brown, moist, agriculturally disturbed			2-2-3 (5)
	S-2	SS	18	10	(CL) LEAN CLAY, trace sand, brown, moist, stiff			3-7-7 (14)
5							312	
	S-3	SS	18	8				3-6-7 (13)
	S-4	SS	18	8				4-5-6 (11)
10							307	
	S-5	SS	18	8				5-7-8 (15)
15							302	
	S-6	SS	18	10				3-4-4 (8)
20					**END OF BORING AT 20 FT**		297	
25							292	
30							287	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Feb 14 2022**	CAVE IN DEPTH:
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Feb 14 2022**	HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV** / LOGGED BY:	DRILLING METHOD: **HSA/SPT**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**

PROJECT NO.: **26:5272**

BORING NO.: **B-08**

SHEET: **1 of 1**

PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**

DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**

SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

NORTHING: **420457.1**

EASTING: **946835.4**

STATION:

SURFACE ELEVATION: **317**

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

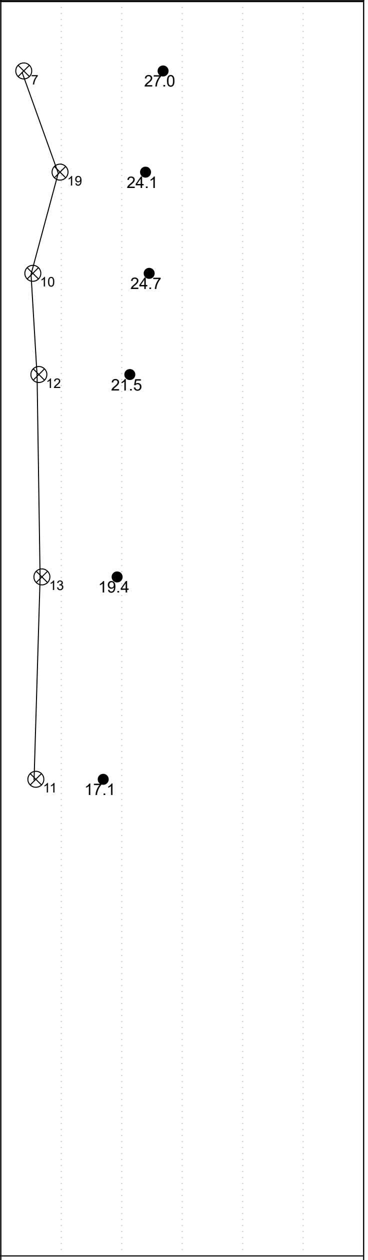
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	10	(CL) LEAN CLAY, trace gravel, brown, moist, agriculturally disturbed			2-3-4 (7)
	S-2	SS	18	10	(CL) LEAN CLAY, brown, moist, stiff to very stiff			7-7-12 (19)
5							312	
	S-3	SS	18	16				4-4-6 (10)
	S-4	SS	18	13				5-6-6 (12)
10							307	
	S-5	SS	18	12				5-6-7 (13)
15							302	
	S-6	SS	18	18				4-5-6 (11)
20					**END OF BORING AT 20 FT**		297	
25							292	
30							287	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**

BORING COMPLETED: **Feb 14 2022**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD:

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**

PROJECT NO.: **26:5272**

BORING NO.: **B-09**

SHEET: **1 of 1**

PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**

DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**

SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**

NORTHING: **420285.2**

EASTING: **946835.1**

STATION:

SURFACE ELEVATION: **317**

LOSS OF CIRCULATION ⟩100%⟩

BOTTOM OF CASING ▶

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

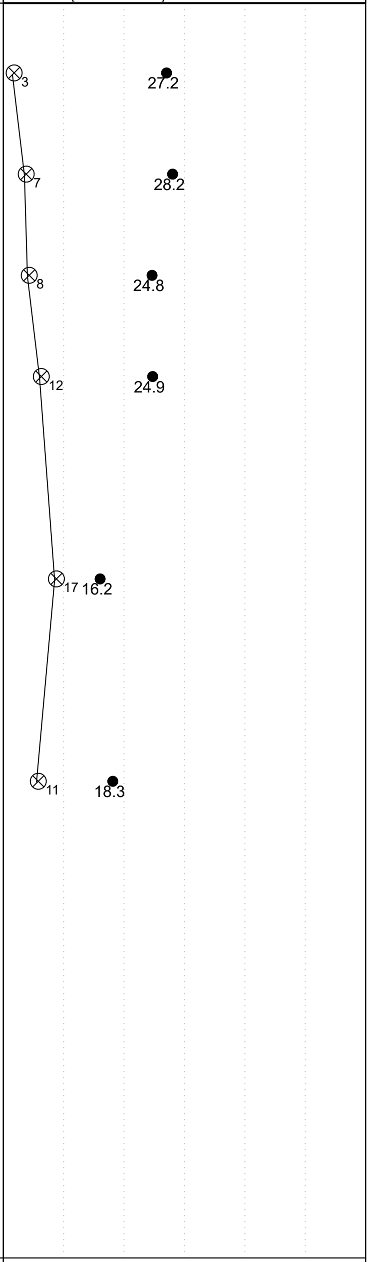
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace gravel, light brown, moist, agriculturally disturbed			
	S-1	SS	18	18	(CL) LEAN CLAY, trace sand, brown, moist, firm to very stiff			1-1-2 (3)
	S-2	SS	18	16				2-3-4 (7)
5							313	
	S-3	SS	18	12				3-4-4 (8)
	S-4	SS	18	10				3-5-7 (12)
10							308	
	S-5	SS	18	18				3-7-10 (17)
15							303	
	S-6	SS	18	18				4-5-6 (11)
20					**END OF BORING AT 20 FT**		298	
25							293	
30							288	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**

BORING COMPLETED: **Feb 14 2022**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**

PROJECT NO.: **26:5272**

BORING NO.: **B-10**

SHEET: **1 of 1**

PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**

DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**

SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**

LOSS OF CIRCULATION

BOTTOM OF CASING

NORTHING: **420448.3**

EASTING: **946722.2**

STATION:

SURFACE ELEVATION: **320**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(CL) LEAN CLAY, trace gravel, trace organics, brown, moist			2-3-4 (7)
	S-2	SS	18	13	(CL) LEAN CLAY, brown, moist, firm to stiff			1-4-5 (9)
5							315	
	S-3	SS	18	10				2-3-5 (8)
	S-4	SS	18	10				3-5-6 (11)
10							310	
	S-5	SS	18	12				2-3-5 (8)
15							305	
	S-6	SS	18	10				2-4-7 (11)
20					**END OF BORING AT 20 FT**		300	
25							295	
30							290	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ **STANDARD PENETRATION BLOWS/FT**

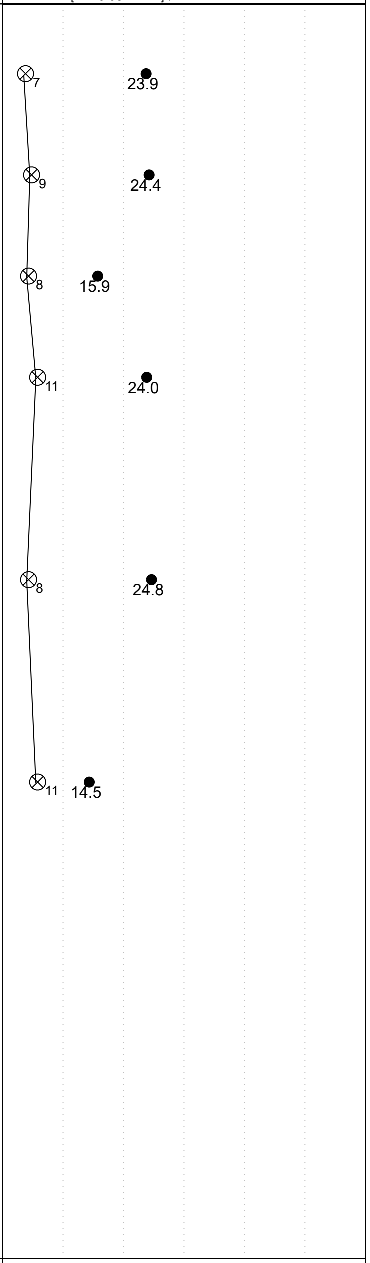
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**

BORING COMPLETED: **Feb 14 2022**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**		PROJECT NO.: **26:5272**	BORING NO.: **B-11**	SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**		DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**		
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**				LOSS OF CIRCULATION 100%
NORTHING: **420472.6**	EASTING: **946673.8**	STATION:	SURFACE ELEVATION: **320**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ **STANDARD PENETRATION BLOWS/FT**

ROCK QUALITY DESIGNATION & RECOVERY

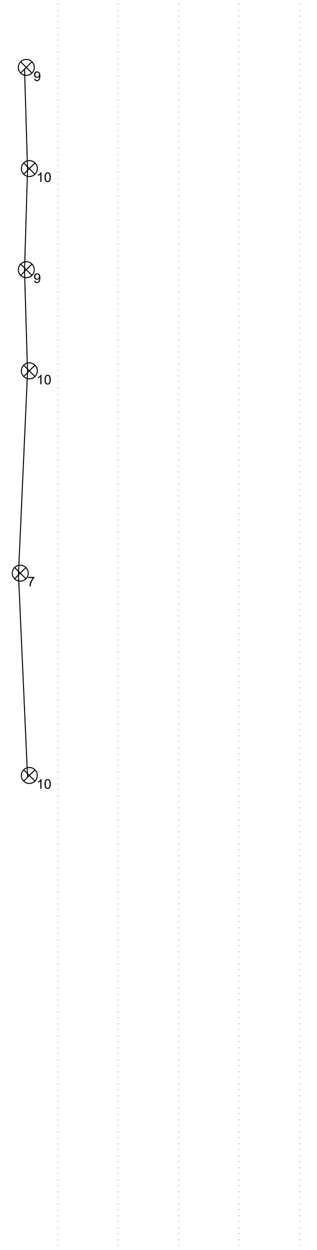
RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(CL) LEAN CLAY, trace gravel, brown, moist, agriculturally disturbed			3-4-5 (9)
					(CL) LEAN CLAY, trace sand, light brown, moist, stiff			
	S-2	SS	18	12				4-3-7 (10)
5							315	
	S-3	SS	18	8				3-3-6 (9)
	S-4	SS	18	10				5-6-4 (10)
10							310	
	S-5	SS	18	8				2-3-4 (7)
15							305	
	S-6	SS	18	10				3-5-5 (10)
20					**END OF BORING AT 20 FT**		300	
25							295	
30							290	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Feb 14 2022**	CAVE IN DEPTH:
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Feb 14 2022**	HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:
▽ WL (Stabilized)			DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT:
SSOE Group

PROJECT NO.:
26:5272

BORING NO.:
B-12

SHEET:
1 of 1

PROJECT NAME:
MRM - Stanton TN Geotechnical Exploration

DRILLER/CONTRACTOR:
Tri-State Drilling, LLC

SITE LOCATION:
Keeling Road, Stanton, Tennessee 38069

LOSS OF CIRCULATION 100%

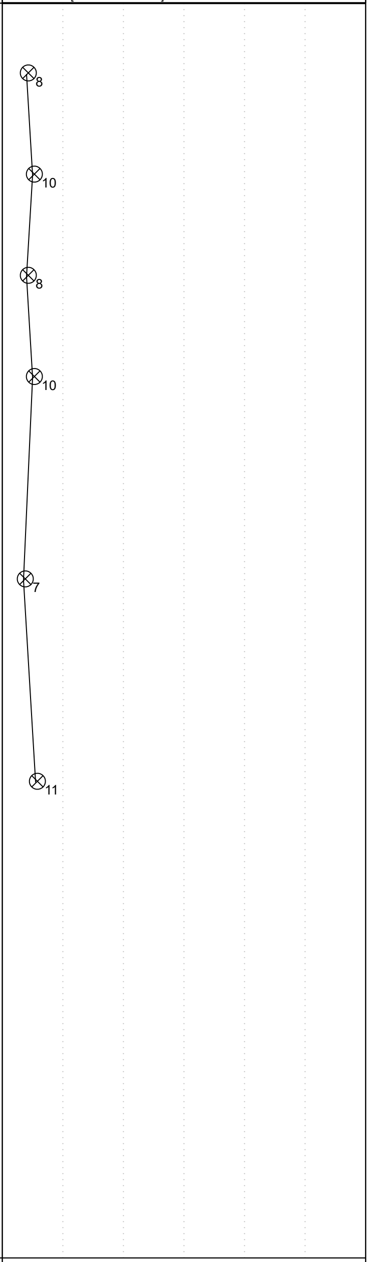
BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
420419.4	**946672.9**		**321**

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace gravel, light brown, moist, agriculturally disturbed			
	S-1	SS	18	12	(CL) LEAN CLAY, light brown, moist, stiff			1-3-5 (8)
	S-2	SS	18	10				2-4-6 (10)
5							316	
	S-3	SS	18	10				3-3-5 (8)
	S-4	SS	18	6				6-6-4 (10)
10							311	
	S-5	SS	18	8				2-3-4 (7)
15							306	
	S-6	SS	18	8				3-4-7 (11)
20					**END OF BORING AT 20 FT**		301	
25							296	
30							291	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**

BORING COMPLETED: **Feb 14 2022**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

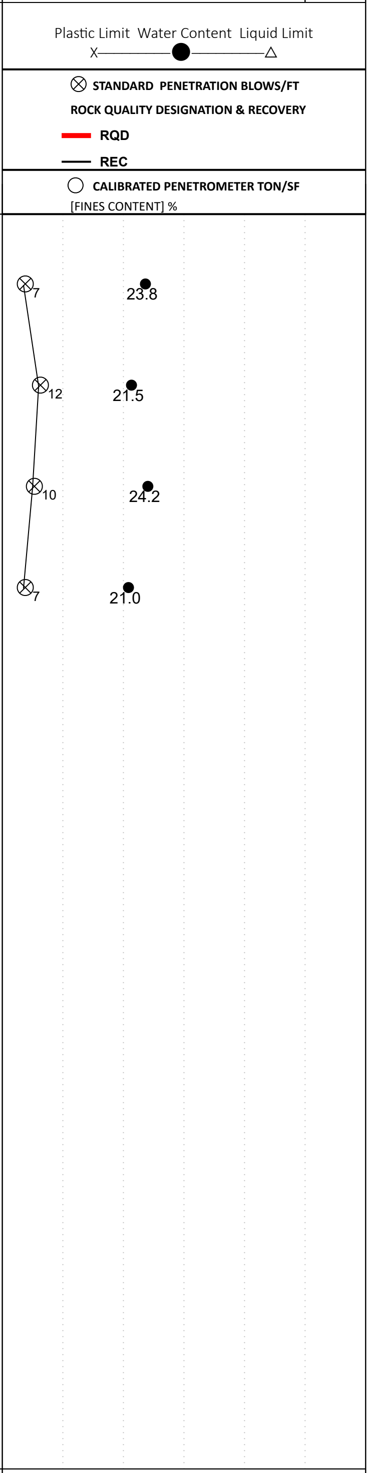
DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**
PROJECT NO.: **26:5272**
BORING NO.: **B-13**
SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**
DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**
NORTHING: **420622.7**
EASTING: **946483.6**
STATION:
SURFACE ELEVATION: **318**

LOSS OF CIRCULATION
BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace gravel, light brown, moist, agriculturally disturbed			
	S-1	SS	18	10	(CL) LEAN CLAY, trace sand, brown, moist, firm to stiff			2-3-4 (7)
	S-2	SS	18	14				2-5-7 (12)
5							313	
	S-3	SS	18	12				3-4-6 (10)
	S-4	SS	18	18				3-2-5 (7)
10					**END OF BORING AT 10 FT**		308	
15							303	
20							298	
25							293	
30							288	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)
▼ WL (Completion) **Dry**
▼ WL (Seasonal High Water)
▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**
BORING COMPLETED: **Feb 14 2022**
EQUIPMENT: **ATV**
LOGGED BY:
CAVE IN DEPTH:
HAMMER TYPE: **Auto**
DRILLING METHOD: **HSA/SPT**

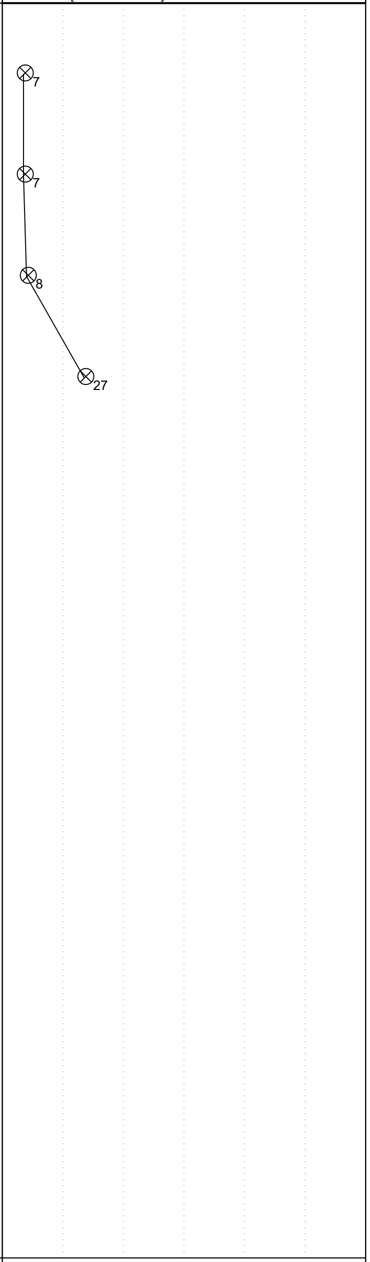
GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**	PROJECT NO.: **26:5272**	BORING NO.: **B-14**	SHEET: **1 of 1**	
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**	DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**			
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**				LOSS OF CIRCULATION
NORTHING: **420497.9**	EASTING: **946482.5**	STATION:	SURFACE ELEVATION: **320**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ STANDARD PENETRATION BLOWS/FT
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC
○ CALIBRATED PENETROMETER TON/SF
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	14	(CL) LEAN CLAY, trace sand, grayish brown, moist, agriculturally disturbed			2-3-4 (7)
	S-2	SS	18	12	(CL) LEAN CLAY, trace sand, brown, moist, firm to very stiff			2-3-4 (7)
5							315	
	S-3	SS	18	10				2-4-4 (8)
	S-4	SS	18	18				3-9-18 (27)
10					**END OF BORING AT 10 FT**		310	
15							305	
20							300	
25							295	
30							290	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Feb 14 2022**	CAVE IN DEPTH:
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Feb 14 2022**	HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **ATV** / LOGGED BY:	DRILLING METHOD: **HSA/SPT**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**

PROJECT NO.: **26:5272**

BORING NO.: **B-15**

SHEET: **1 of 1**

PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**

DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**

SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**

NORTHING: **420285.8**

EASTING: **946483.7**

STATION:

SURFACE ELEVATION: **321**

LOSS OF CIRCULATION

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

X——●——△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

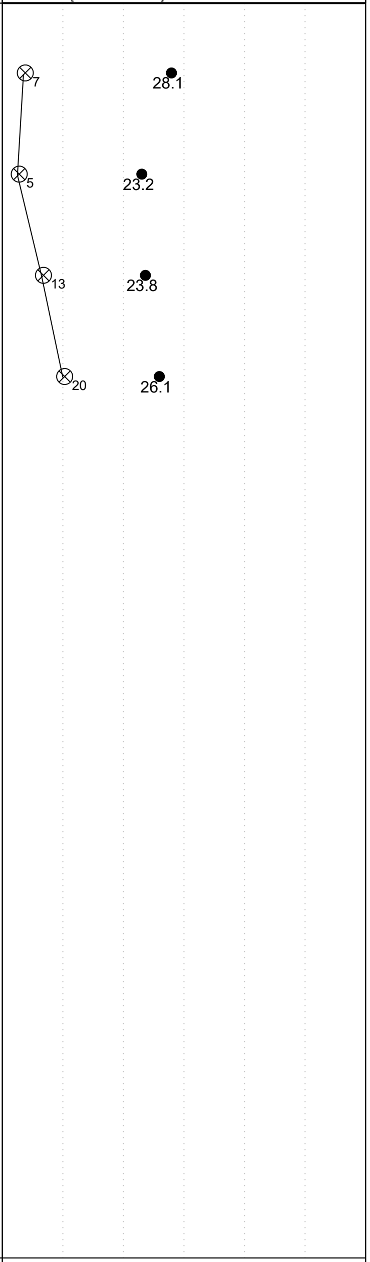
RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace gravel, light brown, moist, agriculturally disturbed			
	S-1	SS	18	10				2-3-4 (7)
					(CL) LEAN CLAY, trace sand, brown, moist, firm to very stiff			
5	S-2	SS	18	18			316	3-3-2 (5)
	S-3	SS	18	12				2-5-8 (13)
10	S-4	SS	18	10			311	4-8-12 (20)
					END OF BORING AT 10 FT			
15							306	
20							301	
25							296	
30							291	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**

BORING COMPLETED: **Feb 14 2022**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**	PROJECT NO.: **26:5272**	BORING NO.: **B-16**	SHEET: **1 of 1**	
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**	DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**			
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**			LOSS OF CIRCULATION	⟩100%⟩
NORTHING: **420281.3**	EASTING: **946633.4**	STATION:	SURFACE ELEVATION: **318**	BOTTOM OF CASING ➤

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

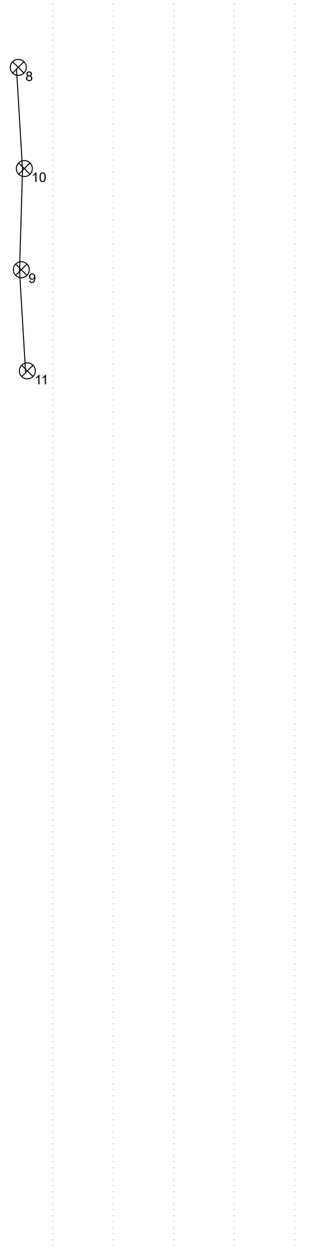
▬ RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace sand, trace gravel, trace organics, brown, moist, agriculturally disturbed			
	S-1	SS	18	12				2-3-5 (8)
					(CL) LEAN CLAY, trace sand, brown, moist, stiff			
	S-2	SS	18	10				2-3-7 (10)
5							313	
	S-3	SS	18	10				4-3-6 (9)
	S-4	SS	18	12				4-3-8 (11)
10					**END OF BORING AT 10 FT**		308	
15							303	
20							298	
25							293	
30							288	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Feb 14 2022**	CAVE IN DEPTH:
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Feb 14 2022**	HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV**	LOGGED BY:
▽ WL (Stabilized)			DRILLING METHOD: **HSA/SPT**

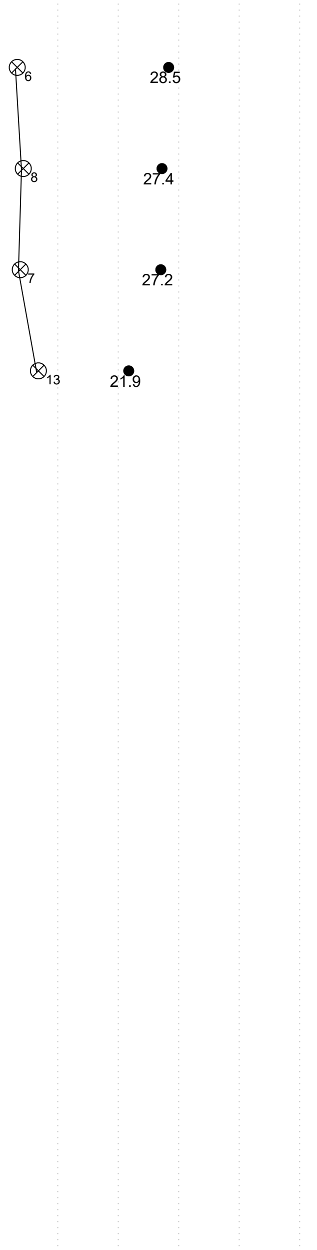
GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**
PROJECT NO.: **26:5272**
BORING NO.: **B-17**
SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**
DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**
NORTHING: **420375.6**
EASTING: **946695.8**
STATION:
SURFACE ELEVATION: **317**

LOSS OF CIRCULATION ⟩100%⟩
BOTTOM OF CASING ■

Plastic Limit Water Content Liquid Limit
X——●——△
⊗ **STANDARD PENETRATION BLOWS/FT**
ROCK QUALITY DESIGNATION & RECOVERY
🟥 **RQD**
— **REC**
○ **CALIBRATED PENETROMETER TON/SF**
[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace sand, brown, agriculturally disturbed			
	S-1	SS	18	10				1-2-4 (6)
					(CL) LEAN CLAY, trace sand, grayish brown, moist, firm to stiff			
	S-2	SS	18	12				2-3-5 (8)
5							312	
	S-3	SS	18	7				2-3-4 (7)
	S-4	SS	18	18				5-6-7 (13)
10					**END OF BORING AT 10 FT**		307	
15							302	
20							297	
25							292	
30							287	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)
▼ WL (Completion) **Dry**
▼ WL (Seasonal High Water)
▽ WL (Stabilized)

BORING STARTED: **Feb 14 2022**
BORING COMPLETED: **Feb 14 2022**
EQUIPMENT: **ATV**
LOGGED BY:
CAVE IN DEPTH:
HAMMER TYPE: **Auto**
DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**	PROJECT NO.: **26:5272**	BORING NO.: **B-18**	SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**	DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**		
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**			

NORTHING: **420507.2**	EASTING: **946736.7**	STATION:	SURFACE ELEVATION: **318**

LOSS OF CIRCULATION	100%
BOTTOM OF CASING	➤

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

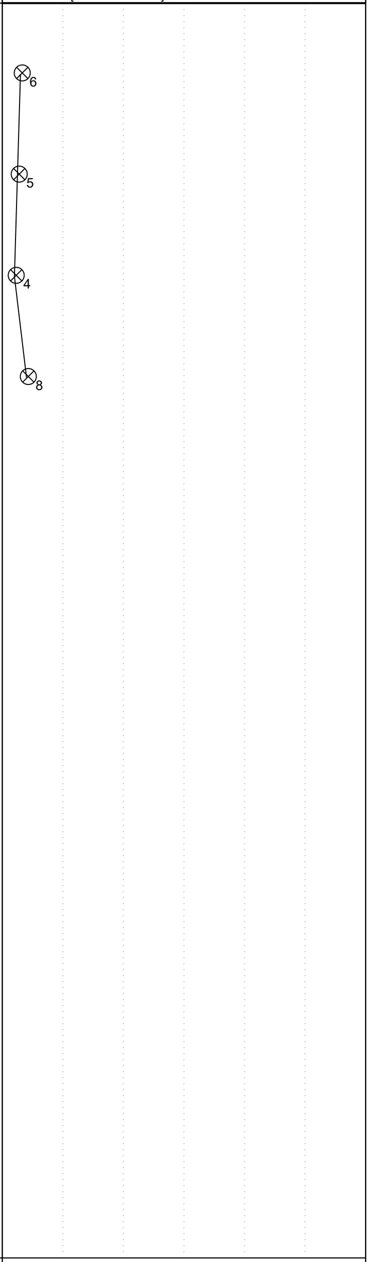
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace sand, brown, moist, firm			
	S-1	SS	18	10				2-3-3 (6)
	S-2	SS	18	18				3-2-3 (5)
5							313	
	S-3	SS	18	8				2-2-2 (4)
	S-4	SS	18	16				4-3-5 (8)
10					**END OF BORING AT 10 FT**		308	
15							303	
20							298	
25							293	
30							288	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Feb 14 2022**	CAVE IN DEPTH:
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Feb 14 2022**	HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **ATV** / LOGGED BY:	DRILLING METHOD: **HSA/SPT**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**

PROJECT NO.: **26:5272**

BORING NO.: **B-19**

SHEET: **1 of 1**

PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**

DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**

SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**

NORTHING: **420611.8**

EASTING: **946942.5**

STATION:

SURFACE ELEVATION: **315**

LOSS OF CIRCULATION

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ **STANDARD PENETRATION BLOWS/FT**

ROCK QUALITY DESIGNATION & RECOVERY

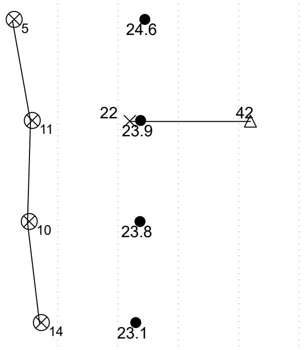
RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(CL) LEAN CLAY, trace sand, brown, moist, agriculturally disturbed			1-2-3 (5)
	S-2	SS	18	10	(CL) LEAN CLAY, trace sand, brown, moist, stiff			4-5-6 (11)
5							310	
	S-3	SS	18	14				4-4-6 (10)
	S-4	SS	18	16				5-6-8 (14)
10					**END OF BORING AT 10 FT**		305	
15							300	
20							295	
25							290	
30							285	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)

WL (Completion) **Dry**

WL (Seasonal High Water)

WL (Stabilized)

BORING STARTED: **Feb 14 2022**

BORING COMPLETED: **Feb 14 2022**

EQUIPMENT: **ATV**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **SSOE Group**	PROJECT NO.: **26:5272**	BORING NO.: **B-20**	SHEET: **1 of 1**
PROJECT NAME: **MRM - Stanton TN Geotechnical Exploration**	DRILLER/CONTRACTOR: **Tri-State Drilling, LLC**		
SITE LOCATION: **Keeling Road, Stanton, Tennessee 38069**			
NORTHING: **420489.0**	EASTING: **946932.8**	STATION:	SURFACE ELEVATION: **315**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

Plastic Limit X Water Content ● Liquid Limit △

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

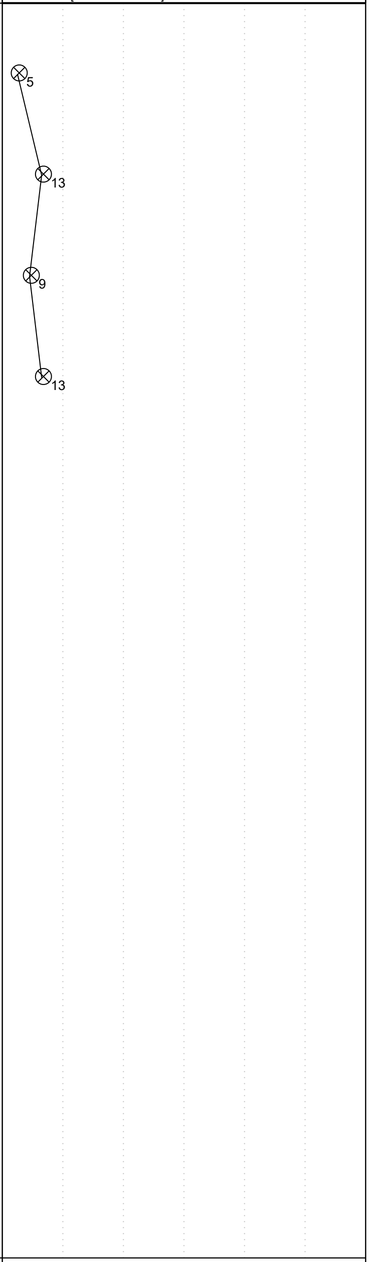
🟥 RQD

— REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					(CL) LEAN CLAY, trace gravel, light brown, moist, agriculturally disturbed			
	S-1	SS	18	10	(CL) LEAN CLAY, trace sand, brown, moist, stiff			2-2-3 (5)
	S-2	SS	18	16				5-6-7 (13)
5							310	
	S-3	SS	18	11				4-4-5 (9)
	S-4	SS	18	13				3-6-7 (13)
10					**END OF BORING AT 10 FT**		305	
15							300	
20							295	
25							290	
30							285	

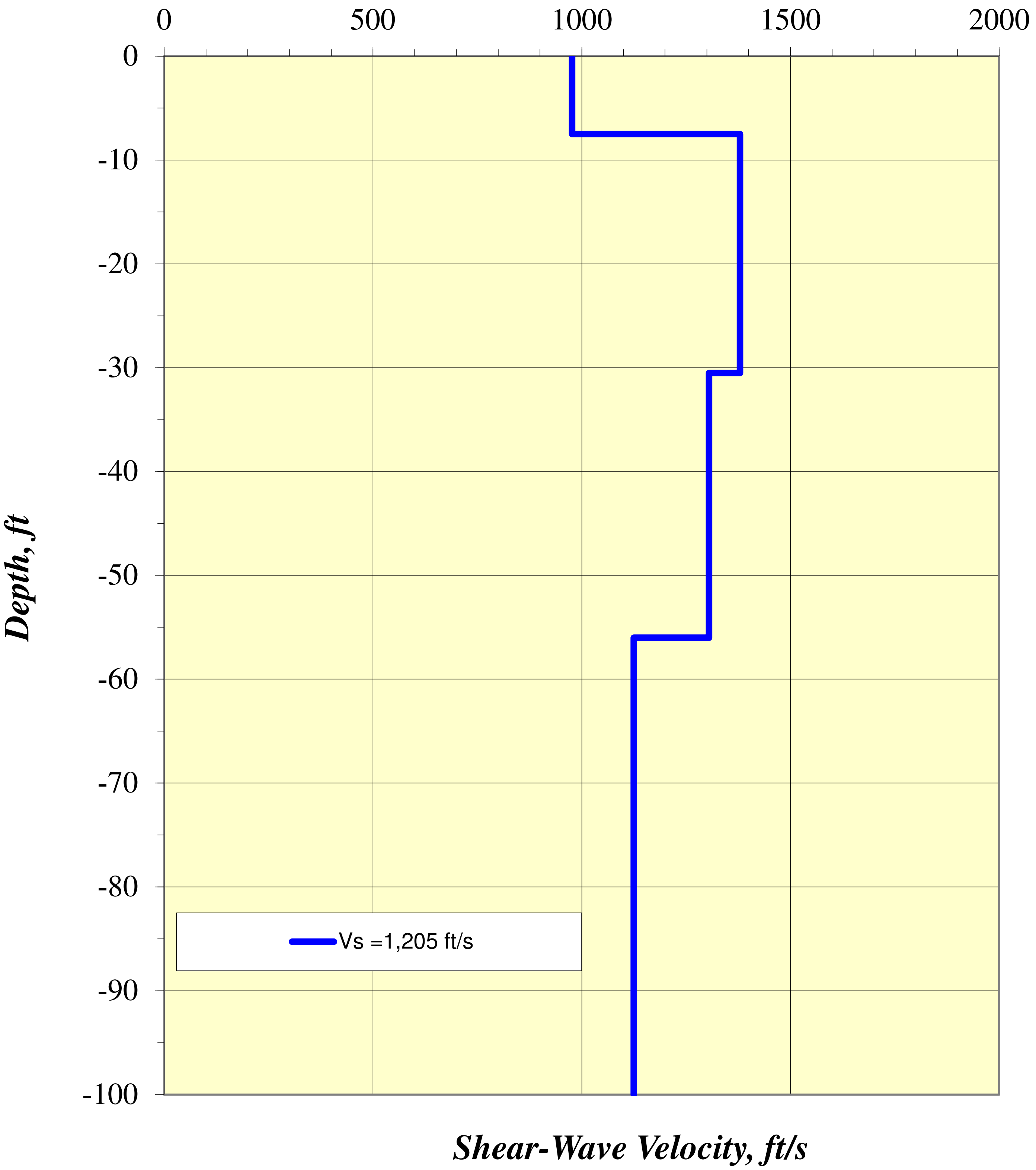


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 14 2022**	CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 14 2022**	HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY:
▽ WL (Stabilized)		DRILLING METHOD: **HSA/SPT**

GEOTECHNICAL BOREHOLE LOG

Shear-Wave Velocity ReMi Plot (Line

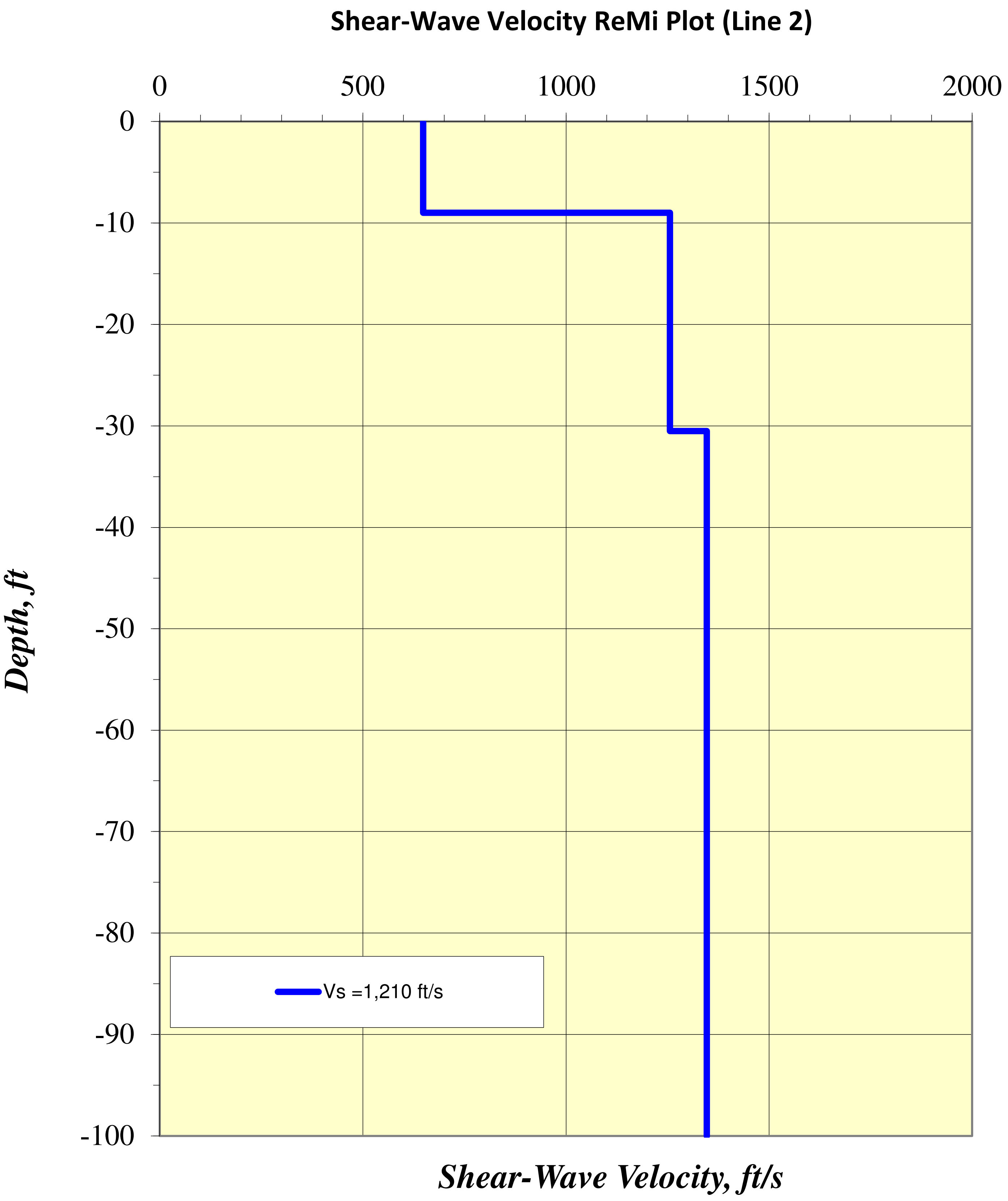


MRM WTP

Keeling Road
Stanton, Tennessee
ECS Project No. 26:5272

ECS

Shear-Wave Velocity Plot
Line 1



MRM WTP

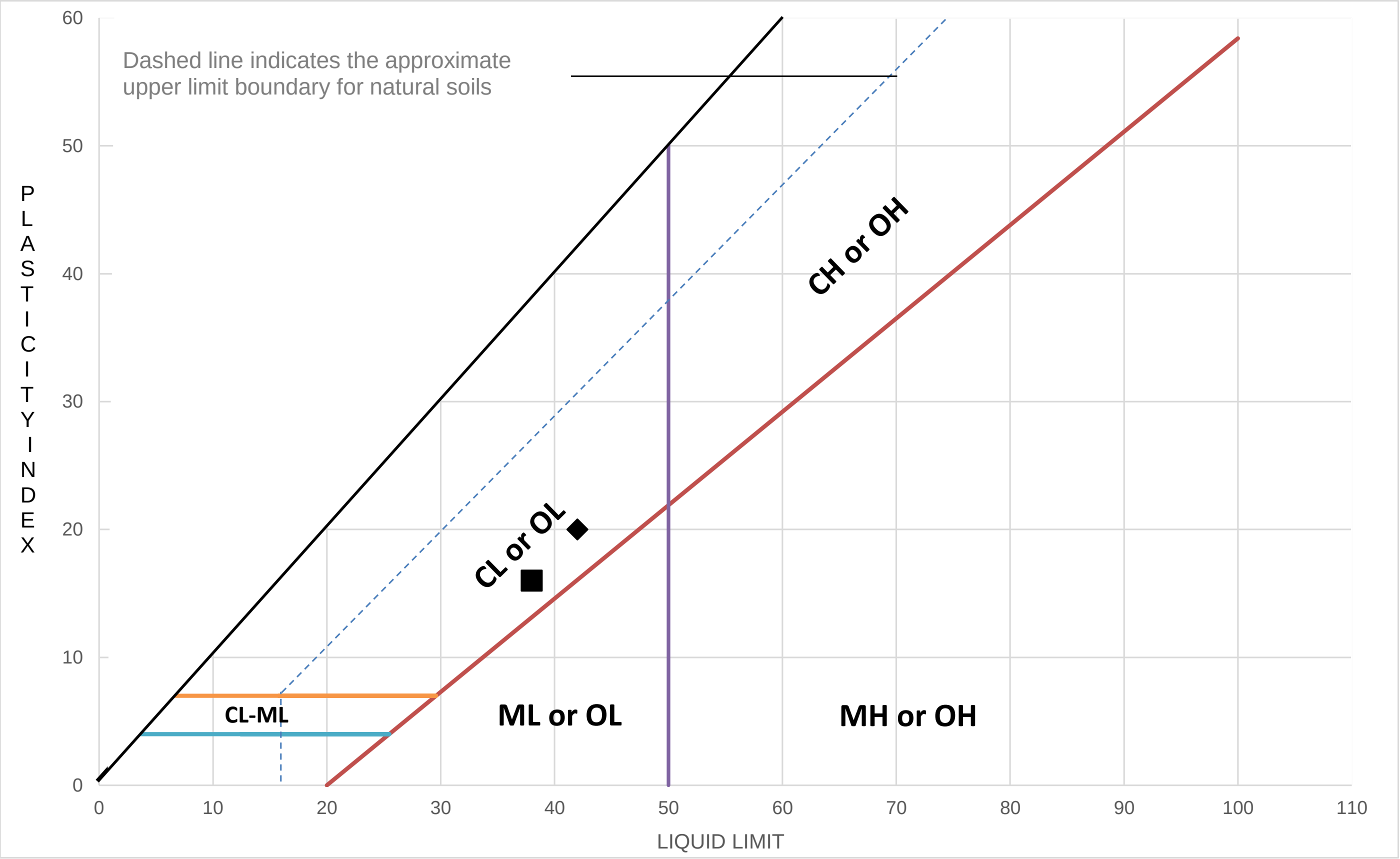
Keeling Road
Stanton, Tennessee
ECS Project No. 26:5272

Shear-Wave Velocity Plot
Line 2

APPENDIX C – Laboratory Testing

Liquid and Plastic Limits Test Report
Laboratory Test Results Summary

LIQUID AND PLASTIC LIMITS TEST REPORT



TEST RESULTS (ASTM D4318-10 (MULTIPOINT TEST))

	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-01	S-3	6-7.5	38	22	16					(CL) Lean Clay, Light Brown
◆	B-19	S-2	3.5-5	42	22	20					(CL) Lean Clay, Light Brown

Project: MRM - Stanton TN Geotechnical Exploration
Client: SSOE Group

Project No.: 26:5272
Date Reported: 3/21/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Nashville	318 Seaboard Lane Suite 208 Franklin, TN 37067	(615)885-4983 (615)771-4134

Tested by	Checked by	Approved by	Date Received
mbeguiristain	rbanner	rbanner	3/10/2022

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-01	S-1	1-2.5	22.6										
B-01	S-2	3.5-5	20.8										
B-01	S-3	6-7.5	20.2		38	22	16						
B-01	S-4	8.5-10	20.3										
B-01	S-5	13.5-15	19.6										
B-01	S-6	18.5-20	14.4										
B-01	S-7	23.5-25	17.6										
B-02	S-1	1-2.5	29.7										
B-02	S-2	3.5-5	24.8										
B-02	S-3	6-7.5	23.2										

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

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Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-02	S-4	8.5-10	21.8										
B-02	S-5	13.5-15	22.6										
B-02	S-6	18.5-20	16.1										
B-02	S-7	23.5-25	17.9										
B-05	S-1	1-2.5	27.3										
B-05	S-2	3.5-5	23.1										
B-05	S-3	6-7.5	23.7										
B-05	S-4	8.5-10	22.6										
B-05	S-5	13.5-15	18.1										
B-05	S-6	18.5-20	19.8										

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

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					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-05	S-7	23.5-25	18.2										
B-08	S-1	1-2.5	27.0										
B-08	S-2	3.5-5	24.1										
B-08	S-3	6-7.5	24.7										
B-08	S-4	8.5-10	21.5										
B-08	S-5	13.5-15	19.4										
B-08	S-6	18.5-20	17.1										
B-09	S-1	1-2.5	27.2										
B-09	S-2	3.5-5	28.2										
B-09	S-3	6-7.5	24.8										

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

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					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-09	S-4	8.5-10	24.9										
B-09	S-5	13.5-15	16.2										
B-09	S-6	18.5-20	18.3										
B-10	S-1	1-2.5	23.9										
B-10	S-2	3.5-5	24.4										
B-10	S-3	6-7.5	15.9										
B-10	S-4	8.5-10	24.0										
B-10	S-5	13.5-15	24.8										
B-10	S-6	18.5-20	14.5										
B-13	S-1	1-2.5	23.8										

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					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-13	S-2	3.5-5	21.5										
B-13	S-3	6-7.5	24.2										
B-13	S-4	8.5-10	21.0										
B-15	S-1	1-2.5	28.1										
B-15	S-2	3.5-5	23.2										
B-15	S-3	6-7.5	23.8										
B-15	S-4	8.5-10	26.1										
B-17	S-1	1-2.5	28.5										
B-17	S-2	3.5-5	27.4										
B-17	S-3	6-7.5	27.2										

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					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-17	S-4	8.5-10	21.9										
B-19	S-1	1-2.5	24.6										
B-19	S-2	3.5-5	23.9		42	22	20						
B-19	S-3	6-7.5	23.8										
B-19	S-4	8.5-10	23.1										

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

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mbeguiristain	rbanner	rbanner	3/10/2022

APPENDIX D – Supplemental Report Documents and Calculations

Important Information

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org   www.geoprofessional.org

APPENDIX E

Report of Geotechnical Exploration
Blue Oval City - North Water Tower
Stanton-Sommerville Road
Stanton, Tennessee
S&ME Project No. 21470016

PREPARED FOR:

SSOE Group
320 Seven Spring Way, Suite 350
Brentwood, Tennessee 37027

PREPARED BY:

S&ME, Inc.
658 Grassmere Park Drive, Suite 100
Nashville, Tennessee 37211

February 2, 2022

February 2, 2022

SSOE Group
320 Seven Spring Way, Suite 350
Brentwood, Tennessee 37027

Attention: Mr. Dwain Hibdon

Reference: **Report of Geotechnical Exploration**
Blue Oval City - North Water Tower
Stanton-Sommerville Road, Stanton, Tennessee
S&ME Project No. 21470016

Dear Mr. Hibdon:

S&ME, Inc. (S&ME) is pleased to submit the following *Report of Geotechnical Exploration* performed for the planned North Water Tower for the Blue Oval City project located south of Stanton-Summerville Road in Stanton, Tennessee. Our services were provided in general accordance with our Proposal No. 21470016 Revision 1 dated December 16, 2021, as authorized by Mr. Mr. Dwain Hibdon of SSOE by PO number 22010348 on December 22, 2021.

This report describes our understanding of the project and the subsurface conditions encountered and presents our preliminary conclusions and recommendations for site preparation, foundation, and pavement support. We appreciate the opportunity to serve as the geotechnical engineering consultant during this phase of the project. Please contact us with questions regarding this report, or if we may be of further assistance.

Sincerely,

S&ME, Inc.

JEFFREY A. DOUBRAVA
No. 114351

Simone Metzger, P.E.
Project Engineer / Manager
TN Reg. No. 116603
smetzger@smeinc.com

Jeffrey A. Doubrava, P.E.
Vice President / Principal Engineer
TN Reg. No. 114351
jdoubrava@smeinc.com

Table of Contents

List of Tables

Appendix

Report at a Glance

Key geotechnical findings based on our current understanding of the proposed project are presented below. These findings are presented as an overview and should not be used in place of the more detailed recommendations presented in the remainder of this report.

Category	Key Geotechnical Finding
Site Development Challenges	The subsurface conditions encountered during this exploration are generally consistent with other sites in the area and amenable to the proposed development. Specific geotechnical issues identified on this site that should be considered include: • Deep foundations will be required to support the planned structure. • Moisture conditioning for proper compaction of soils during site preparation.
Subsurface Conditions	Generally, much of the site is comprised of about ½ to 3 feet of cultivated materials underlain by loess materials derived from wind deposits and marine sediments. The materials were predominately firm to stiff silts and clays with varying amounts of sand and medium dense to very dense sands with varying amounts of silt. Transitions between strata were noted to be less clayey and more sandy with depth. Groundwater was interpreted to be approximately 42 to 59 feet below existing grade.
Seismic Design	Seismic Site Class D
Foundation Type	Deep foundations (auger cast piles).
Use of Site Soil as Fill	Site soils are suitable for use as structural fill.
Excavation Conditions	Conventional earthmoving equipment should be able to excavate to the anticipated depths.
Construction Dewatering	Construction dewatering is not anticipated, but may be required for local perched water and surface water infiltration following inclement weather.
Remedial Grading	Clayey site soils are highly susceptible to loss of strength at elevated moisture contents. If site soils increase in moisture content during construction, remedial grading may be required.
Schedule/Cost Considerations	• Deep Foundations will be required to support the planned structure. • *Soil Moisture Content* – Depending upon weather conditions preceding grading, drying of subgrade soils may be required to achieve a compactable soil moisture content. Late fall and winter weather conditions are typically not conducive to drying soils and the risk of schedule delays and additional costs will be increased for construction during these times.

1.0 Introduction

1.1 Purpose

The purpose of our work was to explore the subsurface soil conditions at the site, evaluate those conditions, and provide recommendations for site preparation, foundation, and pavement support. This preliminary report provides the following:

- A summary of the project and provided information.
- A summary of current site conditions, topography, and area geology.
- A summary of the field exploration methods.
- A summary of the subsurface conditions encountered in the soundings and test borings.
- A summary of the laboratory test methods and results.
- Site Assessment and Conclusions.
- Recommendations for site preparation, including subgrade preparation, excavation, structural fill placement, and groundwater control.
- Recommendations for deep foundation design parameters; including recommended pile or pier type(s), estimated pile/pier lengths, pile driving criteria, pile/pier testing criteria, and estimated axial and uplift capacities, as well as estimates of lateral deflection versus a range of applied lateral loads for single piles under both free head and fixed head conditions. An estimate of the static settlement magnitude for single piles/piers under the applied loads would also be provided. Unknown groups of piles or piers will not be considered.
- Recommended seismic site classification in accordance with the 2018 International Building Code (IBC).
- Site-specific Seismic Response Analysis (SSRA).
- An Appendix with Site Location Plan, Test Location Plan, individual boring logs for each test boring, Shear Wave Velocity Profile, SSRA plots, and individual laboratory test reports.

1.2 Project Information

Initial project information was provided through November 2021 through January 2022 telephone conversations and e-mails between Mr. Hibdon, P.E. of SSOE and Mr. Jeff Doubrava, P.E. of S&ME and Mr. David Flynn, P.E. of SSOE and Ms. Simone Metzger P.E of S&ME. Appended to the emails were the following documents:

- *CBI Suggested Soil Investigation for Elevated Tanks - 2016*
- Screen shots showing the location of planned construction
- *Memphis Reginal Megasite – North Water Tower, Preliminary* dated 12/29/2021

Based on the provided information, we understand a new 44-foot diameter elevated water tank is planned for the north side of the Blue Oval City site in Stanton, Tennessee. The water tower will be located about 300 feet south of Stanton-Summerville Road, approximately 1,500 feet west of its intersection with State Route 222. A grading plan and loads have not been provided at this time. We assume a maximum of 5 feet cut and fill across the tank footprint. The provided survey information shows approximately 10 feet of relief across the fenced in area for the tower and 4 feet of relief across the tower footprint, sloping downward to the south. We assume this water tower will have a 1-million gallon capacity.

We have been requested to perform a geotechnical exploration for the subject project using 4 test borings as requested in the CB&I document. The project information and assumptions detailed above should be reviewed and confirmed by the appropriate team members. Modifications to our proposed scope of services may be required if the actual conditions vary from the project information and assumptions described herein.

1.3 Scope of Study and Report Format

This geotechnical exploration included a site reconnaissance, field and laboratory testing, and engineering analysis. The following sections of this report present discussions of the field exploration, site conditions, laboratory test results, and conclusions and recommendations. Following the text of this report, figures, and sounding and boring logs are provided in the Appendix.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, or subsurface water. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

2.0 Field Exploration

2.1 General

Our field exploration was conducted between January 5 and 28, 2022 and included a site reconnaissance by members of our engineering staff, four test borings, and MASW and MAM shear wave velocity tests. The borings were performed to obtain samples for classification purposes to help assess liquefaction potential. Test Location Plans show the approximate sounding, boring, and resistivity testing locations and are provided in the Appendix.

The test locations were located and marked in the field by members of our engineering staff utilizing a commercial-grade, hand-held global positioning system (GPS) unit loaded with pre-established locations. Ground surface elevations for the test locations were estimated by interpolating between contours on the provided topographic survey. Based on the methods used to establish the locations and elevations of the tests, this information should be considered approximate. If more specific information is required, we recommend a licensed surveyor be engaged to obtain this information.

2.2 Test Borings

The test borings were advanced by mechanically twisting 3 ¼-inch diameter hollow stem augers (HSA) into the ground with a tracked rig in general accordance with ASTM D6151, the *Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling*. Soil samples were obtained with a standard 1.4-inch inside diameter (ID), 2-inch outside diameter (OD) split-spoon sampler at selected intervals in general accordance with ASTM D1586, the *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of* Soils. The sampler was first seated 6 inches and then driven an additional foot with blows of the 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and is designated the “standard penetration resistance” (N-value) with units of blows per foot (bpf). The N-value provides a general indication of in-situ soil conditions and has been correlated with certain engineering properties of soils. An automatic trip drop hammer was used for the standard penetration resistance testing. The automatic hammer generally has a higher efficiency than a manual hammer, and may yield lower N values. The N values reported on our boring logs are the field values without any adjustments or "corrections".

The soil samples obtained during our field activities were visually classified by members of our engineering staff in general accordance with ASTM D2488, the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. Soil consistencies provided on the boring logs are based on correlations with N-values and visual/manual procedures.

Subsurface water level readings were taken in selected borings during drilling and upon completion of the soil drilling process. Upon completion of drilling and sampling, each borehole was backfilled with soil cuttings and a borehole closure device. Delayed subsurface water level measurements were obtained where we could safely leave borings open overnight. Upon completion of drilling or delayed water readings, each borehole was backfilled with soil cuttings and a borehole closure device.

3.0 Laboratory Testing

Six representative soil samples were obtained and subjected to laboratory index testing consisting of natural moisture content (ASTM D2216), percent pass the No. 200 sieve (fines content) (ASTM D1140), and Atterberg limits testing (ASTM D4318). The intent of the laboratory testing was to help characterize a soil profile and evaluate material for liquefaction potential. The resulting soil descriptions from the index testing are shown on the Test Boring Records in the Appendix.

4.0 Geology

4.1 Cultivated Materials

Cultivated materials are derived from farming or forestry activities where the upper few feet are plowed, harrowed, or turned over seasonally for planting. Cultivated materials are generally similar in composition to the residual materials beneath them, with the exception they typically contain more silt or sand and may contain significant organic content. They are typically moisture sensitive and can be difficult to properly compact during grading operations. The engineering properties of cultivated materials are usually poor and can vary significantly depending on their depth, organic content, and moisture content.

4.2 Loess Deposits

The *USGS Geologic Map of Tennessee – West Sheet*, dated 1966 indicates this site is underlain by Pleistocene aged Loess deposits. Loess deposits are predominantly clayey and sandy silts, gray to brown. These deposits have maximum thicknesses of about 100 feet along bluffs of the Mississippi River but thin out eastward. The engineering properties of Loess materials can change rapidly in short horizontal and vertical distances.

4.3 Marine Sediments

Below the aforementioned Loess deposits, marine sediments are present. The marine sediments are generally comprised of clays and silts with interbedded sand layers that can be several hundred feet deep and generally increase in depth toward western Tennessee.

5.0 Subsurface Conditions

The subsurface descriptions below are of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the Appendix should be reviewed for specific information at individual test locations. The depth and thickness of the subsurface strata indicated on the sounding and boring logs were generalized from and interpolated between boring locations. The transition between materials may be more gradual than indicated on the logs. Variations may occur and should be expected between sounding and boring locations. The stratification lines were used for our analytical purposes and, unless specifically stated otherwise, should not be used as the basis for design or construction cost estimates.

5.1 Subsurface Conditions

5.1.1 Surface Cover

The test borings encountered 3 to 6 inches of topsoil.

5.1.2 Cultivated Soil

Beneath the topsoil, the test borings typically encountered 1 ½ to 3 feet of cultivated soil visually classified as lean clays with various amounts of silt and sand. N-values in these materials ranged from 4 to 11 bpf indicating soft to stiff consistencies. More generally, the cultivated soils were firm to stiff.

5.1.3 Loess

Beneath the cultivated soil, the borings encountered Loess materials to depths of about 10 to 18 feet below the existing ground surface. The Loess generally consisted by silty and sandy lean clays. N-values in these materials ranged from 6 to 11 bpf indicating firm to stiff consistencies.

5.1.4 Marine Sediments

Marine soils were encountered below the loess to termination depths. Marine sediments consisted of lean clays and silts with varying amounts of sand transitioning to silty sands, poorly graded sands, and poorly graded sands with silt. N-values in the clay and silt materials ranged from 3 to 38 bpf indicating soft to hard consistencies. More generally, the marine sediments were firm to stiff. N-values in the sand materials ranged from 7 bpf to 50 blows per 5 inches indicating loose to very dense relative densities. More generally, the marine sediments were medium dense to very dense.

5.1.5 *Groundwater*

Ground water was interpreted to be at depths ranging from 42 to 59 feet below the existing ground surface at the time of drilling.

5.2 Laboratory Test Results

The moisture contents of selected split-spoon samples ranged from approximately 19.2 to 37.1 percent. A summary of the index testing is show in the table below.

Table 5-1 - Laboratory Test Summary

Boring	Sample Depth (ft)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Finer than #200 Sieve (%)	Classification
B-02	8.5 – 10	24.4	29	20	9	-	Lean Clay (CL)
B-02	48.5 – 50	28.2	34	26	8	-	Silt (ML)
B-02	68.5 – 70	23.4	-	-	-	68.3	Sandy Silt (ML)
B-02	78.5 – 80	19.7	-	-	-	11.6	Poorly Graded Sand with Silt (SP-SM)

Classifications are based on a combination of visual manual tests and laboratory testing. Laboratory test results are contained in our Appendix.

6.0 Geophysical Services

6.1 Methodology, Field Services, and Data Processing

We completed a surface wave seismic survey to help recommend a Seismic Site Class for the subject site. The Seismic Site Class is based on the average shear wave velocity (Vs) to a depth of 100 feet (Vs100) and analysis of surface waves (Rayleigh waves) can be used to determine shear wave velocities.

Surface waves generated from either an active or passive energy source (e.g., sledgehammer striking a metal plate or background noise, respectively) are recorded at the ground surface along a spread of low-frequency sensors (i.e., geophones). Active sources typically provide relatively higher frequencies (i.e., better resolution at shallower depths) while passive sources generally provide relatively lower frequencies (e.g., greater depth at lower resolution). Seismic measurements are transformed from time domain into frequency domain from which the phase characteristics of the surface waves can be calculated. A dispersion curve (i.e., phase velocity curve vs frequency) is developed and then transformed into a one-dimensional (1D) shear wave velocity profile through an inversion and iterative process in which Vs100 is calculated.

- We used a combination of the active Multi-Channel Analysis of Surface Waves (MASW) and passive Microtremor Array Measurements (MAM) methods.

- The MASW was conducted using a Geometrics seismograph equipped with twenty-four (24) 4.5 Hz vertical geophones at set spacings of 5 feet along linear arrays and a 16-lb sledgehammer as the energy source.
- The MAM survey was conducted using a Geometrics seismograph equipped with eleven (11) 4.5 Hz vertical geophones at a set spacing of 30 feet along an L-shaped array using background noise as the energy source.
- Data analysis was conducted using the Geogiga Technology Corp. Seismic Pro^{TM} software (SURFACE PLUS module).

Approximate locations were located near the boring locations and are shown on the Test Location Plan in the Appendix. Field data sheets are included in the Appendix as well.

6.2 Seismic Results

The following summarizes the results of the geophysical services:

- Based on Sections 20 and Equation 20.4.1 of ASCE 7-16, the calculated weighted average Vs100 value is 996 feet per second (ft/s).
- A shear wave velocity profile is presented in the attachments.

6.3 Geophysical Limitations

Regardless of the thoroughness of a geophysical survey, there is always a possibility that actual conditions may not match the interpretations. The results should be considered accurate only to the degree implied by the methods used and the method's limitations and data coverage. Accordingly, the possibility exists that not all features at a project site will be located due to either subsurface soil conditions or the occurrence of features outside the lateral limits and below the depth of penetration of the methods used. The geophysical methods used for this survey also have inherent limitations. Site activity (e.g., heavy vehicle traffic, etc.) can cause noise/interference in the data sets. Depth restrictions are also associated with the MASW/MAM methods and associated energy source.

7.0 Conclusions and Recommendations

The conclusions and recommendations presented in this report are based on the preceding project information, and the results of this exploration. Actual subsurface conditions may vary between the boring locations. If it becomes apparent during construction that encountered conditions vary substantially from those presented herein, this office should be notified at once. At that time, the conditions can be evaluated and the recommendations of this report modified, in written form, if necessary. Also, if the scope of the project should change significantly from that described herein, we should be notified and these recommendations should be re-evaluated.

7.1 Site Assessment

Based on the subsurface data collected during this geotechnical exploration and our experience with similar projects, it is our professional opinion that the site is adaptable for the proposed construction. However, the following items will likely affect construction costs and schedule:

- Deep foundations will be required to support the new structure. Similar to the foundation construction on the south water tower, auger cast piles are recommended.

- As noted above, up to 5 feet of new fill may be required to establish final site grades. We recommend new fill be placed prior to the installation of the deep foundation system to help reduce the potential of negative skin friction on the piles (down drag). Based on the subsurface information we anticipate the settlements induced by the weight of the new fill will be relatively elastic and should primarily occur during the fill placement.

- The near-surface conditions following the stripping of surface materials could potentially impact the development budget and/or schedule. The strength characteristics of fine-grained soils (i.e. silts and clays), especially those with various amounts of organics, are typically sensitive to moisture conditions. A loss of strength will occur in these type soils with an increase in moisture content. If grading is performed during wet, cool periods, significant remedial repair of the near-surface soils may be required prior to fill placement. Experience indicates that the amount of remedial repair is not as extensive if grading occurs during hot, dry periods. However, even if grading occurs during summer months, remedial repair of soft subgrades should be expected.

- The proposed access road from Stanton-Sommerville Road will traverse and existing ditchline. We anticipate some remedial work (undercut and backfill) will be required at this location.

Below are the recommendations for site preparation, structural fill criteria, fill placement guidelines, seismic site class, seismic site-specific response analyses, and foundation construction recommendations.
Based on the subsurface conditions encountered during this exploration, the subject site is adaptable for the planned construction.

7.2 Site Preparation

Initially, surface materials including grass, roots, topsoil, or other organic materials should be stripped to prepare the site for construction. The stripping, clearing, and grubbing should extend at least 10 horizontal feet beyond the construction limits, or as practical. Any materials suitable for reuse as topsoil may be stockpiled and subsequently reused in landscaped areas, if suitable for that purpose. Otherwise, these materials should be wasted from the site.

After initial site preparation is complete, the stability of the exposed subgrade in areas to receive fill and/or at-grade areas should be thoroughly assessed by a member of our engineering staff. This evaluation can consist of, but not be limited to, random probing with a small diameter steel rod, observation of a proofroll, and/or shallow test pits/hand auger borings. A proofroll consists of repeated passes from a loaded tandem-axle dump truck, off-road haul truck, and/or similar piece of heavy, rubber-tired equipment through the subject area.

Firm, loose, or yielding areas should be anticipated. There is typically a stiffer upper crust underlain by firm or loose Loess materials. Depending on final grades and weather conditions, some over-excavation of these materials should be anticipated. We recommend contract documents contain provisions for the compaction, removal, and/or replacement of lower consistency surficial soils should they be encountered. Areas noted to pump, rut, or deflect under the applied loading should generally be undercut to firm, suitable soils and replaced with properly compacted structural fill. Our personnel can assist with recommendations for remedial activities during site grading.

Additionally, alluvial materials encountered in the ditchline near Stanton-Sommerville Road should be evaluated prior to fill placement. It is unlikely these materials will be stable or suitable for re-use as structural fill. Filter fabric and/or new structural fills / stone may be needed to stabilize these areas prior to fill placement under structures.

7.3 Fill Placement and Compaction

7.3.1 Structural Soil Fill

We anticipate fills of less than 5 feet will be required to establish final site grades. This fill should be placed prior to the construction of foundations. Fill operations should not begin until representative soil samples are collected and tested (allow 3 days for sampling and testing). The test results will be used to evaluate whether the proposed fill soils meet appropriate specifications and for quality control during grading.

We recommend structural soil fill be defined as inorganic, natural soil with maximum particle sizes of 4 inches, maximum gravel content of 20 percent, and plasticity index (PI) of less than 30. Structural soil fill should be placed in loose, horizontal lifts not exceeding 8 inches in thickness. Structural fill should have a maximum dry density of at least 90 pcf as determined by the standard Proctor test (ASTM D 698). Each lift should be compacted to at least 95 percent of the maximum dry density as determined by the standard Proctor method. The moisture content should be controlled to within 2 percentage points of optimum moisture content. In addition to meeting the compaction requirement, fill material should be satisfactorily stable under movement of the loaded construction equipment (i.e. a proofroll). Moisture conditioning (drying or wetting) should be expected depending on the weather and temperature during grading activities

It is important that the fill be uniformly well compacted. Accordingly, fill placement should be observed by a qualified field technician working under the direction of our geotechnical engineer. In addition to this visual evaluation, the technician should perform in-place field density tests to confirm whether the contractor's means and methods are capable of achieving the recommended compaction. The frequency of tests should be determined by our geotechnical engineer at the time of construction.

7.4 Site Degradation during Construction

Subgrade surfaces that are stable at the time of grading can become unstable during wet weather and/or as heavy construction equipment traffic moves over the prepared surface. Subgrade damage can be reduced by maintaining positive surface drainage during grading operations and construction to prevent water from ponding on the surface. Additionally, the surface should be rolled smooth to enhance drainage if precipitation is expected. Subgrades damaged by construction equipment should be promptly repaired to avoid further degradation in adjacent areas and to prevent water ponding. Construction traffic should be limited to specific areas during grading to help avoid degrading subgrades throughout the site, particularly after precipitation events. The geotechnical engineer should be contacted to provide recommendations for treatment if the soils become excessively wet or dry, or frozen. Lime modification and soil cementing are two methods to provide some longer term protection of the subgrades during construction.

7.4.1 Lime Modification

Typically, about 5 to 8 percent hydrated lime, by weight or volume, is spread and blended into the soil utilizing a mechanized rotary tiller. The amount of lime may need to be adjusted depending on the plasticity and moisture content of the soils. Depending on the plasticity and moisture content of the soils and the amount of lime added, substantial improvements in reducing the plasticity and moisture content and improving the stability of the materials are typically achieved within 4 to 24 hours. Lime modified soils should have new Proctor tests performed as the maximum dry density and optimum moisture content of the modified materials may change by several pounds or percent, respectively. Timing of the lime modification is critical as inclement weather can negate improvements if the area is not properly sealed or covered following the modification. Following lime modification, compact the soils to 100 percent of its maximum dry density and protect by placing a minimum of 4 inches of dense grade aggregate (DGA) compacted to 100 percent of its maximum dry density as determined by the standard Proctor test.

7.4.2 Soil Cementing

Typically, soil cementing is done by incorporating about 5 to 8 percent cement, by volume or weight, into the upper 12 to 16 inches of the soil subgrade utilizing a mechanized rotary tiller. Typically, the cement hydrates within about 12 to 24 hours creating a stable working platform and helps limit degradation of the surface during construction. Sometimes, higher plasticity or very wet materials may require additional cement. Our field staff can assist with assessing the soil conditions and providing additional guidance. Further, we can provide soil cement mix designs to help optimize the blended mixture for the intended use.

7.5 Foundations

7.5.1 Auger-Cast Piles

We recommend supporting the elevated water tower using a deep foundation system consisting of auger cast-piles. Auger-cast piles are created by advancing augers into the ground and pressure grouting the columns during auger removal. The auger-cast piles will develop their capacity through a combination of end bearing and skin friction. Our estimates of allowable load as a function of tip elevation for several pile diameters are presented in Table 7-1. We have included a factor of safety of 2 for skin friction and 3 for end bearing in our analyses.

Table 7-1 - Allowable Load (Geotechnical) of Auger-Cast Piles

Pile Diameter (inches)	Allowable Axial Compression (kips)	Allowable Uplift (kips)	Estimated Tip Elevation (feet)	
14	160	140	EL.	260
	185	165	EL.	255
	210	190	EL.	250
16	185	155	EL.	260
	215	185	EL.	255
	240	210	EL.	250

Estimates of lateral deflections versus a range of applied lateral loads for single piles under both free head and fixed head conditions are summarized in Table 7-2.

Table 7-2 – Lateral Deflection Estimates

Pile Size	Condition	Head Deflection (inches)	Allowable Shear (kips)
16 inch	Free	0.5	19.9
		1	23.6
	Fixed	0.5	36.7
		1	37.3
18 inch	Free	0.5	24.7
		1	30.1
	Fixed	0.5	46.8
		1	48.8

We recommend a group efficiency of 1 be used for the piles spaced 3 pile diameters or more. The structural capacity of the pile will need to be evaluated. We note that the subsurface conditions include some dense or stiff strata that may be difficult to penetrate with conventional crane-mounted auger cast pile equipment. Larger rigs and/or hydraulic rigs with crowd capability may improve production. Based on the boring data and the provided structural loading information as discussed in the project information section of this report, we estimate total settlements for the auger cast pile group will be less than one inch.

The auger-cast pile contractor should be qualified, experienced and properly equipped to drill piles of the specified diameters into the soil types encountered in the borings and referenced in this report. At the start of pumping grout, the contractor should raise the auger from 6 to 12 inches and, after a grout head of 5 feet is built up on the augers, redrill the auger back to the bottom of the hole and fill the pile hole with grout as the auger is removed, without interruption. During the forming of the pile, the minimum required pump strokes per linear foot of pile, as determined by pump calibration and load test, shall be achieved. Should less than the required pump strokes per foot occur in any 1-foot increment, the auger shall immediately be advanced 3 feet below the point in question and forming of the pile resumed. Pressure of the grout during pumping is to be maintained between 75 and 150 pounds per square inch (psi). If the pressure falls below 75 psi, the auger should be advanced to a point 3 feet lower than the elevation at which the pressure loss occurred. The auger hoisting equipment shall be capable of withdrawing the auger smoothly and at a constant rate. If the auger jumps upward during withdrawal, if the process is interrupted, or if there is decreased grouting pressure, the auger should be reinserted at least 3 feet below the point in question and the pumping process continued.

The leads should be marked for the purpose of measurement of auger penetration, at a minimum of 1-foot intervals, in such a manner that the elevation of the auger tip can easily be determined from observations made at the ground level. Auger flights should be continuous and have a nominal outside diameter equal to the pile’s design diameter. A cork should be provided at the point of discharge for protection of the hollow shaft during augering. Excessively worn augers should be replaced. The bit should be a bottom discharge bit or should discharge at a point below the auger cutting teeth. Cutting teeth should periodically be replaced as they wear.

Augered cast-in-place piles will require special attention during construction to assure that recently placed pile grout is not damaged by adjacent pile installation. A minimum edge to edge spacing of at least six pile diameters should be maintained between piles installed on the same day. We recommend that detailed field records be maintained by our geotechnical engineer to verify pile type, location, length, diameter, tip and butt elevations, the quantity of grout actually pumped into each pile hole, and any pertinent remarks. Grout volumes should be monitored both by recording actual pump displacement and by observing the time rate of auger withdrawal. Compressive strength of the grout should be confirmed by casting, curing, and testing grout cubes on a regular basis. We request that we be allowed to review the contractor’s proposed equipment and installation procedure prior to mobilization and construction.

We recommend that a static load-testing program, consisting of at least one static pile load test, be performed to confirm pile capacity and installation procedures. For additional information, strain gauges could be placed on a test pile at the tip, along the shaft, and at the top of the pile to monitor the distribution of load transfer from the pile to the adjacent soil during the testing program. Revisions to pile design embedment depths and/or capacities may be necessary based on the results of the testing program and the strain gauge data would be valuable in revising the length. The static load-testing program should be performed in accordance with ASTM D 1143 (Quick Test) to a minimum of 200 percent of the final design load.

7.6 Seismic Site Response Analysis

The following sections discuss the assumptions, methodologies, and results of our seismic site response analysis (SSRA). We performed the SSRA using the program DEEPSOIL v7.0[1] in general accordance with the IBC 2018 and ASCE 7-16.

7.6.1 Subsurface Conditions and Soil Model

Subsurface conditions were based on the results of geotechnical exploration as discussed in the section above.

7.6.1.1 Seismic Site Class and Soil Model

Shear-wave velocity (Vs) data were collected at the site via using the Multi-Channel Analysis of Surface Waves (MASW) method at array location SW-1. Using this method, the computed V_{s100} value is approximately 1,000 ft/second. Therefore, a Seismic Site Class D was assigned in accordance with Section 20.1 of ASCE 7-16. Based on our evaluation, the site is generally not susceptible to liquefaction and does not have a likely potential to liquefy.

A general summary of the subsurface information and shear-wave velocity profile used as our DEEPSOIL "base" model are presented in Table 7-3 below and Figure 3 of the Appendix. The input parameters for the shear modulus reduction and damping ratio relationships such as plasticity index (PI), unit weights, at-rest earth pressure coefficient (K_o), and shear strength values were based on published data and our experience. Groundwater was set at 15 feet deep. The input ground motions were applied at a depth, H (i.e., the assumed depth to the B/C boundary), of 400 feet.

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[1] DEEPSOIL v7.0 is a one-dimensional site response analysis program that can perform nonlinear and equivalent linear site response analyses with and without pore water pressure control. Hashash, Y.M.A., Musgrove, M.I., Harmon, J.A., Groholski, D.R., Phillips,C.A., and Park, D. (2019). *DEEPSOIL 7.0, User Manual.* University of Illinois at Urbana-Champaign, Urbana, IL.

Table 7-3 - Base Model Properties

Layer	Thickness (ft)	General Material Type	V_s (ft/sec)	Unit Weight (pcf)	Plasticity Index	Friction Angle (deg)	Undrained Shear Strength (psf)
1	8	Loess	500	110	8		1,500
2	7		650				
3	8	Marine soils – clay and silt	650	110	15	-	2,000
4	10		840	110	15	-	2,000
5	25		1,200	115	15	-	2,500
6	12	Silty sand	1,350	125	0	35	-
7	40	Dense sand	1,350	125	0	40	-
8	290		1,650	125	0	40	-
9		B/C Boundary	2,500	160			

7.6.2 *Ground Motions*

7.6.2.1 Site Hazard

The earthquake hazard associated with the site was deaggregated using the 2014 update (version 4.2.0) of the USGS Unified Hazard Tool website to determine the modal magnitude and site-to-source distance of the earthquake contributing to the peak ground surface acceleration. Considering a 2 percent probability of exceedance (2% PE) in 50 years, the modal magnitude and site-to-source distance are approximately 7.8 and 75 km, respectively (corresponding to the New Madrid seismic zone). The deaggregation plot is presented in Figure 4 of the Appendix.

7.6.2.2 Target Spectrum (B/C Boundary)

The B/C boundary Risk-Targeted Maximum Considered Earthquake (MCE_R) response spectrum for a 1% risk of structural collapse in 50 years was defined as the target spectrum using spectral accelerations values at 5 Hz (S_{MS}) and 1 Hz (S_{M1}) assuming a Site Class B in accordance with IBC 2018 and ASCE 7-16. The S_{MS} and S_{M1} parameters are 0.78 g and 0.244 g, respectively. These values were used to generate a Site Class B MCE_R response spectrum consistent with Figure 11.4-1 of ASCE 7-16, which served as our target acceleration response spectrum (ARS). The target spectrum is presented in Figure 5 of the Appendix.

7.6.2.3 Ground Motions

A set of six earthquake records were selected from the NGA-West2 database as seed motions for spectral matching. The selected motions generally possess a similar spectral shape as the B/C boundary target spectrum, correspond to events having a similar magnitude and distance as the design event, and were recorded on materials generally consistent with the B/C boundary (i.e., V_{S30} of 2500 ft/s or 760 m/s). Table 7-4 presents the details of these selected earthquake records.

Table 7-4 - Selected NGA West2 Records

Record Sequence Number	Earthquake Name	Year	Station Name	Magnitude	Mechanism	R_{jb} (km)	R_{rup} (km)	V_{S30} (m/sec)
774	Loma Prieta	1989	Hayward City Hall - North	6.93	Reverse oblique	55.0	55.1	735
1256	Chi-Chi, Taiwan	1999	HWA002	7.62	Reverse oblique	53.3	56.9	789
1319	Chi-Chi, Taiwan	1999	ILA015	7.62	Reverse oblique	83.0	85.4	783
1763	Hector Mine	1999	Anza - Pinyon Flat	7.13	Strike slip	90.0	90.0	725
6031	El Mayor-Cucapah, Mexico	2010	Anza - Pinyon Flat	7.2	Strike slip	124.4	124.4	725
6702	Niigata, Japan	2004	NGNH09	6.63	Reverse	113.8	113.9	771

SeismoMatch[2] was used to spectrally match the NGA-West2 records listed in Table 7-4 to the target ARS. SeismoMatch is a computer program developed by SeismoSoft, Inc. capable of adjusting earthquake accelerograms to match a specific target response spectrum. The program adds adjustment wavelets to the seed acceleration time history to generate a modified time history. The spectral matching focused on a period range of 0.01 to 5 seconds.

The mean of the spectrally matched motions is shown with the B/C boundary target spectrum on Figure 5 of the Appendix and the acceleration time histories, before and after spectral matching, are shown in Figures 6 and 7 of the Appendix. Each of the modified motions reasonably fit the target spectrum while generally maintaining the original record characteristics.

7.6.3 Methodology

The site-specific acceleration response spectrum (ARS) was developed using the one-dimensional site response analysis program DEEPSOIL v7.0. Both the nonlinear (NL) and equivalent linear (EL) analysis options available in DEEPSOIL were used to simulate the earthquake wave propagation from the assumed bedrock (B/C boundary) to the ground surface. The required inputs are the soil profile information, base rock acceleration time histories, and dynamic soil properties. The measured shear-wave velocity profiles were used to generate the “base” site

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[2] Seismosoft. (2018). SeismoMatch (2018 Version) - A computer program for spectral matching of earthquake records.

response model. The dynamic soil properties were modeled using the Darendeli (2001)3 shear modulus versus strain (i.e. modulus reduction) and damping versus strain relationships.

The spectrally matched time histories were applied as input rock-motions at the base of the model. To assess the sensitivity of ground surface response to uncertainty in the soil properties, we performed multiple analyses. Each of the variations was simulated with both EL and NL analyses options following the guidelines provided by Matasovic and Hashash[4]. A total of 84 analyses (i.e., 42 EL and 42 NL analyses) were performed using different shear-wave velocity profiles, modulus and damping reduction curves, and acceleration time histories. The sensitivity analyses consisted of:

- Six spectrally matched acceleration time histories;
- Two variations for depth to the BC boundary (i.e., the "base" model of 400 ft and an alternate model of 500 ft);
- Two variations for depth to the CD boundary (the "base" model of 30 feet and an alternate model of 50 feet)
- Three shear wave velocity profiles (i.e., the "base" model and ±20% from the "base" model; and
- Three shear strength profiles (i.e., the "base" model, 20% higher strengths, and 20% lower strengths). Since the selected DEEPSOIL model (i.e., General Quadratic Model or GQ/H model) modifies the modulus reduction and damping curves to match the implied shear strength to the estimated shear strength of each soil layer, the ±20% strength variation results in a variation of the damping and shear modulus reduction curves, especially at the higher strain region.

Each time history was applied to each of the model profile variations. A site-specific MCE_R response spectrum for a 1% risk of structural collapse in 50 years (with an equivalent viscous damping ratio of 5%) was generated for each of the analytical iterations. The 5% damped site-specific design ARS at the ground surface for each iteration is equal to two-thirds of the MCE_R ARS as defined in Section 21.3 of ASCE 7-16.

Per ASCE 7-16, the site-specific spectral response acceleration for the short period (S_{DS}) is 90 percent of the maximum spectral acceleration (S_a) from the site-specific spectrum, at any period between 0.2 and 0.5 seconds, inclusive. The site-specific spectral response acceleration for the 1.0 second period (S_{D1}) is the maximum value of the product, T x S_a, where T is period and S_a is the site-specific acceleration, for periods from 1.0 to 5.0 seconds. The site-specific PGA_M is taken as the MCE_R (before two-thirds reduction) spectral acceleration at the 0.01 second period (0.01 second is the smallest period for which the output spectral acceleration is available from DEEPSOIL analysis).

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[3] Darendeli, Mehmet B. (2001). Development of a New Family of Normalized Modulus Reduction and Material Damping Curves. Ph.D. Dissertation. The University of Texas at Austin, August 2001.

[4] Matasovic, N. and Hashash, Y. (2012). *Practices and Procedures for Site-specific Evaluations of Earthquake Ground Motions*. (No. Project 20-05 (Topic 42-03)).

7.6.4 Results

Figure 8 in the Appendix shows example EL and NL analysis results for our "base" profile as well as the average surface response spectrum for each analysis procedure. The EL results show a very "flat" response at small periods – which is a typical limitation of this model when high levels of strain occur. Therefore, only the NL results were included in the computing the site average response spectrum.

Figure 9 shows the average surface response spectrum based on the NL results for each model variation, as well as the calculated overall average response spectrum. Based on the results of our analyses and the observed sensitivity of the ground surface response to the soil parameter variations, the base profile appears to be a representative and appropriate average response spectrum.

Figure 10 shows the computed strain in the soil profile versus depth for each model variation. Our base model shear wave velocity profile is shown as well for reference. The maximum strains for the models ranged from about 0.1 to 0.16 percent. For each of the models, the maximum shear strain occurs a depth of about 23 feet.

The base profile response spectrum was then modified in general accordance with Chapter 21 of ASCE 7-16 to develop the design ARS. The combined and code-limited site-specific design ARS is shown as the red line on Figure 11 of the Appendix. The light blue line on Figure 11 represents the 80 percent limited code-based spectra.

Section 11.4.8 of ASCE7-16 requires that an SSRA be performed for structures on Site Class D or E with a mapped spectral acceleration S_1 greater than 0.2 seconds (with some exceptions as noted in the code). Since the value of S_1 for this site is 0.303, the general procedure does not apply for this site; however, we still computed and show the general procedure results in order to determine the 80 percent limit for the site-specific design spectrum.

As illustrated in Figure 11, the short period spectral acceleration parameter, S_{DS}, has increased compared to the general procedure results. The resulting site specific and code-limited, design response accelerations from the SSRA are presented in Table 7-5. The site-specific analysis indicates that Seismic Design Category D (IBC 2018 Section 1613.2.5) should be considered for Risk Categories I-IV.

Table 7-5 - Summary of Design Acceleration Parameters

IBC 2018 / ASCE 7-16 Design Response Accelerations				
Site-Specific Procedure				
S_{DS} (g)	S_{D1} (g)	PGA_M (g)	Seismic Design Category	
			RC I-III	RC IV
0.85	0.33	0.40	D	D

8.0 Follow-Up Services

Field observations, monitoring, and Quality Assurance testing during site grading, foundation, and paving activities are an important extension of the geotechnical design. We recommend that we be allowed to continue our involvement in the project through these phases of construction.

Competent personnel under the general administrative supervision of our geotechnical engineering team familiar with the design requirements and considerations of this project should perform Quality Assurance observations and testing related to earthwork. We recommend that qualified geotechnical personnel observe proofrolling and associated undercutting (as required), evaluate foundation excavation and subgrades, evaluate the materials to be used as fill, and test the compaction of fill and backfill. The monitoring of the earthwork activities should be performed on a full-time basis.

9.0 Limitations

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either expressed or implied, is made.

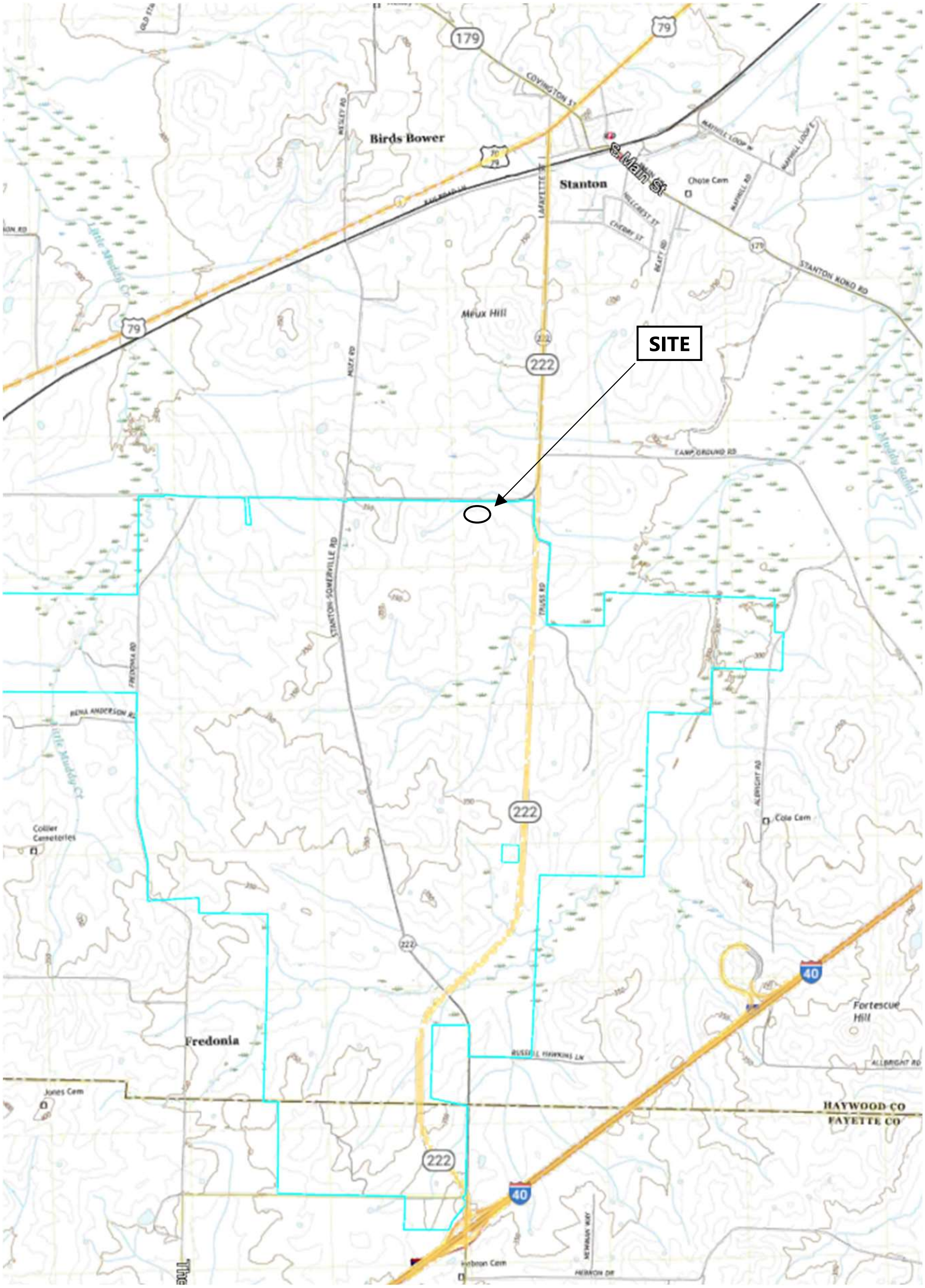
We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information, if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, and bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested. S&ME should be provided the opportunity to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME’s review of final plans and specifications followed by observation and monitoring of earthwork and foundation construction activities.

The recommendations in this report are only applicable to areas within the vicinity of our exploration and should not be used for other areas or for structures not specifically addressed in this report.

Appendix



Reference:
Stanton Quadrangle, Tennessee, USGS 7.5 Minute Series, 2019

N

SITE VICINITY PLAN

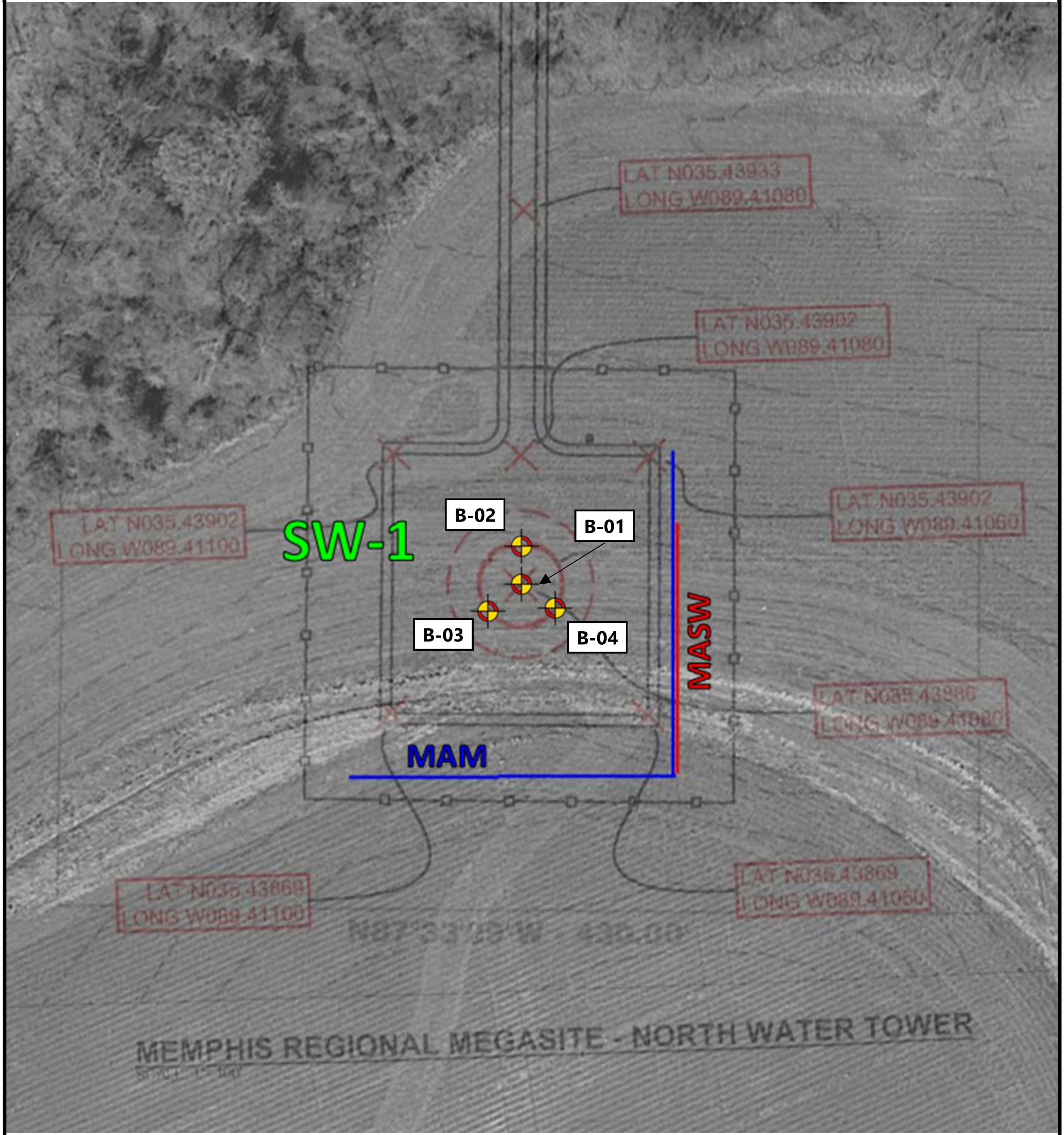
BLUE OVAL CITY – NORTH WATER TOWER
STANTON SOMMERVILLE ROAD
STANTON, TENNESSEE

SCALE:
AS SHOWN

DATE:
01-31-2022

PROJECT NUMBER
21470016

FIGURE NO.
1A



Reference:
Google Earth aerial image accessed 01-31-2022
Memphis Reginal Megasite – North Water Tower,
Preliminary dated 12-29-2021

Legend:
- ⊕ Approximate Test Boring Location
- — Approximate MAM Location
- — Approximate MASW Location

N

TEST LOCATION PLAN

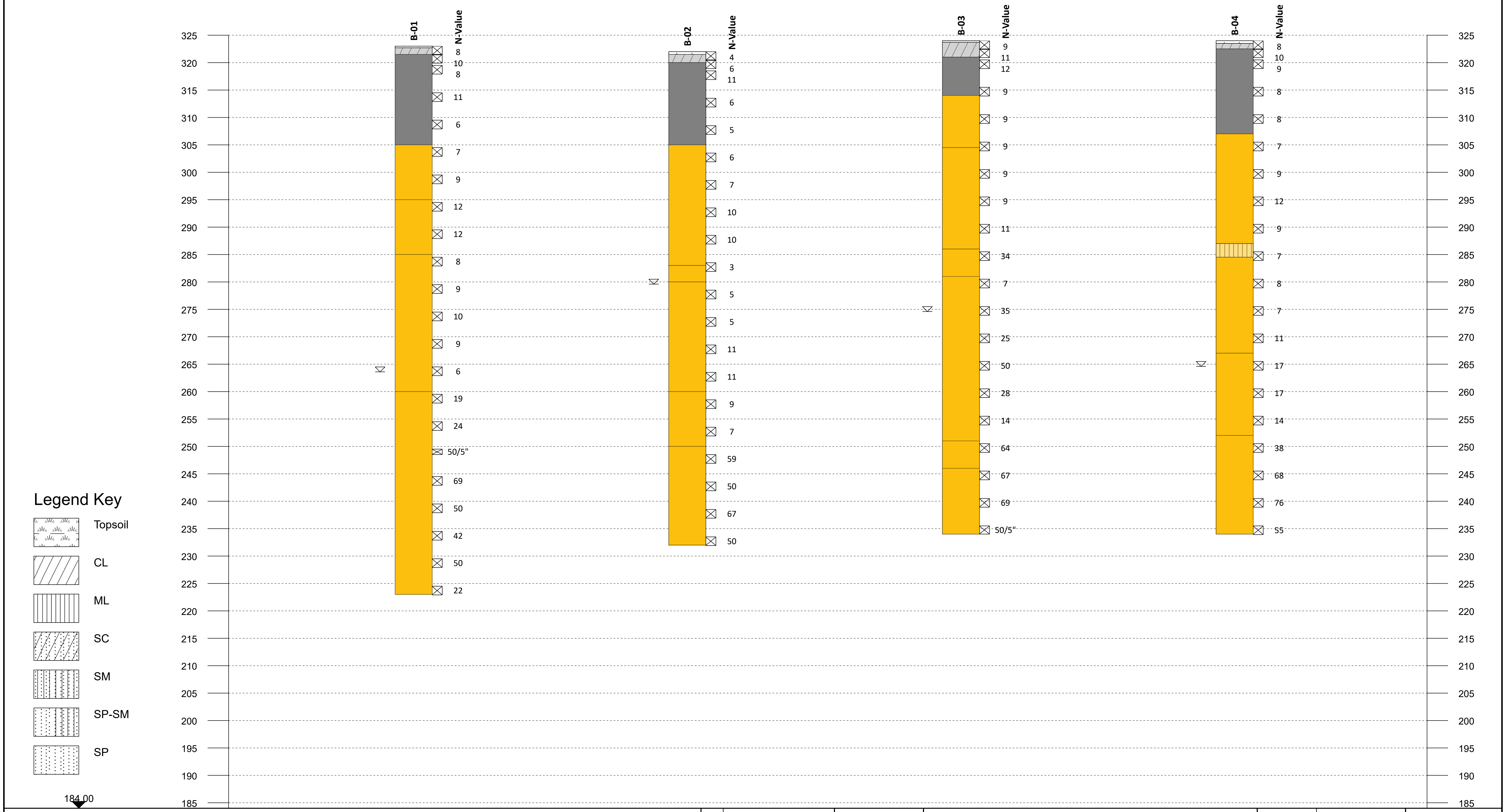
BLUE OVAL CITY – NORTH WATER TOWER
STANTON SOMMERVILLE ROAD
STANTON, TENNESSEE

SCALE:
AS SHOWN

DATE:
01-31-2022

PROJECT NUMBER
21470016

FIGURE NO.
1B



The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface conditions will vary between boring locations.

▽	AT TIME OF DRILLING
▼	END OF DRILLING
▼	AFTER DRILLING

General Subsurface Profile

Blue Oval City - North Water Tower
Stanton, Tennessee

SCALE:	Not to scale
DATE:	Feb 01, 2022
PROJECT NUMBER:	21470016

FIGURE NO.

2

TEST BORING LOG LEGEND

FINE AND COARSE GRAINED SOIL INFORMATION

COARSE GRAINED SOILS
(SANDS AND GRAVELS)

N	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
Over 50	Very Dense

FINE GRAINED SOILS
(CLAYS AND SILTS)

N	Consistency
0-2	Very Soft
3-4	Soft
5-8	Firm
9-15	Stiff
16-30	Very Stiff
Over 30	Hard

PARTICLE SIZE

Boulders	Greater than 300 mm (12”)
Cobbles	75 mm—300 mm (3-12”)
Gravel	4.75 mm—75 mm (3/16-3”)
Coarse Sand	2 mm—4.74 mm
Medium Sand	.425 mm—2 mm
Fine Sand	0.075 mm—0.425 mm
Silts and Clays	Less than 0.075 mm

The STANDARD PENETRATION TEST as defined by ASTM D 1586 is a method to obtain a disturbed soil sample for examination and testing and to obtain relative density and consistency information. A standard 1.4-inch I.D. / 2.0-inch O.D. split barrel sampler is driven three 6-inch increments with a 140 lb. hammer falling 30 inches. The hammer can either be of a trip, free-fall design, or actuated by a rope and cathead. The blow counts required to drive the sampler the final two 6-inch increments are added together and designated the N-value defined in the above tables.

ROCK PROPERTIES

RQD

Percent RQD	Quality
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

ROCK HARDNESS

Very Hard	Rock can be broken by heavy hammer blows.
Hard	Rock cannot be broken by thumb pressure, but can be broken by moderate hammer blows.
Moderately Hard	Small pieces can be broken off along sharp edges by considerable thumb pressure; can be broken with light hammer blows.
Soft	Rock is coherent but breaks very easily with thumb pressure at sharp edges and crumbles with firm hand pressure.
Very Soft	Rock disintegrates or easily compresses when touched; can be hard to very hard soil.

KEY

■	**Undisturbed Sample**
☒	**Standard Penetration Test Sample**
☐	**Rock Core Sample**

Core Diameter (I.D.)	Inches
BQ	1-7/16
NQ	1-7/8
HQ	2-1/2

$$\text{RQD} = \frac{\text{Sum of 4” and Longer Rock Pieces Recovered}}{\text{Length of Core Run}} \text{ x100}$$

(Rock Quality Designation)

$$\text{REC} = \frac{\text{Length of Rock Core Recovered}}{\text{Length of Core Run}} \text{ x100}$$

(Recovery)

SOIL PROPERTY SYMBOLS

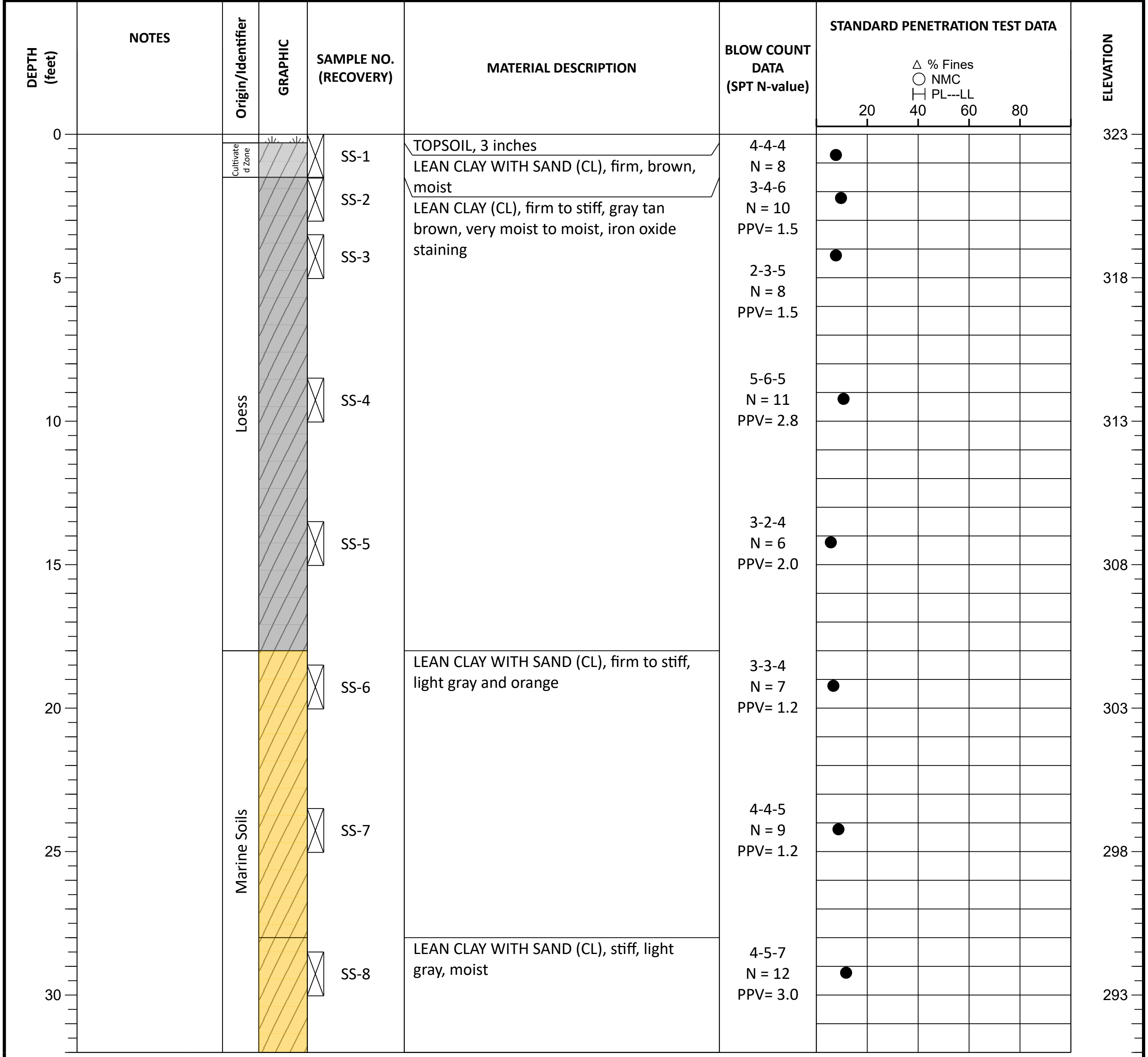
N	Standard Penetration, BPF
NMC	Natural Moisture Content, %
LL	Liquid Limit, %
PL	Plastic Limit, %
PI	Plasticity Index, %
PPV	Pocket Penetrometer Value, TSF
Qu	Unconfined Compressive Strength, TSF
Yd	Dry Unit Weight, PCF
F	Fines Content

PROJECT: Blue Oval City - North Water Tower
Stanton-Sommerville Road; Stanton, Tennessee
S&ME Project No. 21470016

BORING LOG: B-01

Sheet 1 of 4

DATE DRILLED: 01/26/2022
ELEVATION: 323 ft
DRILL RIG: CME-550X
DATUM: NAVD88
DRILLER: S&ME
BORING DEPTH: 100.0 ft
HAMMER TYPE: Auto Hammer (140 lb)
CLOSURE: Cuttings
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Simone Metzger
NOTES:
LATITUDE: 35.438857 **LONGITUDE:** -89.41080
SAMPLING METHOD: SS
PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane Tennessee FIPS 4100 Feet



SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
SS-1	TOPSOIL, 3 inches LEAN CLAY WITH SAND (CL), firm, brown, moist	4-4-4 N = 8
SS-2	LEAN CLAY (CL), firm to stiff, gray tan brown, very moist to moist, iron oxide staining	3-4-6 N = 10 PPV= 1.5
SS-3		2-3-5 N = 8 PPV= 1.5
SS-4		5-6-5 N = 11 PPV= 2.8
SS-5		3-2-4 N = 6 PPV= 2.0
SS-6	LEAN CLAY WITH SAND (CL), firm to stiff, light gray and orange	3-3-4 N = 7 PPV= 1.2
SS-7		4-4-5 N = 9 PPV= 1.2
SS-8	LEAN CLAY WITH SAND (CL), stiff, light gray, moist	4-5-7 N = 12 PPV= 3.0

GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/26/2022	59.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
HC = Hole Cave, AR = Auger Refusal

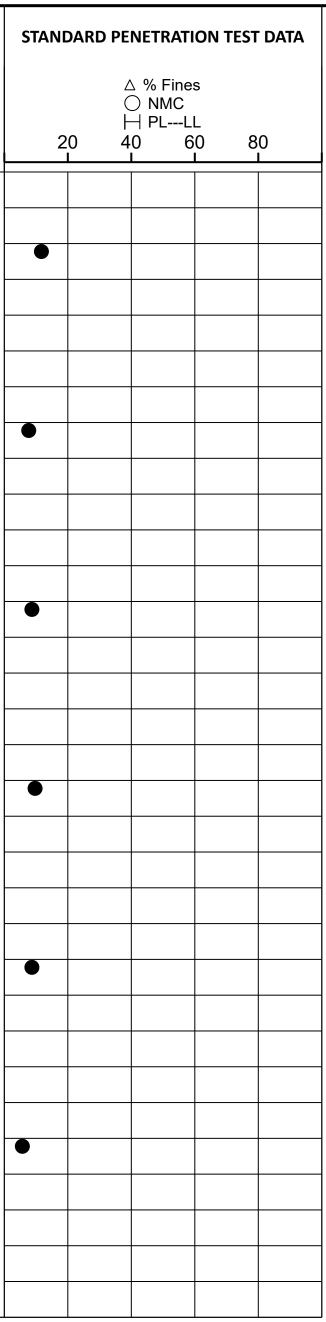
PROJECT: Blue Oval City - North Water Tower
Stanton-Sommerville Road; Stanton, Tennessee
S&ME Project No. 21470016

BORING LOG: B-01

Sheet 2 of 4

DATE DRILLED: 01/26/2022
ELEVATION: 323 ft
DRILL RIG: CME-550X
DATUM: NAVD88
DRILLER: S&ME
BORING DEPTH: 100.0 ft
HAMMER TYPE: Auto Hammer (140 lb)
CLOSURE: Cuttings
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Simone Metzger
SAMPLING METHOD: SS
NOTES:
LATITUDE: 35.438857 **LONGITUDE:** -89.41080
PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane Tennessee FIPS 4100 Feet

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
35		Marine Soils		SS-9	LEAN CLAY WITH SAND (CL), stiff, light gray, moist	5-6-6 N = 12 PPV= 3.0	288
40				SS-10	SILT (ML), firm to stiff, dark gray, moist to wet	4-4-4 N = 8 PPV= 1.5	283
45				SS-11		4-4-5 N = 9 PPV= 1.5	278
50				SS-12		4-5-5 N = 10 PPV= 1.5	273
55				SS-13		2-4-5 N = 9 PPV= 1.5	268
60	wet spoon ▽			SS-14		2-3-3 N = 6	263
					POORLY GRADED SAND WITH SILT (SP-SM), dense to very dense, orange, medium to coarse grained, wet	7-7-12	



GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/26/2022	59.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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HC = Hole Cave, AR = Auger Refusal

PROJECT: Blue Oval City - North Water Tower
Stanton-Sommerville Road; Stanton, Tennessee
S&ME Project No. 21470016

BORING LOG: B-01

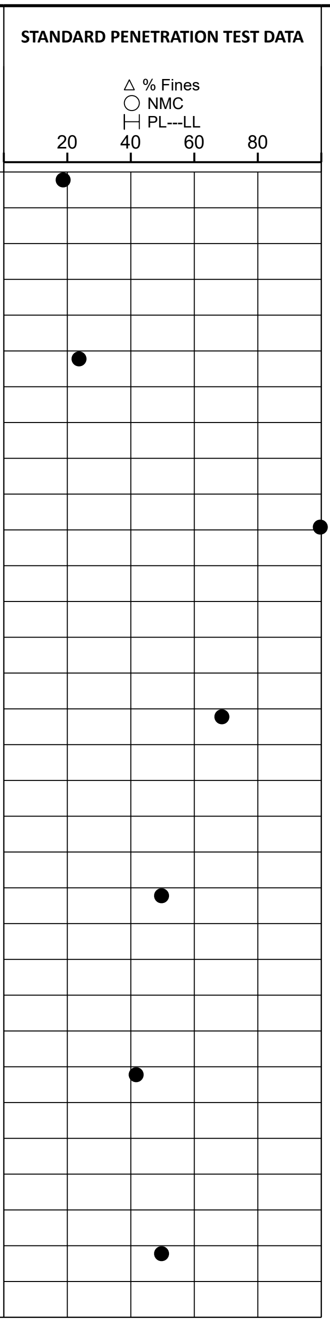
Sheet 3 of 4

DATE DRILLED: 01/26/2022	**ELEVATION:** 323 ft
DRILL RIG: CME-550X	**DATUM:** NAVD88
DRILLER: S&ME	**BORING DEPTH:** 100.0 ft
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Simone Metzger
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Tennessee FIPS 4100 Feet

NOTES:

LATITUDE: 35.438857 **LONGITUDE:** -89.41080

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
		Marine Soils		SS-15	POORLY GRADED SAND WITH SILT (SP-SM), dense to very dense, orange, medium to coarse grained, wet	N = 19	
65							258
				SS-16		6-6-18 N = 24	
70							253
				SS-17		32-50/5" N = 50/5"	
75							248
				SS-18		20-30-39 N = 69	
80							243
				SS-19		19-23-27 N = 50	
85							238
				SS-20		16-21-21 N = 42	
90							233
				SS-21		24-23-27 N = 50	
95							228



GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/26/2022	59.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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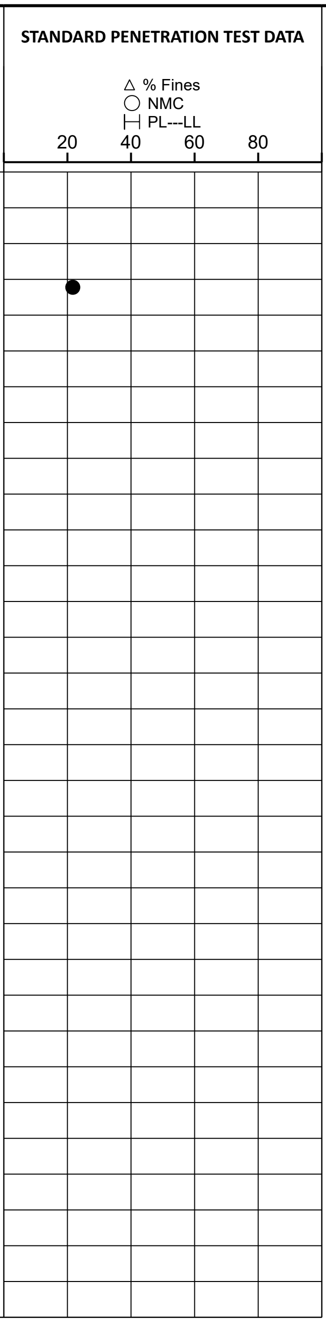
HC = Hole Cave, AR = Auger Refusal

PROJECT:	**Blue Oval City - North Water Tower** **Stanton-Sommerville Road; Stanton, Tennessee** **S&ME Project No. 21470016**	**BORING LOG: B-01** *Sheet 4 of 4*

DATE DRILLED: 01/26/2022	**ELEVATION:** 323 ft	**NOTES:**
DRILL RIG: CME-550X	**DATUM:** NAVD88	
DRILLER: S&ME	**BORING DEPTH:** 100.0 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Simone Metzger	**LATITUDE:** 35.438857 **LONGITUDE:** -89.41080
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Tennessee FIPS 4100 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
		Marine Soils		SS-22	POORLY GRADED SAND WITH SILT (SP-SM), dense to very dense, orange, medium to coarse grained, wet	11-10-12 N = 22	
100					Borehole terminated at 100.0 feet		223
105							218
110							213
115							208
120							203
125							198

STANDARD PENETRATION TEST DATA



GROUNDWATER		**DATE/TIME**	**DEPTH (FT)**	**REMARKS**
ATD	▽	01/26/2022	59.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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HC = Hole Cave, AR = Auger Refusal

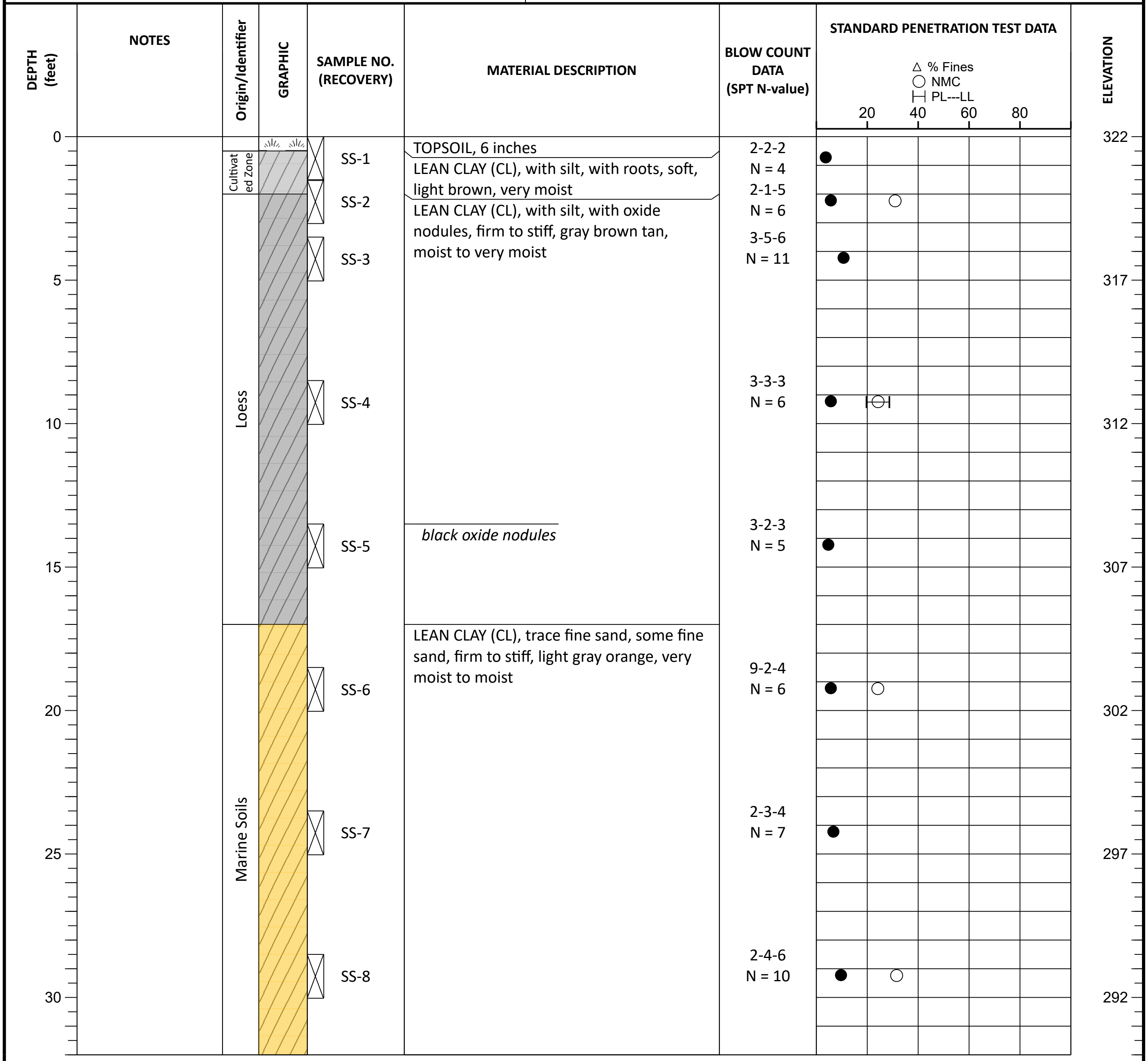
PROJECT: Blue Oval City - North Water Tower
Stanton-Sommerville Road; Stanton, Tennessee
S&ME Project No. 21470016

BORING LOG: B-02

Sheet 1 of 3

DATE DRILLED: 01/06/2022	**ELEVATION:** 322 ft	**NOTES:**
DRILL RIG: CME-550X	**DATUM:** NAVD88	
DRILLER: S&ME	**BORING DEPTH:** 90.0 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Alfred Futrell	**LATITUDE:** 35.438908 **LONGITUDE:** -89.41080

SAMPLING METHOD: SS **PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Tennessee FIPS 4100 Feet



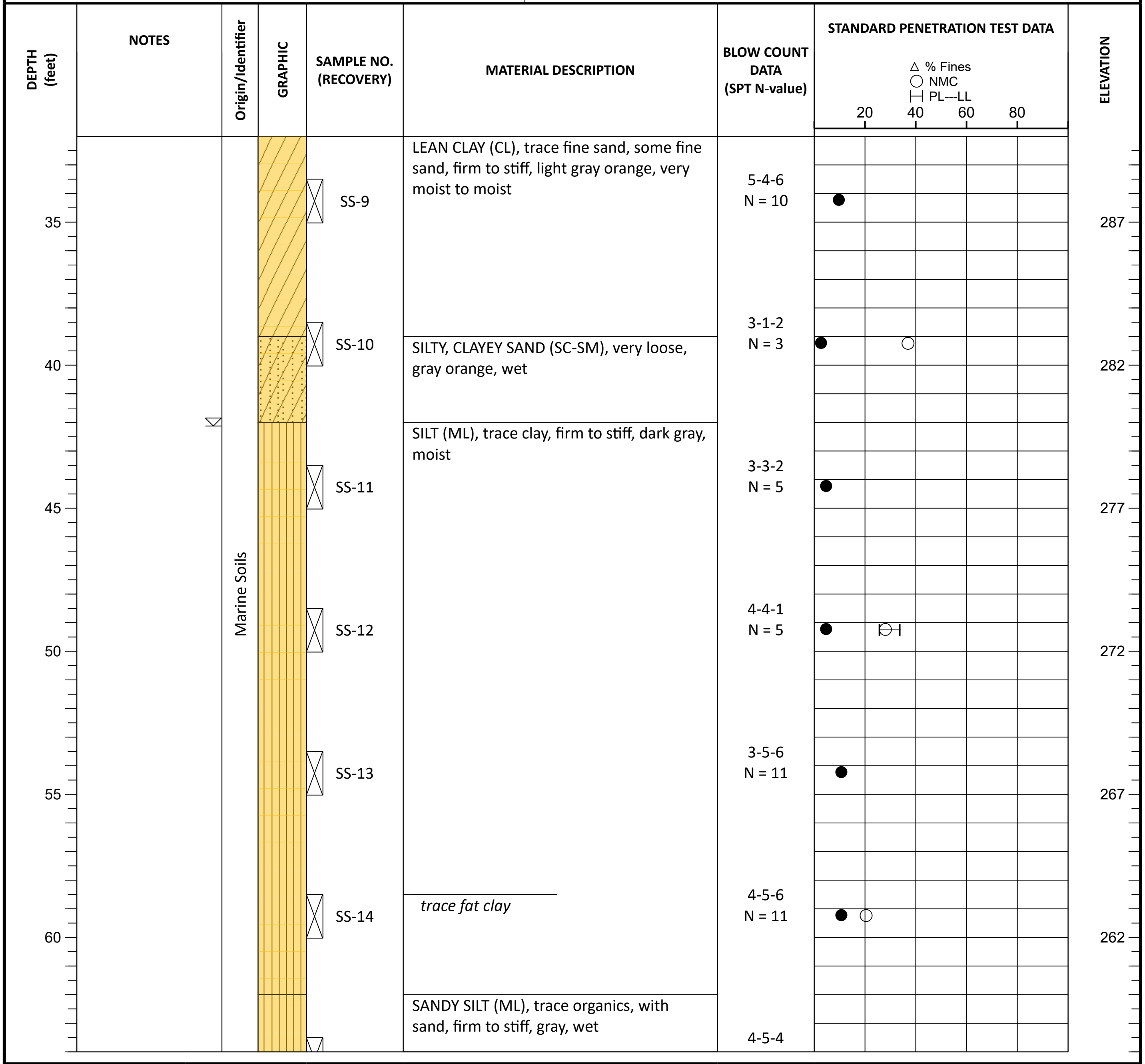
SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)
SS-1	TOPSOIL, 6 inches LEAN CLAY (CL), with silt, with roots, soft, light brown, very moist	2-2-2 N = 4
SS-2	LEAN CLAY (CL), with silt, with oxide nodules, firm to stiff, gray brown tan, moist to very moist	2-1-5 N = 6
SS-3		3-5-6 N = 11
SS-4		3-3-3 N = 6
SS-5	*black oxide nodules*	3-2-3 N = 5
SS-6	LEAN CLAY (CL), trace fine sand, some fine sand, firm to stiff, light gray orange, very moist to moist	9-2-4 N = 6
SS-7		2-3-4 N = 7
SS-8		2-4-6 N = 10

GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/06/2022	42.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
HC = Hole Cave, AR = Auger Refusal

PROJECT:	Blue Oval City - North Water Tower Stanton-Sommerville Road; Stanton, Tennessee S&ME Project No. 21470016	**BORING LOG: B-02** *Sheet 2 of 3*

DATE DRILLED: 01/06/2022	**ELEVATION:** 322 ft	**NOTES:**
DRILL RIG: CME-550X	**DATUM:** NAVD88	
DRILLER: S&ME	**BORING DEPTH:** 90.0 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Alfred Futrell	**LATITUDE:** 35.438908 **LONGITUDE:** -89.41080
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Tennessee FIPS 4100 Feet	



DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
		Marine Soils	SS-9	LEAN CLAY (CL), trace fine sand, some fine sand, firm to stiff, light gray orange, very moist to moist	5-4-6 N = 10	
35						287
			SS-10	SILTY, CLAYEY SAND (SC-SM), very loose, gray orange, wet	3-1-2 N = 3	
40						282
	▽		SS-11	SILT (ML), trace clay, firm to stiff, dark gray, moist	3-3-2 N = 5	
45						277
			SS-12		4-4-1 N = 5	
50						272
			SS-13		3-5-6 N = 11	
55						267
			SS-14	*trace fat clay*	4-5-6 N = 11	
60						262
				SANDY SILT (ML), trace organics, with sand, firm to stiff, gray, wet	4-5-4	

GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/06/2022	42.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
HC = Hole Cave, AR = Auger Refusal

PROJECT: Blue Oval City - North Water Tower
Stanton-Sommerville Road; Stanton, Tennessee
S&ME Project No. 21470016

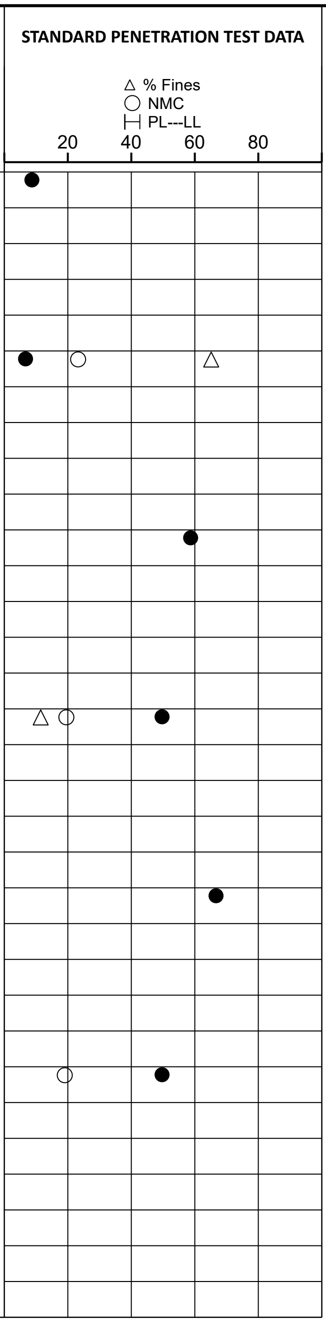
BORING LOG: B-02

Sheet 3 of 3

DATE DRILLED: 01/06/2022
ELEVATION: 322 ft
DRILL RIG: CME-550X
DATUM: NAVD88
DRILLER: S&ME
BORING DEPTH: 90.0 ft
HAMMER TYPE: Auto Hammer (140 lb)
CLOSURE: Cuttings
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Alfred Futrell
SAMPLING METHOD: SS
NOTES:
LATITUDE: 35.438908 **LONGITUDE:** -89.41080
PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane Tennessee FIPS 4100 Feet

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
		Marine Soils	SS-15	SANDY SILT (ML), trace organics, with sand, firm to stiff, gray, wet	N = 9	
65						257
			SS-16		3-4-3 N = 7	
70						252
			SS-17	POORLY GRADED SAND WITH SILT (SP-SM), very dense, pink orange to gray, wet	17-24-35 N = 59	
75						247
			SS-18		20-22-28 N = 50	
80						242
			SS-19		28-37-30 N = 67	
85						237
			SS-20		28-50 N = 50	
90				Borehole terminated at 90.0 feet		232
95						227

STANDARD PENETRATION TEST DATA



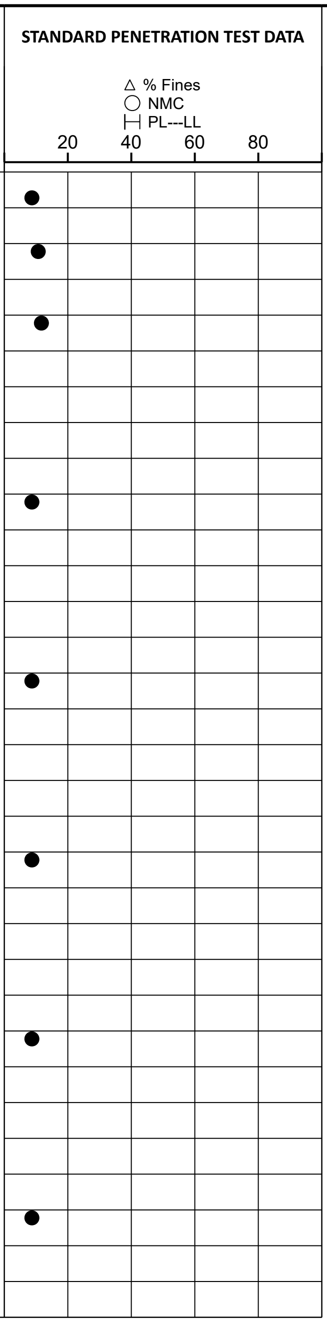
GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/06/2022	42.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
HC = Hole Cave, AR = Auger Refusal

PROJECT:	**Blue Oval City - North Water Tower** **Stanton-Sommerville Road; Stanton, Tennessee** **S&ME Project No. 21470016**	**BORING LOG: B-03** *Sheet 1 of 3*

DATE DRILLED: 01/28/2022	**ELEVATION:** 324 ft	**NOTES:**
DRILL RIG: CME-550X	**DATUM:** NAVD88	
DRILLER: S&ME	**BORING DEPTH:** 90.0 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Simone Metzger	**LATITUDE:** 35.438831 **LONGITUDE:** -89.41085
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Tennessee FIPS 4100 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
0		Cultivated Zone	SS-1	TOPSOIL, 3 inches LEAN CLAY (CL), stiff, brown, moist	3-4-5 N = 9	324
			SS-2		4-4-7 N = 11	
5		Loess	SS-3	LEAN CLAY (CL), stiff, gray tan brown, moist to very moist, iron oxide staining	2-5-7 N = 12 PPV= 1.5	319
			SS-4		4-4-5 N = 9	
10		Marine Soils		LEAN CLAY (CL), trace sand, stiff, gray and orange, very moist		314
15			SS-5		4-5-4 N = 9 PPV= 0.8	309
			SS-6		5-4-5 N = 9 PPV= 0.8	
20				SILT WITH SAND (ML), stiff, light gray, moist *cemented sand*		304
25			SS-7		4-5-4 N = 9 PPV= 1.0	299
30			SS-8		5-4-5 N = 9 PPV= 1.5	294



GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/28/2022	49.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
HC = Hole Cave, AR = Auger Refusal

PROJECT: Blue Oval City - North Water Tower
Stanton-Sommerville Road; Stanton, Tennessee
S&ME Project No. 21470016

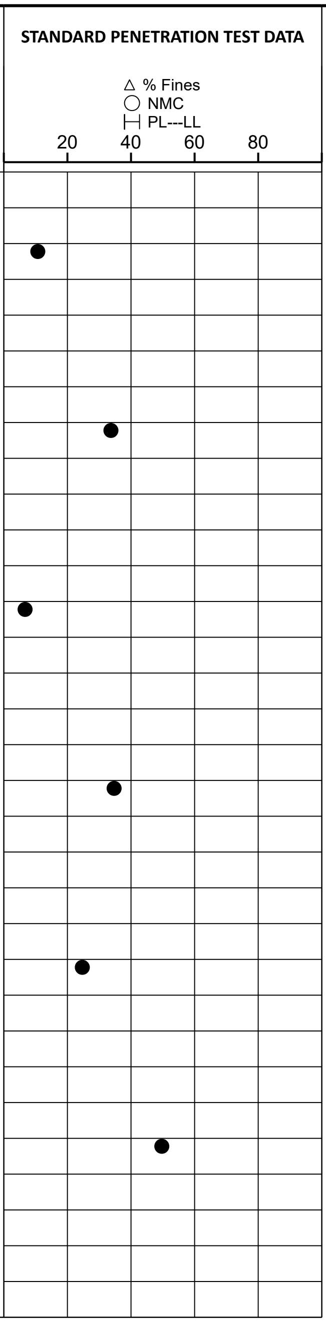
BORING LOG: B-03

Sheet 2 of 3

DATE DRILLED: 01/28/2022
ELEVATION: 324 ft
DRILL RIG: CME-550X
DATUM: NAVD88
DRILLER: S&ME
BORING DEPTH: 90.0 ft
HAMMER TYPE: Auto Hammer (140 lb)
CLOSURE: Cuttings
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Simone Metzger
NOTES:
LATITUDE: 35.438831 **LONGITUDE:** -89.41085
SAMPLING METHOD: SS
PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane Tennessee FIPS 4100 Feet

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
35		Marine Soils	SS-9	SILT WITH SAND (ML), stiff, light gray, moist	5-5-6 N = 11 PPV= 2.0	289
40			SS-10	SILT (ML), little sand, hard, light gray with orange, moist	6-15-19 N = 34	284
45			SS-11	SILTY SAND (SM), loose to dense, light gray to orange brown, medium grained, moist to wet	3-4-3 N = 7	279
50	wet spoon ▽		SS-12		12-17-18 N = 35	274
55			SS-13		12-12-13 N = 25	269
60			SS-14		11-23-27 N = 50	264
				orange brown	11-12-16	

STANDARD PENETRATION TEST DATA



GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/28/2022	49.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

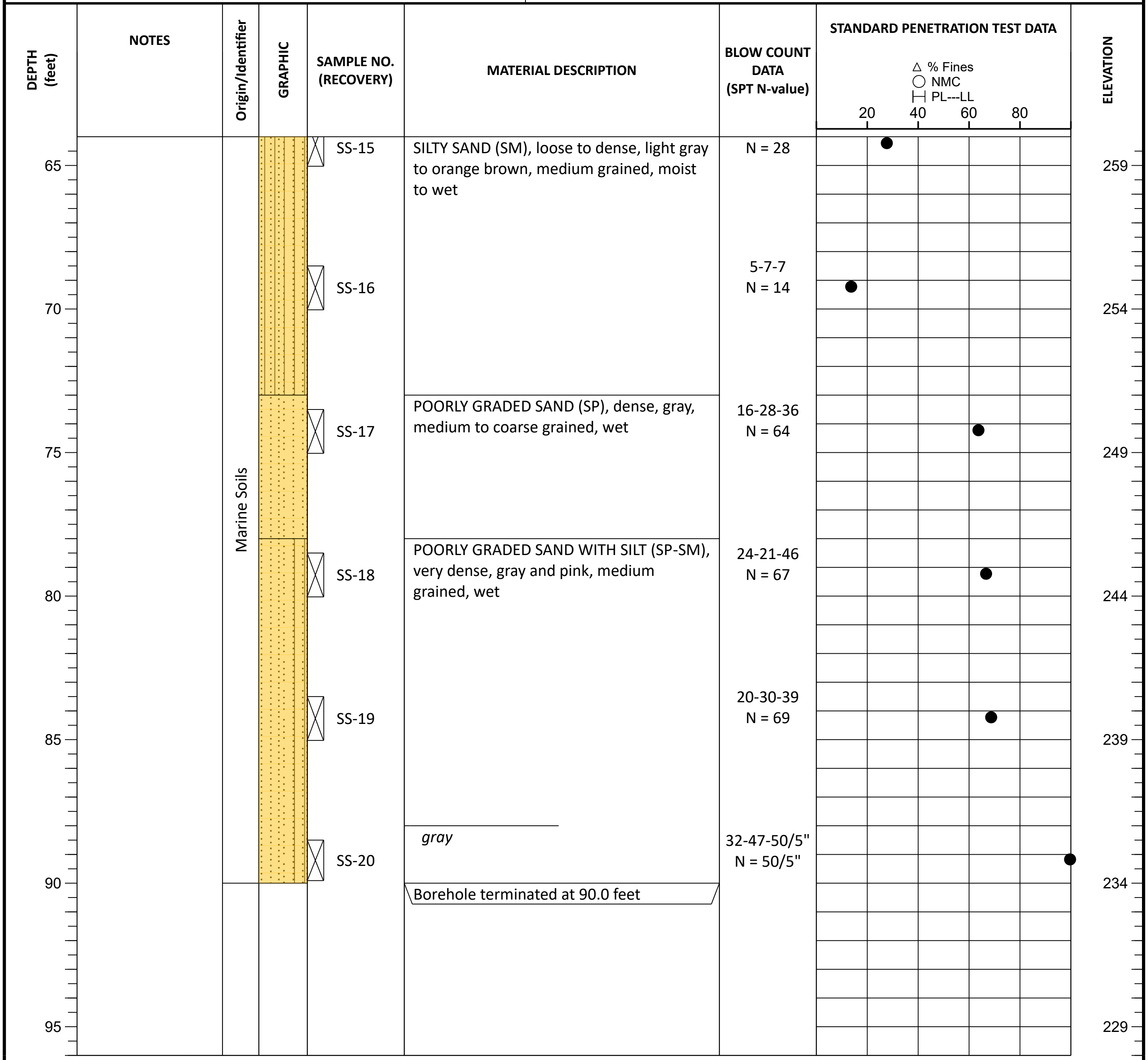
GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
HC = Hole Cave, AR = Auger Refusal

PROJECT: Blue Oval City - North Water Tower
Stanton-Sommerville Road; Stanton, Tennessee
S&ME Project No. 21470016

BORING LOG: B-03

Sheet 3 of 3

DATE DRILLED: 01/28/2022
ELEVATION: 324 ft
DRILL RIG: CME-550X
DATUM: NAVD88
DRILLER: S&ME
BORING DEPTH: 90.0 ft
HAMMER TYPE: Auto Hammer (140 lb)
CLOSURE: Cuttings
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Simone Metzger
SAMPLING METHOD: SS
NOTES:
LATITUDE: 35.438831 **LONGITUDE:** -89.41085
PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane Tennessee FIPS 4100 Feet



Origin/Identifier	Sample No.	Material Description	Blow Count Data (SPT N-value)
Marine Soils	SS-15	SILTY SAND (SM), loose to dense, light gray to orange brown, medium grained, moist to wet	N = 28
	SS-16		5-7-7 N = 14
	SS-17	POORLY GRADED SAND (SP), dense, gray, medium to coarse grained, wet	16-28-36 N = 64
	SS-18	POORLY GRADED SAND WITH SILT (SP-SM), very dense, gray and pink, medium grained, wet	24-21-46 N = 67
	SS-19		20-30-39 N = 69
	SS-20	*gray*	32-47-50/5" N = 50/5"
		Borehole terminated at 90.0 feet	

GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/28/2022	49.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
HC = Hole Cave, AR = Auger Refusal

PROJECT: Blue Oval City - North Water Tower
Stanton-Sommerville Road; Stanton, Tennessee
S&ME Project No. 21470016

BORING LOG: B-04

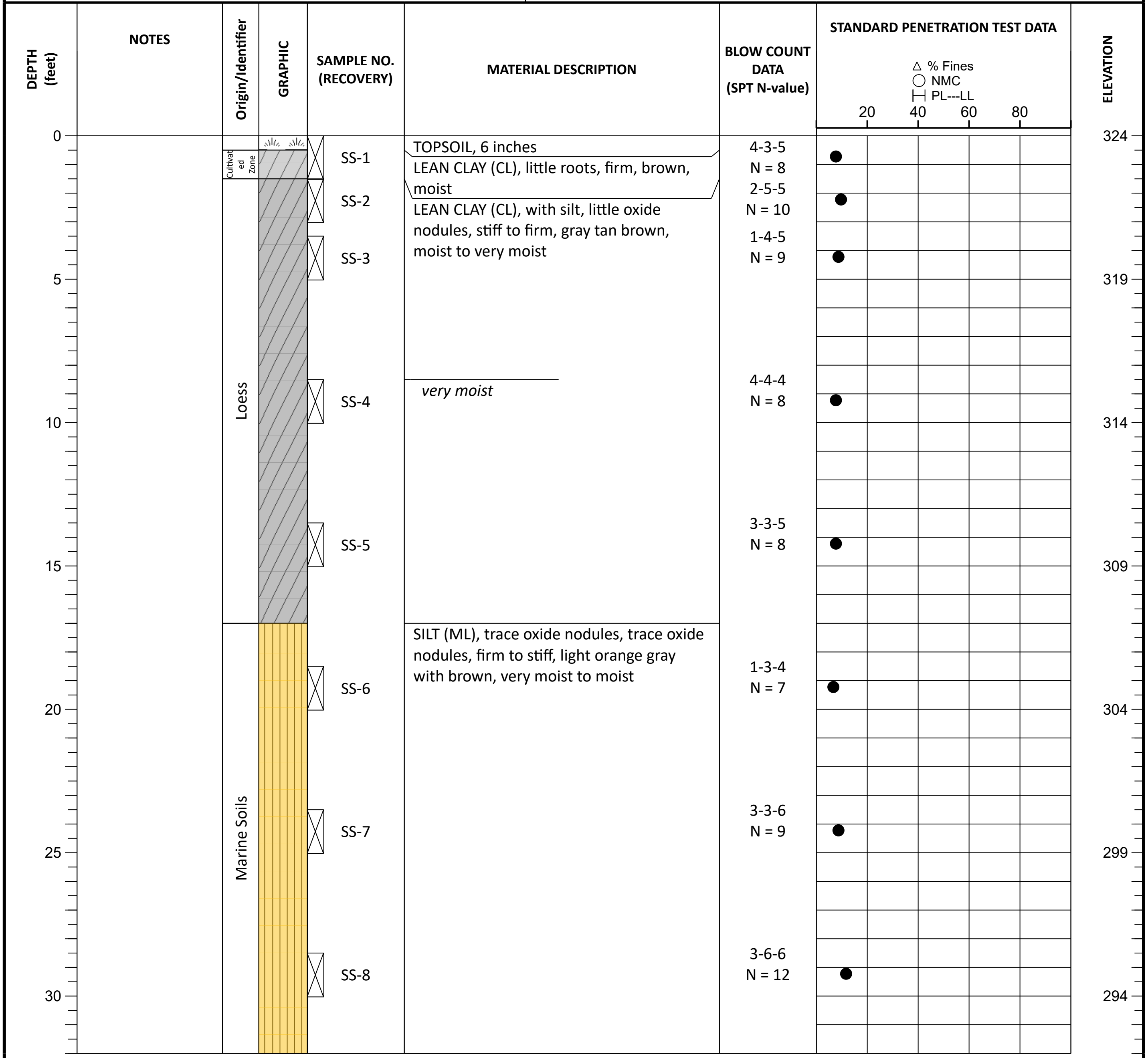
Sheet 1 of 3

DATE DRILLED: 01/05/2022
ELEVATION: 324 ft
DRILL RIG: CME-550X
DATUM: NAVD88
DRILLER: S&ME
BORING DEPTH: 90.0 ft
HAMMER TYPE: Auto Hammer (140 lb)
CLOSURE: Cuttings
DRILLING METHOD: 3-1/4" HSA
LOGGED BY: Alfred Futrell
SAMPLING METHOD: SS

NOTES:

LATITUDE: 35.438831 **LONGITUDE:** -89.41075

PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane Tennessee FIPS 4100 Feet



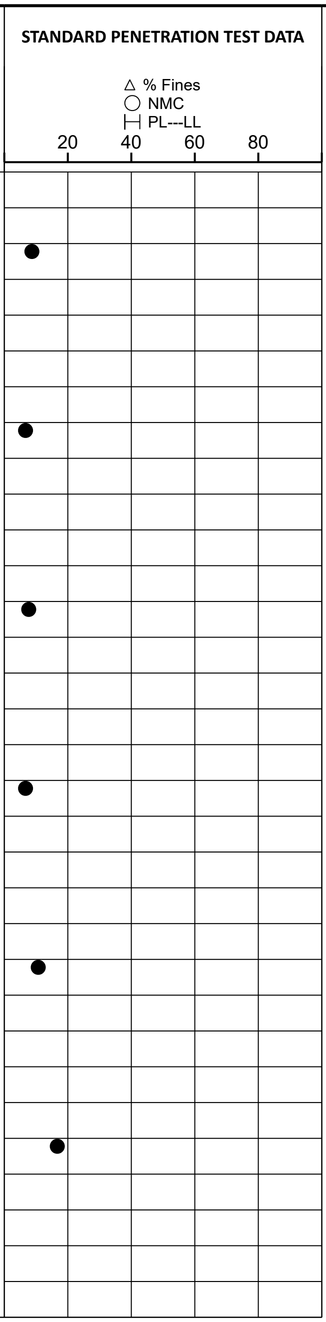
Origin/Identifier	Sample No.	Material Description	Blow Count Data (SPT N-value)
Cultivated Zone	SS-1	TOPSOIL, 6 inches LEAN CLAY (CL), little roots, firm, brown, moist	4-3-5 N = 8
Loess	SS-2	LEAN CLAY (CL), with silt, little oxide nodules, stiff to firm, gray tan brown, moist to very moist	2-5-5 N = 10
	SS-3		1-4-5 N = 9
	SS-4	*very moist*	4-4-4 N = 8
	SS-5		3-3-5 N = 8
Marine Soils	SS-6	SILT (ML), trace oxide nodules, trace oxide nodules, firm to stiff, light orange gray with brown, very moist to moist	1-3-4 N = 7
	SS-7		3-3-6 N = 9
	SS-8		3-6-6 N = 12

GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/05/2022	59.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),
HC = Hole Cave, AR = Auger Refusal

PROJECT:	Blue Oval City - North Water Tower Stanton-Sommerville Road; Stanton, Tennessee **S&ME Project No. 21470016**	**BORING LOG: B-04** *Sheet 2 of 3*	
DATE DRILLED: 01/05/2022	**ELEVATION:** 324 ft	**NOTES:**	
DRILL RIG: CME-550X	**DATUM:** NAVD88		
DRILLER: S&ME	**BORING DEPTH:** 90.0 ft		
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings		
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Alfred Futrell	**LATITUDE:** 35.438831	**LONGITUDE:** -89.41075
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Tennessee FIPS 4100 Feet		

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
		Marine Soils		SS-9	SILT (ML), trace oxide nodules, trace oxide nodules, firm to stiff, light orange gray with brown, very moist to moist	4-4-5 N = 9	
35							289
				SS-10	SILT (ML), with clay, light gray and brown	3-3-4 N = 7	
40					SILT (ML), trace fine sand, little organics, firm to stiff, dark gray, moist		284
				SS-11		3-3-5 N = 8	
45							279
				SS-12		3-3-4 N = 7	
50							274
				SS-13	*black organics*	4-5-6 N = 11	
55							269
	▽			SS-14	SILTY SAND (SM), little clay, medium dense, dark gray to brown, fine grained, very moist to wet	5-7-10 N = 17	
60							264
						5-7-10	



GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/05/2022	59.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
AFTER DRILLING	▼			

GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING
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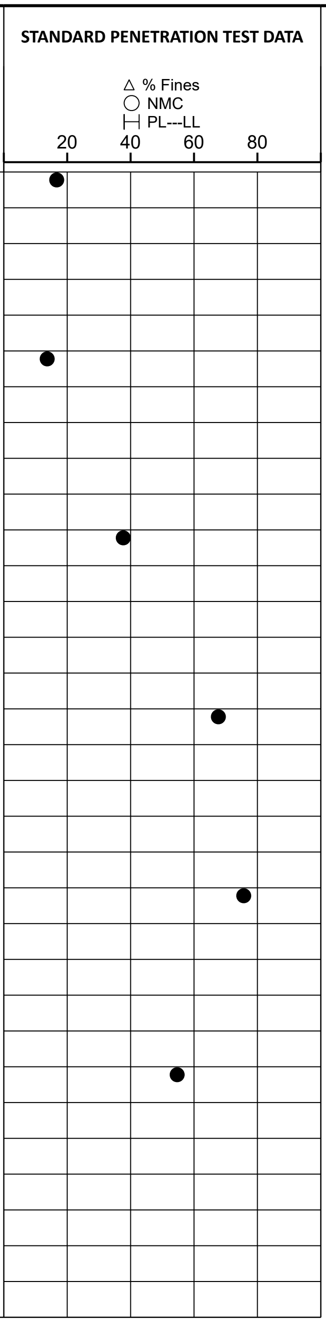
PROJECT:	Blue Oval City - North Water Tower Stanton-Sommerville Road; Stanton, Tennessee S&ME Project No. 21470016	**BORING LOG: B-04** *Sheet 3 of 3*

DATE DRILLED: 01/05/2022	**ELEVATION:** 324 ft	**NOTES:**
DRILL RIG: CME-550X	**DATUM:** NAVD88	
DRILLER: S&ME	**BORING DEPTH:** 90.0 ft	
HAMMER TYPE: Auto Hammer (140 lb)	**CLOSURE:** Cuttings	
DRILLING METHOD: 3-1/4" HSA	**LOGGED BY:** Alfred Futrell	**LATITUDE:** 35.438831 **LONGITUDE:** -89.41075
SAMPLING METHOD: SS	**PROJECT COORDINATE SYSTEM -** NAD 1983 StatePlane Tennessee FIPS 4100 Feet	

DEPTH (feet)	NOTES	Origin/Identifier	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	ELEVATION
65		Marine Soils	SS-15	SILTY SAND (SM), little clay, medium dense, dark gray to brown, fine grained, very moist to wet	N = 17	259
70			SS-16	*little clay*	4-5-9 N = 14	254
75			SS-17	SANDY SILT (ML), hard, gray pink, fine to medium grained, wet	18-18-20 N = 38	249
80			SS-18		28-32-36 N = 68	244
85			SS-19		30-36-40 N = 76	239
90			SS-20	Borehole terminated at 90.0 feet	20-27-28 N = 55	234
95						229



GROUNDWATER		DATE/TIME	DEPTH (FT)	REMARKS
ATD	▽	01/05/2022	59.0	interpretation
END OF DRILLING	▼			
AFTER DRILLING	▼			
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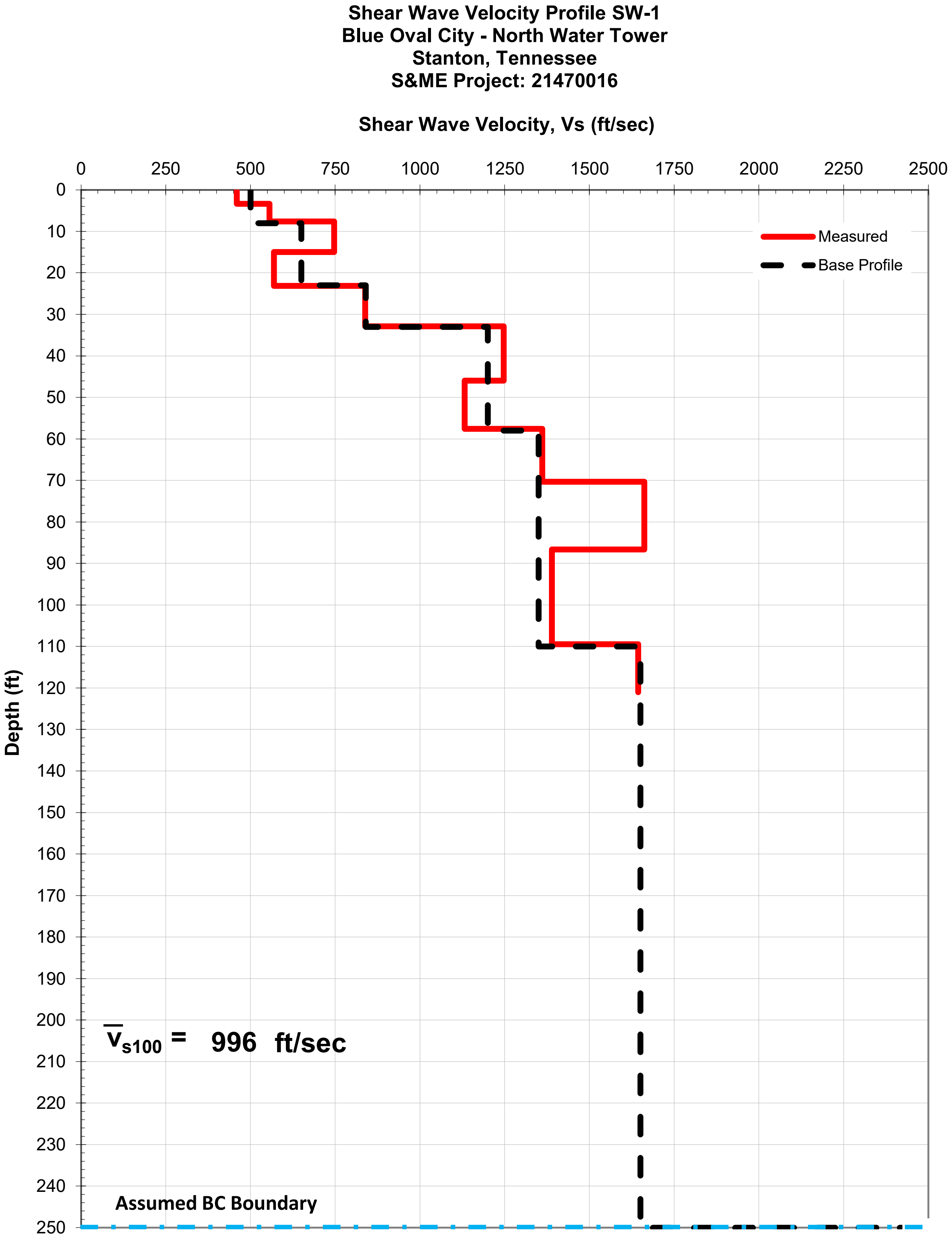
HC = Hole Cave, AR = Auger Refusal



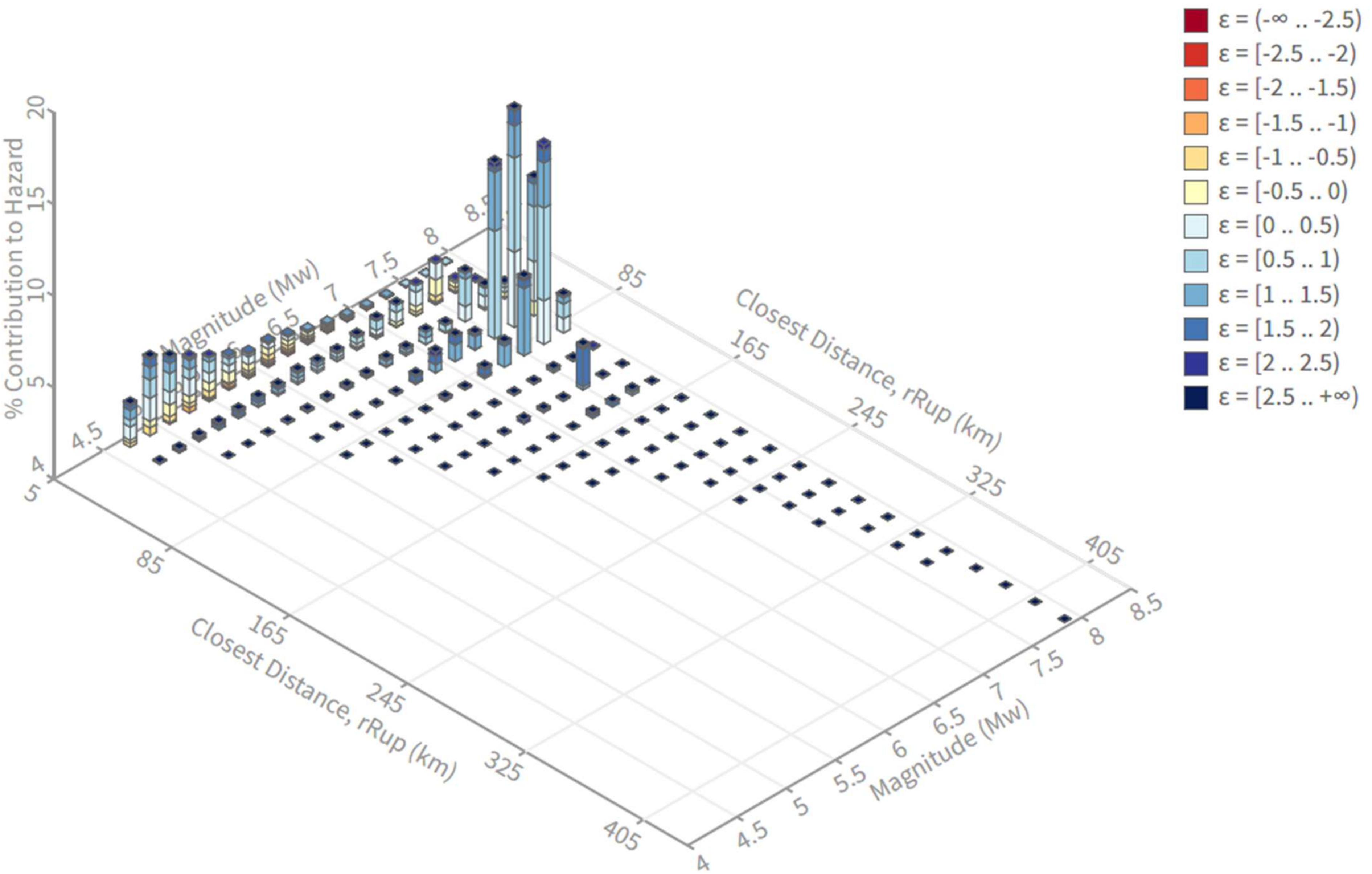
SHEAR WAVE VELOCITY PROFILES

BLUE OVAL CITY – NORTH WATER TOWER
STANTON, TENNESSEE

DATE:
1-24-2022

PROJECT NUMBER
21470016

FIGURE NO.
3



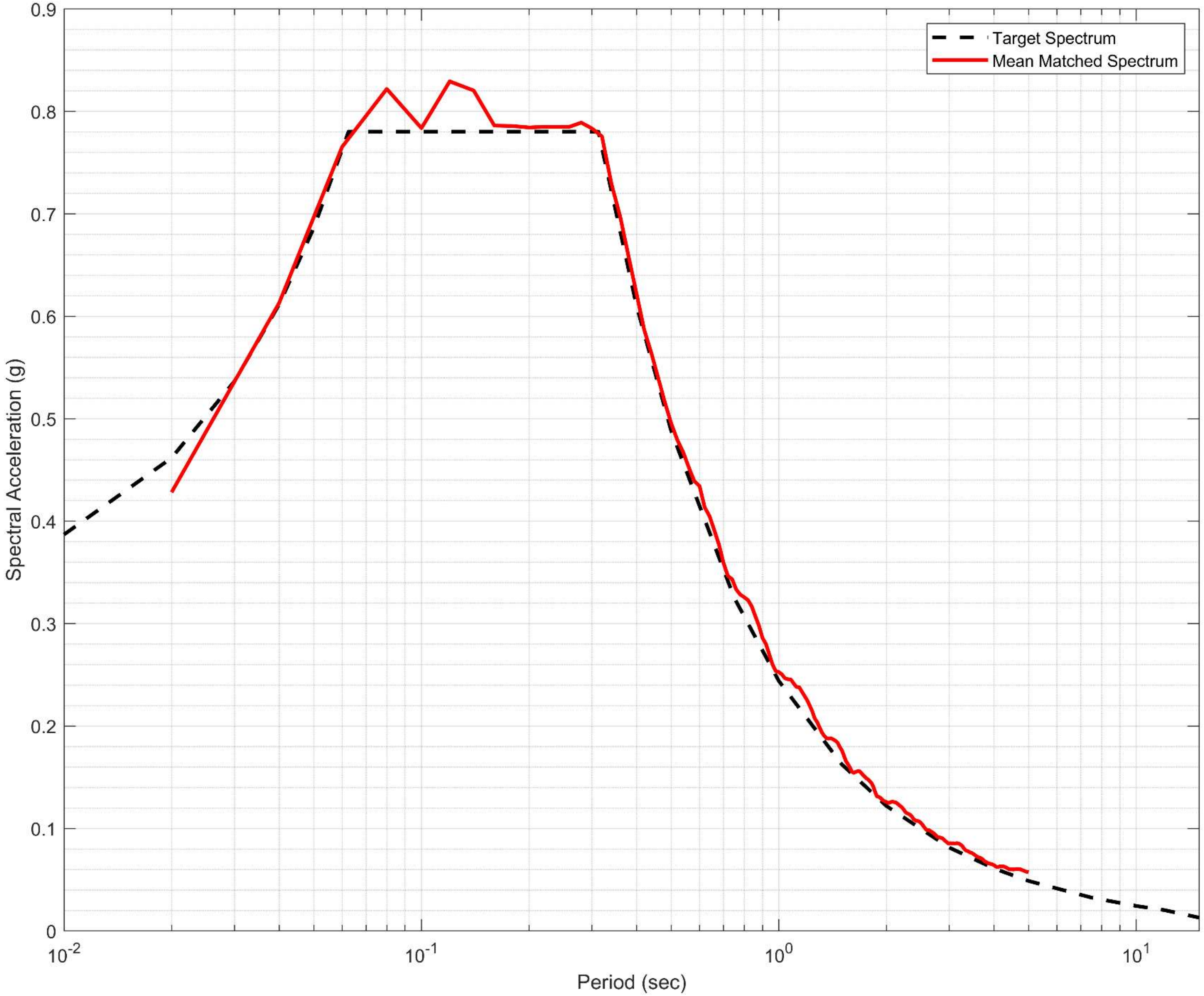
SEISMIC HAZARD DEAGGREGATION, PEAK GROUND ACCELERATION

BLUE OVAL CITY – NORTH WATER TOWER
STANTON, TENNESSEE

DATE:
1-24-2022

PROJECT NUMBER
21470016

FIGURE NO.
4



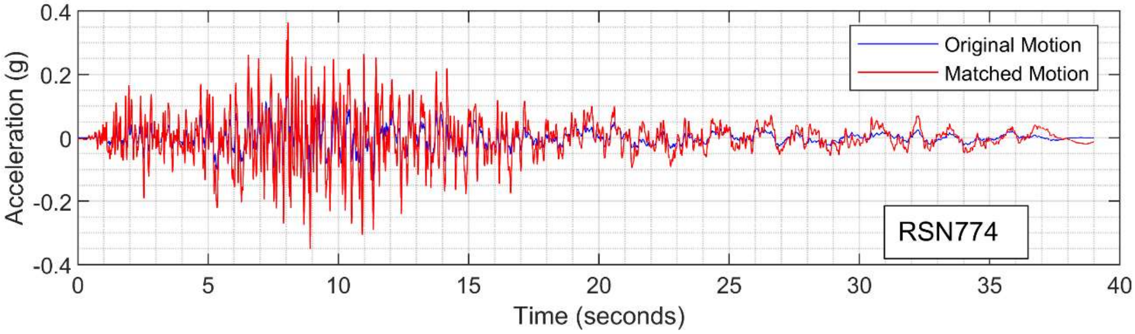
SPECTRALLY MATCHED RECORDED MOTIONS
B/C BOUNDARY

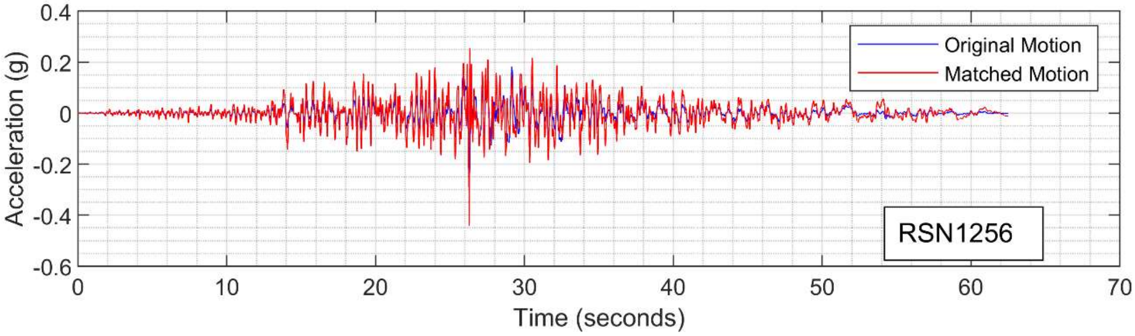
BLUE OVAL CITY – NORTH WATER TOWER
STANTON, TENNESSEE

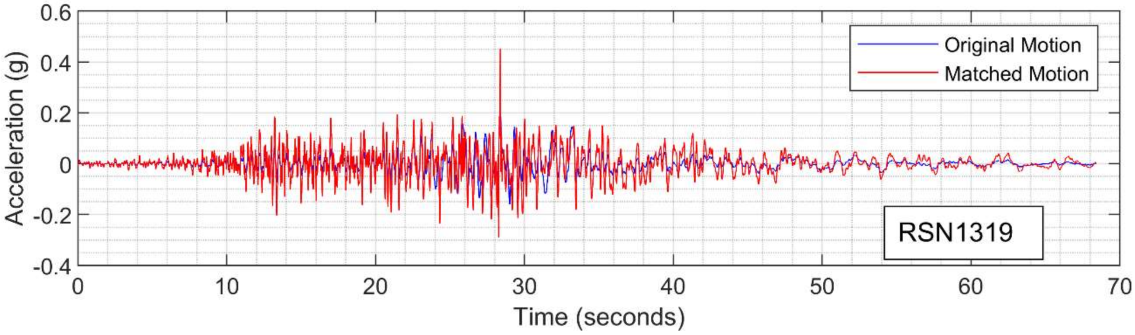
DATE:
1-24-2022

PROJECT NUMBER
21470016

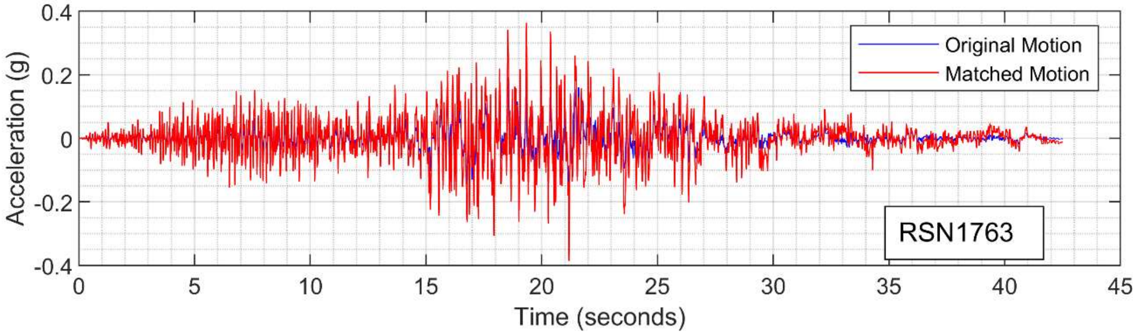
FIGURE NO.
5

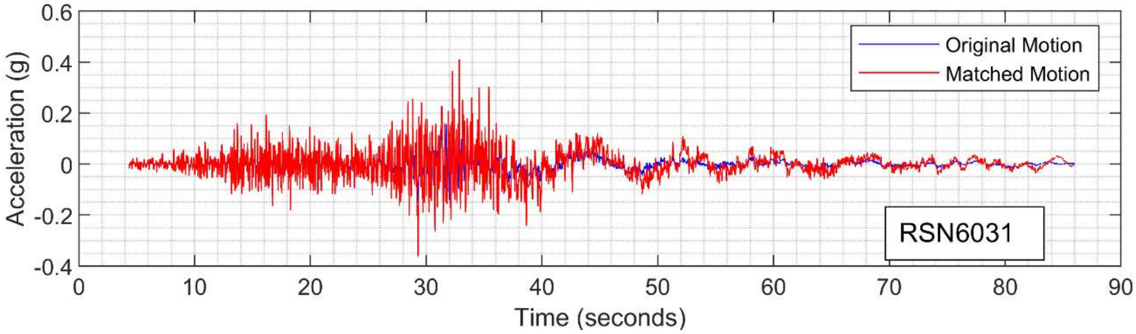


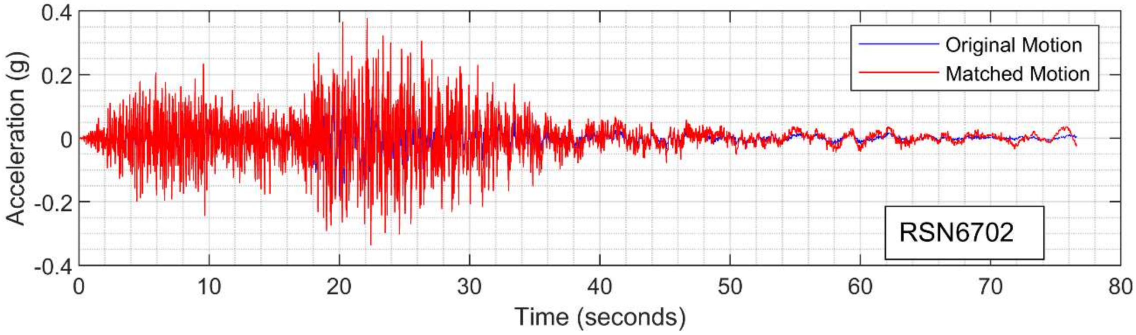




S&ME	**SPECTRALLY MATCHED ACCELERATION TIME HISTORIES**	DATE: 1-24-2022	FIGURE NO. 6
	BLUE OVAL CITY – NORTH WATER TOWER STANTON, TENNESSEE	PROJECT NUMBER 21470016	







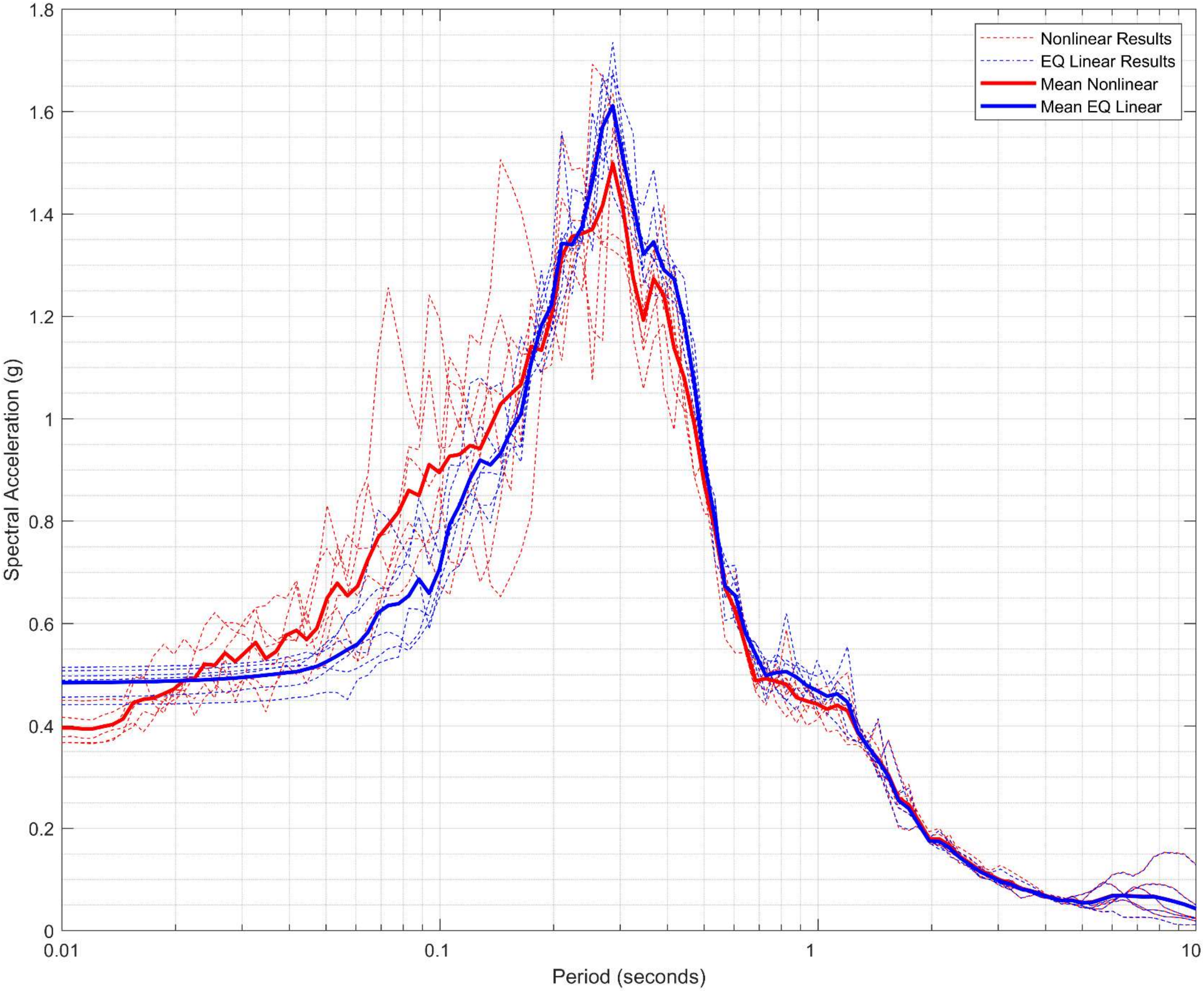
SPECTRALLY MATCHED ACCELERATION TIME HISTORIES

BLUE OVAL CITY – NORTH WATER TOWER
STANTON, TENNESSEE

DATE:
1-24-2022

PROJECT NUMBER
21470016

FIGURE NO.
7



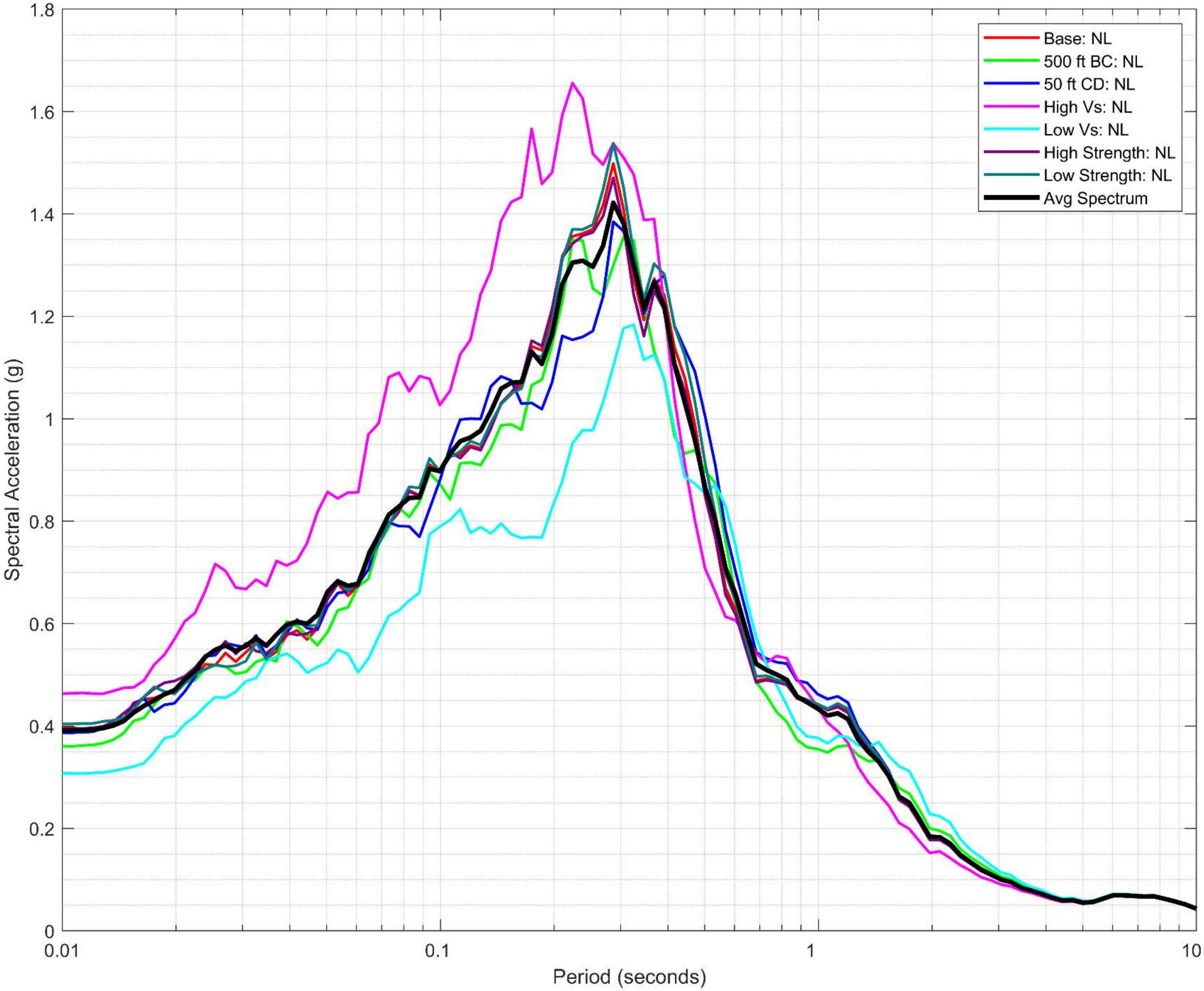
SURFACE RESPONSE SPECTRUM – BASE PROFILE
1% PROBABILTY OF STRUCTURAL COLLAPSE IN 50 YEARS, 5% DAMPING

FORD BLUE OVAL CITY
STANTON, TENNESSEE

DATE:
1-24-2022

PROJECT NUMBER
21470016

FIGURE NO.
8



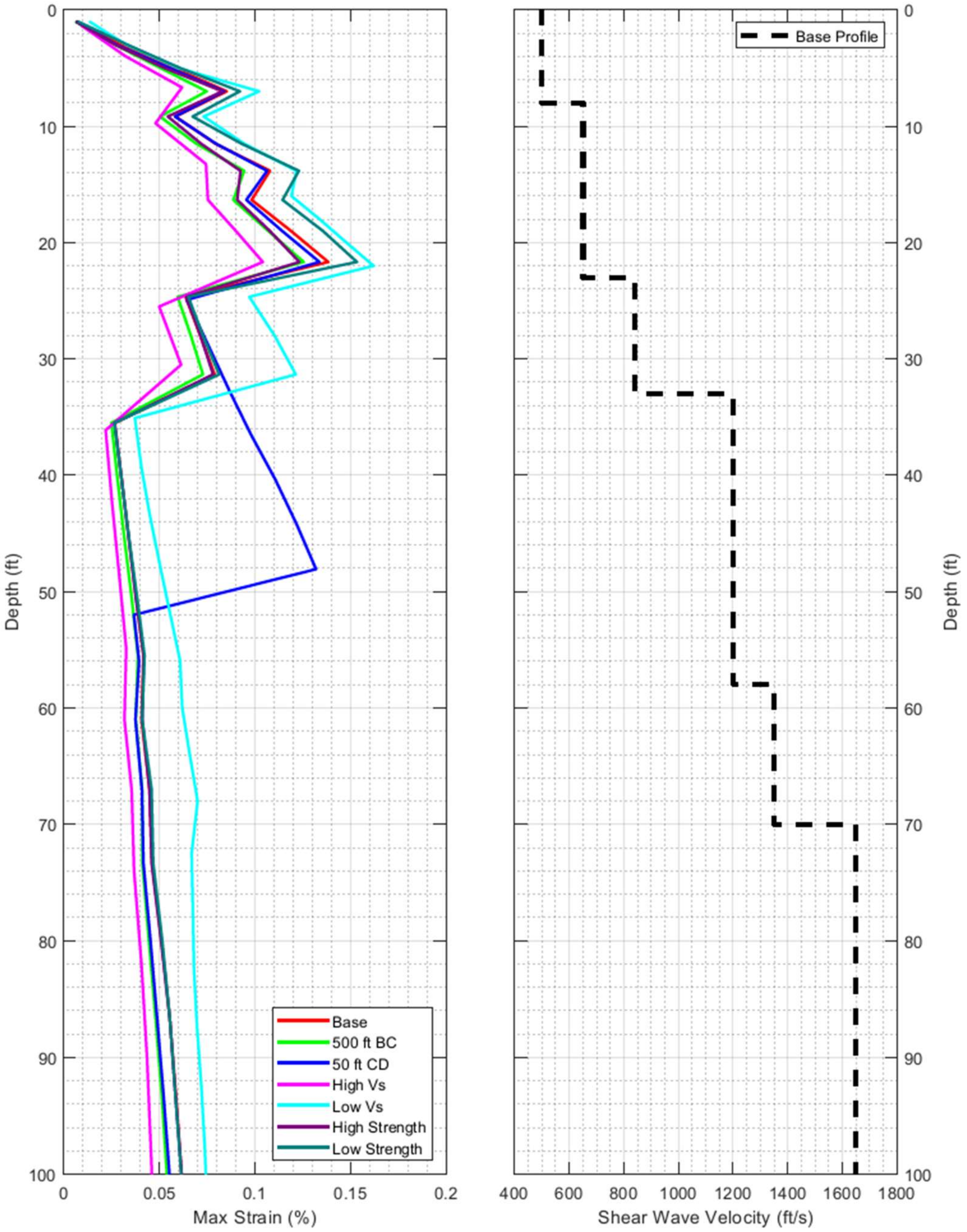
SURFACE AVERAGE RESPONSE SPECTRA
1% PROBABILTY OF STRUCTURAL COLLAPSE IN 50 YEARS, 5% DAMPING

BLUE OVAL CITY – NORTH WATER TOWER
STANTON, TENNESSEE

DATE:
1-24-2022

PROJECT NUMBER
21470016

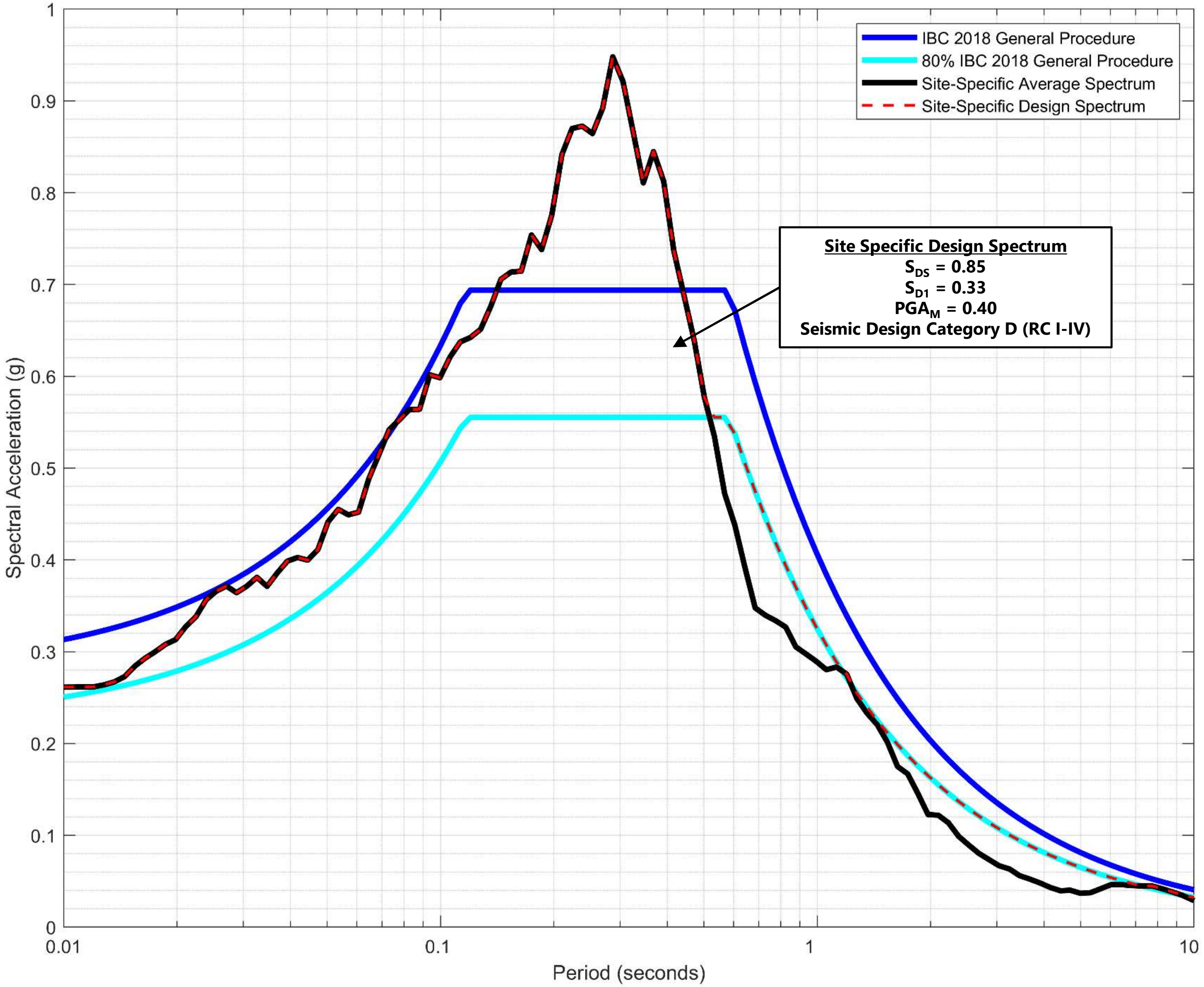
FIGURE NO.
9



MAXIMUM STRAIN VERSUS DEPTH

BLUE OVAL CITY – NORTH WATER TOWER
STANTON, TENNESSEE

DATE:	1-24-2022
PROJECT NUMBER	21470016
FIGURE NO.	10



Site Specific Design Spectrum
S_{DS} = 0.85
S_{D1} = 0.33
PGA_M = 0.40
Seismic Design Category D (RC I-IV)

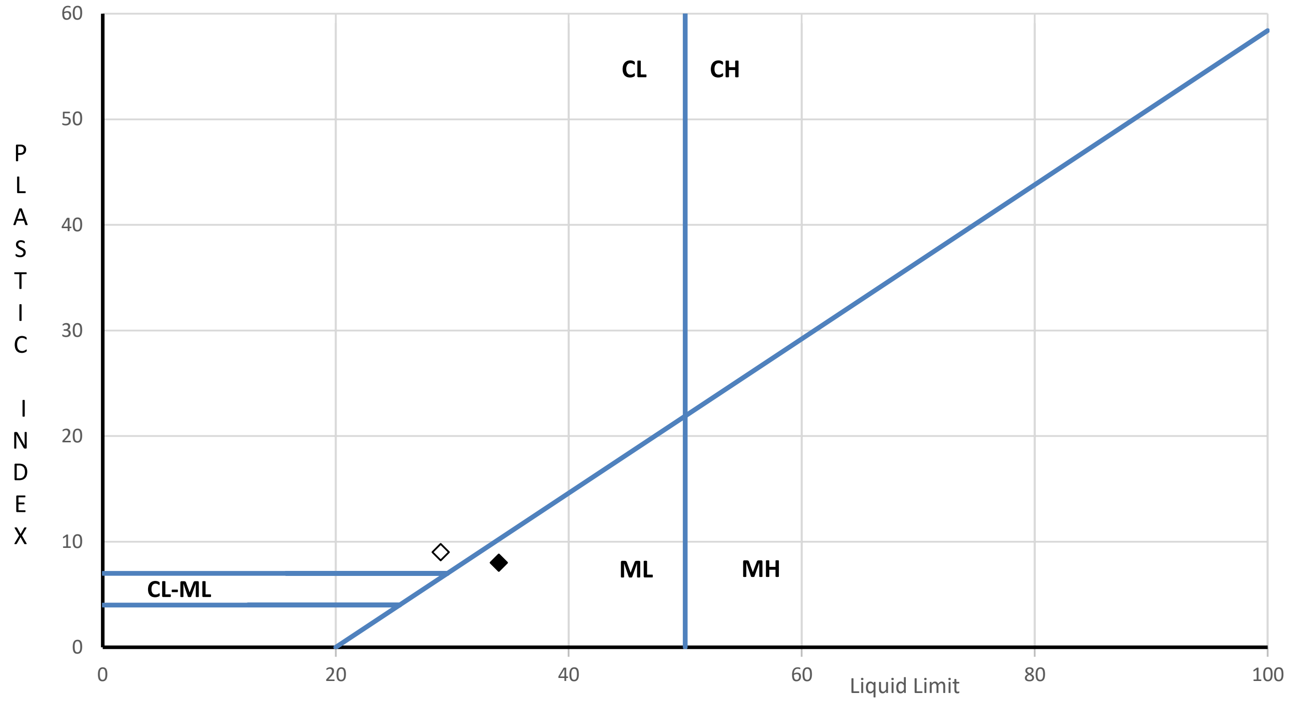
DESIGN ACCLERATION RESPONSE SPECTRA AT GROUND SURFACE
1% PROBABILTY OF STRUCTURAL COLLAPSE IN 50 YEARS, 5% DAMPING

BLUE OVAL CITY – NORTH WATER TOWER
STANTON, TENNESSEE

DATE:
1-24-2022

PROJECT NUMBER
21470016

FIGURE NO.
11



Specimen Identification				MC	LL	PL	PI	Fines	Classification (symbol is based on minus 40 material only when no grain size information is present.)	
	ID	No.	Top Depth						Symbol	Name
	B-02	**SS-10**	**38.5**	**37.1**						
◆	**B-02**	**SS-12**	**48.5**	**28.2**	**34**	**26**	**8**		**ML**	
	B-02	**SS-14**	**58.5**	**20.6**						
	B-02	**SS-16**	**68.5**	**23.4**				**65.3**		**SANDY SILT**
	B-02	**SS-18**	**78.5**	**19.7**				**11.6**		**POORLY GRADED SAND WITH SILT**
	B-02	**SS-2**	**1.5**	**31.1**						
	B-02	**SS-20**	**88.5**	**19.2**						
◇	**B-02**	**SS-4**	**8.5**	**24.4**	**29**	**20**	**9**		**CL**	
	B-02	**SS-6**	**18.5**	**24.3**						
	B-02	**SS-8**	**28.5**	**31.7**						

INDEX TEST RESULTS

Project Name	Blue Oval City - North Water Tower
Project Number	21470016

Approved by	Date
Ben Fesmire	1/28/2022 8:58

Report No.
Report Date

Important Information About Your
Geotechnical Engineering Report

Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.

Geotechnical Findings Are Professional Opinions

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

Scope of Geotechnical Services

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

Services Are Performed for Specific Projects

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project. Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

Geo-Environmental Issues

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

Geotechnical Recommendations Are Not Final

Recommendations are developed based on the geotechnical engineer’s understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.

Portion obtained with permission from “Important Information About Your Geotechnical Engineering Report”, ASFE, 2004

APPENDIX F

Appendix F

- TN Megasite Liquid Level Notes and assumptions
- Pump Data and curves provided by WILO for pumps.
- Well Pump Operation overview
- Phase 1 Operation: Blue Oval - 4.3 MGD Flow
- Future Scenario: Flows from Blue Oval and East Tenant (Handy) total flow 6.3 MGD

TN Megasite Liquid Level Notes and assumptions

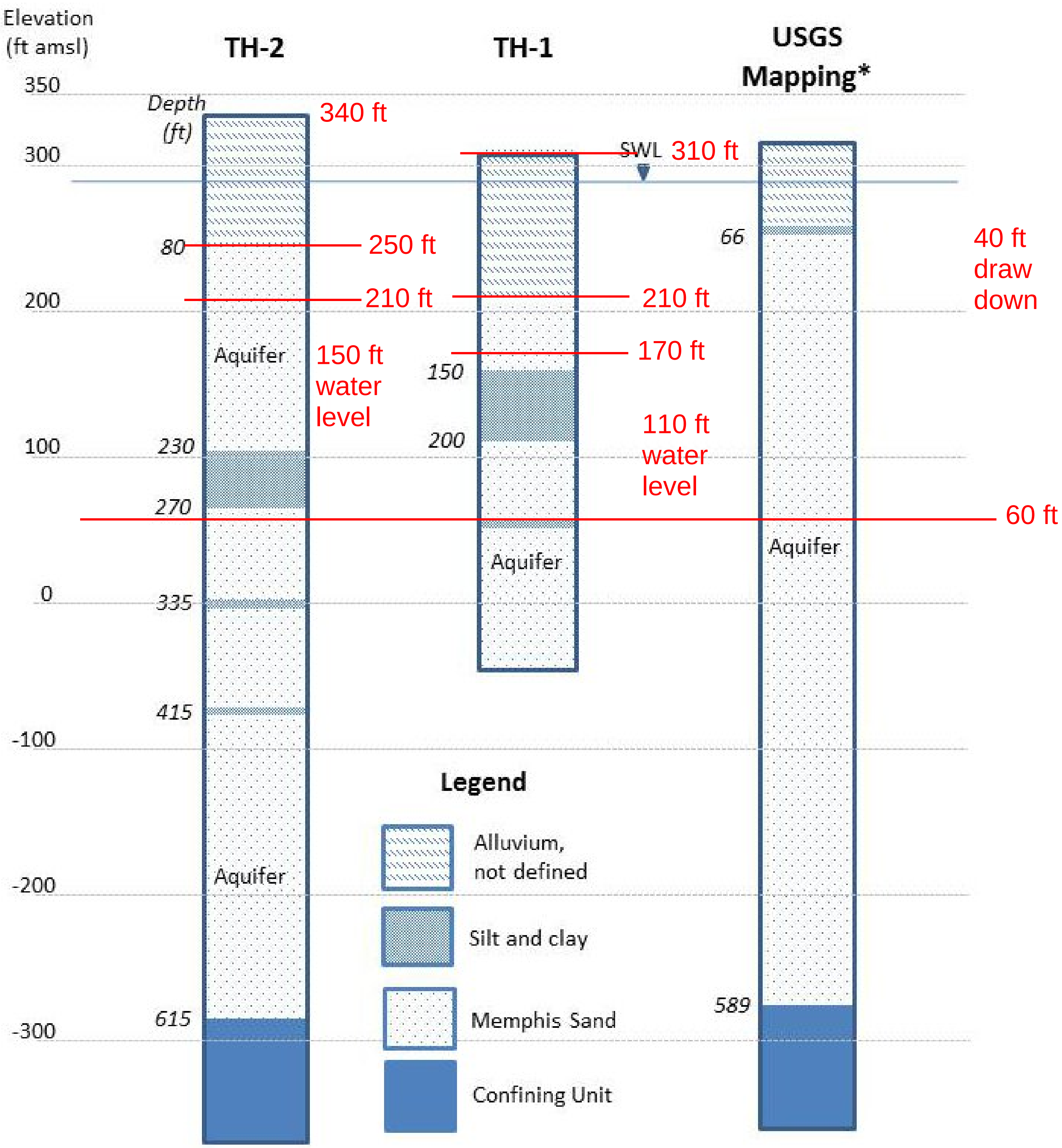


Figure 4. Aquifer configuration and thickness of three data points at the Megasite (*Jackson, 2012).

3.4. GROUNDWATER MOVEMENT AND BOUNDARIES

A USGS groundwater level contour map shows the water generally flows toward, then parallel to the Mississippi River towards the south, except where influenced by large pumping centers (Schrader, TN Megasite – WILO pump data and pump curves

Customer :
Reference :

Pump Performance Datasheet

Wilo Quotation System 22.2.2

Item number : 001
Service :
Quantity : 1
Quote number : 1160793

Size : SPI 10.1200-3
Stages : 3 (0 / 0x / 3x)
Based on curve number : SPI 10.1200-1.400
Article Number :
Date last saved : 29 Jul 2022 2:36 PM

Operating Conditions

Flow, rated : 1,111.0 USgpm
Differential head / pressure, rated (requested) : 241.0 ft
Differential head / pressure, rated (actual) : 260.1 ft
Suction pressure, rated / max : 0.00 / 0.00 psi.g
NPSH available, rated : Ample
Site Supply Frequency : 60 Hz

Performance

Speed criteria : Synchronous
Speed, rated : 3450 rpm
Impeller diameter, rated : 3C
Impeller diameter, maximum : A
Impeller diameter, minimum : C
Efficiency : 80.48 %
PEI (CL) : -
NPSH required / margin required : - / 0.00 ft
Ns (imp. eye flow) / Nss (imp. eye flow) : 3,378 / - US Units
MCSF : 360.0 USgpm
Head, maximum, rated diameter : 445.3 ft
Head rise to shutoff : 71.21 %
Flow, best eff. point : 1,049.5 USgpm
Flow ratio, rated / BEP : 105.86 %
Diameter ratio (rated / max) : 100.00 %
Head ratio (rated dia / max dia) : 75.25 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010] : 1.00 / 1.00 / 1.00 / 1.00
Selection status : Acceptable

Liquid

Liquid type : Water
Additional liquid description :
Solids Diameter, required / pump max : 0.00 in / 0.00 in
Solids concentration, by volume : 0.00 %
Temperature, max : 68.00 deg F
Fluid density, rated / max : 1.000 / 1.000 SG
Viscosity, rated : 1.00 cP
Vapor pressure, rated : 0.34 psi.a

Material

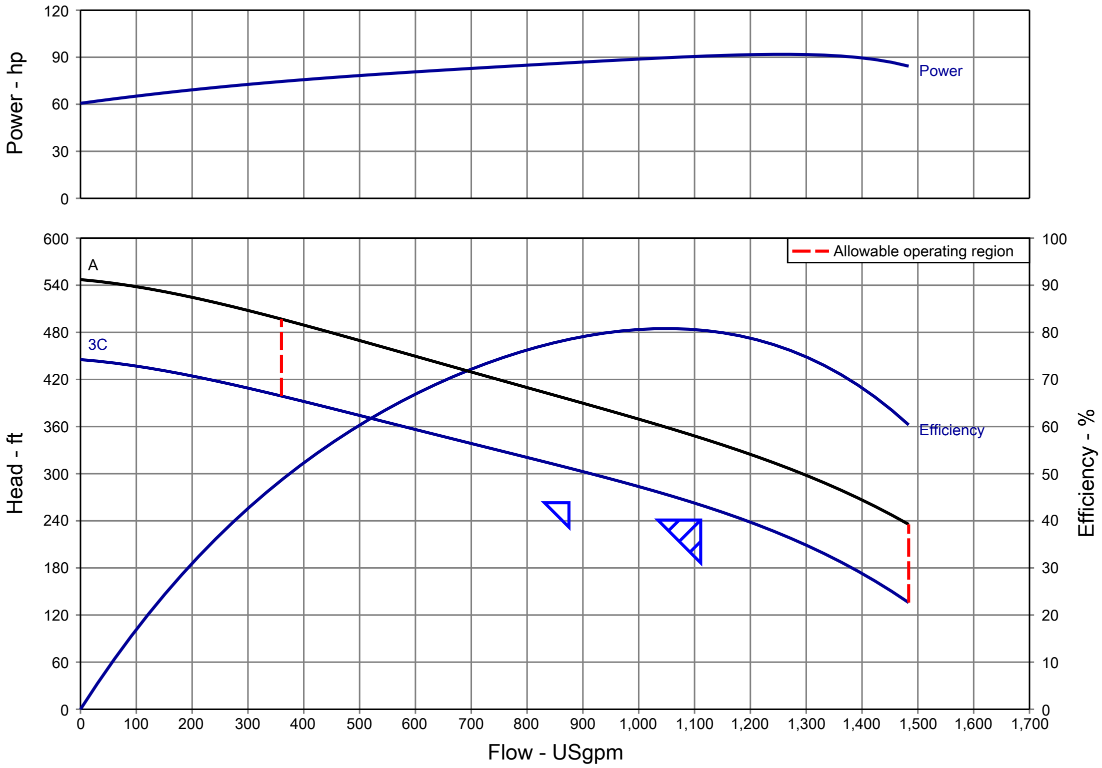
Material selected : Standard

Pressure Data

Maximum working pressure : 192.7 psi.g
Maximum allowable working pressure : N/A
Maximum allowable suction pressure : N/A
Hydrostatic test pressure : N/A

Driver & Power Data (@Max density)

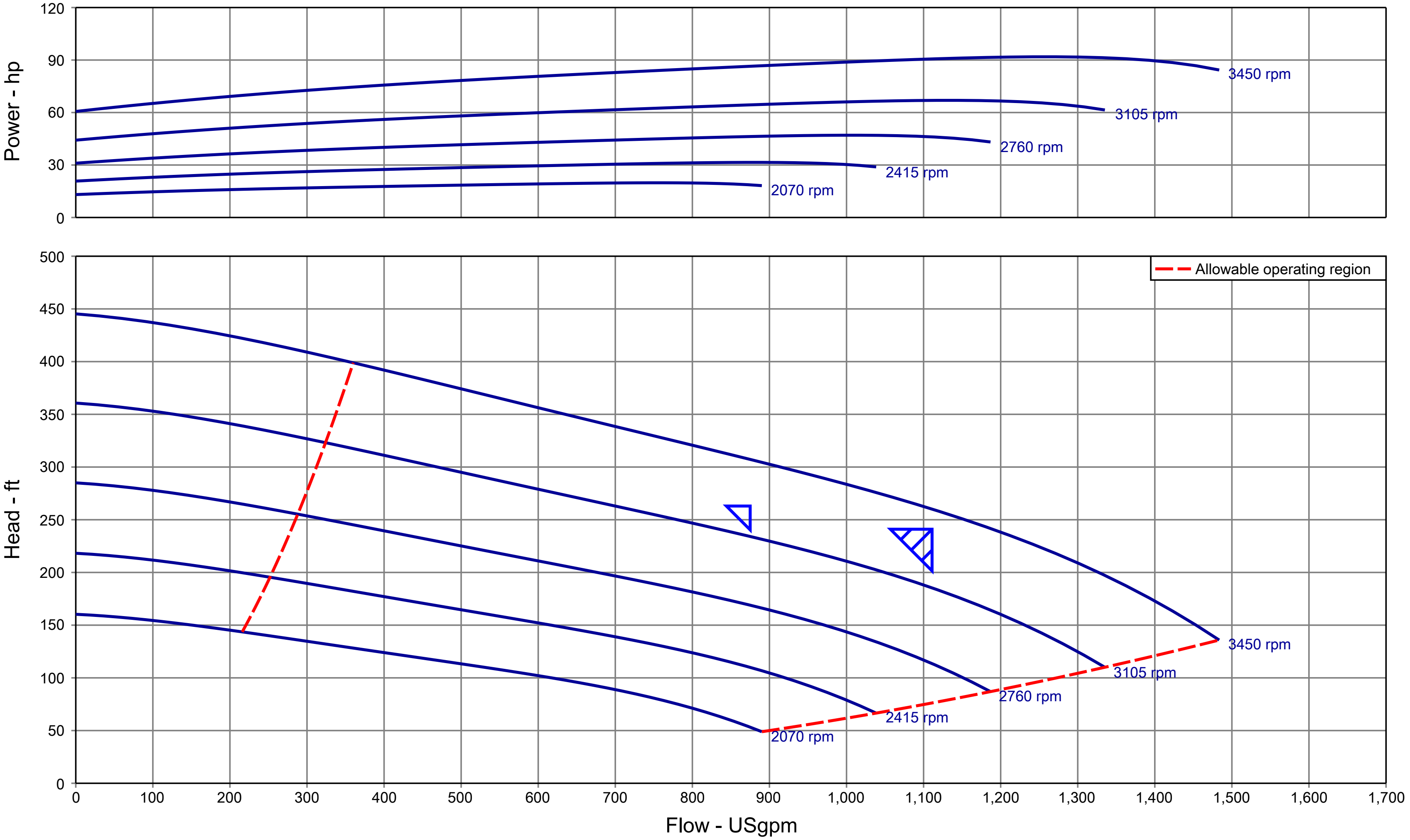
Driver sizing specification : Maximum power
Margin over specification : 0.00 %
Service factor : 1.00
Power, hydraulic : 72.95 hp
Power, rated : 90.64 hp
Power, maximum, rated diameter : 91.87 hp
Minimum recommended motor rating : 100 hp / 74.57 kW



Customer :
Reference :

Multi-Speed Performance Curve

Wilo Quotation System 22.2.2



Item number	: 001	Size	: SPI 10.1200-3	Flow, rated	: 1,111.0 USgpm
Service	:	Stages	: 3 (0 / 0x / 3x)	Differential head / pressure, rated	: 241.0 ft
Quantity	: 1	Efficiency	: 80.48 %	Speed, rated	: 3450 rpm
Quote number	: 1160793	PEI (VL)	: -	Impeller diameter, rated	: 6.83 in
Based on curve number	: SPI 10.1200-1.400	Power, rated	: 90.64 hp	Fluid density, rated / max	: 1.000 / 1.000 SG
		NPSH required	: -	Viscosity	: 1.00 cP
Basic model number	: -	Site Supply Frequency	: 60 Hz	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Date last saved	: 29 Jul 2022 2:36 PM	Nominal speed	: 3500 rpm		

Customer :
Reference :

Pump Performance - Additional Data

Wilo Quotation System 22.2.2

Item number	: 001	Size	: SPI 10.1200-3
Service	:	Stages	: 3 (0 / 0x / 3x)
Quantity	: 1	Speed	: 3450 rpm
Quote number	: 1160793	Article Number	:
		Date last saved	: 29 Jul 2022 4:16 PM

Performance Data

Head, maximum diameter, rated flow	: 345.6 ft
Head, minimum diameter, rated flow	: 260.1 ft
Head max.	: 445.3 ft
Efficiency adjustment factor, total	: 1.00
Power adjustment, total	: 0.00 hp
Head adjustment factor, total	: 1.00
Flow adjustment factor, total	: 1.00
NPSHR adjustment factor, total	: 1.00
NPSH margin dictated by pump supplier	: 0.00 ft
NPSH margin dictated by user	: 0.00 ft
NPSH margin used (added to 'required' values)	: 0.00 ft

Mechanical Limits

Torque, rated power, rated speed	: 2.63 hp/100 rpm
Torque, maximum power, rated speed	: 2.66 hp/100 rpm
Torque, driver power, full load speed	: 2.86 hp/100 rpm
Torque, driver power, rated speed	: 2.86 hp/100 rpm
Torque, pump shaft limit	: -
Radial load, worst case	: -
Radial load limit	: -
Impeller peripheral speed, rated	: -
Impeller peripheral speed limit	: -

Stage, Speed and Solids Limits

Stages, maximum	: 6
Stages, minimum	: 1
Pump speed limit, maximum	: 3600 rpm
Pump speed limit, minimum	: 1800 rpm
Curve speed limit, maximum	: 3500 rpm
Curve speed limit, minimum	: 1800 rpm
Variable speed limit, maximum	: 3500 rpm
Variable speed limit, minimum	: -
Solids size limit	: 0.00 in

Energy Indexes

Bare pump model number	: SPI 10.1200-3
Basic model number	: -
PEI CL/VL	: - / -
ER CL/VL	: - / -

Typical Driver Data

Driver speed, full load	: 3500 rpm
Driver speed, rated load	: 3509 rpm
Driver efficiency, 100% load	: N/A
Driver efficiency, 75% load	: N/A
Driver efficiency, 50% load	: N/A

Various Performance Data	Flow (USgpm)	Head (ft)	Efficiency (%)	NPSHr (ft)	Power (hp)
Shutoff, rated	0.00	445.3	-	-	60.63
Shutoff, maximum	0.00	547.2	-	-	81.38
MCSF	360.0	398.9	48.64	-	74.53
Rated flow, minimum	1,111.0	260.1	80.48	-	90.64
Rated flow, maximum	1,111.0	345.6	80.00	-	121
BEP flow, rated	1,049.5	273.5	80.80	-	89.69
120% rated flow, rated	1,333.2	197.9	72.92	-	91.34
End of curve, rated	1,483.6	135.9	60.36	-	84.31
End of curve, minimum	1,483.6	135.9	60.36	-	84.31
End of curve, maximum	1,483.6	235.5	73.34	-	120
Maximum value, rated	-	445.3	80.80	-	91.87
Maximum value, maximum	-	-	79.57	-	124

System differential pressure	@ Density, rated	@ Density, max
Differential pressure, rated flow, rated (psi)	112.6	112.6
Differential pressure, shutoff, rated (psi)	192.7	192.7
Differential pressure, shutoff, maximum (psi)	236.8	236.8

Discharge pressure	@ Suction pressure, rated	@ Suction pressure, max	@ Suction pressure, rated	@ Suction pressure, max
Discharge pressure, rated flow, rated (psi.g)	112.6	112.6	112.6	112.6
Discharge pressure, shutoff, rated (psi.g)	192.7	192.7	192.7	192.7
Discharge pressure, shutoff, maximum (psi.g)	236.8	236.8	236.8	236.8

Ratios

Maximum flow / rated flow, rated	: 133.53 %	Head rated diameter / head minimum diameter, rated flow	: 100.00 %

Wilo-TWI, SPI, TWU

All NSF Certified

Drinking Water
NSF / ANSI 61

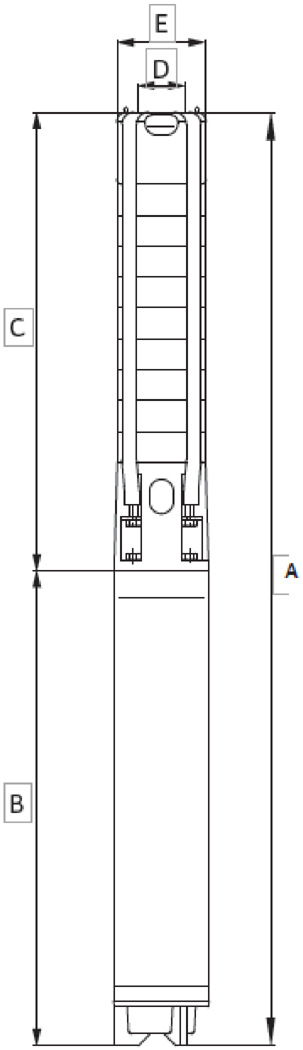
Certified to
NSF/ANSI 61 & 372

Dimensional Drawing

10”

Weights and Dimensions

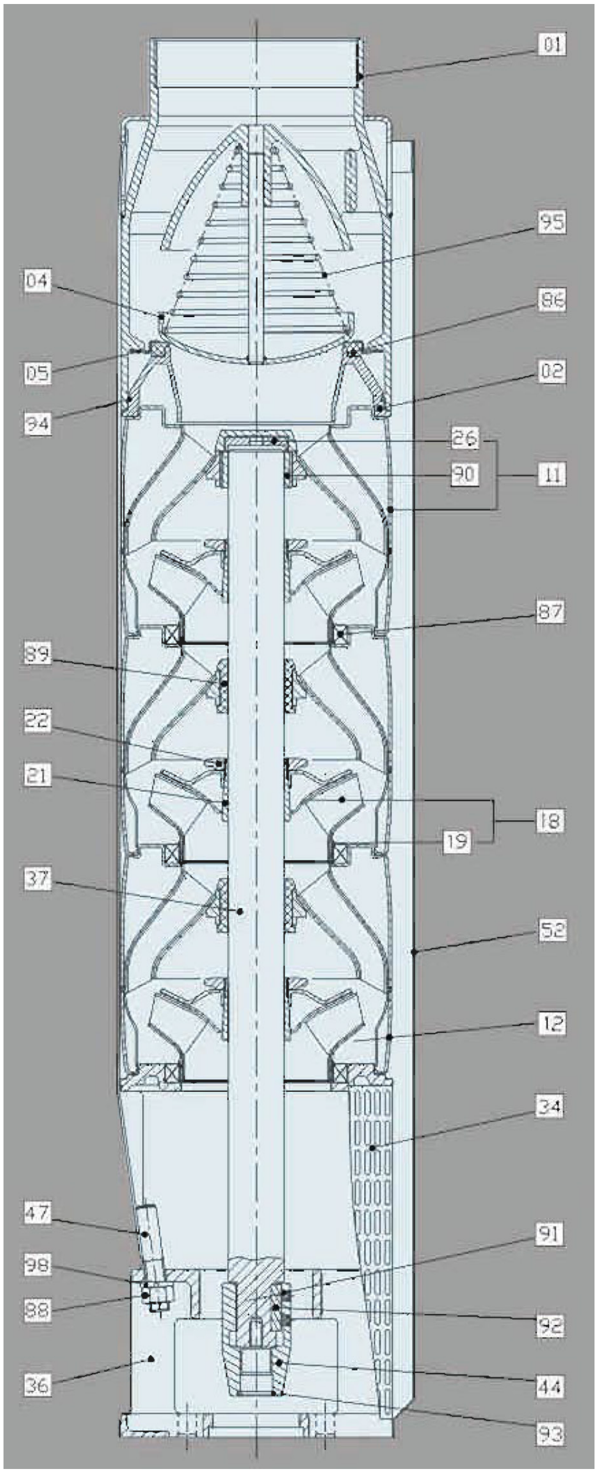
1200 GPM								
	Dimensions (In.)					Weights (Lbs.)		
Model	A	B	C	D	E	Complete Unit	Pump End	Motor
SPI 10.1200-03	105.6	54.7	45.2	6	7.6	564	146	418



Certified to NSF/ANSI 61 & 372

General Material Data

10”



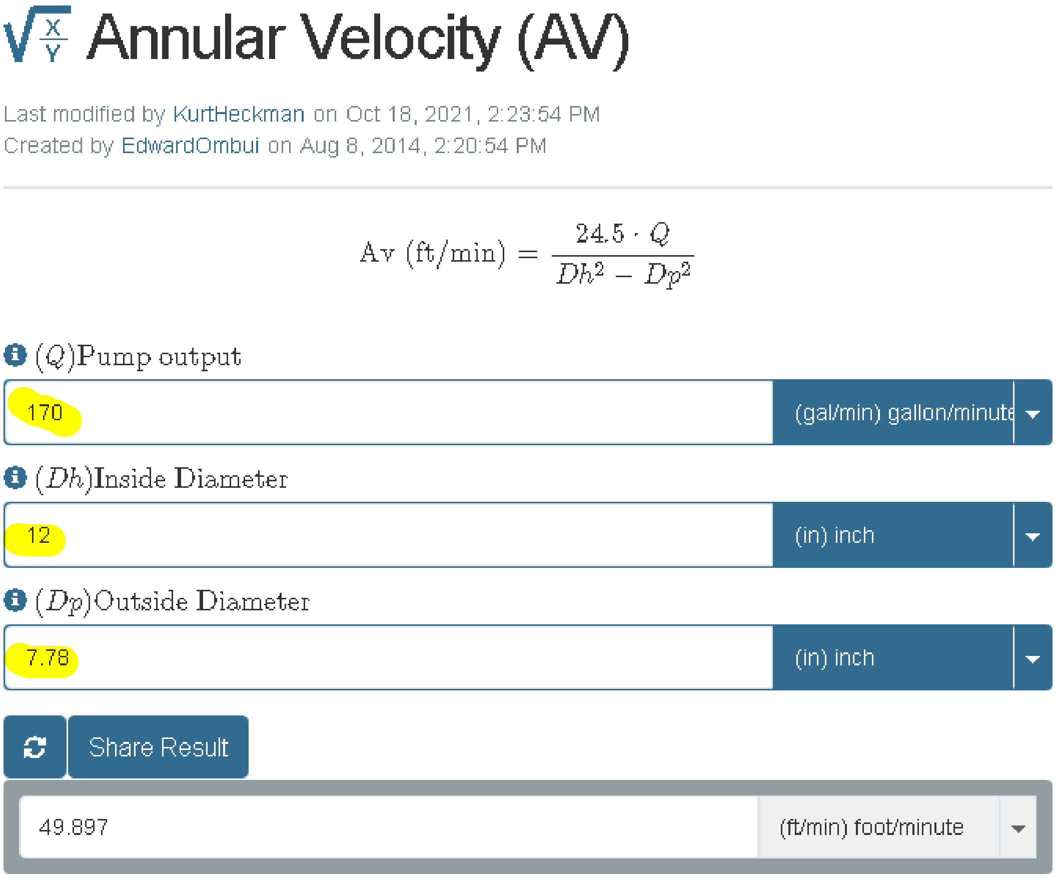
Pos.	Components	Material	Standard
01	Discharge	Stainless Steel	304
02	Lower Valve Seat Retainer	Stainless Steel	304
04	Valve Cup	Stainless Steel	304
05	Upper Valve Seat Retainer	Stainless Steel	304
11	Upper Diffuser	Stainless Steel	304
+26	Spacing Washer For Stop Ring	Carbon Fiber +MoS2+PTFE	
+90	Upper Bearing	SUS304+NBR	
12	Diffuser	Stainless Steel	304
18	Impeller	Stainless Steel	304
18	Impeller – A	Stainless Steel	304
+19	Ring of Impeller	Stainless Steel	304
21	Split Cone	Stainless Steel	304
22	Split Cone Nut	Stainless Steel	304
34	Strainer – one lead	Stainless Steel	304
34	Strainer – two leads	Stainless Steel	304
36	Suction Interconnector – 6”	Stainless Steel	304
36	Suction Interconnector – 8”	Stainless Steel	304
37	Shaft	Stainless Steel	431
44	Coupling – 6”	Stainless Steel	304
44	Coupling – 8”	Stainless Steel	304
47	Strap	Stainless Steel	304
52	Cable Guard	Stainless Steel	304
86	Valve Seat	NBR	70
87	Neck Ring	PPS+NBR	
88	Nut	Stainless Steel	304
89	Bearing	NBR	70
91	Screw – 6”	Stainless Steel	304
91	Screw – 8”	Stainless Steel	304
92	Key – 6”	Stainless Steel	304
92	Key – 8”	Stainless Steel	304
93	O-Ring – 6”	NBR	70
93	O-Ring – 8”	NBR	70
94	O-Ring	NBR	70
95	Spring	Stainless Steel	304
98	Spring Washer	Stainless Steel	304

*AISI 316 Stainless Steel Pumps are available on request.

8” Motor Data

8” R Series Motors

HP	kW	PH (~)	Voltage	FL Amps	SF Amps	Cos Φ	Eff.	Article Number
100	75	3	460	123.1	141.6	0.9	85%	2761167



Annular Velocity (AV)

Last modified by KurtHeckman on Oct 18, 2021, 2:23:54 PM
Created by EdwardOmbui on Aug 8, 2014, 2:20:54 PM

$$\text{Av (ft/min)} = \frac{24.5 \cdot Q}{Dh^2 - Dp^2}$$

(Q)Pump output: 170 (gal/min) gallon/minute

(Dh)Inside Diameter: 12 (in) inch

(Dp)Outside Diameter: 7.78 (in) inch

49.897 (ft/min) foot/minute

Minimum GPM to maintain motor cooling. 12" ID steel casing and 7.78" OD motor

Wire Sizing – 75°C

6”-7”-8”-10“ 3~ 60 Hz

Motor Rating		Copper Wire Size												
Voltage	**HP**	**14**	**12**	**10**	**8**	**6**	**4**	**2**	**0**	**00**	**000**	**0000**	**250**	**350**
208	5		170'	280'	440'	690'	1080'	1660'	2490'					
	7½			200	310	490	770	1180	1770	2170'	2600'			
	10				230	370	570	880	1330	1640	1970			
	15					250	390	600	910	1110	1340			
	10						300	460	700	860	1050	1270'		
	25							370	570	700	840	1030		
	30							310	470	580	700	850		
230	5		230'	370'	590'	920'	1430'	2190'						
	7½			260	420	650	1020	1560	2340'	2870'				
	10				310	490	760	1170	1760	2160	2610'			
	15					330	520	800	1200	1470	1780			
	10						400	610	930	1140	1380	1450'		
	25						320	500	750	920	1120	1170		
	30							410	620	760	930	970		
460	5	590'	950'	1500'	2360'	3700'	5750'							
	7½	420	680	1070	1690	2640	4100	6260'						
	10	310	500	790	1250	1960	3050	4680						
	15			540	850	1340	2090	3200	4810'					
	10			410	650	1030	1610	2470	3730					
	25				530	830	1300	1990	3010	3700'				
	30				430	680	1070	1640	2490	3060	3700'			
	40						790	1210	1830	2250	2710	3290'	3730'	
	50						640	980	1480	1810	2190	2650	3010	3830'
	60							830	1250	1540	1850	2240	2540	3240
	75								1030	1260	1520	1850	2100	2700
	100									940	1130	1380	1560	2010
	125										890	1000	1220	1560
	150												1050	1340
	200													1030
	250													990

Well Pump Operation overview

Seven (7) wells are located along the north edge of the Memphis Regional Megasite. The seven wells are spaced at 1000 feet apart as recommended by the study completed by Layne Hydro.

The water treatment process for the Memphis Regional Megasite is designed to nominal 7.0 MGD. Based upon the hydraulic model, five (5) pumps will operate to produce the intended nominal flow rate. The attached pump data and calculations are provided to denote pump flow from the wells to the aerators. Flow from each pump is denoted on the included curves to indicate flow as an individual pump and with four pumps in operation. The pumps are each run through variable speed drives (VFD's) and will be controlled through flow meters in each pump discharge.

The quantity of well pumps that will operate will be determined by the operating level in the clearwells. Through the monitoring of flows at the flow meters through the PLC it will be possible to determine time periods for general pump operation and also temporarily remove a pump from rotation if preventative maintenance needs to be performed or the unit needs repair. As the level decreases additional pumps will be brought online to maintain adequate volume of water in the clearwells. Inversely as the levels reach higher levels, the quantity of pumps operating can be reduced. It is the intent that pumps in operation will be rotated to ensure all pumps to be used rather than to continually run the same units for a prolonged period of time. Data is compiled to show operation of individual pumps as well as all pumps in operation. Data will be logged for each pump including hours of operation to aid in balancing use if each pump.

Two scenarios hare reviewed for well pump operations. Initial installation for phase 1 build-out as included in the design drawings addresses flows required by Ford (Blue Oval) presently noted at 4.3 MGD for the installation including revision to operations to add a Central Utilities Plant. We have also included scenario for delivering total of 6.3 MGD based upon Blue Oval and future east tenant (Handy). Pump curves also include operating point for single pump operation and all seven pumps running.

The data provided for the well pumps herein includes Pipe-Flo models noting operating points on the selected curves for the specific scenario. It should be noted that the program used allows development of a dynamic system model and as calculations are completed provides the output for the selected option based upon input. The piping system is entered into the program based upon selected pump curve, specific materials of construction, valves, pipe size, length, and elevations that reflect the design drawings, as well as fluid properties.

Phase 1 Operation

Blue Oval - 4.3 MGD Flow

The design flow rate for Phase 1 operation includes the flows for initial tenant, Ford Motor Company also referred to as "Blue Oval". The requested and agreed upon volume is 4.3 MGD, providing an averaged flow rate over 24 hours as 2986 GPM. We anticipate variation in flow for the tenant and have provided ability for well pumps to operate as needed to retain the volume of water in the clearwells. *The well pumps are on VFD's and will direct flow to the aerators as needed based upon clearwell levels.* All seven well pumps are connected to a common header system that directs flow to four aerators located at the water treatment plant.

The included pump scenarios for Phase 1 include output noting the operation of individual pumps to provide a low flow point of less than 1500 GPM as well as include higher anticipated flows. In addition, added options include use of two pump operation and also three or four pumps to retain the clearwell operating levels. We have also included the well pump numbers on the pump curves to better understand the operating points for the individual pumps.

Each selected scenario includes a flow diagram output from Pipe-Flo model, pump data sheet noting the operating point on curves for each pump, and a line list report from the Pipe-Flo model. Selected line-up of pumps can also be identified in the Project information section of the included Flow diagram.

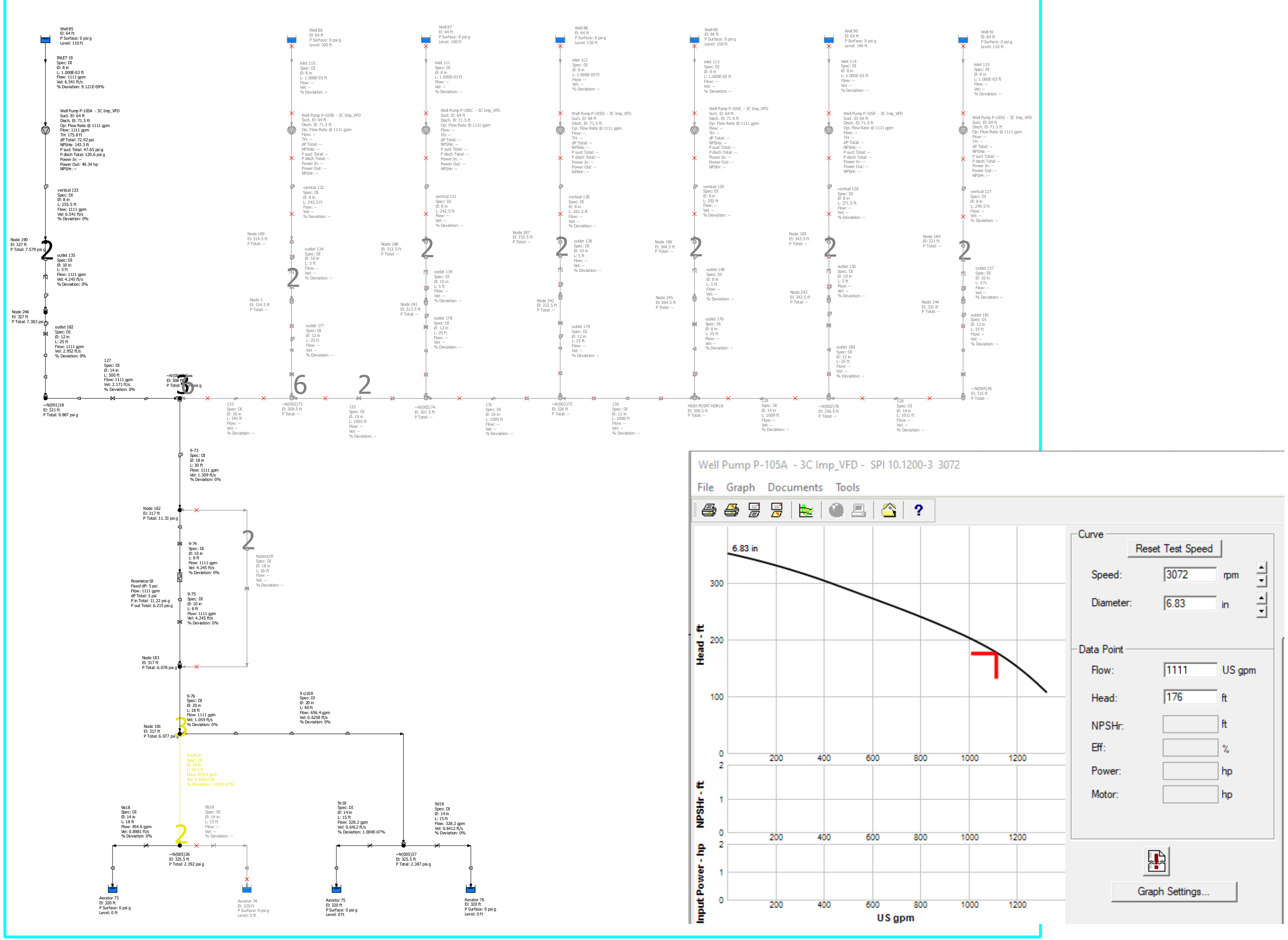
Phase 1 Operation

Blue Oval - 4.3 MGD Flow

Single Pump operation

For view of a Single pump operation, we have included curves for two pumps closest to the water treatment plant, pumps P-105A and P-105B.

14" PIPE - 3 stage pumps



Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3072

Curve

Speed: 3072 rpm

Diameter: 6.83 in

Data Point

Flow: 1111 US gpm

Head: 176 ft

NPSHr: ft

Eff: %

Power: hp

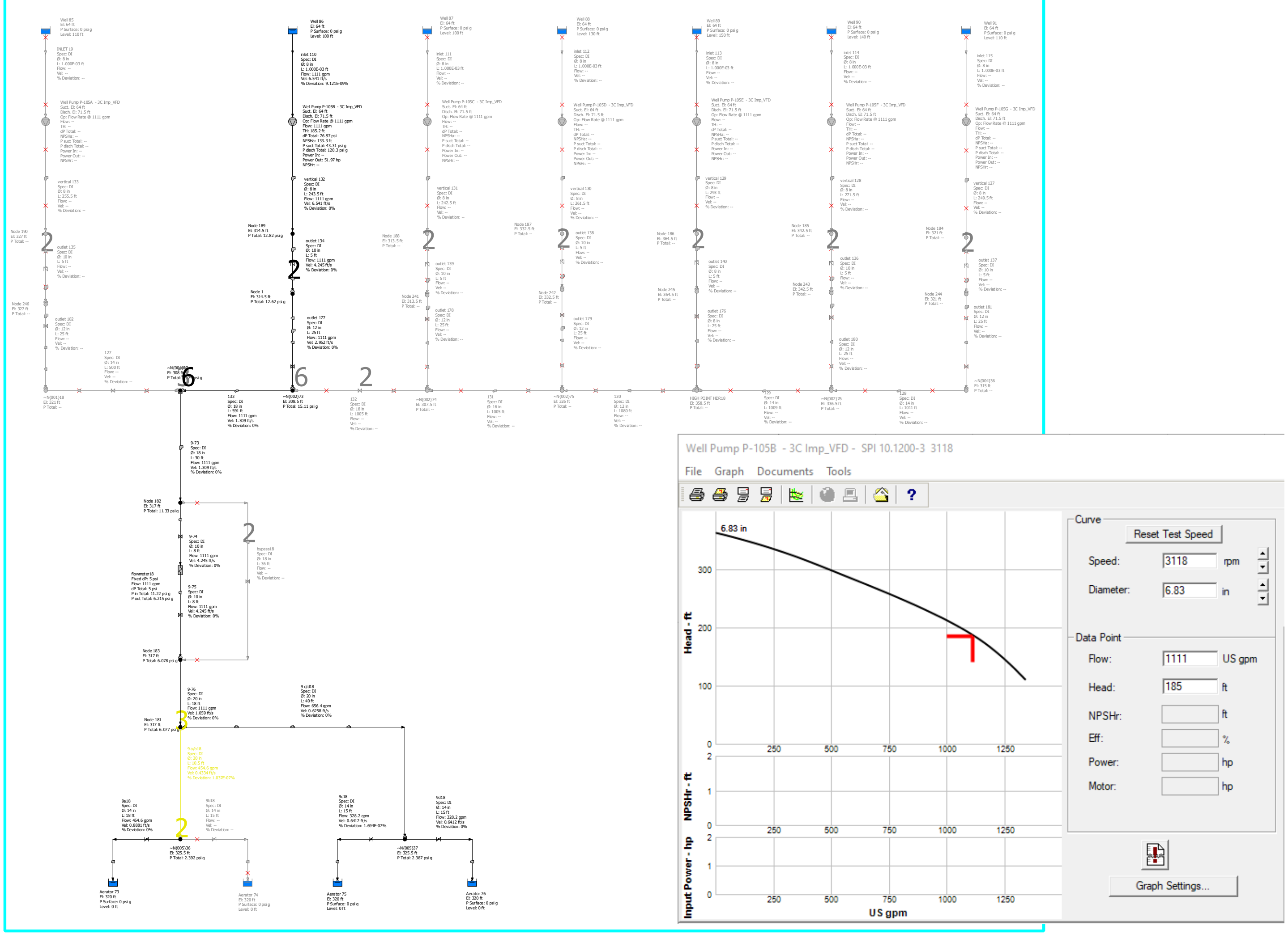
Motor: hp

PIPE-FLO Professional	
Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units					
Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information	
Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	1 Pump P-105A
Print Date:	Tuesday, August 02, 2022 10:17 AM

14" PIPE - 3 stage pumps



Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3118

Speed: 3118 rpm

Diameter: 6.83 in

Flow: 1111 US gpm

Head: 185 ft

NPSHr: ft

Eff: %

Power: hp

Motor: hp

PIPE-FLO Professional	
Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units					
Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information	
Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	1 Pump P-105B
Print Date:	Tuesday, August 02, 2022 10:16 AM

Phase 1 Operation

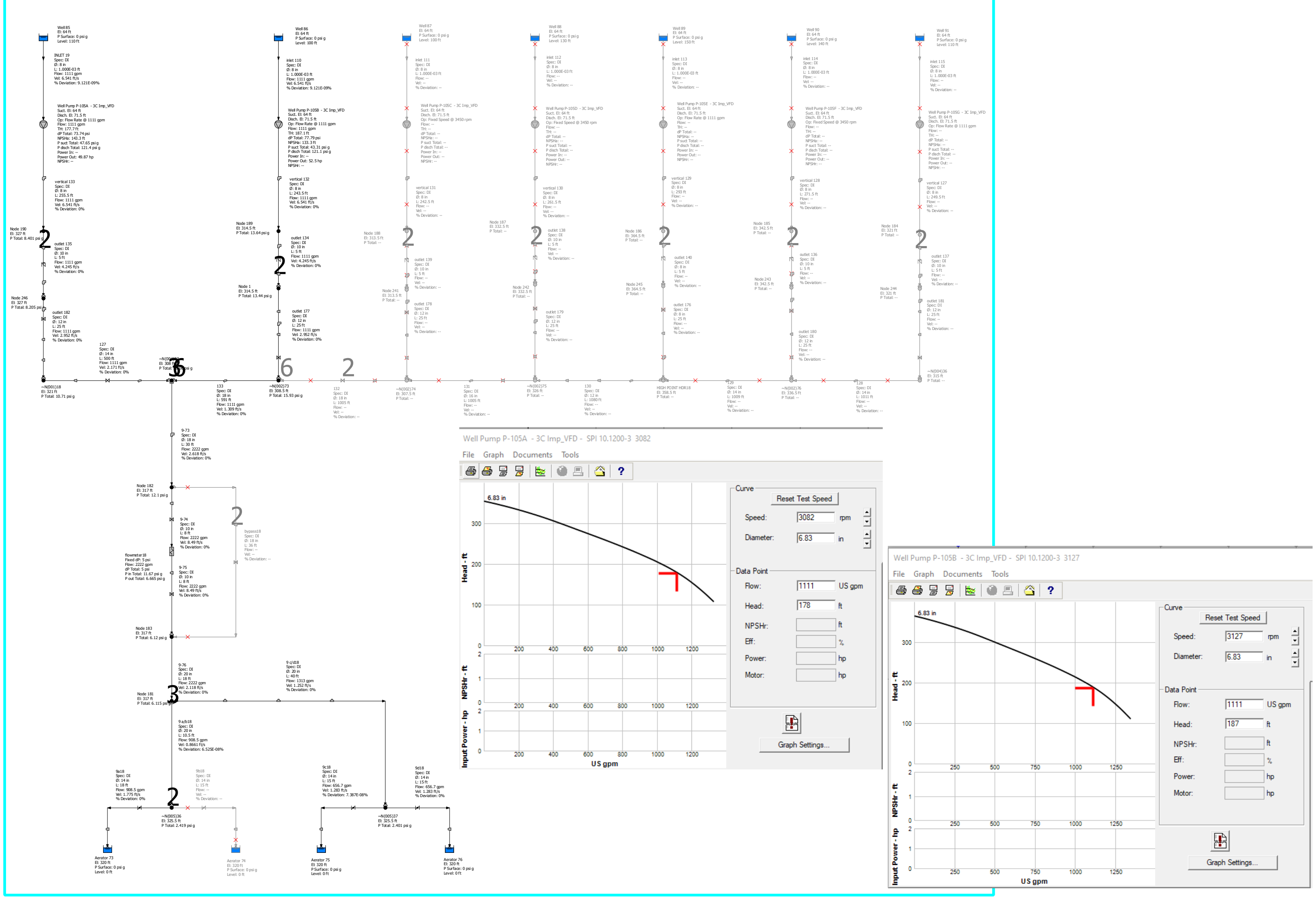
Blue Oval - 4.3 MGD Flow

Two pump operation

For view of a two pump operation, we have included curves for selected pumps P-105A and P-105B, and pumps the second pair of pumps P-105F and Pump P-105G

PIPE-FLO

14" PIPE - 3 stage pumps



Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3082

Speed: 3082 rpm

Diameter: 6.83 in

Flow: 1111 US gpm

Head: 178 ft

Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3127

Speed: 3127 rpm

Diameter: 6.83 in

Flow: 1111 US gpm

Head: 187 ft

PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

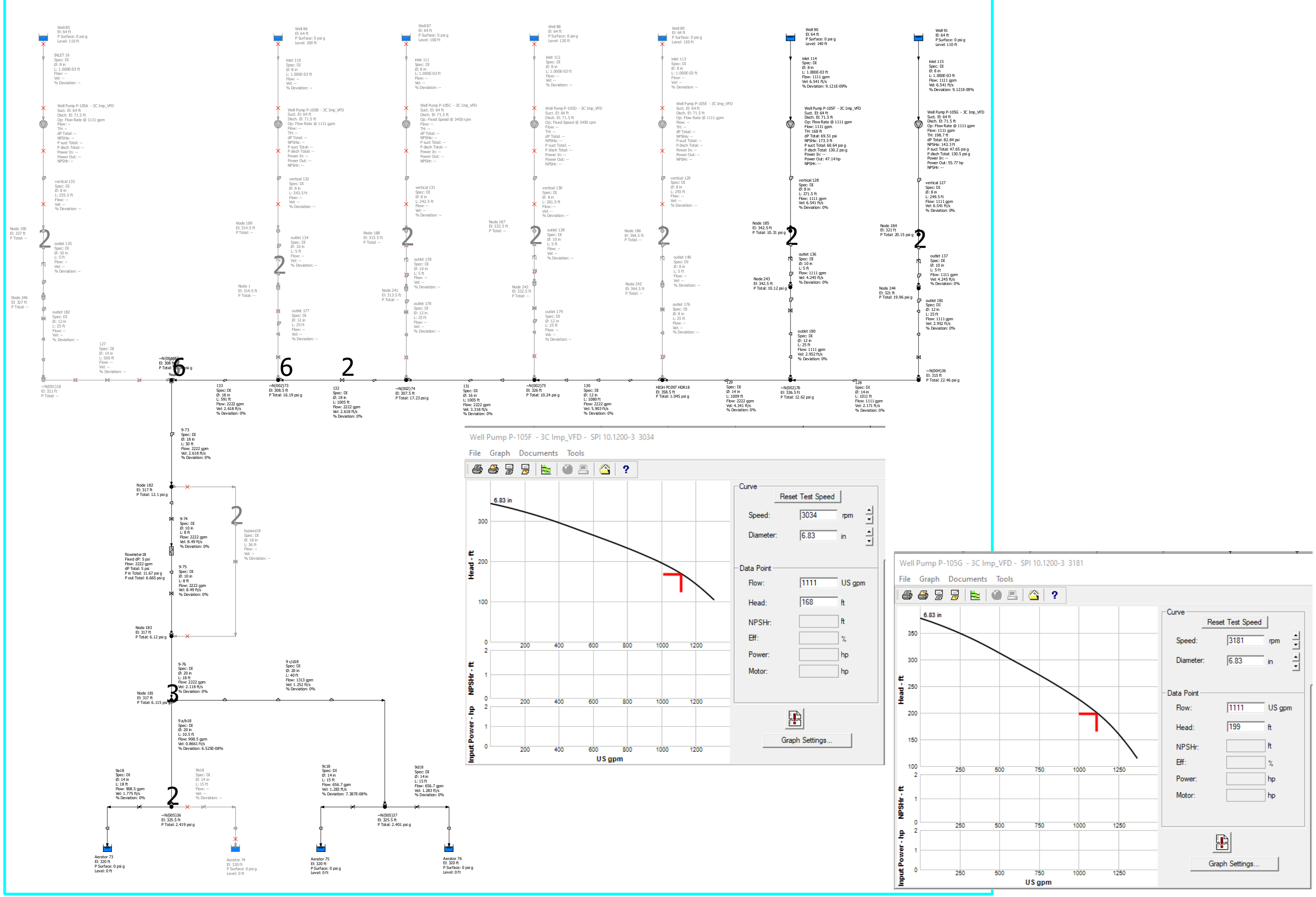
Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	2 Pumps
Print Date:	Tuesday, August 02, 2022 10:22 AM

PIPE-FLO

14" PIPE - 3 stage pumps



Well Pump P-105F - 3C Imp_VFD - SPI 10.1200-3 3034

Curve
Speed: 3034 rpm
Diameter: 6.83 in

Data Point
Flow: 1111 US gpm
Head: 168 ft
NPSHr: ft
Eff: %
Power: hp
Motor: hp

Well Pump P-105G - 3C Imp_VFD - SPI 10.1200-3 3181

Curve
Speed: 3181 rpm
Diameter: 6.83 in

Data Point
Flow: 1111 US gpm
Head: 199 ft
NPSHr: ft
Eff: %
Power: hp
Motor: hp

PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	2 Pumps
Print Date:	Tuesday, August 02, 2022 10:40 AM

Phase 1 Operation

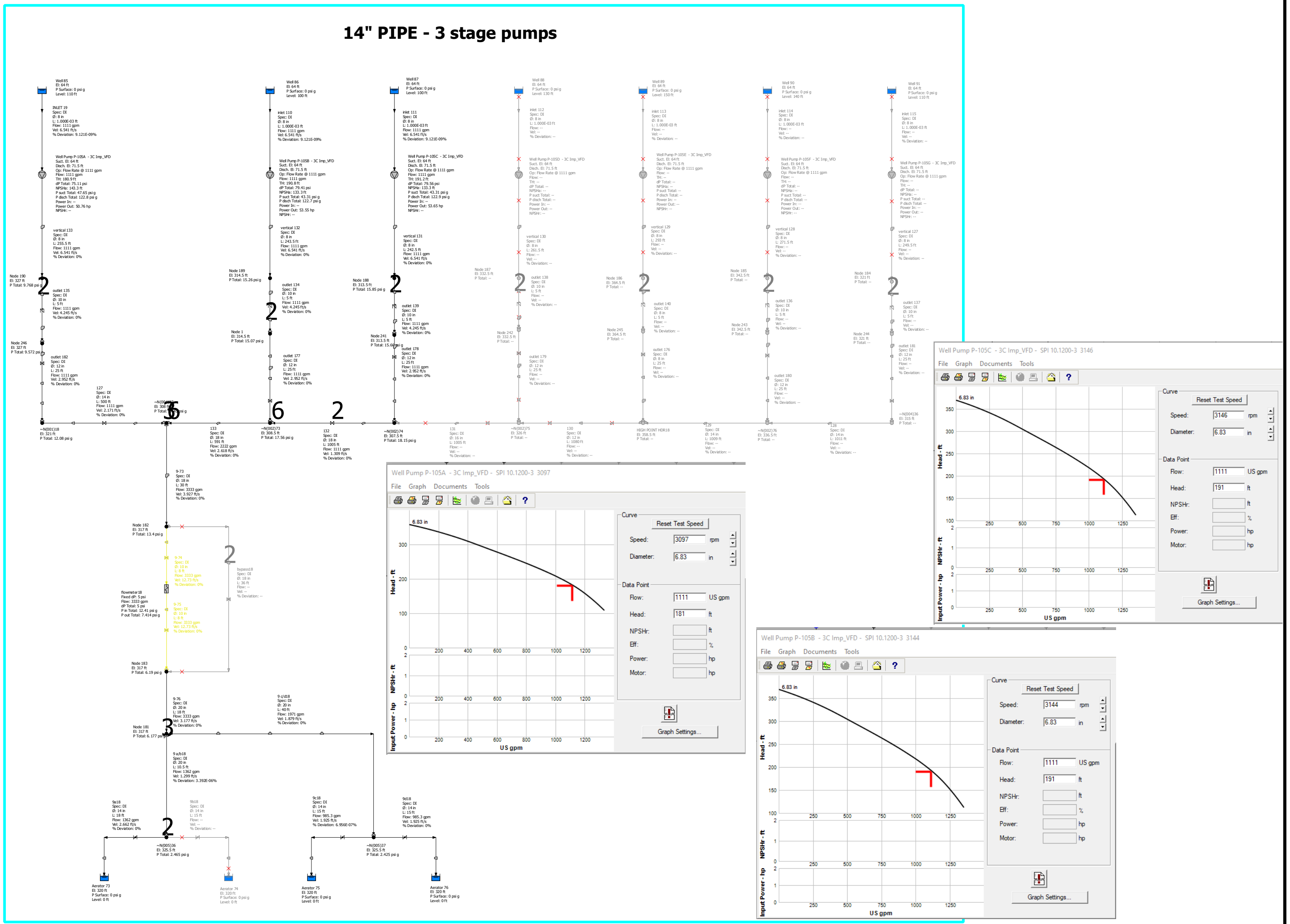
Blue Oval - 4.3 MGD Flow

Three pump operation

For view of a three pump operation, we have included curves for selected pump sets P-105A, P-105B and P-105C, and pumps the second pair of pumps P-105E, P-105F and Pump P-105G

PIPE-FLO

14" PIPE - 3 stage pumps



Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3097
- Speed: 3097 rpm
- Diameter: 6.83 in
- Flow: 1111 US gpm
- Head: 181 ft

Well Pump P-105C - 3C Imp_VFD - SPI 10.1200-3 3146
- Speed: 3146 rpm
- Diameter: 6.83 in
- Flow: 1111 US gpm
- Head: 191 ft

Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3144
- Speed: 3144 rpm
- Diameter: 6.83 in
- Flow: 1111 US gpm
- Head: 191 ft

PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

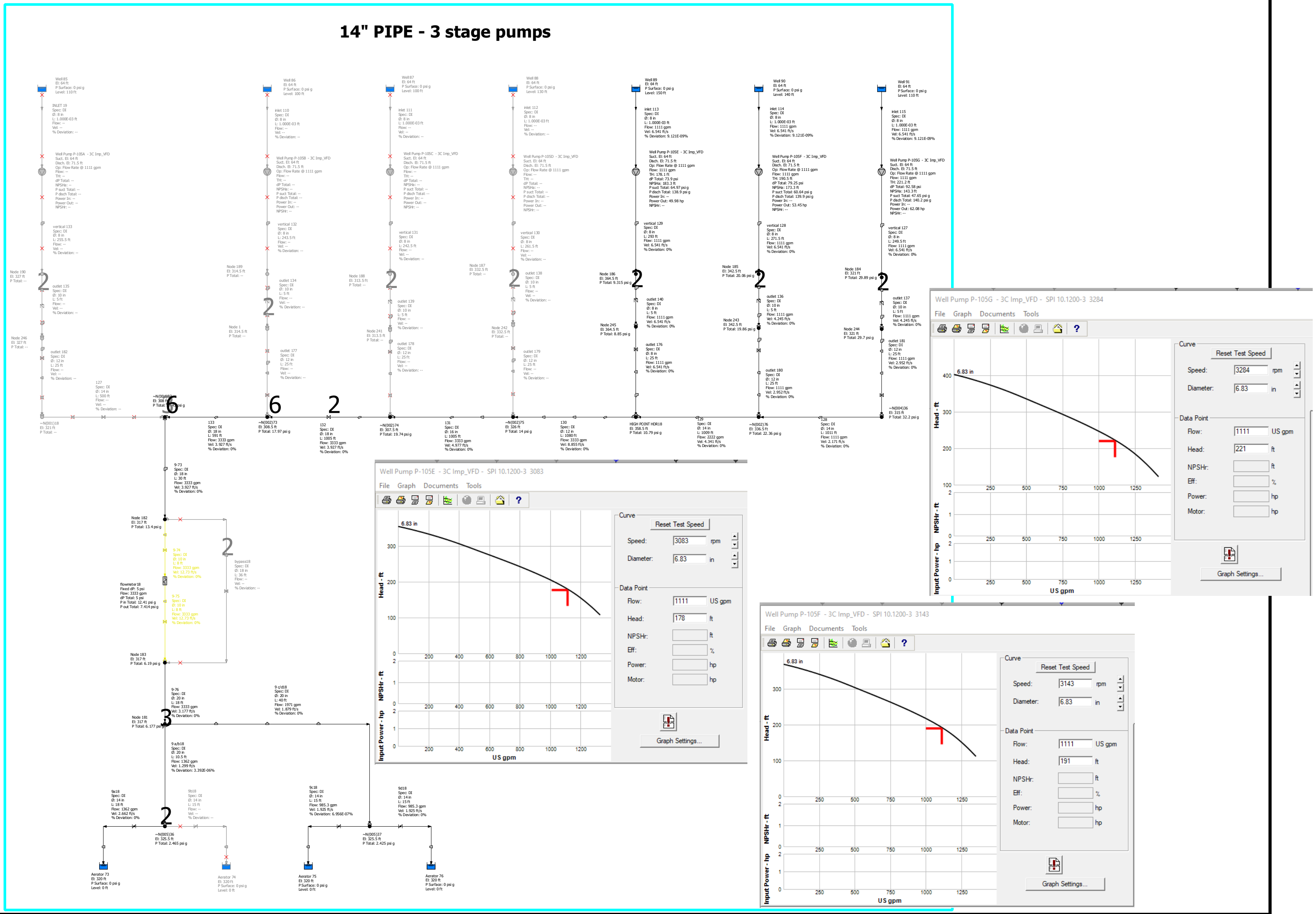
Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	3 Pumps
Print Date:	Tuesday, August 02, 2022 10:43 AM

14" PIPE - 3 stage pumps



Well Pump P-105E - 3C Imp_VFD - SPI 10.1200-3 3083

Speed: 3083 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 178 ft

Well Pump P-105F - 3C Imp_VFD - SPI 10.1200-3 3143

Speed: 3143 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 191 ft

Well Pump P-105G - 3C Imp_VFD - SPI 10.1200-3 3284

Speed: 3284 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 221 ft

PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	3 Pumps
Print Date:	Tuesday, August 02, 2022 10:36 AM

Phase 1 Operation

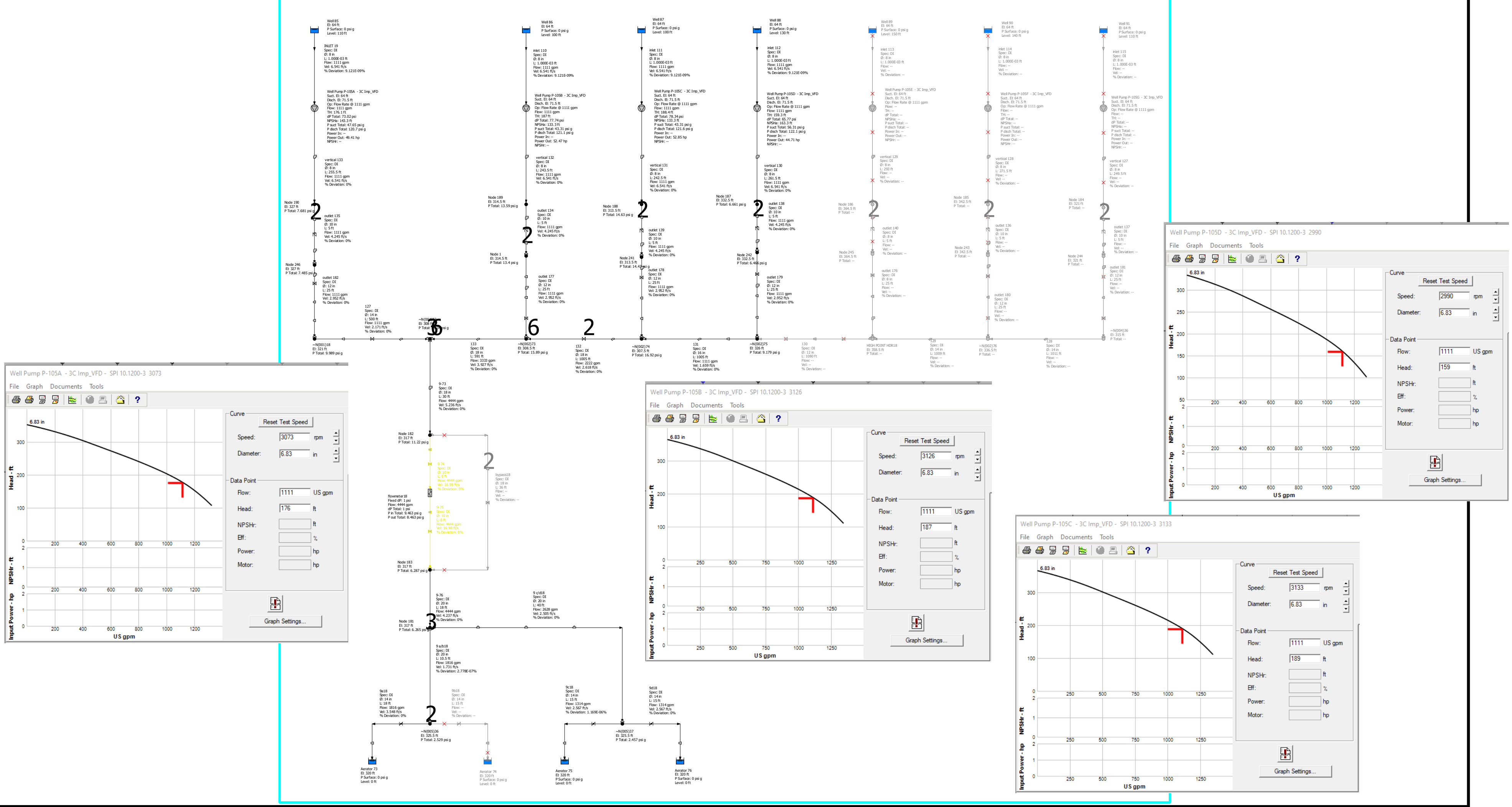
Blue Oval - 4.3 MGD Flow

Four pump operation

For view of a four pump operation, we have included curves for selected pumps P-105A, P-105B,
P-105C, and pump P-105D.

PIPE-FLO

14" PIPE - 3 stage pumps



Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3073

Curve
Speed: 3073 rpm
Diameter: 6.83 in

Data Point
Flow: 1111 US gpm
Head: 176 ft
NPSHr: ft
Eff: %
Power: hp
Motor: hp

Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3126

Curve
Speed: 3126 rpm
Diameter: 6.83 in

Data Point
Flow: 1111 US gpm
Head: 187 ft
NPSHr: ft
Eff: %
Power: hp
Motor: hp

Well Pump P-105C - 3C Imp_VFD - SPI 10.1200-3 3133

Curve
Speed: 3133 rpm
Diameter: 6.83 in

Data Point
Flow: 1111 US gpm
Head: 189 ft
NPSHr: ft
Eff: %
Power: hp
Motor: hp

Well Pump P-105D - 3C Imp_VFD - SPI 10.1200-3 2990

Curve
Speed: 2990 rpm
Diameter: 6.83 in

Data Point
Flow: 1111 US gpm
Head: 159 ft
NPSHr: ft
Eff: %
Power: hp
Motor: hp

PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

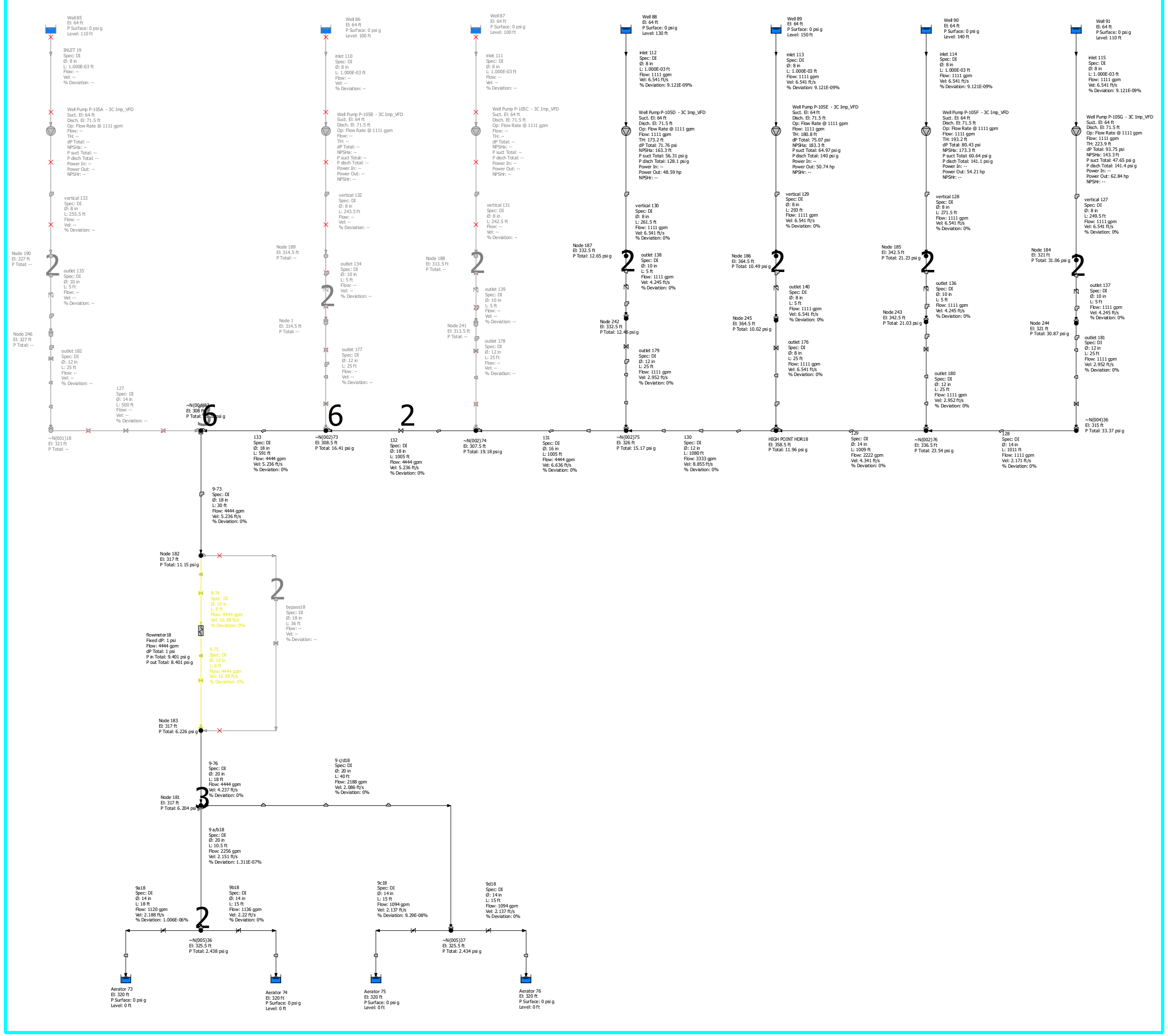
Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	4 Pumps
Print Date:	Tuesday, August 02, 2022 10:49 AM

14" PIPE - 3 stage pumps



PIPE-FLO Professional

Program Version: 18.0
Calculation Method: Darcy-Weisbach
Maximum Iterations: 100
Percent Tolerance: 0.01 %
Laminar Cutoff Re: 2100
Allowable Deviation: 1 %

Units

Area: ft²
Length: ft
Elevation: ft
Diameter: in
Velocity: ft/s
Volume: ft³
Flow rate: gpm
Pressure: psi
Power: hp
Temperature: °F
Density: lb/ft³
Viscosity: cP
Heat Transfer Rate: BTU/h
Heat Transfer Coefficient: BTU/h*ft²°F
Specific Heat Capacity: BTU/lb°F
Thermal Capacitance: BTU/h°F
Thermal Insulance: h*ft²°F/BTU
Atmospheric Pressure: 14.7 psi a

Project Information

Company: SSOE Inc.
Project: TN Megasite
Drawn by:
File Name: Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup: 4 Pumps
Print Date: Tuesday, August 02, 2022 10:46 AM

Phase 2 Operation

Future Scenario

Flows from Blue Oval and East Tenant (Handy) total flow 6.3 MGD

The design flow rate for Phase 2 operation includes the flows for initial tenant, Ford Motor Company also referred to as “Blue Oval” and the future east tenant “Handy”. The requested and agreed upon volume is 4.3 MGD for Ford and the tentative flow for the east tenant “Handy” is 2.0 MGD, providing an averaged flow rate over 24 hours as 4375 GPM. Similar to phase 1, we anticipate variation in flow for the tenants and have provided ability for well pumps to operate as needed to retain the volume of water in the clearwells. *The well pumps are on VFD’s and will direct flow to the aerators as needed based upon clearwell levels.* All seven well pumps are connected to a common header system that directs flow to four aerators located at the water treatment plant.

The included pump scenarios for Phase 2 include output noting the operation of two well pumps to provide a low flow point of a nominal 2200 GPM as well as include other scenarios to satisfy higher anticipated flows. In addition, added options include use of four pump operation which can provide a combined flow of 4444 GPM and also five pumps which can provide a nominal of 5555 GPM. The five pumps are on VFD’s, and discharge rate can be reduced as levels in the clearwells rise of fall. We have also provided operation scenario for six pumps to provide point for the pump curves. We anticipate dependent upon actual usage rates that normal operation will be four or five well pumps functioning with VFD’s in operation to retain the clearwell operating levels. We have also included the well pump numbers on the pump curves to better understand the operating points for the individual pumps, including RPM to attain flow.

Each selected scenario includes a flow diagram output from Pipe-Flo model, pump data sheet noting the operating point on curves for each pump, and a line list report from the Pipe-Flo model. Selected line-up of pumps can also be identified in the Project information section of the included Flow diagram.

Phase 2 Operation

Future Scenario

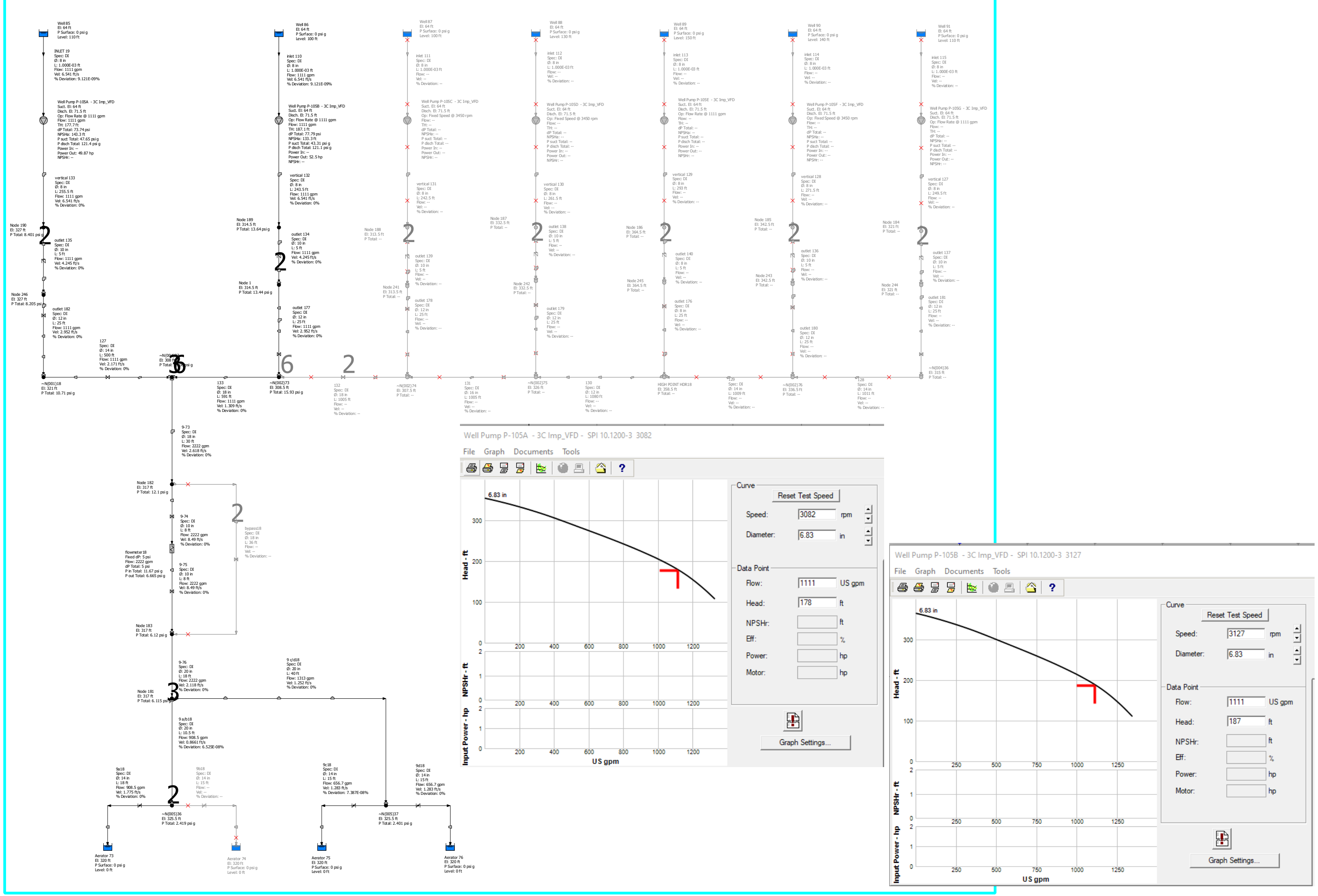
Flows from Blue Oval and East Tenant (Handy) total flow 6.3 MGD

Two pump operation

For view of a two pump operation, we have included curves for selected pumps P-105A and P-105B, and pumps the second pair of pumps P-105F and Pump P-105G

PIPE-FLO®

14" PIPE - 3 stage pumps



Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3082

6.83 in

Speed: 3082 rpm

Diameter: 6.83 in

Flow: 1111 US gpm

Head: 178 ft

NPSHr: ft

Eff: %

Power: hp

Motor: hp

Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3127

6.83 in

Speed: 3127 rpm

Diameter: 6.83 in

Flow: 1111 US gpm

Head: 187 ft

NPSHr: ft

Eff: %

Power: hp

Motor: hp

PIPE-FLO Professional

Program Version: 18.0
Calculation Method: Darcy-Weisbach
Maximum Iterations: 100
Percent Tolerance: 0.01 %
Laminar Cutoff Re: 2100
Allowable Deviation: 1 %

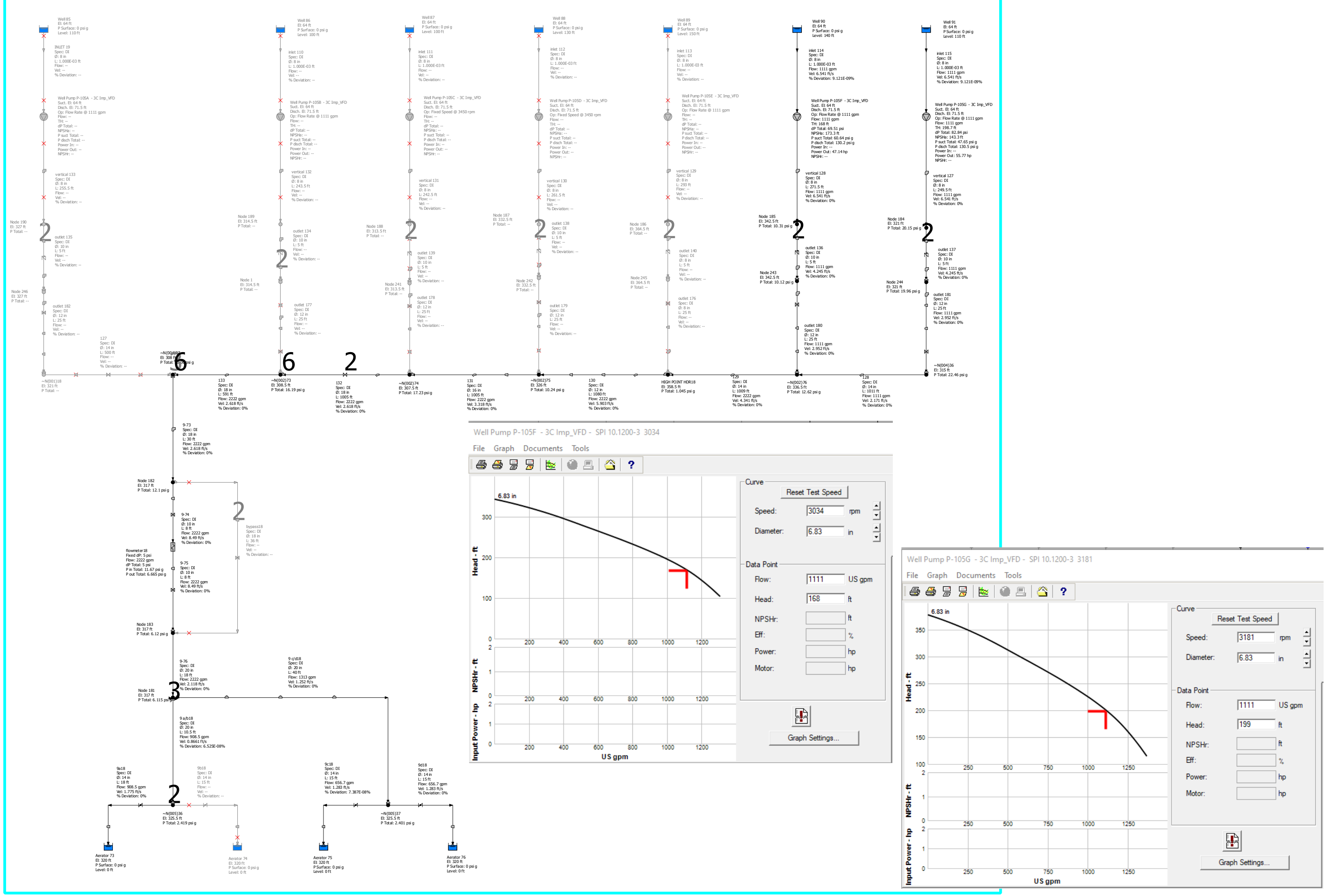
Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company: SSOE Inc.
Project: TN Megasite
Drawn by:
File Name: Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup: 2 Pumps
Print Date: Tuesday, August 02, 2022 10:22 AM

14" PIPE - 3 stage pumps



Well Pump P-105F - 3C Imp_VFD - SPI 10.1200-3 3034

Speed: 3034 rpm

Diameter: 6.83 in

Flow: 1111 US gpm

Head: 168 ft

Well Pump P-105G - 3C Imp_VFD - SPI 10.1200-3 3181

Speed: 3181 rpm

Diameter: 6.83 in

Flow: 1111 US gpm

Head: 199 ft

PIPE-FLO Professional	
Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units					
Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information	
Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	2 Pumps
Print Date:	Tuesday, August 02, 2022 10:40 AM

Phase 2 Operation

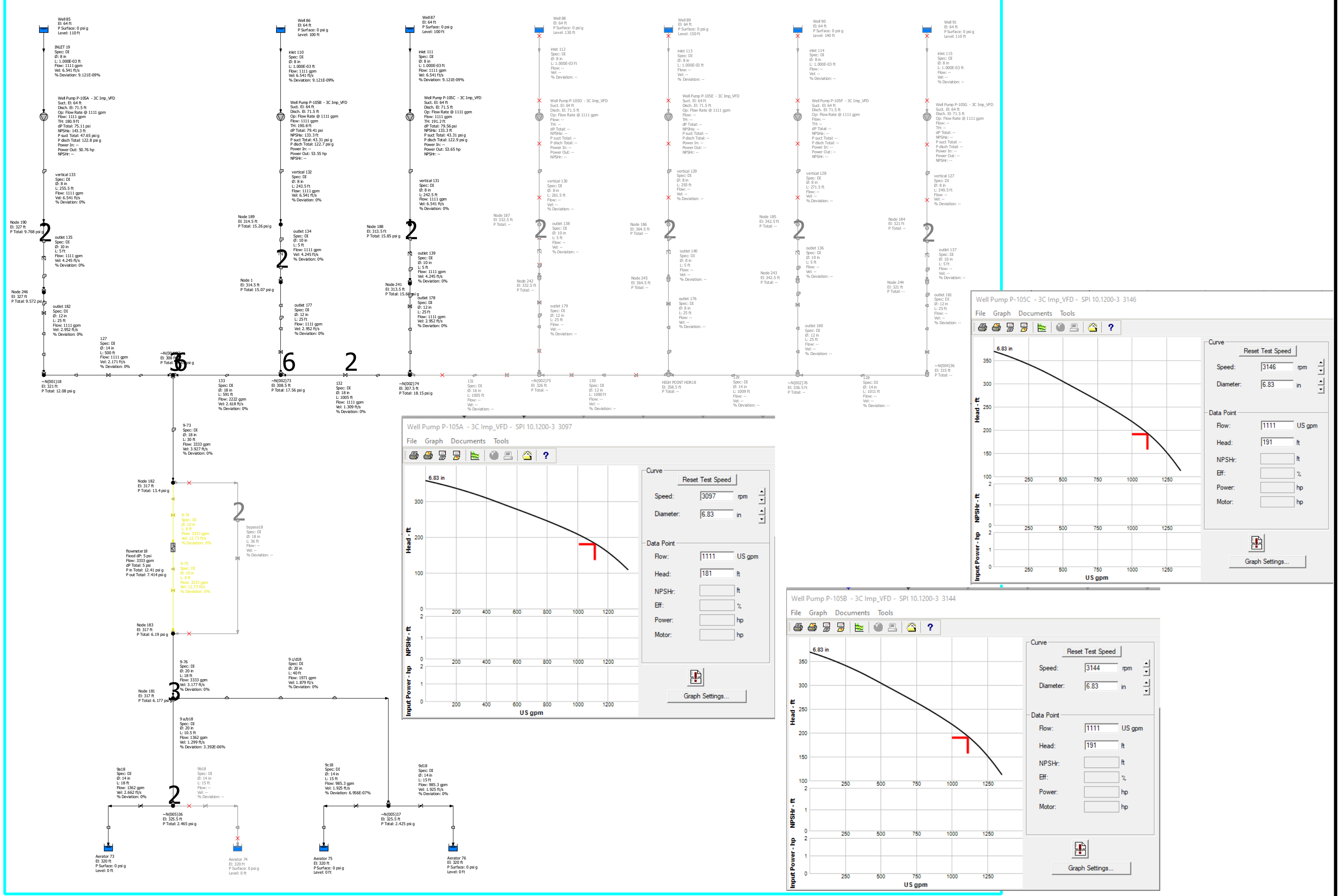
Future Scenario

Flows from Blue Oval and East Tenant (Handy) total flow 6.3 MGD

Three pump operation

For view of a three pump operation, we have included curves for selected pump sets P-105A, P-105B and P-105C, and pumps the second pair of pumps P-105E, P-105F and Pump P-105G

14" PIPE - 3 stage pumps



Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3097

Speed: 3097 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 181 ft

Well Pump P-105C - 3C Imp_VFD - SPI 10.1200-3 3146

Speed: 3146 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 191 ft

Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3144

Speed: 3144 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 191 ft

PIPE-FLO Professional

Program Version: 18.0
Calculation Method: Darcy-Weisbach
Maximum Iterations: 100
Percent Tolerance: 0.01 %
Laminar Cutoff Re: 2100
Allowable Deviation: 1 %

Units

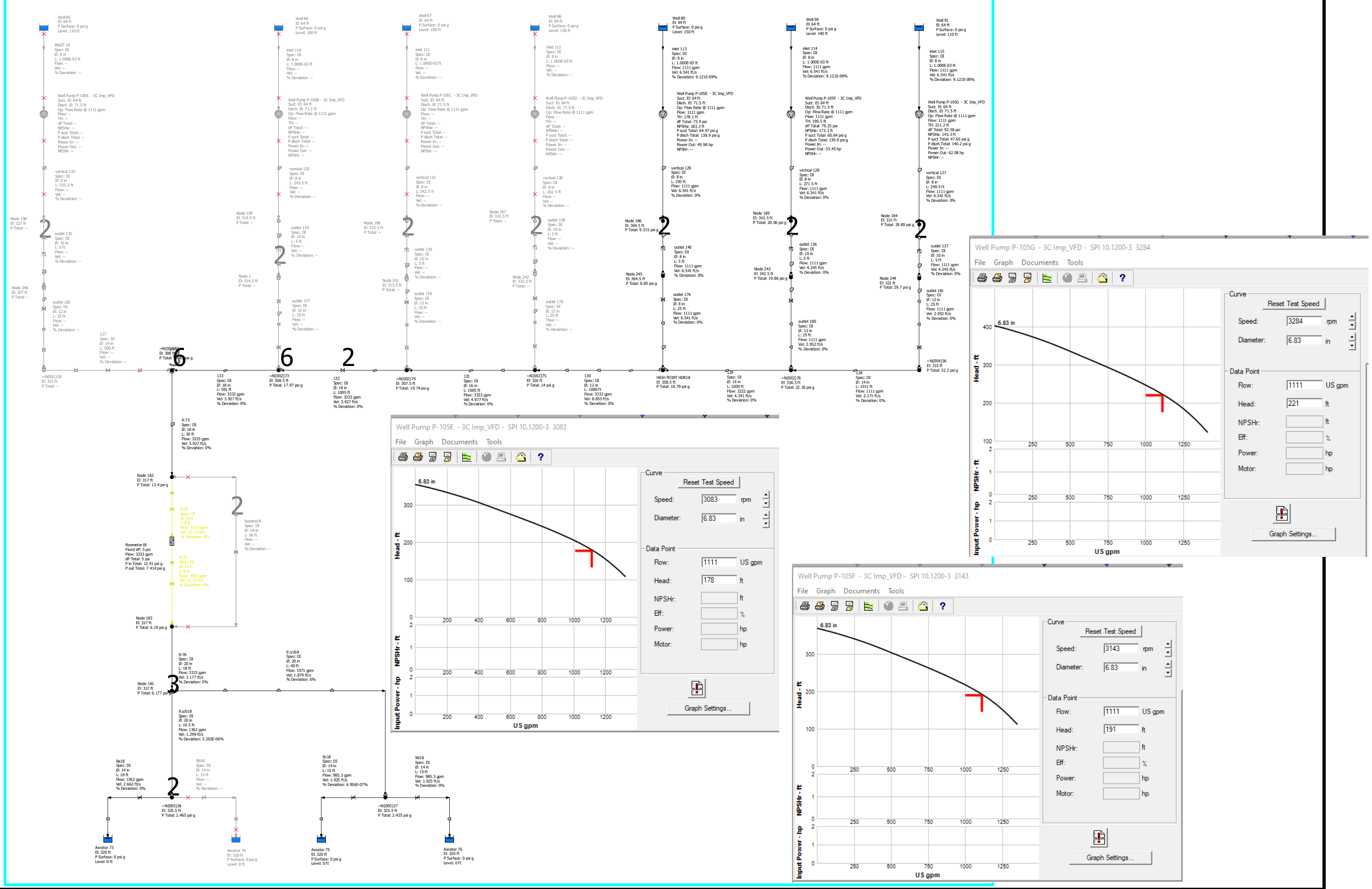
Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company: SSOE Inc.
Project: TN Megasite
Drawn by:
File Name: Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup: 3 Pumps
Print Date: Tuesday, August 02, 2022 10:43 AM

PIPE-FLO

14" PIPE - 3 stage pumps



Well Pump P-105G - 3C Imp_VFD - SPI 10.1200-3 3284

Curve

Speed: 3284 rpm

Diameter: 6.83 in

Data Point

Flow: 1111 US gpm

Head: 221 ft

NPSHr: ft

Eff: %

Power: hp

Motor: hp

Well Pump P-105E - 3C Imp_VFD - SPI 10.1200-3 3083

Curve

Speed: 3083 rpm

Diameter: 6.83 in

Data Point

Flow: 1111 US gpm

Head: 178 ft

NPSHr: ft

Eff: %

Power: hp

Motor: hp

Well Pump P-105F - 3C Imp_VFD - SPI 10.1200-3 3143

Curve

Speed: 3143 rpm

Diameter: 6.83 in

Data Point

Flow: 1111 US gpm

Head: 191 ft

NPSHr: ft

Eff: %

Power: hp

Motor: hp

PIPE-FLO Professional

Program Version: 18.0
Calculation Method: Darcy-Weisbach
Maximum Iterations: 100
Percent Tolerance: 0.01 %
Laminar Cutoff Re: 2100
Allowable Deviation: 1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company: SSOE Inc.
Project: TN Megasite
Drawn by:
File Name: Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup: 3 Pumps
Print Date: Tuesday, August 02, 2022 10:36 AM

Phase 2 Operation

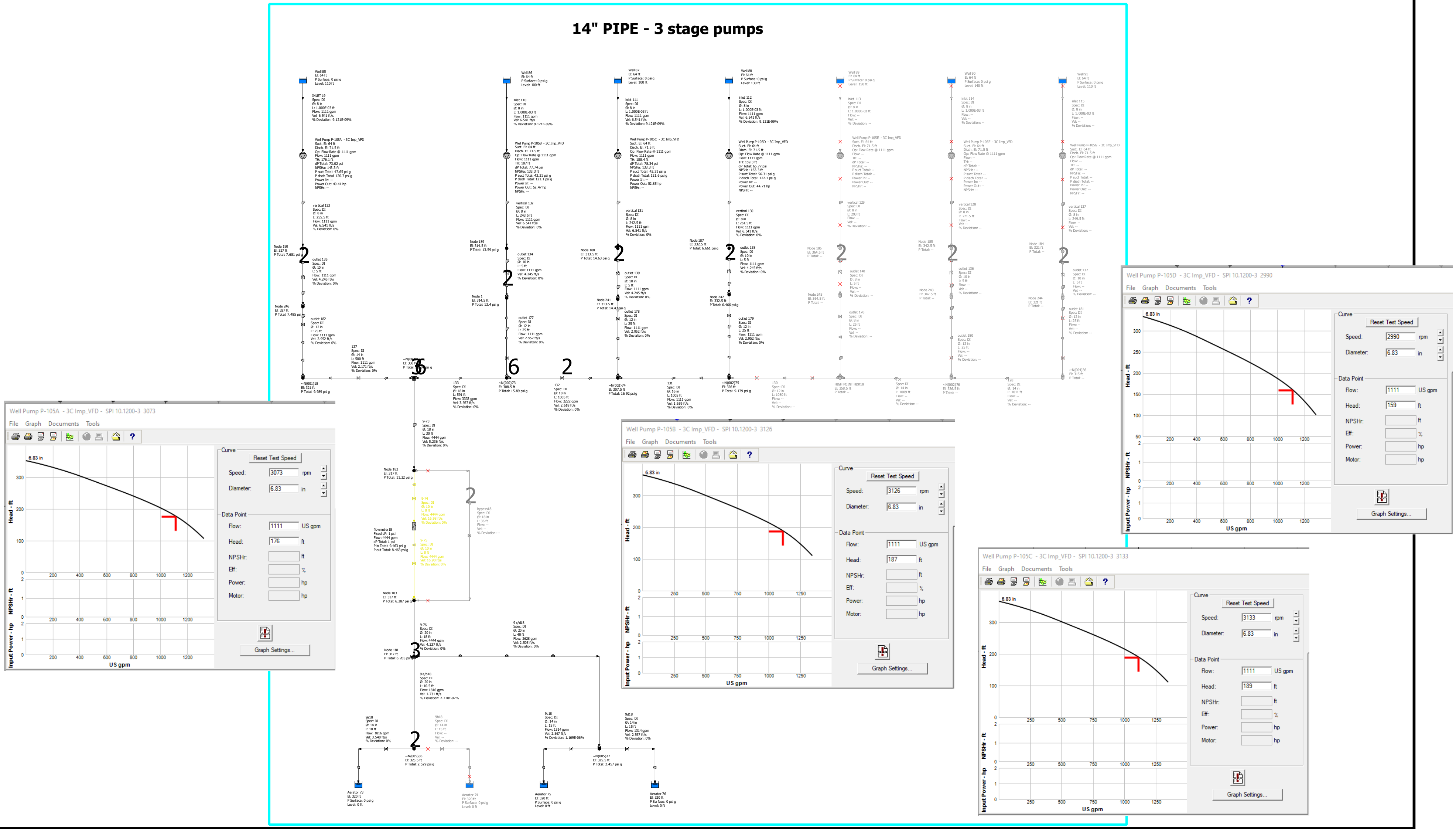
Future Scenario

Flows from Blue Oval and East Tenant (Handy) total flow 6.3 MGD

Four pump operation

For view of a four pump operation, we have included curves for selected pumps P-105A, P-105B, P-105C, and pump P-105D.

14" PIPE - 3 stage pumps



Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3073

Speed: 3073 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 176 ft

Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3126

Speed: 3126 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 187 ft

Well Pump P-105C - 3C Imp_VFD - SPI 10.1200-3 3133

Speed: 3133 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 189 ft

Well Pump P-105D - 3C Imp_VFD - SPI 10.1200-3 2990

Speed: 2990 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 159 ft

PIPE-FLO Professional

Program Version: 18.0
Calculation Method: Darcy-Weisbach
Maximum Iterations: 100
Percent Tolerance: 0.01 %
Laminar Cutoff Re: 2100
Allowable Deviation: 1 %

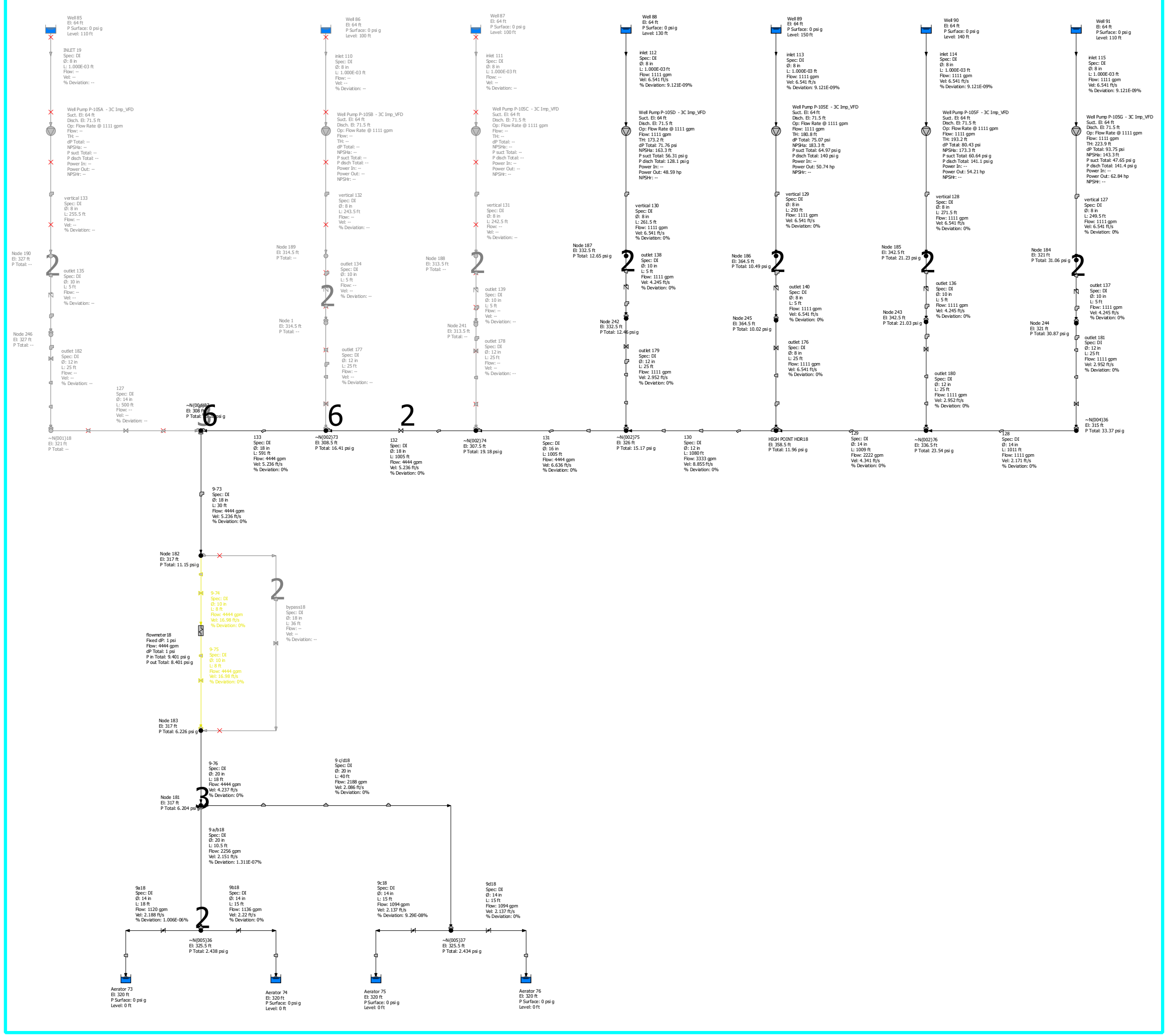
Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company: SSOE Inc.
Project: TN Megasite
Drawn by:
File Name: Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup: 4 Pumps
Print Date: Tuesday, August 02, 2022 10:49 AM

14" PIPE - 3 stage pumps



PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	4 Pumps
Print Date:	Tuesday, August 02, 2022 10:46 AM

Phase 2 Operation

Future Scenario

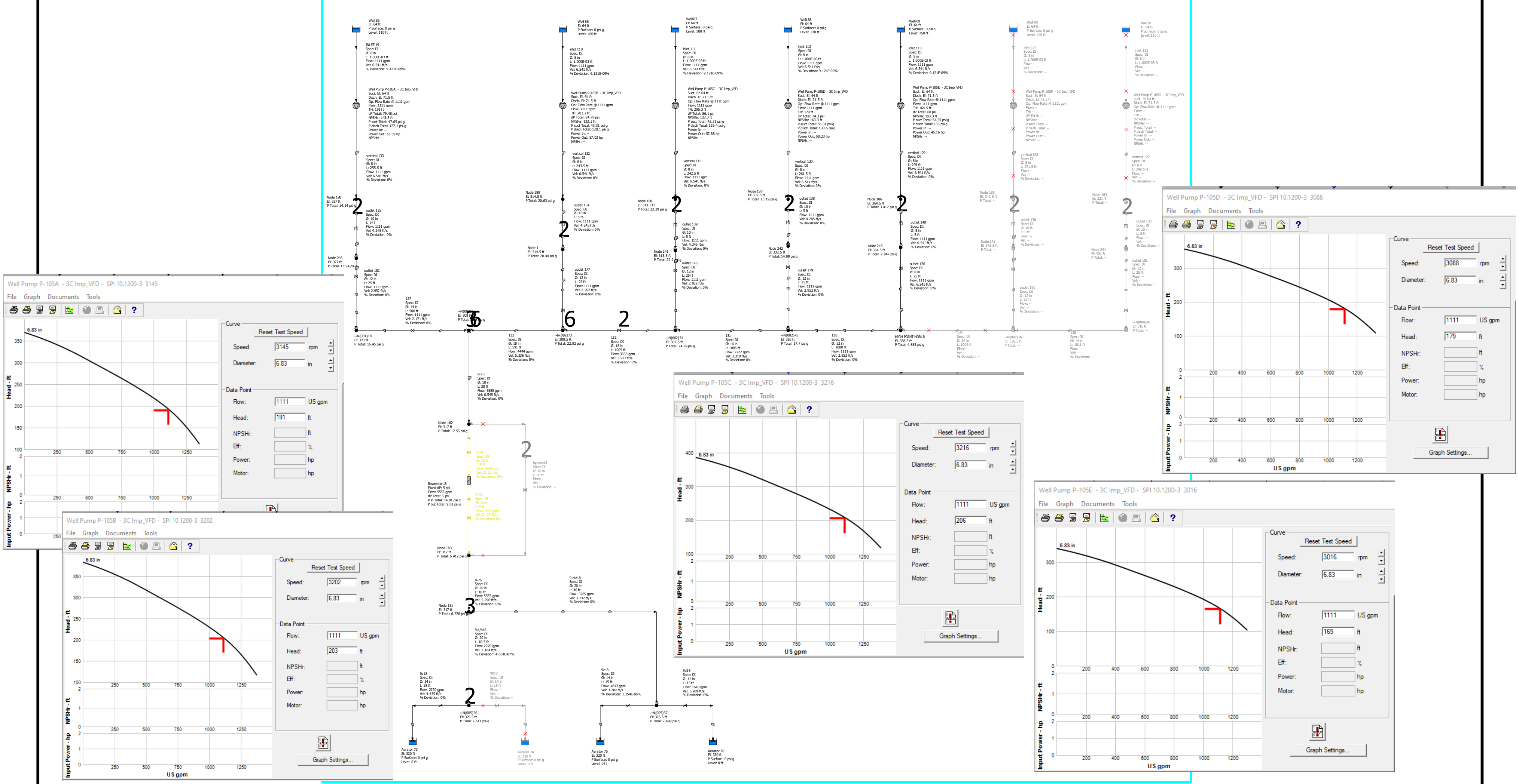
Flows from Blue Oval and East Tenant (Handy) total flow 6.3 MGD

Five pump operation

For view of a four pump operation, we have included curves for selected pumps P-105A, P-105B, P-105C, P-105D and pump P-105E.

PIPE-FLO

14" PIPE - 3 stage pumps


Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3145
Speed: 3145 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 191 ft

Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3202
Speed: 3202 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 203 ft

Well Pump P-105C - 3C Imp_VFD - SPI 10.1200-3 3216
Speed: 3216 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 206 ft

Well Pump P-105D - 3C Imp_VFD - SPI 10.1200-3 3088
Speed: 3088 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 179 ft

Well Pump P-105E - 3C Imp_VFD - SPI 10.1200-3 3016
Speed: 3016 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 165 ft

PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	5 Pumps
Print Date:	Tuesday, August 02, 2022 10:55 AM

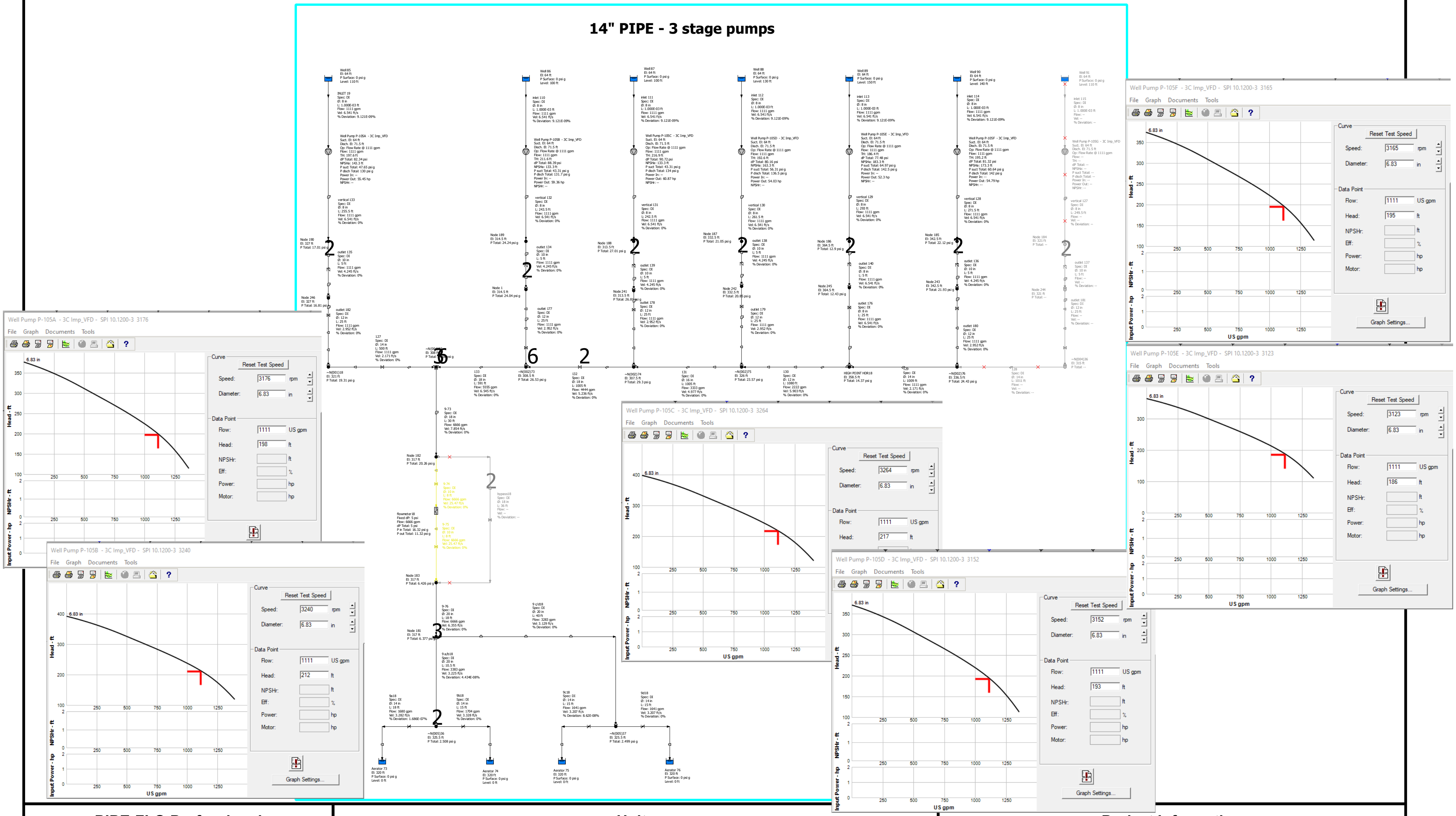
Phase 2 Operation

Future Scenario

Flows from Blue Oval and East Tenant (Handy) total flow 6.3 MGD

To provide peak flow for flow to the aerators in Phase 2 we have included curves for six selected pumps P-105A, P-105B, P-105C, P-105D, P-105E, and pump P-105F. This is not a normal situation as the intent is to provide minimum of two (2) pumps as redundant units.

14" PIPE - 3 stage pumps



Well Pump P-105A - 3C Imp_VFD - SPI 10.1200-3 3176

Speed: 3176 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 198 ft

Well Pump P-105B - 3C Imp_VFD - SPI 10.1200-3 3240

Speed: 3240 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 212 ft

Well Pump P-105C - 3C Imp_VFD - SPI 10.1200-3 3264

Speed: 3264 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 217 ft

Well Pump P-105D - 3C Imp_VFD - SPI 10.1200-3 3152

Speed: 3152 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 193 ft

Well Pump P-105E - 3C Imp_VFD - SPI 10.1200-3 3123

Speed: 3123 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 186 ft

Well Pump P-105F - 3C Imp_VFD - SPI 10.1200-3 3165

Speed: 3165 rpm
Diameter: 6.83 in
Flow: 1111 US gpm
Head: 195 ft

PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	ft³	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	TN Megasite
Drawn by:	
File Name:	Well Pump Model 2022_Pump-Submittal-3 stage.pipe
Lineup:	6 Pumps
Print Date:	Tuesday, August 02, 2022 11:02 AM

APPENDIX G

Appendix G

- Distribution Pump Operation overview
- Phase 1 Operation: Blue Oval - 4.3 MGD Flow
- Future Scenario: Flows from Blue Oval and East Tenant (Handy) total flow 6.3 MGD

Distribution Pump Operation overview

Two clearwells each with four (4) distribution pumps on VFD's are provided to supply water to the users and fill towers.

The water treatment process for the Memphis Regional Megasite is designed to nominal 7.0 MGD. Based upon the hydraulic model, four (4) pumps will operate (two from Each clearwell) to produce the intended nominal 7.0 MGD flow rate. The attached pump data and calculations are provided to denote pump-flow from the clearwells to the tenants and water towers. Flow from each pump is denoted on the included curves to indicate flow as an individual pump and with four pumps in operation.

The quantity of well pumps that will operate will be determined by the operating level in the towers and required by tenants.–Through the monitoring of flows at the flow meters through the PLC it will be possible to determine time periods for general pump operation and also temporarily remove a pump from rotation if preventative maintenance needs to be performed or the unit needs repair. Pump VFD's will assist to adjust flows to the system as needed. As the level decreases in the towers or demand increases additional pumps will be brought online to maintain adequate volume of water to the tenants. Inversely as the levels in the towers reach higher levels, the VFD's can reduce flows or quantity of pumps operating can be reduced. It is the intent that pumps in operation will be rotated to ensure all pumps to be used rather than to continually run the same units for a prolonged period of time. Data is compiled to show operation of individual distribution pumps as well as all pumps in operation. Data will be logged for each pump including hours of operation to aid in balancing use if each pump.

Two scenarios hare reviewed for distribution pump operations. Initial installation for phase 1 build-out as included in the design drawings addresses flows required by Ford (Blue Oval) presently noted at 4.3 MGD for the installation including revision to operations to add a Central Utilities Plant. We have also included scenario for delivering total of 6.3 MGD based upon Blue Oval and future east tenant (Handy). Pump curves also include operating point for two pump operation and up to six pumps running.

The data provided for the distribution pumps herein includes Pipe-Flo models noting operating points on the selected curves for the specific scenario. It should be noted that the program used allows development of a dynamic system model and as calculations are completed provides the output for the selected option based upon input. The piping system is entered into the program based upon selected pump curve, specific materials of construction, valves, pipe size, length, and elevations that reflect the design drawings, as well as fluid properties.

Phase 1 Operation

Blue Oval - 4.3 MGD Design Flow

The design flow rate for Phase 1 operation includes the flows for initial tenant, Ford Motor Company also referred to as “Blue Oval”. The requested and agreed upon volume is 4.3 MGD, providing an averaged flow rate over 24 hours as 2986 GPM. We anticipate some variation in flow for the tenant and have provided ability for distribution pumps to operate as needed to retain the volume of water in the clearwells. The distribution pumps are on VFD’s which will also allow for flow variations.

The included pump scenarios for Phase 1 include output noting the operation of individual pumps to provide a low flow point of less than 2345 GPM to provide flow to tenant and to fill tower and lower flows. We have also included scenarios with model output and pump curves for higher anticipated flow rates. These options include operation of three or four pumps.

Each selected scenario includes a flow diagram output from Pipe-Flo model, pump data sheet noting the operating point on curves for each pump, and a line list report from the Pipe-Flo model. Selected line-up of pumps can also be identified in the Project information section of the included Flow diagram.

Phase 1 Operation

Blue Oval - 4.3 MGD Design Flow

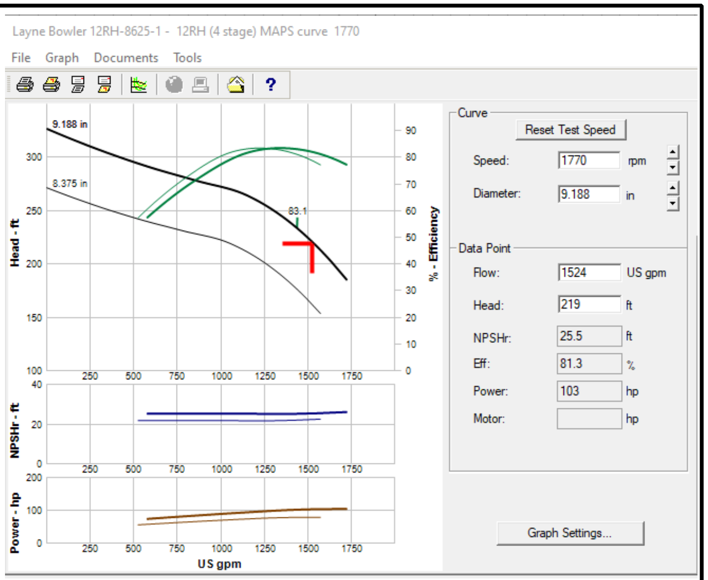
Two Pump operation

For view of a two pump operation, we have included operation of one pump in each clearwell. General pump curve is attached to the Pipe-Flow diagram

The data for two pumps for reference we have included provides the Pipe-Flo model denoting two pump operation which results in flow being drawn from the tower on site (yellow at south tower) to maintain the required flow from the tenants. Through the PLC, as tower levels continue to drop, additional pumps will be started to increase flow levels and pressure to fill towers, or the pump speed will be increased through the VFDs if not at elevated level.

The operation of 2 pumps provides a total flow of 3047 GPM allowing for filling the north tower at a noted rate of 687 GPM it provides a flow of 2345 GPM to tenant and to fill the south tower. The two towers can also see flow out of the towers and instantaneous demand from the tenant fluctuates to a higher level. If initial flow for initial tenant, it may be possible to two pump arrangement to supply required water, however; we do not anticipate this arrangement continuing for an extended period of time.

In this model, the pressure at the south tower is 72.77 PSIG (168 feet) plus Elev. 348 = 516 feet. Tower flow is out until the level will reach 516 feet. Though 2 pumps may be able to provide the minimum flows, filing the south tower will not occur at all times to high level of 524.0 feet.


Layne Bowler 12RH-8625-1 - 12RH (4 stage) MAPS curve 1770

Curve

Speed: 1770 rpm

Diameter: 9.188 in

Data Point

Flow: 1524 US gpm

Head: 219 ft

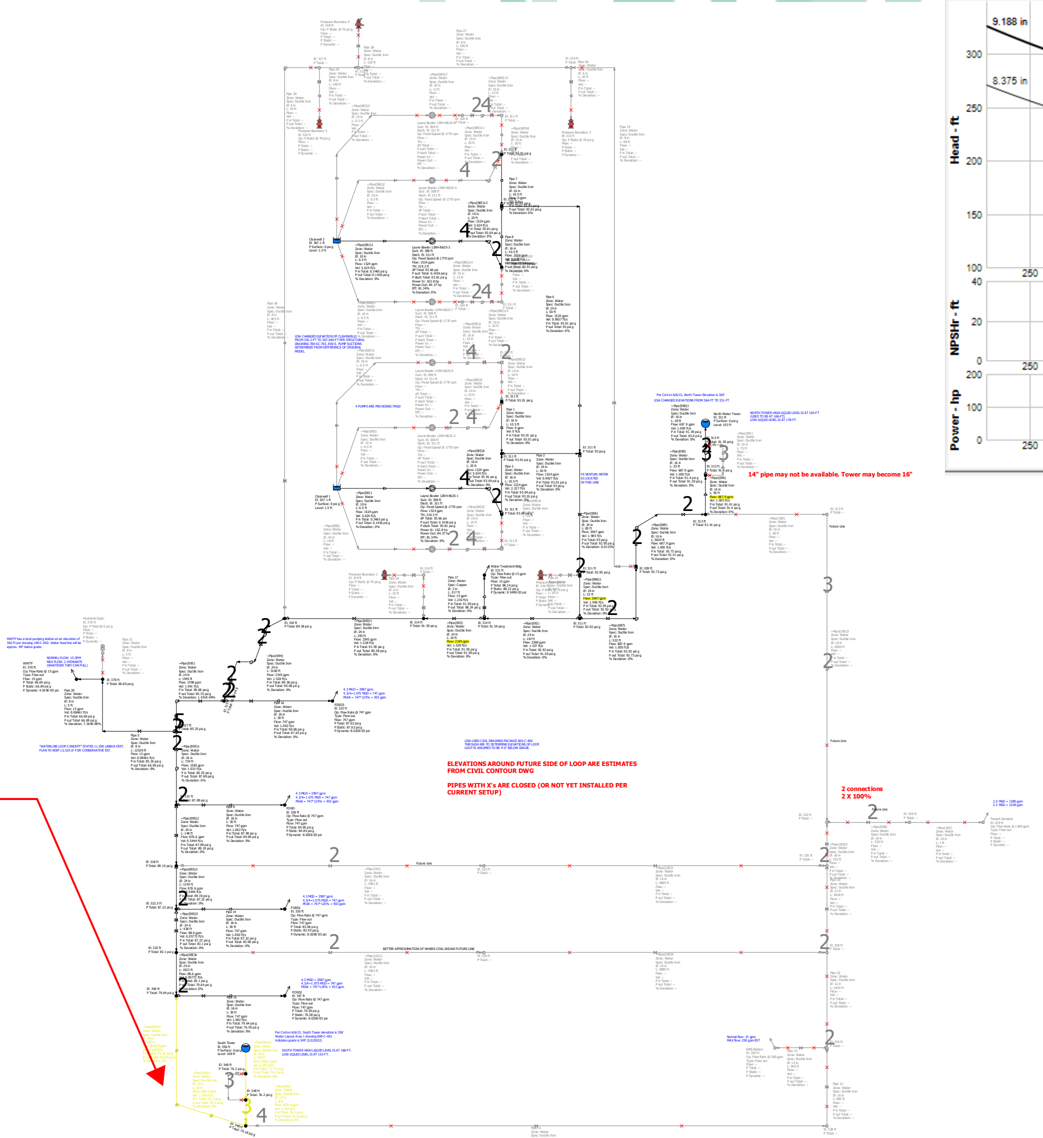
NPSHr: 25.5 ft

Eff: 81.3 %

Power: 103 hp

Motor: hp

2 pumps will provide 2345 GPM to the system, and due to flow to the tenant pressure to the south tower is reduced; tower is also used to provide water to the users and maintain pressure in the system.



PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	gal	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	
Drawn by:	
File Name:	Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.pipe
Lineup:	Typical Day Case Phase 1
Print Date:	Monday, July 18, 2022 02:34 PM

List Report

File Name: Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.
Lineup: Typical Day Case Phase 1
Progam Name: PIPE-FLO Professional
Version: 18.0

Calculation Method: Darcy-Weisbach
Laminar Cutoff Re: 2100
Max Iterations: 100
Percent Tolerance: 0.01
Allowable Deviation: 1 %

Company: SSOE Inc.
Project:
by:
Date: Monday, July 18, 2022 02:37 PM
Atmospheric Pressure: 14.7 psi a

Pipe Specifications

Specification Name **Valve Table**	**Material** **Schedule**	**Absolute Roughness** **Hazen Williams C Factor**	**Sizing Criteria** **Sizing Criteria Value**		**Design Limits** **Velocity**	 **Pressure**	 **Re Number**	 **Mach**
Copper standard	Copper Pipe B302 Schedule: STD	6E-05 in 140	Criteria - none specified 0.0	**Min:** **Max:**	ft/s ft/s	psi g psi g		
Ductile Iron standard	Ductile Iron AWWA C151 Mech Schedule: 50	0.0102 in 140	Velocity = 5 ft/s 5.0 ft/s	**Min:** **Max:**	0 ft/s 12 ft/s	0 psi g 150 psi g		
PVC standard	PVC Plastic Pipe Schedule: 40	6E-05 in 140	Velocity = 5 ft/s 5.0 ft/s	**Min:** **Max:**	2 ft/s 12 ft/s	0 psi g 150 psi g		

Fluid Zones

Fluid Zone Name **Table Name**	**Temperature** **Pressure**	**Fluid State** **Relative Molecular Mass**	**Density** **Viscosity**	**Vapor Pressure** **Critical Pressure**	**Specific Heat Capacity (cp)** **Specific Heat Ratio (k)**
Water Water	60 °F 0 psi g	Liquid 18	62.37 lb/ft³ 1.105 cP	0.2564 psi a 3198 psi a	-- --

Centrifugal Pumps

Pump Name **Operational Mode and Set Point**	**Test Speed** **Operating Speed**	**Suction Elevation** **Suction Pressure**	**Discharge Elevation** **Discharge Pressure**	**Total Head** **dP**	**Flow Rate** **Input Power**	**Efficiency** **BEP Efficiency**	**NPSHa** **NPSHr**	**Design NPSH Margin Ratio**
Layne Bowler 12RH-8625-1 Fixed Speed @ 1770 rpm	1770	308 ft 0.1436 psi g	311 ft 93.81 psi g	219.2 ft 93.66 psi	1524 gpm 102.8 hp	81.34 % 83.1 %	33.68 ft 25.49 ft	--
Layne Bowler 12RH-8625-2 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Layne Bowler 12RH-8625-3 Fixed Speed @ 1770 rpm	1770	308 ft 0.1436 psi g	311 ft 93.81 psi g	219.2 ft 93.66 psi	1524 gpm 102.8 hp	81.34 % 83.1 %	33.68 ft 25.49 ft	--

Layne Bowler 12RH-8625-1:

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Layne Bowler 12RH-8625-2:

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Layne Bowler 12RH-8625-3:

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-4	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-5	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-6	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-7	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-8	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 1	16 in	Node 4	0 gpm	93.01 psi g	0 psi	93.01 psi g	0.01215
Ductile Iron	16.72 in	311 ft	0 ft/s	93.01 psi g		93.01 psi g	0.00
Water	10.5 ft	Node 5	0	525.7 ft	0 ft	525.7 ft	0 psi
		311 ft	--	525.7 ft		525.7 ft	0 ft
Pipe 10	12 in	Node 28	--	--	--	--	--
Ductile Iron	12.58 in	335 ft	--	--		--	0.00
Water	1820 ft	Node 39	--	--	--	--	--
		338 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 11 Ductile Iron Water	16 in 16.72 in 9200 ft	~N{037} 348 ft Node 30 338 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
Pipe 12 Ductile Iron Water	16 in 16.72 in 895 ft	Node 30 338 ft Node 29 336 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
Pipe 13 Ductile Iron Water	12 in 12.58 in 945 ft	Node 29 336 ft EMS Station 336 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
Pipe 14 Ductile Iron Water	16 in 16.72 in 30 ft	Node 33 322.5 ft FORD1 330 ft	747 gpm 1.092 ft/s 127759 0.0202	87.22 psi g 87.21 psi g 523.9 ft 523.8 ft	3.261 psi 0.02784 ft	83.96 psi g 83.95 psi g 523.8 ft 523.8 ft	0.01215 0.00 8.570E-03 psi 0.01979 ft
Pipe 15 Ductile Iron Water	16 in 16.72 in 30 ft	Node 32 340 ft FORD2 347 ft	747 gpm 1.092 ft/s 127759 0.0202	79.64 psi g 79.63 psi g 523.9 ft 523.8 ft	3.044 psi 0.02784 ft	76.59 psi g 76.58 psi g 523.8 ft 523.8 ft	0.01215 0.00 8.570E-03 psi 0.01979 ft
Pipe 16 Ductile Iron Water	16 in 16.72 in 30 ft	~N{036} 315 ft FORD3 322 ft	747 gpm 1.092 ft/s 127759 0.0202	90.68 psi g 90.67 psi g 524.3 ft 524.3 ft	3.044 psi 0.02784 ft	87.63 psi g 87.63 psi g 524.3 ft 524.3 ft	0.01215 0.00 8.570E-03 psi 0.01979 ft
Pipe 17 Copper Water	2 in 2.245 in 217 ft	~N{034} 314 ft Water Treatment Bldg 321 ft	15 gpm 1.216 ft/s 19107 0.02623	91.59 psi g 91.58 psi g 525.5 ft 525.4 ft	3.352 psi 0.7394 ft	88.24 psi g 88.23 psi g 524.7 ft 524.7 ft	0.01862 0.00 0.01753 psi 0.04047 ft
Pipe 18 Ductile Iron Water	8 in 8.51 in 463 ft	~N{035} 319 ft Node 45 317 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
Pipe 19 Ductile Iron Water	8 in 8.51 in 98 ft	~N{031} 309 ft Node 36 310 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
Pipe 2 Ductile Iron Water	24 in 25.04 in 50 ft	Node 5 311 ft ~N{030} 311 ft	1524 gpm 0.9927 ft/s 174015 0.0186	93.01 psi g 93 psi g 525.7 ft 525.7 ft	7.440E-03 psi 0.01718 ft	93 psi g 92.99 psi g 525.7 ft 525.7 ft	0.01126 0.00 4.483E-03 psi 0.01035 ft

Pipes

Pipe Name **Specification** **Fluid Zone**	**Size** **Inside Diameter** **Length**	**Inlet Device** **Inlet Elevation** **Outlet Device** **Outlet Elevation**	**Flow Rate** **Fluid Velocity** **Reynolds Number** **Pipe Friction Factor**	**Inlet Total Pressure** **Inlet Static Pressure** **Inlet Energy Grade** **Inlet Hydraulic Grade**	**Total dP** **Total Head Loss**	**Outlet Total Pressure** **Outlet Static Pressure** **Outlet Energy Grade** **Outlet Hydraulic Grade**	**V&F Friction Factor** **V&F Resistance K** **V&F dP** **V&F Head Loss**
Pipe 20	8 in	Node 38	15 gpm	66.69 psi g	1.312E-05 psi	66.69 psi g	0.01389
Ductile Iron	8.51 in	370 ft	0.08461 ft/s	66.69 psi g		66.69 psi g	0.00
Water	5 ft	WWTP	5040	524 ft	3.03E-05 ft	524 ft	0 psi
		370 ft	0.03863	524 ft		524 ft	0 ft
Pipe 21	8 in	Node 38	--	--	--	--	--
Ductile Iron	8.51 in	370 ft	--	--		--	0.00
Water	5 ft	Hydrants Open	--	--	--	--	--
		370 ft	--	--		--	--
Pipe 22	12 in	Node 39	--	--	--	--	--
Ductile Iron	12.58 in	338 ft	--	--		--	0.00
Water	1454 ft	Node 29	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 23	8 in	Node 41	--	--	--	--	--
Ductile Iron	8.51 in	314 ft	--	--		--	0.00
Water	166 ft	Node 42	--	--	--	--	--
		314 ft	--	--		--	--
Pipe 24	6 in	Node 42	--	--	--	--	--
Ductile Iron	6.4 in	314 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 1	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 25	6 in	Node 43	--	--	--	--	--
Ductile Iron	6.4 in	311 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 2	--	--	--	--	--
		316 ft	--	--		--	--
Pipe 26	6 in	Node 36	--	--	--	--	--
Ductile Iron	6.4 in	310 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 3	--	--	--	--	--
		315 ft	--	--		--	--
Pipe 27	8 in	Node 36	--	--	--	--	--
Ductile Iron	8.51 in	310 ft	--	--		--	0.00
Water	196 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--
Pipe 28	8 in	Node 44	--	--	--	--	--
Ductile Iron	8.51 in	313 ft	--	--		--	0.00
Water	128 ft	Pressure Boundary 4	--	--	--	--	--
		318 ft	--	--		--	--
Pipe 29	8 in	Node 45	--	--	--	--	--
Ductile Iron	8.51 in	317 ft	--	--		--	0.00
Water	148 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 3	16 in	Node 3	1524 gpm	93.04 psi g	0.03782 psi	93.01 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.227 ft/s	93.01 psi g		92.97 psi g	0.00
Water	10.5 ft	Node 5	260606	525.8 ft	0.08733 ft	525.7 ft	0.03305 psi
		311 ft	0.01898	525.7 ft		525.7 ft	0.07631 ft
Pipe 30	6 in	Node 45	--	--	--	--	--
Ductile Iron	6.4 in	317 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 5	--	--	--	--	--
		322 ft	--	--		--	--
Pipe 5	8 in	Node 10	15 gpm	85.35 psi g	18.66 psi	66.69 psi g	0.01389
Ductile Iron	8.51 in	327 ft	0.08461 ft/s	85.35 psi g		66.69 psi g	0.00
Water	12520 ft	Node 38	5040	524 ft	0.07602 ft	524 ft	6.692E-05 psi
		370 ft	0.03863	524 ft		524 ft	1.545E-04 ft
Pipe 6	24 in	Node 19	1524 gpm	93.01 psi g	7.440E-03 psi	93 psi g	0.01126
Ductile Iron	25.04 in	311 ft	0.9927 ft/s	93 psi g		92.99 psi g	0.00
Water	50 ft	~N{030}	174015	525.7 ft	0.01718 ft	525.7 ft	4.483E-03 psi
		311 ft	0.0186	525.7 ft		525.7 ft	0.01035 ft
Pipe 7	16 in	Node 18	0 gpm	93.01 psi g	0 psi	93.01 psi g	0.01215
Ductile Iron	16.72 in	311 ft	0 ft/s	93.01 psi g		93.01 psi g	0.00
Water	10.5 ft	Node 19	0	525.7 ft	0 ft	525.7 ft	0 psi
		311 ft	--	525.7 ft		525.7 ft	0 ft
Pipe 8	16 in	Node 17	1524 gpm	93.04 psi g	0.03782 psi	93.01 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.227 ft/s	93.01 psi g		92.97 psi g	0.00
Water	10.5 ft	Node 19	260606	525.8 ft	0.08733 ft	525.7 ft	0.03305 psi
		311 ft	0.01898	525.7 ft		525.7 ft	0.07631 ft
Pipe 9	16 in	Node 22	747 gpm	87.89 psi g	3.044 psi	84.85 psi g	0.01215
Ductile Iron	16.72 in	321 ft	1.092 ft/s	87.89 psi g		84.84 psi g	0.00
Water	30 ft	FORD	127759	523.9 ft	0.02784 ft	523.9 ft	8.570E-03 psi
		328 ft	0.0202	523.9 ft		523.9 ft	0.01979 ft
~Pipe{080}	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	16 ft	Layne Bowler 12RH-8625-5	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{080}1	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-7	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{081}	10 in	Clearwell 1	1524 gpm	0.3465 psi g	0.2029 psi	0.1436 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.624 ft/s	0.1336 psi g		-0.06933 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-1	414195	308.6 ft	0.2515 ft	308.3 ft	0.1065 psi
		308 ft	0.02022	308.1 ft		307.8 ft	0.2458 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{081}1 Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 2 307.8 ft Layne Bowler 12RH-8625-3 308 ft	1524 gpm 5.624 ft/s 414195 0.02022	0.3465 psi g 0.1336 psi g 308.6 ft 308.1 ft	0.2029 psi 0.2515 ft	0.1436 psi g -0.06933 psi g 308.3 ft 307.8 ft	0.0133 0.00 0.1065 psi 0.2458 ft
~Pipe{082} Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 1 307.8 ft Layne Bowler 12RH-8625-2 308 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{082}1 Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 1 307.8 ft Layne Bowler 12RH-8625-6 308 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{082}2 Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 2 307.8 ft Layne Bowler 12RH-8625-4 308 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{082}3 Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 2 307.8 ft Layne Bowler 12RH-8625-8 308 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}1 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-6 311 ft Node 6 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}10 Ductile Iron Water	16 in 16.72 in 10 ft	Node 21 311 ft Node 17 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}11 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-4 311 ft Node 18 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}12 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-3 311 ft Node 17 311 ft	1524 gpm 5.624 ft/s 414195 0.02022	93.81 psi g 93.6 psi g 527.6 ft 527.1 ft	0.763 psi 1.762 ft	93.04 psi g 92.83 psi g 525.8 ft 525.3 ft	0.0133 0.00 0.6402 psi 1.478 ft
~Pipe{085}13 Ductile Iron Water	10 in 10.52 in 25 ft	Node 1 324 ft Node 20 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{085}14	10 in	Layne Bowler 12RH-8625-7	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 27	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}15	10 in	Node 27	--	--	--	--	--
Ductile Iron	10.52 in	324 ft	--	--		--	0.00
Water	25 ft	Node 21	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}2	16 in	Node 6	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 4	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}3	10 in	Layne Bowler 12RH-8625-5	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 15	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}4	16 in	Node 15	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 3	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}5	10 in	Layne Bowler 12RH-8625-2	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 4	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}6	10 in	Layne Bowler 12RH-8625-1	1524 gpm	93.81 psi g	0.763 psi	93.04 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.624 ft/s	93.6 psi g		92.83 psi g	0.00
Water	25 ft	Node 3	414195	527.6 ft	1.762 ft	525.8 ft	0.6402 psi
		311 ft	0.02022	527.1 ft		525.3 ft	1.478 ft
~Pipe{085}7	10 in	Layne Bowler 12RH-8625-8	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 1	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}8	16 in	Node 20	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 18	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{086}	24 in	~N{030}	3047 gpm	93 psi g	0.04757 psi	92.95 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.985 ft/s	92.97 psi g		92.93 psi g	0.00
Water	85 ft	Node 43	348030	525.7 ft	0.1098 ft	525.6 ft	0.02869 psi
		311 ft	0.01747	525.6 ft		525.5 ft	0.06623 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{086}1	24 in	Node 43	3047 gpm	92.95 psi g	0.02724 psi	92.92 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.985 ft/s	92.93 psi g		92.9 psi g	0.00
Water	15 ft	~N{001}	348030	525.6 ft	0.06289 ft	525.5 ft	0.02391 psi
		311 ft	0.01747	525.5 ft		525.5 ft	0.05519 ft
~Pipe{087}	16 in	~N{001}	687.9 gpm	92.92 psi g	-0.8053 psi	93.73 psi g	0.01215
Ductile Iron	16.72 in	311 ft	1.005 ft/s	92.92 psi g		93.72 psi g	0.00
Water	522 ft	~N{031}	117650	525.5 ft	0.1409 ft	525.4 ft	9.089E-03 psi
		309 ft	0.02038	525.5 ft		525.4 ft	0.02098 ft
~Pipe{089}	16 in	~N{031}	687.9 gpm	93.73 psi g	2.316 psi	91.41 psi g	0.01215
Ductile Iron	16.72 in	309 ft	1.005 ft/s	93.72 psi g		91.41 psi g	0.00
Water	5824 ft	~N{039}	117650	525.4 ft	1.348 ft	524 ft	4.627E-03 psi
		313 ft	0.02038	525.4 ft		524 ft	0.01068 ft
~Pipe{090}	16 in	~N{033}	687.9 gpm	91.4 psi g	9.097E-03 psi	91.39 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.005 ft/s	91.4 psi g		91.39 psi g	0.00
Water	25 ft	Node 14	117650	524 ft	0.021 ft	524 ft	6.610E-03 psi
		313 ft	0.02038	524 ft		524 ft	0.01526 ft
~Pipe{090}1	16 in	Node 14	687.9 gpm	91.39 psi g	7.799 psi	83.6 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.005 ft/s	91.39 psi g		83.59 psi g	0.00
Water	20 ft	North Water Tower	117650	524 ft	4.593E-03 ft	524 ft	0 psi
		331 ft	0.02038	524 ft		524 ft	0 ft
~Pipe{091}	16 in	Node 14	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	72 ft	~N{033}	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{092}	24 in	~N{001}	2360 gpm	92.92 psi g	1.331 psi	91.59 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.537 ft/s	92.91 psi g		91.58 psi g	0.00
Water	142 ft	~N{034}	269471	525.5 ft	0.07267 ft	525.5 ft	0.01218 psi
		314 ft	0.01782	525.5 ft		525.4 ft	0.02813 ft
~Pipe{093}	24 in	~N{034}	2345 gpm	91.59 psi g	6.295E-03 psi	91.59 psi g	0.01126
Ductile Iron	25.04 in	314 ft	1.528 ft/s	91.58 psi g		91.57 psi g	0.00
Water	10 ft	Node 41	267758	525.5 ft	0.01453 ft	525.5 ft	4.953E-03 psi
		314 ft	0.01783	525.4 ft		525.4 ft	0.01143 ft
~Pipe{093}1	24 in	Node 41	2345 gpm	91.59 psi g	2.21 psi	89.38 psi g	0.01126
Ductile Iron	25.04 in	314 ft	1.528 ft/s	91.57 psi g		89.36 psi g	0.00
Water	295 ft	~N{035}	267758	525.5 ft	0.1029 ft	525.3 ft	4.953E-03 psi
		319 ft	0.01783	525.4 ft		525.3 ft	0.01143 ft
~Pipe{094}	24 in	~N{035}	2345 gpm	89.38 psi g	-1.3 psi	90.68 psi g	0.01126
Ductile Iron	25.04 in	319 ft	1.528 ft/s	89.36 psi g		90.66 psi g	0.00
Water	3100 ft	~N{036}	267758	525.3 ft	0.9983 ft	524.3 ft	0.01624 psi
		315 ft	0.01783	525.3 ft		524.3 ft	0.0375 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{095}	24 in	~N{036}	1598 gpm	90.68 psi g	5.331 psi	85.35 psi g	0.01126
Ductile Iron	25.04 in	315 ft	1.041 ft/s	90.67 psi g		85.34 psi g	0.00
Water	1945 ft	Node 10	182449	524.3 ft	0.3086 ft	524 ft	7.869E-03 psi
		327 ft	0.01851	524.3 ft		524 ft	0.01817 ft
~Pipe{095}1	24 in	Node 10	1583 gpm	85.35 psi g	-2.548 psi	87.89 psi g	0.01126
Ductile Iron	25.04 in	327 ft	1.031 ft/s	85.34 psi g		87.89 psi g	0.00
Water	734 ft	Node 22	180736	524 ft	0.1181 ft	523.9 ft	4.499E-03 psi
		321 ft	0.01853	524 ft		523.9 ft	0.01039 ft
~Pipe{095}2	24 in	Node 22	835.6 gpm	87.89 psi g	-1.296 psi	89.19 psi g	0.01126
Ductile Iron	25.04 in	321 ft	0.5444 ft/s	87.89 psi g		89.19 psi g	0.00
Water	148 ft	Node 25	95427	523.9 ft	8.010E-03 ft	523.9 ft	6.291E-04 psi
		318 ft	0.02007	523.9 ft		523.9 ft	1.452E-03 ft
~Pipe{095}3	24 in	Node 25	835.6 gpm	89.19 psi g	1.973 psi	87.22 psi g	0.01126
Ductile Iron	25.04 in	318 ft	0.5444 ft/s	89.19 psi g		87.21 psi g	0.00
Water	1243 ft	Node 33	95427	523.9 ft	0.05611 ft	523.9 ft	4.493E-04 psi
		322.5 ft	0.02007	523.9 ft		523.9 ft	1.037E-03 ft
~Pipe{095}4	24 in	Node 32	658.4 gpm	76.18 psi g	-3.454 psi	79.64 psi g	0.01126
Ductile Iron	25.04 in	340 ft	0.429 ft/s	76.18 psi g		79.63 psi g	0.00
Water	790 ft	~N{037}	75191	523.9 ft	0.02525 ft	523.9 ft	1.180E-03 psi
		348 ft	0.0208	523.9 ft		523.9 ft	2.725E-03 ft
Messages: Reversed flow							
~Pipe{095}5	24 in	Node 33	88.6 gpm	87.22 psi g	4.115 psi	83.1 psi g	0.01126
Ductile Iron	25.04 in	322.5 ft	0.05772 ft/s	87.22 psi g		83.1 psi g	0.00
Water	438 ft	Node 40	10118	523.9 ft	3.624E-04 ft	523.9 ft	9.093E-06 psi
		332 ft	0.03141	523.9 ft		523.9 ft	2.099E-05 ft
~Pipe{095}6	24 in	Node 40	88.6 gpm	83.1 psi g	3.466 psi	79.64 psi g	0.01126
Ductile Iron	25.04 in	332 ft	0.05772 ft/s	83.1 psi g		79.64 psi g	0.00
Water	1923 ft	Node 32	10118	523.9 ft	1.499E-03 ft	523.9 ft	0 psi
		340 ft	0.03141	523.9 ft		523.9 ft	0 ft
~Pipe{096}	14 in	~N{037}	658.4 gpm	76.2 psi g	0.01473 psi	76.18 psi g	0.01246
Ductile Iron	14.64 in	348 ft	1.255 ft/s	76.19 psi g		76.17 psi g	0.00
Water	8 ft	Node 9	128605	523.9 ft	0.034 ft	523.9 ft	0.0133 psi
		348 ft	0.02054	523.9 ft		523.9 ft	0.0307 ft
Messages: Reversed flow							
~Pipe{096}1	14 in	Node 9	658.4 gpm	76.2 psi g	4.427E-03 psi	76.2 psi g	0.01246
Ductile Iron	14.64 in	348 ft	1.255 ft/s	76.19 psi g		76.19 psi g	0.00
Water	10 ft	Node 12	128605	523.9 ft	0.01022 ft	523.9 ft	2.642E-03 psi
		348 ft	0.02054	523.9 ft		523.9 ft	6.101E-03 ft
Messages: Reversed flow							

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{096}2	14 in	Node 12	658.4 gpm	72.77 psi g	-3.433 psi	76.2 psi g	0.01246
Ductile Iron	14.64 in	348 ft	1.255 ft/s	72.76 psi g		76.19 psi g	0.00
Water	165 ft	South Tower	128605	524 ft	0.07408 ft	523.9 ft	2.642E-03 psi
		356 ft	0.02054	524 ft		523.9 ft	6.101E-03 ft
Messages: Reversed flow							
~Pipe{097}	14 in	Node 12	--	--	--	--	--
Ductile Iron	14.64 in	348 ft	--	--		--	0.00
Water	25 ft	Node 9	--	--	--	--	--
		348 ft	--	--		--	--
~Pipe{098}	16 in	Node 23	--	--	--	--	--
Ductile Iron	16.72 in	322 ft	--	--		--	0.00
Water	525 ft	~N{041}	--	--	--	--	--
		329 ft	--	--		--	--
~Pipe{099}	16 in	~N{039}	687.9 gpm	91.41 psi g	9.931E-03 psi	91.4 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.005 ft/s	91.41 psi g		91.4 psi g	0.00
Water	50 ft	~N{033}	117650	524 ft	0.02293 ft	524 ft	4.958E-03 psi
		313 ft	0.02038	524 ft		524 ft	0.01145 ft
~Pipe{100}	16 in	~N{039}	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	40 ft	Node 37	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{100}1	16 in	~N{040}	--	--	--	--	--
Ductile Iron	16.72 in	323 ft	--	--		--	0.00
Water	5885 ft	Node 28	--	--	--	--	--
		335 ft	--	--		--	--
~Pipe{100}2	16 in	Node 28	--	--	--	--	--
Ductile Iron	16.72 in	335 ft	--	--		--	0.00
Water	752 ft	Node 23	--	--	--	--	--
		322 ft	--	--		--	--
~Pipe{100}3	16 in	Node 37	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	6300 ft	Node 23	--	--	--	--	--
		322 ft	--	--		--	--
~Pipe{100}4	16 in	~N{040}1	--	--	--	--	--
Ductile Iron	16.72 in	335 ft	--	--		--	0.00
Water	5885 ft	Node 39	--	--	--	--	--
		338 ft	--	--		--	--
~Pipe{101}	16 in	Node 25	--	--	--	--	--
Ductile Iron	16.72 in	318 ft	--	--		--	0.00
Water	3991 ft	~N{040}	--	--	--	--	--
		323 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{101}1	16 in	Node 40	--	--	--	--	--
Ductile Iron	16.72 in	332 ft	--	--		--	0.00
Water	3991 ft	~N{040}1	--	--	--	--	--
		335 ft	--	--		--	--
~Pipe{102}	16 in	~N{041}	--	--	--	--	--
Ductile Iron	16.72 in	329 ft	--	--		--	0.00
Water	1 ft	Tenant Demand	--	--	--	--	--
		329 ft	--	--		--	--

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 1	324 ft	--	--
Node 10	327 ft	85.35 psi g	524 ft
Node 12	348 ft	76.2 psi g	523.9 ft
Node 14	313 ft	91.39 psi g	524 ft
Node 15	311 ft	--	--
Node 17	311 ft	93.04 psi g	525.5 ft
Node 18	311 ft	93.01 psi g	525.7 ft
Node 19	311 ft	93.01 psi g	525.7 ft
Node 20	311 ft	--	--
Node 21	311 ft	--	--
Node 22	321 ft	87.89 psi g	523.9 ft
Node 23	322 ft	--	--
Node 25	318 ft	89.19 psi g	523.9 ft
Node 27	324 ft	--	--
Node 28	335 ft	--	--
Node 29	336 ft	--	--
Node 3	311 ft	93.04 psi g	525.5 ft
Node 30	338 ft	--	--
Node 32	340 ft	79.64 psi g	523.8 ft
Node 33	322.5 ft	87.22 psi g	523.9 ft
Node 36	310 ft	--	--
Node 37	313 ft	--	--
Node 38	370 ft	66.69 psi g	524 ft
Node 39	338 ft	--	--

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 4	311 ft	93.01 psi g	525.7 ft
Node 40	332 ft	83.1 psi g	523.9 ft
Node 41	314 ft	91.59 psi g	525.4 ft
Node 42	314 ft	--	--
Node 43	311 ft	92.95 psi g	525.5 ft
Node 44	313 ft	--	--
Node 45	317 ft	--	--
Node 5	311 ft	93.01 psi g	525.7 ft
Node 6	311 ft	--	--
Node 9	348 ft	76.2 psi g	523.9 ft
~N{001}	311 ft	92.92 psi g	525.5 ft
~N{030}	311 ft	93 psi g	525.7 ft
~N{031}	309 ft	93.73 psi g	525.4 ft
~N{033}	313 ft	91.4 psi g	524 ft
~N{034}	314 ft	91.59 psi g	525.4 ft
~N{035}	319 ft	89.38 psi g	525.3 ft
~N{036}	315 ft	90.68 psi g	524.3 ft
~N{037}	348 ft	76.18 psi g	523.9 ft
~N{039}	313 ft	91.41 psi g	524 ft
~N{040}	323 ft	--	--
~N{040}1	335 ft	--	--
~N{041}	329 ft	--	--

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Hydrants Open P Total @ 0 psi g	370 ft	-- -- --	-- -- --	--
Pressure Boundary 1 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 2 P Static @ 70 psi g	316 ft	-- -- --	-- -- --	--

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Pressure Boundary 3 P Static @ 70 psi g	315 ft	-- -- --	-- -- --	--
Pressure Boundary 4 P Static @ 70 psi g	318 ft	-- -- --	-- -- --	--
Pressure Boundary 5 P Static @ 70 psi g	322 ft	-- -- --	-- -- --	--

Flow Demands

Flow Demand Name Operation Flow Direction	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
EMS Station Flow Rate @ 300 gpm Flow out	336 ft	-- -- --	-- -- --	--
FORD Flow Rate @ 747 gpm Flow out	328 ft	84.85 psi g 84.84 psi g 8.020E-03 psi	523.9 ft 523.9 ft 0.01852 ft	747 gpm
FORD1 Flow Rate @ 747 gpm Flow out	330 ft	83.96 psi g 83.95 psi g 8.020E-03 psi	523.8 ft 523.8 ft 0.01852 ft	747 gpm
FORD2 Flow Rate @ 747 gpm Flow out	347 ft	76.59 psi g 76.58 psi g 8.020E-03 psi	523.8 ft 523.8 ft 0.01852 ft	747 gpm
FORD3 Flow Rate @ 747 gpm Flow out	322 ft	87.63 psi g 87.63 psi g 8.020E-03 psi	524.3 ft 524.3 ft 0.01852 ft	747 gpm
Tenant Demand Flow Rate @ 1389 gpm Flow out	329 ft	-- -- --	-- -- --	--
WWTP Flow Rate @ 15 gpm Flow out	370 ft	66.69 psi g 66.69 psi g 4.819E-05 psi	524 ft 524 ft 1.113E-04 ft	15 gpm
Water Treatment Bldg Flow Rate @ 15 gpm Flow out	321 ft	88.24 psi g 88.23 psi g 9.949E-03 psi	524.7 ft 524.7 ft 0.02297 ft	15 gpm

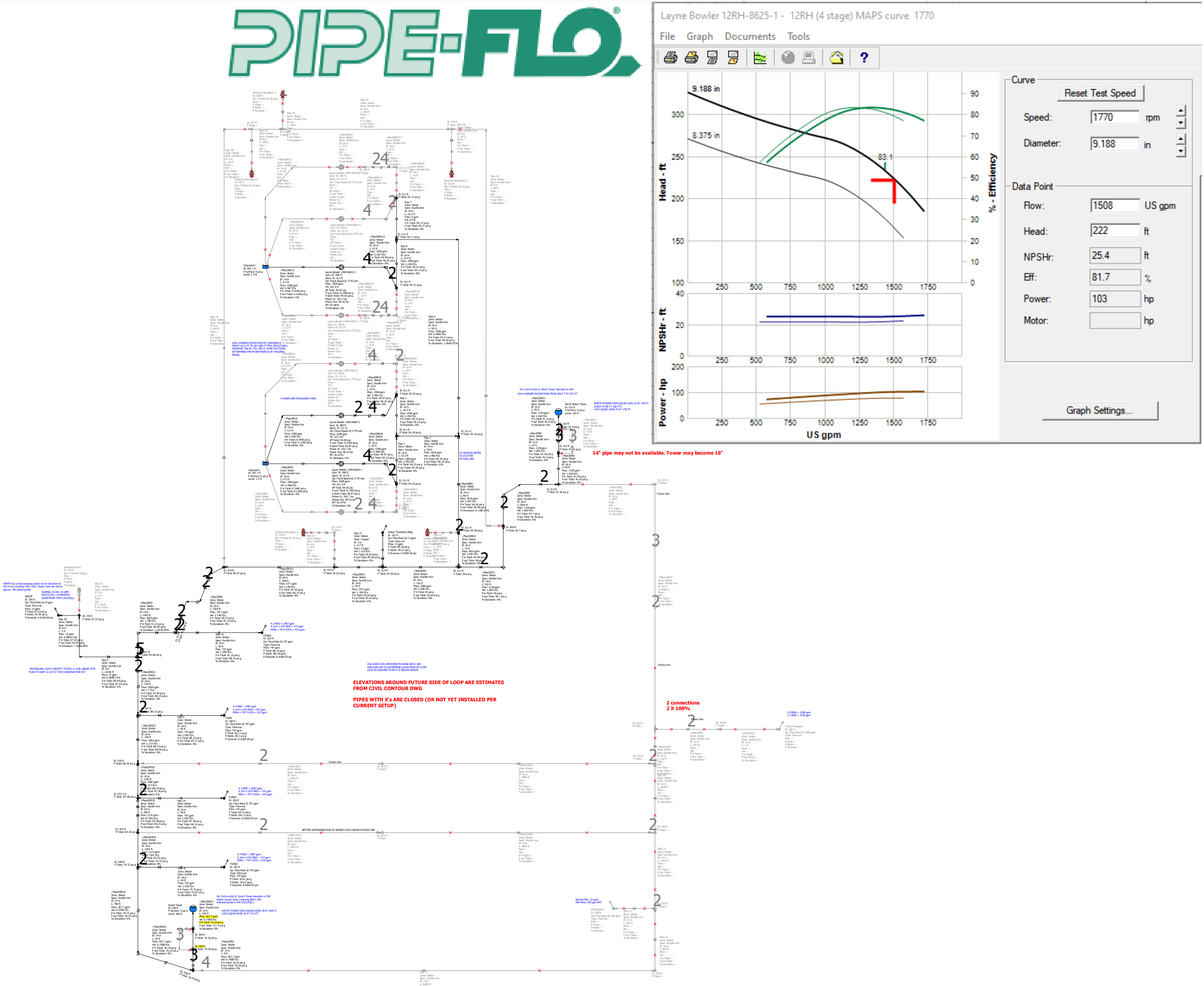
Phase 1 Operation

Blue Oval - 4.3 MGD Design Flow

Three pump operation

For view of a three pump operation, we have included pumps from two clearwells. Two pumps in one well and a single pump in the second well to prevent stagnation from occurring. The curves for selected pump are imposed on the flow diagram. General flow rate for this scenario is 3371 GPM which is slightly above the nominal 4.3 MGD average flow of 2986 GPM. The pump flow on VFD can be adjusted if needed to reduce flow or maintain levels to fill towers.

In this model, the pressure at the south tower is 76.24 PSIG (176.1 feet) plus Elev. 348 = 524.1 feet. Allowing ability to fully fill the south tower. Flow into the tower with four pumps operating and normal flow to tenant is 367 GPM.



Layne Bowler 12RH-8625-1 - 12RH (4 stage) MAPS curve 1770

Curve

Speed: 1770 rpm

Diameter: 9.188 in

Data Point

Flow: 1508 US gpm

Head: 222 ft

NPSHr: 25.4 ft

Eff: 81.7 %

Power: 103 hp

Motor: hp

PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	gal	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	
Drawn by:	
File Name:	Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.pipe
Lineup:	Typical Day Case Phase 1
Print Date:	Wednesday, July 20, 2022 02:46 PM

List Report

File Name: Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.
Lineup: Typical Day Case Phase 1
Progam Name: PIPE-FLO Professional
Version: 18.0

Calculation Method: Darcy-Weisbach
Laminar Cutoff Re: 2100
Max Iterations: 100
Percent Tolerance: 0.01
Allowable Deviation: 1 %

Company: SSOE Inc.
Project:
by:
Date: Wednesday, July 20, 2022 02:48 PM
Atmospheric Pressure: 14.7 psi a

Pipe Specifications

Specification Name Valve Table	Material Schedule	Absolute Roughness Hazen Williams C Factor	Sizing Criteria Sizing Criteria Value		Design Limits Velocity	 Pressure	 Re Number	 Mach
Copper standard	Copper Pipe B302 Schedule: STD	6E-05 in 140	Criteria - none specified 0.0	**Min:** **Max:**	ft/s ft/s	psi g psi g		
Ductile Iron standard	Ductile Iron AWWA C151 Mech Schedule: 50	0.0102 in 140	Velocity = 5 ft/s 5.0 ft/s	**Min:** **Max:**	0 ft/s 12 ft/s	0 psi g 150 psi g		
PVC standard	PVC Plastic Pipe Schedule: 40	6E-05 in 140	Velocity = 5 ft/s 5.0 ft/s	**Min:** **Max:**	2 ft/s 12 ft/s	0 psi g 150 psi g		

Fluid Zones

Fluid Zone Name Table Name	Temperature Pressure	Fluid State Relative Molecular Mass	Density Viscosity	Vapor Pressure Critical Pressure	Specific Heat Capacity (cp) Specific Heat Ratio (k)
Water Water	60 °F 0 psi g	Liquid 18	62.37 lb/ft³ 1.105 cP	0.2564 psi a 3198 psi a	-- --

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-1 Fixed Speed @ 1770 rpm	1770	308 ft 0.1459 psi g	311 ft 94.97 psi g	221.9 ft 94.83 psi	1508 gpm 102.7 hp	81.67 % 83.1 %	33.68 ft 25.44 ft	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-2 Fixed Speed @ 1770 rpm	1770	308 ft 0.1459 psi g	311 ft 94.97 psi g	221.9 ft 94.83 psi	1508 gpm 102.7 hp	81.67 % 83.1 %	33.68 ft 25.44 ft	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-3 Fixed Speed @ 1770 rpm	1770	308 ft 0.1458 psi g	311 ft 94.95 psi g	221.9 ft 94.81 psi	1508 gpm 102.7 hp	81.66 % 83.1 %	33.68 ft 25.44 ft	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-4	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-5	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-6	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-7	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-8	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 1	16 in	Node 4	1508 gpm	94.23 psi g	0.03705 psi	94.19 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.203 ft/s	94.2 psi g		94.16 psi g	0.00
Water	10.5 ft	Node 5	257895	528.5 ft	0.08553 ft	528.5 ft	0.03237 psi
		311 ft	0.01899	528.5 ft		528.4 ft	0.07473 ft
Pipe 10	12 in	Node 28	--	--	--	--	--
Ductile Iron	12.58 in	335 ft	--	--		--	0.00
Water	1820 ft	Node 39	--	--	--	--	--
		338 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 11	16 in	~N{037}	--	--	--	--	--
Ductile Iron	16.72 in	348 ft	--	--		--	0.00
Water	9200 ft	Node 30	--	--	--	--	--
		338 ft	--	--		--	--
Pipe 12	16 in	Node 30	--	--	--	--	--
Ductile Iron	16.72 in	338 ft	--	--		--	0.00
Water	895 ft	Node 29	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 13	12 in	Node 29	--	--	--	--	--
Ductile Iron	12.58 in	336 ft	--	--		--	0.00
Water	945 ft	EMS Station	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 14	16 in	Node 33	747 gpm	87.38 psi g	3.261 psi	84.12 psi g	0.01215
Ductile Iron	16.72 in	322.5 ft	1.092 ft/s	87.37 psi g		84.11 psi g	0.00
Water	30 ft	FORD1	127759	524.2 ft	0.02784 ft	524.2 ft	8.570E-03 psi
		330 ft	0.0202	524.2 ft		524.2 ft	0.01979 ft
Pipe 15	16 in	Node 32	747 gpm	79.72 psi g	3.044 psi	76.67 psi g	0.01215
Ductile Iron	16.72 in	340 ft	1.092 ft/s	79.71 psi g		76.67 psi g	0.00
Water	30 ft	FORD2	127759	524 ft	0.02784 ft	524 ft	8.570E-03 psi
		347 ft	0.0202	524 ft		524 ft	0.01979 ft
Pipe 16	16 in	~N{036}	747 gpm	91.23 psi g	3.044 psi	88.19 psi g	0.01215
Ductile Iron	16.72 in	315 ft	1.092 ft/s	91.22 psi g		88.18 psi g	0.00
Water	30 ft	FORD3	127759	525.6 ft	0.02784 ft	525.6 ft	8.570E-03 psi
		322 ft	0.0202	525.6 ft		525.6 ft	0.01979 ft
Pipe 17	2 in	~N{034}	15 gpm	92.64 psi g	3.352 psi	89.28 psi g	0.01862
Copper	2.245 in	314 ft	1.216 ft/s	92.63 psi g		89.27 psi g	0.00
Water	217 ft	Water Treatment Bldg	19107	527.9 ft	0.7394 ft	527.1 ft	0.01753 psi
		321 ft	0.02623	527.8 ft		527.1 ft	0.04047 ft
Pipe 18	8 in	~N{035}	--	--	--	--	--
Ductile Iron	8.51 in	319 ft	--	--		--	0.00
Water	463 ft	Node 45	--	--	--	--	--
		317 ft	--	--		--	--
Pipe 19	8 in	~N{031}	--	--	--	--	--
Ductile Iron	8.51 in	309 ft	--	--		--	0.00
Water	98 ft	Node 36	--	--	--	--	--
		310 ft	--	--		--	--
Pipe 2	24 in	Node 5	3016 gpm	94.19 psi g	0.02844 psi	94.16 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.965 ft/s	94.16 psi g		94.14 psi g	0.00
Water	50 ft	~N{030}	344409	528.5 ft	0.06567 ft	528.4 ft	0.01756 psi
		311 ft	0.01748	528.4 ft		528.3 ft	0.04054 ft

Pipes

Pipe Name **Specification** **Fluid Zone**	**Size** **Inside Diameter** **Length**	**Inlet Device** **Inlet Elevation** **Outlet Device** **Outlet Elevation**	**Flow Rate** **Fluid Velocity** **Reynolds Number** **Pipe Friction Factor**	**Inlet Total Pressure** **Inlet Static Pressure** **Inlet Energy Grade** **Inlet Hydraulic Grade**	**Total dP** **Total Head Loss**	**Outlet Total Pressure** **Outlet Static Pressure** **Outlet Energy Grade** **Outlet Hydraulic Grade**	**V&F Friction Factor** **V&F Resistance K** **V&F dP** **V&F Head Loss**
Pipe 20	8 in	Node 38	15 gpm	67.03 psi g	1.312E-05 psi	67.03 psi g	0.01389
Ductile Iron	8.51 in	370 ft	0.08461 ft/s	67.03 psi g		67.03 psi g	0.00
Water	5 ft	WWTP	5040	524.8 ft	3.03E-05 ft	524.8 ft	0 psi
		370 ft	0.03863	524.8 ft		524.8 ft	0 ft
Pipe 21	8 in	Node 38	--	--	--	--	--
Ductile Iron	8.51 in	370 ft	--	--		--	0.00
Water	5 ft	Hydrants Open	--	--	--	--	--
		370 ft	--	--		--	--
Pipe 22	12 in	Node 39	--	--	--	--	--
Ductile Iron	12.58 in	338 ft	--	--		--	0.00
Water	1454 ft	Node 29	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 23	8 in	Node 41	--	--	--	--	--
Ductile Iron	8.51 in	314 ft	--	--		--	0.00
Water	166 ft	Node 42	--	--	--	--	--
		314 ft	--	--		--	--
Pipe 24	6 in	Node 42	--	--	--	--	--
Ductile Iron	6.4 in	314 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 1	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 25	6 in	Node 43	--	--	--	--	--
Ductile Iron	6.4 in	311 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 2	--	--	--	--	--
		316 ft	--	--		--	--
Pipe 26	6 in	Node 36	--	--	--	--	--
Ductile Iron	6.4 in	310 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 3	--	--	--	--	--
		315 ft	--	--		--	--
Pipe 27	8 in	Node 36	--	--	--	--	--
Ductile Iron	8.51 in	310 ft	--	--		--	0.00
Water	196 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--
Pipe 28	8 in	Node 44	--	--	--	--	--
Ductile Iron	8.51 in	313 ft	--	--		--	0.00
Water	128 ft	Pressure Boundary 4	--	--	--	--	--
		318 ft	--	--		--	--
Pipe 29	8 in	Node 45	--	--	--	--	--
Ductile Iron	8.51 in	317 ft	--	--		--	0.00
Water	148 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 3	16 in	Node 3	1508 gpm	94.23 psi g	0.03705 psi	94.19 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.203 ft/s	94.2 psi g		94.16 psi g	0.00
Water	10.5 ft	Node 5	257895	528.5 ft	0.08553 ft	528.5 ft	0.03237 psi
		311 ft	0.01899	528.5 ft		528.4 ft	0.07473 ft
Pipe 30	6 in	Node 45	--	--	--	--	--
Ductile Iron	6.4 in	317 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 5	--	--	--	--	--
		322 ft	--	--		--	--
Pipe 5	8 in	Node 10	15 gpm	85.69 psi g	18.66 psi	67.03 psi g	0.01389
Ductile Iron	8.51 in	327 ft	0.08461 ft/s	85.69 psi g		67.03 psi g	0.00
Water	12520 ft	Node 38	5040	524.8 ft	0.07602 ft	524.8 ft	6.692E-05 psi
		370 ft	0.03863	524.8 ft		524.8 ft	1.545E-04 ft
Pipe 6	24 in	Node 19	1508 gpm	94.17 psi g	7.292E-03 psi	94.16 psi g	0.01126
Ductile Iron	25.04 in	311 ft	0.9826 ft/s	94.16 psi g		94.16 psi g	0.00
Water	50 ft	~N{030}	172237	528.4 ft	0.01683 ft	528.4 ft	4.391E-03 psi
		311 ft	0.01862	528.4 ft		528.4 ft	0.01014 ft
Pipe 7	16 in	Node 18	0 gpm	94.17 psi g	0 psi	94.17 psi g	0.01215
Ductile Iron	16.72 in	311 ft	0 ft/s	94.17 psi g		94.17 psi g	0.00
Water	10.5 ft	Node 19	0	528.4 ft	0 ft	528.4 ft	0 psi
		311 ft	--	528.4 ft		528.4 ft	0 ft
Pipe 8	16 in	Node 17	1508 gpm	94.21 psi g	0.03706 psi	94.17 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.204 ft/s	94.17 psi g		94.14 psi g	0.00
Water	10.5 ft	Node 19	257944	528.5 ft	0.08556 ft	528.4 ft	0.03238 psi
		311 ft	0.01899	528.4 ft		528.3 ft	0.07476 ft
Pipe 9	16 in	Node 22	747 gpm	88.15 psi g	3.044 psi	85.11 psi g	0.01215
Ductile Iron	16.72 in	321 ft	1.092 ft/s	88.14 psi g		85.1 psi g	0.00
Water	30 ft	FORD	127759	524.5 ft	0.02784 ft	524.5 ft	8.570E-03 psi
		328 ft	0.0202	524.5 ft		524.5 ft	0.01979 ft
~Pipe{080}	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	16 ft	Layne Bowler 12RH-8625-5	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{080}1	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-7	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{081}	10 in	Clearwell 1	1508 gpm	0.3465 psi g	0.2007 psi	0.1459 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.566 ft/s	0.138 psi g		-0.06267 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-1	409886	308.6 ft	0.2463 ft	308.3 ft	0.1043 psi
		308 ft	0.02023	308.1 ft		307.9 ft	0.2407 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{081}1	10 in	Clearwell 2	1508 gpm	0.3465 psi g	0.2007 psi	0.1458 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.567 ft/s	0.1379 psi g		-0.06279 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-3	409963	308.6 ft	0.2464 ft	308.3 ft	0.1043 psi
		308 ft	0.02023	308.1 ft		307.9 ft	0.2408 ft
~Pipe{082}	10 in	Clearwell 1	1508 gpm	0.3465 psi g	0.2007 psi	0.1459 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.566 ft/s	0.138 psi g		-0.06267 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-2	409886	308.6 ft	0.2463 ft	308.3 ft	0.1043 psi
		308 ft	0.02023	308.1 ft		307.9 ft	0.2407 ft
~Pipe{082}1	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-6	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{082}2	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-4	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{082}3	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-8	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{085}1	10 in	Layne Bowler 12RH-8625-6	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 6	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}10	16 in	Node 21	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 17	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}11	10 in	Layne Bowler 12RH-8625-4	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 18	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}12	10 in	Layne Bowler 12RH-8625-3	1508 gpm	94.95 psi g	0.7475 psi	94.21 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.567 ft/s	94.75 psi g		94 psi g	0.00
Water	25 ft	Node 17	409963	530.2 ft	1.726 ft	528.5 ft	0.6272 psi
		311 ft	0.02023	529.7 ft		528 ft	1.448 ft
~Pipe{085}13	10 in	Node 1	--	--	--	--	--
Ductile Iron	10.52 in	324 ft	--	--		--	0.00
Water	25 ft	Node 20	--	--	--	--	--
		311 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{085}14	10 in	Layne Bowler 12RH-8625-7	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 27	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}15	10 in	Node 27	--	--	--	--	--
Ductile Iron	10.52 in	324 ft	--	--		--	0.00
Water	25 ft	Node 21	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}2	16 in	Node 6	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 4	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}3	10 in	Layne Bowler 12RH-8625-5	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 15	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}4	16 in	Node 15	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 3	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}5	10 in	Layne Bowler 12RH-8625-2	1508 gpm	94.97 psi g	0.7472 psi	94.23 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.566 ft/s	94.77 psi g		94.02 psi g	0.00
Water	25 ft	Node 4	409886	530.3 ft	1.725 ft	528.5 ft	0.627 psi
		311 ft	0.02023	529.8 ft		528.1 ft	1.447 ft
~Pipe{085}6	10 in	Layne Bowler 12RH-8625-1	1508 gpm	94.97 psi g	0.7472 psi	94.23 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.566 ft/s	94.77 psi g		94.02 psi g	0.00
Water	25 ft	Node 3	409886	530.3 ft	1.725 ft	528.5 ft	0.627 psi
		311 ft	0.02023	529.8 ft		528.1 ft	1.447 ft
~Pipe{085}7	10 in	Layne Bowler 12RH-8625-8	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 1	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}8	16 in	Node 20	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 18	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{086}	24 in	~N{030}	4524 gpm	94.16 psi g	0.1038 psi	94.06 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.947 ft/s	94.1 psi g		94 psi g	0.00
Water	85 ft	Node 43	516646	528.4 ft	0.2396 ft	528.2 ft	0.06322 psi
		311 ft	0.01703	528.3 ft		528 ft	0.146 ft

Pipes

Pipe Name **Specification** **Fluid Zone**	**Size** **Inside Diameter** **Length**	**Inlet Device** **Inlet Elevation** **Outlet Device** **Outlet Elevation**	**Flow Rate** **Fluid Velocity** **Reynolds Number** **Pipe Friction Factor**	**Inlet Total Pressure** **Inlet Static Pressure** **Inlet Energy Grade** **Inlet Hydraulic Grade**	**Total dP** **Total Head Loss**	**Outlet Total Pressure** **Outlet Static Pressure** **Outlet Energy Grade** **Outlet Hydraulic Grade**	**V&F Friction Factor** **V&F Resistance K** **V&F dP** **V&F Head Loss**
~Pipe{086}1	24 in	Node 43	4524 gpm	94.06 psi g	0.05984 psi	94 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.947 ft/s	94 psi g		93.94 psi g	0.00
Water	15 ft	~N{001}	516646	528.2 ft	0.1382 ft	528 ft	0.05268 psi
		311 ft	0.01703	528 ft		527.9 ft	0.1216 ft
~Pipe{087}	16 in	~N{001}	1138 gpm	94 psi g	-0.706 psi	94.7 psi g	0.01215
Ductile Iron	16.72 in	311 ft	1.663 ft/s	93.98 psi g		94.69 psi g	0.00
Water	522 ft	~N{031}	194676	528 ft	0.37 ft	527.6 ft	0.02489 psi
		309 ft	0.0194	528 ft		527.6 ft	0.05746 ft
~Pipe{089}	16 in	~N{031}	1138 gpm	94.7 psi g	3.256 psi	91.45 psi g	0.01215
Ductile Iron	16.72 in	309 ft	1.663 ft/s	94.69 psi g		91.43 psi g	0.00
Water	5824 ft	~N{039}	194676	527.6 ft	3.516 ft	524.1 ft	0.01267 psi
		313 ft	0.0194	527.6 ft		524.1 ft	0.02925 ft
~Pipe{090}	16 in	~N{033}	1138 gpm	91.42 psi g	0.02458 psi	91.4 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.663 ft/s	91.4 psi g		91.38 psi g	0.00
Water	25 ft	Node 14	194676	524.1 ft	0.05675 ft	524 ft	0.0181 psi
		313 ft	0.0194	524 ft		524 ft	0.04179 ft
~Pipe{090}1	16 in	Node 14	1138 gpm	91.4 psi g	7.802 psi	83.6 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.663 ft/s	91.38 psi g		83.58 psi g	0.00
Water	20 ft	North Water Tower	194676	524 ft	0.01197 ft	524 ft	0 psi
		331 ft	0.0194	524 ft		524 ft	0 ft
~Pipe{091}	16 in	Node 14	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	72 ft	~N{033}	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{092}	24 in	~N{001}	3386 gpm	94 psi g	1.363 psi	92.64 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.206 ft/s	93.97 psi g		92.6 psi g	0.00
Water	142 ft	~N{034}	386655	528 ft	0.1471 ft	527.9 ft	0.02508 psi
		314 ft	0.01734	527.9 ft		527.8 ft	0.05791 ft
~Pipe{093}	24 in	~N{034}	3371 gpm	92.64 psi g	0.01293 psi	92.62 psi g	0.01126
Ductile Iron	25.04 in	314 ft	2.196 ft/s	92.6 psi g		92.59 psi g	0.00
Water	10 ft	Node 41	384942	527.9 ft	0.02986 ft	527.8 ft	0.01024 psi
		314 ft	0.01734	527.8 ft		527.8 ft	0.02363 ft
~Pipe{093}1	24 in	Node 41	3371 gpm	92.62 psi g	2.256 psi	90.37 psi g	0.01126
Ductile Iron	25.04 in	314 ft	2.196 ft/s	92.59 psi g		90.33 psi g	0.00
Water	295 ft	~N{035}	384942	527.8 ft	0.2074 ft	527.6 ft	0.01024 psi
		319 ft	0.01734	527.8 ft		527.6 ft	0.02363 ft
~Pipe{094}	24 in	~N{035}	3371 gpm	90.37 psi g	-0.8627 psi	91.23 psi g	0.01126
Ductile Iron	25.04 in	319 ft	2.196 ft/s	90.33 psi g		91.2 psi g	0.00
Water	3100 ft	~N{036}	384942	527.6 ft	2.008 ft	525.6 ft	0.03357 psi
		315 ft	0.01734	527.6 ft		525.5 ft	0.0775 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{095}	24 in	~N{036}	2624 gpm	91.23 psi g	5.543 psi	85.69 psi g	0.01126
Ductile Iron	25.04 in	315 ft	1.709 ft/s	91.21 psi g		85.67 psi g	0.00
Water	1945 ft	Node 10	299633	525.6 ft	0.7968 ft	524.8 ft	0.02122 psi
		327 ft	0.01767	525.6 ft		524.8 ft	0.049 ft
~Pipe{095}1	24 in	Node 10	2609 gpm	85.69 psi g	-2.466 psi	88.15 psi g	0.01126
Ductile Iron	25.04 in	327 ft	1.7 ft/s	85.67 psi g		88.13 psi g	0.00
Water	734 ft	Node 22	297920	524.8 ft	0.3073 ft	524.5 ft	0.01222 psi
		321 ft	0.01768	524.8 ft		524.5 ft	0.02822 ft
~Pipe{095}2	24 in	Node 22	1862 gpm	88.15 psi g	-1.284 psi	89.44 psi g	0.01126
Ductile Iron	25.04 in	321 ft	1.213 ft/s	88.14 psi g		89.43 psi g	0.00
Water	148 ft	Node 25	212611	524.5 ft	0.03675 ft	524.5 ft	3.123E-03 psi
		318 ft	0.01822	524.5 ft		524.5 ft	7.209E-03 ft
~Pipe{095}3	24 in	Node 25	1862 gpm	89.44 psi g	2.059 psi	87.38 psi g	0.01126
Ductile Iron	25.04 in	318 ft	1.213 ft/s	89.43 psi g		87.37 psi g	0.00
Water	1243 ft	Node 33	212611	524.5 ft	0.2533 ft	524.2 ft	2.230E-03 psi
		322.5 ft	0.01822	524.5 ft		524.2 ft	5.150E-03 ft
~Pipe{095}4	24 in	Node 32	367.7 gpm	79.72 psi g	3.469 psi	76.25 psi g	0.01126
Ductile Iron	25.04 in	340 ft	0.2396 ft/s	79.72 psi g		76.25 psi g	0.00
Water	790 ft	~N{037}	41993	524 ft	8.614E-03 ft	524 ft	3.682E-04 psi
		348 ft	0.02299	524 ft		524 ft	8.500E-04 ft
~Pipe{095}5	24 in	Node 33	1115 gpm	87.38 psi g	4.131 psi	83.25 psi g	0.01126
Ductile Iron	25.04 in	322.5 ft	0.7262 ft/s	87.37 psi g		83.24 psi g	0.00
Water	438 ft	Node 40	127302	524.2 ft	0.03654 ft	524.2 ft	1.439E-03 psi
		332 ft	0.01931	524.2 ft		524.2 ft	3.323E-03 ft
~Pipe{095}6	24 in	Node 40	1115 gpm	83.25 psi g	3.528 psi	79.72 psi g	0.01126
Ductile Iron	25.04 in	332 ft	0.7262 ft/s	83.24 psi g		79.71 psi g	0.00
Water	1923 ft	Node 32	127302	524.2 ft	0.1458 ft	524 ft	0 psi
		340 ft	0.01931	524.2 ft		524 ft	0 ft
~Pipe{096}	14 in	~N{037}	367.7 gpm	76.25 psi g	4.624E-03 psi	76.24 psi g	0.01246
Ductile Iron	14.64 in	348 ft	0.7008 ft/s	76.25 psi g		76.24 psi g	0.00
Water	8 ft	Node 9	71825	524 ft	0.01068 ft	524 ft	4.148E-03 psi
		348 ft	0.02198	524 ft		524 ft	9.576E-03 ft
~Pipe{096}1	14 in	Node 9	367.7 gpm	76.24 psi g	1.420E-03 psi	76.24 psi g	0.01246
Ductile Iron	14.64 in	348 ft	0.7008 ft/s	76.24 psi g		76.24 psi g	0.00
Water	10 ft	Node 12	71825	524 ft	3.278E-03 ft	524 ft	8.242E-04 psi
		348 ft	0.02198	524 ft		524 ft	1.903E-03 ft
~Pipe{096}2	14 in	Node 12	367.7 gpm	76.24 psi g	3.476 psi	72.77 psi g	0.01246
Ductile Iron	14.64 in	348 ft	0.7008 ft/s	76.24 psi g		72.76 psi g	0.00
Water	165 ft	South Tower	71825	524 ft	0.02459 ft	524 ft	8.242E-04 psi
		356 ft	0.02198	524 ft		524 ft	1.903E-03 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{097}	14 in	Node 12	--	--	--	--	--
Ductile Iron	14.64 in	348 ft	--	--		--	0.00
Water	25 ft	Node 9	--	--	--	--	--
		348 ft	--	--		--	--
~Pipe{098}	16 in	Node 23	--	--	--	--	--
Ductile Iron	16.72 in	322 ft	--	--		--	0.00
Water	525 ft	~N{041}	--	--	--	--	--
		329 ft	--	--		--	--
~Pipe{099}	16 in	~N{039}	1138 gpm	91.45 psi g	0.02654 psi	91.42 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.663 ft/s	91.43 psi g		91.4 psi g	0.00
Water	50 ft	~N{033}	194676	524.1 ft	0.06128 ft	524.1 ft	0.01357 psi
		313 ft	0.0194	524.1 ft		524 ft	0.03134 ft
~Pipe{100}	16 in	~N{039}	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	40 ft	Node 37	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{100}1	16 in	~N{040}	--	--	--	--	--
Ductile Iron	16.72 in	323 ft	--	--		--	0.00
Water	5885 ft	Node 28	--	--	--	--	--
		335 ft	--	--		--	--
~Pipe{100}2	16 in	Node 28	--	--	--	--	--
Ductile Iron	16.72 in	335 ft	--	--		--	0.00
Water	752 ft	Node 23	--	--	--	--	--
		322 ft	--	--		--	--
~Pipe{100}3	16 in	Node 37	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	6300 ft	Node 23	--	--	--	--	--
		322 ft	--	--		--	--
~Pipe{100}4	16 in	~N{040}1	--	--	--	--	--
Ductile Iron	16.72 in	335 ft	--	--		--	0.00
Water	5885 ft	Node 39	--	--	--	--	--
		338 ft	--	--		--	--
~Pipe{101}	16 in	Node 25	--	--	--	--	--
Ductile Iron	16.72 in	318 ft	--	--		--	0.00
Water	3991 ft	~N{040}	--	--	--	--	--
		323 ft	--	--		--	--
~Pipe{101}1	16 in	Node 40	--	--	--	--	--
Ductile Iron	16.72 in	332 ft	--	--		--	0.00
Water	3991 ft	~N{040}1	--	--	--	--	--
		335 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{102}	16 in	~N{041}	--	--	--	--	--
Ductile Iron	16.72 in	329 ft	--	--		--	0.00
Water	1 ft	Tenant Demand	--	--	--	--	--
		329 ft	--	--		--	--

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 1	324 ft	--	--
Node 10	327 ft	85.69 psi g	524.8 ft
Node 12	348 ft	76.24 psi g	524 ft
Node 14	313 ft	91.4 psi g	524 ft
Node 15	311 ft	--	--
Node 17	311 ft	94.21 psi g	528.2 ft
Node 18	311 ft	94.17 psi g	528.4 ft
Node 19	311 ft	94.17 psi g	528.4 ft
Node 20	311 ft	--	--
Node 21	311 ft	--	--
Node 22	321 ft	88.15 psi g	524.5 ft
Node 23	322 ft	--	--
Node 25	318 ft	89.44 psi g	524.5 ft
Node 27	324 ft	--	--
Node 28	335 ft	--	--
Node 29	336 ft	--	--
Node 3	311 ft	94.23 psi g	528.3 ft
Node 30	338 ft	--	--
Node 32	340 ft	79.72 psi g	524 ft
Node 33	322.5 ft	87.38 psi g	524.2 ft
Node 36	310 ft	--	--
Node 37	313 ft	--	--
Node 38	370 ft	67.03 psi g	524.8 ft
Node 39	338 ft	--	--
Node 4	311 ft	94.23 psi g	528.3 ft
Node 40	332 ft	83.25 psi g	524.2 ft
Node 41	314 ft	92.62 psi g	527.8 ft

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 42	314 ft	--	--
Node 43	311 ft	94.06 psi g	528 ft
Node 44	313 ft	--	--
Node 45	317 ft	--	--
Node 5	311 ft	94.19 psi g	528.4 ft
Node 6	311 ft	--	--
Node 9	348 ft	76.24 psi g	524 ft
~N{001}	311 ft	94 psi g	527.9 ft
~N{030}	311 ft	94.16 psi g	528.3 ft
~N{031}	309 ft	94.7 psi g	527.6 ft
~N{033}	313 ft	91.42 psi g	524 ft
~N{034}	314 ft	92.64 psi g	527.8 ft
~N{035}	319 ft	90.37 psi g	527.6 ft
~N{036}	315 ft	91.23 psi g	525.6 ft
~N{037}	348 ft	76.25 psi g	524 ft
~N{039}	313 ft	91.45 psi g	524.1 ft
~N{040}	323 ft	--	--
~N{040}1	335 ft	--	--
~N{041}	329 ft	--	--

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Hydrants Open P Total @ 0 psi g	370 ft	-- -- --	-- -- --	--
Pressure Boundary 1 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 2 P Static @ 70 psi g	316 ft	-- -- --	-- -- --	--
Pressure Boundary 3 P Static @ 70 psi g	315 ft	-- -- --	-- -- --	--

Pressure Boundaries

Pressure Boundary Name	Elevation	Total Pressure	Energy Grade	Flow Rate
Operation		Static Pressure	Hydraulic Grade	
		Dynamic Pressure	Dynamic Head	
Pressure Boundary 4	318 ft	--	--	--
P Static @ 70 psi g		--	--	
		--	--	
Pressure Boundary 5	322 ft	--	--	--
P Static @ 70 psi g		--	--	
		--	--	

Flow Demands

Flow Demand Name	Elevation	Total Pressure	Energy Grade	Flow Rate
Operation		Static Pressure	Hydraulic Grade	
Flow Direction		Dynamic Pressure	Dynamic Head	
EMS Station	336 ft	--	--	--
Flow Rate @ 300 gpm		--	--	
Flow out		--	--	
FORD	328 ft	85.11 psi g	524.5 ft	747 gpm
Flow Rate @ 747 gpm		85.1 psi g	524.5 ft	
Flow out		8.020E-03 psi	0.01852 ft	
FORD1	330 ft	84.12 psi g	524.2 ft	747 gpm
Flow Rate @ 747 gpm		84.11 psi g	524.2 ft	
Flow out		8.020E-03 psi	0.01852 ft	
FORD2	347 ft	76.67 psi g	524 ft	747 gpm
Flow Rate @ 747 gpm		76.67 psi g	524 ft	
Flow out		8.020E-03 psi	0.01852 ft	
FORD3	322 ft	88.19 psi g	525.6 ft	747 gpm
Flow Rate @ 747 gpm		88.18 psi g	525.6 ft	
Flow out		8.020E-03 psi	0.01852 ft	
Tenant Demand	329 ft	--	--	--
Flow Rate @ 1389 gpm		--	--	
Flow out		--	--	
WWTP	370 ft	67.03 psi g	524.8 ft	15 gpm
Flow Rate @ 15 gpm		67.03 psi g	524.8 ft	
Flow out		4.819E-05 psi	1.113E-04 ft	
Water Treatment Bldg	321 ft	89.28 psi g	527.1 ft	15 gpm
Flow Rate @ 15 gpm		89.27 psi g	527.1 ft	
Flow out		9.949E-03 psi	0.02297 ft	

Phase 1 Operation

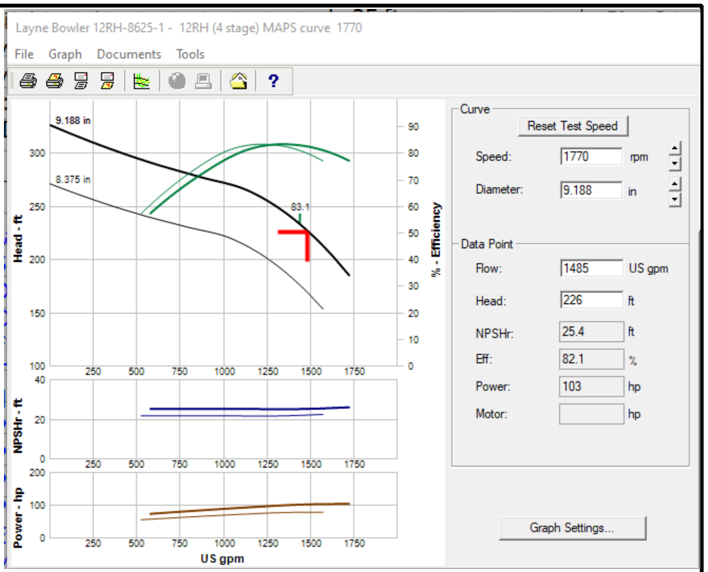
Blue Oval - 4.3 MGD Design Flow

Four pump operation

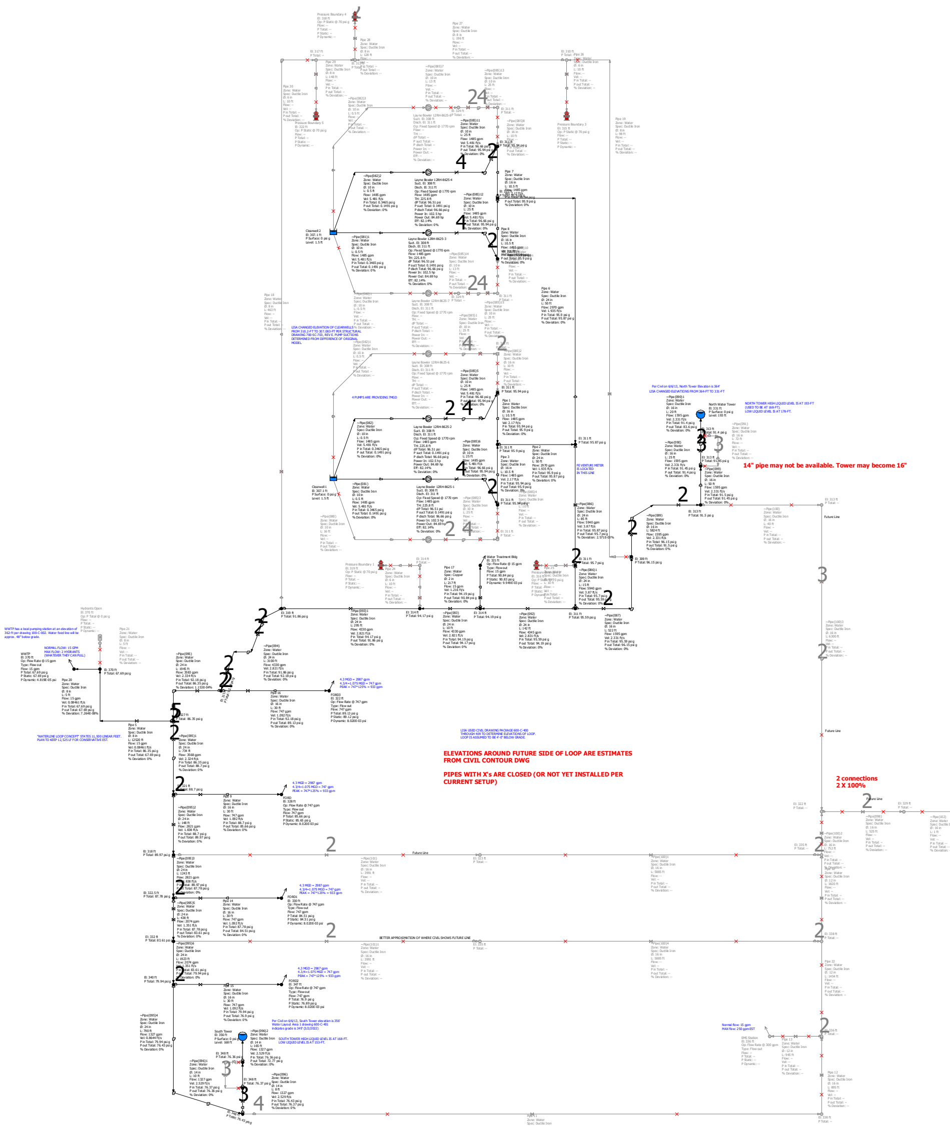
For view of a four pump operation, we have included in the Pie-Flo model two pumps from each clearwell. Pumps are operating at full size impeller at full speed. The pump curve is imposed on the flow diagram. The flow can be reduced through use of VFD's to maintain steady flow to users and maintain tower levels. Flow rate to the tenant with four pumps is 4330 GPM, in excess of the average flow of 2986 GPM to tenant.

In this model, the pressure at the south tower is 76.36 PSIG (176.3 feet) plus Elev. 348 = 524.3 feet. Allowing ability to fully fill the south tower. Flow into the tower with four pumps operating and normal flow to tenant is 1327 GPM.

PIPE-FLO



Speed:	1770	rpm
Diameter:	9.188	in
Flow:	1485	US gpm
Head:	226	ft
NPSHr:	25.4	ft
Eff:	82.1	%
Power:	103	hp
Motor:		hp



PIPE-FLO Professional

Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	gal	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	
Drawn by:	
File Name:	Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.pipe
Lineup:	Typical Day Case Phase 1
Print Date:	Monday, July 18, 2022 12:53 PM

List Report

File Name: Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.
Lineup: Typical Day Case Phase 1
Progam Name: PIPE-FLO Professional
Version: 18.0

Calculation Method: Darcy-Weisbach
Laminar Cutoff Re: 2100
Max Iterations: 100
Percent Tolerance: 0.01
Allowable Deviation: 1 %

Company: SSOE Inc.
Project:
by:
Date: Monday, July 18, 2022 12:56 PM
Atmospheric Pressure: 14.7 psi a

Pipe Specifications

Specification Name Valve Table	Material Schedule	Absolute Roughness Hazen Williams C Factor	Sizing Criteria Sizing Criteria Value		Design Limits Velocity	Pressure	Re Number	Mach
Copper	Copper Pipe B302	6E-05 in	Criteria - none specified	**Min:**	ft/s	psi g		
standard	Schedule: STD	140	0.0	**Max:**	ft/s	psi g		
Ductile Iron	Ductile Iron AWWA C151 Mech	0.0102 in	Velocity = 5 ft/s	**Min:**	0 ft/s	0 psi g		
standard	Schedule: 50	140	5.0 ft/s	**Max:**	12 ft/s	150 psi g		
PVC	PVC Plastic Pipe	6E-05 in	Velocity = 5 ft/s	**Min:**	2 ft/s	0 psi g		
standard	Schedule: 40	140	5.0 ft/s	**Max:**	12 ft/s	150 psi g		

Fluid Zones

Fluid Zone Name Table Name	Temperature Pressure	Fluid State Relative Molecular Mass	Density Viscosity	Vapor Pressure Critical Pressure	Specific Heat Capacity (cp) Specific Heat Ratio (k)
Water	60 °F	Liquid	62.37 lb/ft³	0.2564 psi a	--
Water	0 psi g	18	1.105 cP	3198 psi a	--

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-1	1770	308 ft	311 ft	225.8 ft	1485 gpm	82.14 %	33.69 ft	--
Fixed Speed @ 1770 rpm		0.1491 psi g	96.66 psi g	96.51 psi	102.5 hp	83.1 %	25.37 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-2	1770	308 ft	311 ft	225.8 ft	1485 gpm	82.14 %	33.69 ft	--
Fixed Speed @ 1770 rpm		0.1491 psi g	96.66 psi g	96.51 psi	102.5 hp	83.1 %	25.37 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-3	1770	308 ft	311 ft	225.8 ft	1485 gpm	82.14 %	33.69 ft	--
Fixed Speed @ 1770 rpm		0.1491 psi g	96.66 psi g	96.51 psi	102.5 hp	83.1 %	25.37 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-4 Fixed Speed @ 1770 rpm	1770	308 ft 0.1491 psi g	311 ft 96.66 psi g	225.8 ft 96.51 psi	1485 gpm 102.5 hp	82.14 % 83.1 %	33.69 ft 25.37 ft	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-5 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-6 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-7 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-8 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 1 Ductile Iron Water	16 in 16.72 in 10.5 ft	Node 4 311 ft Node 5 311 ft	1485 gpm 2.17 ft/s 253974 0.01901	95.94 psi g 95.91 psi g 532.5 ft 532.4 ft	0.03593 psi 0.08296 ft	95.9 psi g 95.87 psi g 532.4 ft 532.3 ft	0.01215 0.00 0.03139 psi 0.07247 ft
Pipe 10 Ductile Iron Water	12 in 12.58 in 1820 ft	Node 28 335 ft Node 39 338 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 11	16 in	~N{037}	--	--	--	--	--
Ductile Iron	16.72 in	348 ft	--	--		--	0.00
Water	9200 ft	Node 30	--	--	--	--	--
		338 ft	--	--		--	--
Pipe 12	16 in	Node 30	--	--	--	--	--
Ductile Iron	16.72 in	338 ft	--	--		--	0.00
Water	895 ft	Node 29	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 13	12 in	Node 29	--	--	--	--	--
Ductile Iron	12.58 in	336 ft	--	--		--	0.00
Water	945 ft	EMS Station	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 14	16 in	Node 33	747 gpm	87.78 psi g	3.261 psi	84.51 psi g	0.01215
Ductile Iron	16.72 in	322.5 ft	1.092 ft/s	87.77 psi g		84.51 psi g	0.00
Water	30 ft	FORD1	127759	525.1 ft	0.02784 ft	525.1 ft	8.570E-03 psi
		330 ft	0.0202	525.1 ft		525.1 ft	0.01979 ft
Pipe 15	16 in	Node 32	747 gpm	79.94 psi g	3.044 psi	76.9 psi g	0.01215
Ductile Iron	16.72 in	340 ft	1.092 ft/s	79.93 psi g		76.89 psi g	0.00
Water	30 ft	FORD2	127759	524.6 ft	0.02784 ft	524.5 ft	8.570E-03 psi
		347 ft	0.0202	524.5 ft		524.5 ft	0.01979 ft
Pipe 16	16 in	~N{036}	747 gpm	92.18 psi g	3.044 psi	89.13 psi g	0.01215
Ductile Iron	16.72 in	315 ft	1.092 ft/s	92.17 psi g		89.12 psi g	0.00
Water	30 ft	FORD3	127759	527.8 ft	0.02784 ft	527.8 ft	8.570E-03 psi
		322 ft	0.0202	527.8 ft		527.8 ft	0.01979 ft
Pipe 17	2 in	~N{034}	15 gpm	94.19 psi g	3.352 psi	90.84 psi g	0.01862
Copper	2.245 in	314 ft	1.216 ft/s	94.18 psi g		90.83 psi g	0.00
Water	217 ft	Water Treatment Bldg	19107	531.5 ft	0.7394 ft	530.7 ft	0.01753 psi
		321 ft	0.02623	531.4 ft		530.7 ft	0.04047 ft
Pipe 18	8 in	~N{035}	--	--	--	--	--
Ductile Iron	8.51 in	319 ft	--	--		--	0.00
Water	463 ft	Node 45	--	--	--	--	--
		317 ft	--	--		--	--
Pipe 19	8 in	~N{031}	--	--	--	--	--
Ductile Iron	8.51 in	309 ft	--	--		--	0.00
Water	98 ft	Node 36	--	--	--	--	--
		310 ft	--	--		--	--
Pipe 2	24 in	Node 5	2970 gpm	95.9 psi g	0.0276 psi	95.87 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.935 ft/s	95.88 psi g		95.85 psi g	0.00
Water	50 ft	~N{030}	339173	532.4 ft	0.06371 ft	532.3 ft	0.01703 psi
		311 ft	0.0175	532.4 ft		532.3 ft	0.03932 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 20	8 in	Node 38	15 gpm	67.69 psi g	1.312E-05 psi	67.69 psi g	0.01389
Ductile Iron	8.51 in	370 ft	0.08461 ft/s	67.69 psi g		67.69 psi g	0.00
Water	5 ft	WWTP	5040	526.3 ft	3.03E-05 ft	526.3 ft	0 psi
		370 ft	0.03863	526.3 ft		526.3 ft	0 ft
Pipe 21	8 in	Node 38	--	--	--	--	--
Ductile Iron	8.51 in	370 ft	--	--		--	0.00
Water	5 ft	Hydrants Open	--	--	--	--	--
		370 ft	--	--		--	--
Pipe 22	12 in	Node 39	--	--	--	--	--
Ductile Iron	12.58 in	338 ft	--	--		--	0.00
Water	1454 ft	Node 29	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 23	8 in	Node 41	--	--	--	--	--
Ductile Iron	8.51 in	314 ft	--	--		--	0.00
Water	166 ft	Node 42	--	--	--	--	--
		314 ft	--	--		--	--
Pipe 24	6 in	Node 42	--	--	--	--	--
Ductile Iron	6.4 in	314 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 1	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 25	6 in	Node 43	--	--	--	--	--
Ductile Iron	6.4 in	311 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 2	--	--	--	--	--
		316 ft	--	--		--	--
Pipe 26	6 in	Node 36	--	--	--	--	--
Ductile Iron	6.4 in	310 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 3	--	--	--	--	--
		315 ft	--	--		--	--
Pipe 27	8 in	Node 36	--	--	--	--	--
Ductile Iron	8.51 in	310 ft	--	--		--	0.00
Water	196 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--
Pipe 28	8 in	Node 44	--	--	--	--	--
Ductile Iron	8.51 in	313 ft	--	--		--	0.00
Water	128 ft	Pressure Boundary 4	--	--	--	--	--
		318 ft	--	--		--	--
Pipe 29	8 in	Node 45	--	--	--	--	--
Ductile Iron	8.51 in	317 ft	--	--		--	0.00
Water	148 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 3	16 in	Node 3	1485 gpm	95.94 psi g	0.03593 psi	95.9 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.17 ft/s	95.91 psi g		95.87 psi g	0.00
Water	10.5 ft	Node 5	253974	532.5 ft	0.08296 ft	532.4 ft	0.03139 psi
		311 ft	0.01901	532.4 ft		532.3 ft	0.07247 ft
Pipe 30	6 in	Node 45	--	--	--	--	--
Ductile Iron	6.4 in	317 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 5	--	--	--	--	--
		322 ft	--	--		--	--
Pipe 5	8 in	Node 10	15 gpm	86.35 psi g	18.66 psi	67.69 psi g	0.01389
Ductile Iron	8.51 in	327 ft	0.08461 ft/s	86.35 psi g		67.69 psi g	0.00
Water	12520 ft	Node 38	5040	526.4 ft	0.07602 ft	526.3 ft	6.692E-05 psi
		370 ft	0.03863	526.4 ft		526.3 ft	1.545E-04 ft
Pipe 6	24 in	Node 19	2970 gpm	95.9 psi g	0.0276 psi	95.87 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.935 ft/s	95.88 psi g		95.85 psi g	0.00
Water	50 ft	~N{030}	339173	532.4 ft	0.06371 ft	532.3 ft	0.01703 psi
		311 ft	0.0175	532.4 ft		532.3 ft	0.03932 ft
Pipe 7	16 in	Node 18	1485 gpm	95.94 psi g	0.03593 psi	95.9 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.17 ft/s	95.91 psi g		95.87 psi g	0.00
Water	10.5 ft	Node 19	253974	532.5 ft	0.08296 ft	532.4 ft	0.03139 psi
		311 ft	0.01901	532.4 ft		532.3 ft	0.07247 ft
Pipe 8	16 in	Node 17	1485 gpm	95.94 psi g	0.03593 psi	95.9 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.17 ft/s	95.91 psi g		95.87 psi g	0.00
Water	10.5 ft	Node 19	253974	532.5 ft	0.08296 ft	532.4 ft	0.03139 psi
		311 ft	0.01901	532.4 ft		532.3 ft	0.07247 ft
Pipe 9	16 in	Node 22	747 gpm	88.7 psi g	3.044 psi	85.66 psi g	0.01215
Ductile Iron	16.72 in	321 ft	1.092 ft/s	88.7 psi g		85.65 psi g	0.00
Water	30 ft	FORD	127759	525.8 ft	0.02784 ft	525.8 ft	8.570E-03 psi
		328 ft	0.0202	525.8 ft		525.7 ft	0.01979 ft
~Pipe{080}	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	16 ft	Layne Bowler 12RH-8625-5	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{080}1	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-7	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{081}	10 in	Clearwell 1	1485 gpm	0.3465 psi g	0.1974 psi	0.1491 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.481 ft/s	0.1443 psi g		-0.05316 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-1	403655	308.6 ft	0.2388 ft	308.3 ft	0.1011 psi
		308 ft	0.02024	308.1 ft		307.9 ft	0.2334 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{081}1	10 in	Clearwell 2	1485 gpm	0.3465 psi g	0.1974 psi	0.1491 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.481 ft/s	0.1443 psi g		-0.05316 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-3	403655	308.6 ft	0.2388 ft	308.3 ft	0.1011 psi
		308 ft	0.02024	308.1 ft		307.9 ft	0.2334 ft
~Pipe{082}	10 in	Clearwell 1	1485 gpm	0.3465 psi g	0.1974 psi	0.1491 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.481 ft/s	0.1443 psi g		-0.05316 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-2	403655	308.6 ft	0.2388 ft	308.3 ft	0.1011 psi
		308 ft	0.02024	308.1 ft		307.9 ft	0.2334 ft
~Pipe{082}1	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-6	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{082}2	10 in	Clearwell 2	1485 gpm	0.3465 psi g	0.1974 psi	0.1491 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.481 ft/s	0.1443 psi g		-0.05316 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-4	403655	308.6 ft	0.2388 ft	308.3 ft	0.1011 psi
		308 ft	0.02024	308.1 ft		307.9 ft	0.2334 ft
~Pipe{082}3	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-8	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{085}1	10 in	Layne Bowler 12RH-8625-6	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 6	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}10	16 in	Node 21	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 17	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}11	10 in	Layne Bowler 12RH-8625-4	1485 gpm	96.66 psi g	0.7247 psi	95.94 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.481 ft/s	96.46 psi g		95.74 psi g	0.00
Water	25 ft	Node 18	403655	534.2 ft	1.673 ft	532.5 ft	0.608 psi
		311 ft	0.02024	533.7 ft		532 ft	1.404 ft
~Pipe{085}12	10 in	Layne Bowler 12RH-8625-3	1485 gpm	96.66 psi g	0.7247 psi	95.94 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.481 ft/s	96.46 psi g		95.74 psi g	0.00
Water	25 ft	Node 17	403655	534.2 ft	1.673 ft	532.5 ft	0.608 psi
		311 ft	0.02024	533.7 ft		532 ft	1.404 ft
~Pipe{085}13	10 in	Node 1	--	--	--	--	--
Ductile Iron	10.52 in	324 ft	--	--		--	0.00
Water	25 ft	Node 20	--	--	--	--	--
		311 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{085}14 Ductile Iron Water	10 in 10.52 in 13 ft	Layne Bowler 12RH-8625-7 311 ft Node 27 324 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}15 Ductile Iron Water	10 in 10.52 in 25 ft	Node 27 324 ft Node 21 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}2 Ductile Iron Water	16 in 16.72 in 10 ft	Node 6 311 ft Node 4 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}3 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-5 311 ft Node 15 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}4 Ductile Iron Water	16 in 16.72 in 10 ft	Node 15 311 ft Node 3 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}5 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-2 311 ft Node 4 311 ft	1485 gpm 5.481 ft/s 403655 0.02024	96.66 psi g 96.46 psi g 534.2 ft 533.7 ft	0.7247 psi 1.673 ft	95.94 psi g 95.74 psi g 532.5 ft 532 ft	0.0133 0.00 0.608 psi 1.404 ft
~Pipe{085}6 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-1 311 ft Node 3 311 ft	1485 gpm 5.481 ft/s 403655 0.02024	96.66 psi g 96.46 psi g 534.2 ft 533.7 ft	0.7247 psi 1.673 ft	95.94 psi g 95.74 psi g 532.5 ft 532 ft	0.0133 0.00 0.608 psi 1.404 ft
~Pipe{085}7 Ductile Iron Water	10 in 10.52 in 13 ft	Layne Bowler 12RH-8625-8 311 ft Node 1 324 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}8 Ductile Iron Water	16 in 16.72 in 10 ft	Node 20 311 ft Node 18 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{086} Ductile Iron Water	24 in 25.04 in 85 ft	~N{030} 311 ft Node 43 311 ft	5940 gpm 3.87 ft/s 678346 0.0168	95.87 psi g 95.77 psi g 532.3 ft 532.1 ft	0.178 psi 0.4108 ft	95.7 psi g 95.6 psi g 531.9 ft 531.7 ft	0.01126 0.00 0.109 psi 0.2516 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{086}1	24 in	Node 43	5940 gpm	95.7 psi g	0.103 psi	95.59 psi g	0.01126
Ductile Iron	25.04 in	311 ft	3.87 ft/s	95.6 psi g		95.49 psi g	0.00
Water	15 ft	~N{001}	678346	531.9 ft	0.2378 ft	531.7 ft	0.09082 psi
		311 ft	0.0168	531.7 ft		531.5 ft	0.2097 ft
~Pipe{087}	16 in	~N{001}	1595 gpm	95.59 psi g	-0.5582 psi	96.15 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.331 ft/s	95.56 psi g		96.12 psi g	0.00
Water	522 ft	~N{031}	272817	531.7 ft	0.7113 ft	531 ft	0.04887 psi
		309 ft	0.01892	531.6 ft		530.9 ft	0.1128 ft
~Pipe{089}	16 in	~N{031}	1595 gpm	96.15 psi g	4.65 psi	91.5 psi g	0.01215
Ductile Iron	16.72 in	309 ft	2.331 ft/s	96.12 psi g		91.47 psi g	0.00
Water	5824 ft	~N{039}	272817	531 ft	6.735 ft	524.3 ft	0.02488 psi
		313 ft	0.01892	530.9 ft		524.2 ft	0.05744 ft
~Pipe{090}	16 in	~N{033}	1595 gpm	91.45 psi g	0.04796 psi	91.4 psi g	0.01215
Ductile Iron	16.72 in	313 ft	2.331 ft/s	91.41 psi g		91.37 psi g	0.00
Water	25 ft	Node 14	272817	524.1 ft	0.1107 ft	524 ft	0.03554 psi
		313 ft	0.01892	524 ft		523.9 ft	0.08206 ft
~Pipe{090}1	16 in	Node 14	1595 gpm	91.4 psi g	7.806 psi	83.6 psi g	0.01215
Ductile Iron	16.72 in	313 ft	2.331 ft/s	91.37 psi g		83.56 psi g	0.00
Water	20 ft	North Water Tower	272817	524 ft	0.02293 ft	524 ft	0 psi
		331 ft	0.01892	523.9 ft		523.9 ft	0 ft
~Pipe{091}	16 in	Node 14	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	72 ft	~N{033}	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{092}	24 in	~N{001}	4345 gpm	95.59 psi g	1.403 psi	94.19 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.831 ft/s	95.54 psi g		94.14 psi g	0.00
Water	142 ft	~N{034}	496178	531.7 ft	0.24 ft	531.5 ft	0.0413 psi
		314 ft	0.01707	531.6 ft		531.3 ft	0.09536 ft
~Pipe{093}	24 in	~N{034}	4330 gpm	94.19 psi g	0.02127 psi	94.17 psi g	0.01126
Ductile Iron	25.04 in	314 ft	2.821 ft/s	94.14 psi g		94.12 psi g	0.00
Water	10 ft	Node 41	494465	531.5 ft	0.04911 ft	531.4 ft	0.01689 psi
		314 ft	0.01707	531.3 ft		531.3 ft	0.03899 ft
~Pipe{093}1	24 in	Node 41	4330 gpm	94.17 psi g	2.312 psi	91.86 psi g	0.01126
Ductile Iron	25.04 in	314 ft	2.821 ft/s	94.12 psi g		91.8 psi g	0.00
Water	295 ft	~N{035}	494465	531.4 ft	0.3374 ft	531.1 ft	0.01689 psi
		319 ft	0.01707	531.3 ft		530.9 ft	0.03899 ft
~Pipe{094}	24 in	~N{035}	4330 gpm	91.86 psi g	-0.3189 psi	92.18 psi g	0.01126
Ductile Iron	25.04 in	319 ft	2.821 ft/s	91.8 psi g		92.12 psi g	0.00
Water	3100 ft	~N{036}	494465	531.1 ft	3.264 ft	527.8 ft	0.05539 psi
		315 ft	0.01707	530.9 ft		527.7 ft	0.1279 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{095}	24 in	~N{036}	3583 gpm	92.18 psi g	5.828 psi	86.35 psi g	0.01126
Ductile Iron	25.04 in	315 ft	2.334 ft/s	92.14 psi g		86.31 psi g	0.00
Water	1945 ft	Node 10	409156	527.8 ft	1.454 ft	526.4 ft	0.03958 psi
		327 ft	0.01727	527.7 ft		526.3 ft	0.09137 ft
~Pipe{095}1	24 in	Node 10	3568 gpm	86.35 psi g	-2.355 psi	88.7 psi g	0.01126
Ductile Iron	25.04 in	327 ft	2.324 ft/s	86.31 psi g		88.67 psi g	0.00
Water	734 ft	Node 22	407443	526.4 ft	0.563 ft	525.8 ft	0.02286 psi
		321 ft	0.01727	526.3 ft		525.7 ft	0.05278 ft
~Pipe{095}2	24 in	Node 22	2821 gpm	88.7 psi g	-1.264 psi	89.97 psi g	0.01126
Ductile Iron	25.04 in	321 ft	1.838 ft/s	88.68 psi g		89.94 psi g	0.00
Water	148 ft	Node 25	322134	525.8 ft	0.08194 ft	525.7 ft	7.169E-03 psi
		318 ft	0.01757	525.7 ft		525.7 ft	0.01655 ft
~Pipe{095}3	24 in	Node 25	2821 gpm	89.97 psi g	2.192 psi	87.78 psi g	0.01126
Ductile Iron	25.04 in	318 ft	1.838 ft/s	89.94 psi g		87.75 psi g	0.00
Water	1243 ft	Node 33	322134	525.7 ft	0.561 ft	525.1 ft	5.120E-03 psi
		322.5 ft	0.01757	525.7 ft		525.1 ft	0.01182 ft
~Pipe{095}4	24 in	Node 32	1327 gpm	79.94 psi g	3.506 psi	76.43 psi g	0.01126
Ductile Iron	25.04 in	340 ft	0.8644 ft/s	79.93 psi g		76.43 psi g	0.00
Water	790 ft	~N{037}	151517	524.6 ft	0.09414 ft	524.5 ft	4.793E-03 psi
		348 ft	0.0189	524.5 ft		524.5 ft	0.01107 ft
~Pipe{095}5	24 in	Node 33	2074 gpm	87.78 psi g	4.166 psi	83.61 psi g	0.01126
Ductile Iron	25.04 in	322.5 ft	1.351 ft/s	87.76 psi g		83.6 psi g	0.00
Water	438 ft	Node 40	236825	525.1 ft	0.1189 ft	525 ft	4.981E-03 psi
		332 ft	0.01803	525.1 ft		525 ft	0.0115 ft
~Pipe{095}6	24 in	Node 40	2074 gpm	83.61 psi g	3.669 psi	79.94 psi g	0.01126
Ductile Iron	25.04 in	332 ft	1.351 ft/s	83.6 psi g		79.93 psi g	0.00
Water	1923 ft	Node 32	236825	525 ft	0.4714 ft	524.6 ft	0 psi
		340 ft	0.01803	525 ft		524.5 ft	0 ft
~Pipe{096}	14 in	~N{037}	1327 gpm	76.43 psi g	0.05948 psi	76.37 psi g	0.01246
Ductile Iron	14.64 in	348 ft	2.529 ft/s	76.39 psi g		76.33 psi g	0.00
Water	8 ft	Node 9	259151	524.5 ft	0.1373 ft	524.3 ft	0.054 psi
		348 ft	0.01941	524.4 ft		524.2 ft	0.1247 ft
~Pipe{096}1	14 in	Node 9	1327 gpm	76.37 psi g	0.01758 psi	76.36 psi g	0.01246
Ductile Iron	14.64 in	348 ft	2.529 ft/s	76.33 psi g		76.31 psi g	0.00
Water	10 ft	Node 12	259151	524.3 ft	0.04058 ft	524.3 ft	0.01073 psi
		348 ft	0.01941	524.2 ft		524.2 ft	0.02477 ft
~Pipe{096}2	14 in	Node 12	1327 gpm	76.36 psi g	3.589 psi	72.77 psi g	0.01246
Ductile Iron	14.64 in	348 ft	2.529 ft/s	76.31 psi g		72.72 psi g	0.00
Water	165 ft	South Tower	259151	524.3 ft	0.2857 ft	524 ft	0.01073 psi
		356 ft	0.01941	524.2 ft		523.9 ft	0.02477 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{097}	14 in	Node 12	--	--	--	--	--
Ductile Iron	14.64 in	348 ft	--	--		--	0.00
Water	25 ft	Node 9	--	--	--	--	--
		348 ft	--	--		--	--
~Pipe{098}	16 in	Node 23	--	--	--	--	--
Ductile Iron	16.72 in	322 ft	--	--		--	0.00
Water	525 ft	~N{041}	--	--	--	--	--
		329 ft	--	--		--	--
~Pipe{099}	16 in	~N{039}	1595 gpm	91.5 psi g	0.05149 psi	91.45 psi g	0.01215
Ductile Iron	16.72 in	313 ft	2.331 ft/s	91.47 psi g		91.41 psi g	0.00
Water	50 ft	~N{033}	272817	524.3 ft	0.1189 ft	524.1 ft	0.02666 psi
		313 ft	0.01892	524.2 ft		524 ft	0.06155 ft
~Pipe{100}	16 in	~N{039}	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	40 ft	Node 37	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{100}1	16 in	~N{040}	--	--	--	--	--
Ductile Iron	16.72 in	323 ft	--	--		--	0.00
Water	5885 ft	Node 28	--	--	--	--	--
		335 ft	--	--		--	--
~Pipe{100}2	16 in	Node 28	--	--	--	--	--
Ductile Iron	16.72 in	335 ft	--	--		--	0.00
Water	752 ft	Node 23	--	--	--	--	--
		322 ft	--	--		--	--
~Pipe{100}3	16 in	Node 37	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	6300 ft	Node 23	--	--	--	--	--
		322 ft	--	--		--	--
~Pipe{100}4	16 in	~N{040}1	--	--	--	--	--
Ductile Iron	16.72 in	335 ft	--	--		--	0.00
Water	5885 ft	Node 39	--	--	--	--	--
		338 ft	--	--		--	--
~Pipe{101}	16 in	Node 25	--	--	--	--	--
Ductile Iron	16.72 in	318 ft	--	--		--	0.00
Water	3991 ft	~N{040}	--	--	--	--	--
		323 ft	--	--		--	--
~Pipe{101}1	16 in	Node 40	--	--	--	--	--
Ductile Iron	16.72 in	332 ft	--	--		--	0.00
Water	3991 ft	~N{040}1	--	--	--	--	--
		335 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{102}	16 in	~N{041}	--	--	--	--	--
Ductile Iron	16.72 in	329 ft	--	--		--	0.00
Water	1 ft	Tenant Demand	--	--	--	--	--
		329 ft	--	--		--	--

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 1	324 ft	--	--
Node 10	327 ft	86.35 psi g	526.3 ft
Node 12	348 ft	76.36 psi g	524.2 ft
Node 14	313 ft	91.4 psi g	523.9 ft
Node 15	311 ft	--	--
Node 17	311 ft	95.94 psi g	532.2 ft
Node 18	311 ft	95.94 psi g	532.2 ft
Node 19	311 ft	95.9 psi g	532.3 ft
Node 20	311 ft	--	--
Node 21	311 ft	--	--
Node 22	321 ft	88.7 psi g	525.7 ft
Node 23	322 ft	--	--
Node 25	318 ft	89.97 psi g	525.7 ft
Node 27	324 ft	--	--
Node 28	335 ft	--	--
Node 29	336 ft	--	--
Node 3	311 ft	95.94 psi g	532.2 ft
Node 30	338 ft	--	--
Node 32	340 ft	79.94 psi g	524.5 ft
Node 33	322.5 ft	87.78 psi g	525.1 ft
Node 36	310 ft	--	--
Node 37	313 ft	--	--
Node 38	370 ft	67.69 psi g	526.3 ft
Node 39	338 ft	--	--
Node 4	311 ft	95.94 psi g	532.2 ft
Node 40	332 ft	83.61 psi g	525 ft
Node 41	314 ft	94.17 psi g	531.3 ft

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 42	314 ft	--	--
Node 43	311 ft	95.7 psi g	531.7 ft
Node 44	313 ft	--	--
Node 45	317 ft	--	--
Node 5	311 ft	95.9 psi g	532.3 ft
Node 6	311 ft	--	--
Node 9	348 ft	76.37 psi g	524.2 ft
~N{001}	311 ft	95.59 psi g	531.6 ft
~N{030}	311 ft	95.87 psi g	532.2 ft
~N{031}	309 ft	96.15 psi g	530.9 ft
~N{033}	313 ft	91.45 psi g	524 ft
~N{034}	314 ft	94.19 psi g	531.4 ft
~N{035}	319 ft	91.86 psi g	530.9 ft
~N{036}	315 ft	92.18 psi g	527.7 ft
~N{037}	348 ft	76.43 psi g	524.4 ft
~N{039}	313 ft	91.5 psi g	524.2 ft
~N{040}	323 ft	--	--
~N{040}1	335 ft	--	--
~N{041}	329 ft	--	--

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Hydrants Open P Total @ 0 psi g	370 ft	-- -- --	-- -- --	--
Pressure Boundary 1 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 2 P Static @ 70 psi g	316 ft	-- -- --	-- -- --	--
Pressure Boundary 3 P Static @ 70 psi g	315 ft	-- -- --	-- -- --	--

Pressure Boundaries

Pressure Boundary Name **Operation**	**Elevation**	**Total Pressure** **Static Pressure** **Dynamic Pressure**	**Energy Grade** **Hydraulic Grade** **Dynamic Head**	**Flow Rate**
Pressure Boundary 4 P Static @ 70 psi g	318 ft	-- -- --	-- -- --	--
Pressure Boundary 5 P Static @ 70 psi g	322 ft	-- -- --	-- -- --	--

Flow Demands

Flow Demand Name **Operation** **Flow Direction**	**Elevation**	**Total Pressure** **Static Pressure** **Dynamic Pressure**	**Energy Grade** **Hydraulic Grade** **Dynamic Head**	**Flow Rate**
EMS Station Flow Rate @ 300 gpm Flow out	336 ft	-- -- --	-- -- --	--
FORD Flow Rate @ 747 gpm Flow out	328 ft	85.66 psi g 85.65 psi g 8.020E-03 psi	525.8 ft 525.7 ft 0.01852 ft	747 gpm
FORD1 Flow Rate @ 747 gpm Flow out	330 ft	84.51 psi g 84.51 psi g 8.020E-03 psi	525.1 ft 525.1 ft 0.01852 ft	747 gpm
FORD2 Flow Rate @ 747 gpm Flow out	347 ft	76.9 psi g 76.89 psi g 8.020E-03 psi	524.5 ft 524.5 ft 0.01852 ft	747 gpm
FORD3 Flow Rate @ 747 gpm Flow out	322 ft	89.13 psi g 89.12 psi g 8.020E-03 psi	527.8 ft 527.8 ft 0.01852 ft	747 gpm
Tenant Demand Flow Rate @ 1389 gpm Flow out	329 ft	-- -- --	-- -- --	--
WWTP Flow Rate @ 15 gpm Flow out	370 ft	67.69 psi g 67.69 psi g 4.819E-05 psi	526.3 ft 526.3 ft 1.113E-04 ft	15 gpm
Water Treatment Bldg Flow Rate @ 15 gpm Flow out	321 ft	90.84 psi g 90.83 psi g 9.949E-03 psi	530.7 ft 530.7 ft 0.02297 ft	15 gpm

Pump Data Sheet - Mid-America Pump & Supply

Company: SSOE Group
Name: Lisa
Date: 4/26/2022

MIDAMERICA PUMP & SUPPLY

Pump:

Size: 12RH (4 stage)

Type: Vertical Turbine Synch Speed: 1800 rpm	Speed: 1770 rpm Dia: 9.188 in
Curve: MAPS	Impeller: enclosed
Specific Speeds:	Ns: 2891 Nss: 6211
Dimensions:	Suction: 8 in Discharge: 10 in
Vertical Turbine:	Bowl Size: 11.4 in Max Lateral: 0.9 in Thrust K Factor: 9.4 lbf/ft

Pump Limits:

Temperature: 140 °F Pressure: 400 psi g Sphere Size: 0.75 in	Power: 416 hp Eye Area: 25.5 in²

Search Criteria:

Flow: ---	Head: ---

Fluid:

Water Density: 62.32 lb/ft³ Viscosity: 0.9946 cP	Temperature: 68 °F Vapor Pressure: 0.3391 psi a Atm Pressure: 14.7 psi a
NPSHa: ---	

Motor:

Standard: NEMA/TITAN Enclosure: WP-1/TEFC	Size: 125 hp Speed: 1800 rpm Frame: 405TP WP-1

Sizing Criteria: Max Power on Design Curve

---- Duty Point ----

Flow:	1343 US gpm
Head:	249 ft
Eff:	84%
Power:	101 hp
NPSHr:	22.8 ft

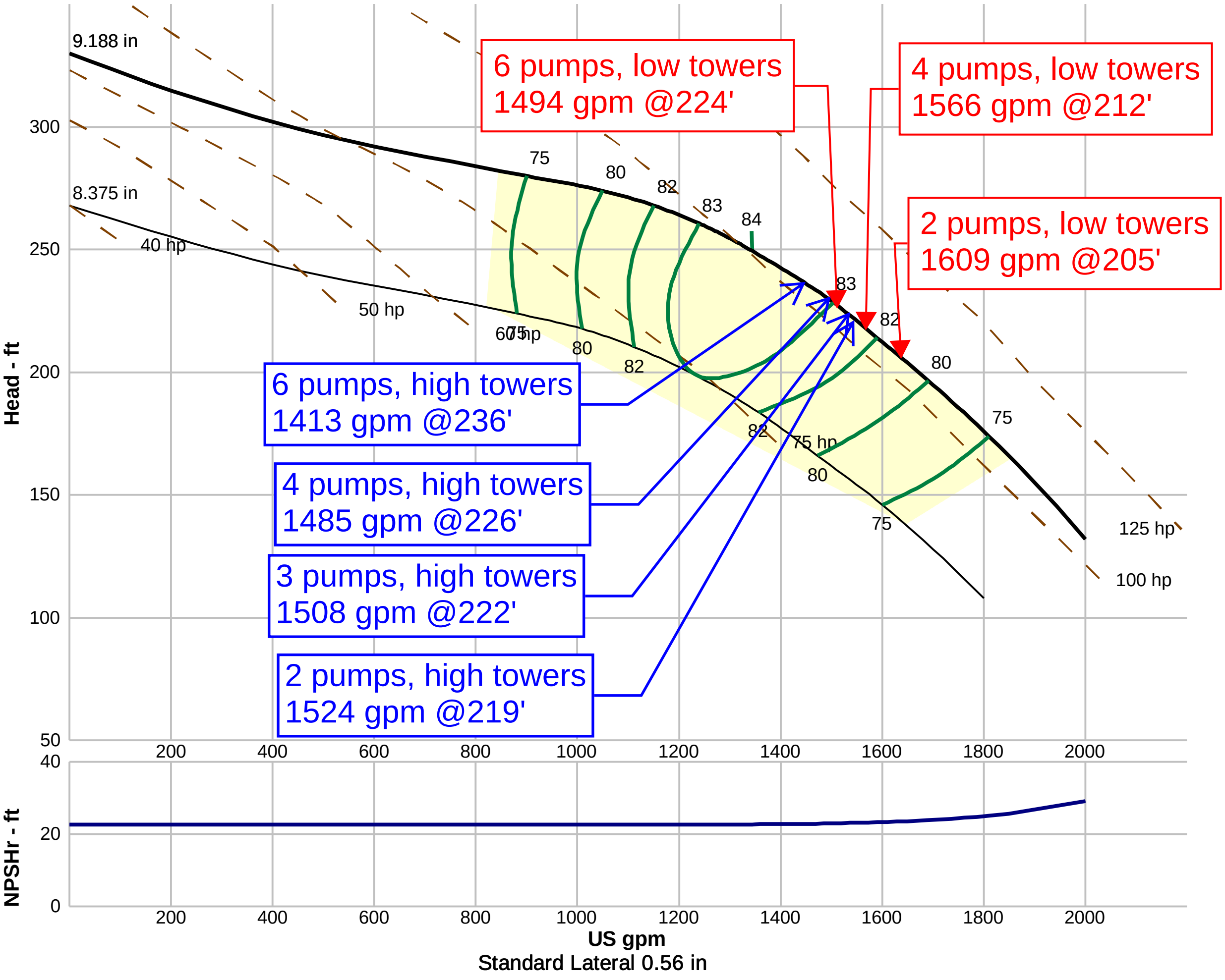
---- Design Curve ----

Shutoff Head:	330 ft
Shutoff dP:	143 psi
Min Flow:	---
BEP:	84% @ 1343 US gpm
NOL Power:	106 hp @ 1810 US gpm

-- Max Curve --

Max Power:
106 hp @ 1810 US gpm

Clearwell Pumps - Phase 1 (4.3 MGD)



6 pumps, low towers
1494 gpm @224'

4 pumps, low towers
1566 gpm @212'

2 pumps, low towers
1609 gpm @205'

6 pumps, high towers
1413 gpm @236'

4 pumps, high towers
1485 gpm @226'

3 pumps, high towers
1508 gpm @222'

2 pumps, high towers
1524 gpm @219'

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
1920	1770	150	68.7	105	27.5
1600	1770	212	81.8	105	23.4
1280	1770	257	83.7	99.1	22.8
960	1770	278	77	87.1	22.8
640	1770	291	58	78.1	22.8

Phase 2 Operation

Future Scenario

Flows to Blue Oval and East Tenant (Handy) total Design flow 6.3 MGD

Flows to Blue Oval and East Tenant (Handy) total Design flow 6.3 MGD

The design flow rate for Phase 2 operation includes the flows for initial tenant, Ford Motor Company also referred to as “Blue Oval” and the future east tenant “Handy”. The requested and agreed upon volume is 4.3 MGD for Ford and the tentative flow for the east tenant “Handy” is 2.0 MGD, providing an averaged flow rate over 24 hours as 4375 GPM. Similar to phase 1, we anticipate some variation in flow for the tenants and have provided ability for distribution pumps to operate as needed to maintain the volume of water required for operation by the tenants. The Distribution pumps are on VFD’s and include the ability to adjust flow levels as needed. The two clearwells each include four (4) high service distribution pumps. Normal operation (6.3 MGD) we anticipate that four pumps (two per clearwell) will operate. These distribution pumps are connected to a common header system that directs flow to the tenants and the two elevated water towers.

The included pump scenarios for Phase 2 include output noting the operation of three distribution pumps to provide a low flow point to the tenants of a nominal 3371 GPM for the distribution pumps that are on VFD. The pump capacity can be lowered through VFD if needed.

We have also included other scenarios to satisfy higher anticipated flows. In addition, added options include use of four pumps to provide a nominal 5950 GPM which we anticipate being normal situation for Phase 2, but also provide operation scenario for six pumps to provide operation point for the pump possible peak demands. We anticipate that normal operation will be the use of four (4) distribution pumps in operation to maintain required flow to the two tenants.

Each selected scenario includes a flow diagram output from Pipe-Flo model, pump data sheet noting the operating point on curves for each pump, and a line list report from the Pipe-Flo model. Selected line-up of pumps can also be identified in the Project information section of the included Flow diagram.

Phase 2 Operation

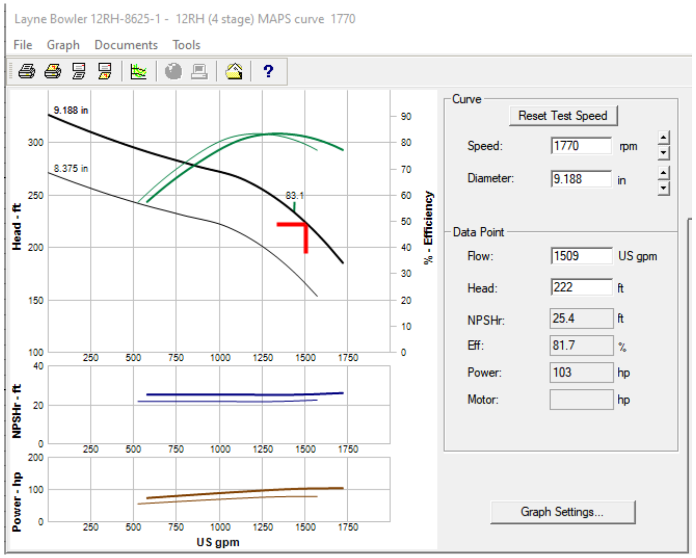
Future Scenario

Flows to Blue Oval and East Tenant (Handy) total Design flow 6.3 MGD

Three pump operation

For view of a three pump operation, we have included pumps from two clearwells. Two pumps in one well and a single pump in the second well to prevent stagnation from occurring. The curves for selected pump are imposed on the flow diagram. General flow rate for this scenario is 4526 GPM which is slightly below the nominal 7.0 MGD average flow of 4875 GPM, but above the tenant flow demand of 6.3 MGD (4375 GPM). The pump flow on VFD can be adjusted if needed to reduce flow or maintain levels to fill towers. Fluctuations in instantaneous flow rates may require need to run an additional pump.

In this model, the pressure at the south tower is 72.77 PSIG (168 feet) plus Elev. 348 = 516 feet. Not allowing ability to fully fill the south tower. Flow out of the tower is noted in this scenario. Fluctuations in tenant demand and north tower level will impact flow and pressure to the south tower.



Curve

Speed: 1770 rpm

Diameter: 9.188 in

Data Point

Flow: 1509 US gpm

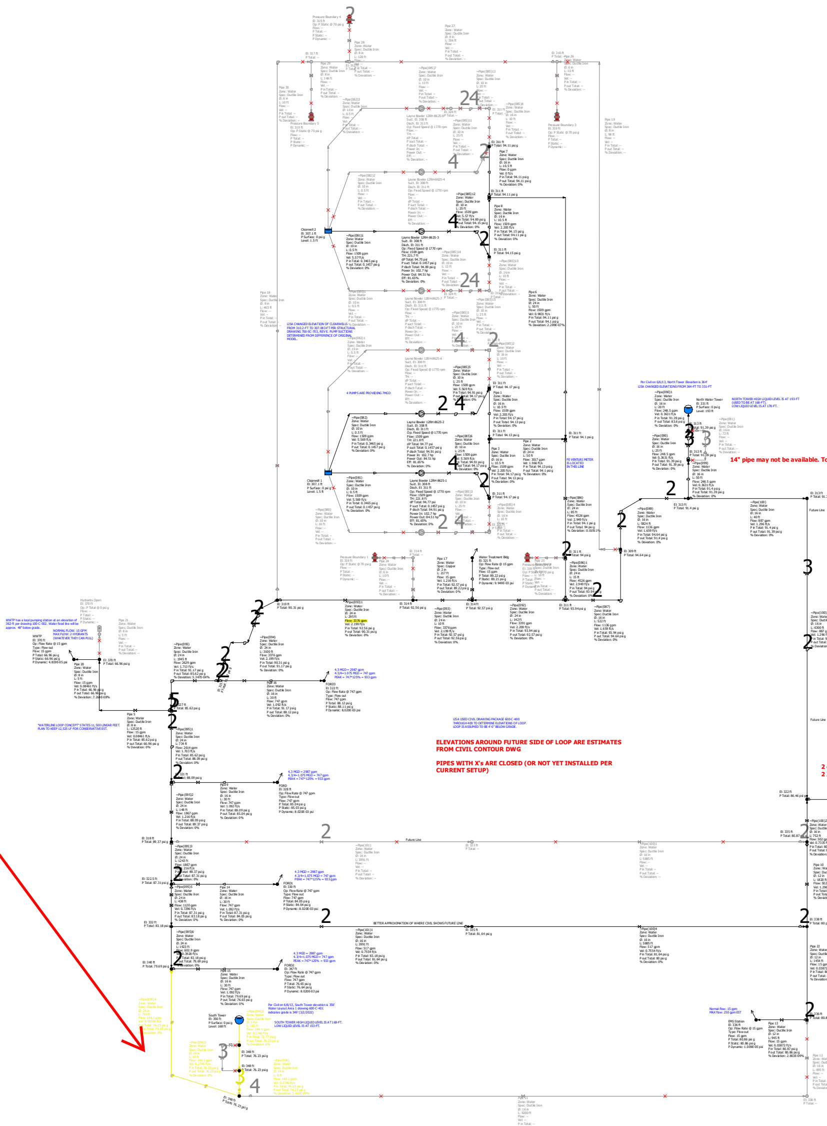
Head: 222 ft

NPSHr: 25.4 ft

Eff: 81.7 %

Power: 103 hp

Motor: hp



Three pump operation due to demand flows for filling north tower and flow to tenants may not provide ability to fill south tower to full point at all times. This scenario is noting flow from the south tower to feed the system. This scenario assumes full flow to tenants.

PIPE-FLO Professional	
Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units					
Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	gal	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information	
Company:	SSOE Inc.
Project:	
Drawn by:	
File Name:	Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.pipe
Lineup:	Typical Day Case Phase 2
Print Date:	Wednesday, July 20, 2022 02:57 PM

List Report

File Name: Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.
Lineup: Typical Day Case Phase 2
Progam Name: PIPE-FLO Professional
Version: 18.0

Calculation Method: Darcy-Weisbach
Laminar Cutoff Re: 2100
Max Iterations: 100
Percent Tolerance: 0.01
Allowable Deviation: 1 %

Company: SSOE Inc.
Project:
by:
Date: Wednesday, July 20, 2022 02:58 PM
Atmospheric Pressure: 14.7 psi a

Pipe Specifications

Specification Name	Material	Absolute Roughness	Sizing Criteria		Design Limits			
Valve Table	**Schedule**	**Hazen Williams C Factor**	**Sizing Criteria Value**		**Velocity**	**Pressure**	**Re Number**	**Mach**
Copper	Copper Pipe B302	6E-05 in	Criteria - none specified	**Min:**	ft/s	psi g		
standard	Schedule: STD	140	0.0	**Max:**	ft/s	psi g		
Ductile Iron	Ductile Iron AWWA C151 Mech	0.0102 in	Velocity = 5 ft/s	**Min:**	0 ft/s	0 psi g		
standard	Schedule: 50	140	5.0 ft/s	**Max:**	12 ft/s	150 psi g		
PVC	PVC Plastic Pipe	6E-05 in	Velocity = 5 ft/s	**Min:**	2 ft/s	0 psi g		
standard	Schedule: 40	140	5.0 ft/s	**Max:**	12 ft/s	150 psi g		

Fluid Zones

Fluid Zone Name	Temperature	Fluid State	Density	Vapor Pressure	Specific Heat Capacity (cp)
Table Name	**Pressure**	**Relative Molecular Mass**	**Viscosity**	**Critical Pressure**	**Specific Heat Ratio (k)**
Water	60 °F	Liquid	62.37 lb/ft³	0.2564 psi a	--
Water	0 psi g	18	1.105 cP	3198 psi a	--

Centrifugal Pumps

Pump Name	Test Speed	Suction Elevation	Discharge Elevation	Total Head	Flow Rate	Efficiency	NPSHa	Design NPSH
Operational Mode and Set Point	**Operating Speed**	**Suction Pressure**	**Discharge Pressure**	**dP**	**Input Power**	**BEP Efficiency**	**NPSHr**	**Margin Ratio**
Layne Bowler 12RH-8625-1	1770	308 ft	311 ft	221.8 ft	1509 gpm	81.65 %	33.68 ft	--
Fixed Speed @ 1770 rpm		0.1457 psi g	94.91 psi g	94.77 psi	102.7 hp	83.1 %	25.44 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Pump Name	Test Speed	Suction Elevation	Discharge Elevation	Total Head	Flow Rate	Efficiency	NPSHa	Design NPSH
Layne Bowler 12RH-8625-2	1770	308 ft	311 ft	221.8 ft	1509 gpm	81.65 %	33.68 ft	--
Fixed Speed @ 1770 rpm		0.1457 psi g	94.91 psi g	94.77 psi	102.7 hp	83.1 %	25.44 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Pump Name	Test Speed	Suction Elevation	Discharge Elevation	Total Head	Flow Rate	Efficiency	NPSHa	Design NPSH
Layne Bowler 12RH-8625-3	1770	308 ft	311 ft	221.7 ft	1509 gpm	81.65 %	33.68 ft	--
Fixed Speed @ 1770 rpm		0.1457 psi g	94.89 psi g	94.75 psi	102.7 hp	83.1 %	25.45 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:
Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-4	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-5	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-6	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-7	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-8	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 1	16 in	Node 4	1509 gpm	94.17 psi g	0.03709 psi	94.13 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.205 ft/s	94.13 psi g		94.1 psi g	0.00
Water	10.5 ft	Node 5	258035	528.4 ft	0.08562 ft	528.3 ft	0.0324 psi
		311 ft	0.01899	528.3 ft		528.2 ft	0.07481 ft
Pipe 10	12 in	Node 39	502 gpm	80 psi g	-0.8731 psi	80.87 psi g	0.01284
Ductile Iron	12.58 in	338 ft	1.296 ft/s	79.99 psi g		80.86 psi g	0.00
Water	1820 ft	Node 28	114105	522.7 ft	0.9843 ft	521.7 ft	9.867E-03 psi
		335 ft	0.02123	522.7 ft		521.7 ft	0.02278 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 11	16 in	~N{037}	--	--	--	--	--
Ductile Iron	16.72 in	348 ft	--	--		--	0.00
Water	9200 ft	Node 30	--	--	--	--	--
		338 ft	--	--		--	--
Pipe 12	16 in	Node 30	--	--	--	--	--
Ductile Iron	16.72 in	338 ft	--	--		--	0.00
Water	895 ft	Node 29	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 13	12 in	Node 29	15 gpm	80.87 psi g	3.975E-04 psi	80.86 psi g	0.01284
Ductile Iron	12.58 in	336 ft	0.03872 ft/s	80.87 psi g		80.86 psi g	0.00
Water	945 ft	EMS Station	3410	522.7 ft	9.178E-04 ft	522.7 ft	9.847E-06 psi
		336 ft	0.04262	522.7 ft		522.7 ft	2.273E-05 ft
Pipe 14	16 in	Node 33	747 gpm	87.31 psi g	3.261 psi	84.05 psi g	0.01215
Ductile Iron	16.72 in	322.5 ft	1.092 ft/s	87.3 psi g		84.04 psi g	0.00
Water	30 ft	FORD1	127759	524.1 ft	0.02784 ft	524 ft	8.570E-03 psi
		330 ft	0.0202	524.1 ft		524 ft	0.01979 ft
Pipe 15	16 in	Node 32	747 gpm	79.69 psi g	3.044 psi	76.65 psi g	0.01215
Ductile Iron	16.72 in	340 ft	1.092 ft/s	79.69 psi g		76.64 psi g	0.00
Water	30 ft	FORD2	127759	524 ft	0.02784 ft	524 ft	8.570E-03 psi
		347 ft	0.0202	524 ft		523.9 ft	0.01979 ft
Pipe 16	16 in	~N{036}	747 gpm	91.17 psi g	3.044 psi	88.12 psi g	0.01215
Ductile Iron	16.72 in	315 ft	1.092 ft/s	91.16 psi g		88.11 psi g	0.00
Water	30 ft	FORD3	127759	525.5 ft	0.02784 ft	525.4 ft	8.570E-03 psi
		322 ft	0.0202	525.5 ft		525.4 ft	0.01979 ft
Pipe 17	2 in	~N{034}	15 gpm	92.57 psi g	3.352 psi	89.22 psi g	0.01862
Copper	2.245 in	314 ft	1.216 ft/s	92.56 psi g		89.21 psi g	0.00
Water	217 ft	Water Treatment Bldg	19107	527.7 ft	0.7394 ft	527 ft	0.01753 psi
		321 ft	0.02623	527.7 ft		527 ft	0.04047 ft
Pipe 18	8 in	~N{035}	--	--	--	--	--
Ductile Iron	8.51 in	319 ft	--	--		--	0.00
Water	463 ft	Node 45	--	--	--	--	--
		317 ft	--	--		--	--
Pipe 19	8 in	~N{031}	--	--	--	--	--
Ductile Iron	8.51 in	309 ft	--	--		--	0.00
Water	98 ft	Node 36	--	--	--	--	--
		310 ft	--	--		--	--
Pipe 2	24 in	Node 5	3017 gpm	94.13 psi g	0.02847 psi	94.1 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.966 ft/s	94.1 psi g		94.08 psi g	0.00
Water	50 ft	~N{030}	344596	528.3 ft	0.06574 ft	528.3 ft	0.01758 psi
		311 ft	0.01748	528.3 ft		528.2 ft	0.04058 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 20	8 in	Node 38	15 gpm	66.96 psi g	1.312E-05 psi	66.96 psi g	0.01389
Ductile Iron	8.51 in	370 ft	0.08461 ft/s	66.96 psi g		66.96 psi g	0.00
Water	5 ft	WWTP	5040	524.6 ft	3.03E-05 ft	524.6 ft	0 psi
		370 ft	0.03863	524.6 ft		524.6 ft	0 ft
Pipe 21	8 in	Node 38	--	--	--	--	--
Ductile Iron	8.51 in	370 ft	--	--		--	0.00
Water	5 ft	Hydrants Open	--	--	--	--	--
		370 ft	--	--		--	--
Pipe 22	12 in	Node 39	15 gpm	80 psi g	-0.8657 psi	80.87 psi g	0.01284
Ductile Iron	12.58 in	338 ft	0.03872 ft/s	80 psi g		80.87 psi g	0.00
Water	1454 ft	Node 29	3410	522.7 ft	1.377E-03 ft	522.7 ft	0 psi
		336 ft	0.04262	522.7 ft		522.7 ft	0 ft
Pipe 23	8 in	Node 41	--	--	--	--	--
Ductile Iron	8.51 in	314 ft	--	--		--	0.00
Water	166 ft	Node 42	--	--	--	--	--
		314 ft	--	--		--	--
Pipe 24	6 in	Node 42	--	--	--	--	--
Ductile Iron	6.4 in	314 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 1	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 25	6 in	Node 43	--	--	--	--	--
Ductile Iron	6.4 in	311 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 2	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 26	6 in	Node 36	--	--	--	--	--
Ductile Iron	6.4 in	310 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 3	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 27	8 in	Node 36	--	--	--	--	--
Ductile Iron	8.51 in	310 ft	--	--		--	0.00
Water	196 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--
Pipe 28	8 in	Node 44	--	--	--	--	--
Ductile Iron	8.51 in	313 ft	--	--		--	0.00
Water	128 ft	Pressure Boundary 4	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 29	8 in	Node 45	--	--	--	--	--
Ductile Iron	8.51 in	317 ft	--	--		--	0.00
Water	148 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 3	16 in	Node 3	1509 gpm	94.17 psi g	0.03709 psi	94.13 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.205 ft/s	94.13 psi g		94.1 psi g	0.00
Water	10.5 ft	Node 5	258035	528.4 ft	0.08562 ft	528.3 ft	0.0324 psi
		311 ft	0.01899	528.3 ft		528.2 ft	0.07481 ft
Pipe 30	6 in	Node 45	--	--	--	--	--
Ductile Iron	6.4 in	317 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 5	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 5	8 in	Node 10	15 gpm	85.62 psi g	18.66 psi	66.96 psi g	0.01389
Ductile Iron	8.51 in	327 ft	0.08461 ft/s	85.62 psi g		66.96 psi g	0.00
Water	12520 ft	Node 38	5040	524.7 ft	0.07602 ft	524.6 ft	6.692E-05 psi
		370 ft	0.03863	524.7 ft		524.6 ft	1.545E-04 ft
Pipe 6	24 in	Node 19	1509 gpm	94.11 psi g	7.299E-03 psi	94.1 psi g	0.01126
Ductile Iron	25.04 in	311 ft	0.9831 ft/s	94.1 psi g		94.09 psi g	0.00
Water	50 ft	~N{030}	172330	528.3 ft	0.01685 ft	528.3 ft	4.396E-03 psi
		311 ft	0.01862	528.3 ft		528.2 ft	0.01015 ft
Pipe 7	16 in	Node 18	0 gpm	94.11 psi g	0 psi	94.11 psi g	0.01215
Ductile Iron	16.72 in	311 ft	0 ft/s	94.11 psi g		94.11 psi g	0.00
Water	10.5 ft	Node 19	0	528.3 ft	0 ft	528.3 ft	0 psi
		311 ft	--	528.3 ft		528.3 ft	0 ft
Pipe 8	16 in	Node 17	1509 gpm	94.15 psi g	0.0371 psi	94.11 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.205 ft/s	94.11 psi g		94.08 psi g	0.00
Water	10.5 ft	Node 19	258083	528.4 ft	0.08565 ft	528.3 ft	0.03242 psi
		311 ft	0.01899	528.3 ft		528.2 ft	0.07484 ft
Pipe 9	16 in	Node 22	747 gpm	88.09 psi g	3.044 psi	85.04 psi g	0.01215
Ductile Iron	16.72 in	321 ft	1.092 ft/s	88.08 psi g		85.03 psi g	0.00
Water	30 ft	FORD	127759	524.4 ft	0.02784 ft	524.3 ft	8.570E-03 psi
		328 ft	0.0202	524.3 ft		524.3 ft	0.01979 ft
~Pipe{080}	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	16 ft	Layne Bowler 12RH-8625-5	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{080}1	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-7	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{081}	10 in	Clearwell 1	1509 gpm	0.3465 psi g	0.2008 psi	0.1457 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.569 ft/s	0.1378 psi g		-0.06301 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-1	410108	308.6 ft	0.2465 ft	308.3 ft	0.1044 psi
		308 ft	0.02023	308.1 ft		307.9 ft	0.241 ft

Pipes

Pipe Name	Size	Inlet Device	Flow Rate	Inlet Total Pressure	Total dP	Outlet Total Pressure	V&F Friction Factor
Specification	**Inside Diameter**	**Inlet Elevation**	**Fluid Velocity**	**Inlet Static Pressure**		**Outlet Static Pressure**	**V&F Resistance K**
Fluid Zone	**Length**	**Outlet Device**	**Reynolds Number**	**Inlet Energy Grade**	**Total Head Loss**	**Outlet Energy Grade**	**V&F dP**
		Outlet Elevation	**Pipe Friction Factor**	**Inlet Hydraulic Grade**		**Outlet Hydraulic Grade**	**V&F Head Loss**
~Pipe{081}1	10 in	Clearwell 2	1509 gpm	0.3465 psi g	0.2008 psi	0.1457 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.57 ft/s	0.1377 psi g		-0.06313 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-3	410186	308.6 ft	0.2466 ft	308.3 ft	0.1044 psi
		308 ft	0.02023	308.1 ft		307.9 ft	0.2411 ft
~Pipe{082}	10 in	Clearwell 1	1509 gpm	0.3465 psi g	0.2008 psi	0.1457 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.569 ft/s	0.1378 psi g		-0.06301 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-2	410108	308.6 ft	0.2465 ft	308.3 ft	0.1044 psi
		308 ft	0.02023	308.1 ft		307.9 ft	0.241 ft
~Pipe{082}1	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-6	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{082}2	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-4	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{082}3	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-8	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{085}1	10 in	Layne Bowler 12RH-8625-6	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 6	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}10	16 in	Node 21	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 17	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}11	10 in	Layne Bowler 12RH-8625-4	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 18	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}12	10 in	Layne Bowler 12RH-8625-3	1509 gpm	94.89 psi g	0.7483 psi	94.15 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.57 ft/s	94.69 psi g		93.94 psi g	0.00
Water	25 ft	Node 17	410186	530.1 ft	1.728 ft	528.4 ft	0.6279 psi
		311 ft	0.02023	529.6 ft		527.9 ft	1.45 ft
~Pipe{085}13	10 in	Node 1	--	--	--	--	--
Ductile Iron	10.52 in	324 ft	--	--		--	0.00
Water	25 ft	Node 20	--	--	--	--	--
		311 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{085}14	10 in	Layne Bowler 12RH-8625-7	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 27	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}15	10 in	Node 27	--	--	--	--	--
Ductile Iron	10.52 in	324 ft	--	--		--	0.00
Water	25 ft	Node 21	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}2	16 in	Node 6	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 4	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}3	10 in	Layne Bowler 12RH-8625-5	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 15	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}4	16 in	Node 15	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 3	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}5	10 in	Layne Bowler 12RH-8625-2	1509 gpm	94.91 psi g	0.748 psi	94.17 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.569 ft/s	94.71 psi g		93.96 psi g	0.00
Water	25 ft	Node 4	410108	530.1 ft	1.727 ft	528.4 ft	0.6276 psi
		311 ft	0.02023	529.6 ft		527.9 ft	1.449 ft
~Pipe{085}6	10 in	Layne Bowler 12RH-8625-1	1509 gpm	94.91 psi g	0.748 psi	94.17 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.569 ft/s	94.71 psi g		93.96 psi g	0.00
Water	25 ft	Node 3	410108	530.1 ft	1.727 ft	528.4 ft	0.6276 psi
		311 ft	0.02023	529.6 ft		527.9 ft	1.449 ft
~Pipe{085}7	10 in	Layne Bowler 12RH-8625-8	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 1	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}8	16 in	Node 20	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 18	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{086}	24 in	~N{030}	4526 gpm	94.1 psi g	0.1039 psi	94 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.949 ft/s	94.04 psi g		93.94 psi g	0.00
Water	85 ft	Node 43	516926	528.3 ft	0.2399 ft	528 ft	0.06329 psi
		311 ft	0.01703	528.1 ft		527.9 ft	0.1461 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{086}1	24 in	Node 43	4526 gpm	94 psi g	0.05991 psi	93.94 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.949 ft/s	93.94 psi g		93.88 psi g	0.00
Water	15 ft	~N{001}	516926	528 ft	0.1383 ft	527.9 ft	0.05274 psi
		311 ft	0.01703	527.9 ft		527.7 ft	0.1218 ft
~Pipe{087}	16 in	~N{001}	1136 gpm	93.94 psi g	-0.7068 psi	94.64 psi g	0.01215
Ductile Iron	16.72 in	311 ft	1.659 ft/s	93.92 psi g		94.63 psi g	0.00
Water	522 ft	~N{031}	194207	527.9 ft	0.3683 ft	527.5 ft	0.02477 psi
		309 ft	0.01941	527.8 ft		527.5 ft	0.05718 ft
~Pipe{089}	16 in	~N{031}	1136 gpm	94.64 psi g	3.249 psi	91.4 psi g	0.01215
Ductile Iron	16.72 in	309 ft	1.659 ft/s	94.63 psi g		91.38 psi g	0.00
Water	5824 ft	~N{039}	194207	527.5 ft	3.5 ft	524 ft	0.01261 psi
		313 ft	0.01941	527.5 ft		524 ft	0.02911 ft
~Pipe{090}	16 in	~N{033}	248.5 gpm	91.39 psi g	1.237E-03 psi	91.39 psi g	0.01215
Ductile Iron	16.72 in	313 ft	0.3631 ft/s	91.39 psi g		91.39 psi g	0.00
Water	25 ft	Node 14	42498	524 ft	2.856E-03 ft	524 ft	8.625E-04 psi
		313 ft	0.02353	524 ft		524 ft	1.991E-03 ft
~Pipe{090}1	16 in	Node 14	248.5 gpm	91.39 psi g	7.797 psi	83.6 psi g	0.01215
Ductile Iron	16.72 in	313 ft	0.3631 ft/s	91.39 psi g		83.6 psi g	0.00
Water	20 ft	North Water Tower	42498	524 ft	6.919E-04 ft	524 ft	0 psi
		331 ft	0.02353	524 ft		524 ft	0 ft
~Pipe{091}	16 in	Node 14	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	72 ft	~N{033}	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{092}	24 in	~N{001}	3391 gpm	93.94 psi g	1.363 psi	92.57 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.209 ft/s	93.9 psi g		92.54 psi g	0.00
Water	142 ft	~N{034}	387248	527.9 ft	0.1476 ft	527.7 ft	0.02516 psi
		314 ft	0.01733	527.8 ft		527.7 ft	0.05808 ft
~Pipe{093}	24 in	~N{034}	3376 gpm	92.57 psi g	0.01297 psi	92.56 psi g	0.01126
Ductile Iron	25.04 in	314 ft	2.199 ft/s	92.54 psi g		92.53 psi g	0.00
Water	10 ft	Node 41	385535	527.7 ft	0.02995 ft	527.7 ft	0.01027 psi
		314 ft	0.01734	527.7 ft		527.6 ft	0.02371 ft
~Pipe{093}1	24 in	Node 41	3376 gpm	92.56 psi g	2.256 psi	90.31 psi g	0.01126
Ductile Iron	25.04 in	314 ft	2.199 ft/s	92.53 psi g		90.27 psi g	0.00
Water	295 ft	~N{035}	385535	527.7 ft	0.208 ft	527.5 ft	0.01027 psi
		319 ft	0.01734	527.6 ft		527.4 ft	0.02371 ft
~Pipe{094}	24 in	~N{035}	3376 gpm	90.31 psi g	-0.8601 psi	91.17 psi g	0.01126
Ductile Iron	25.04 in	319 ft	2.199 ft/s	90.27 psi g		91.13 psi g	0.00
Water	3100 ft	~N{036}	385535	527.5 ft	2.014 ft	525.5 ft	0.03367 psi
		315 ft	0.01734	527.4 ft		525.4 ft	0.07774 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{095}	24 in	~N{036}	2629 gpm	91.17 psi g	5.544 psi	85.62 psi g	0.01126
Ductile Iron	25.04 in	315 ft	1.713 ft/s	91.15 psi g		85.6 psi g	0.00
Water	1945 ft	Node 10	300227	525.5 ft	0.7998 ft	524.7 ft	0.02131 psi
		327 ft	0.01766	525.4 ft		524.6 ft	0.0492 ft
~Pipe{095}1	24 in	Node 10	2614 gpm	85.62 psi g	-2.465 psi	88.09 psi g	0.01126
Ductile Iron	25.04 in	327 ft	1.703 ft/s	85.6 psi g		88.07 psi g	0.00
Water	734 ft	Node 22	298513	524.7 ft	0.3085 ft	524.4 ft	0.01227 psi
		321 ft	0.01767	524.6 ft		524.3 ft	0.02833 ft
~Pipe{095}2	24 in	Node 22	1867 gpm	88.09 psi g	-1.283 psi	89.37 psi g	0.01126
Ductile Iron	25.04 in	321 ft	1.216 ft/s	88.08 psi g		89.36 psi g	0.00
Water	148 ft	Node 25	213205	524.4 ft	0.03695 ft	524.3 ft	3.140E-03 psi
		318 ft	0.01821	524.3 ft		524.3 ft	7.250E-03 ft
~Pipe{095}3	24 in	Node 25	1867 gpm	89.37 psi g	2.059 psi	87.31 psi g	0.01126
Ductile Iron	25.04 in	318 ft	1.216 ft/s	89.36 psi g		87.3 psi g	0.00
Water	1243 ft	Node 33	213205	524.3 ft	0.2546 ft	524.1 ft	2.243E-03 psi
		322.5 ft	0.01821	524.3 ft		524.1 ft	5.178E-03 ft
~Pipe{095}4	24 in	Node 32	144.1 gpm	76.23 psi g	-3.464 psi	79.69 psi g	0.01126
Ductile Iron	25.04 in	340 ft	0.09386 ft/s	76.23 psi g		79.69 psi g	0.00
Water	790 ft	~N{037}	16452	524 ft	1.580E-03 ft	524 ft	5.651E-05 psi
		348 ft	0.02796	524 ft		524 ft	1.305E-04 ft
Messages: Reversed flow							
~Pipe{095}5	24 in	Node 33	1120 gpm	87.31 psi g	4.131 psi	83.18 psi g	0.01126
Ductile Iron	25.04 in	322.5 ft	0.7296 ft/s	87.31 psi g		83.18 psi g	0.00
Water	438 ft	Node 40	127896	524.1 ft	0.03686 ft	524 ft	1.453E-03 psi
		332 ft	0.01929	524.1 ft		524 ft	3.354E-03 ft
~Pipe{095}6	24 in	Node 40	602.9 gpm	83.18 psi g	3.485 psi	79.69 psi g	0.01126
Ductile Iron	25.04 in	332 ft	0.3928 ft/s	83.18 psi g		79.69 psi g	0.00
Water	1923 ft	Node 32	68857	524 ft	0.04662 ft	524 ft	0 psi
		340 ft	0.0211	524 ft		524 ft	0 ft
~Pipe{096}	14 in	~N{037}	144.1 gpm	76.23 psi g	7.217E-04 psi	76.23 psi g	0.01246
Ductile Iron	14.64 in	348 ft	0.2746 ft/s	76.23 psi g		76.23 psi g	0.00
Water	8 ft	Node 9	28140	524 ft	1.666E-03 ft	524 ft	6.366E-04 psi
		348 ft	0.02556	524 ft		524 ft	1.470E-03 ft
Messages: Reversed flow							
~Pipe{096}1	14 in	Node 9	144.1 gpm	76.23 psi g	2.328E-04 psi	76.23 psi g	0.01246
Ductile Iron	14.64 in	348 ft	0.2746 ft/s	76.23 psi g		76.23 psi g	0.00
Water	10 ft	Node 12	28140	524 ft	5.376E-04 ft	524 ft	1.265E-04 psi
		348 ft	0.02556	524 ft		524 ft	2.921E-04 ft
Messages: Reversed flow							

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{096}2	14 in	Node 12	144.1 gpm	72.77 psi g	-3.463 psi	76.23 psi g	0.01246
Ductile Iron	14.64 in	348 ft	0.2746 ft/s	72.77 psi g		76.23 psi g	0.00
Water	165 ft	South Tower	28140	524 ft	4.343E-03 ft	524 ft	1.265E-04 psi
		356 ft	0.02556	524 ft		524 ft	2.921E-04 ft
Messages: Reversed flow							
~Pipe{097}	14 in	Node 12	--	--	--	--	--
Ductile Iron	14.64 in	348 ft	--	--		--	0.00
Water	25 ft	Node 9	--	--	--	--	--
		348 ft	--	--		--	--
~Pipe{098}	16 in	Node 23	1389 gpm	86.46 psi g	3.257 psi	83.2 psi g	0.01215
Ductile Iron	16.72 in	322 ft	2.03 ft/s	86.43 psi g		83.18 psi g	0.00
Water	525 ft	~N{041}	237560	521.6 ft	0.52 ft	521.1 ft	0.0256 psi
		329 ft	0.0191	521.6 ft		521 ft	0.05911 ft
~Pipe{099}	16 in	~N{039}	248.5 gpm	91.4 psi g	1.396E-03 psi	91.39 psi g	0.01215
Ductile Iron	16.72 in	313 ft	0.3631 ft/s	91.39 psi g		91.39 psi g	0.00
Water	50 ft	~N{033}	42498	524 ft	3.223E-03 ft	524 ft	6.469E-04 psi
		313 ft	0.02353	524 ft		524 ft	1.494E-03 ft
~Pipe{100}	16 in	~N{039}	887 gpm	91.4 psi g	9.191E-03 psi	91.39 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.296 ft/s	91.38 psi g		91.38 psi g	0.00
Water	40 ft	Node 37	151708	524 ft	0.02122 ft	524 ft	2.748E-03 psi
		313 ft	0.01985	524 ft		524 ft	6.344E-03 ft
~Pipe{100}1	16 in	~N{040}	--	--	--	--	--
Ductile Iron	16.72 in	323 ft	--	--		--	0.00
Water	5885 ft	Node 28	--	--	--	--	--
		335 ft	--	--		--	--
~Pipe{100}2	16 in	Node 28	502 gpm	80.87 psi g	-5.589 psi	86.46 psi g	0.01215
Ductile Iron	16.72 in	335 ft	0.7335 ft/s	80.87 psi g		86.46 psi g	0.00
Water	752 ft	Node 23	85852	521.7 ft	0.09633 ft	521.6 ft	3.520E-04 psi
		322 ft	0.02117	521.7 ft		521.6 ft	8.127E-04 ft
~Pipe{100}3	16 in	Node 37	887 gpm	91.39 psi g	4.925 psi	86.46 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.296 ft/s	91.38 psi g		86.45 psi g	0.00
Water	6300 ft	Node 23	151708	524 ft	2.369 ft	521.6 ft	0.01154 psi
		322 ft	0.01985	524 ft		521.6 ft	0.02664 ft
~Pipe{100}4	16 in	~N{040}1	517 gpm	81.64 psi g	1.645 psi	80 psi g	0.01215
Ductile Iron	16.72 in	335 ft	0.7554 ft/s	81.64 psi g		80 psi g	0.00
Water	5885 ft	Node 39	88417	523.5 ft	0.798 ft	522.7 ft	3.547E-03 psi
		338 ft	0.02109	523.5 ft		522.7 ft	8.189E-03 ft
~Pipe{101}	16 in	Node 25	--	--	--	--	--
Ductile Iron	16.72 in	318 ft	--	--		--	0.00
Water	3991 ft	~N{040}	--	--	--	--	--
		323 ft	--	--		--	--

Pipes

Pipe Name	Size	Inlet Device	Flow Rate	Inlet Total Pressure	Total dP	Outlet Total Pressure	V&F Friction Factor
Specification	**Inside Diameter**	**Inlet Elevation**	**Fluid Velocity**	**Inlet Static Pressure**		**Outlet Static Pressure**	**V&F Resistance K**
Fluid Zone	**Length**	**Outlet Device**	**Reynolds Number**	**Inlet Energy Grade**	**Total Head Loss**	**Outlet Energy Grade**	**V&F dP**
		Outlet Elevation	**Pipe Friction Factor**	**Inlet Hydraulic Grade**		**Outlet Hydraulic Grade**	**V&F Head Loss**
~Pipe{101}1	16 in	Node 40	517 gpm	83.18 psi g	1.535 psi	81.64 psi g	0.01215
Ductile Iron	16.72 in	332 ft	0.7554 ft/s	83.18 psi g		81.64 psi g	0.00
Water	3991 ft	~N{040}1	88417	524 ft	0.5438 ft	523.5 ft	3.547E-03 psi
		335 ft	0.02109	524 ft		523.5 ft	8.189E-03 ft
~Pipe{102}	16 in	~N{041}	1389 gpm	83.2 psi g	3.802E-04 psi	83.2 psi g	0.01215
Ductile Iron	16.72 in	329 ft	2.03 ft/s	83.18 psi g		83.18 psi g	0.00
Water	1 ft	Tenant Demand	237560	521.1 ft	8.778E-04 ft	521.1 ft	0 psi
		329 ft	0.0191	521 ft		521 ft	0 ft

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 1	324 ft	--	--
Node 10	327 ft	85.62 psi g	524.6 ft
Node 12	348 ft	76.23 psi g	524 ft
Node 14	313 ft	91.39 psi g	524 ft
Node 15	311 ft	--	--
Node 17	311 ft	94.15 psi g	528.1 ft
Node 18	311 ft	94.11 psi g	528.3 ft
Node 19	311 ft	94.11 psi g	528.2 ft
Node 20	311 ft	--	--
Node 21	311 ft	--	--
Node 22	321 ft	88.09 psi g	524.3 ft
Node 23	322 ft	86.46 psi g	521.6 ft
Node 25	318 ft	89.37 psi g	524.3 ft
Node 27	324 ft	--	--
Node 28	335 ft	80.87 psi g	521.7 ft
Node 29	336 ft	80.87 psi g	522.7 ft
Node 3	311 ft	94.17 psi g	528.1 ft
Node 30	338 ft	--	--
Node 32	340 ft	79.69 psi g	524 ft
Node 33	322.5 ft	87.31 psi g	524.1 ft
Node 36	310 ft	--	--
Node 37	313 ft	91.39 psi g	524 ft
Node 38	370 ft	66.96 psi g	524.6 ft
Node 39	338 ft	80 psi g	522.7 ft

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 4	311 ft	94.17 psi g	528.1 ft
Node 40	332 ft	83.18 psi g	524 ft
Node 41	314 ft	92.56 psi g	527.6 ft
Node 42	314 ft	--	--
Node 43	311 ft	94 psi g	527.9 ft
Node 44	313 ft	--	--
Node 45	317 ft	--	--
Node 5	311 ft	94.13 psi g	528.2 ft
Node 6	311 ft	--	--
Node 9	348 ft	76.23 psi g	524 ft
~N{001}	311 ft	93.94 psi g	527.8 ft
~N{030}	311 ft	94.1 psi g	528.2 ft
~N{031}	309 ft	94.64 psi g	527.5 ft
~N{033}	313 ft	91.39 psi g	524 ft
~N{034}	314 ft	92.57 psi g	527.7 ft
~N{035}	319 ft	90.31 psi g	527.4 ft
~N{036}	315 ft	91.17 psi g	525.4 ft
~N{037}	348 ft	76.23 psi g	524 ft
~N{039}	313 ft	91.4 psi g	524 ft
~N{040}	323 ft	--	--
~N{040}1	335 ft	81.64 psi g	523.5 ft
~N{041}	329 ft	83.2 psi g	521 ft

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Hydrants Open P Total @ 0 psi g	370 ft	-- -- --	-- -- --	--
Pressure Boundary 1 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 2 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Pressure Boundary 3 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 4 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 5 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--

Flow Demands

Flow Demand Name Operation Flow Direction	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
EMS Station Flow Rate @ 15 gpm Flow out	336 ft	80.86 psi g 80.86 psi g 1.009E-05 psi	522.7 ft 522.7 ft 2.33E-05 ft	15 gpm
FORD Flow Rate @ 747 gpm Flow out	328 ft	85.04 psi g 85.03 psi g 8.020E-03 psi	524.3 ft 524.3 ft 0.01852 ft	747 gpm
FORD1 Flow Rate @ 747 gpm Flow out	330 ft	84.05 psi g 84.04 psi g 8.020E-03 psi	524 ft 524 ft 0.01852 ft	747 gpm
FORD2 Flow Rate @ 747 gpm Flow out	347 ft	76.65 psi g 76.64 psi g 8.020E-03 psi	524 ft 523.9 ft 0.01852 ft	747 gpm
FORD3 Flow Rate @ 747 gpm Flow out	322 ft	88.12 psi g 88.11 psi g 8.020E-03 psi	525.4 ft 525.4 ft 0.01852 ft	747 gpm
Tenant Demand Flow Rate @ 1389 gpm Flow out	329 ft	83.2 psi g 83.18 psi g 0.02773 psi	521.1 ft 521 ft 0.06402 ft	1389 gpm
WWTP Flow Rate @ 15 gpm Flow out	370 ft	66.96 psi g 66.96 psi g 4.819E-05 psi	524.6 ft 524.6 ft 1.113E-04 ft	15 gpm
Water Treatment Bldg Flow Rate @ 15 gpm Flow out	321 ft	89.22 psi g 89.21 psi g 9.949E-03 psi	527 ft 527 ft 0.02297 ft	15 gpm

Phase 2 Operation

Future Scenario

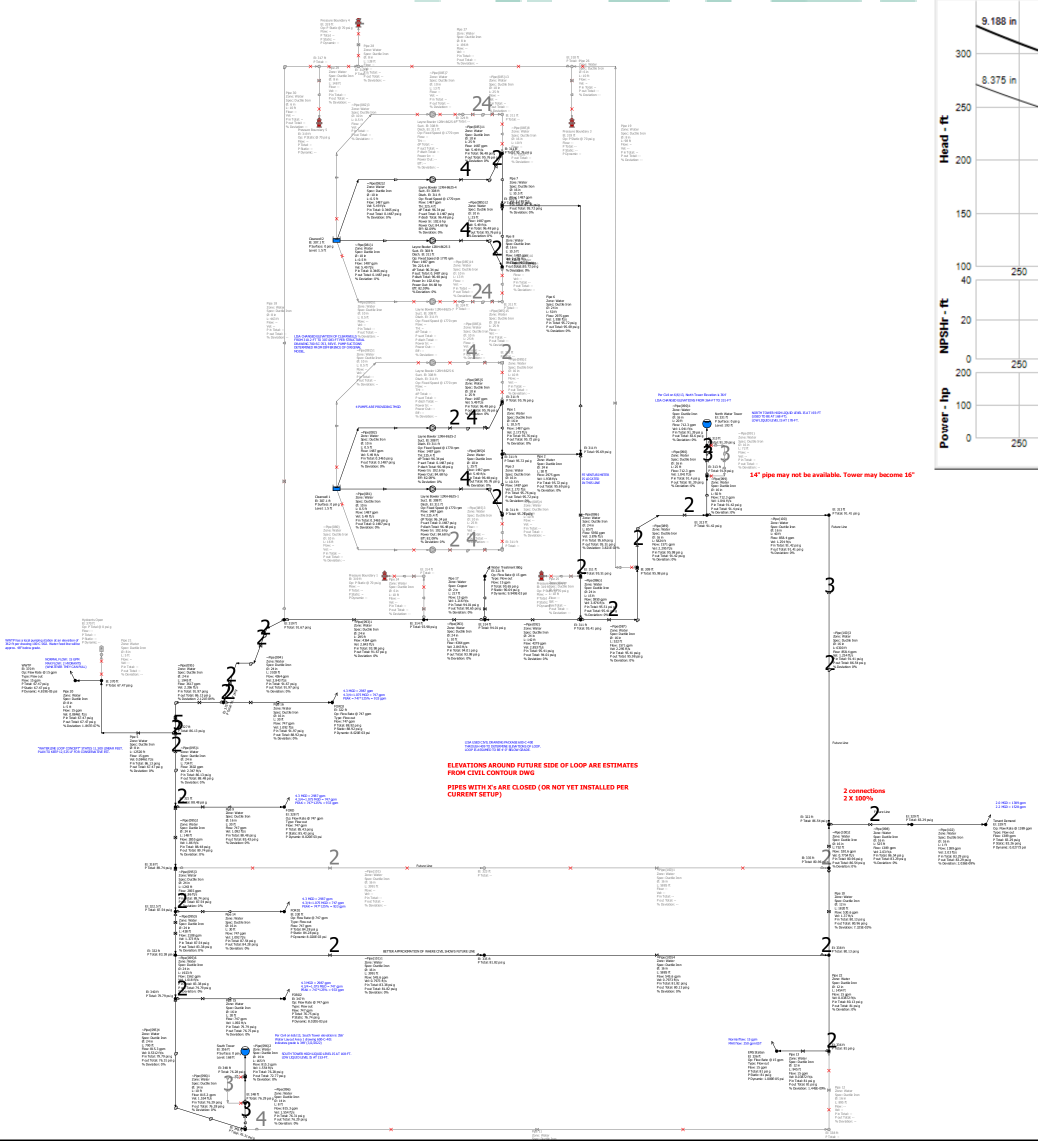
Flows to Blue Oval and East Tenant (Handy) total Design flow 6.3 MGD

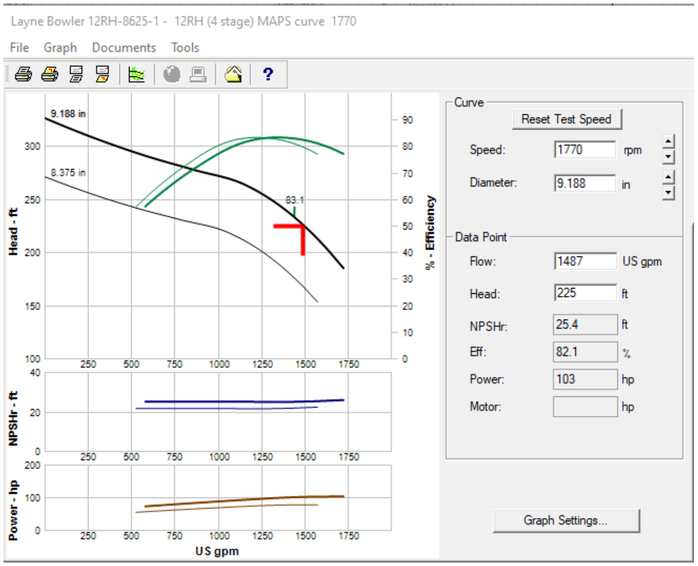
Four pump operation

For view of a four pump operation, we have included in the Pie-Flo model two pumps from each clearwell. Pumps are operating at full size impeller at full speed. The pump curve is imposed on the flow diagram. The flow can be reduced through use of VFD's to maintain steady flow to users and maintain tower levels. Flow rate to the tenant with four pumps is 5950 GPM, in excess of the average flow of 4375 GPM to tenants.

In this model, the pressure at the south tower is 76.28 PSIG (176.2 feet) plus Elev. 348 = 524.2 feet. Allowing ability to fully fill the south tower. Flow into the tower with four pumps operating and normal flow to tenant is 815 GPM.

Normal operation for the Phase 2 design is anticipated to be use of 4 pumps.





Layne Bowler 12RH-8625-1 - 12RH (4 stage) MAPS curve 1770

Curve

Speed: 1770 rpm

Diameter: 9.188 in

Data Point

Flow: 1487 US gpm

Head: 225 ft

NPSHr: 25.4 ft

Eff: 82.1 %

Power: 103 hp

Motor: hp

PIPE-FLO Professional

Program Version: 18.0
Calculation Method: Darcy-Weisbach
Maximum Iterations: 100
Percent Tolerance: 0.01 %
Laminar Cutoff Re: 2100
Allowable Deviation: 1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	gal	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company: SSOE Inc.
Project:
Drawn by:
File Name: Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.pipe
Lineup: Typical Day Case Phase 2
Print Date: Monday, July 18, 2022 03:05 PM

List Report

File Name: Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.
Lineup: Typical Day Case Phase 2

Progam Name: PIPE-FLO Professional
Version: 18.0

Calculation Method: Darcy-Weisbach
Laminar Cutoff Re: 2100

Max Iterations: 100
Percent Tolerance: 0.01

Allowable Deviation: 1 %

Company: SSOE Inc.
Project:

by:
Date: Monday, July 18, 2022 03:11 PM

Atmospheric Pressure: 14.7 psi a

Pipe Specifications

Specification Name Valve Table	Material Schedule	Absolute Roughness Hazen Williams C Factor	Sizing Criteria Sizing Criteria Value		Design Limits Velocity	Pressure	Re Number	Mach
Copper	Copper Pipe B302	6E-05 in	Criteria - none specified	**Min:**	ft/s	psi g		
standard	Schedule: STD	140	0.0	**Max:**	ft/s	psi g		
Ductile Iron	Ductile Iron AWWA C151 Mech	0.0102 in	Velocity = 5 ft/s	**Min:**	0 ft/s	0 psi g		
standard	Schedule: 50	140	5.0 ft/s	**Max:**	12 ft/s	150 psi g		
PVC	PVC Plastic Pipe	6E-05 in	Velocity = 5 ft/s	**Min:**	2 ft/s	0 psi g		
standard	Schedule: 40	140	5.0 ft/s	**Max:**	12 ft/s	150 psi g		

Fluid Zones

Fluid Zone Name Table Name	Temperature Pressure	Fluid State Relative Molecular Mass	Density Viscosity	Vapor Pressure Critical Pressure	Specific Heat Capacity (cp) Specific Heat Ratio (k)
Water	60 °F	Liquid	62.37 lb/ft³	0.2564 psi a	--
Water	0 psi g	18	1.105 cP	3198 psi a	--

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-1	1770	308 ft	311 ft	225.4 ft	1487 gpm	82.09 %	33.69 ft	--
Fixed Speed @ 1770 rpm		0.1487 psi g	96.48 psi g	96.34 psi	102.6 hp	83.1 %	25.38 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:

Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-2	1770	308 ft	311 ft	225.4 ft	1487 gpm	82.09 %	33.69 ft	--
Fixed Speed @ 1770 rpm		0.1487 psi g	96.48 psi g	96.34 psi	102.6 hp	83.1 %	25.38 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:

Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-3	1770	308 ft	311 ft	225.4 ft	1487 gpm	82.09 %	33.69 ft	--
Fixed Speed @ 1770 rpm		0.1487 psi g	96.48 psi g	96.34 psi	102.6 hp	83.1 %	25.38 ft	

Company: Layne Bowler
Curve: Manual Pump
Type:

Size: 12RH (4 stage)
Diameter: 9.188 in
POR: from -- to --

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-4 Fixed Speed @ 1770 rpm	1770	308 ft 0.1487 psi g	311 ft 96.48 psi g	225.4 ft 96.34 psi	1487 gpm 102.6 hp	82.09 % 83.1 %	33.69 ft 25.38 ft	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-5 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-6 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-7 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						
Layne Bowler 12RH-8625-8 Fixed Speed @ 1770 rpm	1770	308 ft --	311 ft --	-- --	-- --	-- 83.1 %	-- --	--
Company: Layne Bowler Curve: Manual Pump Type:		Size: 12RH (4 stage) Diameter: 9.188 in POR: from -- to --						

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 1 Ductile Iron Water	16 in 16.72 in 10.5 ft	Node 4 311 ft Node 5 311 ft	1487 gpm 2.173 ft/s 254389 0.01901	95.76 psi g 95.73 psi g 532.1 ft 532 ft	0.03605 psi 0.08323 ft	95.72 psi g 95.69 psi g 532 ft 531.9 ft	0.01215 0.00 0.03149 psi 0.07271 ft
Pipe 10 Ductile Iron Water	12 in 12.58 in 1820 ft	Node 39 338 ft Node 28 335 ft	530.6 gpm 1.37 ft/s 120623 0.02112	80.13 psi g 80.12 psi g 523 ft 523 ft	-0.8255 psi 1.094 ft	80.96 psi g 80.95 psi g 521.9 ft 521.9 ft	0.01284 0.00 0.01103 psi 0.02546 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 11	16 in	~N{037}	--	--	--	--	--
Ductile Iron	16.72 in	348 ft	--	--		--	0.00
Water	9200 ft	Node 30	--	--	--	--	--
		338 ft	--	--		--	--
Pipe 12	16 in	Node 30	--	--	--	--	--
Ductile Iron	16.72 in	338 ft	--	--		--	0.00
Water	895 ft	Node 29	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 13	12 in	Node 29	15 gpm	81 psi g	3.975E-04 psi	81 psi g	0.01284
Ductile Iron	12.58 in	336 ft	0.03872 ft/s	81 psi g		81 psi g	0.00
Water	945 ft	EMS Station	3410	523 ft	9.178E-04 ft	523 ft	9.847E-06 psi
		336 ft	0.04262	523 ft		523 ft	2.273E-05 ft
Pipe 14	16 in	Node 33	747 gpm	87.54 psi g	3.261 psi	84.28 psi g	0.01215
Ductile Iron	16.72 in	322.5 ft	1.092 ft/s	87.54 psi g		84.28 psi g	0.00
Water	30 ft	FORD1	127759	524.6 ft	0.02784 ft	524.6 ft	8.570E-03 psi
		330 ft	0.0202	524.6 ft		524.6 ft	0.01979 ft
Pipe 15	16 in	Node 32	747 gpm	79.79 psi g	3.044 psi	76.75 psi g	0.01215
Ductile Iron	16.72 in	340 ft	1.092 ft/s	79.78 psi g		76.74 psi g	0.00
Water	30 ft	FORD2	127759	524.2 ft	0.02784 ft	524.2 ft	8.570E-03 psi
		347 ft	0.0202	524.2 ft		524.2 ft	0.01979 ft
Pipe 16	16 in	~N{036}	747 gpm	91.97 psi g	3.044 psi	88.92 psi g	0.01215
Ductile Iron	16.72 in	315 ft	1.092 ft/s	91.96 psi g		88.92 psi g	0.00
Water	30 ft	FORD3	127759	527.3 ft	0.02784 ft	527.3 ft	8.570E-03 psi
		322 ft	0.0202	527.3 ft		527.3 ft	0.01979 ft
Pipe 17	2 in	~N{034}	15 gpm	94.01 psi g	3.352 psi	90.65 psi g	0.01862
Copper	2.245 in	314 ft	1.216 ft/s	94 psi g		90.64 psi g	0.00
Water	217 ft	Water Treatment Bldg	19107	531 ft	0.7394 ft	530.3 ft	0.01753 psi
		321 ft	0.02623	531 ft		530.3 ft	0.04047 ft
Pipe 18	8 in	~N{035}	--	--	--	--	--
Ductile Iron	8.51 in	319 ft	--	--		--	0.00
Water	463 ft	Node 45	--	--	--	--	--
		317 ft	--	--		--	--
Pipe 19	8 in	~N{031}	--	--	--	--	--
Ductile Iron	8.51 in	309 ft	--	--		--	0.00
Water	98 ft	Node 36	--	--	--	--	--
		310 ft	--	--		--	--
Pipe 2	24 in	Node 5	2975 gpm	95.72 psi g	0.02769 psi	95.69 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.938 ft/s	95.7 psi g		95.67 psi g	0.00
Water	50 ft	~N{030}	339727	532 ft	0.06392 ft	531.9 ft	0.01708 psi
		311 ft	0.0175	531.9 ft		531.9 ft	0.03944 ft

PIPE-FLO

Pipes

Pipe Name **Specification** **Fluid Zone**	**Size** **Inside Diameter** **Length**	**Inlet Device** **Inlet Elevation** **Outlet Device** **Outlet Elevation**	**Flow Rate** **Fluid Velocity** **Reynolds Number** **Pipe Friction Factor**	**Inlet Total Pressure** **Inlet Static Pressure** **Inlet Energy Grade** **Inlet Hydraulic Grade**	**Total dP** **Total Head Loss**	**Outlet Total Pressure** **Outlet Static Pressure** **Outlet Energy Grade** **Outlet Hydraulic Grade**	**V&F Friction Factor** **V&F Resistance K** **V&F dP** **V&F Head Loss**
Pipe 20	8 in	Node 38	15 gpm	67.47 psi g	1.312E-05 psi	67.47 psi g	0.01389
Ductile Iron	8.51 in	370 ft	0.08461 ft/s	67.47 psi g		67.47 psi g	0.00
Water	5 ft	WWTP	5040	525.8 ft	3.03E-05 ft	525.8 ft	0 psi
		370 ft	0.03863	525.8 ft		525.8 ft	0 ft
Pipe 21	8 in	Node 38	--	--	--	--	--
Ductile Iron	8.51 in	370 ft	--	--		--	0.00
Water	5 ft	Hydrants Open	--	--	--	--	--
		370 ft	--	--		--	--
Pipe 22	12 in	Node 39	15 gpm	80.13 psi g	-0.8657 psi	81 psi g	0.01284
Ductile Iron	12.58 in	338 ft	0.03872 ft/s	80.13 psi g		81 psi g	0.00
Water	1454 ft	Node 29	3410	523 ft	1.377E-03 ft	523 ft	0 psi
		336 ft	0.04262	523 ft		523 ft	0 ft
Pipe 23	8 in	Node 41	--	--	--	--	--
Ductile Iron	8.51 in	314 ft	--	--		--	0.00
Water	166 ft	Node 42	--	--	--	--	--
		314 ft	--	--		--	--
Pipe 24	6 in	Node 42	--	--	--	--	--
Ductile Iron	6.4 in	314 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 1	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 25	6 in	Node 43	--	--	--	--	--
Ductile Iron	6.4 in	311 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 2	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 26	6 in	Node 36	--	--	--	--	--
Ductile Iron	6.4 in	310 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 3	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 27	8 in	Node 36	--	--	--	--	--
Ductile Iron	8.51 in	310 ft	--	--		--	0.00
Water	196 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--
Pipe 28	8 in	Node 44	--	--	--	--	--
Ductile Iron	8.51 in	313 ft	--	--		--	0.00
Water	128 ft	Pressure Boundary 4	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 29	8 in	Node 45	--	--	--	--	--
Ductile Iron	8.51 in	317 ft	--	--		--	0.00
Water	148 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 3	16 in	Node 3	1487 gpm	95.76 psi g	0.03605 psi	95.72 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.173 ft/s	95.73 psi g		95.69 psi g	0.00
Water	10.5 ft	Node 5	254389	532.1 ft	0.08323 ft	532 ft	0.03149 psi
		311 ft	0.01901	532 ft		531.9 ft	0.07271 ft
Pipe 30	6 in	Node 45	--	--	--	--	--
Ductile Iron	6.4 in	317 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 5	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 5	8 in	Node 10	15 gpm	86.13 psi g	18.66 psi	67.47 psi g	0.01389
Ductile Iron	8.51 in	327 ft	0.08461 ft/s	86.13 psi g		67.47 psi g	0.00
Water	12520 ft	Node 38	5040	525.8 ft	0.07602 ft	525.8 ft	6.692E-05 psi
		370 ft	0.03863	525.8 ft		525.8 ft	1.545E-04 ft
Pipe 6	24 in	Node 19	2975 gpm	95.72 psi g	0.02769 psi	95.69 psi g	0.01126
Ductile Iron	25.04 in	311 ft	1.938 ft/s	95.7 psi g		95.67 psi g	0.00
Water	50 ft	~N{030}	339727	532 ft	0.06392 ft	531.9 ft	0.01708 psi
		311 ft	0.0175	531.9 ft		531.9 ft	0.03944 ft
Pipe 7	16 in	Node 18	1487 gpm	95.76 psi g	0.03605 psi	95.72 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.173 ft/s	95.73 psi g		95.69 psi g	0.00
Water	10.5 ft	Node 19	254389	532.1 ft	0.08323 ft	532 ft	0.03149 psi
		311 ft	0.01901	532 ft		531.9 ft	0.07271 ft
Pipe 8	16 in	Node 17	1487 gpm	95.76 psi g	0.03605 psi	95.72 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.173 ft/s	95.73 psi g		95.69 psi g	0.00
Water	10.5 ft	Node 19	254389	532.1 ft	0.08323 ft	532 ft	0.03149 psi
		311 ft	0.01901	532 ft		531.9 ft	0.07271 ft
Pipe 9	16 in	Node 22	747 gpm	88.48 psi g	3.044 psi	85.43 psi g	0.01215
Ductile Iron	16.72 in	321 ft	1.092 ft/s	88.47 psi g		85.43 psi g	0.00
Water	30 ft	FORD	127759	525.3 ft	0.02784 ft	525.2 ft	8.570E-03 psi
		328 ft	0.0202	525.3 ft		525.2 ft	0.01979 ft
~Pipe{080}	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	16 ft	Layne Bowler 12RH-8625-5	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{080}1	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-7	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{081}	10 in	Clearwell 1	1487 gpm	0.3465 psi g	0.1978 psi	0.1487 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.49 ft/s	0.1436 psi g		-0.05416 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-1	404314	308.6 ft	0.2396 ft	308.3 ft	0.1014 psi
		308 ft	0.02024	308.1 ft		307.9 ft	0.2342 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{081}1 Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 2 307.8 ft Layne Bowler 12RH-8625-3 308 ft	1487 gpm 5.49 ft/s 404314 0.02024	0.3465 psi g 0.1436 psi g 308.6 ft 308.1 ft	0.1978 psi 0.2396 ft	0.1487 psi g -0.05416 psi g 308.3 ft 307.9 ft	0.0133 0.00 0.1014 psi 0.2342 ft
~Pipe{082} Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 1 307.8 ft Layne Bowler 12RH-8625-2 308 ft	1487 gpm 5.49 ft/s 404314 0.02024	0.3465 psi g 0.1436 psi g 308.6 ft 308.1 ft	0.1978 psi 0.2396 ft	0.1487 psi g -0.05416 psi g 308.3 ft 307.9 ft	0.0133 0.00 0.1014 psi 0.2342 ft
~Pipe{082}1 Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 1 307.8 ft Layne Bowler 12RH-8625-6 308 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{082}2 Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 2 307.8 ft Layne Bowler 12RH-8625-4 308 ft	1487 gpm 5.49 ft/s 404314 0.02024	0.3465 psi g 0.1436 psi g 308.6 ft 308.1 ft	0.1978 psi 0.2396 ft	0.1487 psi g -0.05416 psi g 308.3 ft 307.9 ft	0.0133 0.00 0.1014 psi 0.2342 ft
~Pipe{082}3 Ductile Iron Water	10 in 10.52 in 0.5 ft	Clearwell 2 307.8 ft Layne Bowler 12RH-8625-8 308 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}1 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-6 311 ft Node 6 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}10 Ductile Iron Water	16 in 16.72 in 10 ft	Node 21 311 ft Node 17 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --
~Pipe{085}11 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-4 311 ft Node 18 311 ft	1487 gpm 5.49 ft/s 404314 0.02024	96.48 psi g 96.28 psi g 533.8 ft 533.3 ft	0.7271 psi 1.679 ft	95.76 psi g 95.55 psi g 532.1 ft 531.6 ft	0.0133 0.00 0.61 psi 1.408 ft
~Pipe{085}12 Ductile Iron Water	10 in 10.52 in 25 ft	Layne Bowler 12RH-8625-3 311 ft Node 17 311 ft	1487 gpm 5.49 ft/s 404314 0.02024	96.48 psi g 96.28 psi g 533.8 ft 533.3 ft	0.7271 psi 1.679 ft	95.76 psi g 95.55 psi g 532.1 ft 531.6 ft	0.0133 0.00 0.61 psi 1.408 ft
~Pipe{085}13 Ductile Iron Water	10 in 10.52 in 25 ft	Node 1 324 ft Node 20 311 ft	-- -- -- --	-- -- -- --	-- --	-- -- -- --	-- 0.00 -- --

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{085}14	10 in	Layne Bowler 12RH-8625-7	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 27	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}15	10 in	Node 27	--	--	--	--	--
Ductile Iron	10.52 in	324 ft	--	--		--	0.00
Water	25 ft	Node 21	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}2	16 in	Node 6	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 4	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}3	10 in	Layne Bowler 12RH-8625-5	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 15	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}4	16 in	Node 15	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 3	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}5	10 in	Layne Bowler 12RH-8625-2	1487 gpm	96.48 psi g	0.7271 psi	95.76 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.49 ft/s	96.28 psi g		95.55 psi g	0.00
Water	25 ft	Node 4	404314	533.8 ft	1.679 ft	532.1 ft	0.61 psi
		311 ft	0.02024	533.3 ft		531.6 ft	1.408 ft
~Pipe{085}6	10 in	Layne Bowler 12RH-8625-1	1487 gpm	96.48 psi g	0.7271 psi	95.76 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.49 ft/s	96.28 psi g		95.55 psi g	0.00
Water	25 ft	Node 3	404314	533.8 ft	1.679 ft	532.1 ft	0.61 psi
		311 ft	0.02024	533.3 ft		531.6 ft	1.408 ft
~Pipe{085}7	10 in	Layne Bowler 12RH-8625-8	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 1	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}8	16 in	Node 20	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 18	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{086}	24 in	~N{030}	5950 gpm	95.69 psi g	0.1785 psi	95.51 psi g	0.01126
Ductile Iron	25.04 in	311 ft	3.876 ft/s	95.59 psi g		95.41 psi g	0.00
Water	85 ft	Node 43	679455	531.9 ft	0.4122 ft	531.5 ft	0.1093 psi
		311 ft	0.01679	531.7 ft		531.3 ft	0.2524 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{086}1	24 in	Node 43	5950 gpm	95.51 psi g	0.1033 psi	95.41 psi g	0.01126
Ductile Iron	25.04 in	311 ft	3.876 ft/s	95.41 psi g		95.31 psi g	0.00
Water	15 ft	~N{001}	679455	531.5 ft	0.2386 ft	531.3 ft	0.09112 psi
		311 ft	0.01679	531.3 ft		531 ft	0.2104 ft
~Pipe{087}	16 in	~N{001}	1571 gpm	95.41 psi g	-0.5673 psi	95.98 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.295 ft/s	95.38 psi g		95.94 psi g	0.00
Water	522 ft	~N{031}	268622	531.3 ft	0.6902 ft	530.6 ft	0.04738 psi
		309 ft	0.01894	531.2 ft		530.5 ft	0.1094 ft
~Pipe{089}	16 in	~N{031}	1571 gpm	95.98 psi g	4.564 psi	91.42 psi g	0.01215
Ductile Iron	16.72 in	309 ft	2.295 ft/s	95.94 psi g		91.38 psi g	0.00
Water	5824 ft	~N{039}	268622	530.6 ft	6.536 ft	524.1 ft	0.02412 psi
		313 ft	0.01894	530.5 ft		524 ft	0.05569 ft
~Pipe{090}	16 in	~N{033}	712.3 gpm	91.4 psi g	9.743E-03 psi	91.39 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.041 ft/s	91.4 psi g		91.39 psi g	0.00
Water	25 ft	Node 14	121818	524 ft	0.02249 ft	524 ft	7.087E-03 psi
		313 ft	0.0203	524 ft		524 ft	0.01636 ft
~Pipe{090}1	16 in	Node 14	712.3 gpm	91.39 psi g	7.799 psi	83.6 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.041 ft/s	91.39 psi g		83.59 psi g	0.00
Water	20 ft	North Water Tower	121818	524 ft	4.905E-03 ft	524 ft	0 psi
		331 ft	0.0203	524 ft		524 ft	0 ft
~Pipe{091}	16 in	Node 14	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	72 ft	~N{033}	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{092}	24 in	~N{001}	4379 gpm	95.41 psi g	1.405 psi	94.01 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.853 ft/s	95.36 psi g		93.95 psi g	0.00
Water	142 ft	~N{034}	500087	531.3 ft	0.2437 ft	531 ft	0.04196 psi
		314 ft	0.01706	531.2 ft		530.9 ft	0.09687 ft
~Pipe{093}	24 in	~N{034}	4364 gpm	94.01 psi g	0.02161 psi	93.98 psi g	0.01126
Ductile Iron	25.04 in	314 ft	2.843 ft/s	93.95 psi g		93.93 psi g	0.00
Water	10 ft	Node 41	498374	531 ft	0.04988 ft	531 ft	0.01716 psi
		314 ft	0.01706	530.9 ft		530.9 ft	0.03961 ft
~Pipe{093}1	24 in	Node 41	4364 gpm	93.98 psi g	2.314 psi	91.67 psi g	0.01126
Ductile Iron	25.04 in	314 ft	2.843 ft/s	93.93 psi g		91.62 psi g	0.00
Water	295 ft	~N{035}	498374	531 ft	0.3426 ft	530.6 ft	0.01716 psi
		319 ft	0.01706	530.9 ft		530.5 ft	0.03961 ft
~Pipe{094}	24 in	~N{035}	4364 gpm	91.67 psi g	-0.297 psi	91.97 psi g	0.01126
Ductile Iron	25.04 in	319 ft	2.843 ft/s	91.62 psi g		91.91 psi g	0.00
Water	3100 ft	~N{036}	498374	530.6 ft	3.314 ft	527.3 ft	0.05627 psi
		315 ft	0.01706	530.5 ft		527.2 ft	0.1299 ft

Pipes

Pipe Name	Size	Inlet Device	Flow Rate	Inlet Total Pressure	Total dP	Outlet Total Pressure	V&F Friction Factor
Specification	Inside Diameter	Inlet Elevation	Fluid Velocity	Inlet Static Pressure		Outlet Static Pressure	V&F Resistance K
Fluid Zone	Length	Outlet Device	Reynolds Number	Inlet Energy Grade	Total Head Loss	Outlet Energy Grade	V&F dP
		Outlet Elevation	Pipe Friction Factor	Inlet Hydraulic Grade		Outlet Hydraulic Grade	V&F Head Loss
~Pipe{095}	24 in	~N{036}	3617 gpm	91.97 psi g	5.839 psi	86.13 psi g	0.01126
Ductile Iron	25.04 in	315 ft	2.356 ft/s	91.93 psi g		86.09 psi g	0.00
Water	1945 ft	Node 10	413065	527.3 ft	1.481 ft	525.8 ft	0.04034 psi
		327 ft	0.01726	527.2 ft		525.8 ft	0.09313 ft
~Pipe{095}1	24 in	Node 10	3602 gpm	86.13 psi g	-2.35 psi	88.48 psi g	0.01126
Ductile Iron	25.04 in	327 ft	2.347 ft/s	86.09 psi g		88.44 psi g	0.00
Water	734 ft	Node 22	411352	525.8 ft	0.5735 ft	525.3 ft	0.0233 psi
		321 ft	0.01726	525.8 ft		525.2 ft	0.0538 ft
~Pipe{095}2	24 in	Node 22	2855 gpm	88.48 psi g	-1.263 psi	89.74 psi g	0.01126
Ductile Iron	25.04 in	321 ft	1.86 ft/s	88.46 psi g		89.72 psi g	0.00
Water	148 ft	Node 25	326043	525.3 ft	0.08388 ft	525.2 ft	7.344E-03 psi
		318 ft	0.01755	525.2 ft		525.1 ft	0.01695 ft
~Pipe{095}3	24 in	Node 25	2855 gpm	89.74 psi g	2.198 psi	87.54 psi g	0.01126
Ductile Iron	25.04 in	318 ft	1.86 ft/s	89.72 psi g		87.52 psi g	0.00
Water	1243 ft	Node 33	326043	525.2 ft	0.5742 ft	524.6 ft	5.245E-03 psi
		322.5 ft	0.01755	525.1 ft		524.6 ft	0.01211 ft
~Pipe{095}4	24 in	Node 32	815.3 gpm	79.79 psi g	3.481 psi	76.31 psi g	0.01126
Ductile Iron	25.04 in	340 ft	0.5312 ft/s	79.79 psi g		76.31 psi g	0.00
Water	790 ft	~N{037}	93112	524.2 ft	0.03762 ft	524.2 ft	1.810E-03 psi
		348 ft	0.02014	524.2 ft		524.2 ft	4.179E-03 ft
~Pipe{095}5	24 in	Node 33	2108 gpm	87.54 psi g	4.168 psi	83.38 psi g	0.01126
Ductile Iron	25.04 in	322.5 ft	1.373 ft/s	87.53 psi g		83.36 psi g	0.00
Water	438 ft	Node 40	240734	524.6 ft	0.1227 ft	524.5 ft	5.147E-03 psi
		332 ft	0.018	524.6 ft		524.5 ft	0.01188 ft
~Pipe{095}6	24 in	Node 40	1562 gpm	83.38 psi g	3.584 psi	79.79 psi g	0.01126
Ductile Iron	25.04 in	332 ft	1.018 ft/s	83.37 psi g		79.78 psi g	0.00
Water	1923 ft	Node 32	178421	524.5 ft	0.2753 ft	524.2 ft	0 psi
		340 ft	0.01855	524.5 ft		524.2 ft	0 ft
~Pipe{096}	14 in	~N{037}	815.3 gpm	76.31 psi g	0.02254 psi	76.29 psi g	0.01246
Ductile Iron	14.64 in	348 ft	1.554 ft/s	76.29 psi g		76.27 psi g	0.00
Water	8 ft	Node 9	159257	524.2 ft	0.05203 ft	524.1 ft	0.02039 psi
		348 ft	0.02013	524.1 ft		524.1 ft	0.04708 ft
~Pipe{096}1	14 in	Node 9	815.3 gpm	76.29 psi g	6.735E-03 psi	76.28 psi g	0.01246
Ductile Iron	14.64 in	348 ft	1.554 ft/s	76.27 psi g		76.26 psi g	0.00
Water	10 ft	Node 12	159257	524.1 ft	0.01555 ft	524.1 ft	4.052E-03 psi
		348 ft	0.02013	524.1 ft		524.1 ft	9.355E-03 ft
~Pipe{096}2	14 in	Node 12	815.3 gpm	76.28 psi g	3.513 psi	72.77 psi g	0.01246
Ductile Iron	14.64 in	348 ft	1.554 ft/s	76.26 psi g		72.75 psi g	0.00
Water	165 ft	South Tower	159257	524.1 ft	0.1115 ft	524 ft	4.052E-03 psi
		356 ft	0.02013	524.1 ft		524 ft	9.355E-03 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{097}	14 in	Node 12	--	--	--	--	--
Ductile Iron	14.64 in	348 ft	--	--		--	0.00
Water	25 ft	Node 9	--	--	--	--	--
		348 ft	--	--		--	--
~Pipe{098}	16 in	Node 23	1389 gpm	86.54 psi g	3.257 psi	83.29 psi g	0.01215
Ductile Iron	16.72 in	322 ft	2.03 ft/s	86.52 psi g		83.26 psi g	0.00
Water	525 ft	~N{041}	237560	521.8 ft	0.52 ft	521.3 ft	0.0256 psi
		329 ft	0.0191	521.7 ft		521.2 ft	0.05911 ft
~Pipe{099}	16 in	~N{039}	712.3 gpm	91.42 psi g	0.01063 psi	91.4 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.041 ft/s	91.41 psi g		91.4 psi g	0.00
Water	50 ft	~N{033}	121818	524.1 ft	0.02453 ft	524 ft	5.315E-03 psi
		313 ft	0.0203	524 ft		524 ft	0.01227 ft
~Pipe{100}	16 in	~N{039}	858.4 gpm	91.42 psi g	8.625E-03 psi	91.41 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.254 ft/s	91.4 psi g		91.4 psi g	0.00
Water	40 ft	Node 37	146804	524.1 ft	0.01991 ft	524 ft	2.573E-03 psi
		313 ft	0.01991	524 ft		524 ft	5.941E-03 ft
~Pipe{100}1	16 in	~N{040}	--	--	--	--	--
Ductile Iron	16.72 in	323 ft	--	--		--	0.00
Water	5885 ft	Node 28	--	--	--	--	--
		335 ft	--	--		--	--
~Pipe{100}2	16 in	Node 28	530.6 gpm	80.96 psi g	-5.585 psi	86.54 psi g	0.01215
Ductile Iron	16.72 in	335 ft	0.7754 ft/s	80.96 psi g		86.54 psi g	0.00
Water	752 ft	Node 23	90756	521.9 ft	0.1069 ft	521.8 ft	3.934E-04 psi
		322 ft	0.02102	521.9 ft		521.8 ft	9.082E-04 ft
~Pipe{100}3	16 in	Node 37	858.4 gpm	91.41 psi g	4.862 psi	86.54 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.254 ft/s	91.4 psi g		86.53 psi g	0.00
Water	6300 ft	Node 23	146804	524 ft	2.226 ft	521.8 ft	0.01081 psi
		322 ft	0.01991	524 ft		521.8 ft	0.02495 ft
~Pipe{100}4	16 in	~N{040}1	545.6 gpm	81.82 psi g	1.682 psi	80.13 psi g	0.01215
Ductile Iron	16.72 in	335 ft	0.7973 ft/s	81.81 psi g		80.13 psi g	0.00
Water	5885 ft	Node 39	93321	523.9 ft	0.883 ft	523 ft	3.951E-03 psi
		338 ft	0.02094	523.9 ft		523 ft	9.122E-03 ft
~Pipe{101}	16 in	Node 25	--	--	--	--	--
Ductile Iron	16.72 in	318 ft	--	--		--	0.00
Water	3991 ft	~N{040}	--	--	--	--	--
		323 ft	--	--		--	--
~Pipe{101}1	16 in	Node 40	545.6 gpm	83.38 psi g	1.56 psi	81.82 psi g	0.01215
Ductile Iron	16.72 in	332 ft	0.7973 ft/s	83.37 psi g		81.81 psi g	0.00
Water	3991 ft	~N{040}1	93321	524.5 ft	0.6017 ft	523.9 ft	3.951E-03 psi
		335 ft	0.02094	524.5 ft		523.9 ft	9.122E-03 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{102}	16 in	~N{041}	1389 gpm	83.29 psi g	3.802E-04 psi	83.29 psi g	0.01215
Ductile Iron	16.72 in	329 ft	2.03 ft/s	83.26 psi g		83.26 psi g	0.00
Water	1 ft	Tenant Demand	237560	521.3 ft	8.778E-04 ft	521.3 ft	0 psi
		329 ft	0.0191	521.2 ft		521.2 ft	0 ft

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 1	324 ft	--	--
Node 10	327 ft	86.13 psi g	525.8 ft
Node 12	348 ft	76.28 psi g	524.1 ft
Node 14	313 ft	91.39 psi g	524 ft
Node 15	311 ft	--	--
Node 17	311 ft	95.76 psi g	531.8 ft
Node 18	311 ft	95.76 psi g	531.8 ft
Node 19	311 ft	95.72 psi g	531.9 ft
Node 20	311 ft	--	--
Node 21	311 ft	--	--
Node 22	321 ft	88.48 psi g	525.2 ft
Node 23	322 ft	86.54 psi g	521.8 ft
Node 25	318 ft	89.74 psi g	525.1 ft
Node 27	324 ft	--	--
Node 28	335 ft	80.96 psi g	521.9 ft
Node 29	336 ft	81 psi g	523 ft
Node 3	311 ft	95.76 psi g	531.8 ft
Node 30	338 ft	--	--
Node 32	340 ft	79.79 psi g	524.2 ft
Node 33	322.5 ft	87.54 psi g	524.6 ft
Node 36	310 ft	--	--
Node 37	313 ft	91.41 psi g	524 ft
Node 38	370 ft	67.47 psi g	525.8 ft
Node 39	338 ft	80.13 psi g	523 ft
Node 4	311 ft	95.76 psi g	531.8 ft
Node 40	332 ft	83.38 psi g	524.5 ft
Node 41	314 ft	93.98 psi g	530.9 ft

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 42	314 ft	--	--
Node 43	311 ft	95.51 psi g	531.3 ft
Node 44	313 ft	--	--
Node 45	317 ft	--	--
Node 5	311 ft	95.72 psi g	531.9 ft
Node 6	311 ft	--	--
Node 9	348 ft	76.29 psi g	524.1 ft
~N{001}	311 ft	95.41 psi g	531.1 ft
~N{030}	311 ft	95.69 psi g	531.8 ft
~N{031}	309 ft	95.98 psi g	530.5 ft
~N{033}	313 ft	91.4 psi g	524 ft
~N{034}	314 ft	94.01 psi g	530.9 ft
~N{035}	319 ft	91.67 psi g	530.5 ft
~N{036}	315 ft	91.97 psi g	527.3 ft
~N{037}	348 ft	76.31 psi g	524.2 ft
~N{039}	313 ft	91.42 psi g	524 ft
~N{040}	323 ft	--	--
~N{040}1	335 ft	81.82 psi g	523.9 ft
~N{041}	329 ft	83.29 psi g	521.2 ft

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Hydrants Open P Total @ 0 psi g	370 ft	-- -- --	-- -- --	--
Pressure Boundary 1 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 2 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 3 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--

Pressure Boundaries

Pressure Boundary Name **Operation**	**Elevation**	**Total Pressure** **Static Pressure** **Dynamic Pressure**	**Energy Grade** **Hydraulic Grade** **Dynamic Head**	**Flow Rate**
Pressure Boundary 4	319 ft	--	--	--
P Static @ 70 psi g		--	--	
		--	--	
Pressure Boundary 5	319 ft	--	--	--
P Static @ 70 psi g		--	--	
		--	--	

Flow Demands

Flow Demand Name **Operation** **Flow Direction**	**Elevation**	**Total Pressure** **Static Pressure** **Dynamic Pressure**	**Energy Grade** **Hydraulic Grade** **Dynamic Head**	**Flow Rate**
EMS Station	336 ft	81 psi g	523 ft	15 gpm
Flow Rate @ 15 gpm		81 psi g	523 ft	
Flow out		1.009E-05 psi	2.33E-05 ft	
FORD	328 ft	85.43 psi g	525.2 ft	747 gpm
Flow Rate @ 747 gpm		85.43 psi g	525.2 ft	
Flow out		8.020E-03 psi	0.01852 ft	
FORD1	330 ft	84.28 psi g	524.6 ft	747 gpm
Flow Rate @ 747 gpm		84.28 psi g	524.6 ft	
Flow out		8.020E-03 psi	0.01852 ft	
FORD2	347 ft	76.75 psi g	524.2 ft	747 gpm
Flow Rate @ 747 gpm		76.74 psi g	524.2 ft	
Flow out		8.020E-03 psi	0.01852 ft	
FORD3	322 ft	88.92 psi g	527.3 ft	747 gpm
Flow Rate @ 747 gpm		88.92 psi g	527.3 ft	
Flow out		8.020E-03 psi	0.01852 ft	
Tenant Demand	329 ft	83.29 psi g	521.3 ft	1389 gpm
Flow Rate @ 1389 gpm		83.26 psi g	521.2 ft	
Flow out		0.02773 psi	0.06402 ft	
WWTP	370 ft	67.47 psi g	525.8 ft	15 gpm
Flow Rate @ 15 gpm		67.47 psi g	525.8 ft	
Flow out		4.819E-05 psi	1.113E-04 ft	
Water Treatment Bldg	321 ft	90.65 psi g	530.3 ft	15 gpm
Flow Rate @ 15 gpm		90.64 psi g	530.3 ft	
Flow out		9.949E-03 psi	0.02297 ft	

Phase 2 Operation

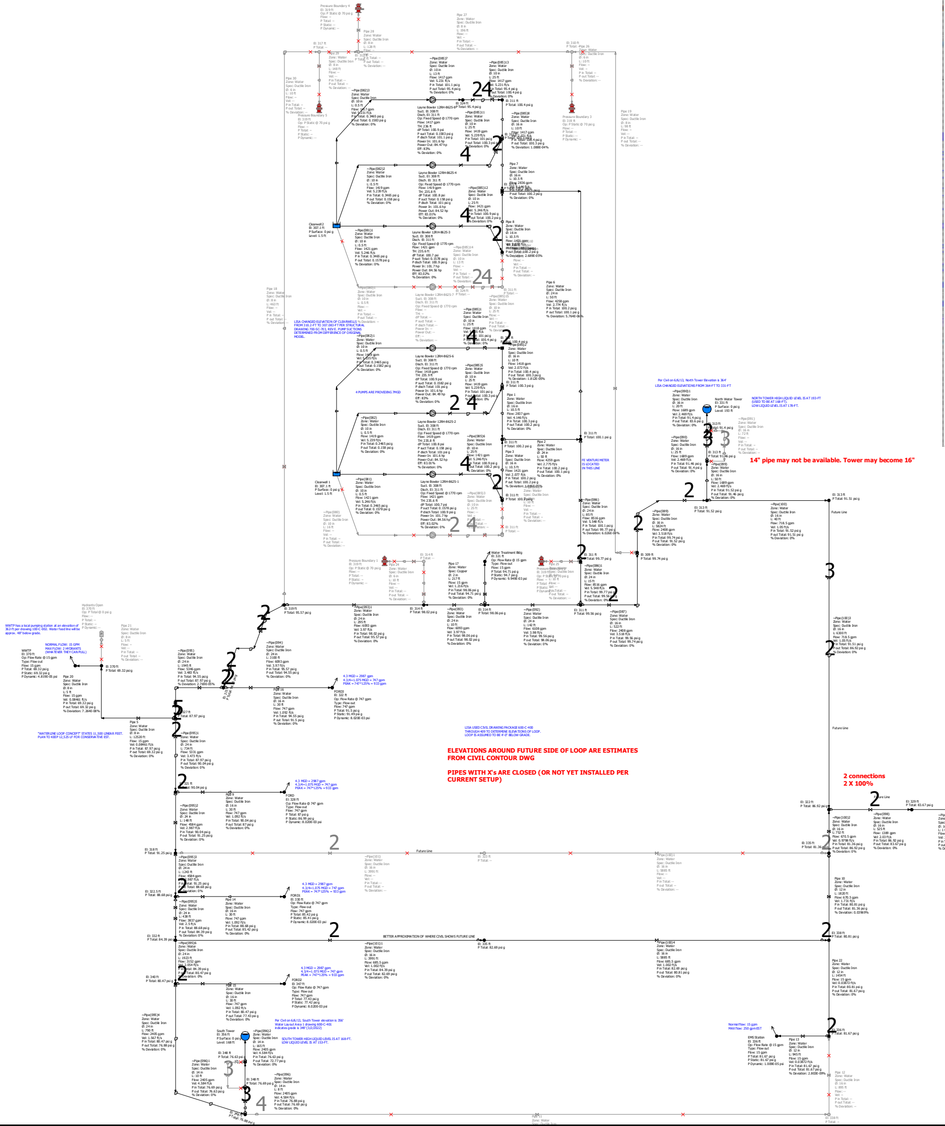
Future Scenario

Flows to Blue Oval and East Tenant (Handy) total Design flow 6.3 MGD

Six pump operation

For view of a six pump operation, we have included in the Pie-Flo model three pumps from each clearwell. Pumps are operating at full size impeller at full speed. The pump curve is imposed on the flow diagram. The flow can be reduced through use of VFD's to maintain steady flow to users and maintain tower levels. Flow rate to the tenant with four pumps is 8516 GPM, well in excess of the average design flow of 4375 GPM to tenants.

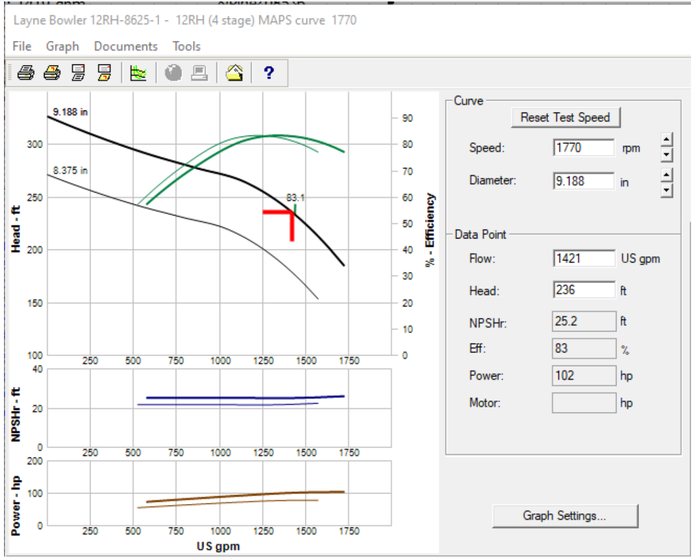
In this model, the pressure at the south tower is 76.63 PSIG (177 feet) plus Elev. 348 = 525 feet. Allowing ability to fully fill the south tower. The peak flow into the tower with four pumps operating and normal flow to tenant is 2405 GPM.



ELEVATIONS AROUND FUTURE SIDE OF LOOP ARE ESTIMATES FROM CIVIL CONTOUR DWG

PIPES WITH X's ARE CLOSED (OR NOT YET INSTALLED PER CURRENT SETUP)

2 connections
2 X 100%



Layne Bowler 12RH-8625-1 - 12RH (4 stage) MAPS curve 1770

Speed: 1770 rpm

Diameter: 9.188 in

Flow: 1421 US gpm

Head: 236 ft

NPSHr: 25.2 ft

Eff: 83 %

Power: 102 hp

Motor: hp

PIPE-FLO Professional	
Program Version:	18.0
Calculation Method:	Darcy-Weisbach
Maximum Iterations:	100
Percent Tolerance:	0.01 %
Laminar Cutoff Re:	2100
Allowable Deviation:	1 %

Units

Area:	ft²	**Flow rate:**	gpm	**Heat Transfer Rate:**	BTU/h
Length:	ft	**Pressure:**	psi	**Heat Transfer Coefficient:**	BTU/h*ft²°F
Elevation:	ft	**Power:**	hp	**Specific Heat Capacity:**	BTU/lb°F
Diameter:	in	**Temperature:**	°F	**Thermal Capacitance:**	BTU/h°F
Velocity:	ft/s	**Density:**	lb/ft³	**Thermal Insulance:**	h*ft²°F/BTU
Volume:	gal	**Viscosity:**	cP	**Atmospheric Pressure:**	14.7 psi a

Project Information

Company:	SSOE Inc.
Project:	
Drawn by:	
File Name:	Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.pipe
Lineup:	Typical Day Case Phase 2
Print Date:	Monday, July 18, 2022 03:06 PM

List Report

File Name: Distribution Pump Model - Rev 3 Layne Bowler_Max-flows.
Lineup: Typical Day Case Phase 2
Progam Name: PIPE-FLO Professional
Version: 18.0

Calculation Method: Darcy-Weisbach
Laminar Cutoff Re: 2100
Max Iterations: 100
Percent Tolerance: 0.01
Allowable Deviation: 1 %

Company: SSOE Inc.
Project:
by:
Date: Monday, July 18, 2022 03:08 PM
Atmospheric Pressure: 14.7 psi a

Pipe Specifications

Specification Name Valve Table	Material Schedule	Absolute Roughness Hazen Williams C Factor	Sizing Criteria Sizing Criteria Value		Design Limits Velocity	Pressure	Re Number	Mach
Copper	Copper Pipe B302	6E-05 in	Criteria - none specified	**Min:**	ft/s	psi g		
standard	Schedule: STD	140	0.0	**Max:**	ft/s	psi g		
Ductile Iron	Ductile Iron AWWA C151 Mech	0.0102 in	Velocity = 5 ft/s	**Min:**	0 ft/s	0 psi g		
standard	Schedule: 50	140	5.0 ft/s	**Max:**	12 ft/s	150 psi g		
PVC	PVC Plastic Pipe	6E-05 in	Velocity = 5 ft/s	**Min:**	2 ft/s	0 psi g		
standard	Schedule: 40	140	5.0 ft/s	**Max:**	12 ft/s	150 psi g		

Fluid Zones

Fluid Zone Name Table Name	Temperature Pressure	Fluid State Relative Molecular Mass	Density Viscosity	Vapor Pressure Critical Pressure	Specific Heat Capacity (cp) Specific Heat Ratio (k)
Water	60 °F	Liquid	62.37 lb/ft³	0.2564 psi a	--
Water	0 psi g	18	1.105 cP	3198 psi a	--

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-1	1770	308 ft	311 ft	235.6 ft	1421 gpm	83.02 %	33.71 ft	--
Fixed Speed @ 1770 rpm		0.1578 psi g	100.9 psi g	100.7 psi	101.7 hp	83.1 %	25.23 ft	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-2	1770	308 ft	311 ft	235.8 ft	1419 gpm	83.01 %	33.71 ft	--
Fixed Speed @ 1770 rpm		0.158 psi g	101 psi g	100.8 psi	101.6 hp	83.1 %	25.23 ft	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-3	1770	308 ft	311 ft	235.6 ft	1421 gpm	83.02 %	33.71 ft	--
Fixed Speed @ 1770 rpm		0.1578 psi g	100.9 psi g	100.7 psi	101.7 hp	83.1 %	25.23 ft	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						

Centrifugal Pumps

Pump Name Operational Mode and Set Point	Test Speed Operating Speed	Suction Elevation Suction Pressure	Discharge Elevation Discharge Pressure	Total Head dP	Flow Rate Input Power	Efficiency BEP Efficiency	NPSHa NPSHr	Design NPSH Margin Ratio
Layne Bowler 12RH-8625-4	1770	308 ft	311 ft	235.8 ft	1419 gpm	83.01 %	33.71 ft	--
Fixed Speed @ 1770 rpm		0.158 psi g	101 psi g	100.8 psi	101.6 hp	83.1 %	25.23 ft	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-5	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-6	1770	308 ft	311 ft	235.9 ft	1418 gpm	83 %	33.71 ft	--
Fixed Speed @ 1770 rpm		0.1582 psi g	101 psi g	100.9 psi	101.6 hp	83.1 %	25.23 ft	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-7	1770	308 ft	311 ft	--	--	--	--	--
Fixed Speed @ 1770 rpm		--	--	--	--	83.1 %	--	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						
Layne Bowler 12RH-8625-8	1770	308 ft	311 ft	236 ft	1417 gpm	83 %	33.71 ft	--
Fixed Speed @ 1770 rpm		0.1583 psi g	101.1 psi g	100.9 psi	101.6 hp	83.1 %	25.23 ft	
Company: Layne Bowler		Size: 12RH (4 stage)						
Curve: Manual Pump		Diameter: 9.188 in						
Type:		POR: from -- to --						

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 1	16 in	Node 4	2837 gpm	100.3 psi g	0.1306 psi	100.2 psi g	0.01215
Ductile Iron	16.72 in	311 ft	4.146 ft/s	100.2 psi g		100.1 psi g	0.00
Water	10.5 ft	Node 5	485291	542.6 ft	0.3015 ft	542.3 ft	0.1146 psi
		311 ft	0.01834	542.4 ft		542.1 ft	0.2646 ft
Pipe 10	12 in	Node 39	670.5 gpm	80.81 psi g	-0.5578 psi	81.36 psi g	0.01284
Ductile Iron	12.58 in	338 ft	1.731 ft/s	80.79 psi g		81.34 psi g	0.00
Water	1820 ft	Node 28	152421	524.6 ft	1.712 ft	522.8 ft	0.01761 psi
		335 ft	0.02068	524.5 ft		522.8 ft	0.04065 ft

Pipes

Pipe Name **Specification** **Fluid Zone**	**Size** **Inside Diameter** **Length**	**Inlet Device** **Inlet Elevation** **Outlet Device** **Outlet Elevation**	**Flow Rate** **Fluid Velocity** **Reynolds Number** **Pipe Friction Factor**	**Inlet Total Pressure** **Inlet Static Pressure** **Inlet Energy Grade** **Inlet Hydraulic Grade**	**Total dP** **Total Head Loss**	**Outlet Total Pressure** **Outlet Static Pressure** **Outlet Energy Grade** **Outlet Hydraulic Grade**	**V&F Friction Factor** **V&F Resistance K** **V&F dP** **V&F Head Loss**
Pipe 11	16 in	~N{037}	--	--	--	--	--
Ductile Iron	16.72 in	348 ft	--	--		--	0.00
Water	9200 ft	Node 30	--	--	--	--	--
		338 ft	--	--		--	--
Pipe 12	16 in	Node 30	--	--	--	--	--
Ductile Iron	16.72 in	338 ft	--	--		--	0.00
Water	895 ft	Node 29	--	--	--	--	--
		336 ft	--	--		--	--
Pipe 13	12 in	Node 29	15 gpm	81.67 psi g	3.975E-04 psi	81.67 psi g	0.01284
Ductile Iron	12.58 in	336 ft	0.03872 ft/s	81.67 psi g		81.67 psi g	0.00
Water	945 ft	EMS Station	3410	524.6 ft	9.178E-04 ft	524.6 ft	9.847E-06 psi
		336 ft	0.04262	524.6 ft		524.6 ft	2.273E-05 ft
Pipe 14	16 in	Node 33	747 gpm	88.68 psi g	3.261 psi	85.42 psi g	0.01215
Ductile Iron	16.72 in	322.5 ft	1.092 ft/s	88.67 psi g		85.41 psi g	0.00
Water	30 ft	FORD1	127759	527.2 ft	0.02784 ft	527.2 ft	8.570E-03 psi
		330 ft	0.0202	527.2 ft		527.2 ft	0.01979 ft
Pipe 15	16 in	Node 32	747 gpm	80.47 psi g	3.044 psi	77.43 psi g	0.01215
Ductile Iron	16.72 in	340 ft	1.092 ft/s	80.46 psi g		77.42 psi g	0.00
Water	30 ft	FORD2	127759	525.8 ft	0.02784 ft	525.8 ft	8.570E-03 psi
		347 ft	0.0202	525.8 ft		525.7 ft	0.01979 ft
Pipe 16	16 in	~N{036}	747 gpm	94.55 psi g	3.044 psi	91.5 psi g	0.01215
Ductile Iron	16.72 in	315 ft	1.092 ft/s	94.54 psi g		91.49 psi g	0.00
Water	30 ft	FORD3	127759	533.3 ft	0.02784 ft	533.3 ft	8.570E-03 psi
		322 ft	0.0202	533.3 ft		533.2 ft	0.01979 ft
Pipe 17	2 in	~N{034}	15 gpm	98.06 psi g	3.352 psi	94.71 psi g	0.01862
Copper	2.245 in	314 ft	1.216 ft/s	98.05 psi g		94.7 psi g	0.00
Water	217 ft	Water Treatment Bldg	19107	540.4 ft	0.7394 ft	539.7 ft	0.01753 psi
		321 ft	0.02623	540.4 ft		539.6 ft	0.04047 ft
Pipe 18	8 in	~N{035}	--	--	--	--	--
Ductile Iron	8.51 in	319 ft	--	--		--	0.00
Water	463 ft	Node 45	--	--	--	--	--
		317 ft	--	--		--	--
Pipe 19	8 in	~N{031}	--	--	--	--	--
Ductile Iron	8.51 in	309 ft	--	--		--	0.00
Water	98 ft	Node 36	--	--	--	--	--
		310 ft	--	--		--	--
Pipe 2	24 in	Node 5	4259 gpm	100.2 psi g	0.05623 psi	100.1 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.775 ft/s	100.1 psi g		100.1 psi g	0.00
Water	50 ft	~N{030}	486359	542.3 ft	0.1298 ft	542.2 ft	0.03502 psi
		311 ft	0.01709	542.2 ft		542.1 ft	0.08084 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 20	8 in	Node 38	15 gpm	69.32 psi g	1.312E-05 psi	69.32 psi g	0.01389
Ductile Iron	8.51 in	370 ft	0.08461 ft/s	69.32 psi g		69.32 psi g	0.00
Water	5 ft	WWTP	5040	530 ft	3.03E-05 ft	530 ft	0 psi
		370 ft	0.03863	530 ft		530 ft	0 ft
Pipe 21	8 in	Node 38	--	--	--	--	--
Ductile Iron	8.51 in	370 ft	--	--		--	0.00
Water	5 ft	Hydrants Open	--	--	--	--	--
		370 ft	--	--		--	--
Pipe 22	12 in	Node 39	15 gpm	80.81 psi g	-0.8657 psi	81.67 psi g	0.01284
Ductile Iron	12.58 in	338 ft	0.03872 ft/s	80.81 psi g		81.67 psi g	0.00
Water	1454 ft	Node 29	3410	524.6 ft	1.377E-03 ft	524.6 ft	0 psi
		336 ft	0.04262	524.6 ft		524.6 ft	0 ft
Pipe 23	8 in	Node 41	--	--	--	--	--
Ductile Iron	8.51 in	314 ft	--	--		--	0.00
Water	166 ft	Node 42	--	--	--	--	--
		314 ft	--	--		--	--
Pipe 24	6 in	Node 42	--	--	--	--	--
Ductile Iron	6.4 in	314 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 1	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 25	6 in	Node 43	--	--	--	--	--
Ductile Iron	6.4 in	311 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 2	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 26	6 in	Node 36	--	--	--	--	--
Ductile Iron	6.4 in	310 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 3	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 27	8 in	Node 36	--	--	--	--	--
Ductile Iron	8.51 in	310 ft	--	--		--	0.00
Water	196 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--
Pipe 28	8 in	Node 44	--	--	--	--	--
Ductile Iron	8.51 in	313 ft	--	--		--	0.00
Water	128 ft	Pressure Boundary 4	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 29	8 in	Node 45	--	--	--	--	--
Ductile Iron	8.51 in	317 ft	--	--		--	0.00
Water	148 ft	Node 44	--	--	--	--	--
		313 ft	--	--		--	--

PIPE-FLO®

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
Pipe 3	16 in	Node 3	1421 gpm	100.2 psi g	0.03293 psi	100.2 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.077 ft/s	100.2 psi g		100.2 psi g	0.00
Water	10.5 ft	Node 5	243084	542.4 ft	0.07603 ft	542.3 ft	0.02876 psi
		311 ft	0.01907	542.3 ft		542.3 ft	0.06639 ft
Pipe 30	6 in	Node 45	--	--	--	--	--
Ductile Iron	6.4 in	317 ft	--	--		--	0.00
Water	10 ft	Pressure Boundary 5	--	--	--	--	--
		319 ft	--	--		--	--
Pipe 5	8 in	Node 10	15 gpm	87.97 psi g	18.66 psi	69.32 psi g	0.01389
Ductile Iron	8.51 in	327 ft	0.08461 ft/s	87.97 psi g		69.32 psi g	0.00
Water	12520 ft	Node 38	5040	530.1 ft	0.07602 ft	530 ft	6.692E-05 psi
		370 ft	0.03863	530.1 ft		530 ft	1.545E-04 ft
Pipe 6	24 in	Node 19	4258 gpm	100.2 psi g	0.0562 psi	100.1 psi g	0.01126
Ductile Iron	25.04 in	311 ft	2.774 ft/s	100.1 psi g		100.1 psi g	0.00
Water	50 ft	~N{030}	486226	542.3 ft	0.1298 ft	542.2 ft	0.035 psi
		311 ft	0.01709	542.2 ft		542.1 ft	0.0808 ft
Pipe 7	16 in	Node 18	2836 gpm	100.3 psi g	0.1305 psi	100.2 psi g	0.01215
Ductile Iron	16.72 in	311 ft	4.144 ft/s	100.2 psi g		100.1 psi g	0.00
Water	10.5 ft	Node 19	485092	542.6 ft	0.3013 ft	542.3 ft	0.1145 psi
		311 ft	0.01834	542.4 ft		542.1 ft	0.2644 ft
Pipe 8	16 in	Node 17	1421 gpm	100.2 psi g	0.03293 psi	100.2 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.077 ft/s	100.2 psi g		100.2 psi g	0.00
Water	10.5 ft	Node 19	243084	542.4 ft	0.07603 ft	542.3 ft	0.02876 psi
		311 ft	0.01907	542.3 ft		542.3 ft	0.06639 ft
Pipe 9	16 in	Node 22	747 gpm	90.04 psi g	3.044 psi	87 psi g	0.01215
Ductile Iron	16.72 in	321 ft	1.092 ft/s	90.03 psi g		86.99 psi g	0.00
Water	30 ft	FORD	127759	528.9 ft	0.02784 ft	528.8 ft	8.570E-03 psi
		328 ft	0.0202	528.9 ft		528.8 ft	0.01979 ft
~Pipe{080}	10 in	Clearwell 1	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	16 ft	Layne Bowler 12RH-8625-5	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{080}1	10 in	Clearwell 2	--	--	--	--	--
Ductile Iron	10.52 in	307.8 ft	--	--		--	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-7	--	--	--	--	--
		308 ft	--	--		--	--
~Pipe{081}	10 in	Clearwell 1	1421 gpm	0.3465 psi g	0.1888 psi	0.1578 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.246 ft/s	0.1613 psi g		-0.02751 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-1	386346	308.6 ft	0.2188 ft	308.4 ft	0.09263 psi
		308 ft	0.02027	308.2 ft		307.9 ft	0.2139 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{081}1	10 in	Clearwell 2	1421 gpm	0.3465 psi g	0.1888 psi	0.1578 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.246 ft/s	0.1613 psi g		-0.02751 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-3	386346	308.6 ft	0.2188 ft	308.4 ft	0.09263 psi
		308 ft	0.02027	308.2 ft		307.9 ft	0.2139 ft
~Pipe{082}	10 in	Clearwell 1	1419 gpm	0.3465 psi g	0.1885 psi	0.158 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.239 ft/s	0.1618 psi g		-0.02669 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-2	385783	308.6 ft	0.2182 ft	308.4 ft	0.09236 psi
		308 ft	0.02027	308.2 ft		307.9 ft	0.2132 ft
~Pipe{082}1	10 in	Clearwell 1	1418 gpm	0.3465 psi g	0.1884 psi	0.1582 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.235 ft/s	0.162 psi g		-0.02631 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-6	385516	308.6 ft	0.2179 ft	308.4 ft	0.09223 psi
		308 ft	0.02027	308.2 ft		307.9 ft	0.2129 ft
~Pipe{082}2	10 in	Clearwell 2	1419 gpm	0.3465 psi g	0.1885 psi	0.158 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.239 ft/s	0.1618 psi g		-0.02669 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-4	385784	308.6 ft	0.2182 ft	308.4 ft	0.09236 psi
		308 ft	0.02027	308.2 ft		307.9 ft	0.2132 ft
~Pipe{082}3	10 in	Clearwell 2	1417 gpm	0.3465 psi g	0.1882 psi	0.1583 psi g	0.0133
Ductile Iron	10.52 in	307.8 ft	5.231 ft/s	0.1624 psi g		-0.02585 psi g	0.00
Water	0.5 ft	Layne Bowler 12RH-8625-8	385198	308.6 ft	0.2175 ft	308.4 ft	0.09208 psi
		308 ft	0.02027	308.2 ft		307.9 ft	0.2126 ft
~Pipe{085}1	10 in	Layne Bowler 12RH-8625-6	1418 gpm	101 psi g	0.6613 psi	100.4 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.235 ft/s	100.8 psi g		100.2 psi g	0.00
Water	25 ft	Node 6	385516	544.3 ft	1.527 ft	542.7 ft	0.5546 psi
		311 ft	0.02027	543.8 ft		542.3 ft	1.28 ft
~Pipe{085}10	16 in	Node 21	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 17	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}11	10 in	Layne Bowler 12RH-8625-4	1419 gpm	101 psi g	0.6622 psi	100.3 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.239 ft/s	100.8 psi g		100.1 psi g	0.00
Water	25 ft	Node 18	385784	544.1 ft	1.529 ft	542.6 ft	0.5554 psi
		311 ft	0.02027	543.7 ft		542.2 ft	1.282 ft
~Pipe{085}12	10 in	Layne Bowler 12RH-8625-3	1421 gpm	100.9 psi g	0.6641 psi	100.2 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.246 ft/s	100.7 psi g		100 psi g	0.00
Water	25 ft	Node 17	386346	543.9 ft	1.533 ft	542.4 ft	0.557 psi
		311 ft	0.02027	543.5 ft		542 ft	1.286 ft
~Pipe{085}13	10 in	Node 1	1417 gpm	95.4 psi g	-4.971 psi	100.4 psi g	0.0133
Ductile Iron	10.52 in	324 ft	5.231 ft/s	95.22 psi g		100.2 psi g	0.00
Water	25 ft	Node 20	385198	544.3 ft	1.524 ft	542.7 ft	0.5537 psi
		311 ft	0.02027	543.8 ft		542.3 ft	1.278 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{085}14	10 in	Layne Bowler 12RH-8625-7	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	13 ft	Node 27	--	--	--	--	--
		324 ft	--	--		--	--
~Pipe{085}15	10 in	Node 27	--	--	--	--	--
Ductile Iron	10.52 in	324 ft	--	--		--	0.00
Water	25 ft	Node 21	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}2	16 in	Node 6	1418 gpm	100.4 psi g	0.04641 psi	100.3 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.072 ft/s	100.3 psi g		100.3 psi g	0.00
Water	10 ft	Node 4	242561	542.7 ft	0.1071 ft	542.6 ft	0.04245 psi
		311 ft	0.01908	542.7 ft		542.6 ft	0.09801 ft
~Pipe{085}3	10 in	Layne Bowler 12RH-8625-5	--	--	--	--	--
Ductile Iron	10.52 in	311 ft	--	--		--	0.00
Water	25 ft	Node 15	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}4	16 in	Node 15	--	--	--	--	--
Ductile Iron	16.72 in	311 ft	--	--		--	0.00
Water	10 ft	Node 3	--	--	--	--	--
		311 ft	--	--		--	--
~Pipe{085}5	10 in	Layne Bowler 12RH-8625-2	1419 gpm	101 psi g	0.6622 psi	100.3 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.239 ft/s	100.8 psi g		100.1 psi g	0.00
Water	25 ft	Node 4	385783	544.1 ft	1.529 ft	542.6 ft	0.5554 psi
		311 ft	0.02027	543.7 ft		542.2 ft	1.282 ft
~Pipe{085}6	10 in	Layne Bowler 12RH-8625-1	1421 gpm	100.9 psi g	0.6641 psi	100.2 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.246 ft/s	100.7 psi g		100 psi g	0.00
Water	25 ft	Node 3	386346	543.9 ft	1.533 ft	542.4 ft	0.557 psi
		311 ft	0.02027	543.5 ft		542 ft	1.286 ft
~Pipe{085}7	10 in	Layne Bowler 12RH-8625-8	1417 gpm	101.1 psi g	5.686 psi	95.4 psi g	0.0133
Ductile Iron	10.52 in	311 ft	5.231 ft/s	100.9 psi g		95.22 psi g	0.00
Water	13 ft	Node 1	385198	544.4 ft	0.1278 ft	544.3 ft	0 psi
		324 ft	0.02027	544 ft		543.8 ft	0 ft
~Pipe{085}8	16 in	Node 20	1417 gpm	100.4 psi g	0.04633 psi	100.3 psi g	0.01215
Ductile Iron	16.72 in	311 ft	2.071 ft/s	100.3 psi g		100.3 psi g	0.00
Water	10 ft	Node 18	242362	542.7 ft	0.107 ft	542.6 ft	0.04238 psi
		311 ft	0.01908	542.7 ft		542.6 ft	0.09785 ft
~Pipe{086}	24 in	~N{030}	8516 gpm	100.1 psi g	0.3638 psi	99.77 psi g	0.01126
Ductile Iron	25.04 in	311 ft	5.548 ft/s	99.93 psi g		99.57 psi g	0.00
Water	85 ft	Node 43	972585	542.2 ft	0.84 ft	541.3 ft	0.224 psi
		311 ft	0.01656	541.7 ft		540.9 ft	0.5172 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{086}1	24 in	Node 43	8516 gpm	99.77 psi g	0.2114 psi	99.56 psi g	0.01126
Ductile Iron	25.04 in	311 ft	5.548 ft/s	99.57 psi g		99.35 psi g	0.00
Water	15 ft	~N{001}	972585	541.3 ft	0.488 ft	540.9 ft	0.1867 psi
		311 ft	0.01656	540.9 ft		540.4 ft	0.431 ft
~Pipe{087}	16 in	~N{001}	2408 gpm	99.56 psi g	-0.1781 psi	99.74 psi g	0.01215
Ductile Iron	16.72 in	311 ft	3.518 ft/s	99.48 psi g		99.66 psi g	0.00
Water	522 ft	~N{031}	411824	540.9 ft	1.589 ft	539.3 ft	0.1114 psi
		309 ft	0.01848	540.7 ft		539.1 ft	0.2571 ft
~Pipe{089}	16 in	~N{031}	2408 gpm	99.74 psi g	8.225 psi	91.52 psi g	0.01215
Ductile Iron	16.72 in	309 ft	3.518 ft/s	99.66 psi g		91.43 psi g	0.00
Water	5824 ft	~N{039}	411824	539.3 ft	14.99 ft	524.3 ft	0.0567 psi
		313 ft	0.01848	539.1 ft		524.1 ft	0.1309 ft
~Pipe{090}	16 in	~N{033}	1689 gpm	91.46 psi g	0.05375 psi	91.4 psi g	0.01215
Ductile Iron	16.72 in	313 ft	2.469 ft/s	91.42 psi g		91.36 psi g	0.00
Water	25 ft	Node 14	288945	524.1 ft	0.1241 ft	524 ft	0.03987 psi
		313 ft	0.01885	524.1 ft		523.9 ft	0.09205 ft
~Pipe{090}1	16 in	Node 14	1689 gpm	91.4 psi g	7.808 psi	83.6 psi g	0.01215
Ductile Iron	16.72 in	313 ft	2.469 ft/s	91.36 psi g		83.56 psi g	0.00
Water	20 ft	North Water Tower	288945	524 ft	0.02563 ft	524 ft	0 psi
		331 ft	0.01885	523.9 ft		523.9 ft	0 ft
~Pipe{091}	16 in	Node 14	--	--	--	--	--
Ductile Iron	16.72 in	313 ft	--	--		--	0.00
Water	72 ft	~N{033}	--	--	--	--	--
		313 ft	--	--		--	--
~Pipe{092}	24 in	~N{001}	6108 gpm	99.56 psi g	1.503 psi	98.06 psi g	0.01126
Ductile Iron	25.04 in	311 ft	3.98 ft/s	99.46 psi g		97.95 psi g	0.00
Water	142 ft	~N{034}	697596	540.9 ft	0.4695 ft	540.4 ft	0.08164 psi
		314 ft	0.01677	540.6 ft		540.1 ft	0.1885 ft
~Pipe{093}	24 in	~N{034}	6093 gpm	98.06 psi g	0.04198 psi	98.02 psi g	0.01126
Ductile Iron	25.04 in	314 ft	3.97 ft/s	97.95 psi g		97.91 psi g	0.00
Water	10 ft	Node 41	695883	540.4 ft	0.09692 ft	540.3 ft	0.03345 psi
		314 ft	0.01678	540.1 ft		540 ft	0.07723 ft
~Pipe{093}1	24 in	Node 41	6093 gpm	98.02 psi g	2.451 psi	95.57 psi g	0.01126
Ductile Iron	25.04 in	314 ft	3.97 ft/s	97.91 psi g		95.46 psi g	0.00
Water	295 ft	~N{035}	695883	540.3 ft	0.6581 ft	539.6 ft	0.03345 psi
		319 ft	0.01678	540 ft		539.4 ft	0.07723 ft
~Pipe{094}	24 in	~N{035}	6093 gpm	95.57 psi g	1.021 psi	94.55 psi g	0.01126
Ductile Iron	25.04 in	319 ft	3.97 ft/s	95.46 psi g		94.44 psi g	0.00
Water	3100 ft	~N{036}	695883	539.6 ft	6.358 ft	533.3 ft	0.1097 psi
		315 ft	0.01678	539.4 ft		533 ft	0.2533 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{095}	24 in	~N{036}	5346 gpm	94.55 psi g	6.571 psi	87.97 psi g	0.01126
Ductile Iron	25.04 in	315 ft	3.483 ft/s	94.46 psi g		87.89 psi g	0.00
Water	1945 ft	Node 10	610574	533.3 ft	3.17 ft	530.1 ft	0.08813 psi
		327 ft	0.01688	533.1 ft		529.9 ft	0.2035 ft
~Pipe{095}1	24 in	Node 10	5331 gpm	87.97 psi g	-2.066 psi	90.04 psi g	0.01126
Ductile Iron	25.04 in	327 ft	3.473 ft/s	87.89 psi g		89.96 psi g	0.00
Water	734 ft	Node 22	608861	530.1 ft	1.231 ft	528.9 ft	0.05106 psi
		321 ft	0.01688	529.9 ft		528.7 ft	0.1179 ft
~Pipe{095}2	24 in	Node 22	4584 gpm	90.04 psi g	-1.208 psi	91.25 psi g	0.01126
Ductile Iron	25.04 in	321 ft	2.987 ft/s	89.98 psi g		91.19 psi g	0.00
Water	148 ft	Node 25	523553	528.9 ft	0.211 ft	528.7 ft	0.01894 psi
		318 ft	0.01702	528.7 ft		528.5 ft	0.04372 ft
~Pipe{095}3	24 in	Node 25	4584 gpm	91.25 psi g	2.571 psi	88.68 psi g	0.01126
Ductile Iron	25.04 in	318 ft	2.987 ft/s	91.19 psi g		88.62 psi g	0.00
Water	1243 ft	Node 33	523553	528.7 ft	1.436 ft	527.2 ft	0.01353 psi
		322.5 ft	0.01702	528.5 ft		527.1 ft	0.03123 ft
~Pipe{095}4	24 in	Node 32	2405 gpm	80.47 psi g	3.592 psi	76.88 psi g	0.01126
Ductile Iron	25.04 in	340 ft	1.567 ft/s	80.46 psi g		76.86 psi g	0.00
Water	790 ft	~N{037}	274646	525.8 ft	0.2934 ft	525.5 ft	0.01575 psi
		348 ft	0.0178	525.7 ft		525.5 ft	0.03636 ft
~Pipe{095}5	24 in	Node 33	3837 gpm	88.68 psi g	4.284 psi	84.39 psi g	0.01126
Ductile Iron	25.04 in	322.5 ft	2.5 ft/s	88.63 psi g		84.35 psi g	0.00
Water	438 ft	Node 40	438244	527.2 ft	0.39 ft	526.8 ft	0.01706 psi
		332 ft	0.01719	527.1 ft		526.7 ft	0.03938 ft
~Pipe{095}6	24 in	Node 40	3152 gpm	84.39 psi g	3.921 psi	80.47 psi g	0.01126
Ductile Iron	25.04 in	332 ft	2.054 ft/s	84.36 psi g		80.44 psi g	0.00
Water	1923 ft	Node 32	359955	526.8 ft	1.052 ft	525.8 ft	0 psi
		340 ft	0.01742	526.8 ft		525.7 ft	0 ft
~Pipe{096}	14 in	~N{037}	2405 gpm	76.88 psi g	0.1949 psi	76.69 psi g	0.01246
Ductile Iron	14.64 in	348 ft	4.584 ft/s	76.74 psi g		76.54 psi g	0.00
Water	8 ft	Node 9	469750	525.5 ft	0.4499 ft	525 ft	0.1774 psi
		348 ft	0.01883	525.2 ft		524.7 ft	0.4096 ft
~Pipe{096}1	14 in	Node 9	2405 gpm	76.69 psi g	0.05708 psi	76.63 psi g	0.01246
Ductile Iron	14.64 in	348 ft	4.584 ft/s	76.54 psi g		76.49 psi g	0.00
Water	10 ft	Node 12	469750	525 ft	0.1318 ft	524.9 ft	0.03525 psi
		348 ft	0.01883	524.7 ft		524.6 ft	0.08139 ft
~Pipe{096}2	14 in	Node 12	2405 gpm	76.63 psi g	3.861 psi	72.77 psi g	0.01246
Ductile Iron	14.64 in	348 ft	4.584 ft/s	76.49 psi g		72.63 psi g	0.00
Water	165 ft	South Tower	469750	524.9 ft	0.913 ft	524 ft	0.03525 psi
		356 ft	0.01883	524.6 ft		523.7 ft	0.08139 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{097}	14 in	Node 12	--	--	--	--	--
Ductile Iron	14.64 in	348 ft	--	--		--	0.00
Water	25 ft	Node 9	--	--	--	--	--
		348 ft	--	--		--	--
~Pipe{098}	16 in	Node 23	1389 gpm	86.92 psi g	3.257 psi	83.67 psi g	0.01215
Ductile Iron	16.72 in	322 ft	2.03 ft/s	86.9 psi g		83.64 psi g	0.00
Water	525 ft	~N{041}	237560	522.7 ft	0.52 ft	522.2 ft	0.0256 psi
		329 ft	0.0191	522.6 ft		522.1 ft	0.05911 ft
~Pipe{099}	16 in	~N{039}	1689 gpm	91.52 psi g	0.05765 psi	91.46 psi g	0.01215
Ductile Iron	16.72 in	313 ft	2.469 ft/s	91.47 psi g		91.42 psi g	0.00
Water	50 ft	~N{033}	288945	524.3 ft	0.1331 ft	524.1 ft	0.0299 psi
		313 ft	0.01885	524.2 ft		524.1 ft	0.06904 ft
~Pipe{100}	16 in	~N{039}	718.5 gpm	91.52 psi g	6.122E-03 psi	91.51 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.05 ft/s	91.51 psi g		91.5 psi g	0.00
Water	40 ft	Node 37	122880	524.3 ft	0.01413 ft	524.3 ft	1.803E-03 psi
		313 ft	0.02028	524.3 ft		524.3 ft	4.162E-03 ft
~Pipe{100}1	16 in	~N{040}	--	--	--	--	--
Ductile Iron	16.72 in	323 ft	--	--		--	0.00
Water	5885 ft	Node 28	--	--	--	--	--
		335 ft	--	--		--	--
~Pipe{100}2	16 in	Node 28	670.5 gpm	81.36 psi g	-5.559 psi	86.92 psi g	0.01215
Ductile Iron	16.72 in	335 ft	0.9798 ft/s	81.36 psi g		86.92 psi g	0.00
Water	752 ft	Node 23	114681	522.8 ft	0.166 ft	522.7 ft	6.281E-04 psi
		322 ft	0.02044	522.8 ft		522.7 ft	1.450E-03 ft
~Pipe{100}3	16 in	Node 37	718.5 gpm	91.51 psi g	4.586 psi	86.92 psi g	0.01215
Ductile Iron	16.72 in	313 ft	1.05 ft/s	91.5 psi g		86.92 psi g	0.00
Water	6300 ft	Node 23	122880	524.3 ft	1.588 ft	522.7 ft	7.572E-03 psi
		322 ft	0.02028	524.3 ft		522.7 ft	0.01748 ft
~Pipe{100}4	16 in	~N{040}1	685.5 gpm	82.69 psi g	1.887 psi	80.81 psi g	0.01215
Ductile Iron	16.72 in	335 ft	1.002 ft/s	82.69 psi g		80.8 psi g	0.00
Water	5885 ft	Node 39	117246	525.9 ft	1.357 ft	524.6 ft	6.237E-03 psi
		338 ft	0.02039	525.9 ft		524.5 ft	0.0144 ft
~Pipe{101}	16 in	Node 25	--	--	--	--	--
Ductile Iron	16.72 in	318 ft	--	--		--	0.00
Water	3991 ft	~N{040}	--	--	--	--	--
		323 ft	--	--		--	--
~Pipe{101}1	16 in	Node 40	685.5 gpm	84.39 psi g	1.7 psi	82.69 psi g	0.01215
Ductile Iron	16.72 in	332 ft	1.002 ft/s	84.39 psi g		82.69 psi g	0.00
Water	3991 ft	~N{040}1	117246	526.8 ft	0.9249 ft	525.9 ft	6.237E-03 psi
		335 ft	0.02039	526.8 ft		525.9 ft	0.0144 ft

Pipes

Pipe Name Specification Fluid Zone	Size Inside Diameter Length	Inlet Device Inlet Elevation Outlet Device Outlet Elevation	Flow Rate Fluid Velocity Reynolds Number Pipe Friction Factor	Inlet Total Pressure Inlet Static Pressure Inlet Energy Grade Inlet Hydraulic Grade	Total dP Total Head Loss	Outlet Total Pressure Outlet Static Pressure Outlet Energy Grade Outlet Hydraulic Grade	V&F Friction Factor V&F Resistance K V&F dP V&F Head Loss
~Pipe{102}	16 in	~N{041}	1389 gpm	83.67 psi g	3.802E-04 psi	83.67 psi g	0.01215
Ductile Iron	16.72 in	329 ft	2.03 ft/s	83.64 psi g		83.64 psi g	0.00
Water	1 ft	Tenant Demand	237560	522.2 ft	8.778E-04 ft	522.2 ft	0 psi
		329 ft	0.0191	522.1 ft		522.1 ft	0 ft

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 1	324 ft	95.4 psi g	543.8 ft
Node 10	327 ft	87.97 psi g	530 ft
Node 12	348 ft	76.63 psi g	524.6 ft
Node 14	313 ft	91.4 psi g	523.9 ft
Node 15	311 ft	--	--
Node 17	311 ft	100.2 psi g	542.1 ft
Node 18	311 ft	100.3 psi g	542.4 ft
Node 19	311 ft	100.2 psi g	542.2 ft
Node 20	311 ft	100.4 psi g	542.5 ft
Node 21	311 ft	--	--
Node 22	321 ft	90.04 psi g	528.8 ft
Node 23	322 ft	86.92 psi g	522.6 ft
Node 25	318 ft	91.25 psi g	528.5 ft
Node 27	324 ft	--	--
Node 28	335 ft	81.36 psi g	522.8 ft
Node 29	336 ft	81.67 psi g	524.6 ft
Node 3	311 ft	100.2 psi g	542.1 ft
Node 30	338 ft	--	--
Node 32	340 ft	80.47 psi g	525.7 ft
Node 33	322.5 ft	88.68 psi g	527.1 ft
Node 36	310 ft	--	--
Node 37	313 ft	91.51 psi g	524.3 ft
Node 38	370 ft	69.32 psi g	530 ft
Node 39	338 ft	80.81 psi g	524.5 ft
Node 4	311 ft	100.3 psi g	542.4 ft
Node 40	332 ft	84.39 psi g	526.8 ft
Node 41	314 ft	98.02 psi g	540 ft

Nodes

Node Name	Elevation	Pressure	Hydraulic Grade
Node 42	314 ft	--	--
Node 43	311 ft	99.77 psi g	540.9 ft
Node 44	313 ft	--	--
Node 45	317 ft	--	--
Node 5	311 ft	100.2 psi g	542.2 ft
Node 6	311 ft	100.4 psi g	542.5 ft
Node 9	348 ft	76.69 psi g	524.7 ft
~N{001}	311 ft	99.56 psi g	540.6 ft
~N{030}	311 ft	100.1 psi g	541.9 ft
~N{031}	309 ft	99.74 psi g	539.1 ft
~N{033}	313 ft	91.46 psi g	524.1 ft
~N{034}	314 ft	98.06 psi g	540.2 ft
~N{035}	319 ft	95.57 psi g	539.4 ft
~N{036}	315 ft	94.55 psi g	533.1 ft
~N{037}	348 ft	76.88 psi g	525.3 ft
~N{039}	313 ft	91.52 psi g	524.2 ft
~N{040}	323 ft	--	--
~N{040}1	335 ft	82.69 psi g	525.9 ft
~N{041}	329 ft	83.67 psi g	522.1 ft

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Hydrants Open P Total @ 0 psi g	370 ft	-- -- --	-- -- --	--
Pressure Boundary 1 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 2 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 3 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--

Pressure Boundaries

Pressure Boundary Name Operation	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
Pressure Boundary 4 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--
Pressure Boundary 5 P Static @ 70 psi g	319 ft	-- -- --	-- -- --	--

Flow Demands

Flow Demand Name Operation Flow Direction	Elevation	Total Pressure Static Pressure Dynamic Pressure	Energy Grade Hydraulic Grade Dynamic Head	Flow Rate
EMS Station Flow Rate @ 15 gpm Flow out	336 ft	81.67 psi g 81.67 psi g 1.009E-05 psi	524.6 ft 524.6 ft 2.33E-05 ft	15 gpm
FORD Flow Rate @ 747 gpm Flow out	328 ft	87 psi g 86.99 psi g 8.020E-03 psi	528.8 ft 528.8 ft 0.01852 ft	747 gpm
FORD1 Flow Rate @ 747 gpm Flow out	330 ft	85.42 psi g 85.41 psi g 8.020E-03 psi	527.2 ft 527.2 ft 0.01852 ft	747 gpm
FORD2 Flow Rate @ 747 gpm Flow out	347 ft	77.43 psi g 77.42 psi g 8.020E-03 psi	525.8 ft 525.7 ft 0.01852 ft	747 gpm
FORD3 Flow Rate @ 747 gpm Flow out	322 ft	91.5 psi g 91.49 psi g 8.020E-03 psi	533.3 ft 533.2 ft 0.01852 ft	747 gpm
Tenant Demand Flow Rate @ 1389 gpm Flow out	329 ft	83.67 psi g 83.64 psi g 0.02773 psi	522.2 ft 522.1 ft 0.06402 ft	1389 gpm
WWTP Flow Rate @ 15 gpm Flow out	370 ft	69.32 psi g 69.32 psi g 4.819E-05 psi	530 ft 530 ft 1.113E-04 ft	15 gpm
Water Treatment Bldg Flow Rate @ 15 gpm Flow out	321 ft	94.71 psi g 94.7 psi g 9.949E-03 psi	539.7 ft 539.6 ft 0.02297 ft	15 gpm

Pump Data Sheet - Mid-America Pump & Supply

Company: SSOE Group
Name: Lisa
Date: 4/26/2022

MIDAMERICA PUMP & SUPPLY

Pump:

Size: 12RH (4 stage)

Type: Vertical Turbine
Synch Speed: 1800 rpm

Speed: 1770 rpm
Dia: 9.188 in

Curve: MAPS

Impeller: enclosed

Specific Speeds:

Ns: 2891
Nss: 6211

Dimensions:

Suction: 8 in
Discharge: 10 in

Vertical Turbine:

Bowl Size: 11.4 in
Max Lateral: 0.9 in
Thrust K Factor: 9.4 lbf/ft

Search Criteria:

Flow: ---

Head: ---

Fluid:

Water
Density: 62.32 lb/ft³
Viscosity: 0.9946 cP

Temperature: 68 °F
Vapor Pressure: 0.3391 psi a
Atm Pressure: 14.7 psi a

NPSHa: ---

Motor:

Standard: NEMA/TITAN
Enclosure: WP-1/TEFC

Size: 125 hp
Speed: 1800 rpm
Frame: 405TP WP-1

Sizing Criteria: Max Power on Design Curve

Pump Limits:

Temperature: 140 °F
Pressure: 400 psi g
Sphere Size: 0.75 in

Power: 416 hp
Eye Area: 25.5 in²

---- Duty Point ----

Flow:	1343 US gpm
Head:	249 ft
Eff:	84%
Power:	101 hp
NPSHr:	22.8 ft

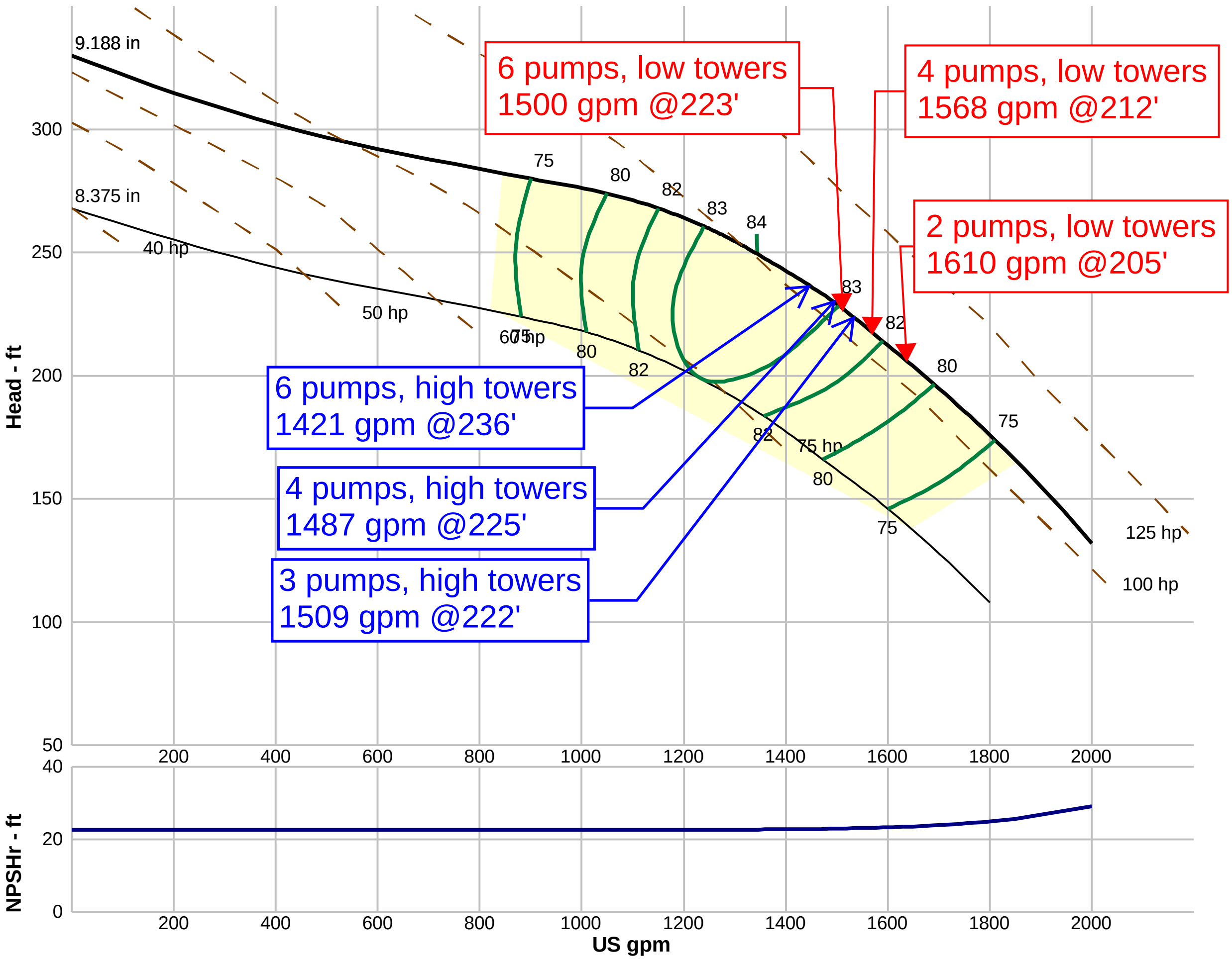
---- Design Curve ----

Shutoff Head: 330 ft
Shutoff dP: 143 psi
Min Flow: ---
BEP: 84% @ 1343 US gpm
NOL Power:
106 hp @ 1810 US gpm

-- Max Curve --

Max Power:
106 hp @ 1810 US gpm

Clearwell Pumps - Phase 2 (6.3 MGD)



6 pumps, low towers
1500 gpm @223'

4 pumps, low towers
1568 gpm @212'

2 pumps, low towers
1610 gpm @205'

6 pumps, high towers
1421 gpm @236'

4 pumps, high towers
1487 gpm @225'

3 pumps, high towers
1509 gpm @222'

Standard Lateral 0.56 in

Performance Evaluation:

Flow US gpm	Speed rpm	Head ft	Efficiency %	Power hp	NPSHr ft
1920	1770	150	68.7	105	27.5
1600	1770	212	81.8	105	23.4
1280	1770	257	83.7	99.1	22.8
960	1770	278	77	87.1	22.8
640	1770	291	58	78.1	22.8

APPENDIX H

MEMPHIS REGIONAL MEGASITE
WATER TREATMENT PLANT

AERATOR DESIGN CRITERIA

Aeration desgin for reduction of CO2 level in incoming water stream.

Avaerage Design Flow:	7 MGD	4875 GPM
Normal Design flow:		5200 GPM
Peak Design flow:		6000 GPM

Source water: On-site wells - Memphis Sand Aquifer

Incoming pH level:	5.9 to 6.2	Derived from water analysis
Temperature Deg . C	59 to 63	Derived from water analysis

Incoming CO2 level	53 - 81 mg/L
Expected CO2 level at outlet	4 - 10 mg/L

Aertor Loading rate:	Average	16.2 GPM/ft2
	Normal:	20 GPM/ft2

Desgin to inlcude ability to shut down one unit.

Normal flow: 5200 GPM/2000 GPM/unit Three units required
Normal design flow require three units @ 100 Ft2

20 GPM/ft2 x 100 ft2 = 2000 GPM/Unit

Air to water ratio (one unit out of service): 7500 CFM/1733 GPM= 4.32 CFM:GPM)

Aerator design for removal of CO2 requires fill media design by equpiment suppliers.

Design based by supplier upon Henry's Law:

$Cw=K_{H}xCg$

Cw= equilibrium concentration of gas in water
K_{H}= Henry's constant or distributin coeficcient
Cg= Concentration of the gas in the air

K_{H} (for CO2) = 0.942 @ 20 Deg. C MW=44 g/mol

CO2 reduction of up to 90% can be achieved through aeration with aerator with 60 inches ofpacking material. 2000 Ft3

West Tennessee Megasite

Engineer
SSOE Group

Representative
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WesTech®

Proposal Number: 2260013
Monday, January 10, 2022

Table of Contents

Technical Proposal

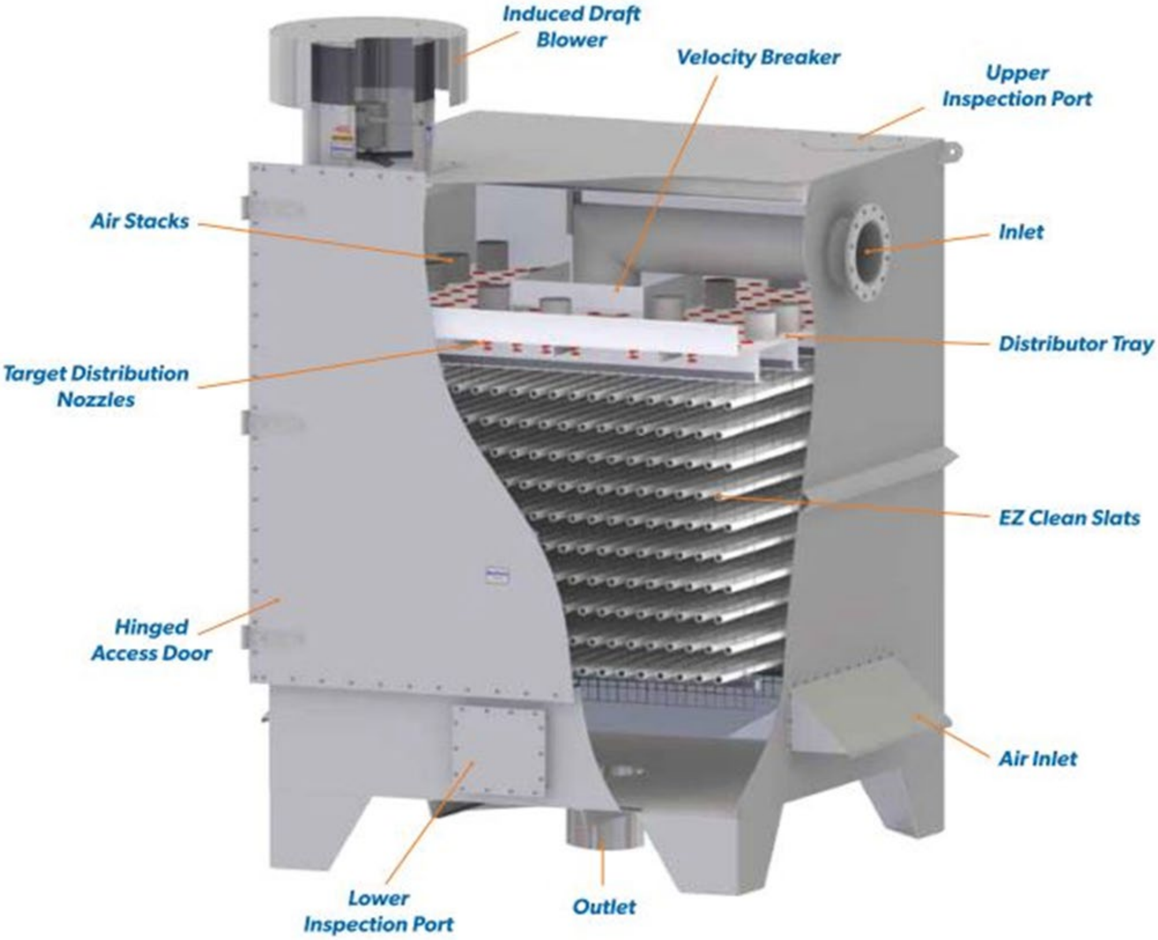
Item A – Four (4) Aluminum Induced Draft Aerators (AIDA™), Model AWI31C

Design Criteria	
Application	pH adjustment
Design Flow	4,861 gpm (7 MGD)
Number of Units	4 (one redundant)
Unit Size	120 in square x 120 in shell height
Loading Rate	16.2 gpm/ft^2 with one unit out of service
Blower Capacity	7,500 cfm @ 3/8 in SP (Total/unit)
Air to Water Ratio	4.63:1 (cfm:gpm) with one unit out of service

Features and Benefits

A counter-current flow of air, supplied by an induced draft type blower, continuously sweeps through the aerator oxidizing the ferrous iron and carrying away released gases that may be present. Dissolved solids such as iron are transformed to their oxidized states, enabling them to be removed by downstream equipment. In addition, unwanted dissolved gases (e.g., carbon dioxide) are removed to reduce chemical requirements, stabilize pH, or eliminate objectionable tastes and odors.

- Aluminum construction eliminates painting, and corrosion-resistant internals simplify maintenance.
- Multiple internal media configurations optimize treatment performance.
- Factory assembly minimizes installation costs and prevents field errors.
- Gravity inlet tray ensures uniform water distribution and air collection across internals, and eliminates troublesome spray distribution nozzles. It also minimizes inlet pressure requirements and reduces long-term pumping costs compared to spray aerators.
- General Filter target nozzles equipped with a bell mouthed entrance to minimize clogging and provide even water droplet distribution in the aeration section are located in the distribution tray
- Top-mounted induction blower minimizes footprint.



Aluminum Induced Draft Aerator. Graphic may not entirely represent the unit quoted.

Aluminum Induced Draft Aerator Shell Scope of Supply

Quantity	Dimension	Notes
3	120 in Square x 120 in High	Materials of construction are Type 3000 series aluminum plates with Type 6061 aluminum structural members, Shipped complete with the following features

Feature	Notes
Shell sides and bottom plate	1/4 in thick
Shell top plate	3/16 in thick
Lifting lugs	Included
Nameplate assembly	Included
Support legs	Includes predrilled anchor holes (Anchor bolts are not by WesTech.)
Air intake	Included
Media access	Two bolt-on media access ports on side
Water distributor	Distribution tray complete with velocity breaker box and air stacks
Target nozzles	Included
Media	Loose fill—see below
Media support	Aluminum grating
Lower inspection port	13 in x 15 in placed below the internals
Upper inspection port	18 in diameter placed in the cover
Inlet connection	14 in flanged top side
Outlet connection	18 in plain end bottom
Air exhaust connection	Includes moisture separator in the cover

Induced Draft Blower Scope of Supply

Quantity	Volume	Pressure	Model	Motor
2/unit	3,750 scfm/blower	3/8 in SP	ID-244L	1/2 hp, 230 V, 60 Hz, 1 ph, TENV

Feature	Notes
Housing	Aluminum with stainless steel trim and rain hood
Exhaust screen	Aluminum and stainless steel
Hardware	Type 18-8 stainless steel, includes hardware for mounting

Aerator Media Scope of Supply

Type	Quantity	Layer Depth	Packaging
Polypropylene	2,000 ft^3	60 in	10-ft^3 boxes

Fabrications Scope of Supply

Feature	Quantity	Notes
Air Inlet Hoods	8	Aluminum construction, with hood mounting bolts and screened air intake with quick release screen

Notes:

- Due to the aluminum (or stainless steel) alloy used, exposed surfaces may have a dull or uneven appearance, and water staining is possible.
- It is recommended that a delay timer be used to keep the blower running for at least 10 minutes after the pump stops. This is to dry the unit out to prevent icing of the outlet screens in colder climates.
- It is recommended that the installing contractor provide an appropriate coating or product barrier for aluminum surfaces in contact with concrete or mortar to prevent corrosion.
- Aerator influent flanged connection is not designed to support the weight of the influent piping. Alternate means of influent pipe support should be provided.

Weights

Estimated Shipping Weight/Heaviest Piece	4,300 lbs
Estimated Operating Weight/Vessel	14,250 lbs

WesTech Trips to the Site

Total Trips	Total Days	Includes
1	1	Installation inspection, startup, instruction of plant personnel, and training

Note: Any item not listed above to be furnished by others.

Clarifications and Exceptions

General Clarifications

Terms & Conditions: This proposal, including all terms and conditions contained herein, shall become part of any resulting contract or purchase order. Changes to any terms and conditions, including but not limited to submittal and shipment days, payment terms, and escalation clause shall be negotiated at order placement, otherwise the proposal terms and conditions contained herein shall apply.

Escalation: If during the performance of the contract, the price of labor, material, freight, and other costs significantly increase, through no fault of WesTech, the price shall be equitably adjusted and subject to escalation. A significant price increase shall mean any price increase from proposal date to material procurement greater than 2.5% from stated prices. Delays and costs associated with a Force Majeure event shall also be equitably adjusted and subject to a change in price and/or schedule. Escalation to be based on cost increases, (without additional profit, overhead or margin) and shall include labor, material, freight, and other costs to WesTech that occur in the specified time period. Any revisions or changes requested by the customer will be priced on a case-by-case basis. Such price increases shall be documented through third party sources. Carbon material escalation will be based on the US Midwest Domestic Index, current flats and longs indexes, in effect at the time of bid. Stainless material escalation will be based the Argus Metals Stainless Steel ex works US base price plus surcharge for flat and bar (per design specified alloy), in effect at the time of bid.

USA Tariffs and Current Trade Laws: All prices are based on current USA and North America tariffs and trade laws/agreements at time of bid. Any changes in costs due to USA Tariffs and trade laws/ agreements will be passed through to the purchaser at cost.

Aluminum Induced Draft Aerator Comments and Clarifications

- Availability of equipment components specified may dictate substitutions of equal quality at the discretion of WesTech.
- All hardware is crated and shipped to the jobsite for assembly by the contractor.

Items Not Furnished by WesTech

- Unloading of equipment from delivering carrier, protected storage of equipment, installation, supervision of installation
- All underground and interconnecting piping, pipe supports, wall inserts or sleeves, Dresser or flexible couplings, hangers, air release piping and valves, sampling lines and sinks, field work of piping (i.e., drilling and tapping for instrumentation) and flow meters
- Walkways, handrails, stairways and ladders, air ducts and roof flashing
- All chemical feeders, feed lines, start-up chemicals, chemicals, labor, and procedures for the disinfection of equipment, laboratory test equipment
- Structural design, supply and installation of concrete pads, tanks. foundations, rebar, anchors, concrete, grout and sealant
- Motor control center, motor starters, disconnects, electrical wiring and conduit, telemetering equipment and supports for controls
- Any equipment and service not listed in this proposal

Exceptions

Not applicable

Commercial Proposal

Proposal Name: West Tennessee Megasite
Proposal Number: 2260013
Monday, January 10, 2022

1. Bidder's Contact Information

Company Name	WesTech Engineering, LLC
Primary Contact Name	Tom Dumbaugh
Phone	801.265.1000
Email	tdumbaugh@westech-inc.com
Address: Number/Street	3665 S West Temple
Address: City, State, Zip	Salt Lake City, UT 84115

2. Budget Pricing

Currency: US Dollars

Scope of Supply

A	(4) Aluminum Induced Draft Aerators, Model AWI31C	$480,000
	Taxes (sales, use, VAT, IVA, IGV, duties, import fees, etc.)	Not Included

Prices are valid for a period not to exceed 30 days from date of proposal.

Additional Field Service

Daily Rate (Applicable Only to Field Service Not Included in Scope)	$1,200

Pricing does not include field service unless noted in scope of supply, but is available at the daily rate plus expenses. The greater of a two week notice or visa procurement time is required prior to departure date. Our field service policy can be provided upon request for more details.

3. Payment Terms

Purchase Order Acceptance and Contract Execution	10%
Submittals Provided by WesTech	15%
Release for Fabrication	35%
Notification of Ready to Ship	40%

All payments are net 30 days. Partial shipments are allowed. An approved Letter of Credit is required if Incoterms CIF, CFR, DAP, CIP, or CPT are applicable. Payment is required in full for all other Incoterms prior to international shipment. Other terms per WesTech proforma invoice. Please note that the advising bank must be named as: Wells Fargo Bank, International Department, 9000 Flair Drive, 3rd Floor, El Monte, California 91731, USA.

4. Schedule

Submittals, after Purchase Order Acceptance and Contract Execution	6 to 8 weeks
Ready to Ship, after Receipt of Final Submittal Approval	18 to 20 weeks
Estimated Weeks to Ready to Ship	**24 to 28 weeks***

*Customer submittal approval is typically required to proceed with equipment fabrication and is not accounted for in the schedule above. Project schedule will be extended to account for time associated with receipt of customer submittal approval.

5. Freight

Domestic: FOB Shipping Point - Full Freight Allowed to Jobsite (FSP-FFA)

From	**Final Destination**	**Number of Trucks or Containers**
WesTech Shops	Memphis, TN	TBD

One-Year Warranty

WesTech equipment is backed by WesTech's reputation as a quality manufacturer, and by many years of experience in the design of reliable equipment.

Equipment manufactured or sold by WesTech Engineering, LLC, once paid for in full, is backed by the following warranty:

For the benefit of the original user, WesTech warrants all new equipment manufactured by WesTech Engineering, LLC. to be free from defects in material and workmanship, and will replace or repair, F.O.B. its factories or other location designated by it, any part or parts returned to it which WesTech's examination shall show to have failed under normal use and service by the original user within one (1) year following initial start-up, or eighteen (18) months from shipment to the purchaser, whichever occurs first.

Such repair or replacement shall be free of charge for all items except for those items such as resin, filter media and the like that are consumable and normally replaced during maintenance, with respect to which, repair or replacement shall be subject to a pro-rata charge based upon WesTech's estimate of the percentage of normal service life realized from the part. WesTech's obligation under this warranty is conditioned upon its receiving prompt notice of claimed defects, which shall in no event be later than thirty (30) days following expiration of the warranty period, and is limited to repair or replacement as aforesaid.

This warranty is expressly made by WesTech and accepted by purchaser in lieu of all other warranties, including warranties of merchantability and fitness for particular purpose, whether written, oral, express, implied, or statutory. WesTech neither assumes nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever.

This warranty shall not apply to equipment or parts thereof which have been altered or repaired outside of a WesTech factory, or damaged by improper installation, application, or maintenance, or subjected to misuse, abuse, neglect, accident, or incomplete adherence to all manufacturer's requirements, including, but not limited to, Operations & Maintenance Manual guidelines & procedures.

This warranty applies only to equipment made or sold by WesTech Engineering, LLC.

WesTech Engineering, LLC. makes no warranty with respect to parts, accessories, or components purchased by the customer from others. The warranties which apply to such items are those offered by their respective manufacturers.

Terms & Conditions

Terms and Conditions appearing in any order based on this proposal which are inconsistent herewith shall not be binding on WesTech Engineering, LLC The sale and purchase of equipment described herein shall be governed exclusively by the foregoing proposal and the following provisions:

1. SPECIFICATIONS: WesTech Engineering, LLC is furnishing its standard equipment as outlined in the proposal and as will be covered by final approved drawings. The equipment may not be in strict compliance with the Engineer's/Owner's plans, specifications, or addenda as there may be deviations. The equipment will, however, meet the general intention of the mechanical specifications of these documents.

2. ITEMS INCLUDED: This proposal includes only the equipment specified herein and does not include erection, installation, accessories, nor associated materials such as controls, piping, etc., unless specifically listed.

3. PARTIES TO CONTRACT: WesTech Engineering, LLC is not a party to or bound by the terms of any contract between WesTech Engineering, LLC's customer and any other party. WesTech Engineering, LLC's undertakings are limited to those defined in the contract between WesTech Engineering, LLC and its direct customers.

4. PRICE AND DELIVERY: All selling prices quoted are subject to change without notice after 30 days from the date of this proposal unless specified otherwise. Unless otherwise stated, all prices are F.O.B. WesTech Engineering, LLC or its supplier's shipping points. All claims for damage, delay or shortage arising from such equipment shall be made by Purchaser directly against the carrier. When shipments are quoted F.O.B. job site or other designation, Purchaser shall inspect the equipment shipped, notifying WesTech Engineering, LLC of any damage or shortage within forty-eight hours of receipt, and failure to so notify WesTech Engineering, LLC shall constitute acceptance by Purchaser, relieving WesTech Engineering, LLC of any liability for shipping damages or shortages.

5. PAYMENTS: All invoices are net 30 days. Delinquencies are subject to a 1.5 percent service charge per month or the maximum permitted by law, whichever is less on all past due accounts. Pro rata payments are due as shipments are made. If shipments are delayed by the Purchaser, invoices shall be sent on the date when WesTech Engineering, LLC is prepared to make shipment and payment shall become due under standard invoicing terms. If the work to be performed hereunder is delayed by the Purchaser, payments shall be based on the purchase price and percentage of completion. Products held for the Purchaser shall be at the risk and expense of the Purchaser. Unless specifically stated otherwise, prices quoted are for equipment only. These terms are independent of and not contingent upon the time and manner in which the Purchaser receives payment from the owner.

6. PAYMENT TERMS: Credit is subject to acceptance by WesTech Engineering, LLC's Credit Department. If the financial condition of the Purchaser at any time is such as to give WesTech Engineering, LLC, in its judgment, doubt concerning the Purchaser's ability to pay, WesTech Engineering, LLC may require full or partial payment in advance or may suspend any further deliveries or continuance of the work to be performed by the WesTech Engineering, LLC until such payment has been received.

7. ESCALATION: If during the performance of the contract, the price of labor, material, freight, and other costs significantly increase, through no fault of WesTech, the price shall be equitably adjusted and subject to escalation. A significant price increase shall mean any price increase from proposal date to material procurement greater than 2.5% from stated prices. Delays and costs associated with a Force Majeure event shall also be equitably adjusted and subject to a change in price and/or schedule. Escalation to be based on cost increases, (without additional profit, overhead or margin) and shall include labor, material, freight, and other costs to WesTech that occur in the specified time period. Any revisions or changes requested by the customer will be priced on a case-by-case basis. Such price increases shall be documented through third party sources. Carbon material escalation will be based on the US Midwest Domestic Index, current flats and longs indexes, in effect at the time of bid. Stainless material escalation will be based the Argus Metals Stainless Steel ex works US base price plus surcharge for flat and bar (per design specified alloy), in effect at the time of bid.

8. APPROVAL: If approval of equipment submittals by Purchaser or others is required, a condition precedent to WesTech Engineering, LLC supplying any equipment shall be such complete approval.

9. INSTALLATION SUPERVISION: Prices quoted for equipment do not include installation supervision. WesTech Engineering, LLC recommends and will, upon request, make available, at WesTech Engineering, LLC's then current rate, an experienced installation supervisor to act as the Purchaser's employee and agent to supervise installation of the equipment. Purchaser shall at its sole expense furnish all necessary labor equipment, and materials needed for installation.

Responsibility for proper operation of equipment, if not installed by WesTech Engineering, LLC or installed in accordance with WesTech Engineering, LLC's instructions, and inspected and accepted in writing by WesTech Engineering, LLC, rests entirely with Purchaser; and any work performed by WesTech Engineering, LLC personnel in making adjustment or changes must be paid for at WesTech Engineering, LLC's then current per diem rates plus living and traveling expenses.

WesTech Engineering, LLC will supply the safety devices described in this proposal or shown in WesTech Engineering, LLC's drawings furnished as part of this order but excepting these, WesTech Engineering, LLC shall not be required to supply or install any safety devices whether required by law or otherwise. The Purchaser hereby agrees to indemnify and hold harmless WesTech Engineering, LLC from any claims or losses arising due to alleged or actual insufficiency or inadequacy of the safety devices offered or supplied hereunder, whether specified by WesTech Engineering, LLC or Purchaser, and from any damage resulting from the use of the equipment supplied hereunder.

10. ACCEPTANCE OF PRODUCTS: Products will be deemed accepted without any claim by Purchaser unless written notice of non-acceptance is received by WesTech Engineering, LLC within 30 days of delivery if shipped F.O.B. point of shipment, or 48 hours of delivery if shipped F.O.B. point of destination. Such written notice shall not be considered received by WesTech Engineering, LLC unless it is accompanied by all freight bills for said shipment, with Purchaser's notations as to damages, shortages and conditions of equipment, containers, and seals. Non-accepted products are subject to the return policy stated below.

11. TAXES: Any federal, state, or local sales, use or other taxes applicable to this transaction, unless specifically included in the price, shall be for Purchaser's account.

12. TITLE: The equipment specified herein, and any replacements or substitutes therefore shall, regardless of the manner in which affixed to or used in connection with realty, remain the sole and personal property of WesTech Engineering, LLC until the full purchase price has been paid. Purchaser agrees to do all things necessary to protect and maintain WesTech Engineering, LLC's title and interest in and to such equipment; and upon Purchaser's default, WesTech Engineering, LLC may retain as liquidated damages any and all partial payments made and shall be free to enter the premises where such equipment is located and remove the same as its property without prejudice to any further claims on account of damages or loss which WesTech Engineering, LLC may suffer from any cause.

13. INSURANCE: From date of shipment until the invoice is paid in full, Purchaser agrees to provide and maintain at its expense, but for WesTech Engineering, LLC's benefit, adequate insurance including, but not limited to, builders risk insurance on the equipment against any loss of any nature whatsoever.

14. SHIPMENTS: Any shipment of delivery dates recited represent WesTech Engineering, LLC's best estimate but no liability, direct or indirect, is assumed by WesTech Engineering, LLC for failure to ship or deliver on such dates.

WesTech Engineering, LLC shall have the right to make partial shipments; and invoices covering the same shall be due and payable by Purchaser in accordance with the payment terms thereof. If Purchaser defaults in any payment when due hereunder, WesTech Engineering, LLC may, without incurring any liability therefore to Purchaser or Purchaser's customers, declare all payments immediately due and payable with maximum legal interest thereon from due date of said payment, and at its option, stop all further work and shipments until all past due payments have been made, and/or require that any further deliveries be paid for prior to shipment.

If Purchaser requests postponements of shipments, the purchase price shall be due and payable upon notice from WesTech Engineering, LLC that the equipment is ready for shipment; and thereafter any storage or other charge WesTech Engineering, LLC incurs on account of the equipment shall be for the Purchaser's account.

If delivery is specified at a point other than WesTech Engineering, LLC or its supplier's shipping points, and delivery is postponed or prevented by strike, accident, embargo, or other cause beyond WesTech Engineering, LLC's reasonable control and occurring at a location other than WesTech Engineering, LLC or its supplier's shipping points, WesTech Engineering, LLC assumes no liability in delivery delay. If Purchaser refuses such delivery, WesTech Engineering, LLC may store the equipment at Purchaser's expense. For all purposes of this agreement such tender of delivery or storage shall constitute delivery.

15. WARRANTY: ~~WESTECH ENGINEERING, LLC WARRANTS EQUIPMENT IT SUPPLIES ONLY IN ACCORDANCE WITH THE WARRANTY EXPRESSED IN THE ATTACHED COPY OF "WESTECH WARRANTY" AGAINST DEFECTS IN WORKMANSHIP AND MATERIALS WHICH IS MADE A PART HEREOF. SUCH WARRANTY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, WHETHER WRITTEN, ORAL, EXPRESSED, IMPLIED OR STATUTORY, WESTECH ENGINEERING, LLC SHALL NOT BE LIABLE ANY CONTINGENT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES FOR ANY REASON WHATSOEVER.~~

16. PATENTS: WesTech Engineering, LLC agrees that it will, at its own expense, defend all suits or proceedings instituted against Purchaser and pay any award of damages assessed against it in such suits or proceedings, so far as the same are based on any claim that the said equipment or any part thereof constitutes an infringement of any apparatus patent of the United States issued at the date of this Agreement, provided WesTech Engineering, LLC is given prompt notice in writing of the institution or threatened institution of any suit or proceeding and is given full control of the defense, settlement, or compromise of any such action; and Purchaser agrees to give WesTech Engineering, LLC needed information, assistance, and authority to enable WesTech Engineering, LLC so to do. In the event said equipment is held or conceded to infringe such a patent, WesTech Engineering, LLC shall have the right at its sole option and expense to a) modify the equipment to be non-infringing, b) obtain for Purchaser the license to continue using said equipment, or c) accept return of the equipment and refund to the Purchaser the purchase price thereof less a reasonable charge for the use thereof. WesTech Engineering, LLC will reimburse Purchaser for actual out-of-pocket expenses, exclusive of legal fees, incurred in preparing such information and rendering such assistance at WesTech Engineering, LLC's request. The foregoing states the entire liability of WesTech Engineering, LLC, with respect to patent infringement; and except as otherwise agreed to in writing, WesTech Engineering, LLC assumes no responsibility for process patent infringement.

17. SURFACE PREPARATION AND PAINTING: If furnished, shop primer paint is intended to serve only as minimal protective finish. WesTech Engineering, LLC will not be responsible for the condition of primed or finish painted surfaces after equipment leaves its shops. Purchasers are invited to inspect paint in shops for proper preparation and application prior to shipment. WesTech Engineering, LLC assumes no responsibility for field surface preparation or touch-up of shipping damage to paint. Painting of fasteners and other touch-up to painted surfaces will be by Purchaser's painting contractor after mechanism installation.

Motors, gear motors, and other components not manufactured by WesTech Engineering, LLC will be painted with that manufacturer's standard paint system. It is WesTech Engineering, LLC's intention to ship major steel components as soon as fabricated, often before drive, motors, and other manufactured components. Unless Purchaser can ensure that shop primed steel shall be field painted within thirty (30) days after arrival at the job site, WesTech Engineering, LLC encourages the Purchaser to order these components without primer.

WesTech Engineering, LLC's prices are based on paints and surface preparations as outlined in the main body of this proposal. In the event that an alternate paint system is selected, WesTech Engineering, LLC requests that Purchaser's order advise of the paint selection. WesTech Engineering, LLC will then either adjust the price as may be necessary to comply or ship the material unpainted if compliance is not possible due to application problems or environmental controls.

18. CANCELLATION, SUSPENSION, OR DELAY: After acceptance by WesTech Engineering, LLC, this proposal, or Purchaser's order based on this proposal, shall be a firm agreement and is not subject to cancellation, suspension, or delay except upon payment by Purchaser of appropriate charges which shall include all costs incurred by WesTech Engineering, LLC to date of cancellation, suspension, or delay plus a reasonable profit. Additionally, all charges related to storage and/or resumption of work, at WesTech Engineering, LLC's plant or elsewhere, shall be for Purchaser's sole account; and all risks incidental to storage shall be assumed by Purchaser.

19. FORCE MAJEURE: Neither party hereto shall be liable to the other for default or delay in delivery caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, act of government, pandemic, delay of carriers, failure of normal sources of supply, complete or partial shutdown of plant by reason of inability to attain sufficient raw materials or power, and/or other similar contingency beyond the reasonable control of the respective parties. The time for delivery specified herein shall be extended during the continuance of such conditions, or any other cause beyond such party's reasonable control.

20. RETURN OF PRODUCTS: No products may be returned to WesTech Engineering, LLC without WesTech Engineering, LLC's prior written permission. Said permission may be withheld by WesTech Engineering, LLC at its sole discretion.

21. BACKCHARGES: WesTech Engineering, LLC will not approve or accept backcharges for labor, materials, or other costs incurred by Purchaser or others in modification, adjustment, service, or repair of WesTech Engineering, LLC-furnished materials unless such back charge has been authorized in advance in writing by a WesTech Engineering, LLC employee, by a WesTech Engineering, LLC purchase order, or work requisition signed by WesTech Engineering, LLC

22. INDEMNIFICATION: Purchaser agrees to indemnify WesTech Engineering, LLC from all costs incurred, including but not limited to court costs and reasonable attorney fees, from enforcing any provisions of this contract, including but not limited to breach of contract or costs incurred in collecting monies owed on this contract.

23. ENTIRE AGREEMENT: This proposal expresses the entire agreement between the parties hereto superseding any prior understandings, and is not subject to modification except by a writing signed by an authorized officer of each party.

24. MOTORS AND MOTOR DRIVES: In order to avoid shipment delays of WesTech Engineering, LLC equipment, the motor drives may be sent directly to the job site for installation by the equipment installer. Minor fit-up may be required.

25. EXTENDED STORAGE: Extended storage instructions will be part of information provided to shipment. If equipment installation and start-up is delayed more than 30 days, the provisions of the storage instructions must be followed to keep WARRANTY in force.

26. LIABILITY: Professional liability insurance, including but not limited to, errors and omissions insurance, is included. In any event, liability for errors and omissions shall be limited to the lesser of $100,000USD or the value of the particular piece of equipment (not the value of the entire order) supplied by WesTech Engineering, LLC against which a claim is sought.

27. ARBITRATION NEGOTIATION: Any controversy or claim arising out of or relating to the performance of any contract resulting from this proposal or contract issued, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator(s) may be entered to any court having jurisdiction.

ACCEPTED BY PURCHASER

Customer Name: ____

Customer Address:____

____

____

Contact Name:____

Contact Phone: ____

Contact Email: ____

Signature: ____

Printed Name: ____

Title: ____

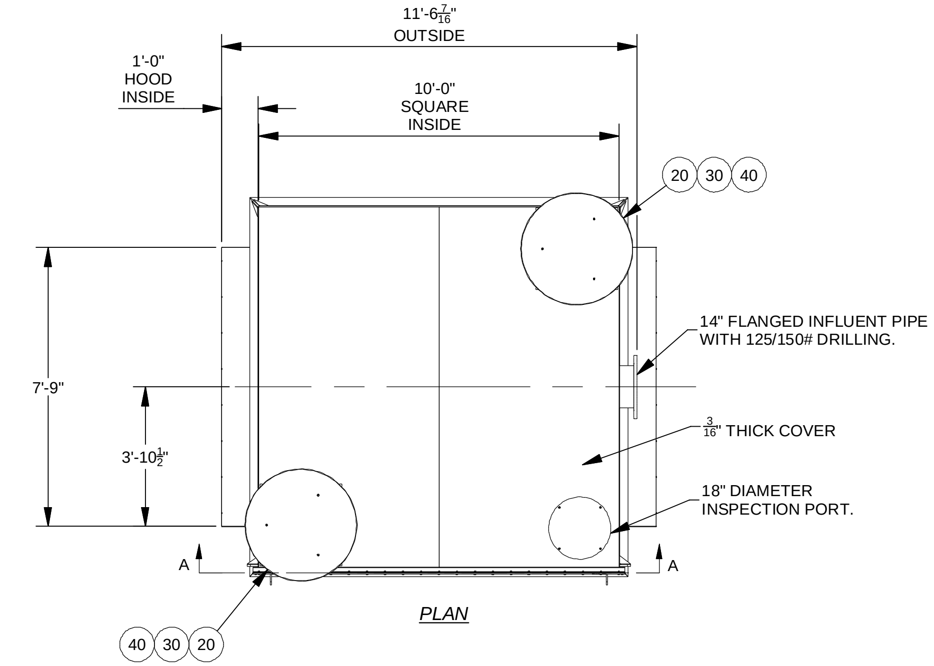
Date: ____

Supplemental Information

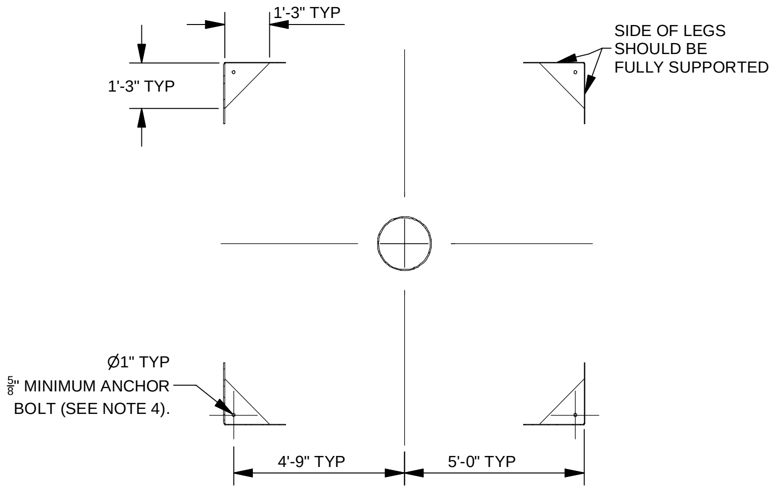
Drawings

BILL OF MATERIAL							
PIECE	UNIT QTY	PART NO	DESCRIPTION	MATERIAL	LENGTH	WIDTH	TOTAL WT, LB
10	1	2-17424	AERATOR ASSEMBLY, INDUCED DRAFT, 120 SQ, 120 HIGH, LF, 0.900, PE				3292.0
20	2	1-9240	BLOWER, ID-244L, 230V, 3PH, 60HZ, 0.5HP, W/RAINHOOD				231.4
30	74	2-8996	BOLT, TAP, 0.25-20UNC x 1	STN STL, 18-8			1.3
40	58	2-9028	WSHR, BOND SEALING, 0.25	STN STL, 18-8			0.2
50	2	1-11981	HOOD, INTAKE ID, SCREENED, BOLTED, 12 X 93				73.4
110	500	2-14356	PACKNG;PLASTIC;3.5 IN;POLYPROPYLENE	POLYPROPYLENE			1400.0
120	4	1-16476	ADHSV/SEALANT;PERMATEX	SILICONE			10.0

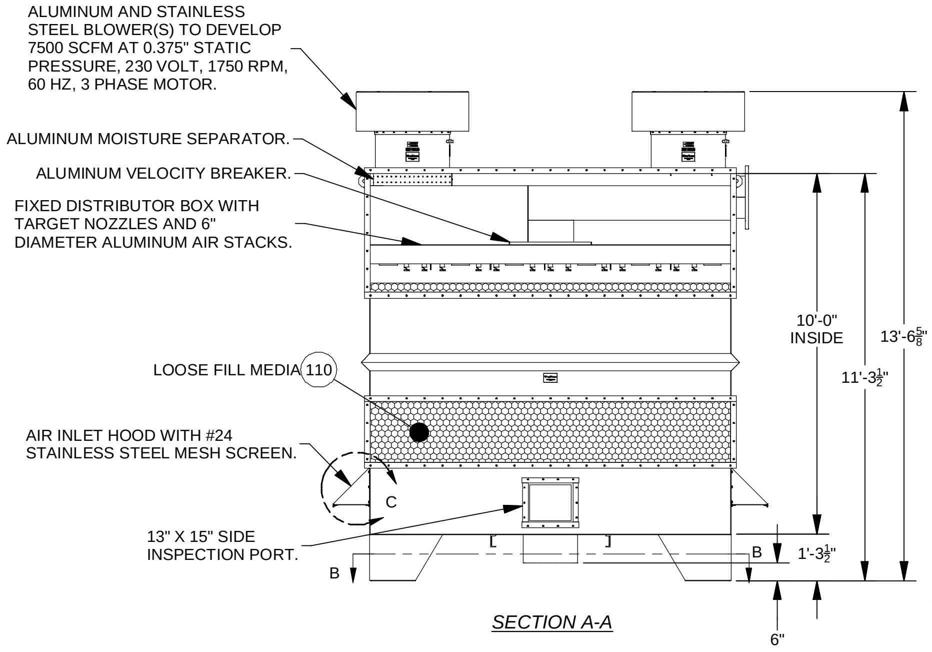
APPROX. OPERATING WEIGHT: 17470 LB



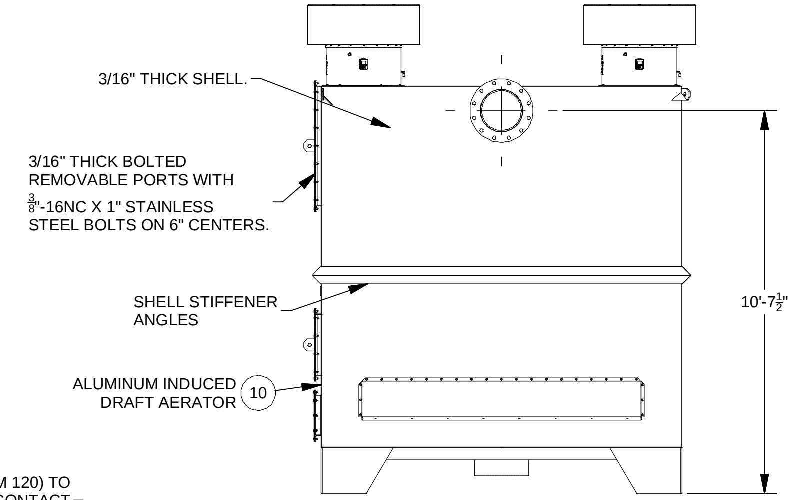
PLAN



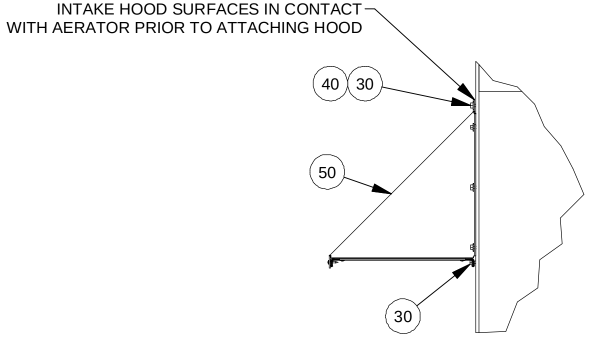
SECTION B-B



SECTION A-A



SIDE ELEVATION



DETAIL C

NOTES:

1.) AERATOR IS SHIPPED FULLY ASSEMBLED EXCEPT FOR SOME AIR HANDLING EQUIPMENT, HARDWARE, AND SEALANT. REFER TO BILL OF MATERIAL FOR IDENTIFICATION OFFIELD ASSEMBLED ITEMS.

2.) AERATOR SHIPS WITHOUT ALL PORT COVER HARDWARE INSTALLED TO AID IN MEDIA LOADING. REMAINING CAP SCREWS AND SEALANT FOR PORT COVERS ARE SHIPPED LOOSE.

3.) ALL AERATOR PLATE IS TO BE 3003 ALUMINUM. STRUCTURALS TO BE 6061 ALUMINUM.

4.) THE AERATOR SHALL BE WELDED INSIDE AND OUTSIDE WITH FILLET WELDS EQUAL TO THE THICKNESS OF THE PLATES. ALL MAIN HOUSING SEAM WELDS SHALL BE DYE PENETRANT CHECKED AT THE FACTORY BEFORE SHIPMENT TO ENSURE THEY ARE WATERTIGHT.

5.) THE MAXIMUM ANCHOR BOLT DIAMETER IS 7/8". THE MINIMUM WASHER DIAMETER IS 2" FOR ALL ANCHOR SIZES. ANCHORAGE IS BY OTHERS.

6.) FLANGE BOLT HOLE PATTERN IS TO STRADDLE UNIT CENTERLINE.

7.) AERATOR INLET AND EFFLUENT PIPE STUBS ARE NOT DESIGNED TO SUPPORT INLET AND EFFLUENT PIPING. ADDITIONAL PIPE SUPPORTS SHOULD BE USED BUT WILL BE SUPPLIED BY OTHERS.

8.) INFLUENT AND EFFLUENT PIPE MOUNTING HARDWARE AND GASKETS ARE PROVIDED BY OTHERS.

9.) IF INSTALLATION INSTRUCTIONS ARE NOT CLEARLY UNDERSTOOD, CONSULT WESTECH FOR ADDITIONAL INFORMATION BEFORE COMMENCING ERECTION.

10.) IMPROPER STORAGE, HANDLING, INSTALLATION, OR FIELD MODIFICATIONS OF EQUIPMENT MAY RESULT IN DAMAGE AND LOSS OF WARRANTY PROTECTION.

11.) THE BLOWER MOTOR MUST BE WIRED CORRECTLY TO THE VOLTAGE LISTED ON THE UNIT.

12.) REMOVE THE DRAIN PLUG ON THE BLOWER CONDENSATION DRAIN BEFORE START UP.

13.) PLACE 3/8" BEAD OF BLUE PERMATEX SEALANT (PIECE 120) ON PORT COVERS INSIDE OF BOLT PATTERN BEFORE INSTALLING BOLTS.

14.) AERATOR MEDIA SHIPPED LOOSE FOR FIELD INSTALLATION.

WESTECH

TITLE **AIDA, 120 SQ, 120, LF, 0.900, PE, 2500 GPM 7500SCFM**

DESIGNER	CHECKER	APPROVER	DATE
MO96	SH40	JA20	5/26/2015

DOCUMENT NUMBER	SHEET	REV
1-18340	1 OF 1	A

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE	REFERENCE DOCUMENTS
A	NOTES ADDED	2449	LU11	BR63	2017-05-26	QR-00-063

APPENDIX I

Appendix I Contains:

- Clearwell design parameters, volumes.
- Choring Contact Time (CT) data
- Buoyancy calculations for clearwells.
- Buoyancy calculations for mixing chamber

Chlorine contact time CT has been calculated utilizing EPA Contact Time (CT) Calculator.

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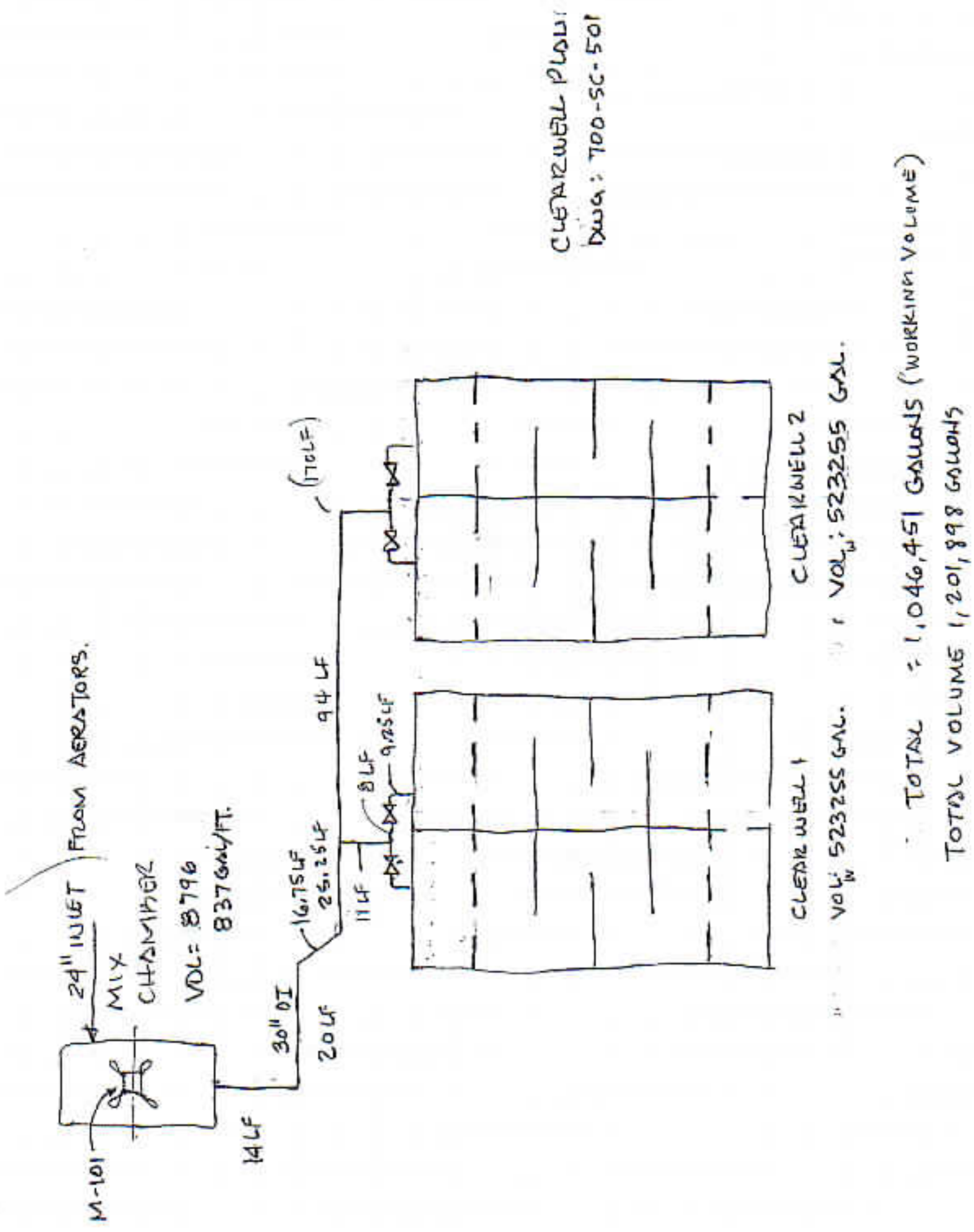
Client: MRM WT PLANT		Sheet Number 1 of
Subject: CLEARWELLS		
By:	Chk'd:	Project Number 012-02080-21
Date:	Date:	



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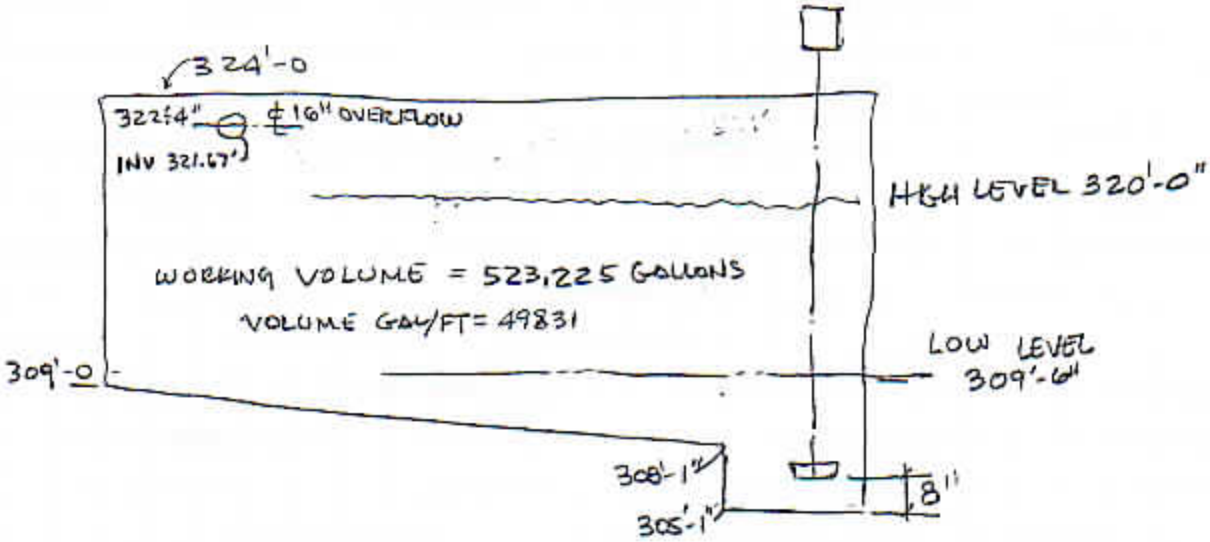
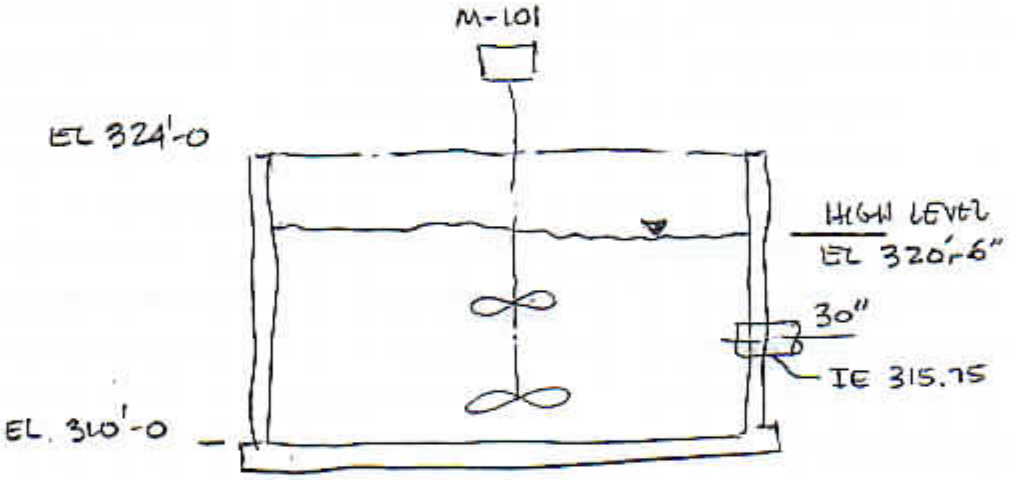
Client: MRM WT PLANT
Subject: CLEARWELLS
By:
Date: -
Chk'd:
Date:
Sheet Number 2 of
Project Number 012-02080-21



WORKING VOLUME = 523,225 GALLONS
VOLUME GAL/FT = 49831

CLEARWELL ELEVATION (TYPICAL #1 & #2)



MIX CHAMBER
ELEVATION

VOL = 837.8 GAL/FT
WORKING VOLUME = 8796

Client: MRM WT PLANT Subject: CLEAR WELLS		Sheet Number 3 of
By: Date:	Chk'd: Date:	Project Number 012-02080-21

CLEARWELL AREA (INTERNAL)

LENGTH 100'-0

WIDTH 70'-0

INTERNAL WALLS AREA: 338 FT^2

$(100 \times 70) - 338 = 6662\ FT^2$

VOLUME = $6662 \times 7.48\ gal/ft^2 = 49{,}831$ gal/FT of LEVEL

10'-6 OPER. LEVEL

10.5 × 49831 GAL = 523,225 GALLONS

CLEARWELL #1 VOLUME	523,225 GALLONS
CLEARWELL # 2 VOLUME	523,225 GALLONS
TOTAL VOLUME	1,046,451 GALLONS.

MIX CHAMBER

AREA 18'-8" LONG × 6'-0 WIDE

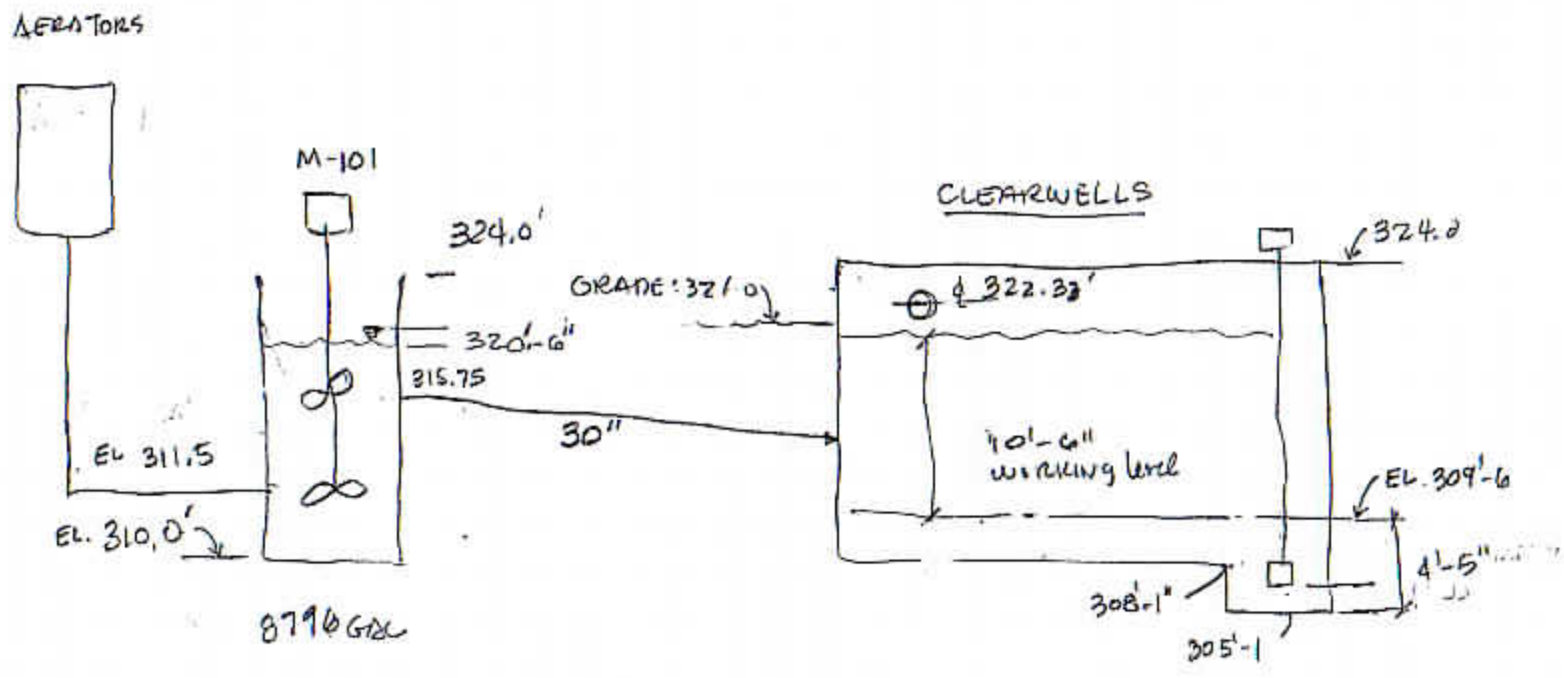
DEPTH 14'-0

OPERATING DEPTH 10'-6".

AREA: 837.7 GAL/FT

W. VOLUME 837.7 GAL/FT × 10.5' Depth = 8796 GALLONS

Client: MRM WT PLANT
Subject: CLEARWELLS
By:
Date:
Chk'd:
Date:
Sheet Number 4 of
Project Number 012.02080-21



FRICTION LOSS IN 30" PIPE.

EQUIVALENT LENGTHS FROM CAMERON HYDRAULIC DATA

	LENGTH	EQUIV. LENGTH						
	30" PIPE	90° ELLS	45° ELLS	TEE	ENT. LOSS	GATE VA		
	200	3(70)	2(38)	1(140)	1(25)	1(19)		
TOTAL	200	210	76	140	25	19	=	670 EQUIV. FT OF PIPE

	FLOW (GPM)	VELOCITY	h_f/100LF		LENGTH.	
30"	5000	2.27FT/SEC	0.049	×	670LF	= 0.328' LOSS
	6000	2.72FT/SEC	0.069	×	670LF	= 0.462' LOSS

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Client: MRM WT PLANT
Subject: CLEARWELLS
Sheet Number 5 of
By:
Date: -
Chk'd:
Date:
Project Number 012-02080-21

PEAK VOLUME

VOLUME OF WATER WITH TWO CLEARWELLS IN OPERATION

MIX CHAMBER OUTLET PIPE 200 LFx 38GAL/FT= 7600 GAL.

CLEARWELL #1 600949 GALLONS
CLEARWELL #2 600949 GALLONS

TOTAL VOLUME: 1,209,498 GALLONS

VOLUME WITH CLEARWELLS AT LOW LEVEL

MIX CHAMBER OUTLET PIPING 200LFx38gal/FT = 7600 GAL.

CLEARWELL #1 261 627 GAL.
CLEARWELL #2 261 627 GAL.

TOTAL: 530,855 GALLONS.

VOLUME WITH ONE CLEARWELL IN OPERATION

MIX CHAMBER OUTLET PIPE: 200LFx38GAL/LF = 7600 GAL.

CLEARWELL #2 600949 GAL

TOTAL VOLUME: 608 549 GALLONS

VOLUME WITH CLEARWELL #2 AT LOW LEVEL

MIX CHAMBER OUTLET PIPE: 200LFx38GAL/LF = 7600 GAL

CLEARWELL #2 : 261 627 GAL

TOTAL : 269227 GALLONS

If CT is obtained using a length of pipe enter a Baffling Factor of 1.00 below
Otherwise enter the Baffling Factor for your storage tank as approved by the State.
For additional guidance on determining your baffling factor see Appendix G of EPA's Benchmarking and Profiling Guidance Manual (www.epa.gov/safewater)

Enter name of GWTF: MRM Water Treatment Plant
(This is for your records - Provides no input to calculations)

Enter Baffling Factor for GWTF: 0.70

Minimum Log Inactivation Provided: 37.63

Sample Site	**Sample Date**	**Disinfectant**	**Residual Conc. (C) (mg/L)**	**pH**	**Temp. (Celsius)**	**Peak Flow (GPM)**	**Volume (gal)**	**TDT (min)**	**Contact Time (T) (min)**	**CT_{calc}**	**4-log CT_{req}**	**Log Inactivation (viruses) See Error Messages in Columns S - Y**	**Additional Log Treatment Needed for 4-Log**	**No Disinfectant choosen in Column E**	**pH outside the range of values specified for systems using Chlorine Dioxide**	**pH outside the range of values specified for systems using Free Chlorine**	**pH outside the range of values specified for systems using Chloramines**	**Temperature has either not been entered or falls outside the range of values specified on the CT tables**	**Free chlorine residual concentration is not entered**	**No value is entered in the “Peak Flow (GPM)” column or if the value is zero.**
1		Free Chlorine	0.20	7.20	20.0	6,000.0	1,209,498.0	201.6	141.1	28.2	3.00	**37.63**	**0.00**							

If CT is obtained using a length of pipe enter a Baffling
Factor of 1.00 below
Otherwise enter the Baffling Factor for your storage tank
as approved by the State.
For additional guidance on determining your baffling factor
see Appendix G of EPA's Benchmarking and Profiling
Guidance Manual (www.epa.gov/safewater)

Enter name of GWTF: MRM Water Treatment Plant Low Levels

(This is for your records - Provides no input to calculations)

Enter Baffling Factor for GWTF: 0.70

Minimum Log Inactivation Provided: **41.29**

Sample Site	Sample Date	Disinfectant	Residual Conc. (C) (mg/L)	pH	Temp. (Celsius)	Peak Flow (GPM)	Volume (gal)	TDT (min)	Contact Time (T) (min)	CT_{calc}	4-log CT_{req}	Log Inactivation (viruses) See Error Messages in Columns S - Y	Additional Log Treatment Needed for 4-Log	No Disinfectant choosen in Column E	pH outside the range of values specified for systems using Chlorine Dioxide	pH outside the range of values specified for systems using Free Chlorine	pH outside the range of values specified for systems using Chloramines	Temperature has either not been entered or falls outside the range of values specified on the CT tables	Free chlorine residual concentration is not entered	No value is entered in the “Peak Flow (GPM)” column or if the value is zero.
1		Free Chlorine	0.50	7.20	20.0	6,000.0	530,855.0	88.5	61.9	31.0	3.00	**41.29**	**0.00**							

If CT is obtained using a length of pipe enter a Baffling Factor of 1.00 below
Otherwise enter the Baffling Factor for your storage tank as approved by the State.
For additional guidance on determining your baffling factor see Appendix G of EPA's Benchmarking and Profiling Guidance Manual (www.epa.gov/safewater)

Enter name of GWTF: MRM Water Treatment Plant Low Levels one
(This is for your records - Provides no input to calculations)

Enter Baffling Factor for GWTF: 0.70

Minimum Log Inactivation Provided: **20.61**

Sample Site	Sample Date	Disinfectant	Residual Conc. (C) (mg/L)	pH	Temp. (Celsius)	Peak Flow (GPM)	Volume (gal)	TDT (min)	Contact Time (T) (min)	CT_{calc}	4-log CT_{req}	Log Inactivation (viruses) See Error Messages in Columns S - Y	Additional Log Treatment Needed for 4-Log	No Disinfectant choosen in Column E	pH outside the range of values specified for systems using Chlorine Dioxide	pH outside the range of values specified for systems using Free Chlorine	pH outside the range of values specified for systems using Chloramines	Temperature has either not been entered or falls outside the range of values specified on the CT tables	Free chlorine residual concentration is not entered	No value is entered in the “Peak Flow (GPM)” column or if the value is zero.
1		Free Chlorine	0.50	7.20	20.0	6,000.0	265,000.0	44.2	30.9	15.5	3.00	**20.61**	**0.00**							

If CT is obtained using a length of pipe enter a Baffling Factor of 1.00 below
Otherwise enter the Baffling Factor for your storage tank as approved by the State.
For additional guidance on determining your baffling factor see Appendix G of EPA's Benchmarking and Profiling Guidance Manual (www.epa.gov/safewater)

Enter name of GWTF: MRM Water Treatment Plant

(This is for your records - Provides no input to calculations)

Enter Baffling Factor for GWTF: 0.70

Minimum Log Inactivation Provided: **94.07**

Sample Site	Sample Date	Disinfectant	Residual Conc. (C) (mg/L)	pH	Temp. (Celsius)	Peak Flow (GPM)	Volume (gal)	TDT (min)	Contact Time (T) (min)	CT_{calc}	4-log CT_{req}	Log Inactivation (viruses) See Error Messages in Columns S - Y	Additional Log Treatment Needed for 4-Log	No Disinfectant choosen in Column E	pH outside the range of values specified for systems using Chlorine Dioxide	pH outside the range of values specified for systems using Free Chlorine	pH outside the range of values specified for systems using Chloramines	Temperature has either not been entered or falls outside the range of values specified on the CT tables	Free chlorine residual concentration is not entered	No value is entered in the “Peak Flow (GPM)” column or if the value is zero.
1		Free Chlorine	0.50	7.20	20.0	6,000.0	1,209,498.0	201.6	141.1	70.6	3.00	**94.07**	**0.00**							

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Client:
Subject: CLEARWELL BUOYANCY
By:
Date:
Chk'd:
Date:
Sheet Number
of
Project Number

Gravity loads -

Dead Load

Components	**Thickness**	**Length**	**Height / width**	**Nos**				**Volume**	
	ft	**ft**	**ft**					**Cu ft**	
Walls	1.33	439.5	16	1			1.33x439.5x16x1	9352.56	
	1	256	16	1			1x256x16x1	4096.00	
Top slab	0.66	100	74	1			0.66x100x74x1	4884.00	
Bottom Mat	1.75	102	76	1			1.75x102x76x1	13566.00	
							Total Volume	**31898.56**	Cu ft
				Concrete Density			**150**	**pcf**	
							Total load	**4784784**	↓**Lbs**
								4785	**kips**

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Client: ________________________

Subject: ________________________

Sheet Number

_____ of _____

By: ____________

Date: ____________

Chk'd: ____________

Date: ____________

Project Number

____

Buoyancy -

Water level for Buoyancy = 319 ft USGS EL. (Finished Grade EL 321 ft)

Bouyancy

Area	7400	Sq Ft	**H**	10	Ft	**Volume**	7400x10	74000.00	Cu Ft
							Total Volume	74000.00	Cu Ft
						Water density		**62.40**	**pcf**
					Bouyancy		**74000x62.4**	**#########**	↑ **Lbs**
								4618	**kips**

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Client: STTN: WTP
Subject: MIXING CHAMBER BUOYANCY CALCULATION
By:
Date:
Chk'd:
Date:
Sheet Number ____ of ____
Project Number 012-02080-21

Gravity loads -

Dead Load

Components	**Thickness**	**Length**	**Height / width**	**Nos**				**Volume**	
	ft	**ft**	**ft**					**Cu ft**	
Walls	1.33	57.32	14	1			1.33x57.32x14x1	1067.30	
Bottom Mat	1.75	22.66	10	1			1.75x22.66x10x1	396.55	
							Total Volume	**1463.85**	Cu ft
				Concrete Density			**150**	**pcf**	
							Total load	**219577.26**	↓**Lbs**
								220	**kips**

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Client: ______ Subject: ______		Sheet Number ______ of ______
By: ______ Date: ______	Chk'd: ______ Date: ______	Project Number ______

Buoyancy -

Water level for Buoyancy = 319 ft USGS EL. (Finished Grade EL 321 ft)

Bouyancy

Area	165.28	Sq Ft	**H**	10	Ft	**Volume**	165.28x10	1652.80	Cu Ft
							Total Volume	1652.80	Cu Ft
						Water density		**62.40**	**pcf**
					Bouyancy		**1652.8x62.4**	**103134.72**	↑**Lbs**
								103	**kips**

APPENDIX J

Appendix J Contains:

- chemical storage tank information
- containment calculations for interior berms
- SDS sheets for chemicals

March 29, 2022
Quote #24,614

SSOE Group

REF: STATE OF TENNESSEE CHEMICAL TANKS FOR WATER PLANT; SSOE# 012-02080-21

Attn: Kenneth Kowalski Ph: 567-218-2119 Email: kkowalski@ssoe.com

Estimated Lead-Time: 9-11 weeks after approved prints are received and finalized.
Allow 10-15 working days to receive prints for approval
Terms: Net 30 days after completion of fabrication
Applicable State or Local taxes are not included.
F.O.B.: Monroe, LA with **est. freight of $1,425.00 (for 4 tanks) to Memphis, TN**
NOTE: Freight rates are estimates only and may change upon actual shipment. Freight cost is subject to change based on actual loaded dimensions and route provided at time of shipment.
To be Shipped Via: Best Way
Salesperson: Mark Wagner/Gina Spampinato
Quote valid for: 5 days

We are pleased to submit our proposal for the following:

T-101 A/B – 12.5% SODIUM HYPOCHLORITE TANK

Quantity 1 – 1,450 gallon vertical Cross-Linked Polyethylene (XLPE – natural color) single wall tank with OR-1000 lining, 86” diameter x 59” straight side x 78” high. Tank will have a conical top, flat bottom, rated for **1.9** specific gravity and will include the following:

(1) 19” Cover, Safe-surge
(1) 4” PVC U-Vent
(2) 3” PVC Bulkhead fitting, EPDM gasket with flange adapter (inlet, level)
(3) 2” PVC Bulkhead fitting, EPDM gasket with flange adapter (spare, outlet, drain)
(1) 1” PVC Bulkhead fitting, EPDM gasket with flange adapter (sample)

PRICE: **$3,945.00 each tank plus freight**

T-102 A/B – 50% SODIUM HYDROXIDE TANK

Quantity 1 – 755 gallon vertical Cross-Linked Polyethylene (XLPE – natural color) single wall tank, 64” diameter x 55” straight side x 67” high. Tank will have a conical top, flat bottom, rated for **1.9** specific gravity and will include the following:

(1) 19” Cover, Safe-surge
(1) 4” PVC U-Vent
(2) 3” PVC Bulkhead fitting, EPDM gasket with flange adapter (inlet, level)
(3) 2” PVC Bulkhead fitting, EPDM gasket with flange adapter (spare, outlet, drain)
(1) 1” PVC Bulkhead fitting, EPDM gasket with flange adapter (sample)

PRICE: **$3,170.00 each tank plus freight**

PHOSPHATE TANK

Quantity 1 – 220 gallon vertical Cross-Linked Polyethylene (XLPE – natural color) single wall tank, 31" diameter x 30" straight side x 52" high (tank in stand). Tank will have a flat top, 15° cone bottom, rated for **1.9** specific gravity and will include the following:

(1) 10" Lid, mushroom
(1) 4" PVC U-Vent
(1) 3" PVC Bulkhead fitting, EPDM gasket with flange adapter (inlet)
(1) 2" PVC Bolted fitting, C-276 hardware & EPDM gasket with flange adapter (outlet)
(1) 15° Tank Stand, Carbon Steel, painted blue

PRICE: **$3,510.00 each tank plus freight**

This proposal is based on information and on specifications supplied for bidding and our interpretation of that information, along with our recommendations and/or changes for fabrication. Prices are subject to review and possible adjustment for any changes made that deviate from the outline given.

This proposal DOES NOT include any of the following unless noted above:

A. Unloading or Installation of equipment, or any required permits.
B. Hold down bolts / anchors.
C. All fasteners and gaskets.
D. Any electrical, instrumentation, exterior piping, piping hook up, valves, pumps, etc.
E. Testing such as; Hydro Test, Physical Testing, A/E Test, etc.
F. Design calculations, stamped or un-stamped.

If we can be of any further service to you, please contact us.

Sincerely,
WAGNER ENTERPRISE, INC.

Mark S. Wagner

MARK S. WAGNER
MSW/gs

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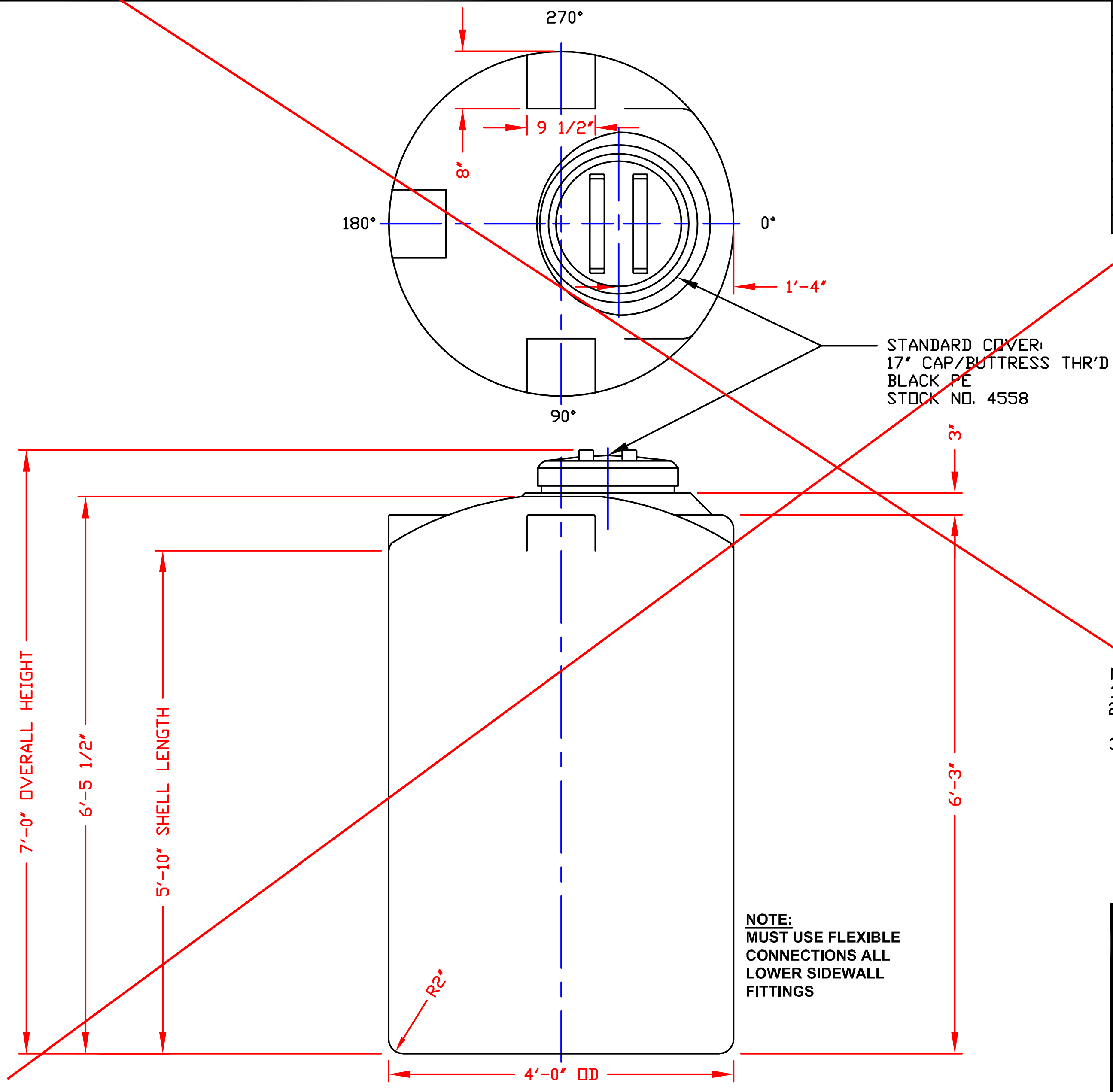

STANDARD COVER:
17" CAP/BUTTRESS THR'D
BLACK PE
STOCK NO. 4558

NOTE:
MUST USE FLEXIBLE CONNECTIONS ALL LOWER SIDEWALL FITTINGS

NOZZLE SCHEDULE & ACCESSORIES						
SERVICE	MK	STOCK NO.	SIZE	FITTING	DEG	ELEV

NOTES
1. THIS IS A COMPUTER GENERATED DWG. DO NOT REVISE BY HAND.
2. DIMENSIONS WILL VARY ±3% DUE TO VARIATIONS IN MULTIPLE MOLDS & CONDITIONS PREVALENT DURING MANUFACTURE & USAGE.
3. MOLDED IN GALLONAGE MARKERS @ APPROX. 15° IN 50 GALLON INCREMENTS UP TO 500 GALLON.

CALCULATED CAPACITIES/ VOLUME IN U.S. GALLONS		
DESIGN CAP	DOME VOL	TOTAL VOL
540	25	565

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DWG TITLE
545 GALLON UPRIGHT TANK

SCALE: 3/4"=1'-0"
DATE: 10/8/19

POLYPROCESSING
SOLUTIONS, SIMPLIFIED.

Central Region
P.O. Box 4150 (71211)
2201 Old Sterlington Rd.
Monroe, LA 71203
(318) 343-7565
FAX (318) 343-8795

DR: B. HARPER
CK:

SHEET: 1 OF 1
COMPUTER FILE: VERT-00545
REV: –

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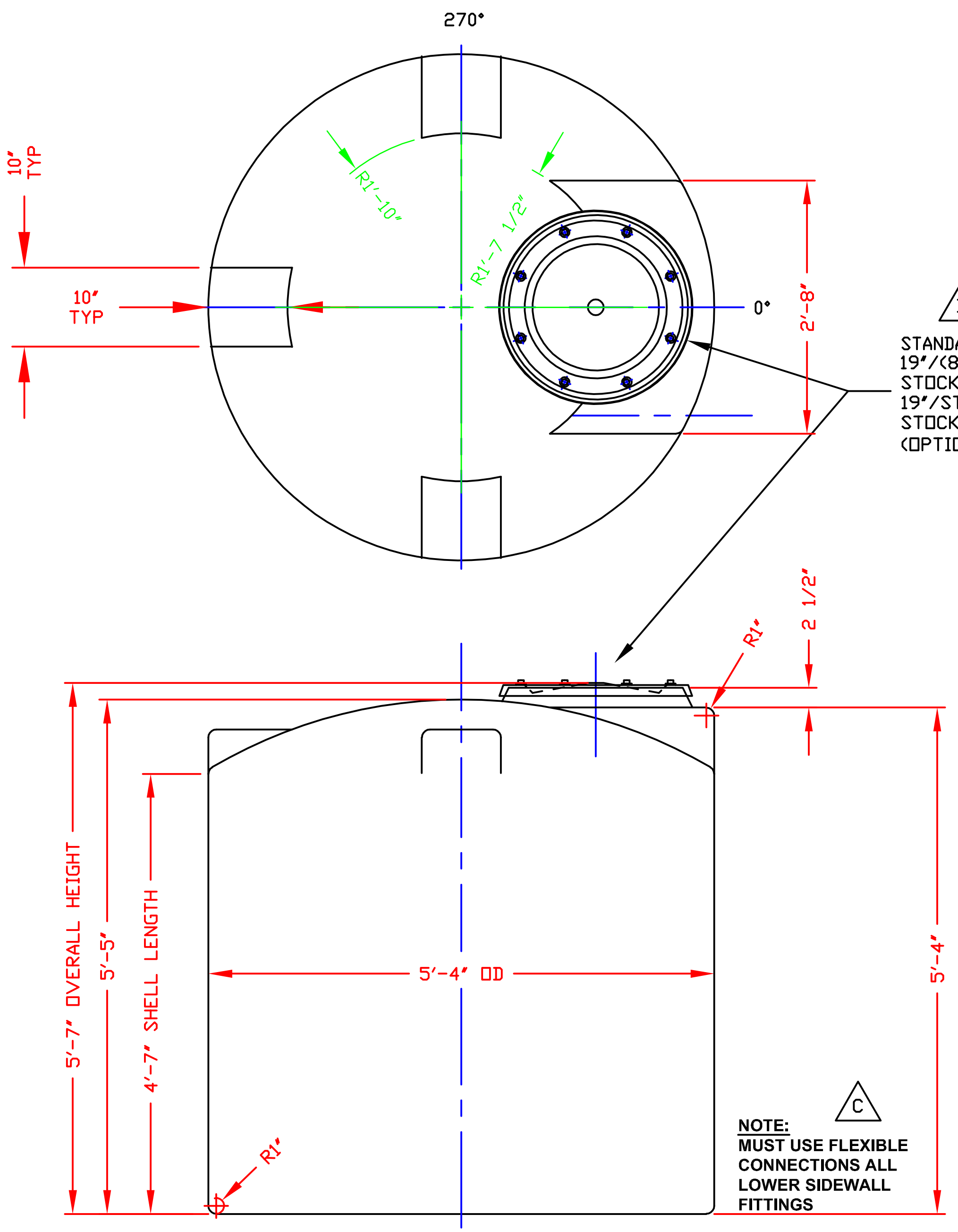

STANDARD COVER:
19″/(8) BOLT MANWAY COVER/PE (SHOWN)
STOCK NO. 3214 OR
19″/STRAPPED MANWAY COVER/PE
STOCK NO. 3212
(OPTIONAL 19″ COVERS AVAILABLE)

NOTE:
MUST USE FLEXIBLE CONNECTIONS ALL LOWER SIDEWALL FITTINGS

NOZZLE SCHEDULE & ACCESSORIES

SERVICE	MK	STOCK NO.	SIZE	FITTING	DEG	ELEV

REV "F" CHANGED MANWAY TO 19″ BY: KS 6/24/19 CK: CR
REV "E" ADDED FTG FLATS TO DOME BY: JB 1/10/13 CK:WM
REV "D" REVISED COVER BY:JB 8/4/09 CK:WM
REV "C" ADDED FITTING NOTE BY:MBW 2/11/03 CK:JB
REV "B" REVISED LID BY:MBW 2/11/03 CK:JB
REV "A" ADDED DIMENSION BY:JB 10/15/02 CK:MBW

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2. DIMENSIONS WILL VARY ±3% DUE TO VARIATIONS IN MULTIPLE MOLDS & CONDITIONS PREVALENT DURING MANUFACTURE & USAGE.
3. NO MOLDED IN GALLONAGE MARKERS THIS TANK.

CALCULATED CAPACITIES/ VOLUME IN U.S. GALLONS		
DESIGN CAP	DOME VOL	TOTAL VOL
756	61	817

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DWG TITLE
755 GALLON UPRIGHT TANK

SCALE: 3/4″=1′-0″
DATE: 10/8/19

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Central Region
P.O. Box 4150 (71211)
2201 Old Sterlington Rd.
Monroe, LA 71203
(318) 343-7565
FAX (318) 343-8795

DR: B. HARPER
CK:

SHEET: 1 OF 1
COMPUTER FILE: VERT-00755
REV: F

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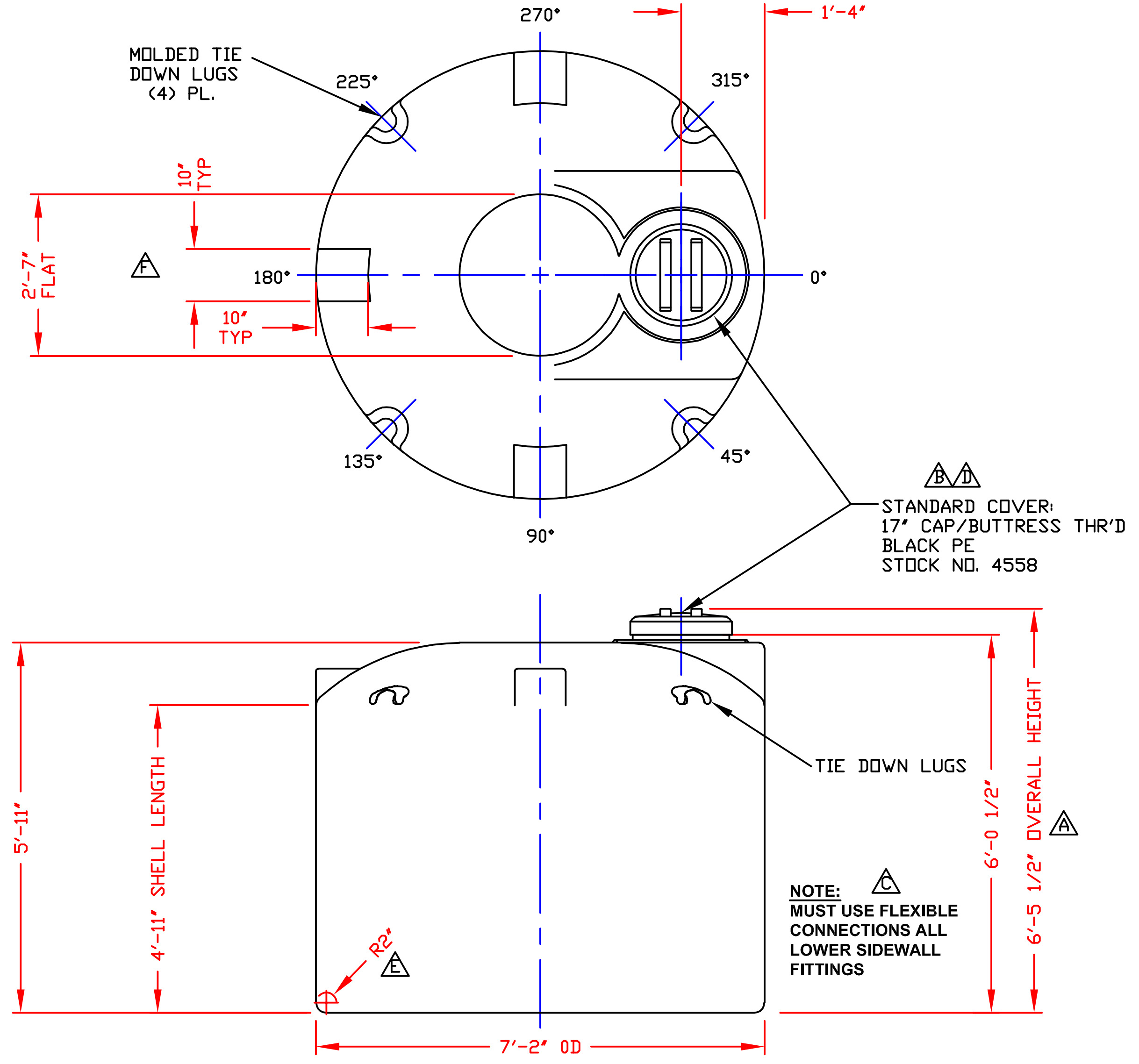
NOZZLE SCHEDULE & ACCESSORIES						
SERVICE	MK	STOCK NO.	SIZE	FITTING	DEG	ELEV



NOTES:

1. THIS IS A COMPUTER GENERATED DWG. DO NOT REVISE BY HAND.
2. DIMENSIONS WILL VARY ±3% DUE TO VARIATIONS IN MULTIPLE MOLDS & CONDITONS PREVALENT DURING MANUFACTURE & USAGE.
3. MOLDED IN GALLONAGE MARKERS IN MANWAY AREA IN 100 GALLON INCREMENTS UP TO 1600 GALLONS.

CALCULATED CAPACITIES/ VOLUME IN U.S. GALLONS		
DESIGN CAP	DOME VOL	TOTAL VOL
1464	147	1611

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DWG TITLE
1450 GALLON UPRIGHT TANK

SCALE: 1/2"=1'-0"
DATE: 10/9/19

POLYPROCESSING
SOLUTIONS, SIMPLIFIED.

Central Region
P.O. Box 4150 (71211)
2201 Old Sterlington Rd.
Monroe, LA 71203
(318) 343-7565
FAX (318) 343-8795

DR: B. HARPER
CK:

SHEET 1 OF 1
COMPUTER FILE VERT-01450
REV F

REV "F" ADDED FTG FLATS TO DOME BY:JB 1/8/12 CK:CD
REV "E" REVISED KNUCKLE RADIUS BY:BT4/26/12 CK:WM
REV "D" REVISED COVER BY:JB 7/23/09 CK:WM
REV "C" ADDED FITTING NOTE BY:MBW 2/17/03 CK:JB
REV "B" REVISED LID BY:MBW 2/17/03 CK:JB
REV "A" ADDED DIMENSION BY:JB 10/16/02 CK:MBW

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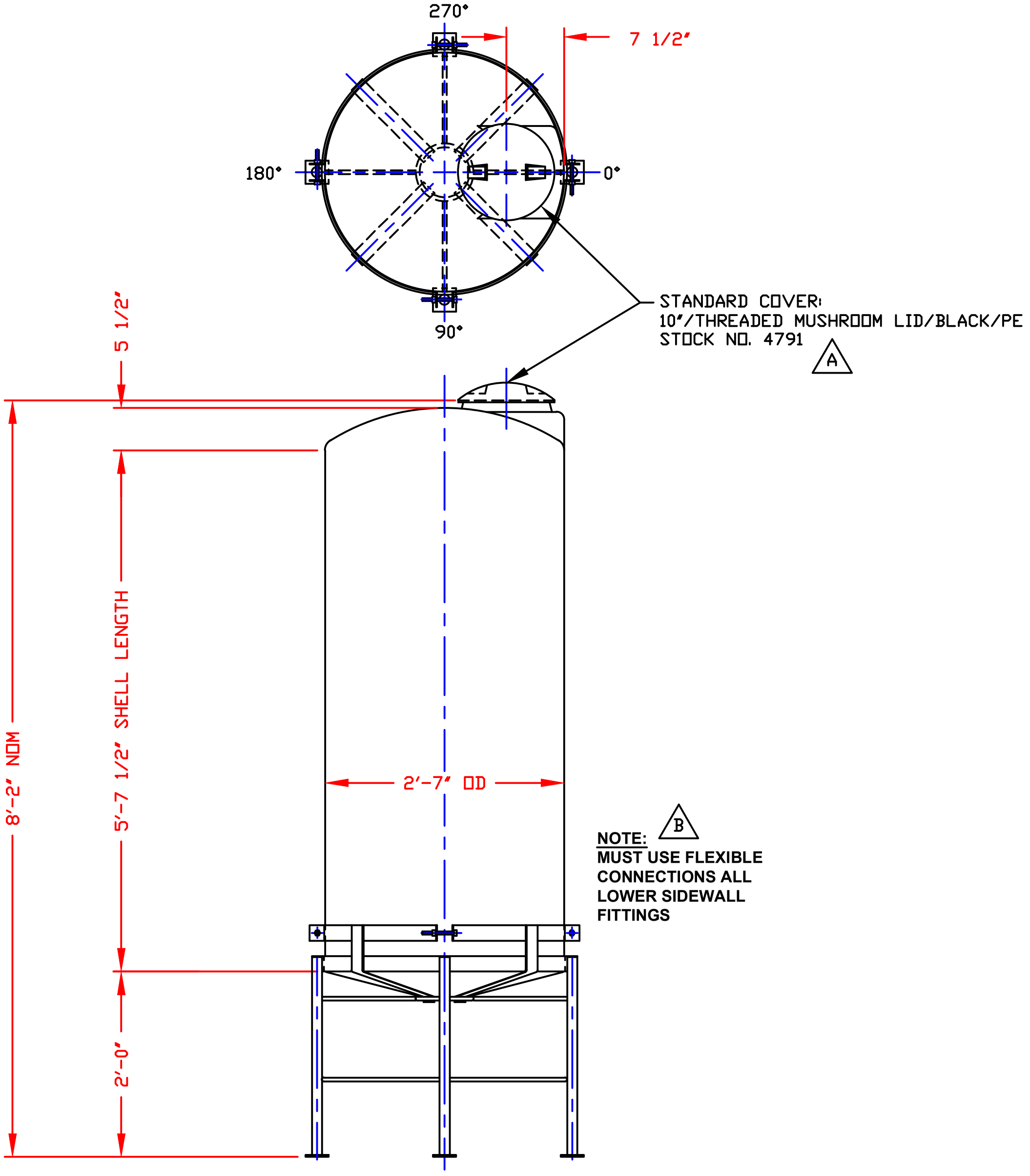
NOZZLE SCHEDULE & ACCESSORIES						
SERVICE	MK	STOCK NO.	SIZE	FITTING	DEG	ELEV



STANDARD COVER:
10"/THREADED MUSHROOM LID/BLACK/PE
STOCK NO. 4791

NOTE:
MUST USE FLEXIBLE CONNECTIONS ALL LOWER SIDEWALL FITTINGS

NOTES
1. THIS IS A COMPUTER GENERATED DWG. DO NOT REVISE BY HAND.
2. DIMENSIONS WILL VARY ±3% DUE TO VARIATIONS IN MULTIPLE MOLDS & CONDITIONS PREVALENT DURING MANUFACTURE & USAGE.
3. MOLDED IN GALLONAGE MARKERS @ 0° IN 50 GAL INCREMENTS UP TO 200 GAL.
4. FOR TANK DETAILS SEE DWG COMPUTER FILE 4000220.

CALCULATED CAPACITIES/ VOLUME IN U.S. GALLONS		
DESIGN CAP	DOME VOL	TOTAL VOL
222	7	229

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DWG TITLE
220 GALLON 15° CONE BOTTOM TANK W/2 FT STAND

SCALE: 3/4"=1'-0"
DATE: 1-12-00

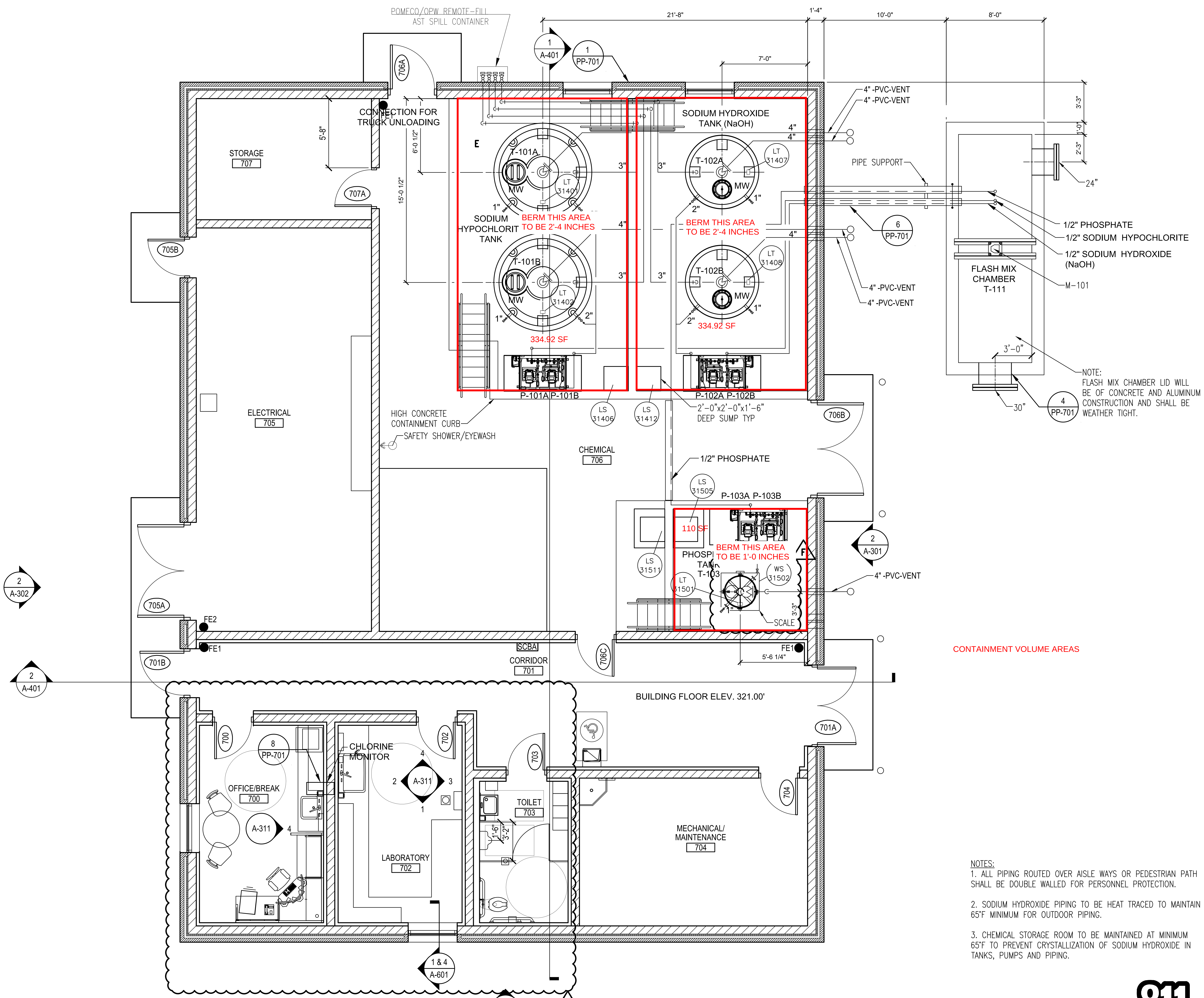
POLYPROCESSING COMPANY

Central Region
P.O. Box 4150 (71211)
2201 Old Sterlington Rd.
Monroe, LA 71203
(318) 343-7565
FAX (318) 343-8795

DR: D. RECTOR
CK: J. BRANTLEY
SHEET 1 OF 1
COMPUTER FILE 4000220S
REV B

REV 'B' ADDED FITTING NOTE BY:JB 6/10/03 CK:MBW
REV 'A' REVISED LID BY:JB 6/10/03 CK:MBW

B-75



WATER TREATMENT PIPING PLAN

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

NOTES:

1. ALL PIPING ROUTED OVER AISLE WAYS OR PEDESTRIAN PATH SHALL BE DOUBLE WALLED FOR PERSONNEL PROTECTION.

2. SODIUM HYDROXIDE PIPING TO BE HEAT TRACED TO MAINTAIN 65̊F MINIMUM FOR OUTDOOR PIPING.

3. CHEMICAL STORAGE ROOM TO BE MAINTAINED AT MINIMUM 65̊F TO PREVENT CRYSTALLIZATION OF SODIUM HYDROXIDE IN TANKS, PUMPS AND PIPING.

811
Know what's below.
Call before you dig.

ssoe

THE SEAL ON THIS DOCUMENT WAS AUTHORIZED BY:

SEAL ID:
DATE:

WATER
TREATMENT PLANT

MEMPHIS REGIONAL MEGASITE

STATE OF TN

SBC PROJ #
529/000-02-2010-04

CLIENT PROJECT NO:

NO.	DATE	SUBJECT
F	06-30-22	ADDENDUM 5
E	06-10-22	ADDENDUM 3
D	04-18-22	FINAL BID SET
C	03-30-22	CDP
B	02-25-22	DDP
A	02-16-22	PRE-DDP PROGRESS

REVISION OR ISSUE

SSOE, Inc.
320 Seven Springs Way, Suite 350
Brentwood, TN 37027
T 615-661-7585

PROJECT NO: 012-02080-21
PROJECT MANAGER: D. HIBDON
DESIGNED: K. KOWALSKI
CHECKED: R. KOWALINSKI

DRAWING TITLE:
WATER TREATMENT
PIPING LAYOUT

DRAWING NO:
700-PP-111

Sodium hydroxide containment area

No safety factor in calculations

Area measured on PDF		**335**	SF
Volume to be contained:		gallons	
Total volume of	Largest tank: NaOH	950	
	Sprinkler water	1340	
		2290	gallons
		306.15	cubic feet required

Sprinkler water desndity:	0.2 GPM/ft2
Duration	20 minutes

Area x density x duration = volume

335 ft2 x 0.2 GPM/ft2 x 20 mi = 1340 gallons

Area determination: deductions from avail. Area

tanks to be deducted from available area

Tank	dia / size	Qty	ht	SF	total
NaOH	5'-4	1	1	22.3	22.3
Conc Base	6'-0	2	0.5	28.27	28.27
pump pad	6'-4 x 3'	1	1	18.99	18.99
Floor sump	2'x2'x2'	1	1	8	-8
		total area			61.56

Note: tank base used as area for displcement

Berm height Calculation:

Required containment volume	306.15	CF
Avaialble area	273.44	SF
Required berm height = volume / Area	1.12	ft
USE	1.33	Ft.

Sodium hypochlorite containment area

No safety factor in calculations

Area measured on PDF		**335**	SF
Volume to be contained:			gallons
Total volume Largest tank:	NaOCl	1950	
Sprinkler water		1340	
		3290	gallons
		439.84	cubic feet required

Sprinkler water desndity:	0.2 GPM/ft2
Duration	20 minutes

Area x density x duration = volume

335 ft2 x 0.2 GPM/ft2 x 20 min = 1340 gallons

Area determination: deductions from avail. Area

tanks to be deducted from available area

Tank	dia / size	Qty	ht	SF	total
NaOCl	7'-2	1	1.75	40.2	70.35
Conc Base	8'-0	2	0.5	50.26	50.26
pump pad	6'-4 x 3'	1	1	18.99	18.99
Floor sump	2'x2'x2'	1	1	8	-8
		total area			131.6

Note: tank base used as area for displcement

Berm height Calculation:

Required containment volume	439.84	CF
Avaialble area	203.40	SF
Required berm height = volume / Area	2.16	ft
USE	2.33	Ft.

Phosphate containment area

No safety factor in calculations

Area measured on PDF **110** SF

Volume to be contained: gallons

Total colume	Largest tank:	Phos	220
	Sprinkler water		440
			660 gallons
			88.24 cubic feet required

Sprinkler water desndity: 0.2 GPM/ft2

Duration 20 minutes

Area x density x duration = volume

110 ft2 x 0.2 GPM/ft2 x 20 min = 440 gallons

Area determination: deductions from avail. Area

tanks to be deducted from available area

Tank	dia / size	Qty	ht	SF	total
Phos	2'-6	1	0	19.6	0
Conc Base	3'-6	1	0.5	9.62	4.81
pump pad	6'-4 x 3'	1	1	18.99	18.99
Floor sump	2'x2'x2'	1	1	8	-8
		total area			15.8

Note: tank base used as area for displcement

Berm height Calculation:

Required containment volume 88.24 CF

Avaialble area 94.20 SF

Required berm height = volume / Area 0.94 ft

USE 1.0 Ft.

SAFETY DATA SHEET

1. Identification

Product identifier	**Sodium Hypochlorite 12.5%**
Other means of identification	
SDS Number	320222-08
Product registration number	EPA 148-1288
Recommended use	Bleaching agent; water treatment; disinfectant; detergent; cleaning agent.
Recommended restrictions	None known.

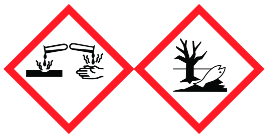
Manufacturer/Importer/Supplier/Distributor information

Company name	Harcros Chemicals Inc
Address	5200 Speaker Rd. Kansas City, KS 66106 United States
Main Telephone Number	1-913-321-3131
Website	www.harcross.com
E-mail	custserv@harcross.com
Emergency #: CHEMTREC	1-800-424-9300 1-703-741-5970 (International Number - Call Collect)

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Skin corrosion/irritation	Category 1
	Serious eye damage/eye irritation	Category 1
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements



Signal word	Danger
Hazard statement	Causes severe skin burns and eye damage. Causes serious eye damage. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.
Precautionary statement	
Prevention	Do not breathe mist or vapors. Avoid release to the environment. Wear eye protection/face protection. Wear protective impervious gloves,protective clothing,eye protection/face protection.
Response	If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Wash contaminated clothing before reuse.
Storage	Store away from incompatible materials. Store in a well-ventilated place. Keep container tightly closed. Store locked up. Store in accordance with local,regional,national, and international regulations.
Disposal	Dispose of contents and container in accordance with local, regional, national, and international regulations.

Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	22.4% of the mixture consists of component(s) of unknown acute dermal toxicity. 12.5% of the mixture consists of component(s) of unknown acute inhalation toxicity. 9.9% of the mixture consists of component(s) of unknown acute hazards to the aquatic environment. 9.9% of the mixture consists of component(s) of unknown long-term hazards to the aquatic environment.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Water		7732-18-5	75 - 80
Sodium Hypochlorite		7681-52-9	11.9 - 15.6
Sodium Hydroxide		1310-73-2	0.1 - 2
Sodium Chloride		7647-14-5	≤ 12.5

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Most important symptoms/effects, acute and delayed	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim under observation. Symptoms may be delayed.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Foam. Powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not breathe mist/vapors. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Absorb/clean with appropriate and compatible material. Stop flow of material if without risk. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Do not breathe mist or vapors. Do not get in eyes, on skin, or on clothing. Avoid prolonged exposure. Provide adequate ventilation. Wear appropriate personal protective equipment. Avoid release to the environment. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Store in tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	PEL	2 mg/m3

US. ACGIH Threshold Limit Values

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

US. Workplace Environmental Exposure Level (WEEL) Guides

Components	Type	Value
Sodium Hypochlorite (CAS 7681-52-9)	STEL	2 mg/m3

Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Not available.

Individual protection measures, such as personal protective equipment

General	It is recommended that users of this product perform a risk assessment to determine the appropriate PPE.
Eye/face protection	Do not get in eyes. Wear chemical goggles and face shield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.
Skin protection	
Hand protection	Wear appropriate chemical resistant, impervious gloves. Wear protective gloves. For prolonged or repeated skin contact use suitable protective and impervious gloves.
Other	Wear appropriate chemical resistant clothing.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	Clear.
Physical state	Liquid.
Form	Liquid.
Color	Clear to pale yellow.
Odor	Chlorine.
Odor threshold	Not available.
pH	12 - 14 (1% in DI Water)
Melting point/freezing point	-4 - 3 °F (-20 - -16.11 °C)

Initial boiling point and boiling range	> 230 °F (> 110 °C)
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	12 mm Hg @ 20°C
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Soluble.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.
Specific gravity	1.209 @ 20°C

10. Stability and reactivity

Reactivity	Reacts violently with strong acids. This product may react with oxidizing agents.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Reacts violently with strong acids. This product may react with oxidizing agents. Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials. Do not mix with other chemicals.
Incompatible materials	Strong acids. Bases, alkalis (organic). Oxidizing agents.
Hazardous decomposition products	Chlorine. Hydrogen chloride.

11. Toxicological information

Information on likely routes of exposure	
Inhalation	May cause irritation to the respiratory system. Prolonged inhalation may be harmful.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
Ingestion	Causes digestive tract burns.
Symptoms related to the physical, chemical and toxicological characteristics	Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.
Information on toxicological effects	
Acute toxicity	Not known.

Components	**Species**	**Test Results**
Sodium Chloride (CAS 7647-14-5)		
<u>Acute</u>		
Oral		
LD50	Rat	3000 mg/kg

Components	Species	Test Results
Sodium Hydroxide (CAS 1310-73-2)		
Acute		
Dermal		
LD50	Rat	1350 mg/kg
Oral		
LD50	Rat	140 - 340 mg/kg
Sodium Hypochlorite (CAS 7681-52-9)		
Acute		
Oral		
LD50	Rat	8.91 g/kg

Skin corrosion/irritation Causes severe skin burns and eye damage.

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization Due to partial or complete lack of data the classification is not possible.

Skin sensitization Due to partial or complete lack of data the classification is not possible.

Germ cell mutagenicity Due to partial or complete lack of data the classification is not possible.

Carcinogenicity Due to partial or complete lack of data the classification is not possible.

IARC Monographs. Overall Evaluation of Carcinogenicity

Sodium Hypochlorite (CAS 7681-52-9)	3 Not classifiable as to carcinogenicity to humans.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity Due to partial or complete lack of data the classification is not possible.

Specific target organ toxicity - single exposure Due to partial or complete lack of data the classification is not possible.

Specific target organ toxicity - repeated exposure Due to partial or complete lack of data the classification is not possible.

Aspiration hazard Due to partial or complete lack of data the classification is not possible.

Chronic effects Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity Very toxic to aquatic life with long lasting effects.

Product		Species	Test Results
Sodium Hypochlorite 12.5%			
	EC50		40 mg/l, 96 hours Nittocra Spinipes Fasciatus
			4 mg/l, 96 hours Gammarus Fasciatus
Aquatic			
Crustacea	EC50	Daphnia	2519.1724 mg/l, 48 hours estimated
			0.07 - 0.7 mg/l, 24 hours magnia
			0.006 mg/l, 24 hours Ceriodaphina sp.
Fish	LC50	Fish	12.5131 mg/l, 96 hours estimated

Components		Species	Test Results
Sodium Chloride (CAS 7647-14-5)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	340.7 - 469.2 mg/l, 48 hours
Fish	LC50	Fathead minnow (Pimephales promelas)	6020 - 7070 mg/l, 96 hours

Components		Species	Test Results
Sodium Hydroxide (CAS 1310-73-2)			
Aquatic			
Crustacea	EC50	Water flea (Ceriodaphnia dubia)	34.59 - 47.13 mg/l, 48 hours
	LC50	Common shrimp, sand shrimp (Crangon crangon)	33 - 100 mg/l, 48 hours
Fish	LC50	Bony fish superclass (Osteichthyes)	33 - 100 mg/l, 48 hours
		Western mosquitofish (Gambusia affinis)	125 mg/l, 96 hours
Sodium Hypochlorite (CAS 7681-52-9)			
Aquatic			
Fish	LC50	Chinook salmon (Oncorhynchus tshawytscha)	0.038 - 0.065 mg/l, 96 hours

Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available.
Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Incinerate the material under controlled conditions in an approved incinerator. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN1791
UN proper shipping name	Hypochlorite solutions (Sodium Hypochlorite), MARINE POLLUTANT
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Label(s)	8
Packing group	III
Environmental hazards	
Marine pollutant	Yes
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	IB3, N34, T4, TP2, TP24
Packaging exceptions	154
Packaging non bulk	203
Packaging bulk	241

Reportable Quantity for Sodium Hypochlorite = 100 lbs.
Not a Marine Pollutant by DOT in containers of 119 gallons or less.

IATA

UN number	UN1791
UN proper shipping name	Hypochlorite solution (Sodium Hypochlorite)
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	III
Environmental hazards	Yes
ERG Code	8L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Other information	
Passenger and cargo aircraft	Allowed with restrictions.
Cargo aircraft only	Allowed with restrictions.
IMDG	
UN number	UN1791
UN proper shipping name	Hypochlorite solution (Sodium Hypochlorite), MARINE POLLUTANT
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Label(s)	8
Packing group	III
Environmental hazards	
Marine pollutant	Yes
EmS	Not available.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not established.

DOT

IATA; IMDG

Marine pollutant

General information	IMDG Regulated Marine Pollutant.

15. Regulatory information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
Toxic Substances Control Act (TSCA)	All components of the mixture on the TSCA 8(b) inventory are designated “active”.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Sodium Hydroxide (CAS 1310-73-2)	Listed.
Sodium Hypochlorite (CAS 7681-52-9)	Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1053)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	Yes
Classified hazard categories	Skin corrosion or irritation Serious eye damage or eye irritation

SARA 313 (TRI reporting)

Not regulated.

US state regulations

California Proposition 65

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins. For more information go to www.P65Warnings.ca.gov.

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Sodium Hydroxide (CAS 1310-73-2)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	05-05-2014
Revision date	11-19-2019
Version #	16
HMIS® ratings	Health: 3 Flammability: 0 Physical hazard: 1
NFPA ratings	Health: 3 Flammability: 0 Instability: 1

Disclaimer	The information provided in this Safety Data Sheet has been obtained from sources believed to be reliable. Chemistry Connection provides no warranties, either expressed or implied and assumes no responsibility for the accuracy or completeness of the data contained herein. This information is offered for your information, consideration, and investigation. You should satisfy yourself that you have all current data relevant to your particular use. Chemistry Connection knows of no medical condition, other than those noted on this Safety Data Sheet, which are generally recognized as being aggravated by exposure to this product.
Revision information	Product and Company Identification: Product and Company Identification Hazard(s) identification: Disposal Hazard(s) identification: Prevention Hazard(s) identification: Storage Accidental release measures: Personal precautions, protective equipment and emergency procedures Accidental release measures: Methods and materials for containment and cleaning up Handling and storage: Precautions for safe handling Exposure controls/personal protection: Appropriate engineering controls Exposure controls/personal protection: General Exposure controls/personal protection: Hand protection Physical & Chemical Properties: Multiple Properties Transport Information: Material Transportation Information Other information, including date of preparation or last revision: Disclaimer GHS: Classification

MATERIAL SAFETY DATA SHEET

Product(s): ACCO Aqua Mag®-L
(Aqua Mag® is a registered name of Carus Corporation.)

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product

Product Name:	ACCO Aqua Mag®-L
Synonyms:	Blended Phosphate Solution
Issue Date:	May 25, 2011

Company Identification

Supplier
ACCO Unlimited Corporation
5300 NW 55 Avenue
Johnston, IA 50131
(515) 278-0487

Manufacturer
Carus Phosphates, Inc.
315 Fifth Street
Peru, IL 61354
(815) 223-1500

FOR CHEMICAL EMERGENCY, CALL CHEMTREC (24 HOURS): 1-800-424-9300

SECTION 2: HAZARDS IDENTIFICATION

Hazardous Materials Identification System (HMIS) Ratings:

Health:	1 - Slight
Flammability:	0 - None
Reactivity:	0 - None
Personnel Protective Equipment:	Goggles, face shield, apron, respirator and proper gloves.

Inhalation: May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.

Ingestion: Phosphates are slowly and incompletely absorbed when ingested, and seldom result in systemic effects. Such effects, however, have occurred. Symptoms may include vomiting, lethargy, diarrhea, blood chemistry effects, heart disturbances and central nervous system effects. The toxicity of phosphates is due to their ability to sequester calcium.

Skin Contact: May cause irritation. May cause inflammation and pain on prolonged contact, especially with moist skin.

Eye Contact: May cause irritation, redness and pain.

Chronic Exposure: May sequester calcium and cause calcium phosphate deposits in the kidneys.

Aggravation of Pre-Existing Conditions: No information found.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Material	PEL	TLV	CAS NO.	E.C. NO.	%
Diphosphoric acid, disodium salt	No Data	No Data	7758-16-9	231-835-0	1 – 15
Other non-hazardous ingredients	No Data	No Data	Not Applicable	Not Applicable	50 - 99

This product contains no toxic chemicals subject to the reporting requirements of Section 313 – Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

All the components in this product are generally considered to be safe and none could be classified as hazardous according to the WHMIS system. None are listed on the Canadian Ingredient Disclosure List.

Carcinogenicity: Not listed by NTP.

Hazard Symbols: None.

Risk Phrases:	22	Harmful if swallowed.	38	Irritating to skin.
Safety Phrases:	2	Keep out of reach of children	61	Avoid releases to the environment.

SECTION 4: FIRST AID MEASURES

Eyes:	Immediately flush eyes with large amounts of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface.
Skin:	Immediately wash contaminated areas with water. Remove contaminated clothing and footwear. Wash clothing and decontaminate footwear before reuse.
Inhalation:	Remove person from contaminated area to fresh air.
Ingestion:	Never give anything by mouth to an unconscious or convulsing person. If person is conscious, give large quantities of water or milk. Seek medical attention immediately.

SECTION 5: FIRE FIGHTING MEASURES

NFPA* Hazard Ratings:

Health:	1	=	Materials which under fire conditions would give off irritating combustion products (less than 1 hour exposure). Materials which on the skin could cause irritation.
Flammability:	0	=	Materials that will not burn.
Reactivity:	0	=	Materials which in themselves are normally stable, even under fire exposure conditions, and which are not reactive with water.
Special Hazard:	None		

***National Fire Protection Association 704**

First Responders:	Wear protective gloves, boots, goggles, and respirator. In case of fire, wear positive pressure breathing apparatus. Approach incident with caution.	
Flash Point	None	
Flammable or Explosive Limits	Lower: Nonflammable	Upper: Nonflammable
Extinguishing Media	Use large quantities of water. Dike to contain.	

SECTION 6: ACCIDENTAL RELEASE MEASURES

Steps To Be Taken If Material Is Released Or Spilled: Contain spill by collecting the liquid in a pit or holding behind a dam (sand or soil). Absorb with inert media and dispose of properly. Disposal of all materials shall be in full and strict compliance with all federal, state, and local regulations pertaining to phosphates. Flush area with large amounts of water.

Personnel Precautions: Personnel should wear protective clothing suitable for the task.

SECTION 7: HANDLING AND STORAGE

Work/Hygiene Practices:	Wash hands thoroughly with soap and water after handling phosphate solution, and before eating or smoking. Wear proper protective equipment. Remove clothing, if it becomes contaminated.
Ventilation Requirements:	Provide sufficient mechanical and/or local exhaust.
Conditions For Safe Storage:	Protect containers from physical damage. Store in a cool, dry area in closed containers.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection:	In cases where overexposure to mist may occur, use an approved NIOSH-MSHA mist respirator (N-95 or better). Engineering or administrative controls should be implemented to control mist.
Eye:	Face shield, goggles, or safety glasses with side shields should be worn. Provide eyewash in working area.
Gloves:	Rubber or plastic gloves should be worn.
Other Protective Equipment:	Normal work clothing covering arms and legs, and rubber, or plastic apron should be worn. Caution: If clothing becomes contaminated, wash off immediately.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance And Odor:	Colorless solution, odorless
Boiling Point, 760 mm Hg:	>101°C
Freezing Point:	< 0°C
Vapor Pressure (mm Hg):	Not applicable
Solubility In Water % By Solution:	Miscible in all proportions
Percentage Volatile By Volume:	55% (as water)
Evaporation Rate:	Same as water
Specific Gravity:	1.37 ± 0.03
pH:	4.7 ± 0.5

SECTION 10: STABILITY AND REACTIVITY

Stability:	Under normal conditions, the material is stable.
Conditions To Avoid:	Do not expose to extreme temperatures.
Incompatible Materials:	Soluble calcium salt solutions and hydrofluoric or hydrofluosilicic acid could cause precipitations.
Hazardous Decomposition:	When involved in a fire, the material may form toxic fumes of phosphorous oxides.
Condition Contributing To Hazardous Polymerization:	Material is not known to polymerize.

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Overexposure:	Irritating to body tissue with which it comes into contact.
Chronic Overexposure:	No known cases of chronic poisoning due to phosphate solutions have been reported. May sequester calcium and cause calcium phosphate deposits in the kidneys.
Carcinogenicity:	None of the components have been classified as a carcinogen by OSHA, NTP, and IARC.
Medical Conditions Generally Aggravated by Exposure:	Phosphate solution will cause further irritation of tissue, open wounds, burns or mucous membranes.

SECTION 12: ECOLOGICAL INFORMATION

None.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal: Disposal of all materials shall be in full and strict compliance with all federal, state, and local regulations pertaining to phosphates. Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

SECTION 14: TRANSPORT INFORMATION

Not regulated by US DOT, Canada TDG, UN, IMDG, IATA regulations.

SECTION 15: REGULATORY INFORMATION

US Federal Regulations
TSCA: All components in this product are listed on the TSCA inventory.
Health & Safety Reporting List: None of the chemicals in this product are on the Health & Safety Reporting List.
Chemical Test Rules: None of the chemicals in this product are under a Chemical Test Rule.
Section 12b: None of the chemicals in this product are listed under TSCA Section 12b.
TSCA Significant New Use Rule: None of the chemicals in this product have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs: None of the chemicals in this product have an RQ.
SARA Section 302 Extremely Hazardous Substances: None of the chemicals in this product have a TPQ.
SARA Codes: Acute **Section 313:** None of chemicals in this product are reportable under Section 313.
Clean Air Act: This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 or Class 2 Ozone depletors.
Clean Water Act: None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Priority Pollutants under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA: None of the chemicals in this product are considered highly hazardous by OSHA.
State: None of the chemicals in this product are present on state lists from CA, PA, WI, MA, or NJ.
California Prop 65: California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives:

Hazard Symbols:	None			
Risk Phrases:	22	Harmful if swallowed.	38	Irritating to skin.
Safety Phrases:	2	Keep out of reach of children	61	Avoid releases to the environment.

WGK (Water Danger/Protection): None

Canada - DSL/NDSL: All components are listed on Canada's DSL List
Canada - WHMIS: None of the components in this product could be classified as hazardous in accordance with the hazard criteria of the Controlled Products Regulations.
Canadian Ingredient Disclosure List: None of the components in this product are listed on the Canadian Ingredient Disclosure List.

SECTION 16: OTHER INFORMATION

NIOSH:	National Institute for Occupational Safety and Health
MSHA:	Mine Safety and Health Administration
OSHA:	Occupational Safety and Health Administration
NTP:	National Toxicology Program
IARC:	International Agency for Research on Cancer
PEL:	Permissible Exposure Limit
DSL/NDSL:	The Domestic Substances and the Non-Domestic Substances List (Canada)
TLV-TWA:	Threshold Limit Value-Time Weighted Average
CAS:	Chemical Abstract Service
EINECS:	Inventory of Existing Chemical Substances (European) (EC. No.)

The information contained herein is provided in good faith and is believed to be correct as of the date hereof. However, ACCO Unlimited Corporation makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgment in determining its appropriateness for a particular purpose. Accordingly, ACCO Unlimited Corporation will not be responsible for damages of any kind resulting from the use of or reliance upon such information. No representations, or warranties, either express or implied, or merchantability fitness for a particular purpose or of any other nature are made hereunder with respect to the information set forth herein or to the product to which the information refers.

ERCO Worldwide

SAFETY DATA SHEET

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

1. Identification

Product identifier	**Sodium Hydroxide Solution**
Other means of identification	Liquid caustic (solution of 18-70% Sodium hydroxide in water), Soda lye solution, Caustic soda solution, Aqueous alkali metal hydroxide, NaOH
Product family	Alkali metal hydroxide
Recommended use	Acid neutralization, petroleum refining, manufacture of paper, cellulose, textiles, plastics, explosives and dyestuffs. Metal cleaning, etching and electroplating. Regeneration of ion exchange resins.
Recommended restrictions	None known

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company name	ERCO Worldwide
Address	335 Carlingview Drive Unit 1 Etobicoke, M9W 5G8 Canada
Telephone	(416) 239-7111 (M- F: 8:00 am – 5:00pm EST)
Website	http://www.ercoworldwide.com
E-mail	productinfo@ercoworldwide.com
Emergency phone number	Canada & USA: 1-800-424-9300 (CHEMTREC)

Supplier Refer to Manufacturer

2. Hazard(s) Identification

Physical hazards	Corrosive to metals	Category 1
Health hazards	Skin corrosion	Category 1A
	Serious eye damage	Category 1
	Acute Toxicity, Oral	Category 3
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation

Environmental hazards Not currently regulated by OSHA, refer to Section 12 for additional information.

OSHA defined hazards This mixture does not meet the classification criteria according to OSHA HazCom 2012.

Label elements	
Signal word	Danger
Hazard statement	May be corrosive to metals. Toxic if swallowed. Causes severe skin burns and eye damage. May cause respiratory irritation.
Precautionary statement	
Prevention	Keep only in original container. Wash hands and face thoroughly after handling. Do not eat, drink or smoke when using this product. Do not breathe dusts or mist. Wear protective gloves, protective clothing, eye protection, face protection. Avoid breathing fume, gas, vapors, spray. Use only outdoors or in a well-ventilated area.
Response	Immediately call a POISON CENTER or doctor/physician. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (OR HAIR): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Absorb spillage to prevent material damage.
Storage	Store locked up. Store in a well-ventilated place. Keep container tightly closed. Store in corrosive resistant container with a resistant inner liner.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	No OSHA defined hazard classes. Other hazards which do not result in classification: Contact with most metals will generate flammable hydrogen gas. Contact with water will generate considerable heat. Reacts vigorously, violently or explosively with many organic and inorganic chemicals, such as strong acids, acid chlorides, acid anhydrides, ketones, glycols and organic peroxides. Chronic skin contact with low concentrations may cause dermatitis.
Supplemental information	Not applicable.

3. Composition/Information on Ingredients

Chemical name	Common name and synonyms	CAS number	Conc. % By Weight
Sodium Hydroxide	Caustic Soda, Lye (Sodium), Sodium Hydrate, Soda Lye	1310-73-2	18 - < 70 w/w%
Dihydrogen oxide	Water	7732-18-5	Balance

Chemical name of impurities, stabilizing solvents and/or additives: None

4. First-Aid Measures

Inhalation	Move to fresh air. If breathing is difficult, trained personnel should give oxygen. If breathing stops, provide artificial respiration. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediately call a POISON CENTER or doctor/physician.
Skin Contact	Take off immediately all contaminated clothing. Immediately flush skin with running water for at least 20 minutes, or until the feeling of slipperiness disappears. Cover wound with sterile dressing. Do not rub area of contact. Wash contaminated clothing before reuse. Leather and shoes that have been contaminated with the solution may need to be destroyed. Immediately call a POISON CENTER or doctor/physician.
Eye Contact	Immediately flush eyes with plenty of water for at least 20 minutes, holding the eyelids open. Remove contact lenses, if present and easy to do. Continue rinsing. Take care not to rinse contaminated water into the unaffected eye or onto the face. Immediately call a POISON CENTER or doctor/physician.
Ingestion	Rinse mouth. Do NOT induce vomiting. Never give anything by mouth to a victim who is unconscious or is having convulsions. If victim can swallow, have him/her drink one cup of water to dilute material in stomach. If vomiting occurs naturally, repeat administration of water. Immediately call a POISON CENTER or doctor/physician.
Most important symptoms/effects, acute and delayed	Inhalation of mists can cause severe respiratory irritation. Symptoms may include coughing, choking and wheezing. Inhalation could result in pulmonary edema (fluid accumulation). Symptoms of pulmonary edema (chest pain, shortness of breath) may be delayed. Direct skin contact may cause corrosive skin burns, deep ulcerations and possibly permanent scarring. Corrosive to the eyes and may cause severe damage including blindness. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. May cause severe irritation and corrosive damage in the mouth, throat

	and stomach. Symptoms may include abdominal pain, vomiting, burns, perforations, bleeding and eventually death.
Indication of immediate medical attention and special treatment needed	Immediate medical attention is required. Causes chemical burns. Symptoms may be delayed.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-Fighting Measures

Suitable extinguishing media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Use as appropriate: Water Spray or Fog. Alcohol resistant foam. Dry chemical powder. Use water with caution. Contact with water will generate considerable heat. Do not apply water directly to sodium hydroxide since it can generate significant heat and cause spattering.
Unsuitable extinguishing media	Carbon dioxide (CO_2). Use chemical extinguishing agents with caution. Some chemical extinguishing agents may react with this material.
Specific hazards arising from the chemical	Not considered flammable. Contact with most metals will generate flammable hydrogen gas. Contact with water will generate considerable heat. The heat that is generated may be sufficient enough to ignite nearby combustible materials. Reacts vigorously, violently or explosively with many organic and inorganic chemicals, such as strong acids, acid chlorides, acid anhydrides, ketones, glycols and organic peroxides. Toxic fumes, gases or vapours may evolve on burning.
Special protective equipment and precautions for firefighters	Firefighters should wear proper protective equipment and self-contained breathing apparatus with full face piece operated in positive pressure mode. A full-body chemical resistant suit should be worn.
Firefighting equipment/instructions	Fight fire with normal precautions from a reasonable distance. Evacuate the area promptly. Move containers from fire area if you can do so without risk. Use water spray to cool unopened containers. Do not allow run-off from firefighting to enter drains or water courses. Dike for water control.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials. When moist, sodium hydroxide can react with metals, such as aluminum, tin and zinc, to form flammable and explosive hydrogen gas. Toxic sodium oxide fumes can be generated by thermal decomposition at elevated temperatures.

Hazardous combustion products

Fight fire with normal precautions from a reasonable distance. Evacuate the area promptly. Move containers from fire area if you can do so without risk. Use water spray to cool unopened containers. Do not allow run-off from firefighting to enter drains or water courses. Dike for water control.

6. Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Immediately evacuate personnel to safe areas. Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up

Ventilate the area. Remove sources of ignition. Stop leak if you can do so without risk. Absorb spillage to prevent material damage. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Water spray may reduce vapor; but may not prevent ignition in closed spaces.

Small Spills: Contain and absorb spilled liquid with non-combustible, inert absorbent material (e.g. sand). Dilute alkali with water and neutralize with acids (e.g. acetic acid / vinegar).

Large Spills: Prevent entry into waterways, sewer, basements or confined areas. If not recoverable, dilute with water or flush to holding area and neutralize. Remove with vacuum trucks or pump to storage/salvage vessels. Contact the proper local authorities.

Never return spills to original containers for re-use. Contaminated absorbent material may pose the same hazards as the spilled product. For waste disposal, see section 13 of the SDS.

Environmental precautions

Avoid discharge into drains, water courses or onto the ground. Contact local authorities in case of spillage to drain/aquatic environment.

7. Handling and Storage

Precautions for safe handling

Wear chemically resistant protective equipment during handling. Wear protective gloves/clothing and eye/face protection. Do not breathe mist. Do not taste or swallow. Avoid contact with eyes, skin and clothing. Keep away from heat. Keep away from metals and other incompatibles. When preparing or diluting solution, always add to water, slowly and with stirring. Use cold water to prevent excessive heat generation. Never add water to the product. Label containers appropriately. Wash thoroughly after handling. When using, do not eat, drink or smoke. Avoid release to the environment.

Conditions for safe storage, including any incompatibilities	Store in a cool, dry place out of direct sunlight. Store in a well-ventilated place. Store locked up. Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Inspect periodically for damage or leaks. Store away from incompatible materials (see Section 10 of the SDS). Store in original tightly closed container. May be corrosive to Aluminum, stainless steels, carbon steel, copper, bronze, etc. Store in corrosive resistant container with a resistant inner liner. Suitable container and packaging materials for safe storage: Nickel. Polyvinyl chloride (PVC). Polytetrafluoroethylene (PTFE). Polypropylene.

8. Exposure Controls/Personal Protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	PEL	2 mg/m^3

US. ACGIH Threshold Limit Values

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m^3

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m^3

Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear eye/face protection. Chemical goggles and face shield are recommended.
Skin protection	
Hand protection	Wear appropriate chemical resistant impervious gloves.
Other	Wear as appropriate: Butyl rubber. Neoprene. Nitrile. Polyvinyl chloride (PVC). VitonTM rubber (fluor rubber).
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment. A NIOSH/MSHA approved air-purifying respirator with

	the appropriate chemical cartridges or a positive-pressure, air-supplied respirator may be used to reduce exposure. Use a positive-pressure air-supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air-purifying respirators may not provide adequate protection. Respirators should be selected based on the form and concentration of contaminants in air, and in accordance with OSHA (29 CFR 1910.134). Advice should be sought from respiratory protection specialists.
Thermal Hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Do not breathe mist. Avoid contact with eyes, skin and clothing. When using, do not eat, drink or smoke. Upon completion of work, wash hands before eating, drinking, smoking or use of toilet facilities. Remove soiled clothing and wash it thoroughly before reuse. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

Appearance	Clear to slightly turbid, viscous liquid
Physical state	Liquid
Form	Viscous liquid
Colour	Clear water-white
Odor	Odorless
Odor threshold	Not Available
pH	> 14 (at high alkali concentration in water, pH scale is not applicable)
Melting point/freezing point	57.2 °F (14 °C) / 57.2 °F (14 °C) (approximately)
Initial boiling point and boiling range	284 °F (140 °C) @ 760 mmHg
Flash point	Not Applicable
Evaporation rate	Not Applicable (the only evaporation that occurs is water)
Flammability (solid, gas)	Not Available
Upper/lower flammability or explosive limits	
Flammability limit – lower (%)	Not Applicable
Flammability limit – upper (%)	Not Applicable
Explosive limit – lower (%)	Not Applicable
Explosive limit – upper (%)	Not Applicable
Vapor pressure	0.2 kPa 1.5 mm Hg
Vapor pressure temp.	77 °F (25 °C)
Vapor density	Not Available
Relative density	1.52 g/cm³
Solubility (ies)	
Solubility (water)	Soluble in all proportions

Solubility (other)	Soluble in absolute alcohol, methanol and glycerol. Moderately soluble in ethanol. Insoluble in acetone and diethyl ether.
Partition coefficient (n-octanol/water)	Not available
Auto-ignition temperature	Not Applicable
Decomposition temperature	Not Available
Viscosity	25.39 cSt (40% solution)
Viscosity temperature	68 °F (20 °C)
Other information	
Specific gravity	1.52 at 20 °C

10.Stability and Reactivity

Reactivity	Contact with most metals will generate flammable hydrogen gas. Contact with water will generate considerable heat. May be corrosive to Aluminum, stainless steels, carbon steel, copper, bronze, etc. Sodium hydroxide does not polymerize itself, but will violently polymerize certain other substances including: acetaldehyde, acrolein, acrylonitrile.
Chemical stability	Material is stable under normal conditions. Rapidly absorbs moisture and carbon dioxide from the air forming sodium carbonate. Water, when added to sodium hydroxide may cause localized overheating and possible spattering.
Possibility of hazardous reactions	Reacts vigorously, violently or explosively with many organic and inorganic chemicals, such as strong acids, acid chlorides, acid anhydrides, ketones, glycols and organic peroxides.
Conditions to Avoid	Contact with incompatible materials. Avoid high temperatures. Do not use in areas without adequate ventilation.
Incompatible materials	Metals. Water, moisture. Acids. Flammable liquids. Organo halogen compounds. Nitromethane. Nitrous compounds. Sodium borohydride. Tetrahydrofuran. Chlorinated compounds. Maleic anhydride. Cyanogen azide. Nitroalkanes. Silver nitrate. Ammonia. Zirconium. Acetaldehyde. Acrolein. Acrylonitrile. Allyl alcohol. Zinc Dust. 1,2- Dichloroethylene, Trichloroethylene or Tetrachloroethane. Phosphorus. Hydroquinone. Cinnamaldehyde. Sugars. Chlorine trifluoride, Phosphorus pentoxide or Trichloronitromethane. Chloroform. Methanol. Sodium hydroxide solutions attack plastics, such as polyamide-imide (Torlon) (10-100% solutions), polybutylene terephthalate and polyethylene terephthalate (20-100%), thermoset polyester isophthalic acid (10-100%), polyvinylidene fluoride (Kynar; PVDF) (70-100% solutions), polyurethane (riged) (80-100%), and polyvinylidene chloride (Saran) (100%); elastomers, such as polysulfide and butadiene-styrene (SBR) (10-100%) and soft rubber (30-100%) (52,55); and coatings, such as polyester and vinyls (10-100%), coal tar epoxy, general purpose epoxy, epoxy polyamide and phenolic (70-100%).

Hazardous decomposition products	Contact with metals (aluminum, zinc, tin) and sodium tetrahydroborate liberates hydrogen gas. In the event of fire the following can be released: Sodium oxides.

11.Toxicological Information

Information on likely routes of exposure

Inhalation	May cause severe irritation and burning of the mouth, throat and esophagus; vomiting; diarrhea; edema (swelling) of larynx and a subsequent suffocation. Perforation of gastro-intestinal tract can occur.
Skin contact	Causes severe skin burns and eye damage. Not expected to be absorbed through the skin. Frequently deep ulcerations and ultimate scarring. Destructive effect on tissues.
Eye contact	Causes serious eye damage. Instantaneous painful irritation of the eyes. Can penetrate deeply causing irritation or severe burns depending on the concentration and duration of exposure. In severe cases, ulceration and permanent blindness may occur.
Ingestion	Toxic if swallowed. Causes digestive tract burns. Irritation of respiratory tract, inflammation of lungs, difficulty breathing. May cause pulmonary edema.

Symptoms related to the physical, chemical and toxicological characteristics	Inhalation of mists can cause severe respiratory irritation. Symptoms may include coughing, choking and wheezing. Symptoms of pulmonary edema (chest pain, shortness of breath) may be delayed. May cause severe irritation and corrosive damage in the mouth, throat and stomach. Symptoms may include abdominal pain, vomiting, burns, perforations, bleeding and eventually death. Direct skin contact may cause corrosive skin burns, deep ulcerations and possibly permanent scarring. Corrosive to the eyes and may cause severe damage including blindness. Symptoms may include stinging, tearing, redness, swelling, and blurred vision.

Delayed and immediate effects and chronic effects from short-term and long-term exposure

Effects of short-term (acute) exposure	Direct contact can cause severe burns with deep ulceration, permanent scarring, and baldness. It can penetrate to deeper layers of the skin and corrosion will continue until removed. With dilute solution, the sensation of irritation may be delayed for hours. Eye damage can range from severe irritation and mild scarring to blistering, disintegration, ulceration, severe scarring and clouding. Ingestion can produced severe corrosive burns to mouth, throat, and esophagus. Symptoms include severe pain, vomiting, diarrhea, collapse and possible death. Small amounts of caustic which enter the lungs during ingestion or vomiting (aspiration) can cause serious lung injury and death. Sodium hydroxide does not readily form a vapor, so inhalation is only likely to occur if aerosol is formed. Severe irritation of the respiratory tract, and possible permanent damage and pulmonary edema may result from aerosol exposure. Symptoms of pulmonary edema may be delayed for up to 48 hours.

Effects of long-term (chronic) exposure Repeated or prolonged exposure of the skin to low concentrations of liquid can cause dermatitis. There are a few reports of chronic respiratory disease from repeated and prolonged exposure to mists. There is no evidence of carcinogenicity in humans from occupational exposures. Sodium hydroxide does not accumulate in the body. Glaucoma and cataracts are possible late developments. In severe cases, permanent blindness results.

Information on toxicological effects

Acute toxicity There is no available data for the product itself, only for the ingredients. See below for individual ingredient acute toxicity data.

Components	Species	Test Results
Sodium Hydroxide (CAS 1310-73-2)		
Acute		
Dermal		
LD_{50}	Rabbit	1,350 mg/kg
Inhalation		
LC_{50}	Rat	No Data in Literature
Oral		
LD_{50}	Rat	140-340 mg/kg
Water (CAS 7732-18-5)		
Acute		
Dermal		
LD_{50}	Rabbit	Not available
Inhalation		
LC_{50}	Rat	Not available
Oral		
LD_{50}	Rat	> 89840 mg/kg

Skin corrosion Hazardous by OSHA criteria.
Category 1A. Causes severe skin burns and eye damage.

Serious eye damage Hazardous by OSHA criteria.
Category 1. Causes serious eye damage.

Respiratory or skin sensitization

Respiratory sensitization Not expected to be a respiratory sensitizer.

Skin sensitizer This product is not expected to be a skin sensitizer.

Germ cell mutagenicity Not expected to be mutagenic in humans.

Carcinogenicity This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)	Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Hazardous by OSHA criteria. Category 3. May cause respiratory irritation.
Specific target organ toxicity - repeated exposure	Not classified as a specific target organ toxicity - repeated exposure.
Aspiration toxicity	This product is not classified as an aspiration hazard.
Chronic effects	Chronic skin contact with low concentrations may cause dermatitis.

12. Ecological Information

Ecotoxicity	May cause shifts in water pH outside the range of pH 5 -10. Because of the high pH of this product, it would be expected to produce significant ecotoxicity upon exposure to aquatic organisms and aquatic systems. However, may be neutralized by naturally occurring acidity in the environment. The ingredient ecotoxicity data appearing below is expected to be primarily associated with pH.

Components			**Species**	**Test Results**
Sodium Hydroxide (CAS 1310-73-2)				
	Aquatic			
	Acute			
	Crustacea	EC_{50}	Water flea (*Ceriodaphnia dubia*)	40 mg/l, 48 hours

Persistence and degradability	No data is available on the degradability of this product. Biodegradation is not applicable to inorganic substances.
Bioaccumulative potential	No accumulation in living organisms is expected due to high solubility and dissociation properties.
Mobility in soil	High water solubility indicates a high mobility in soil.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal Considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container must be disposed of as hazardous waste. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents and containers in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport Information

DOT

UN number	UN1824
UN proper shipping name	Sodium hydroxide solution
Transport hazard class(es)	
Class	8
Subsidiary risk	None
Packing group	II
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling. US CERCLA Reportable Quantity (RQ): 1000 lbs / 454 kg
Special provisions	B2; IB2; N34; T7; TP2
Packaging exceptions	154
Packaging non bulk	202
Packaging bulk	242

IATA

UN number	UN1824
UN proper shipping name	Sodium hydroxide solution
Transport hazard class(es)	
Class	8

Subsidiary risk	None
Packing group	II
Environmental hazards	No
ERG Code	8L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed
Cargo aircraft only	Allowed

IMDG

UN number	UN1824
UN proper shipping name	Sodium hydroxide solution
Transport hazard class(es)	
Class	8
Subsidiary risk	None
Packing group	II
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-B
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not available.

DOT

IATA; IMDG

15. Regulatory Information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All components are on the U.S. EPA TSCA Inventory List.	
TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)	Not regulated.	
CERCLA Hazardous Substance List (40 CFR 302.4)	Sodium hydroxide (CAS 1310-73-2)	Listed.
SARA 304 Emergency release notification	Not regulated.	
OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)	Not listed.	

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - Yes
SARA 302 Extremely hazardous substance	Not listed.
SARA 311/312 Hazardous chemical	No
SARA 313 (TRI reporting)	Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List	Not regulated.
Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)	Not regulated.

Safe Drinking Water Act (SDWA)	Not regulated.

US state regulations

US. Massachusetts RTK - Substance List	Sodium hydroxide (CAS 1310-73-2)
US. New Jersey Worker and Community Right-to-Know Act	Sodium hydroxide (CAS 1310-73-2)
US. Pennsylvania Worker and Community Right-to-Know Law	Sodium hydroxide (CAS 1310-73-2)
US. Rhode Island RTK	Sodium hydroxide (CAS 1310-73-2)
US. California Proposition 65	California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	**Inventory name**	**On inventory (yes/no)***
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16.Other Information

Issue date	11/18/2020
Revision #	4
Revision Indicator	Updated address in Section 1.
List of abbreviations	ACGIH: American Conference of Governmental Industrial Hygienists CAS: Chemical Abstract Services CERCLA: Comprehensive Environmental Response, Compensation and Liability Act of 1980 CFR: Code of Federal Regulations DOT: Department of Transportation DSL: Domestic Substance List EINECS: European Inventory of Existing Commercial chemical Substances EPA: Environmental Protection Agency EPCRA: Emergency Planning and Community Right-to-Know Act HSDB® - Hazardous Substances Data Bank IARC: International Agency for Research on Cancer IATA: International Air Transport Association IBC: Intermediate Bulk Container ICAO: International Civil Aviation Organization IMDG: International Maritime Dangerous Goods LC: Lethal Concentration LD: Lethal Dose NIOSH: National Institute of Occupational Safety and Health NOEC: No observable effect concentration NTP: National Toxicology Program OECD: Organization for Economic Cooperation and Development OSHA: Occupational Safety and Health Administration PPE: Personal Protective Equipment RCRA: Registry of Toxic Effects of Chemical Substances RTECS: Registry of Toxic Effects of Chemical Substances SARA: Superfund Amendments and Reauthorization Act SDS: Safety Data Sheet STEL: Short Term Exposure Limit TLV: Threshold Limit Values TWA: Time Weighted Average
References	ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices (2014) Canadian Centre for Occupational Health and Safety, CCInfoWeb Databases, 2014 (Chempendium, RTECs, HSDB, INCHEM) Material Safety Data Sheet from manufacturer. OECD - The Global Portal to Information on Chemical Substances - eChemPortal, 2014.

Disclaimer

Information presented in this SDS is furnished in accordance with OSHA's Hazard Communication Standard (HCS) 2012.

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APPENDIX K

Appendix K Contains:

- Chemical Metering Pump data
- Chemical Feed Pump calculations - Rates

Blue-White FLEXFLO M3 Peristaltic Metering Pump

A. METERING PUMP – Shall be a positive displacement, peristaltic type tubing pump with a brushless variable speed motor, non-spring-loaded roller assembly located in the pumphead, integral tube failure detection system, tube life roller revolution counter with user alarm set-point and flexible tubing with attached connection fittings. FLEXFLO M3 model shall be capable of output volumes from 0.0002 to 33.3 gallons per hour (0.0007 to 126 liter per hour).

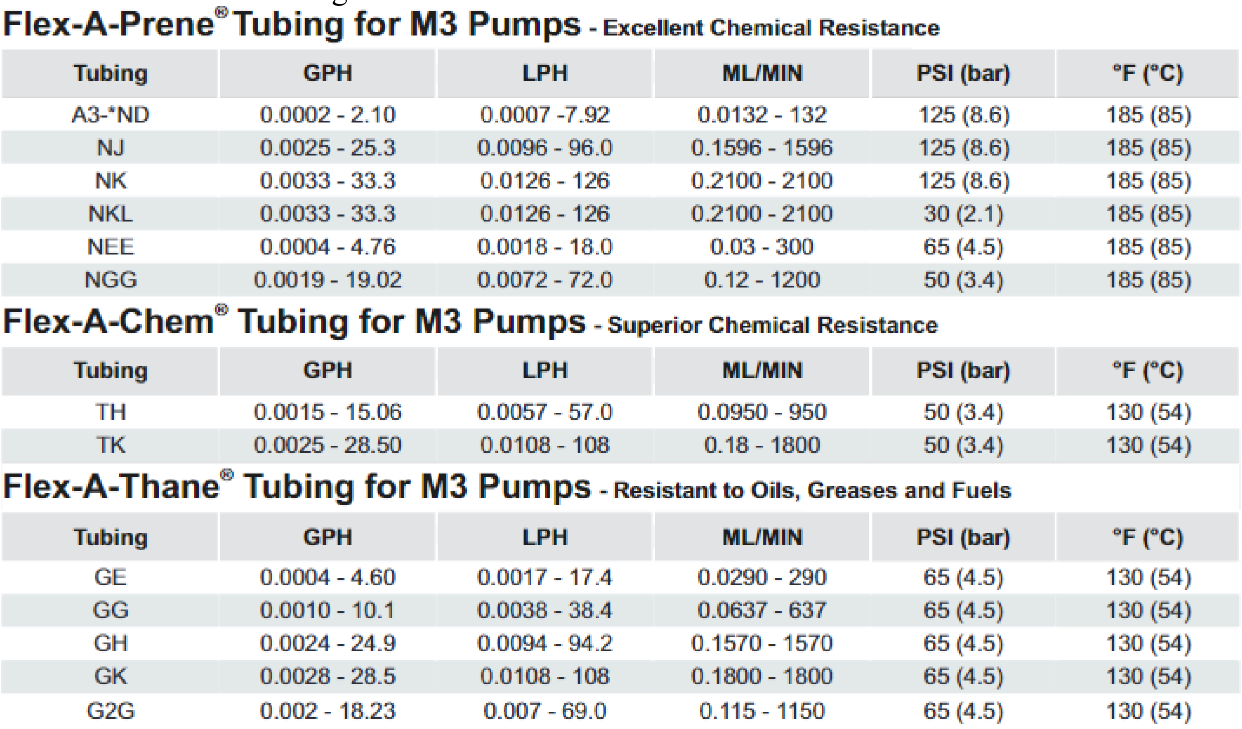
1. There shall be no valves, diaphragms, springs, or dynamic seals in the fluid path. Process fluid shall contact the pump tubing assembly and connection fittings only.
2. Pump shall be capable of 24-hour continuous duty, self-priming and operating in either direction of flow at the rated maximum pressure of up to 125 PSI (8.6 bar).
3. Pump shall be capable of running dry without damage.
4. Pump shall be capable of operating in either direction without output variation.
5. Suction lift shall be 30 feet (9.14 m) of water.
6. Pump shall be warranted by the manufacturer for a period of five years. Warranty shall include chemical damage to the pump head and roller assembly for a period of two years.

B. PUMPHEAD – Shall be a single, unbroken track with a clear removable cover

1. Tube failure detection sensors shall be wholly located in the pump head. Tube failure detection system shall not trigger with water contact. Float type switches shall not be used. Process fluid waste ports or leak drains shall not be provided.
2. Squeeze rollers with encapsulated ball bearings shall be directly coupled to a one-piece thermoplastic rotor. Four nylon rollers shall be provided; two squeeze rollers for tubing compression shall be located 180 degrees apart and two guide rollers that do not compress the tubing shall be located 180 degrees apart. The roller diameters and occlusion gap shall be factory set to provide the optimum tubing compression; field adjustment shall not be required. Spring-loaded or hinged rollers shall not be used.
3. Rotor assembly shall be installed on a D-shaped, chrome plated motor shaft and removable without tools.
4. For tubing installation and removal, rotor assembly shall be rotated by the motor drive at 6 RPM maximum when the pumphead cover is removed. Hand cranking of the rotor assembly shall not be required.
5. Pump head and tubing compression surface shall be corrosion resistant Valox thermoplastic.
6. The pump head cover shall be clear, polycarbonate thermoplastic with an integral ball bearing fitted to support the overhung load on the motor shaft. Cover shall include an imbedded magnetic safety interlock which will limit the motor rotation speed to 6 RPM when removed.
7. Cover shall be positively secured to the pump head using a minimum of four thumb screws. Tools shall not be required to remove the pump head cover.

C. PUMP TUBE ASSEMBLY

1. To ensure pump performance and accuracy, only tubing provided by the manufacturer is acceptable.
2. Pump tube shall be assembled to connection fittings of PVDF material.
3. Connection fittings shall be permanently clamped to the tubing with stainless steel clamps or over molded directly to the tubing. To prevent tubing misalignment and ensure accuracy, fittings shall insert into keyed slots located in the pump head and secured in place by the pump head cover.
4. Connection fittings shall accept 1/4” ID x 3/8” OD flexible tubing.
5. Tube sizes and connections shall be measured in inches.
6. The following tube sizes shall be available:



Flex-A-Prene® Tubing for M3 Pumps - Excellent Chemical Resistance

Tubing	GPH	LPH	ML/MIN	PSI (bar)	°F (°C)
A3-*ND	0.0002 - 2.10	0.0007 -7.92	0.0132 - 132	125 (8.6)	185 (85)
NJ	0.0025 - 25.3	0.0096 - 96.0	0.1596 - 1596	125 (8.6)	185 (85)
NK	0.0033 - 33.3	0.0126 - 126	0.2100 - 2100	125 (8.6)	185 (85)
NKL	0.0033 - 33.3	0.0126 - 126	0.2100 - 2100	30 (2.1)	185 (85)
NEE	0.0004 - 4.76	0.0018 - 18.0	0.03 - 300	65 (4.5)	185 (85)
NGG	0.0019 - 19.02	0.0072 - 72.0	0.12 - 1200	50 (3.4)	185 (85)

Flex-A-Chem® Tubing for M3 Pumps - Superior Chemical Resistance

Tubing	GPH	LPH	ML/MIN	PSI (bar)	°F (°C)
TH	0.0015 - 15.06	0.0057 - 57.0	0.0950 - 950	50 (3.4)	130 (54)
TK	0.0025 - 28.50	0.0108 - 108	0.18 - 1800	50 (3.4)	130 (54)

Flex-A-Thane® Tubing for M3 Pumps - Resistant to Oils, Greases and Fuels

Tubing	GPH	LPH	ML/MIN	PSI (bar)	°F (°C)
GE	0.0004 - 4.60	0.0017 - 17.4	0.0290 - 290	65 (4.5)	130 (54)
GG	0.0010 - 10.1	0.0038 - 38.4	0.0637 - 637	65 (4.5)	130 (54)
GH	0.0024 - 24.9	0.0094 - 94.2	0.1570 - 1570	65 (4.5)	130 (54)
GK	0.0028 - 28.5	0.0108 - 108	0.1800 - 1800	65 (4.5)	130 (54)
G2G	0.002 - 18.23	0.007 - 69.0	0.115 - 1150	65 (4.5)	130 (54)

D. DRIVE SYSTEM – Shall be factory installed and totally enclosed in a NEMA 4X, (IP66) wash-down enclosure. Capable of operating on any input power from 110VAC to 240VAC, 50/60 Hz single phase supply without user configuration or selection switches.

1. Motor
    a. Reversible, brushless DC gear motor rated for continuous duty.
    b. Motor shall include overload protection.
    c. The maximum gear motor RPM shall be 125 RPM.

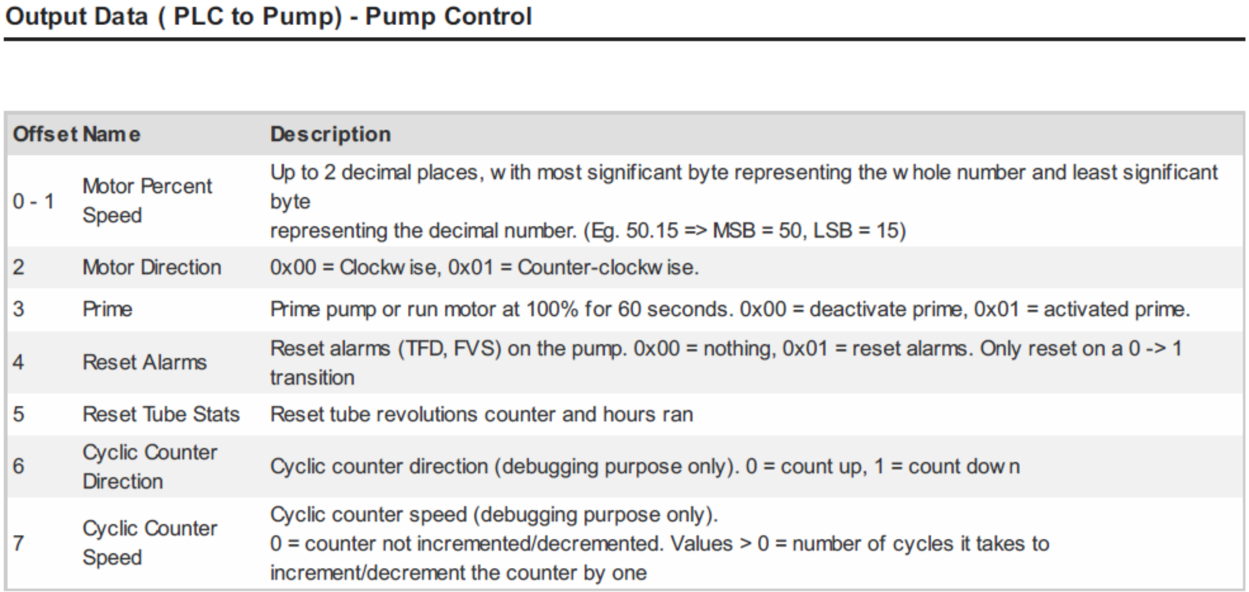
2. Enclosure

   a. Bottom housing shall be pressure cast aluminum with acidic liquid iron phosphate three-stage clean and coat pretreatment and exterior grade corrosion resistant polyester polyurethane powder coat.
   b. Top housing shall be structural foam molded Noryl engineered thermoplastic.
   c. Rated NEMA 4X (IP66).
   d. Provided with 316SS floor/shelf level mounting brackets and hardware.
   e. M12 receptacles shall be located at the rear of the pump for input and output signals.
   f. RJ45 receptacle shall be located at the rear of the pump for use with EtherNet/IP and Modbus TCP/IP
   g. One M12 receptacle shall be located at the rear of the pump for use with Profibus

3. Control Circuitry. All control circuitries shall be integral to the pump.
   a. All control circuitries shall be integral to the pump and capable of adjusting the pump motor speed from 0.01% to 100.0% in 0.01% increments less than 10% motor speed, in 0.01% and in 0.1% increments greater than 10% motor speed (10,000:1 turndown ratio).
   b. The pump output shall be capable of being manually controlled via front panel touchscreen. The pump motor speed shall be adjustable from 0.01% to 100.0% in 0.01% increments less than 10% motor speed and in 0.1% increments greater than 10% motor speed.
   c. The pump output shall be capable of being remotely controlled via 4-20mA analog input. The input resolution shall be 0.01 of input value and capable of adjusting the pump motor speed from 0% to 100.0% motor speed in 0.1% increments. Four values shall be user configurable to define the low and high points on the output slope: a low input value, the required pump percentage of motor speed at the low input value, a high input value, the required pump percentage of motor speed at the high input value.
   d. The pump output shall be capable of being remotely controlled via TTL/CMOS digital high-speed pulse type input and an AC sine wave type pulse input in the range of 0 to 1,000 Hz. The frequency resolution shall be 1 Hz and capable of adjusting the pump motor speed from 0% to 100.0% motor speed in 0.1% increments. Four values shall be user configurable to define the low and high points on the output slope: a low input value, the required pump percentage of motor speed at the low input value, a high input value, the required pump percentage of motor speed at the high input value.
   e. The pump output shall be capable of being remotely controlled via pulse triggered batching. The pump shall accept a TTL/CMOS digital pulse type input and a contact closure type pulse input in the range of 1 to 5,629,499,534,21,312 pulses per batch. The batch time shall be adjustable from 1 to 5,629,499,534,21,312 seconds. The pump motor speed during

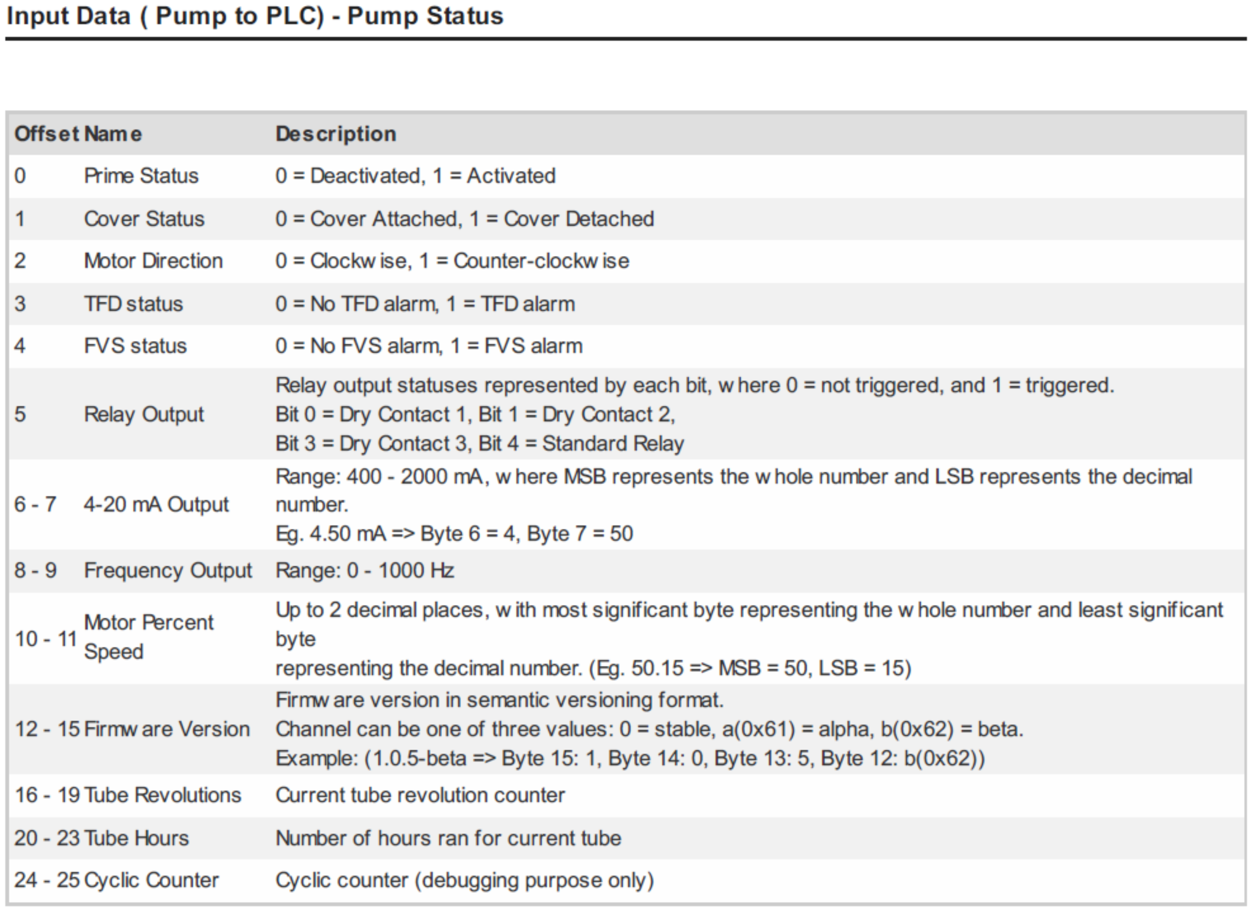
the batch shall be adjustable from 0% to 100.0% motor speed in 0.1% increments.

f. The pump output shall be capable of being controlled via EtherNet/IP, Modbus TCP/IP, or Profibus. Device configuration shall be as follows:



Output Data (PLC to Pump) - Pump Control

Offset	Name	Description
0 - 1	Motor Percent Speed	Up to 2 decimal places, with most significant byte representing the whole number and least significant byte representing the decimal number. (Eg. 50.15 => MSB = 50, LSB = 15)
2	Motor Direction	0x00 = Clockwise, 0x01 = Counter-clockwise.
3	Prime	Prime pump or run motor at 100% for 60 seconds. 0x00 = deactivate prime, 0x01 = activated prime.
4	Reset Alarms	Reset alarms (TFD, FVS) on the pump. 0x00 = nothing, 0x01 = reset alarms. Only reset on a 0 -> 1 transition
5	Reset Tube Stats	Reset tube revolutions counter and hours ran
6	Cyclic Counter Direction	Cyclic counter direction (debugging purpose only). 0 = count up, 1 = count down
7	Cyclic Counter Speed	Cyclic counter speed (debugging purpose only). 0 = counter not incremented/decremented. Values > 0 = number of cycles it takes to increment/decrement the counter by one



Input Data (Pump to PLC) - Pump Status

Offset	Name	Description
0	Prime Status	0 = Deactivated, 1 = Activated
1	Cover Status	0 = Cover Attached, 1 = Cover Detached
2	Motor Direction	0 = Clockwise, 1 = Counter-clockwise
3	TFD status	0 = No TFD alarm, 1 = TFD alarm
4	FVS status	0 = No FVS alarm, 1 = FVS alarm
5	Relay Output	Relay output statuses represented by each bit, where 0 = not triggered, and 1 = triggered. Bit 0 = Dry Contact 1, Bit 1 = Dry Contact 2, Bit 3 = Dry Contact 3, Bit 4 = Standard Relay
6 - 7	4-20 mA Output	Range: 400 - 2000 mA, where MSB represents the whole number and LSB represents the decimal number. Eg. 4.50 mA => Byte 6 = 4, Byte 7 = 50
8 - 9	Frequency Output	Range: 0 - 1000 Hz
10 - 11	Motor Percent Speed	Up to 2 decimal places, with most significant byte representing the whole number and least significant byte representing the decimal number. (Eg. 50.15 => MSB = 50, LSB = 15)
12 - 15	Firmware Version	Firmware version in semantic versioning format. Channel can be one of three values: 0 = stable, a(0x61) = alpha, b(0x62) = beta. Example: (1.0.5-beta => Byte 15: 1, Byte 14: 0, Byte 13: 5, Byte 12: b(0x62))
16 - 19	Tube Revolutions	Current tube revolution counter
20 - 23	Tube Hours	Number of hours ran for current tube
24 - 25	Cyclic Counter	Cyclic counter (debugging purpose only)

g. Provide a front panel touchscreen control for stop/start, configuration menu access and navigation, operating mode selection, display options selection, tube info data, and reverse direction.
h. Provide a multi-color LCD touchscreen display for menu driven configuration settings, pump output value, service alerts, tube failure detection (TFD) system and flow verification system (FVS) alarms status, remote input signal values, tubing life timer value. Display color shall be green when indicating run operation, blue when in idle, yellow when in stand-by, and red to indicate an alarm condition exists.
i. Provide for remote stop/start pump via 6-30 VDC powered loop or non-powered contact closure loop.
j. Provide a user selectable 4-20mA and 0-1,000Hz output signal which are scalable and proportional to pump output volume.
k. Provide four contact closure alarm outputs. Three rated at 1A-115VAC, 0.8A-30VDC and one rated at 6A-250VAC, 5A-30VDC. Each alarm output shall be assignable to monitor any of the following pump functions: TFD system, FVS system, motor run/stop, motor failed to respond to commands, motor is running in reverse, general alarm (TFD, FVS, and/or motor over current), input signal failure, output signal failure, remote/local control status, revolution counter (tube life) set-point, or monitor which of the nine different pump operating modes is currently active.
l. Provide a four-digit password protected configuration menu.
m. Provide a flow verification system with programmable alarm delay time from 1-1000 seconds. FVS system shall monitor the FVS flow sensor while pump is running only. System shall not monitor pump while not running.

E. FLOW VERIFICATION SENSOR – Shall output high-speed digital pulse signal or 4-20 mA, while pump is running only, to verify chemical injection.

1. Flow verification sensor shall be an ultrasonic transit time sensor.
2. Wetted components shall be PVDF (optional PVC), PEEK, and TFE/P (optional EP).
3. End fittings shall be PVDF with optional PVC slip fittings. All are included.
4. Sensor operating range shall be as follows:

Code	Flow Range (GPH)	Flow Range (LPH)	Flow Range (mL/min)
A	0.158-79.2	0.597-299.4	10.0-5,000

5. Shall provide a scalable 4-20 mA sourcing output.
6. Shall provide a scalable 0-1,000 Hz open collector frequency output
7. Shall provide a programmable Form C Solid State Relay rated for a maximum load capacity of 24 VDC and 100 mA.
    a. Programmable for high/low flow rate alarm.
    b. Programmable to energize on specified flow total.
8. Power Requirements: 5 VDC; 5 Watts maximum.

9. Shall be certified to NSF Standard 61 Drinking Water System Components.
10. Accuracy shall be +/- 0.75% full scale. Accuracy shall be +/- 0.25% at the field calibrated setpoint.

F. SAFETY

1. The pump shall be certified to NSF Standard 61 Drinking Water System Components, UL standard 778 motor operated pump and CSA standard C22.2 process control equipment.
2. Manufactured to ISO 9001:2015 requirements and processes.
3. Tube Failure Detection (TFD) system sensors shall be wholly located in the pump head. TFD system will stop the pump within three seconds of leak detection. To prevent false alarms due to rain, wash-down, condensation, etc., tube failure detection system shall not trigger with water contact. Process fluid waste ports or leak drains shall not be provided.
4. Pump head cover shall include an imbedded magnetic safety interlock which will stop the pump when removed. Pump rotor speed shall be limited to 6 RPM when cover is removed.
5. Secondary user confirmation input required for motor reversal, tube life revolution count reset, and factory default configuration reset.

G. MANUFACTURER

1. The pump shall be FLEXFLO Municipal peristaltic pump, manufactured in the U.S.A. by Blue-White Industries and supplied by Bar Environmental.

M3

FLEXFLO® Peristaltic Metering Pump

Video link: ▶

Features

> 5” touchscreen color LCD display
> User-friendly configurations
> Self priming peristaltic metering pump delivers smooth chemical feed
> Tube Failure Detection (TFD) system senses tube failure
> Inputs include: 4-20mA, Pulse Inputs, Industrial Protocols, Remote Start/Stop

NSF Certified to NSF / ANSI Standard 61 · ETL c us LISTED · CE · NEMA 4X

Highlights

Flow range
.0002 - 33.3 GPH
.0007 - 126 LPH

Pressures
125 PSI
(8.6 bar)

Turndown ratio
10,000 : 1

Exclusive
Tube Failure Detection (TFD)

Motor
Brushless DC Motor

Warranty
5 Years

Control Methods

Control Methods	Manual Control	4-20mA Input	Remote Start/Stop	Pulse Input	Frequency Input	Ethernet/ IP	Modbus TCP/IP	Profibus	Alarm Outputs
M3	•	•	•	•	•	•	•	•	•

For more help and information regarding **M3**, please visit www.blue-white.com or scan this QR code.

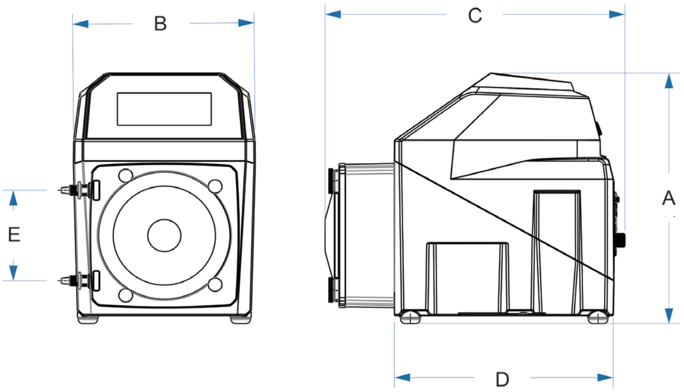
Engineering Specifications

Maximum Working Pressure (excluding pump tubes)	125 psig (8.6 bar)
	NOTE: See individual pump tube assembly maximum pressure ratings.
Maximum Fluid Temperature (excluding pump tubes)	185 °F (85 °C)
	NOTE: See individual pump tube assembly max. temperature ratings.
Maximum Viscosity	12,000 Centipoise
Maximum Suction Lift	30 ft. Water, 0 psig (9.14 m, 0 bar)
Ambient Operating Temperature	14 °F to 115 °F (-10 °C to 46 °C)
Ambient Storage Temperature	-40 °F to 158 °F (-40 °C to 70 °C)
Operating Voltage	115VAC/60Hz, 1ph (2.0 Amp Maximum)
	230VAC/60Hz, 1ph (1.0 Amp Maximum)
	220VAC/50Hz, 1ph (1.0 Amp Maximum)
	240VAC/50Hz, 1ph (1.0 Amp Maximum)
	230VAC/50Hz, 1ph (2.0 Amp Maximum)
Power Cord Options	115V60Hz = NEMA 5/15 (USA)
	230V60Hz = NEMA 6/15 (USA)
	220V50Hz = CEE 7/VII (EU)
	240V50Hz = AS 3112 (Australia/New Zealand)
	230V50Hz = BS 1363/A (UK)
Motor	Brushless DC, 1/4 hp
Motor Speed Adjustment Range	10,000:1 (0.01% - 100% motor speed) Max RPM = 125
Motor Speed Adjustment Resolution	0.1% increments > 1% motor speed and < 100%
	0.01% increments < 1% motor speed
Display	5” touchscreen color LCD, UV resistant.
Display Languages	English, Spanish, French, German, and Portuguese selectable
Maximum Overall Dimensions	8-1/4”W x 11-3/4”H x 13-1/4”D (20.9W x 29.8H x 34.5D cm)
Product Weight	25.4lb. (11.5 Kg)
Security	Programmable 6-digit password
Approximate Shipping Weight	30 lb. (13.6 Kg)
Enclosure	NEMA 4X (IP66), Polyester powder coated aluminum & Noryl
RoHS Compliant	Yes
Standards	cETLus, CE, NSF61

Dimensions

Dim	Inch	cm
A	11-3/4”	29.8
B	8-1/4”	20.9
C	13-1/2”	34.5

Dim	Inch	cm
D	10-1/2”	26.5
E	4-1/4”	10.8



Materials of Construction

Non-wetted Components:
Enclosure: 413 Aluminum (Polyester powder coated) & Noryl
Pump Head: Valox® (PBT) thermoplastic
Pump Head Cover: Polycarbonate
Permanently lubricated sealed motor shaft support ball bearing.
Cover Screws: Stainless steel, polypropylene cap
Roller Assembly:
Rotor: Valox® (PBT)
Rollers: Nylon
Roller Bearings: SS Ball bearings
Motor Shaft: Chrome plated steel
TFD System Sensor: Hastelloy C-276
Power Cord: 3 conductor, SJTW-A water-resistant
Tube Installation Tool: GF nylon
Mounting Brackets and Hardware: 316 Stainless steel

Wetted Components:
Pump Tube Assembly:
Tubing: Flex-A-Prene®, Flex-A-Chem® or Flex-A-Thane®
Adapter Fittings: PVDF

Output Specifications

Feed Rate			Max Speed	Max Pressure	Max Temperature	Tube Material / Size
GPH	LPH	ML/Min	RPM	PSI (bar)	°F (°C)	
Flex-A-Prene® M3 Tube Pumps						
.0002 - 2.10	.0007 - 7.92	.0132 - 132	125	125 (8.6)	185 (85)	ND
.0025 - 25.3	.0096 - 96.0	.1596 - 1596	125	125 (8.6)	185 (85)	NJ
.0033 - 33.3	.0126 - 126	.2100 - 2100	125	125 (8.6)	185 (85)	NK
.0033 - 33.3	.0126 - 126	.2100 - 2100	125	30 (2.1)	185 (85)	NKL
.0004 - 4.76	.0018 - 18.0	.03 - 300	125	110 (7.6)	185 (85)	NEE
.0019 - 19.02	.0072 - 72.0	.12 - 1200	125	110 (7.6)	185 (85)	NGG
Flex-A-Chem® M3 Tube Pumps						
.0015 - 15.06	.0057 - 57.0	.0950 - 950	125	50 (3.4)	130 (54)	TH
.0028 - 28.5	.0108 - 108	.18 - 1800	125	50 (3.4)	130 (54)	TK
Flex-A-Thane® M3 Tube Pumps						
.0004 - 4.60	.0017 - 17.4	.0290 - 290	125	65 (4.5)	130 (54)	GE
.0010 - 10.1	.0038 - 38.4	.0637 - 637	125	65 (4.5)	130 (54)	GG
.0024 - 24.9	.0094 - 94.2	.1570 - 1570	125	65 (4.5)	130 (54)	GH
.0028 - 28.5	.0108 - 108	.1800 - 1800	125	65 (4.5)	130 (54)	GK
.002 - 18.23	.007 - 69.0	.115 - 1150	125	65 (4.5)	130 (54)	G2G

Model Number Matrix

Model Number Model Number

M3	FLEXFLO® Peristaltic metering pump

Power Cord (operating voltage user selectable 115V/240 Vac 50/60Hz)

4	115V / 60Hz, power cord NEMA 5/15 plug (US)	**8**	240V / 50HZ, power cord AS 3112 plug (AU/New Zealand)
5	230V / 60Hz, power cord NEMA 6/15 plug (US)	**9**	230V / 50HZ, power cord BS 1363/A plug (UK)
6	220V / 50HZ, power cord CEE 7/VII plug (EU)	**X**	No Power Cord

Inlet/Outlet Connection Size, Connection Type, Connection Material

S	3/8" OD x 1/4" ID Tube Compression Fitting, Natural PVDF (Kynar)	**C**	1/2" - 3/4" Tri-clamp connections, Natural PVDF (Kynar), available for ND, NEE, NGG, and G2G only
M	1/2" Male NPT Fitting, Natural PVDF (Kynar)	**Q**	Quick Disconnect, Natural PVDF (Kynar), available for ND, NEE, NGG, and G2G only (valves sold seperately)
B	1/2" Hose Barb, Natural PVDF (Kynar), available for ND, NEE, NGG, and G2G only	**MB**	1/2" Male BSPT Fitting, Natural PVDF (Kynar)

Pump Tube Material, Pump Tube Size, Output Range

ND	Flex-A-Prene® .078 ID	**NJ**	Flex-A-Prene® .312 ID	**G2G**	Flex-A-Thane® .187 ID
NF	Flex-A-Prene® .150 ID	**NK**	Flex-A-Prene® .375 ID	**GH**	Flex-A-Thane® .250 ID
NEE	Flex-A-Prene® .093 ID	**NKL**	Flex-A-Prene® .375 ID	**GK**	Flex-A-Thane® .375 ID
NGG	Flex-A-Prene® .187 ID	**GE**	Flex-A-Thane® .125 ID	**TH**	Flex-A-Chem® .250 ID
NH	Flex-A-Prene® .250 ID	**GG**	Flex-A-Thane® .187 ID	**TK**	Flex-A-Chem® .375 ID
NHL	Flex-A-Prene® .250 ID				

Options (leave this blank for standard model with left facing pump head inlet/outlet)

R	Right facing pump head, input / output (Left facing fluid input / output is standard)
D	Down facing pump head, input / output (Left facing fluid input / output is standard)

M3	**S**	**2**	**4**	**-**	**S**	**ND**	**R**	**Sample Model Number**

Accessories

NOTE: For use with the Quick Disconnect Flex-A-Prene® Tube Assembly. Kits sold separately.

KIT-QSV
3/8" OD, 1/4" TUBING

*KIT-QSE EP O-RINGS

KIT-QBV
1/2" HOSE BARB

*KIT-QBE EP O-RINGS

KIT-QMV
1/2" M/NPT

*KIT-QME EP O-RINGS

CABLE-UAC
USB A-C CABLE

KIT-M12
TWO M12 CABLES

*KIT-M12-3 THREE M12 CABLES

KIT-DP3
ONE 3ft PROFIBUS CABLE

KIT-MVM
M-TUBE FITTINGS KIT

KIT-MTVS
S-TUBE FITTINGS KIT

*KIT-MTVB B-TUBE FITTINGS

Blue-White®

CFPS-2

CHEM-FEED® Plastic Duplex Skid System

Video link: ▶

Features

> Chemically resistant polyethylene structure
> Leak free, threadless connections
> Pressure Relief Valve protects the system from over-pressurization
> Check Valve protects the user from back-flow
> Flow Indicator provides a visual indication of chemical movement

Highlights

Piping
PVC Schedule 80
(optional CPVC)

Pressure
150 PSI
(10.3 bar)

Compatibility
M1, M2, M3, M4,
MC2, MC3, MD1,
MD3

Frame material
Polyethylene

Mounting position
Floor or wall

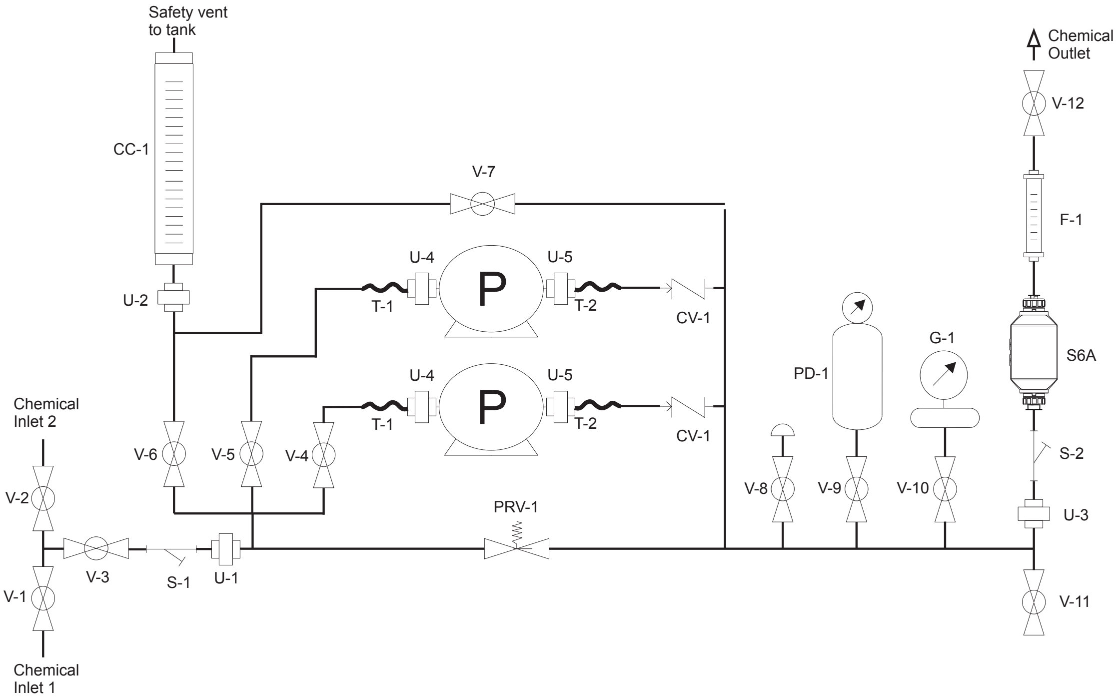
Warranty
2 Years

For more help and information regarding **CFPS-2**, please visit www.blue-white.com or scan this QR code.

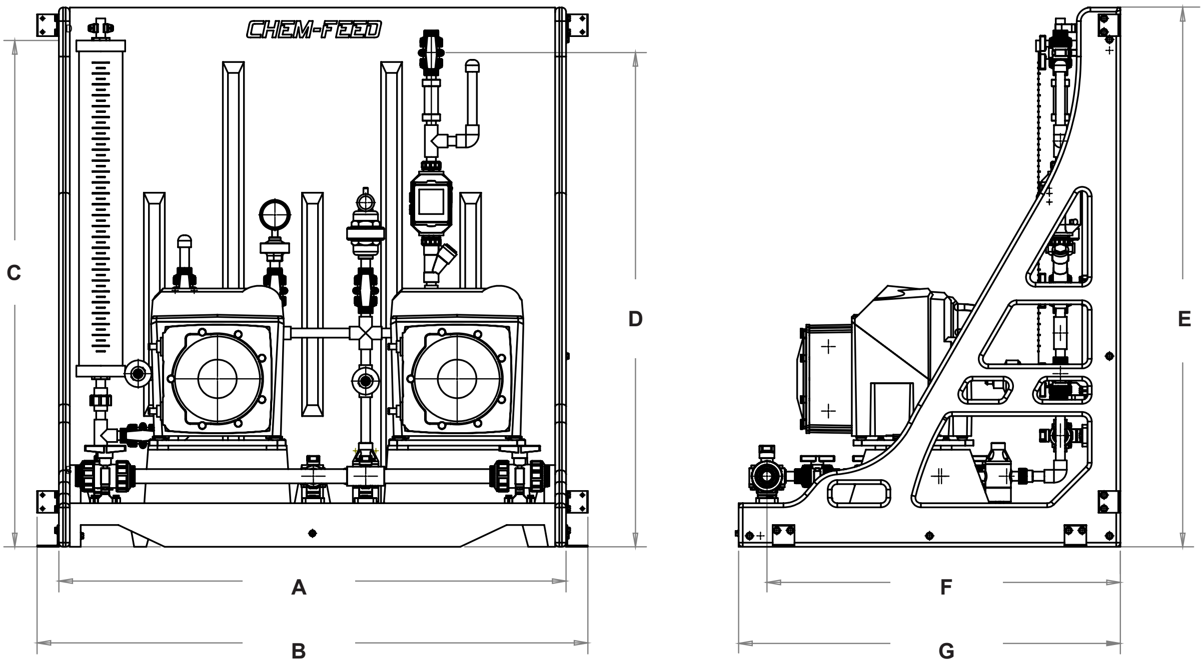
Engineering Specifications

Skid	Chemically resistant polyethylene structure
Pump (sold separately)	FLEXFLO® M1, M2, M3 or M4 peristaltic pumps
	CHEM-FEED® MC2, MC3 or MD1, MD3 diaphragm pumps
Piping	1” Inlet & 1/2” outlet PVC schedule 80 (optional CPVC)
Seals	FKM seals (optional EPDM)
Tubing (T)	Reinforced braided PVC, 200 psi max, meets NSF std. 51. The pump inlet and outlet flexible tubing connections are terminated to half unions and secured to the barbed fitting with stainless steel clamps.
Tubing Clamps	300 series SS band, 400 series SS screw
Unions (U)	PVC body, schedule 80
Ball Valves (V)	True unions, PVC body, PTFE shaft bearings and seats
Pressure Relief Valve (PRV)	PVC body, PTFE primary diaphragm seal. Non-wetted components: EPDM secondary seal, zinc plated steel spring, stainless steel external hardware, HDPE pressure adjustment screw. Infinite adjustment from 10-150 psi.
Calibration Cylinder (CC)	PVC body, PVC end caps, 1/2” PVC pipe outlet vent Available volumes: 1.6 GPH (100ml), 4 GPH (250ml), 8 GPH (500ml), 16 GPH (1000ml), 32 GPH (2000ml), and 64 GPH (4000mL)
Pulsation Dampener (PD)	CPVC body,10 cubic inch volume
Gauge W/Guard (G)	Gauge: liquid filled stainless steel with blowout plug, bottom mount, 1/4” NPT theads. Available pressure ranges: 0-30 psi, 0-100, psi, 0-200 psi. Guard: PVC body, temperature compensated oil filled.
Check Valve (CV)	PVC body. Cracking pressure: 1.0-1.5 psi Maximum working pressure: inlet = 150 psi, back = 100 psi
Flow Indicator (F)	Machined cast acrylic, PVC connections, ceramic ball, PVDF ball stop, PVC half unions
Y Strainer (S)	PVC body, 1/32” Mesh
Universal Mounting Blocks	PA 12
Pump Extended Mounting Brackets	316 Stainless Steel
Skid Mounting Foot Pads	316 Stainless Steel
Mounting Hardware	304 Stainless Steel - Wall or Floor mounting acceptable
Maximum Working Pressure	150 psig (10.3 bar)
Operating Temperature	-40 °F to 158 °F (-40 °C to 70 °C) 14 °F to 115 °F (-10 °C to 46 °C)
Maximum Overall Dimensions	16-1/8”W x 15-1/4”H x 15-5/16”D (40.9W x 38.7H x 38.9D cm)
Approximate Shipping Weight	Standard: 120 lb. (54 Kg) with mounted pumps: 240 lbs (109 Kg)

Piping and Instrumentation Diagrams



Dimensions



Dim	Inch	cm
A	46.50”	118.11
B	50.50”	128.27
C	46.47”	118.04
D	45.37”	115.24

Dim	Inch	cm
E	49.50”	125.73
F	32.40”	82.30
G	35.00”	88.90

Model Number Matrix

CHEM-FEED® Engineered Plastic Skid System M Series Matrix

CFPS-2	Duplex pump system - single chemical / single outlet, PE structure

Piping / Valves / Unions / Seal Materials

A	PVC piping, 1/2" OD PVC braided tubing connections	**D**	CPVC piping, 1/4" ID polyethylene tubing connections
B	CPVC piping, 1/2" OD PVC braided tubing connections	**X**	Skid frame only without piping
C	PVC piping, 1/4" ID polyethylene tubing connections		

Seal Material

V	FKM
E	EPDM

Calibration Cylinder

		PVC	**Glass**
A	64 GPH (4000 ml)	**A**	
B	32 GPH (2000 ml)	**B**	
C	16 GPH (1000 ml)	**C**	**P**
D	8 GPH (500 ml)	**D**	**Q**
E	4 GPH (250 ml)	**E**	**R**
F	1.6 GPH (100 ml)	**F**	**S**
X	None		

Pulsation Dampener

A	10 cubic inch, CPVC body, PTFE diaphragm	**X**	None

Pressure Guage w/Guard

A	200 PSI gauge with guard, PTFE diaphragm	**C**	30 PSI gauge with guard, PTFE diaphragm
B	100 PSI gauge with guard, PTFE diaphragm	**X**	None

Flow Meter and Strainer

C	Model MS6 chemical feed flow meter, 10-5,000 ml/min (0.158 - 79.2 GPH)
D	Model MS6 chemical feed flow meter, 100-10,000 ml/min (1.58 - 158 GPH)
X	Inlet strainer only

Miscellaneous Options (leave blank if not specified)

1	Install and ship with a specific pump model	**A**	Isolation ball shut-off valves at check valves
2	Perform pressure and fluid testing with a specific pump model	**T2**	PTFE tubing
3	Perform pressure, fluid testing, and ship with pump model installed	**C2**	Terminal box and electrical outlet box
5	1/2" Intake manifold plumbing		

CFPS-2	**A**	**V**	**-**	**A**	**A**	**A**	**C**	**1**	**Sample Model Number**

NOTE: When ordering pumps for skids, pump head orientation is standard LEFT facing only.

Blue-White®

Engineering and Technical Data

MS6

SONIC-PRO® Chemical Feed Flow Meter

Features

> Inline pipe fittings for easy installation
> Isolated 4-20 mA output - fully configurable
> Process control via configurable solid state relay
> User configurable flow rate and total set-point triggers
> True unions for ease of maintenance

Video link: ▶

NSF
Certified to NSF / ANSI Standard 61

NEMA 4X

Highlights

Flow rate
10 - 10,000 mL/min
.158 - 158.5 GPH

Pressures
200 PSI
(13.8 bar)

Body material
PVDF

Pipe sizes
½” Barb, ½” M/NPT,
½” PVC slip

Display options
Remote mount or
meter mount

Warranty
5 Years

For more help and information regarding **MS6**, please visit www.blue-white.com or scan this QR code.

Engineering Specifications

General Operation

Compatible Fluid Types	Acoustically conductive fluids, particulate and bubbles with 50,000 ppm or less
Pre-Calibrated Chemical Profiles	Water
	Aqueous Ammonia 10%
	Ammonium Hydroxide 30%
	Ferric Chloride 40%
	Sodium Bisulfite 40%
	Sodium Hypochlorite 12.5%
	Sodium Permanganate 40%
	Hydrofluorosilicic Acid 25%
	Ammonium Sulfate 10%

Blue-Central® Software:

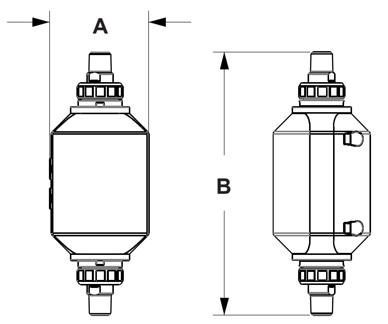
Compatible Operating Systems	Windows 10
	Mac (OSX 10.11/10.12/10.13)
Software Features	Configurable 4-20ma, Pulse Output, Frequency Output,
	Solid State Relay Set-Point
	Monitor flow rate in real time
	Monitor total volume in real time
	Monitor meter diagnostics
	Field Upgradable Firmware
	Factory Resettable
Computer Connector	USB-C (USB-A to USB-C cable included)

Electronics / Hardware SPU(Signal Processing Unit):

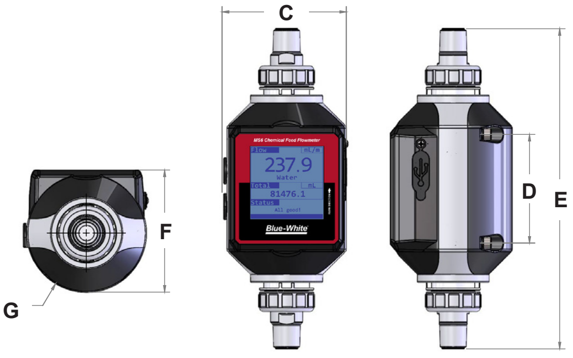
Power Requirements	5 VDC; 5 watts maximum
Operating Temp.	14 °F to 104 °F (-10 °C to 40 °C)
Storage Temp.	-40 °F to 158 °F (-40 °C to 70 °C)
Relative Humidity	0% - 90%
Volume Units	Independently configurable Rate and Total units in: U.S. Gallons, Liters, or Milliliters.
Time Units	Seconds, minutes, hours, days.
Flow Rate Averaging	Selectable: 1, 4, 8, 16, and 32 seconds.
Data Outputs	Isolated 4-20 mA output - fully configurable
	0-1,000 Hz Pulse output - fully configurable
Display	Type: Liquid Crystal Display
	Backlight: White LED backlight
Software Language	English
Process Control	One Solid State Relay
	Load capacity: 24VDC, 100mA max (ex. supplied)
	Configure to flow rate for high/low/range rate trigger. Programmable release values enable auto release or manual latching operation.
	Configure to flow total for automatically triggered, timed batch operations for proportional feed applications.
Power Supply (user configurable) Includes each of the following:	U.S. Transformer, 115VAC 60HZ / 15VDC, NEMA 5/15 plug
	Europe Transformer, 230VAC 50HZ / 15VDC, CEE 7/V11 plug
	AU/ New Zealand Transformer, 240VAC 50HZ / 15VDC, AS 3112 plug
	U.K. Transformer, 230VAC 50Z / 15VDC, BS 1363/A plug
Enclosure	NEMA 4X (IP66)
RoHS Complaint	Yes
Standards	NSF/ANSI

Dimensions

Dim	Inch	cm
A	3.8”	9.7
B	10.0”	25.4
C	3.9”	9.9
D	3.4”	8.6
E	10.02”	25.5
F	3.8”	9.7
G	3.7”	9.4



Remote Mount Display Meter Body

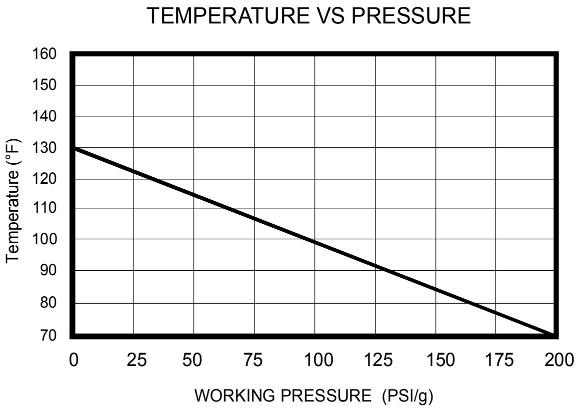


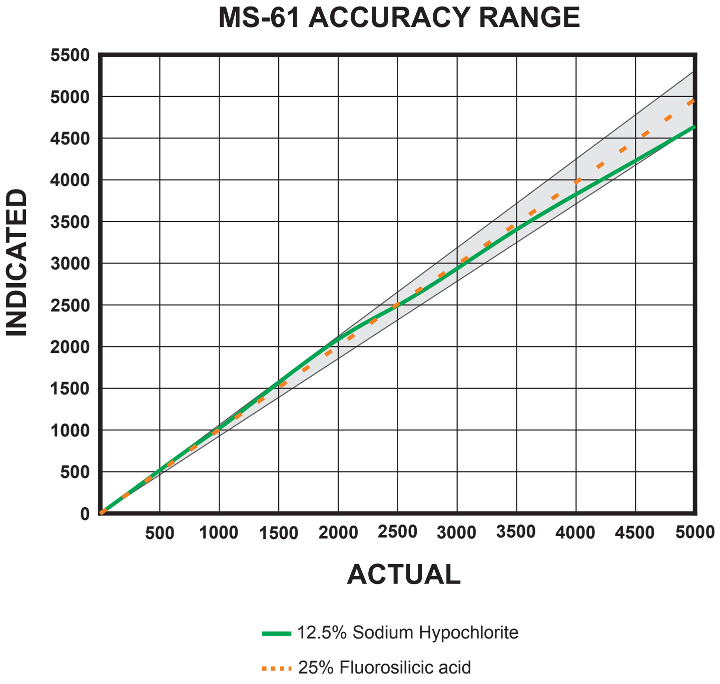
Meter Mount Display Meter Body

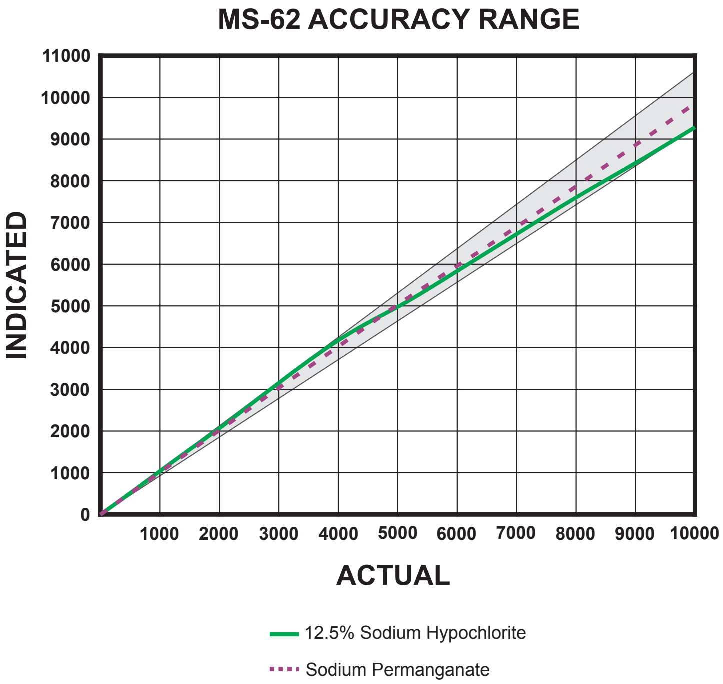
Materials of Construction

Wetted Components:	
Transducer:	PEEK
Body:	PVDF & PEEK
O-Rings:	TFE/P (optional EP)
Fittings (Included):	PVDF 1/2” I.D. Barb
	PVDF 1/2” I.D. Barb Elbow
	PVDF 1/2” M/NPT
	PVDF 1/2” M/NPT Elbow
	PVC 1/2” Slip

Performance







Model Number Matrix

Chemical Meter Model Number

MS6	MS6 Chemical Feed Flow Meter

Flow Range

1	10-5000 mL/min (0.158-79.2 GPH)
2	100-10000 mL/min (1.58 -158.5 GPH)

Display Options

1	Remote Mount Display
2	Meter Mount Display

Elastometer Material (O-Ring)

V	TFE/P
E	EP

MS6	**1**	**1**	**V**	**X**	**Sample Model Number**

Display Options

MS6*1

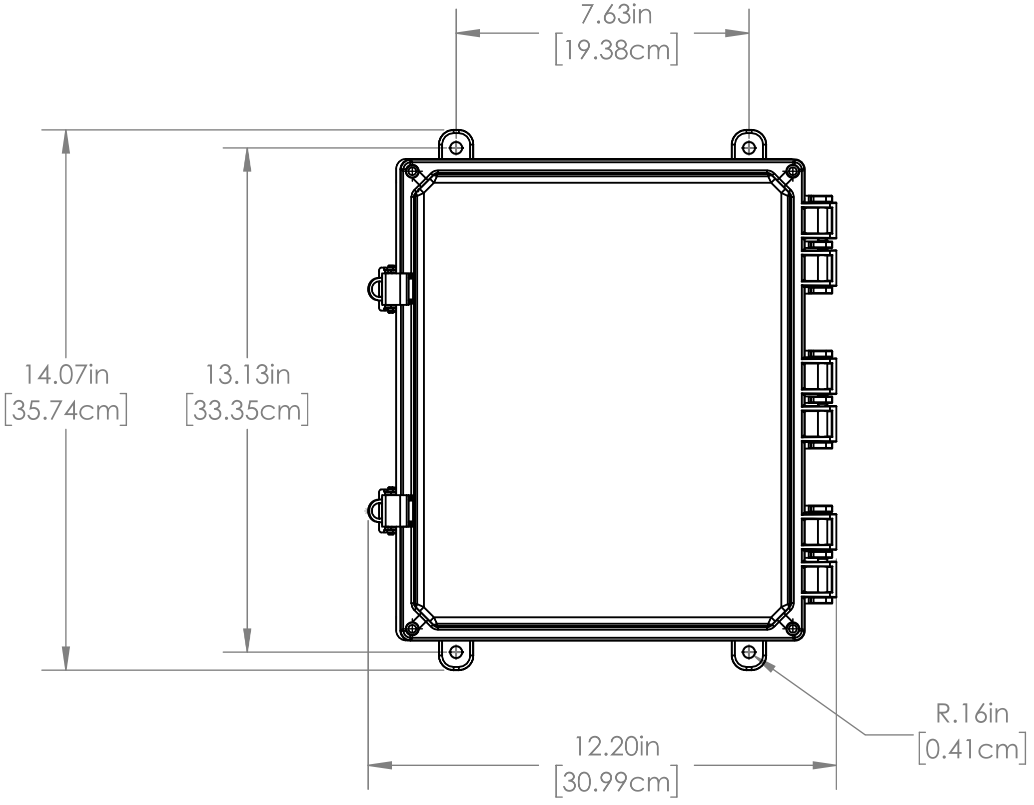
Remote Mount Display

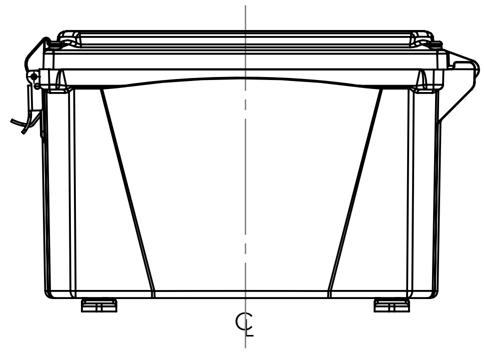
MS6*2

Meter Mount Display

NOTES:

1. Enclosure UL and ULC rated
2. Enclosure IP-66 rated





REV.	DESCRIPTION	DATE	APPROVED

REVISIONS

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NEXT ASSY	USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES:
ALL ANGLES 45° UNLESS NOTED
TOLERANCES:
FRACTIONAL ± 1/64
ANGULAR: MACH ± 1° BEND ± 1°
NO DECIMAL ±.060
ONE PLACE DECIMAL ±.030
TWO PLACE DECIMAL ±.010
THREE PLACE DECIMAL ±.005

INTERPRET GEOMETRIC TOLERANCING PER:

MATERIAL

FINISH

	NAME	DATE
DRAWN	Patrick M.	10/14/2021
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

COMMENTS:

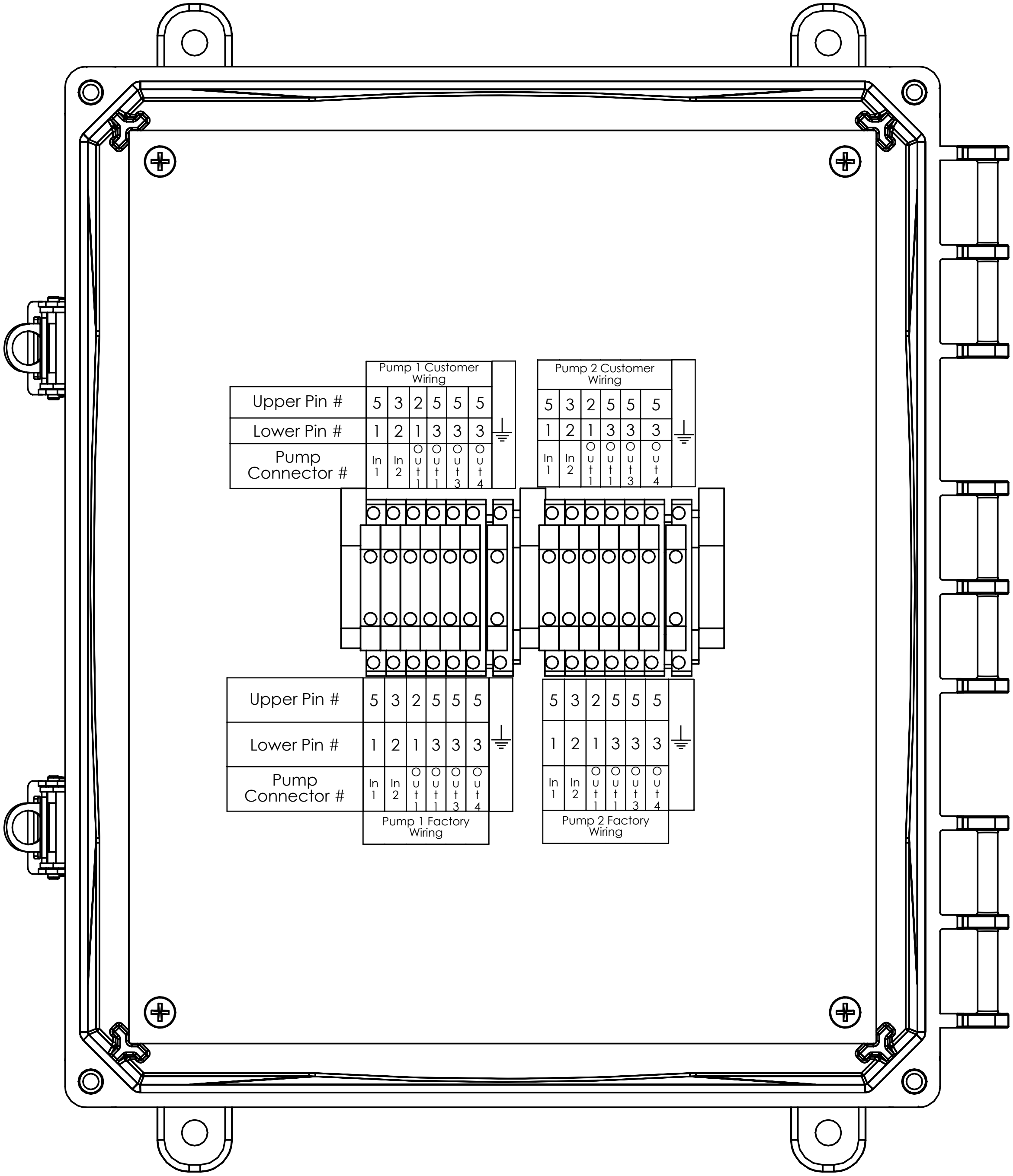
BLUE-WHITE INDUSTRIES
5300 BUSINESS DRIVE HUNTINGTON BEACH CA, 92649

TITLE:

Terminal Box Dual Skid
for A3S/M3S/A4S/M4S Pumps

SIZE	DWG. NO.	REV
A	60200-035	-

SCALE: 1:5 WEIGHT: 1.098 SHEET 1 OF 2



Pump 1 Customer Wiring

Upper Pin #	5	3	2	5	5	5	
Lower Pin #	1	2	1	3	3	3	⏚
Pump Connector #	In 1	In 2	Out 1	Out 1	Out 3	Out 4	

Pump 2 Customer Wiring

5	3	2	5	5	5	
1	2	1	3	3	3	⏚
In 1	In 2	Out 1	Out 1	Out 3	Out 4	

Upper Pin #	5	3	2	5	5	5	
Lower Pin #	1	2	1	3	3	3	⏚
Pump Connector #	In 1	In 2	Out 1	Out 1	Out 3	Out 4	

Pump 1 Factory Wiring

5	3	2	5	5	5	
1	2	1	3	3	3	⏚
In 1	In 2	Out 1	Out 1	Out 3	Out 4	

Pump 2 Factory Wiring

Pump Connector	Pin #	Rating	Wire Color	Description	Electrical SP.
Input #1	1	Open= Stop GND = Run	Brown	Remote Start/Stop (Dry Contact)	0 VDC
	5	(-)	Gray		
Input #2	2	(+)	White	4-20mA Input	250ohm impedance, Non-powered loop
	3	GND	Blue		
Output #1	1	(+)	Brown	4-20mA Output	250ohm impedance, Non-powered loop
	2	(-)	White		
Output #1	3	NORM. OPEN	Blue	Relay Output #1	Form C 1 Amp Max at 125VAC 0.8 Amp Max at 30VDC
	5	COMMON	Gray		
Output #3	3	NORM. OPEN	Blue	Relay Output #2	Form C 1 Amp Max at 125VAC 0.8 Amp Max at 30VDC
	5	COMMON	Gray		
Output #4	3	NORM. OPEN	Blue	Relay Output #3	Form C 1 Amp Max at 125VAC 0.8 Amp Max at 30VDC
	5	COMMON	Gray		

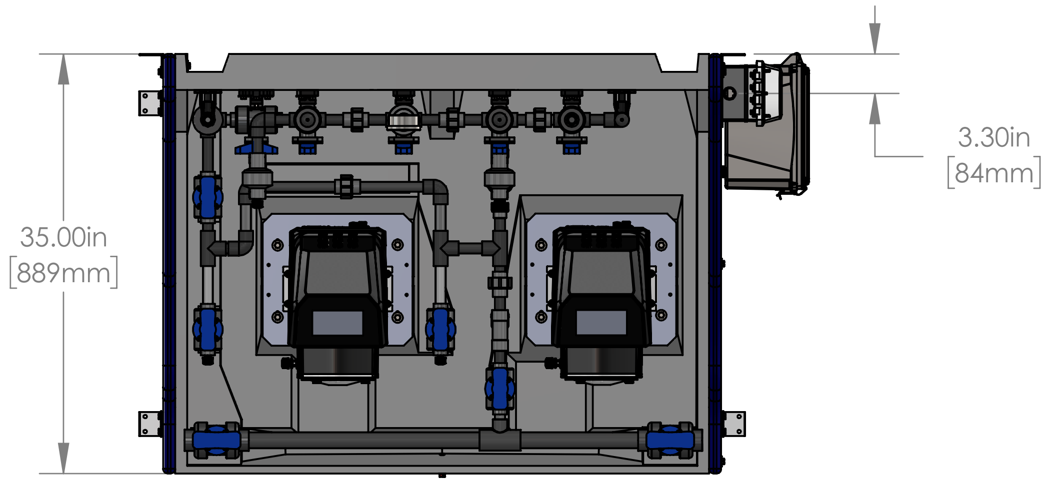
NOTES:

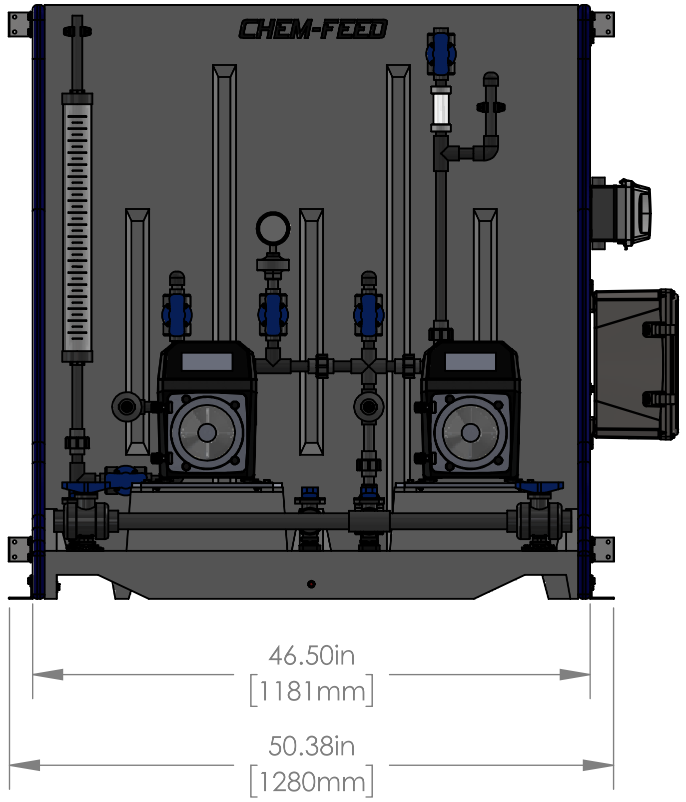
BLUE-WHITE INDUSTRIES
5300 BUSINESS DRIVE HUNTINGTON BEACH CA, 92649

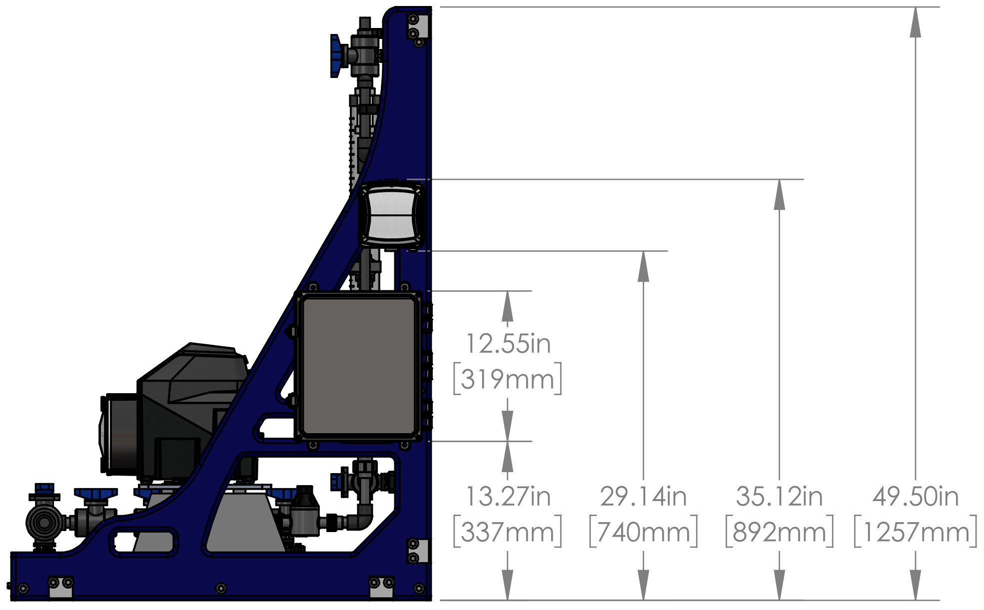
SIZE	DWG. NO.	REV
A	60200-035	-
SCALE: 1:8	WEIGHT: 1.098	SHEET 2 OF 2

NOTES:

1. MAT'L: SCH. 80 PVC PIPING & VALVES, EPDM ELASTOMERS.







REV.	DESCRIPTION	DATE	APPROVED

REVISIONS

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APPLICATION

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DIMENSIONS ARE IN INCHES
ALL ANGLES 45°
TOLERANCES:
FRACTIONAL±1/64
ANGULAR: MACH±1° BEND ±1°
NO DECIMAL ±.060
ONE PLACE DECIMAL ±.030
TWO PLACE DECIMAL ±.010
THREE PLACE DECIMAL ±.005

INTERPRET GEOMETRIC TOLERANCING PER:

MATERIAL SEE NOTE #1

FINISH

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	N.ANDER	3/21/2022
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

COMMENTS:

BLUE-WHITE INDUSTRIES
5300 BUSINESS DRIVE HUNTINGTON BEACH CA, 92649

TITLE:
CFPS-2 W/ M3S PUMPS
TERMINAL BOX & OUTLET

SIZE **B**
DWG. NO. CFPS-2-CE-CXBX-C2-M3S
REV -

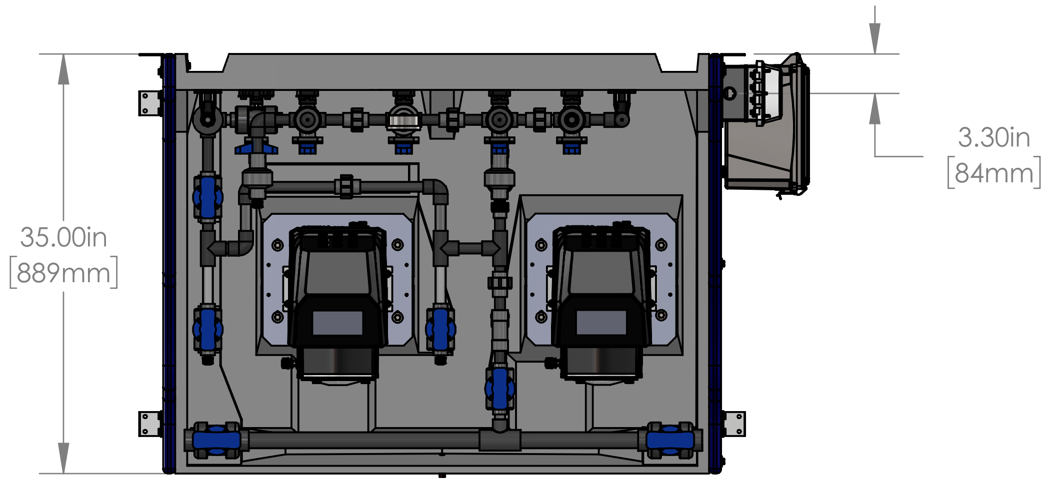
SCALE: 1:16 WEIGHT: SHEET 1 OF 2

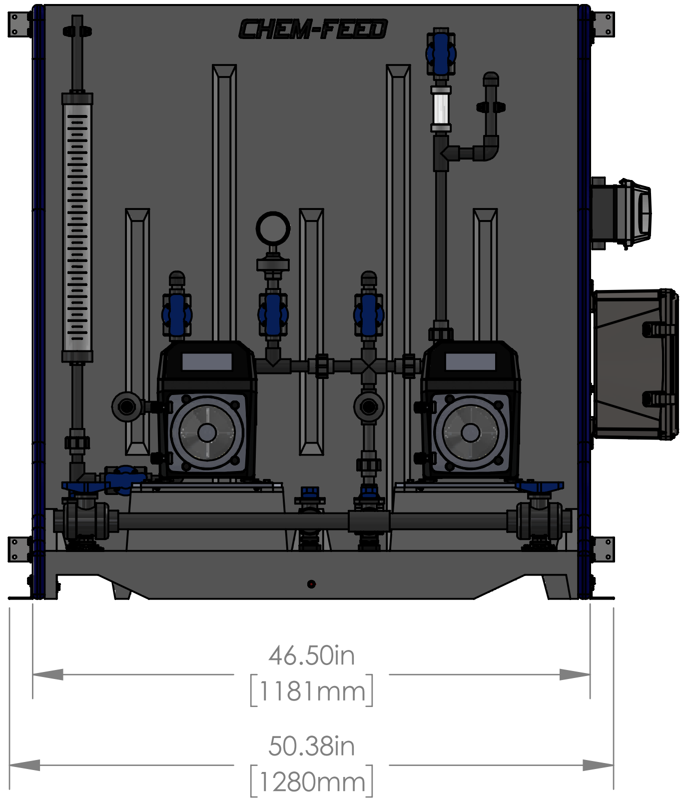
BLUE-WHITE INDUSTRIES
5300 BUSINESS DRIVE HUNTINGTON BEACH CA, 92649

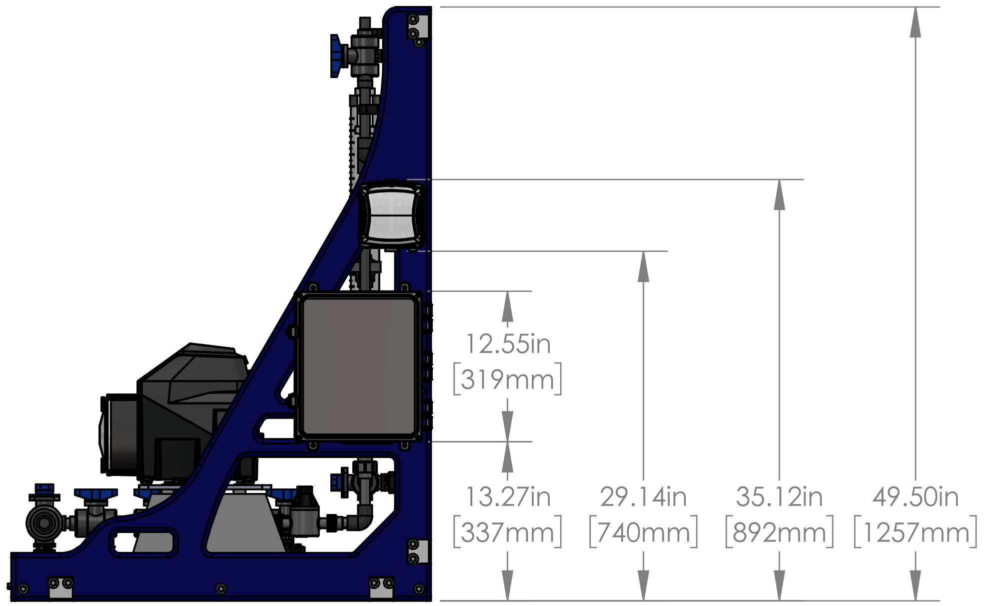
SIZE	DWG. NO.	REV
B	CFPS-2-CE-CXBX-C2-M3S	-
SCALE: 1:10	WEIGHT:	SHEET 2 OF 2

NOTES:

1. MAT'L: SCH. 80 PVC PIPING & VALVES, VITON ELASTOMERS.







REV.	DESCRIPTION	DATE	APPROVED

REVISIONS

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NEXT ASSY	USED ON
APPLICATION	

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TOLERANCES:
FRACTIONAL±1/64
ANGULAR: MACH±1° BEND ±1°
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ONE PLACE DECIMAL ±.030
TWO PLACE DECIMAL ±.010
THREE PLACE DECIMAL ±.005

INTERPRET GEOMETRIC TOLERANCING PER:

MATERIAL
SEE NOTE #1

FINISH

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	NAME	DATE
DRAWN	N.ANDER	3/21/2022
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

COMMENTS:

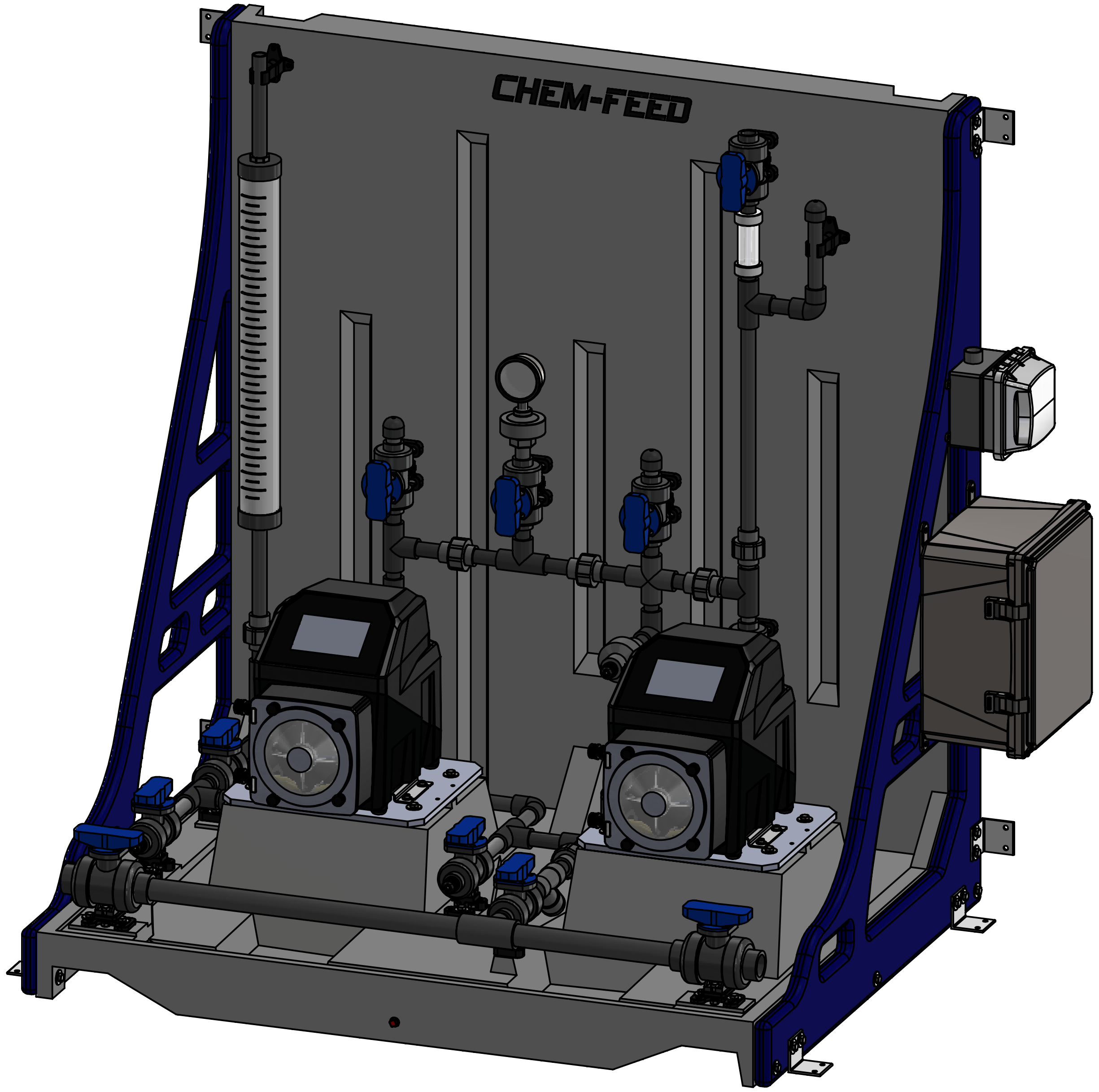
BLUE-WHITE INDUSTRIES
5300 BUSINESS DRIVE HUNTINGTON BEACH CA, 92649

TITLE:

CFPS-2 W/ M3S PUMPS
TERMINAL BOX & OUTLET

SIZE	DWG. NO.	REV
B	CFPS-2-CV-CXBX-C2-M3S	-

SCALE: 1:16 WEIGHT: SHEET 1 OF 2



BLUE-WHITE INDUSTRIES
5300 BUSINESS DRIVE HUNTINGTON BEACH CA, 92649

SIZE	DWG. NO.	REV
B	CFPS-2-CV-CXBX-C2-M3S	-

SCALE: 1:10 WEIGHT: SHEET 2 OF 2

pH Adjustment Calculations

Equations and Constants

1) $pH = -\log [H^+]$
2) $pOH = -\log [OH^-]$
3) $pOH + pH = 14$
4) $K_b=K_w/K_a$
5) $K_w=1 \times 10^{-14}$
6) $K_a[HCO_3^-]=5.6 \times 10^{-11}$

Reactions

2NaOH	+	CO_2	<=>	Na_2CO_3	+	H_2O	Step 1: Sodium Hydroxide reacts with CO_2 in the aerated water. The expected concentration of CO_2 is 7 mg/L. This is equivalent to a molarity of 1.6×10^{-4} gmols/L
Na_2CO_3	+	H_2O	<=>	$2Na^+$	+	CO_3^{-2}	Step 2: Sodium carbonate is a strong electrolyte and dissolves readily in water.
CO_3^{-2}	+	H_2O	<=>	HCO_3^{-1}	+	OH^-	Step 3: The sodium ion is a spectator and does not contribute to a pH change. HCO_3^{-1} acts as a weak base with a higher K_b than K_a.

Equilibrium Table

CO_3^{-2}	+ H2O	<=> HCO_3^{-1}	+ OH^-	
1.6E-04	--	0	0	Initial Concentration
-x	--	+x	+x	Change
1.6E-04 - x	--	x	x	Equilibrium Concentration

Notes:

1) This table assumes that all the CO2 present in the water reacts with the NaOH to form Na_2CO_3. The stoichiometric ratio of CO_2 to Na_2CO_3 is 1:1.

Calculations:

K_b of CO_3^{-2}	= 1E-14 / 5.6E-11	Equations 4, 5, and 6
K_b of CO_3^{-2}	= 1.8E-04	

Also:

K_b of CO_3^{-2}	= $[HCO_3^-]\ [OH^-]/[CO_3^{-2}]$	Autoionization Reaction
K_b of CO_3^{-2}	= x^2 / 1.6E-04 - x	Substituting values from the equilibrium table
1.80E-04	= x^2 / 1.6E-04 - x	Using Kb calculated above
0	= 1 x^2 + 1.8E-04 x -2.9E-08	Multipyling through the equation and simplifying
x_1	= 1.0E-04	Using the quadratic formula gives two answers
x_2	= -2.8E-04	

pOH	= 4.0	Using X_1 as the $[OH^-]$ concentration and equation 2
pH	= 10.0	Equation 3

What concentration of salt is needed to achieve a pH of 7?

Equilibrium Table

CO_3^{-2}	+ H2O	<=> HCO_3^{-1}	+ OH^-	
1.0E-07	--	0	0	Initial Concentration
-x	--	+x	+x	Change
1.0E-07 - x	--	x	x	Equilibrium Concentration

Notes:

1) This table assumes that all the CO2 present in the water reacts with the NaOH to form Na_2CO_3. The stoichiometric ratio of CO_2 to Na_2CO_3 is 1:1.

Calculations:

K_b of CO_3^{-2}	= 1E-14 / 5.6E-11	Equations 4, 5, and 6
K_b of CO_3^{-2}	= 1.8E-04	

Also:

K_b of CO_3^{-2}	= $[HCO_3^-]\ [OH^-]/[CO_3^{-2}]$	Autoionization Reaction
K_b of CO_3^{-2}	= x^2 / 1.6E-04 - x	Substituting values from the equilibrium table
1.80E-04	= x^2 / 1.6E-04 - x	Using Kb calculated above
0	= 1 x^2 + 1.8E-04 x -1.8E-11	Multipyling through the equation and simplifying
x_1	= 1.0E-07	Using the quadratic formula gives two answers
x_2	= -1.8E-04	

pOH	= 7.0	Using X_1 as the $[OH^-]$ concentration and equation 2
pH	= 7.0	Equation 3

NaOH Usage Estimate

CO2	1.1	mols	Mols CO2 present in 3 MM gallons of water (daily design flow)
NaOH	100	lbs	This is the mass of NaOH required to convert the mols of CO_2 to sodium carbonate. The NaOH to CO_2 stoichiometric ratio required is 2:1.
20% NaOH Volume	49	gallons	Volume per day of 20% NaOH required. Density of 20% NaOH is 10.2 lbs/gal.
50% NaOH Volume	16	gallons	Volume per day of 50% NaOH required. Density of 50% NaOH is 12.8 lbs/gal.
	468	gallons/month	

pH Adjustment Calculations

Equations and Constants

1) pH = -log [H$^+$]
2) pOH = -log [OH$^-$]
3) pOH + pH = 14
4) Tested pH of the well water is 5.2

pOH =	8.8	Equation 3
[0H$^-$] =	1.6E-09	Equation 4
[0H$^-$] needed =	9.8E-08	This is the [OH$^-$] concentration needed to lower the pOH to 7 in mols/L
0H$^-$ needed =	2.60	This is the total mols [OH-] needed to lower the pOH to 7 (for 7 million gallons of water)
lbs =	104.2	Lbs of NaOH needed to provide required mols of [OH$^-$]
gal =	51.1	Volume per day of 20% NaOH required. Density of 20% NaOH is 10.2 lbs/gal.
gal =	16.3	Volume per day of 50% NaOH required. Density of 50% NaOH is 12.8 lbs/gal.
gal/month =	489	

ssoe

CHLORINATION DOSING CALCULATION

PROJECT NO. **012-02080-00**

PROJECT: **MEMPHIS REGIONAL MEGASITE**
BY: **KP** CHECKED: DATE: **1/9/12** REV. **0**

ANTICIPATED WATER FLOW RATE (GPM):	4875
DESIRED CONCENTRATION (PPM)[1]:	2
CONVERSION (PPD):	58,406,400
CHLORINE DOSING RATE (PPD):	116.8
NAOCL RATE NEEDED (PPD)[2]:	934.5
NAOCL RATE NEEDED (GPM):	0.065
NAOCL RATE NEEDED (GPD):	93
NAOCL RATE NEEDED (GAL PER MONTH):	2800

1.204

REMARKS:

1) 1-2 PPM IS THE RECOMMENDED CHLORINE CONCENTRATION FOR WELL WATER

2) USING A SODIUM HYPOCHLORITE SOLUTION WITH 12.5% AVAILABLE CHLORINE

3) ASSUMED MINIMAL NATURAL CHLORINE CONCENTRATION IN WELL WATER BASED ON TESTING RESULTS

COMPLETED BY ALLOWAY IN MAY 2011.

4) ASSUMED NO IRON, MANGANESE, AMMONIA, OR ORGANICS CONTAINED IN THE WATER BASED ON TESTING RESULTS

COMPLETED BY ALLOWAY IN MAY 2011.

REV. NO.	DESCRIPTION	BY	DATE	CHECKED	DATE
0	ISSUE FOR PRELIMINARY DESIGN	KP	1/9/2022		

Note: This sheet represents the raw data with days no water treatment occurred removed.

Dupree Water Treatment Plant
Brownsville, Tenn. PWSID #0000080

*********	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********	*********	**********	**********		*********	*********	*********	**RATIOS**
	WATER	CHLORINE	CHLORINE	CHLORINE	FLUORIDE	FLUORIDE	FLUORIDE	ALKALINITY	ALKALINITY	pH	pH	CO2	CO2	POUNDS	POUNDS		PHOSPHATE	MASTER		
	TREATED	POUNDS	MG/L	MG/L	POUNDS	MG/L	MG/L	MG/L	MG/L	RAW	FINISHED	RAW	FINISHED	LIME	PHOSPHATE		MG/L	METER		
DATE	MGD	USED	FREE	DIST.	USED	CALC	TEST	RAW	FINISHED					USED	USED		RESIDUAL	FINISHED		**LIME TO WATER (LBS/MIL GAL)**
1/1/2012	1.260	26	1.8		17	0.971					7.2			50	14	11		1.278		40
1/2/2012	1.323	22	1.8		17	0.925					7.2			50	15	11		1.323		38
1/3/2012	0.144	1	1.9	1.7	1	0.500	0.7	22	30	6.0	7.2	67	6	0	1	7	0.45	0.018		0
1/5/2012	0.025	2	1.7	1.2	0	0.000	1.0	27	30	6.1	7.3	69	5	0	1	40	0.47	0.069		0
1/9/2012	1.320	20	1.8	1.5	16	0.872	1.0		28		7.2		5	100	13	10	0.28	1.354		76
1/10/2012	1.590	16	1.7	1.4	21	0.950	1.0	19	29	6.1	7.3	61	4	100	18	11	0.26	1.386		63
1/11/2012	1.372	10	1.9	1.6	17	0.892	1.0		31		7.3		6	100	14	10	0.20	1.386		73
1/12/2012	1.537	20	1.8	1.7	20	0.936	1.0	20	26	6.0	7.3	65	5	100	17	11	0.22	1.404		65
1/13/2012	1.221	22	1.9	1.7	16	0.943	1.0		28		7.2		4	50	13	11	0.17	1.291		41
1/14/2012	1.524	26	1.8		19	0.897					7.2			100	17	11		1.436		66
1/15/2012	1.372	27	1.8		19	0.997					7.3			100	15	11		1.234		73
1/17/2012	0.039	0	1.9	1.5	0	0.000	1.1	21	29	6.0	7.3	63	5	0	0	0	0.56	0.125		0
1/22/2012	1.020	0	1.4		0	0.000					7.3			0	0	0		0.000		0
1/23/2012	1.320	20	1.6	1.4	14	0.763	1.2		32		7.2		6	100	12	9	0.55	1.064		76
1/24/2012	1.524	27	1.7	1.5	16	0.755	0.9	22	29	6.0	7.3	59	5	100	14	9	0.43	1.386		66
1/25/2012	1.386	28	1.8	1.9	18	0.935	1.0		29		7.3		5	100	17	12	0.32	1.417		72
1/26/2012	1.386	25	1.9	1.3	18	0.935	1.0	22	28	6.0	7.3	56	5	100	15	11	0.40	1.430		72
1/27/2012	1.603	30	1.9	1.5	18	0.808	1.0		29		7.3		5	100	17	11	0.40	1.411		62
1/28/2012	1.234	21	1.9		15	0.875					7.4			100	14	11		1.228		81
1/29/2012	1.465	20	2.0		18	0.884					7.3			0	15	10		1.386		0
1/30/2012	0.139	10	1.8	1.8	1	0.517	1.0		31		7.3		4	0	1	7	0.25	0.085		0
2/6/2012	1.253	24.0	1.8	1.4	16	0.919	1.0		33		7.3		4	100	15	12	0.27	1.335		80
2/7/2012	1.354	10.0	1.9	1.6	15	0.797	1.0	23	28	6.0	7.2	60	5	50	14	10	0.26	1.360		37
2/8/2012	1.335	17.0	1.7	1.6	18	0.970	1.0		28		7.2		7	100	14	10	0.21	1.348		75
2/9/2012	1.430	22.0	1.9	1.9	16	0.805	1.0	21	30	5.9	7.3	72	5	100	16	11	0.57	1.436		70
2/10/2012	1.291	24.0	2.0	1.6	16	0.892	1.0		29		7.1		6	100	14	11	0.13	1.297		77
2/11/2012	1.386	25.0	2.0		16	0.835					7.2			50	16	12		1.323		36
2/12/2012	1.228	22.0	1.9		14	0.820					7.2			0	13	11		1.297		0
2/13/2012	0.091	4.0	1.9	1.7	2	1.582	0.9		27		7.3		7	0	1	11	0.23	0.052		0
2/16/2012	0.151	4.0	1.7	1.6	2	0.953	1.0	25	28	6.0	7.3	56	4	50	2	13	0.34	0.059		331
2/20/2012	1.438	26.0	1.9	1.8	16	0.801	0.9		31		7.3		5	100	17	12	0.76	1.373		70
2/21/2012	1.306	19.0	1.9	1.7	15	0.826	0.9	20	27	5.9	7.3	65	4	50	14	11	0.42	1.386		38
2/22/2012	1.557	22.0	1.9	1.6	18	0.821	0.9		27		7.3		4	100	17	11	0.45	1.386		64
2/23/2012	1.432	12.0	2.0	1.8	16	0.804	0.7	21	27	6.0	7.3	61	4	100	15	10	0.16	1.430		70
2/24/2012	1.597	14.0	2.0	1.7	18	0.811	1.0		31		7.3		4	100	17	11	0.26	1.417		63
2/25/2012	1.267	5.0	1.7		16	0.909					7.3			100	14	11		1.329		79
2/26/2012	1.432	15.0	1.9		19	0.955					7.2			0	14	10		1.348		0
2/27/2012	0.069	1.0	1.8	1.2	1	1.043	1.4		28		7.3		4	0	1	14	0.41	0.058		0
2/28/2012	0.132	3.0	1.7	1.2	1	0.545	1.0	27	28	6.1	7.3	66	4	0	2	15	0.27	0.059		0
3/1/2012	0.151	2	1.5	1.3	2	0.291	1.0	27	28	6.1	7.3	61	5	50	1	7	0.25	0.072		331
3/2/2012	0.069	2	1.6	1.5	2	0.864	1.0		30		7.3		4	0	2	29	0.56	0.211		0
3/5/2012	1.222	27	1.8	1.1	13	0.765	0.9		30		7.3		4	100	13	11	0.55	1.452		82
3/6/2012	1.348	22	1.9	1.6	16	0.854	0.9	23	28	6.0	7.3	62	4	100	15	11	0.31	1.432		74
3/7/2012	1.386	27	1.9	1.9	18	0.935	0.9		27		7.3		6	50	15	11	0.21	1.465		36
3/8/2012	1.335	27	2.0	1.5	16	0.862	1.0	22	27	6.1	7.1	62	5	50	15	11	0.16	1.412		37
3/9/2012	1.241	24	1.9	1.5	15	0.870	0.9		28		7.3		4	50	13	10	0.12	1.320		40
3/10/2012	1.341	27	1.9		17	0.912					7.1			100	25	19		1.405		75
3/11/2012	1.253	26	1.9		14	0.804					7.1			50	13	10		1.326		40
3/12/2012	0.056	1	1.9	1.9	1	1.285	1.0		26		7.3		4	0	1	18	0.14	0.059		0
3/13/2012	0.594	13	1.9	1.4	7	0.848	1.1	24	28	6.1	7.3	55	4	0	8	13	0.45	0.516		0
3/14/2012	0.244	5	2.0	1.2	3	0.885	0.9		27		7.3		4	0	2	8	0.13	0.333		0
3/15/2012	0.204	3	1.7	1.0	3	1.058	0.9	23	28	6.1	7.3	56	4	50	3	15	0.47	0.214		245
3/16/2012	0.125	6	1.6	1.6	3	1.728	1.1		30		7.3		5	0	3	24	0.32	0.157		0
3/17/2012	0.151	3	1.8		1	0.474					7.1			0	1	7		0.220		0
3/18/2012	0.099	2	1.9		2	1.454					7.1			0	2	20		0.170		0
3/19/2012	1.108	21	2.0	1.7	13	0.844	1.0		29		7.2		6	100	13	12	0.30	1.287		90
3/20/2012	1.253	24	1.8	1.5	15	0.861	0.9	26	28	6.0	7.1	66	8	100	13	10	0.29	1.346		80

3/21/2012	1.222	21	1.8	1.8	14	0.824	0.9		27		7.3		5	100	13	11	0.27	1.320	82
3/22/2012	1.285	12	1.9	1.8	15	0.840	0.9	22	27	6.0	7.2	54	6	100	14	11	0.40	1.346	78
3/23/2012	1.228	10	1.8	1.7	10	0.586	0.9		28		7.1		4	100	13	11	0.27	1.287	81
3/24/2012	1.215	18	1.9		14	0.829					7.1			100	13	11		1.273	82
3/25/2012	1.071	15	2.0		12	0.806					7.2			0	13	12		1.201	0
3/26/2012	0.104	4	1.9	1.2	1	0.692	0.9		27		7.2		7	0	1	10	0.26	0.063	0
3/27/2012	0.198	5	1.7	1.5	3	1.090	0.9	24	29	6.1	7.3	57	5	0	2	10	0.29	0.109	0
3/28/2012	0.303	5	1.8	1.7	3	0.712	0.9		27		7.2		7	0	3	10	0.13	0.296	0
3/29/2012	0.019	1	1.6	1.5	1	3.789	0.9	24	24	6.0	7.0	64	8	0	1	53	0.25	0.201	0
3/30/2012	0.303	2	1.5	1.5	2	1.090	1.0		29		7.2		5	50	2	7	0.32	0.025	165
4/1/2012	0.151	6	1.5		2	0.953					7.1			0	3	20		0.157	0
4/2/2012	1.102	20	1.7	1.2	12	0.784	0.9		28		7.2		6	50	12	11	0.18	1.293	45
4/3/2012	1.399	26	1.9	1.9	17	0.874	0.8	23	26	5.9	7.2	66	4	100	14	10	0.48	1.359	71
4/4/2012	1.240	21	1.8	1.5	15	0.870	0.9		29		7.3		4	50	14	11	0.16	1.320	40
4/5/2012	1.346	23	1.8	1.9	16	0.855	0.9	22	29	6.0	7.2	63	4	50	16	12	0.30	1.353	37
4/6/2012	1.188	23	1.8	1.8	15	0.909	0.9		29		7.3		4	100	12	10	0.20	1.306	84
4/7/2012	1.313	17	1.9		15	0.823					7.2			100	14	11		1.306	76
4/8/2012	1.227	13	1.8		15	0.880					7.1			50	15	12		1.280	41
4/9/2012	0.356	10	1.9	1.5	4	0.808	0.9		27		7.3		4	0	3	8	0.20	0.226	0
4/11/2012	0.039	1	1.6	1.6	1	1.846	1.0		27		7.3		6	0	1	26	0.25	0.107	0
4/12/2012	0.389	4	1.5	1.6	4	0.740	1.0	24	31	6.0	7.2	52	4	50	3	8	0.27	0.270	129
4/13/2012	0.132	2	1.9	1.5	3	1.676	0.9		30		7.1		5	50	3	23	0.30	0.195	379
4/14/2012	0.178	3	1.6		3	1.213					7.1			0	2	11		0.239	0
4/15/2012	0.204	2	1.8		3	1.058					7.3			50	2	10		0.207	245
4/16/2012	1.102	15	1.8	1.6	12	0.784	1.0		27		7.2		4	50	13	12	0.20	1.306	45
4/17/2012	1.272	22	2.0	1.2	15	0.849	0.8	21	27	5.9	7.2	66	4	50	13	10	0.12	1.346	39
4/18/2012	1.297	22	1.9	1.6	16	0.888	0.8		26		7.2		5	100	15	12	0.40	1.379	77
4/19/2012	1.278	23	1.8	1.6	15	0.845	0.9	21	27	5.9	7.2	69	5	50	14	11	0.25	1.359	39
4/20/2012	1.228	27	1.9	1.3	16	0.938	0.9		27		7.2		7	100	14	11	0.10	1.313	81
4/21/2012	1.197	24	1.9		12	0.721					7.1			50	14	12		1.254	42
4/22/2012	1.247	21	1.9		16	0.923					7.0			50	13	10		1.346	40
4/23/2012	0.937	19	1.9	1.6	10	0.768	0.8		26		7.2		4	50	10	11	0.17	0.869	53
4/24/2012	1.465	26	1.8	1.7	17	0.835	1.0	20	27	6.0	7.1	47	6	50	16	11	0.16	1.360	34
4/25/2012	0.429	11	1.9	1.4	4	0.671	0.9		30		7.3		5	50	5	12	0.19	0.289	117
4/26/2012	0.184	5	1.8	1.6	3	1.173	0.9	23	29	6.0	7.3	57	4	0	2	11	0.21	0.252	0
4/28/2012	0.310	6	1.7		0	0.000					7.2			50	0	0		0.264	161
4/29/2012	0.270	6	1.8		5	1.333					7.1			0	5	19		0.302	0
4/30/2012	1.207	22	1.7	1.8	14	0.835	0.8		29		7.3		3	100	14	12	0.16	1.304	83
5/1/2012	1.359	24	1.9	1.5	15	0.794	0.8	21	27	6.0	7.0	60	5	100	16	12	0.18	1.335	74
5/2/2012	1.518	27	1.8	1.5	18	0.853	0.8		27		7.2		5	50	16	11	0.36	1.373	33
5/3/2012	1.610	11	1.7	1.7	20	0.894	0.9	24	28	6.0	7.3	57	4	100	17	11	0.22	1.537	62
5/4/2012	1.254	19	1.8	1.8	14	0.803	0.9		28		7.2		4	50	14	11	0.24	1.241	40
5/5/2012	1.465	21	1.6		16	0.786					7.3			50	16	11		1.379	34
5/6/2012	1.293	26	1.8		16	0.890					7.2			100	13	10		1.278	77
5/7/2012	0.349	6	1.8	1.5	4	0.825	0.9		29		7.3		5	50	4	11	0.31	0.204	143
5/8/2012	0.044	0	1.9	1.5	1	1.636	0.9	24	27	6.1	7.3	52	4	50	1	23	0.42	0.158	1136
5/12/2012	0.655	12	1.7		7	0.769					7.3			0	7	11		0.211	0
5/14/2012	1.329	24	1.8	1.5	15	0.812	0.9		26		7.3		4	100	15	11	0.14	1.557	75
5/15/2012	1.329	24	1.7	1.2	16	0.866	0.8	21	29	6.0	7.2	65	5	100	16	12	0.20	1.445	75
5/16/2012	1.505	29	1.7	1.2	19	0.908	0.9		29		7.2		4	100	16	11	0.26	1.577	66
5/17/2012	1.260	24	1.9	1.7	14	0.800	1.1	22	30	6.0	7.1	64	6	100	15	12	0.18	1.372	79
5/18/2012	1.518	23	1.7	1.9	18	0.853	0.9		28		7.1		6	100	16	11	0.19	1.571	66
5/19/2012	1.272	15	1.8		14	0.792					7.2			100	15	12		1.379	79
5/20/2012	1.291	16	1.9		15	0.836					7.3			50	14	11		1.379	39
5/21/2012	0.349	5	1.7	1.6	4	0.825	0.9		34		7.3		4	0	4	11	0.27	0.207	0
5/22/2012	0.468	0	1.9	1.6	5	0.769	0.8	23	35	6.1	7.3	38	3	0	5	11	0.16	0.522	0
5/23/2012	0.640	4	1.9	1.3	7	0.787	0.9		30		7.3		4	100	6	9	0.08	0.611	156
5/24/2012	0.719	11	1.8	1.0	8	0.801	0.9	21	30	6.0	7.3	53	4	50	9	13	0.31	0.781	70
5/25/2012	0.732	13	1.7	1.7	11	1.081	0.9		30		7.3		4	50	9	12	0.21	0.642	68
5/26/2012	0.373	10	1.6		7	0.748					7.3			0	7	19		0.661	0
5/27/2012	0.475	10	1.8		5	0.757					7.2			50	6	13		0.485	105
5/28/2012	0.567	11	1.8		7	0.888					7.2			50	6	11		0.598	88
5/29/2012	1.398	27	1.6	1.4	16	0.824	0.9	21	27	6.0	7.3	48	3	100	16	11	0.65	1.603	72
5/30/2012	1.587	29	1.8	1.9	18	0.816	0.9		29		7.2		6	100	18	11	0.37	1.663	63
5/31/2012	1.272	24	1.7	1.6	16	0.905	0.9	22	28	6.0	7.2	56	5	50	14	11	0.11	1.399	39
6/1/2012	1.423	26	1.9	1.5	17	0.860	0.9		29		7.3		5	50	17	12	0.20	1.498	35

6/2/2012	1.682	28	2.0		20	0.856					7.1			100	20	12		1.762	59
6/3/2012	1.039	21	1.9		12	0.831					7.3			50	9	9		1.161	48
6/4/2012	0.346	11	1.7	1.6	4	0.832	1.0		28		7.3		6	50	4	12	0.31	0.233	145
6/5/2012	0.346	6	1.6	1.4	4	0.832	0.8	23	31	6.0	7.3	59	6	50	4	12	0.25	0.365	145
6/6/2012	0.466	10	1.8	1.4	6	0.927	0.9		32		7.3		3	100	5	11	0.40	0.485	215
6/7/2012	0.504	10	1.8	1.5	6	0.857	0.9	21	32	5.9	7.3	61	3	50	6	12	0.45	0.510	99
6/8/2012	0.522	8	1.9	1.2	5	0.689	0.9		32		7.3		3	0	7	13	0.28	0.535	0
6/9/2012	0.207	2	1.9		3	1.043					7.3			0	2	10		0.214	0
6/10/2012	0.163	4	1.7		1	0.441					7.1			50	1	6		0.189	307
6/11/2012	1.360	28	1.9	1.6	16	0.847	1.0		30		7.3		7	100	15	11	0.25	1.564	74
6/12/2012	1.260	18	1.9	1.4	14	0.800	0.7	21	32	5.9	7.2	66	5	100	14	11	0.18	1.359	79
6/13/2012	1.530	22	1.9	1.9	18	0.847	0.8		29		7.3		3	150	18	12	0.13	1.610	98
6/14/2012	1.278	21	1.9	1.7	15	0.845	0.9	22	31	5.9	7.2	63	4	100	14	11	0.23	1.386	78
6/15/2012	1.562	30	1.7	1.5	18	0.829	0.7		28		7.3		3	50	18	12	0.17	1.623	32
6/16/2012	1.335	21	1.8		16	0.862					7.2			100	15	11		1.399	75
6/17/2012	1.184	18	1.8		14	0.851					7.3			100	13	11		1.313	84
6/18/2012	0.678	14	2.0	1.6	9	0.955	0.9		27		7.3		4	50	8	12	0.23	0.580	74
6/19/2012	0.706	14	2.0	1.4	8	0.815	1.0	22	30	5.9	7.3	61	3	100	8	11	0.14	0.699	142
6/20/2012	0.851	12	1.9	1.4	9	0.761	0.9		28		7.3		3	50	9	11	0.13	0.768	59
6/21/2012	0.726	20	1.8	1.8	9	0.892	0.9	23	28	6.0	7.3	59	3	50	9	12	0.05	0.768	69
6/22/2012	0.877	10	1.8	1.5	10	0.820	0.8		30		7.3		3	50	11	13	0.14	0.768	57
6/23/2012	0.600	12	1.4		10	1.200					7.3			50	5	8		0.642	83
6/24/2012	0.613	11	1.5		6	0.704					7.1			50	8	13		0.674	82
6/25/2012	1.411	24	1.9	1.6	16	0.816	0.7		28		7.2		4	100	15	11	0.36	1.570	71
6/26/2012	1.518	18	1.8	1.2	19	0.901	0.8	22	27	6.0	7.3	65	4	100	18	12	0.16	1.590	66
6/27/2012	1.518	17	1.7	1.9	17	0.806	0.8		28		7.3		5	100	17	11	0.32	1.590	66
6/28/2012	1.499	28	1.9	1.2	18	0.864	0.9	20	27	6.0	7.3	65	5	100	17	11	0.29	1.570	67
6/29/2012	1.593	28	1.6	1.2	21	0.949	0.9		28		7.3		4	100	18	11	0.33	1.669	63
6/30/2012	1.467	26	1.9		17	0.834					7.1			100	15	10		1.544	68
7/1/2012	1.486	26	1.8		18	0.872					7.1			100	17	11		1.551	67
7/2/2012	0.749	11	1.8	1.3	10	0.961	1.0		28		7.2		4	100	8	11	0.21	0.743	134
7/3/2012	0.819	20	1.7	1.7	9	0.791	0.9	23	30	6.0	7.3	63	4	50	9	11	0.17	0.812	61
7/4/2012	0.888	17	1.9		10	0.810					7.2			50	10	11		0.894	56
7/5/2012	0.705	13	1.8	1.4	7	0.714	0.8	21	27	6.0	7.3	62	4	50	8	11	0.23	0.705	71
7/6/2012	0.535	9	1.9	1.0	6	0.807	0.8		28		7.3		3	0	6	11	0.42	0.491	0
7/7/2012	0.604	7	1.9		7	0.834					7.3			50	6	10		0.623	83
7/8/2012	0.491	12	1.6		6	0.879					7.3			50	6	12		0.522	102
7/9/2012	1.465	28	1.7	1.4	15	0.737	0.9		28		7.3		3	100	16	11	0.25	1.584	68
7/10/2012	1.511	24	1.7	1.8	18	0.857	1.0	20	30	6.0	7.3	55	3	100	16	11	0.22	1.577	66
7/11/2012	1.524	30	1.8	1.4	17	0.803	0.9		32		7.3		4	100	17	11	0.19	1.597	66
7/12/2012	1.299	24	1.8	1.6	16	0.886	0.9	21	28	5.9	7.3	61	3	100	15	12	0.32	1.419	77
7/13/2012	1.399	19	1.8	1.5	17	0.874	1.0		29		7.1		5	100	15	11	0.27	1.465	71
7/14/2012	1.333	22	1.7		15	0.810					7.1			100	14	11		1.379	75
7/15/2012	1.326	21	1.9		15	0.814					7.2			100	14	11		1.339	75
7/16/2012	0.594	6	1.9	1.8	7	0.848	0.9		29		7.3		4	0	6	10	0.17	0.441	0
7/17/2012	0.633	10	1.9	1.8	8	0.909	0.9	22	30	6.0	7.3	65	3	0	7	11	0.15	0.598	0
7/18/2012	0.712	7	1.8	1.0	8	0.808	0.9		28		7.3		3	50	7	10	0.09	0.661	70
7/19/2012	0.719	12	1.7	1.4	8	0.801	1.0	20	31	6.0	7.3	64	3	50	9	13	0.40	0.793	70
7/20/2012	1.093	20	1.7	1.5	10	0.810	0.9		30		7.2		4	50	11	10	0.32	0.894	46
7/21/2012	0.587	13	1.8		7	0.858					7.3			50	4	7		0.459	85
7/22/2012	0.756	13	1.8		8	0.761					7.3			50	10	13		0.730	66
7/23/2012	1.442	25	1.9	1.8	17	0.848	0.9		30		7.3		3	100	16	11	0.23	1.518	69
7/24/2012	1.505	28	1.9	1.1	17	0.813	0.9	21	30	6.1	7.3	44	4	50	16	11	0.39	1.505	33
7/25/2012	1.537	30	1.9	1.4	18	0.848	0.8		26		7.3		4	100	11	7	0.25	1.537	65
7/26/2012	1.266	20	1.7	1.0	16	0.909	0.9	20	30	6.0	7.1	46	5	50	11	9	0.25	1.291	39
7/27/2012	1.379	15	1.6	1.4	17	0.887	0.8		29		7.2		4	50	10	7	0.23	1.379	36
7/28/2012	1.360	14	1.9		18	0.846					7.0			150	8	6		1.373	110
7/29/2012	1.260	16	1.7		14	0.800					7.1			100	5	4		1.266	79
7/30/2012	0.340	7	1.7	1.3	4	0.847	0.8		27		7.2		4	0	2	6	0.65	0.237	0
7/31/2012	0.340	4	1.8	1.4	4	0.847	0.9	21	30	5.9	7.3	73	6	0	3	9	0.38	0.376	0
8/1/2012	0.522	9	1.7	1.5	6	0.827	1.0		29		7.3		6	0	6	11	0.31	0.561	0
8/2/2012	0.548	8	1.9	1.4	6	0.788	0.8	23	27	6.0	7.3	67	3	50	7	13	0.13	0.587	91
8/3/2012	0.226	4	1.8	1.6	3	0.955	0.9		28		7.2		6	50	2	9	0.17	0.250	221
8/4/2012	0.176	4	1.6		2	0.818					7.1			50	2	11		0.204	284
8/5/2012	0.302	8	1.7		3	0.715					7.1			0	3	10		0.363	0
8/6/2012	1.273	20	1.9	1.9	14	0.791	0.8		27		7.3		3	50	14	11	0.26	1.392	39

8/7/2012	1.570	28	1.9	1.5	18	0.825	0.9	23	29	5.9	7.3	58	4	100	17	11	0.26	1.438	64
8/8/2012	1.267	22	2.0	1.9	15	0.852	0.9		28		7.1		4	50	14	11	0.27	1.425	39
8/9/2012	1.306	20	1.9	1.5	14	0.771	0.9	22	30	6.0	7.3	60	4	50	15	11	0.13	1.260	38
8/10/2012	0.679	18	2.0	1.5	8	0.848	0.9		31		7.2		3	50	7	10	0.19	0.653	74
8/11/2012	0.719	13	1.8		8	0.807					7.2			0	8	11		0.759	0
8/12/2012	0.607	10	2.0		7	0.830					7.3			50	8	13		0.666	82
8/13/2012	1.333	27	2.0	1.7	14	0.756	0.8		29		7.1		5	100	13	10	0.53	1.432	75
8/14/2012	1.372	26	2.0	1.6	16	0.839	0.9	23	27	6.1	7.3	49	4	50	15	11	0.23	1.432	36
8/15/2012	1.531	27	1.9	1.7	18	0.846	0.9		29		7.2		3	100	18	12	0.26	1.471	65
8/16/2012	1.504	27	1.8	1.3	18	0.861	0.9	23	30	6.1	7.3	54	3	150	16	11	0.26	1.570	100
8/17/2012	0.996	22	1.9	1.2	20	1.445	0.9		31		7.3		3	100	20	20	0.20	1.729	100
8/18/2012	1.458	22	1.6		16	0.790					7.2			0	12	8		1.465	0
8/19/2012	0.600	18	1.8		16	1.920					7.1			50	15	25		1.346	83
8/20/2012	0.642	13	1.9	1.5	8	0.897	0.8		30		7.3		4	50	8	12	0.23	0.598	78
8/21/2012	0.510	3	1.9	1.5	5	0.705	0.9	22	31	5.9	7.3	61	4	0	6	12	0.36	0.478	0
8/22/2012	0.661	15	2.0	1.7	8	0.871	1.0		31		7.3		3	50	8	12	0.30	0.705	76
8/23/2012	0.699	14	1.7	1.4	10	1.030	0.9	24	29	6.1	7.3	65	4	50	7	10	0.32	0.693	72
8/24/2012	0.604	12	1.7	1.9	8	0.953	0.9		32		7.3		3	50	7	12	0.22	0.554	83
8/25/2012	0.252	5	1.8		2	0.571					7.4			0	3	12		0.270	0
8/26/2012	0.441	6	1.6		5	0.816					7.2			0	5	11		0.472	0
8/27/2012	1.398	29	1.5	1.8	17	0.875	1.0		30		7.2		3	100	14	10	0.30	1.505	72
8/28/2012	1.512	29	1.8	1.7	18	0.857	1.0	25	29	6.0	7.2	59	5	100	17	11	0.31	1.518	66
8/29/2012	1.341	15	1.8	1.6	15	0.850	0.9		31		7.3		3	100	15	11	0.28	1.348	75
8/30/2012	1.323	26	1.9	1.9	13	0.707	0.9	25	29	6.0	7.3	69	3	100	14	11	0.21	1.323	76
8/31/2012	1.562	17	1.7	1.5	16	0.737	0.8		27		7.3		3	50	18	12	0.26	1.562	32
9/1/2012	1.278	10	1.6		14	0.788					7.3			100	13	10		1.285	78
9/2/2012	1.260	14	1.9		13	0.742					7.1			50	14	11		1.266	40
9/3/2012	1.354	27	1.6		13	0.691					7.2			50	15	11		1.323	37
9/4/2012	0.264	9	1.8	1.7	3	0.818	0.7	28	29	6.1	7.3	69	4	0	5	19	0.21	0.322	0
9/5/2012	0.384	7	1.9	1.0	5	0.937	0.7		30		7.3		5	50	4	10	0.24	0.435	130
9/6/2012	0.201	4	1.8	1.4	2	0.716	0.7	25	33	6.2	7.3	65	4	0	3	15	0.14	0.224	0
9/7/2012	0.214	5	1.5	1.4	2	0.672	0.7		31		7.3		3	0	3	14	0.15	0.244	0
9/8/2012	0.163	0	1.4		2	0.883					7.4			0	0	0		0.191	0
9/9/2012	0.170	4	1.5		2	0.847					7.3			50	0	0		0.211	294
9/10/2012	1.253	23	1.9	1.6	13	0.747	0.8		29		7.3		6	100	2	2	0.26	1.399	80
9/11/2012	1.449	26	1.9	1.7	14	0.695	0.9	21	29	6.0	7.2	57	5	100	17	12	0.23	1.577	69
9/12/2012	1.505	30	1.9	1.6	14	0.669	0.7		31		7.3		5	100	17	11	0.29	1.597	66
9/13/2012	1.334	26	1.9	1.5	12	0.700	0.7	23	29	6.1	7.3	69	3	100	15	11	0.23	1.320	75
9/14/2012	1.713	38	1.9	1.6	16	0.672	0.8		31		7.3		4	100	21	12	0.22	1.795	58
9/15/2012	1.089	15	1.6		11	0.727					7.2			0	14	13		1.174	0
9/16/2012	1.379	28	1.8		12	0.626					7.3			100	22	16		1.419	73
9/17/2012	0.468	8	1.8	1.9	5	0.769	0.7		29		7.3		4	0	4	9	0.70	0.529	0
9/18/2012	0.990	18	1.8	1.3	10	0.727	0.8	25	31	6.2	7.3	61	4	50	11	11	0.27	0.903	51
9/19/2012	0.739	14	2.0	1.3	8	0.779	0.8		29		7.3		5	50	8	11	0.37	0.772	68
9/20/2012	1.293	16	1.9	1.7	12	0.668	0.8	24	30	6.1	7.2	60	6	100	14	11	0.31	1.366	77
9/21/2012	1.623	24	2.0	1.8	16	0.709	0.8		30		7.3		4	100	18	11	0.30	1.650	62
9/22/2012	1.353	18	1.3		13	0.692					7.1			50	17	13		1.372	37
9/23/2012	1.260	26	1.9		12	0.685					7.1			50	15	12		1.273	40
9/24/2012	1.020	18	2.0	1.8	9	0.635	0.7		28		7.3		4	50	14	14	0.25	1.069	49
9/25/2012	0.365	7	1.8	1.6	4	0.789	0.8	20	27	5.9	7.3	75	4	50	5	14	0.35	0.270	137
9/26/2012	0.207	4	1.8	1.3	2	0.695	0.8		28		7.3		6	0	4	19	0.39	0.270	0
9/27/2012	0.422	6	1.8	1.2	4	0.682	0.8	23	30	6.1	7.3	59	6	50	7	17	0.19	0.429	118
9/28/2012	1.071	19	1.6	1.5	11	0.739	0.7		29		7.1		5	100	19	18	0.20	1.267	93
9/29/2012	1.253	23	1.7		12	0.680					7.1			0	20	16		1.333	0
9/30/2012	1.234	27	1.8		13	0.758					7.2			100	20	16		1.306	81
10/1/2012	1.228	24	1.7	1.7	11	0.644	0.7		27		7.3		4	50	20	16	0.25	1.313	41
10/2/2012	1.354	18	1.9	1.6	13	0.691	0.7	25	29	6.1	7.2	61	7	50	10	7	0.28	1.386	37
10/3/2012	1.241	23	2.0	1.9	13	0.754	0.7		25		6.9		10	50	9	7	0.11	1.359	40
10/4/2012	1.304	16	1.8	1.3	12	0.662	0.7	22	27	5.9	7.1	69	4	50	6	5	0.25	1.386	38
10/5/2012	1.432	13	1.8	1.7	14	0.703	0.9				7.2		3	100	23	16	0.17	1.399	70
10/6/2012	1.266	12	1.9		11	0.625					7.1			100	22	17		1.366	79
10/7/2012	1.442	32	1.8		16	0.798					7.1			50	23	16		1.537	35
10/8/2012	0.088	2	1.8	1.9	1	0.818	0.8		26		7.2		7	0	2	23	0.35	0.000	0
10/9/2012	0.050	3	1.8	1.6	0	0.000	0.7	24	26	6.1	7.2	58	6	0	1	20	0.43	0.088	0
10/11/2012	0.201	2	1.3	1.8	2	0.716	0.8	23	30	6.1	7.3	61	4	0	2	10	0.42	0.239	0
10/12/2012	0.201	11	1.8	1.7	2	0.716	1.0		29		7.3		5	0	2	10	0.23	0.239	0

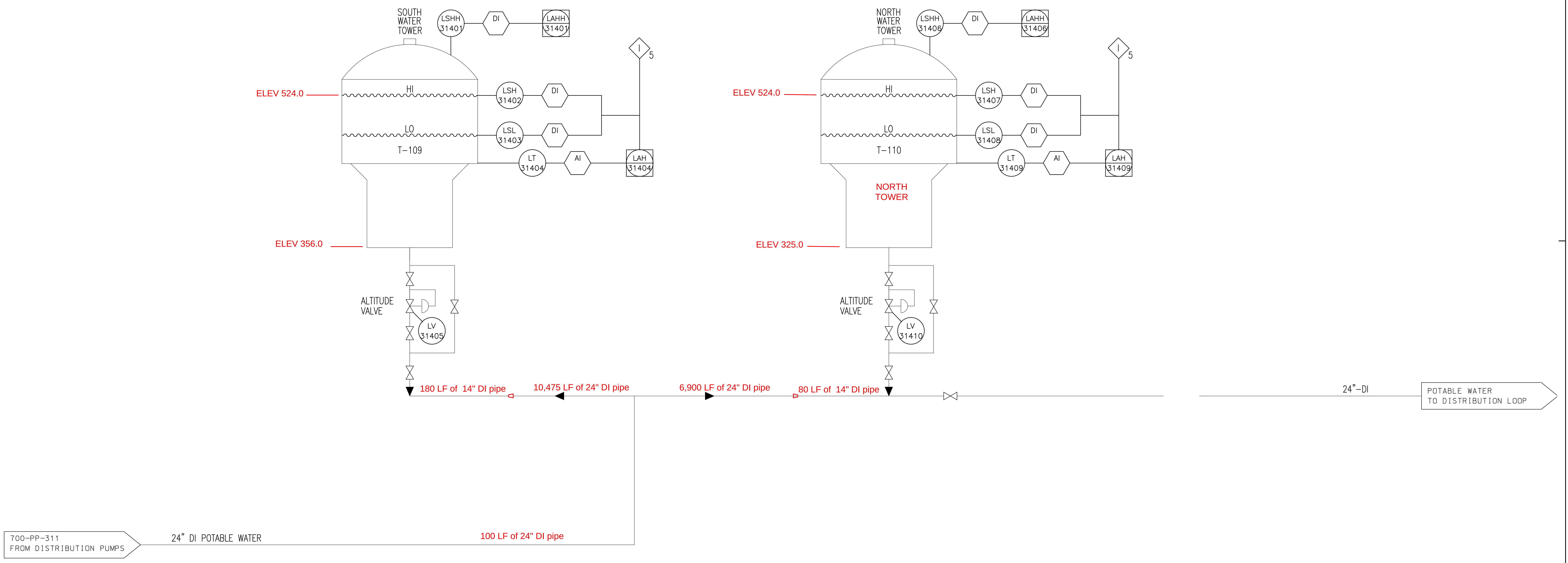
10/13/2012	0.510	9	1.8		5	0.705					7.2			50	2	4		0.516	98
10/15/2012	1.029	14	1.9	1.5	9	0.629	0.9		27		7.2		3	50	13	13	0.21	1.115	49
10/16/2012	1.293	19	1.5	1.2	13	0.723	0.8	22	29	6.1	7.3	64	6	100	21	16	0.17	1.260	77
10/17/2012	1.379	25	1.8	1.4	12	0.626	0.7		30		7.3		3	100	17	12	0.30	1.297	73
10/18/2012	1.108	20	1.9	1.6	11	0.714	0.7	24	31	6.1	7.2	64	3	100	13	12	0.31	1.096	90
10/19/2012	1.372	23	1.7	1.4	13	0.682	0.8		31		7.3		5	100	14	10	0.20	1.285	73
10/20/2012	1.181	22	1.8		11	0.670					7.2			100	11	9		1.222	85
10/21/2012	1.372	25	1.7		13	0.682					7.3			100	10	7		1.291	73
10/22/2012	0.378	6	1.9	1.5	3	0.571	0.7		31		7.3		3	0	4	11	0.36	0.269	0
10/23/2012	0.245	5	1.8	1.7	3	0.881	0.8	23	28	6.0	7.2	65	4	50	2	8	0.33	0.277	204
10/24/2012	0.031	1	1.8	1.7	1	0.732	0.8		31		7.3		6	0	1	32	0.20	0.389	0
10/25/2012	0.623	10	1.5	1.7	6	0.693	0.8	23	26	6.0	7.3	67	5	50	4	6	0.10	0.327	80
10/27/2012	0.302	3	1.6		3	0.715					7.2			50	2	7		0.264	166
10/28/2012	0.144	4	1.4		1	0.500					7.3			0	2	14		0.184	0
10/29/2012	0.207	4	1.6	1.5	2	0.695	0.7		31		7.6		4	0	1	5	0.29	0.237	0
10/30/2012	0.151	2	1.4	1.7	2	0.953	0.7	21	25	6.1	7.2	50	5	0	2	13	0.22	0.178	0
10/31/2012	0.157	3	1.5	1.6	1	0.458	0.7		26		7.2		3	0	1	6	0.24	0.184	0
11/1/2012	0.138	6	1.7	1.4	1	0.521	0.7	24	29	6.1	7.1	42	4	0	1	7	0.48	0.184	0
11/2/2012	0.182	5	1.6	1.5	2	0.791	0.8		28		7.2		5	0	1	5	0.46	0.191	0
11/3/2012	0.239	3	1.6		2	0.602					7.2			0	1	4		0.270	0
11/4/2012	0.163	4	1.8		1	0.441					7.2			50	1	6		0.204	307
11/5/2012	1.023	14	1.6	1.5	9	0.633	0.7		27		7.1		6	50	12	12	0.16	1.077	49
11/6/2012	1.320	15	1.8	1.6	12	0.654	0.9	24	31	6.0	7.2	40	6	50	16	12	0.17	1.278	38
11/7/2012	1.346	11	1.9	1.5	11	0.588	0.7		27		7.3		5	50	14	10	0.19	1.266	37
11/8/2012	1.260	18	1.8	1.5	13	0.742	0.7	22	27	6.0	7.3	57	5	100	15	12	0.17	1.266	79
11/9/2012	1.386	24	1.8	1.3	14	0.727	0.7		29		7.2		5	100	14	10	0.26	1.304	72
11/10/2012	1.306	24	1.8		12	0.661					7.2			0	14	11		1.222	0
11/11/2012	1.260	18	1.8		12	0.685					7.2			50	11	9		1.178	40
11/12/2012	0.145	1	1.7	1.6	6	2.999	0.8		28		7.2		5	0	2	14	0.27	0.018	0
11/15/2012	0.094	2	1.6	1.4	1	0.765	0.8	23	30	6.0	7.2	52	6	0	1	11	0.34	0.165	0
11/16/2012	0.378	0	1.8	1.9	4	0.761	0.8		30		7.1		7	0	6	16	0.32	0.303	0
11/18/2012	0.226	4	0.4		2	0.637					7.2			50	4	18		0.132	221
11/19/2012	1.064	20	1.3	1.5	9	0.609	0.7		29		7.2		4	50	15	14	0.37	1.203	47
11/20/2012	1.310	25	1.8	1.6	12	0.659	0.7	22	31	6.0	7.1	48	6	50	15	11	0.27	1.260	38
11/21/2012	1.159	19	1.9	1.5	12	0.745	0.7	23	26	6.1	7.0	51	8	100	14	12	0.35	1.171	86
11/22/2012	1.190	22	1.9		11	0.813					7.3			50	19	16		1.234	42
11/23/2012	1.278	19	1.8	1.3	12	0.676	0.7		30		7.3		5	100	19	15	0.37	1.260	78
11/24/2012	1.008	7	1.8		10	0.714					7.3			100	16	16		0.963	99
11/25/2012	1.152	20	1.7		10	0.625					7.2			50	22	19		1.178	43
11/26/2012	0.075	1	1.9	1.7	1	0.960	0.7		27		7.3		5	0	1	13	0.43	0.072	0
11/27/2012	0.170	4	1.5	1.6	2	0.847	0.8	24	29	6.0	7.3	67	5	50	1	6	0.48	0.178	294
11/28/2012	0.233	3	1.7	1.4	2	0.618	0.8		30		7.3		5	0	1	4	0.44	0.191	0
11/30/2012	0.277	5	1.8	1.3	2	1.519	0.7		29		7.3		3	0	4	14	0.28	0.231	0
12/1/2012	0.226	1	1.6		2	0.637					7.4			0	4	18		0.204	0
12/2/2012	0.151	4	1.6		2	0.953					7.2			50	1	7		0.178	331
12/3/2012	1.247	7	1.8	1.7	12	0.692	0.8		29		7.3		4	50	0	0	0.47	1.313	40
12/4/2012	1.445	28	1.8	1.7	13	0.647	0.7	24	33	6.0	7.3	68	3	100	19	13	0.00	1.399	69
12/5/2012	1.267	20	1.9	1.7	11	0.625	0.7		31		7.3		4	100	24	19	0.30	1.353	79
12/6/2012	1.313	27	1.9	1.6	12	0.658	0.7	23	29	6.0	7.3	62	4	100	15	11	0.42	1.300	76
12/7/2012	1.445	24	1.9	1.7	12	0.658	0.8		30		7.2		4	100	15	10	0.36	1.399	69
12/8/2012	1.155	20	1.6		11	0.685					7.3			50	25	22		1.155	43
12/9/2012	1.227	21	1.9		10	0.586					7.2			50	14	11		1.260	41
12/10/2012	0.066	3	1.9	1.4	1	1.090	0.7		32		7.3		4	0	1	15	0.16	0.063	0
12/11/2012	0.283	7	1.7	1.9	3	0.763	0.7	24	31	6.1	7.3	62	4	0	3	11	0.29	0.214	0
12/12/2012	0.204	4	1.8	1.7	2	0.705	0.8		31		7.3		4	50	3	15	0.44	0.296	245
12/13/2012	0.217	5	1.7	1.6	2	0.663	0.7	23	30	6.1	7.3	65	6	0	3	14	0.31	0.176	0
12/14/2012	0.105	4	1.4	1.5	2	1.358	0.7		31		7.2		3	50	2	19	0.20	0.176	476
12/16/2012	0.151	3	1.7		1	0.476					7.2			50	2	13		0.170	331
12/17/2012	1.210	22	1.9	1.1	11	0.628	0.8		31		7.3		3	50	13	11	0.36	1.285	41
12/18/2012	1.335	20	1.9	1.0	14	0.755	0.7	22	27	6.0	7.1	60	5	100	16	12	0.28	1.297	75
12/19/2012	1.171	22	1.8	1.5	11	0.676	0.7		30		7.3		3	100	15	13	0.24	1.285	85
12/20/2012	1.278	25	1.7	1.6	12	0.676	0.8	23	32	6.1	7.3	66	4	100	15	12	0.21	1.178	78
12/21/2012	1.304	26	1.8	1.5	13	0.717	0.8		28		7.2		5	100	16	12	0.23	1.373	77
12/22/2012	1.089	13	1.6		10	0.661					7.3			100	13	12		1.020	92
12/23/2012	1.209	16	1.7		12	0.714					7.5			50	14	12		1.203	41
12/24/2012	1.171	14	1.8	1.8	11	0.676	0.7		27		7.3		4	100	16	14	0.45	1.165	85

12/25/2012	1.140	22	1.8		12	0.757					7.4			50	13	11		1.077	44
12/26/2012	1.247	20	1.8	1.8	12	0.692	0.7	22	27	6.1	7.3	48	3	100	14	11	0.30	1.266	80
12/27/2012	1.379	24	1.7	1.7	15	0.783	0.7	23	29	6.1	7.0	50	5	100	18	13	0.28	1.354	73
12/28/2012	1.272	24	1.8	1.6	16	0.905	0.8		30		7.3		4	50	15	12	0.36	1.228	39
12/29/2012	1.140	16	1.6		8	0.505					7.3			100	14	12		1.134	88
12/30/2012	1.247	19	1.8		13	0.750					7.3			100	15	12		1.234	80

12

The Dupree water plant uses ~12 lbs of phosphate per million gallons of water. Based on the "AquaMag" data sheet the fluid is 87.4 lbs/ft^3. Using this value as the density for the phosphate additive ~1 gallon is needed per million gallons of water treatment.

APPENDIX L



Preliminary
Not for Construction
02/02/2022
SSOE, Inc.

INTERLOCK NOTES:

I 5 HIGH LEVEL ON BOTH TOWERS SHUTS PUMPS DOWN

SCALE: 1"= 40'

GRAPHIC SCALE: 1"= 40'
0' 40' 80' 120'

NORTH

Know what's below.
Call before you dig.

SSOE

J.R. WAUFORD & CO.
Consulting Engineers, Inc.

THE SEAL ON THIS DOCUMENT WAS AUTHORIZED BY:

SEAL ID:
DATE:

WATER
TREATMENT PLANT

MEMPHIS REGIONAL MEGASITE

STATE OF TN
SBC PROJ #
529/000-02-2010-010

CLIENT PROJECT NO:

NO.	DATE	SUBJECT

REVISION OR ISSUE

SSOE, Inc.
320 Seven Springs Way, Suite 350
Brentwood, TN 37027
T 615-661-7585

PROJECT NO: 021-02080-21
PROJECT MANAGER: D. HIBDON
DESIGNED: K. PACULA
CHECKED:

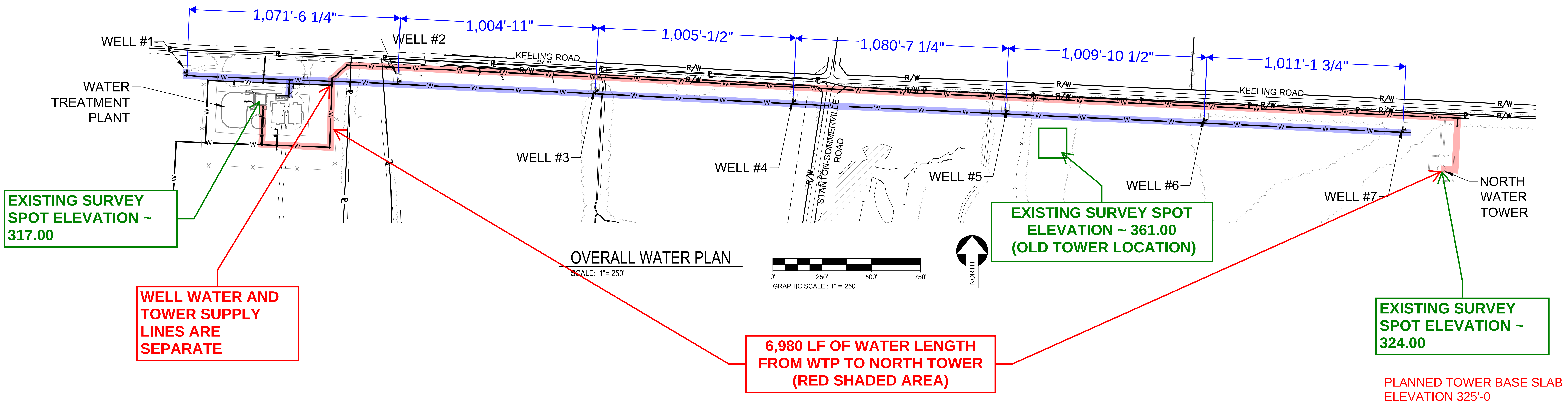
DRAWING TITLE:
P&ID
WATER TOWERS

DRAWING NO:
700-PP-316

WATER PIPING LAYOUT CONCEPT

Preliminary DWG.
in PROGRESS
02/02/2022
SSOE, Inc.

PROPOSED WELL LOCTIONS SET IN BLUE.
NOMINAL 1000 LF SEPARATION. NOMINAL 1000
GPM CAPACITY EACH. FIVE OF SEVEN
OPERATE TO DELIVER 7.0 MGD.



EXISTING SURVEY SPOT ELEVATION ~ 317.00

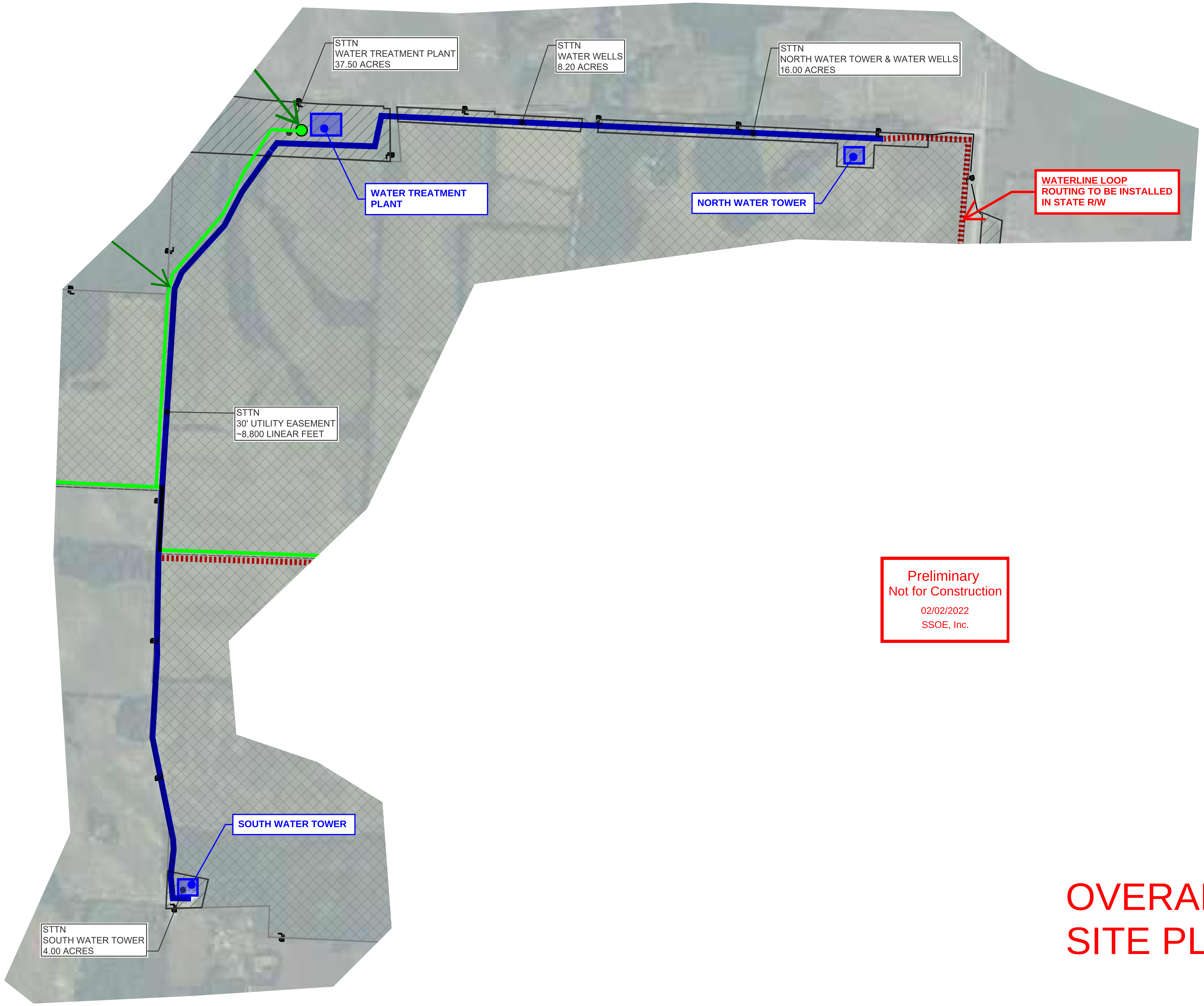
EXISTING SURVEY SPOT ELEVATION ~ 361.00 (OLD TOWER LOCATION)

EXISTING SURVEY SPOT ELEVATION ~ 324.00

WELL WATER AND TOWER SUPPLY LINES ARE SEPARATE

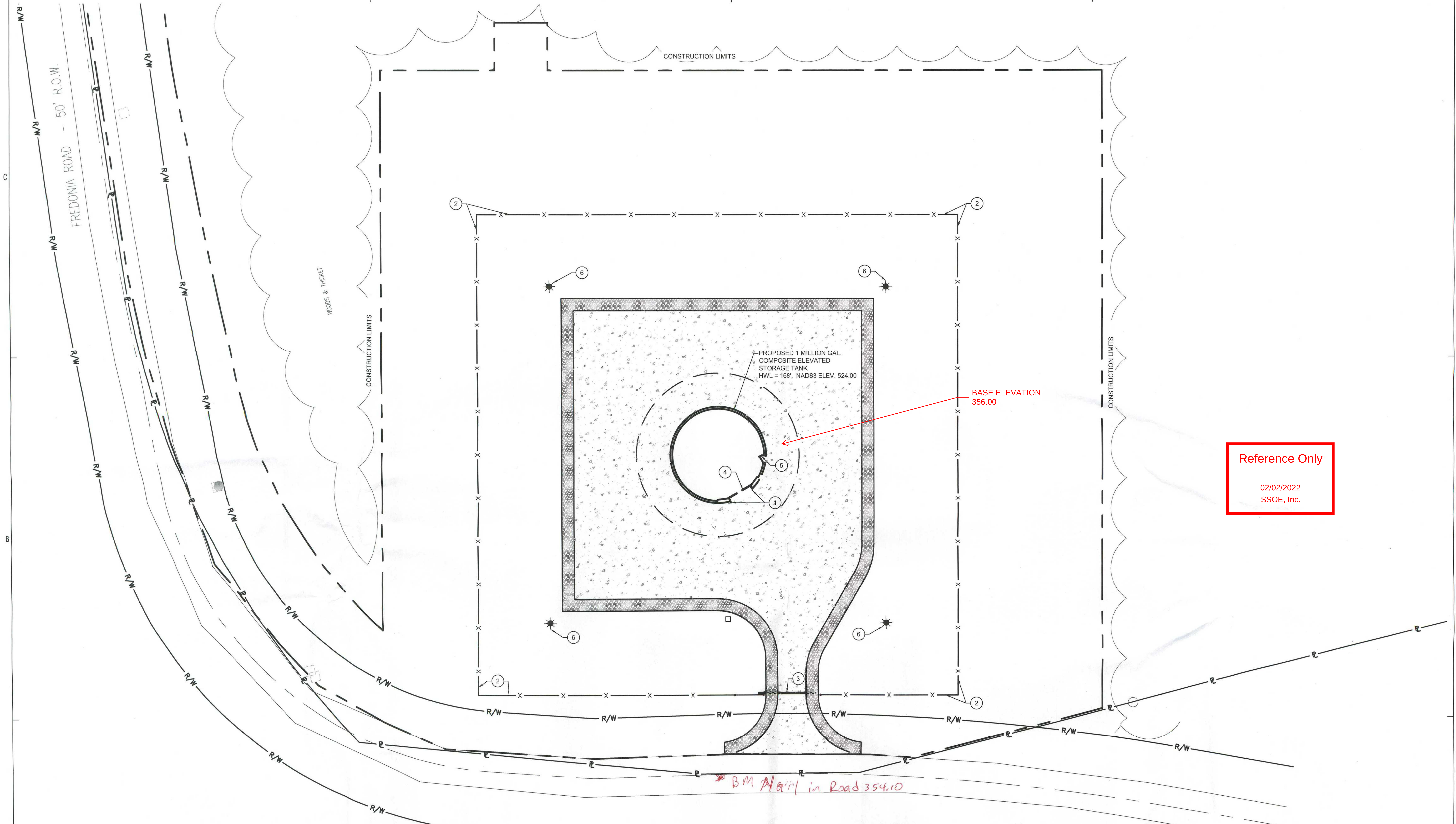
6,980 LF OF WATER LENGTH FROM WTP TO NORTH TOWER (RED SHADED AREA)

PLANNED TOWER BASE SLAB
ELEVATION 325'-0



Preliminary
Not for Construction
02/02/2022
SSOE, Inc.

OVERALL SITE PLAN



* BM ~~N~~ Nail in Road 354.10

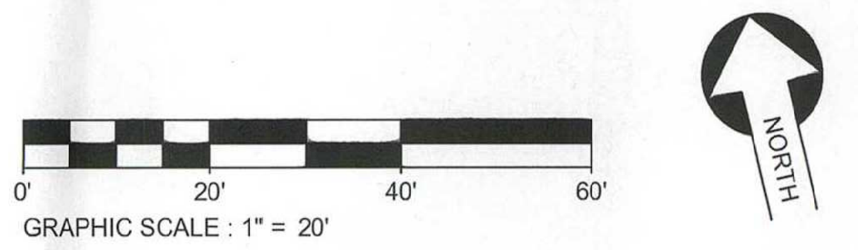
Reference Only

02/02/2022
SSOE, Inc.

SOUTH TOWER

LAYOUT PLAN

SCALE: 1"= 20'



SCHEDULE:

1. 6" DIA. STEEL PIPE BOLLARD, FILLED WITH CONCRETE, PAINTED YELLOW (TYP. 2)
   RE: DETAIL C4 ON SHEET 900-C-820
2. 8' HIGH CHAIN LINK FENCE WITH THREE STRANDS OF BARBED WIRE
   RE: DETAIL B1 ON SHEET 900-C-820
3. 8' HIGH BY 24' WIDE SLIDING GATE WITH THREE STANDS OF BARBED WIRE
   RE: DETAIL B2 ON SHEET 900-C-820,
4. 10'X10' OVERHEAD STEEL ROLLING DOOR
   REFER TO SPECS FOR DETAILS
5. PERSONNEL DOOR
   REFER TO SPECS FOR DETAILS
6. 18' TALL, POLE-MOUNTED FLOOD LIGHT (TYP. 4)
   REFER TO ELECTRICAL PLAN DRAWING, 900-E-100 FOR DETAILS

PAVEMENT LEGEND

☐	HEAVY DUTY CONCRETE PAVEMENT RE: DETAIL C1 ON SHEET 900-C-820
▨	GRAVEL SHOULDER - 5' WIDE RE: DETAIL C2 ON SHEET 900-C-820

811
Know what's below.
Call before you dig.

ssoe

J.R. WAUFORD & CO.
Consulting Engineers, Inc.

THE SEAL ON THIS DOCUMENT WAS AUTHORIZED BY:

JASON E. LOWE
No. 110927
8/9/13

SEAL ID: -
DATE: -

MEMPHIS REGIONAL
MEGASITE

SOUTH WATER TOWER

STATE OF TN

SBC PROJ #
529/000-02-2010-12

CLIENT PROJECT NO:

NO.	DATE	SUBJECT
0	08-09-13	BID ISSUE

REVISION OR ISSUE

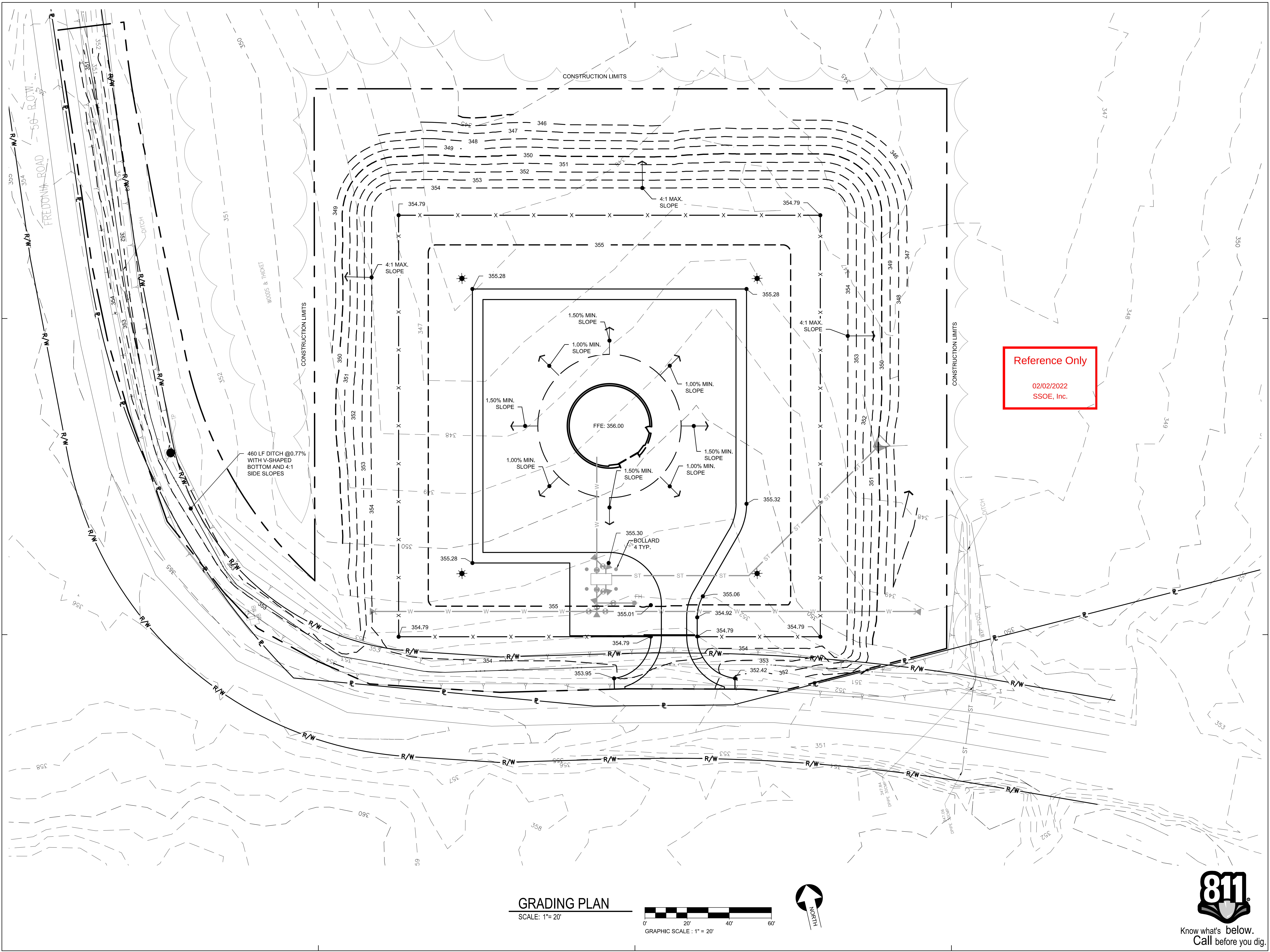
SSOE, Inc.
320 Seven Springs Way, Suite 350
Brentwood, TN 37027
T 615-661-7585

PROJECT NO:	012-02080-00
PROJECT MANAGER:	S. CRUMP
DESIGNED:	M. TOWLES
CHECKED:	J. LOWE

DRAWING TITLE:
LAYOUT PLAN

DRAWING NO:
900-C-100

C:\dgn\d033347\900-C-100.dwg
DATE: Aug 08, 2013 - 10:41am USER: 41409



GRADING PLAN

SCALE: 1"= 20'

Reference Only

02/02/2022

SSOE, Inc.

811

Know what's below.

Call before you dig.

ssoe

J.R. WAUFORD & CO.

Consulting Engineers, Inc.

THE SEAL ON THIS DOCUMENT WAS AUTHORIZED BY:

SEAL ID: -

DATE: -

MEMPHIS REGIONAL MEGASITE

SOUTH WATER TOWER

STATE OF TN

SBC PROJ #
529/000-02-2010-12

CLIENT PROJECT NO:

NO.	DATE	SUBJECT
1	11-24-15	AS BUILT
0	08-09-13	BID ISSUE

REVISION OR ISSUE

SSOE, Inc.
320 Seven Springs Way, Suite 350
Brentwood, TN 37027
T 615-661-7585

PROJECT NO: 012-02080-00

PROJECT MANAGER: S. CRUMP

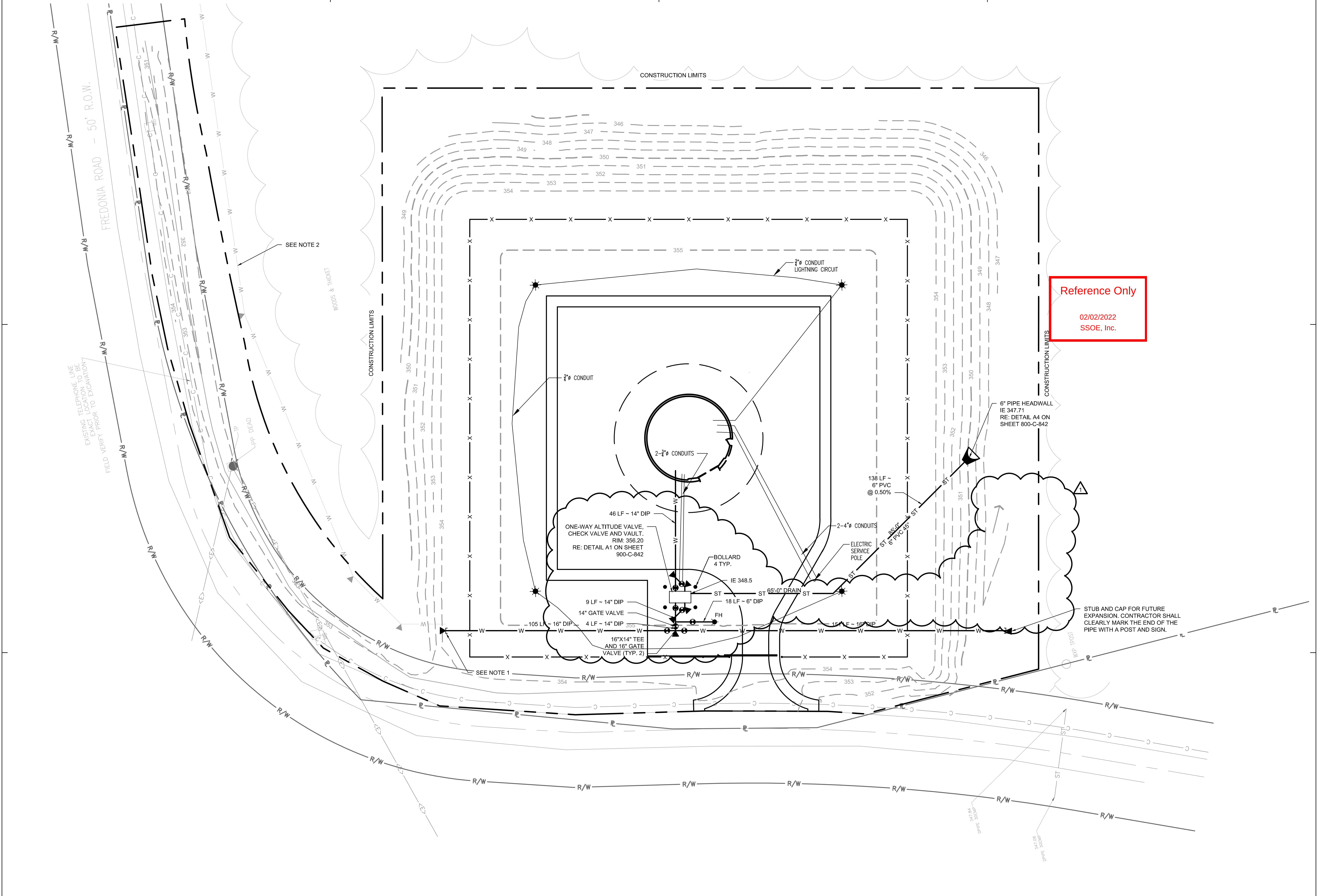
DESIGNED: M. TOWLES

CHECKED: J. LOWE

DRAWING TITLE:
GRADING PLAN

DRAWING NO:
900-C-300

C:\dgn\d0333471\900-C-300.dwg
DATE: Nov 24 2015 - 10:08am USER: 15545



Reference Only

02/02/2022
SSOE, Inc.

NOTES:
1. 16" WATER LINE COORDINATION TIE-IN LOCATION BETWEEN SOUTH WATER TOWER CONSTRUCTION PACKAGE AND SITE WATER PIPING CONSTRUCTION PACKAGE. CONTRACTOR SHALL TEMPORALLY CAP LINE PER DETAIL C1 ON SHEET 900-C-840. CONTRACTOR SHALL CLEARLY MARK THE END WITH A POST AND SIGN.
2. PROPOSED 16" WATER LINE TO BE INSTALLED IN SITE WATER PIPING CONSTRUCTION PACKAGE SHOWN FOR COORDINATION AND REFERENCE.

UTILITY PLAN
SCALE: 1"= 20'

0' 20' 40' 60'
GRAPHIC SCALE : 1" = 20'

NORTH

811
Know what's below.
Call before you dig.

J.R. WAUFORD & CO.
Consulting Engineers, Inc.

THE SEAL ON THIS DOCUMENT WAS AUTHORIZED BY:

SEAL ID: -
DATE: -

MEMPHIS REGIONAL MEGASITE

SOUTH WATER TOWER

STATE OF TN
SBC PROJ #
529/000-02-2010-12

CLIENT PROJECT NO:

NO.	DATE	SUBJECT
1	11-24-15	AS BUILT
0	08-09-13	BID ISSUE

REVISION OR ISSUE

SSOE, Inc.
320 Seven Springs Way, Suite 350
Brentwood, TN 37027
T 615-661-7585

PROJECT NO: 012-02080-00
PROJECT MANAGER: S. CRUMP
DESIGNED: M. TOWLES
CHECKED: J. LOWE

DRAWING TITLE:
UTILITY PLAN

DRAWING NO:
900-C-400

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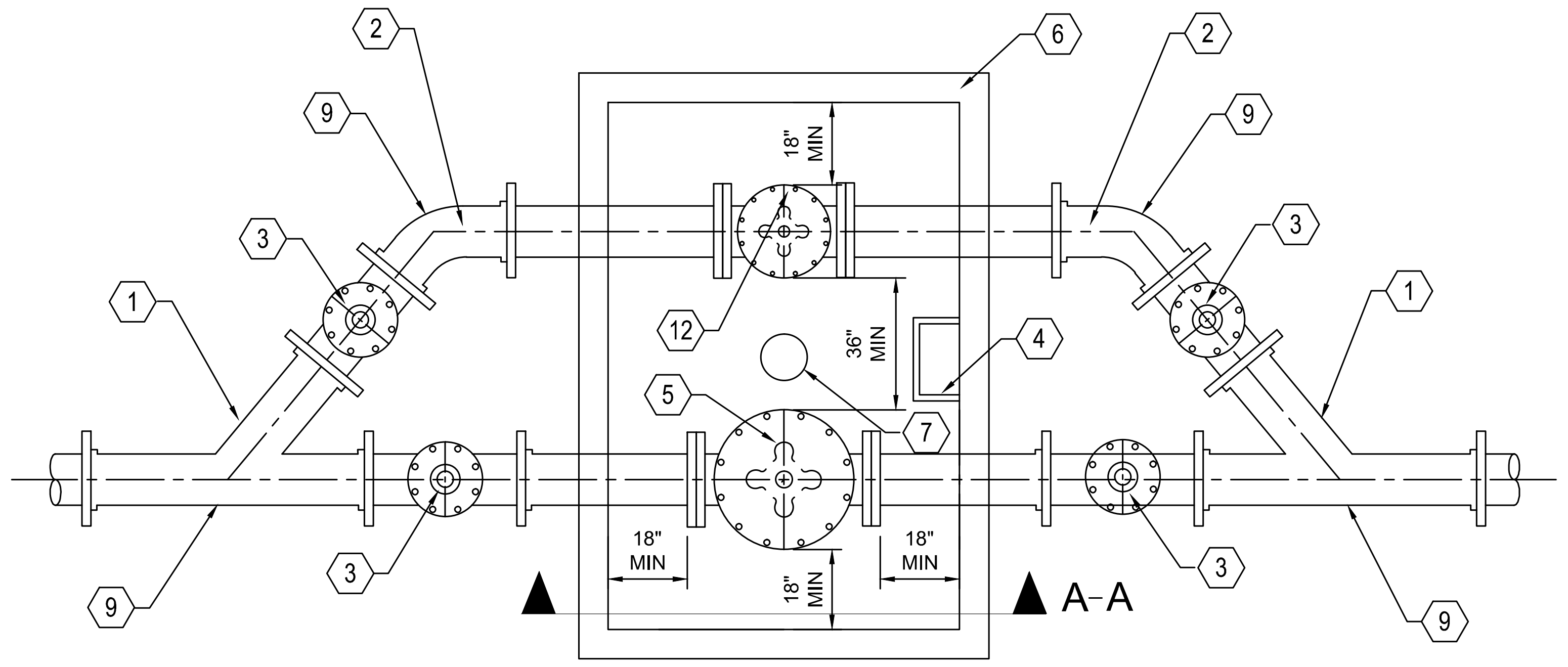
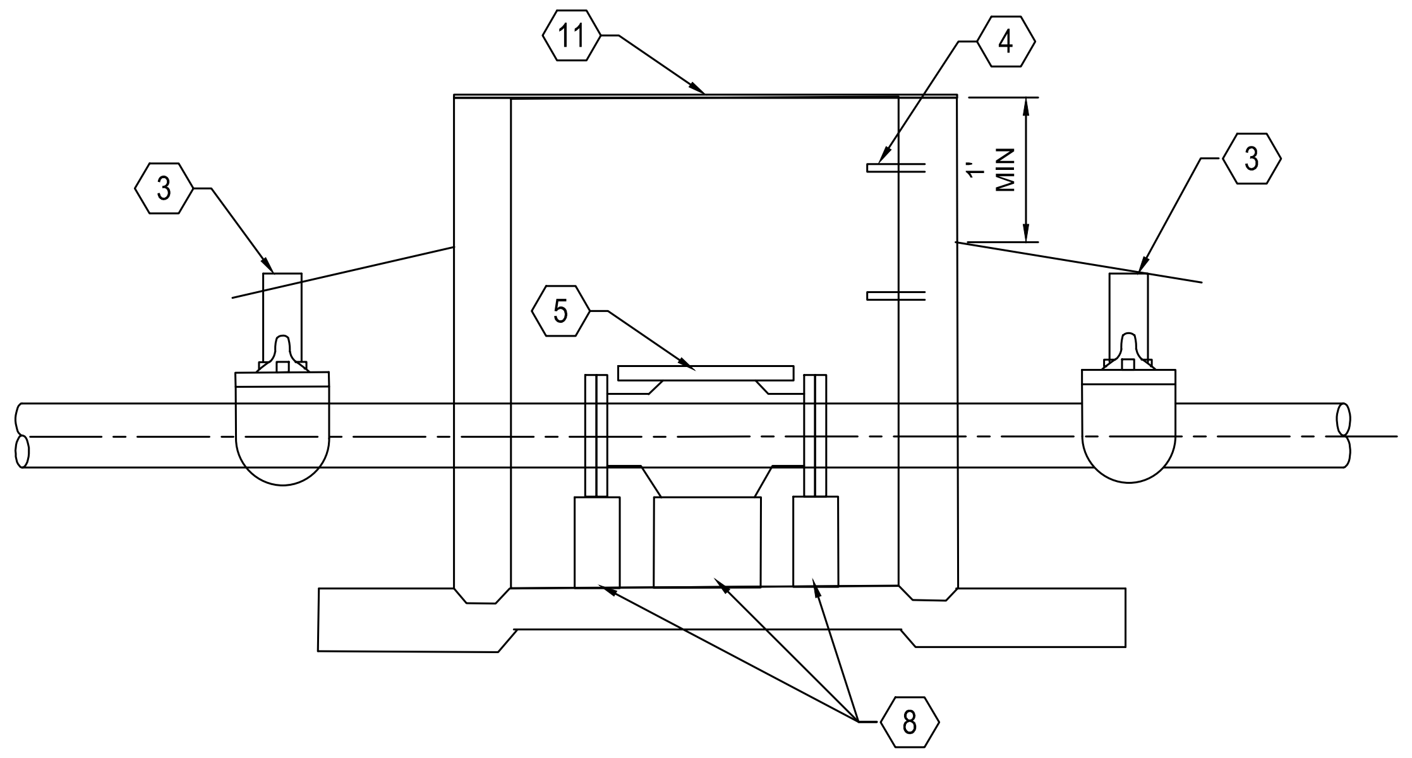


PLAN VIEW



SECTION A-A

Reference Only
02/02/2022
SSOE, Inc.

VALVE VAULT AND PIPING COMPONENTS

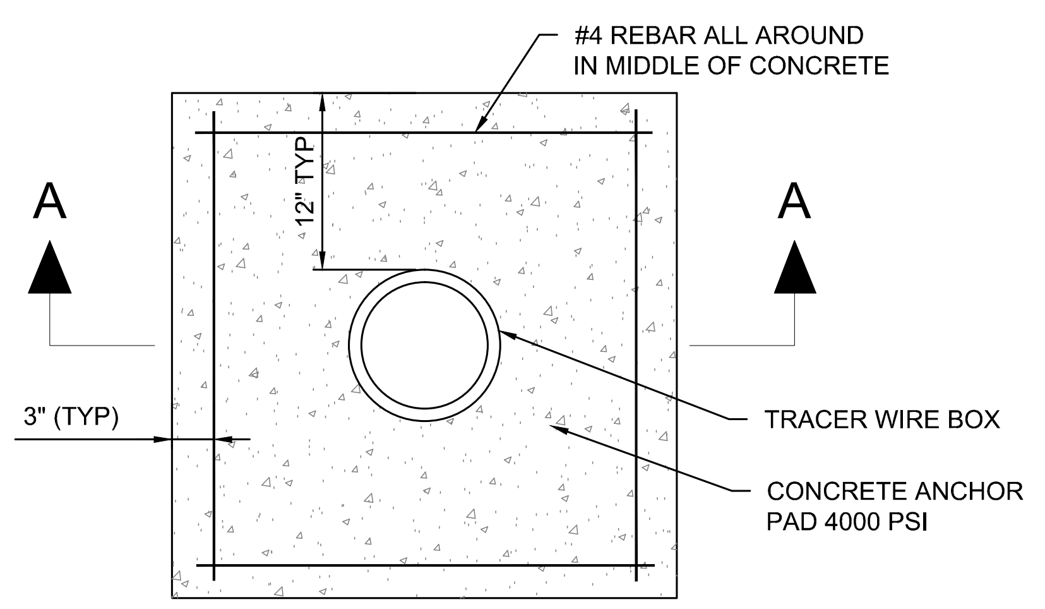
1. 14" X 14" WYE
2. 14" 45° BEND
3. 14" GATE VALVE (MUELLER OR EQUIVALENT) WITH VALVE BOX
4. STEPS @ 16" C/C
5. 14" ALTITUDE VALVE WITH PRESSURE SUSTAINING FEATURE
6. PRECAST VAULT, UTILITY VAULT BY OLD CASTLE PRECAST OR APPROVED EQUAL BY HANSON PIPE AND PRECAST OR SHERMAN DIXIE PIPE AND PRECAST
7. FLOOR DRAIN
8. PIPE SUPPORTS. SEE NOTE 2.
9. CONCRETE THRUST BLOCK (DETAIL 900-C-840).
10. DOUBLE STRAP SST SERVICE SADDLE WITH PRESSURE GAUGE ASSEMBLY
11. REMOVABLE ALUMINUM PIT COVER WITH 100 PSF LOAD CAPACITY
12. CHECK VALVE, FLG-FLG

NOTES:

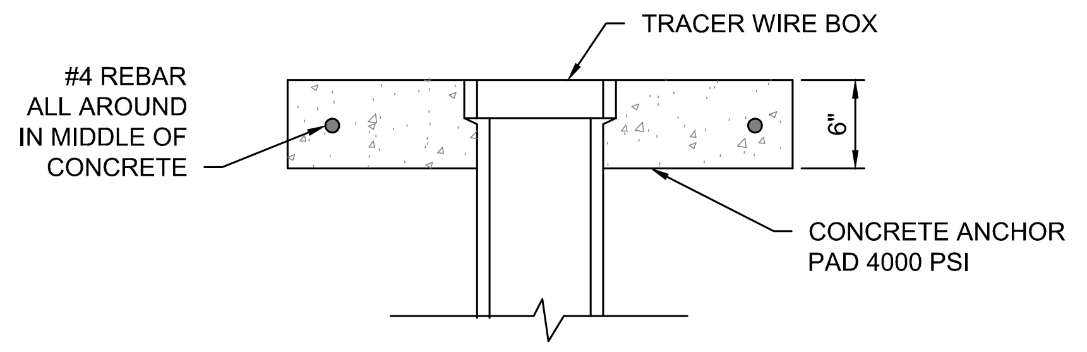
1. CORE DRILL BOTTOM OF SUMP DRAIN AND PROVIDE 6-INCH PVC STORM DRAIN PIPING TO CONNECT TO STORM PIPING PER SHEET 800-C-400 OR 900-C-400.
2. MINIMUM 18-INCH CLEARANCE BETWEEN VAULT JOINTS AND EDGE OF PIPE. CONTRACTOR SHALL CONFIRM PRIOR TO CONSTRUCTION AND ORDER/SUBMIT VAULT ACCORDINGLY.
3. EXTERIOR FITTINGS TO BE MECHANICAL JOINT FITTINGS.

A1 ALTITUDE VALVE VAULT

NO SCALE



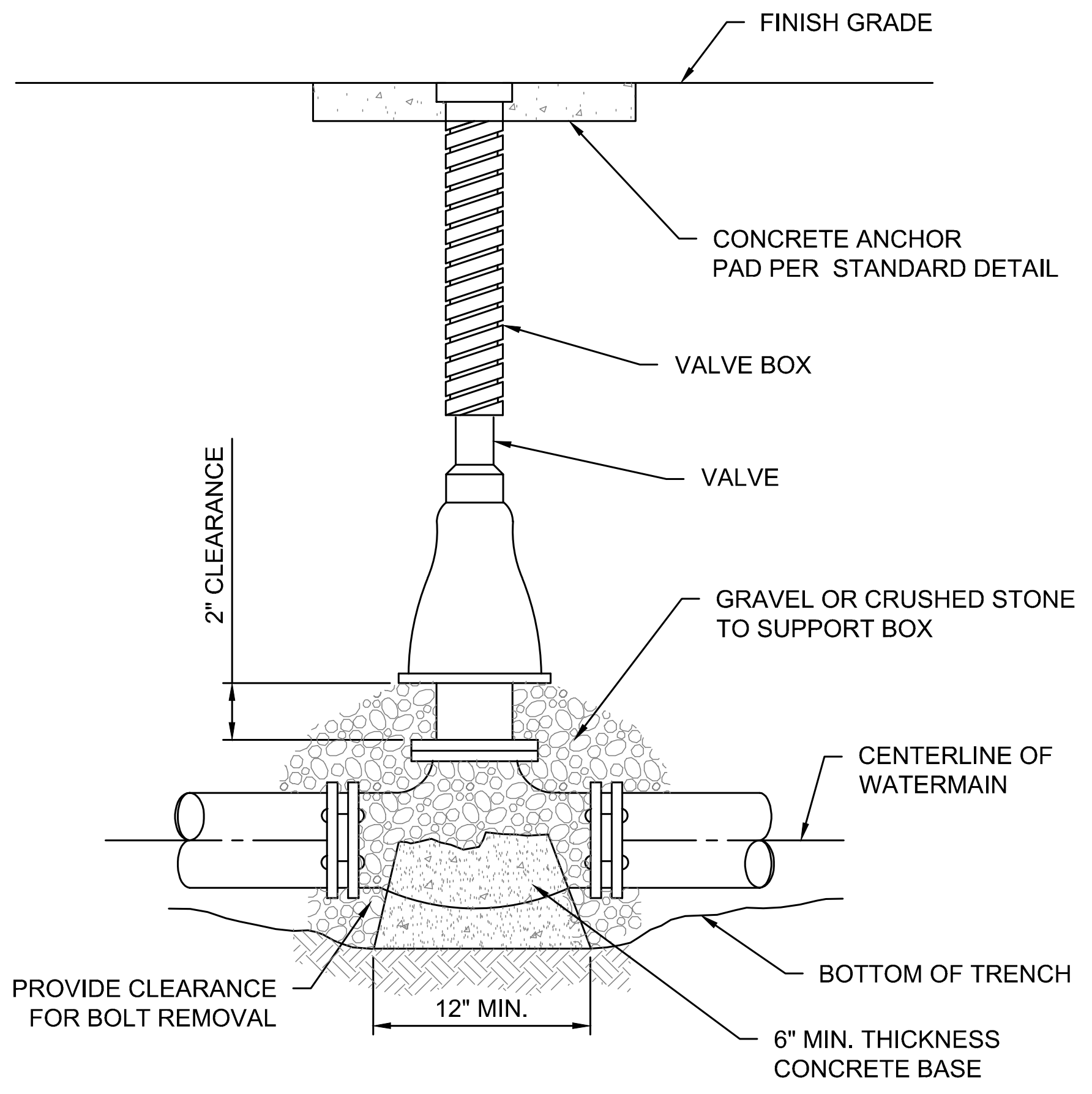
PLAN



SECTION A-A

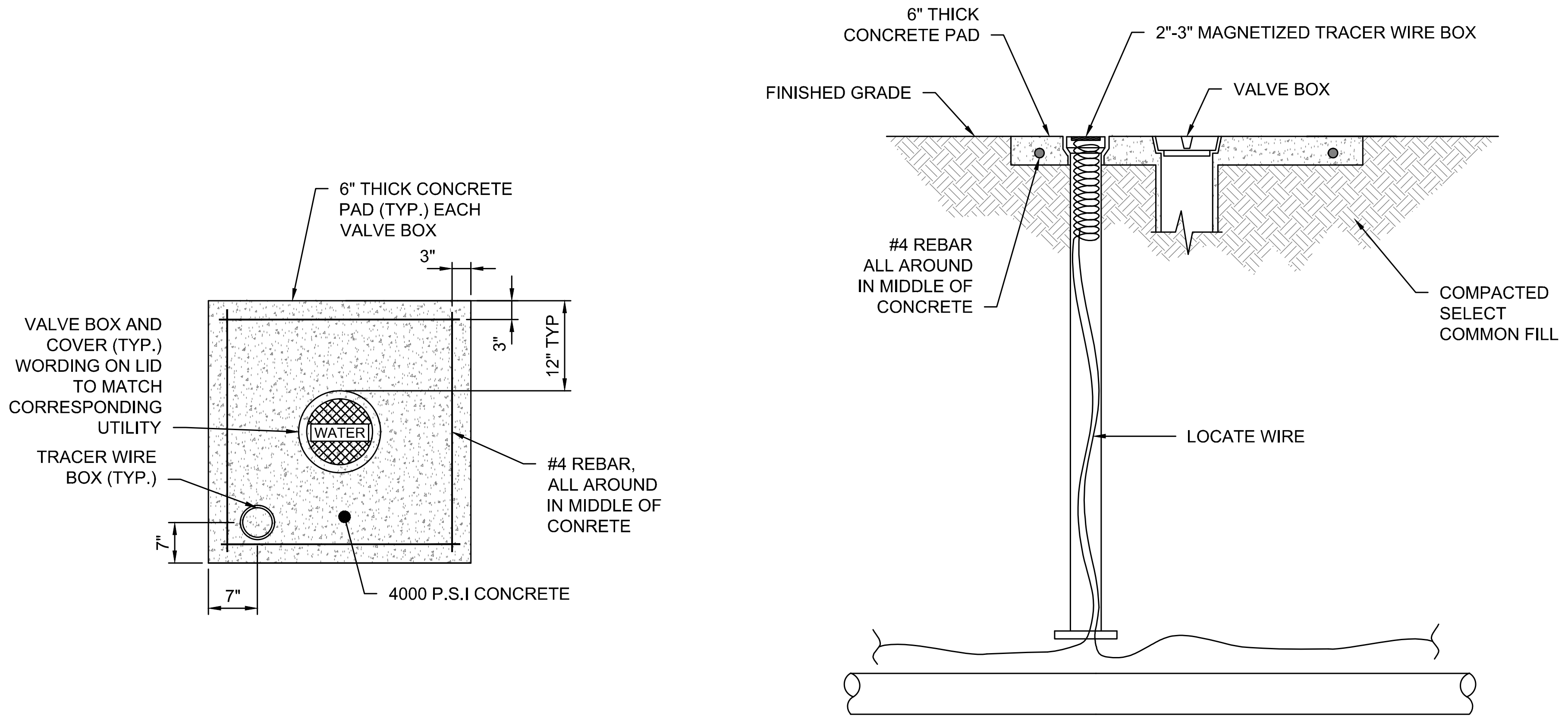
C3 CONCRETE ANCHOR PAD FOR STAND ALONE TRACER WIRE BOX IN NON-PAVED AREAS

NO SCALE



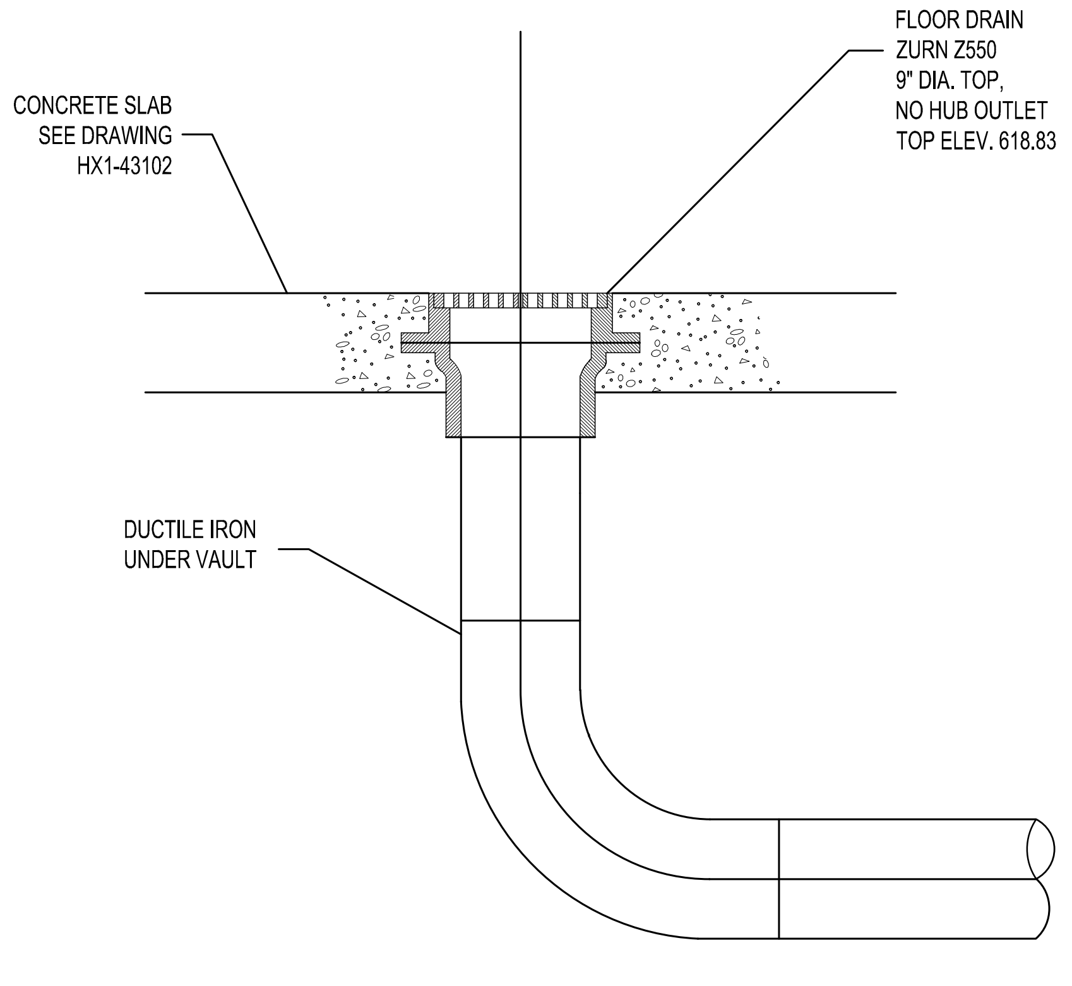
C4 WATER VALVE AND BOX

NO SCALE



B3 CONCRETE ANCHOR PAD FOR VALVE BOX IN NON-PAVED AREAS

NO SCALE



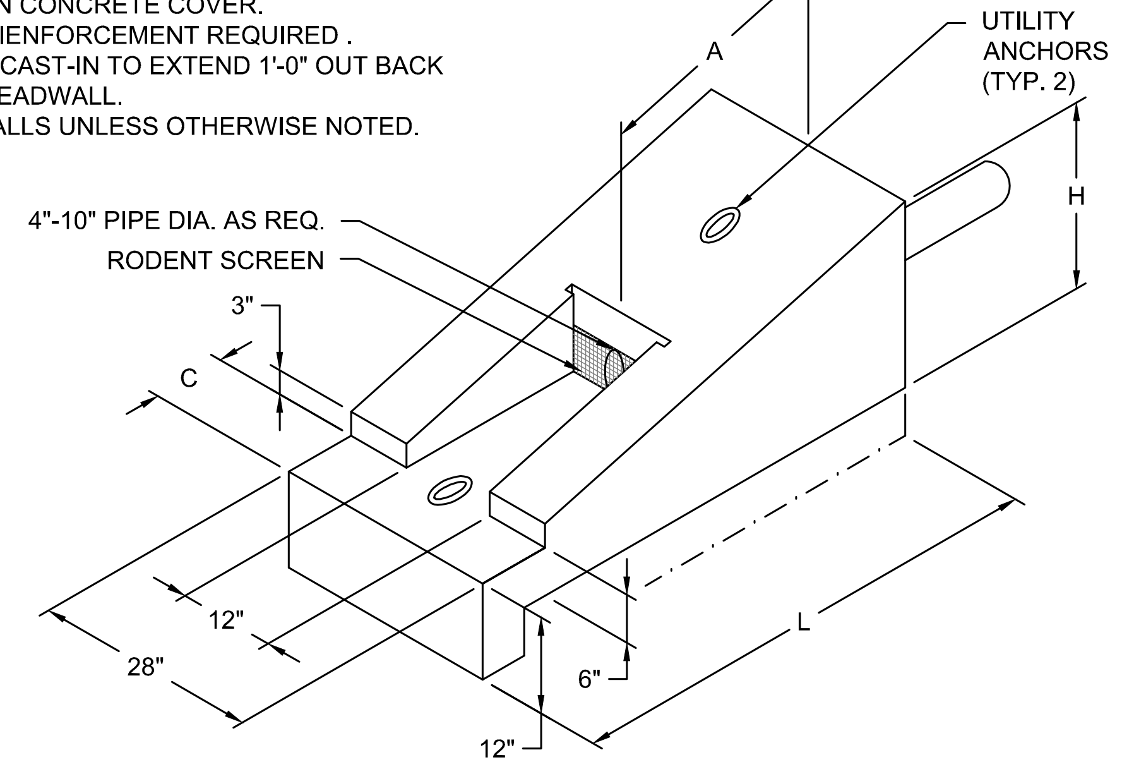
A1 FLOOR DRAIN (MEDIUM DUTY)

NO SCALE

PIPE DIA.	SLOPE	TYPE	DIMENSIONS				WEIGHT LBS.
			L	H	A	C	
4" AND 6"	2:1	1	3'- 4 |"	1'- 8 |"	1'-6"	6"	1539
	3:1	2	5'- 1 |"		2'-3"	9"	2268
	4:1	3	6'- 9 |"		3'-0"	1'-0"	2997
	6:1	4	7'- 2 |"	1'- 2 |"	1'-6"	1'-6"	2511
8"	2:1	1	3'- 9 |"	1'- 10 |"	1'-6"	6"	1741
	3:1	2	5'- 8 |"		2'-3"	9"	2551
	4:1	3	7'- 7"		3'-0"	1'-0"	3361
	6:1	4	8'- 4 |"	1'- 4 |"	1'-6"	1'-6"	2956

NOTES:

1. 2" MIN CONCRETE COVER.
2. NO RIENFORCEMENT REQUIRED .
3. PIPE CAST-IN TO EXTEND 1'-0" OUT BACK OF HEADWALL.
4. 8" WALLS UNLESS OTHERWISE NOTED.



A4 SMALL PIPE HEADWALL

NO SCALE

ssoe

J.R. WAUFORD & CO.
Consulting Engineers, Inc.

THE SEAL ON THIS DOCUMENT WAS AUTHORIZED BY:

SEAL ID:
DATE:

MEMPHIS REGIONAL MEGASITE

SOUTH WATER TOWER

STATE OF TN

SBC PROJ #
529/000-02-2010-12

CLIENT PROJECT NO:

NO.	DATE	SUBJECT
2	11-24-15	AS BUILT
1	02-20-15	CONTRACTOR PRICING
0	08-09-13	BID ISSUE

REVISION OR ISSUE

SSOE, Inc.
320 Seven Springs Way, Suite 350
Brentwood, TN 37027
T 615-661-7585

PROJECT NO: 012-02080-00
PROJECT MANAGER: S. CRUMP
DESIGNED: M. TOWLES
CHECKED: J. LOWE

DRAWING TITLE:
UTILITY DETAILS

DRAWING NO:
900-C-842

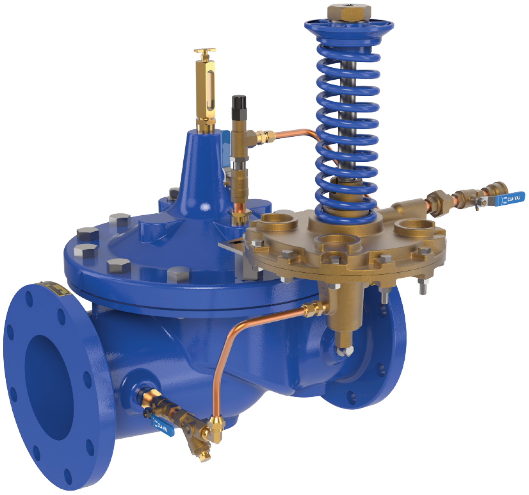
C:\dgn\d0333471\900-C-842.dwg
DATE: Nov 24, 2015 - 10:09am USER: 15545

CLA-VAL™

North Tower Proposed
Altitude Valve

MODEL 210-01

Altitude Valve For One-Way Flow



- **Accurate and Repeatable Level Control**
- **Drip-Tight, Positive Shut-Off**
- **Reliable Hydraulic Operation**
- **Easily Adjustable Control**
- **Completely Automatic Operation**

The Cla-Val Model 210-01 Altitude Valve controls the high water level in reservoirs without the need for floats or other devices. It is a non-throttling valve that remains fully open until the shut-off point is reached. This valve is designed for one-way flow only.

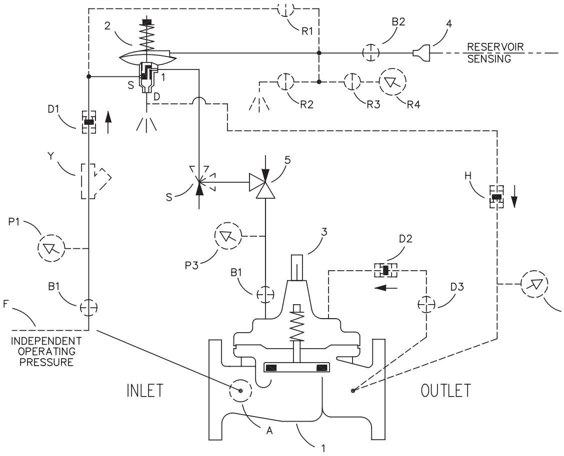
This valve is hydraulically operated and pilot controlled. The pilot control operates on the differential in forces between a spring load and the water level in the reservoir. The desired high water level is set by adjusting the spring force. The pilot control measures the reservoir head through a customer supplied sensing line* connected directly to the reservoir.

This valve can also be furnished with auxiliary controls to meet the need for multiple functions, such as: pressure sustaining, pressure reduction, rate of flow control, solenoid override, etc.

If the check feature option is added and a pressure reversal occurs, the downstream pressure is admitted into the main valve cover chamber and the valve closes to prevent return flow.

Schematic Diagram

Item	Description
1	100-01 Hytrol Main Valve
2	CDS6A Altitude Control
3	X101 Valve Position Indicator
4	Bell Reducer
5	CV Flow Control (Closing)



Note: When "D" check feature is ordered, the "H" feature is required.

Optional Features

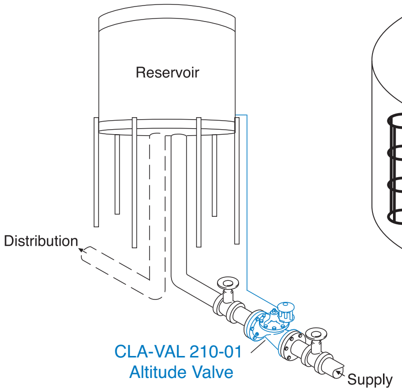
Item	Description
A	X46A Flow Clean Strainer
B	CK2 Isolation Valve
D	Check Valve with Isolation Valve
F	Independent Operating Pressure
H	Dry Drain
P	X141 Pressure Gauge
R	Reservoir Gauge with Tester
S	CV Flow Control (Opening)
Y	X43 "Y" Strainer

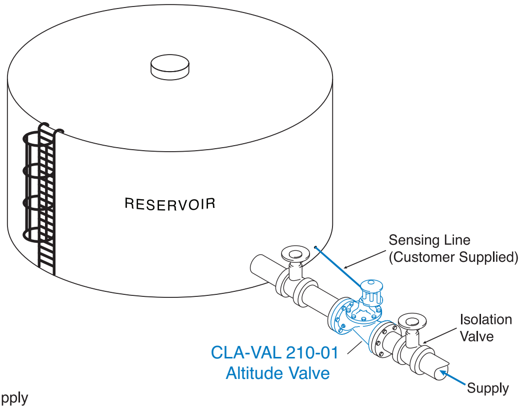
Typical Applications

Used on reservoirs where the water is withdrawn through a separate line or through a bypass equipped with a check valve. The valve opens to refill the reservoir when the water lowers below the shut-off level. For more information see page 4 or data sheet E-CDS6A.

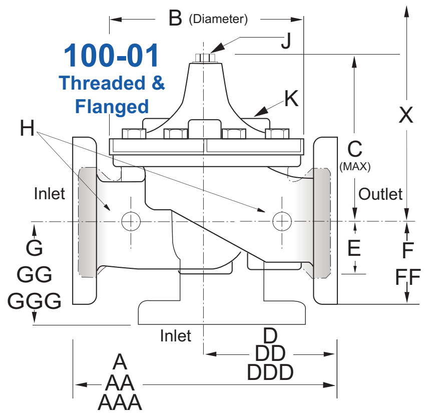
*Note: The reservoir pressure sensing line should be ¾" minimum I.D. installed with a 2° slope from the valve to the reservoir to avoid air pockets.

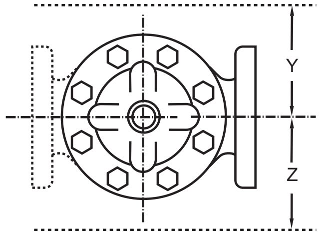
Note: We recommend protecting tubing and valve from freezing temperatures.

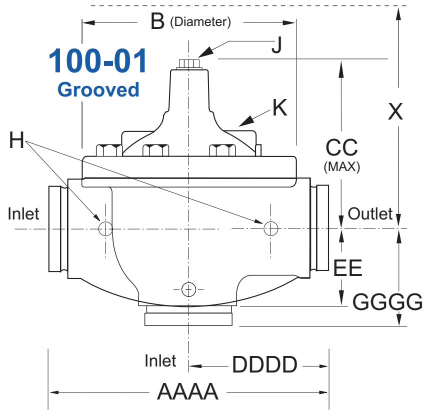




Model 210-01 (Uses Main Valve Model 100-01)







Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class				
		Flanged			Grooved	Threaded
Grade	Material	ANSI Standards*	150 Class	300 Class	300 Class	End‡ Details
ASTM A536	Ductile Iron	B16.42	250	400	400	400
ASTM A216-WCB	Cast Steel	B16.5	285	400	400	400
UNS 87850	Bronze	B16.24	225	400	400	400

Note: * ANSI standards are for flange dimensions only.
Flanged valves are available faced but not drilled.
‡ End Details machined to ANSI B2.1 specifications.

Valves for higher pressure are available; consult factory for details

Cover Capacity

Liquid Volume Displaced from Diaphragm Chamber When Valve Opens or Closes

Valve Size	Displacement
2”	.032 gal
2 1/2”	.043 gal
3”	.080 gal
4”	.169 gal
6”	.531 gal
8”	1.26 gal
10”	2.51 gal
12”	4.00 gal
14”	6.50 gal
16”	9.57 gal
18”	11.00 gal
20”	12.00 gal
24”	29.00 gal
36”	90.00 gal

Materials

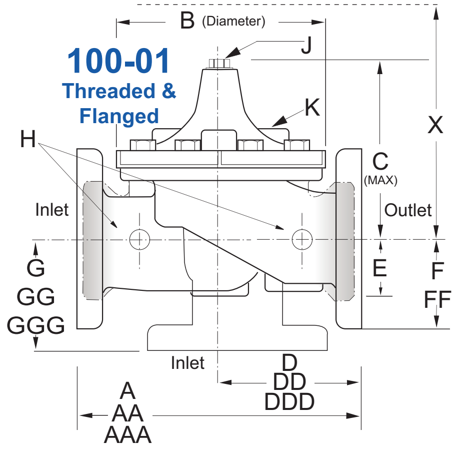
Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes	2" - 36" 50 - 900 mm	2" - 16" 400 - 900 mm	2" - 16" 400 - 900 mm
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze
Trim: Disc Guide, Seat & Cover Bearing	Bronze is Standard Stainless Steel is Optional		
Disc	Buna-N® Rubber		
Diaphragm	Nylon Reinforced Buna-N® Rubber		
Stem, Nut & Spring	Stainless Steel		

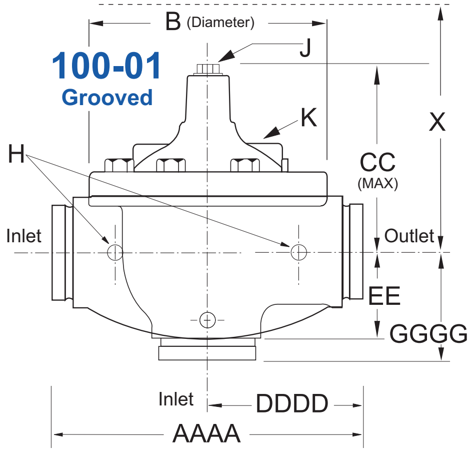
For material options not listed, consult factory.
Cla-Val manufactures valves in more than 50 different alloys.

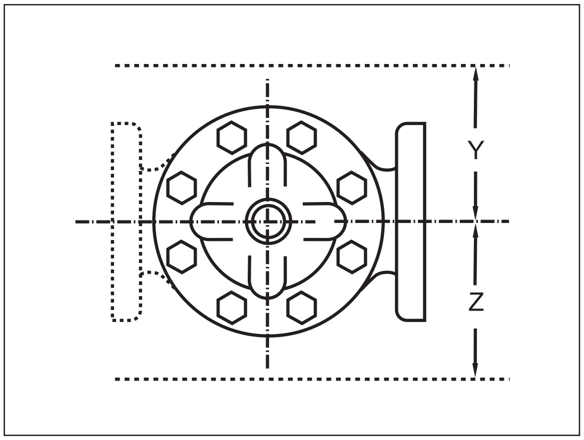
Model 210-01 Dimensions (In Inches)

Valve Size (Inches)	**2**	**2½**	**3**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**24**	**30**	**36**
A Threaded	9.38	11.00	12.50	—	—	—	—	—	—	—	—	—	—	—	—
AA 150 ANSI	9.38	11.00	12.00	15.00	20.00	25.38	29.75	34.00	39.00	41.38	46.00	52.00	61.50	63.00	72.75
AAA 300 ANSI	10.00	11.62	13.25	15.62	21.00	26.38	31.12	35.50	40.50	43.50	47.64	53.62	63.24	64.50	74.75
AAAA Grooved End	9.00	11.00	12.50	15.00	20.00	25.38	—	—	—	—	—	—	—	—	—
B Diameter	6.62	8.00	9.12	11.50	15.75	20.00	23.62	28.00	32.75	35.50	41.50	45.00	53.16	56.00	66.00
C Maximum	6.50	7.56	8.19	10.62	13.38	16.00	17.12	20.88	24.19	25.00	39.06	41.90	43.93	54.60	59.00
CC Maximum Grooved End	5.75	6.88	7.25	9.31	12.12	14.62	—	—	—	—	—	—	—	—	—
D Threaded	4.75	5.50	6.25	—	—	—	—	—	—	—	—	—	—	—	—
DD 150 ANSI	4.75	5.50	6.00	7.50	10.00	12.69	14.88	17.00	19.50	20.81	—	—	30.75	—	—
DDD 300 ANSI	5.00	5.88	6.38	7.88	10.50	13.25	15.56	17.75	20.25	21.62	—	—	31.62	—	—
DDDD Grooved End	4.75	—	6.00	7.50	—	—	—	—	—	—	—	—	—	—	—
E	1.50	1.69	2.06	3.19	4.31	5.31	9.25	10.75	12.62	15.50	12.95	15.00	17.75	21.31	24.56
EE Grooved End	2.50	2.88	3.12	4.25	6.00	7.56	—	—	—	—	—	—	—	—	—
F 150 ANSI	3.00	3.50	3.75	4.50	5.50	6.75	8.00	9.50	10.50	11.75	15.00	16.50	19.25	22.50	28.50
FF 300 ANSI	3.25	3.75	4.13	5.00	6.25	7.50	8.75	10.25	11.50	12.75	15.00	16.50	19.25	24.00	30.00
G Threaded	3.25	4.00	4.50	—	—	—	—	—	—	—	—	—	—	—	—
GG 150 ANSI	3.25	4.00	4.00	5.00	6.00	8.00	8.62	13.75	14.88	15.69	—	—	22.06	—	—
GGG 300 ANSI	3.50	4.31	4.38	5.31	6.50	8.50	9.31	14.50	15.62	16.50	—	—	22.90	—	—
GGGG Grooved End	3.25	—	4.25	5.00	—	—	—	—	—	—	—	—	—	—	—
H NPT Body Tapping	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
J NPT Cover Center Plug	0.50	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00	1.00	1.00	1.00	2.00	2.00
K NPT Cover Tapping	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
Stem Travel	0.60	0.70	0.80	1.10	1.70	2.30	2.80	3.40	4.00	4.50	5.10	5.63	6.75	7.50	8.50
Approx. Ship Weight (lbs)	35	50	70	140	285	500	780	1165	1600	2265	2982	3900	6200	7703	11720
Approx. **X** Pilot System	13	14	15	17	29	31	33	36	40	40	43	47	68	79	85
Approx. **Y** Pilot System	9	10	11	12	20	22	24	26	29	30	32	34	39	40	45
Approx. **Z** Pilot System	9	10	11	12	20	22	24	26	29	30	32	34	39	42	47

Model 210-01 Metric Dimensions (Uses Main Valve Model 100-01)







210-01 Dimensions (mm)

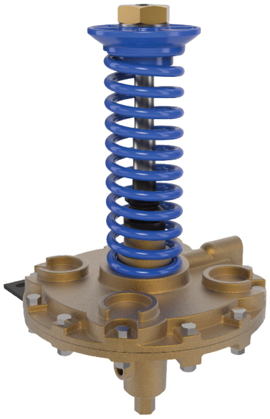
Valve Size (mm)	**50**	**65**	**80**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**500**	**600**	**750**	**900**
A Threaded	238	279	318	—	—	—	—	—	—	—	—	—	—	—	—
AA 150 ANSI	238	279	305	381	508	645	756	864	991	1051	1168	1321	1562	1600	1848
AAA 300 ANSI	254	295	337	397	533	670	790	902	1029	1105	1210	1326	1606	1638	1899
AAAA Grooved End	228	279	318	381	508	645	—	—	—	—	—	—	—	—	—
B Diameter	168	203	232	292	400	508	600	711	832	902	1054	1143	1350	1422	1676
C Maximum	165	192	208	270	340	406	435	530	614	635	992	1064	1116	1387	1499
CC Maximum Grooved End	146	175	184	236	308	371	—	—	—	—	—	—	—	—	—
D Threaded	121	140	159	—	—	—	—	—	—	—	—	—	—	—	—
DD 150 ANSI	121	140	152	191	254	322	378	432	495	528	—	—	781	—	—
DDD 300 ANSI	127	149	162	200	267	337	395	451	514	549	—	—	803	—	—
DDDD Grooved End	121	—	152	191	—	—	—	—	—	—	—	—	—	—	—
E	38	43	52	81	110	135	235	273	321	394	329	381	451	541	624
EE Grooved End	64	73	79	108	152	192	—	—	—	—	—	—	—	—	—
F 150 ANSI	76	89	95	114	140	171	203	241	267	298	381	419	489	572	724
FF 300 ANSI	83	95	105	127	159	191	222	260	292	324	381	419	489	610	762
G Threaded	83	102	114	—	—	—	—	—	—	—	—	—	—	—	—
GG 150 ANSI	83	102	102	127	152	203	219	349	378	399	—	—	560	—	—
GGG 300 ANSI	89	110	111	135	165	216	236	368	397	419	—	—	582	—	—
GGGG Grooved End	83	—	108	127	—	—	—	—	—	—	—	—	—	—	—
H NPT Body Tapping	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
J NPT Cover Center Plug	0.50	0.50	0.50	0.75	0.75	1.00	1.00	1.25	1.50	2.00	1.00	1.00	1.00	2.00	2.00
K NPT Cover Tapping	0.375	0.50	0.50	0.75	0.75	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00
Stem Travel	15	18	20	28	43	58	71	86	102	114	130	143	171	190	216
Approx. Ship Weight (kgs)	16	23	32	64	129	227	354	528	726	1027	1353	1769	2812	3494	5316
Approx. **X** Pilot System	331	356	381	432	737	788	839	915	1016	1016	1093	1194	1728	2007	2159
Approx. **Y** Pilot System	229	254	280	305	508	559	610	661	737	762	813	864	991	1016	1143
Approx. **Z** Pilot System	229	254	280	305	508	559	610	661	737	762	813	864	991	1067	1194

210-01 Valve Selection	**100-01 Pattern:** Globe (G), Angle (A), **End Connections:** Threaded (T), Grooved (GR), Flanged (F) Indicate Available Sizes															
	Inches	2	2½	3	4	6	8	10	12	14	16	18	20	24	30	36
	mm	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900
Main Valve 100-01	Pattern	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G, A	G	G	G, A	G	G
	End Detail	T, F, Gr	T, F, Gr*	T, F, Gr	F, Gr	F, Gr*	F, Gr*	F	F	F	F	F	F	F	F	F
Suggested Flow (gpm)	Maximum	210	300	460	800	1800	3100	4900	7000	8400	11000	14000	17000	25000	42000	50000
	Maximum Intermittent	260	370	580	990	2250	3900	6150	8720	10540	13700	17500	21700	31300	48000	62500
Suggested Flow (Liters/Sec)	Maximum	13	19	29	50	113	195	309	442	530	694	883	1073	1577	2650	3150
	Maximum Intermittent	16	23	37	62	142	246	387	549	664	863	1104	1369	1972	3028	3940

100-01 Series is the full internal port Hytrol.

*Globe Grooved Only

Pilot System Specifications



Adjustment Ranges

5 - 40 ft.
30 - 80 ft.
70 - 120 ft.
110 - 160 ft.
150 - 200 ft.

Temperature Range

Water: to 180°F

If flowing line pressure is less than 10 psi, consult factory for full details.

If inlet pressure is above 150 psi, consult factory for recommendations.

Materials

Standard Pilot System Materials

Pilot Control: Low Lead Bronze
Trim: Stainless Steel Type 303
Rubber: Buna-N® Synthetic Rubber

Optional Pilot System Materials

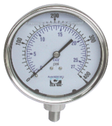
Pilot Systems are available with optional Aluminum, Stainless Steel, or Monel materials. Valve position indicator is standard

When Ordering, Specify:

1. Catalog No. 210-01
2. Valve Size
3. Pattern - Globe or Angle
4. Pressure Class
5. Threaded or Flanged
6. Trim Material
7. Adjustment Range
8. Desired Options
9. When Vertically Installed
10. When “D” ffeatured is ordered, the “H” feature is required.

Valve Options

X141
Pressure
Gauge



X101AR Valve
Position Indicator
with Air Release

X101
Valve Position
Indicator

X144 e-FlowMeter

X43H
Strainer

Stainless
Steel Pilot

For a comprehensive overview of Cla-Val Altitude Control Valves, please vist www.cla-val.com and use. keyword search “Altitude”.

CLA-VAL™

CLA-VAL

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Phone: 905-563-4963
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E-mail: cla-val@cla-val.fr

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New Zealand
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www.cla-valpacific.com
E-mail: info@cla-valpacific.com

visit www.cla-val-latinamerica.com for Spanish literature

ITEMS OF EQUIPMENT

One (1) 14” Ames Model 960G-13 one-way flow altitude valve with delayed opening feature, globe style, DI body, fl x fl, including all stainless steel stem, seat and trim, copper pilot tubing with brass fittings, open/closing speed control pilot, wye strainer, isolation cocks and position indicator.

Altitude valve at existing
south tower.

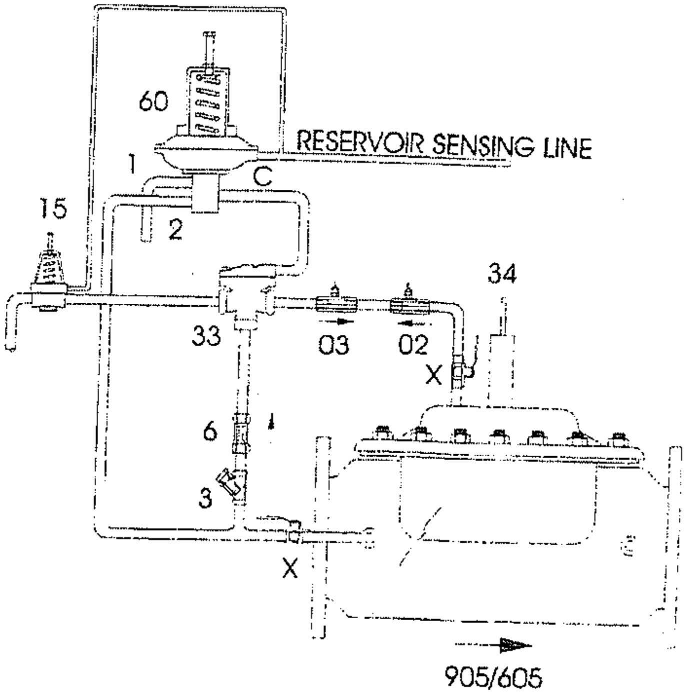
SPECIFICATION BULLETIN
ONE WAY FLOW ALTITUDE VALVE
with DELAYED OPENING FEATURE

AMES CO.
FLUID CONTROL SYSTEMS

MODEL 960G-13 or 660G-13 (GLOBE); 960A-13 or 660A-13 (ANGLE)

STANDARD COMPONENTS

☑	X	Isolation Ball Valves (4" and Larger)
☑	2	Ball Valve
☑	02	Opening Speed Control (6" and Larger)
☑	03	Closing Speed Control (6" and Larger)
☑	3	Wye Strainer
☑	15	Delayed Opening Control
☑	33	3-Way Accelerator Pilot (6" and Larger)
☑	34	Position Indicator
☑	60	Altitude Pilot
☑	905 or 605	Main Valve



OPTIONAL FEATURES

- ☒ Isolation Ball Valves (3" and Smaller)
- ☐ Dry (downstream) Drain
- ☒ (-02) Opening Speed Control (4" and Smaller)
- ☒ (-03) Closing Speed Control (4" and Smaller)
- ☐ (-08) Altitude Gauge
- ☐ (-38) Stainless Steel Trim

Specifications

The One Way Flow Altitude Control Valve with Delayed Opening shall be a hydraulically operated, diaphragm actuated globe or angle valve designed to control the high water level in an reservoir without the use of tank mounted float pilots or electrical probes. The valve shall delay opening until the reservoir lowers to a desired, adjustable, level. Seating shall be accomplished by a synthetic rubber disc having a rectangular cross section, and shall be retained on three and one-half sides. The seat ring shall be secure, and not press fitted into the body. The diaphragm assembly shall be top and bottom guided to assure positive contact with the seat. The diaphragm shall be constructed of nylon reinforced Buna-N, and shall not seal directly against the valve seat. All necessary repairs shall be made from the top of the valve while the body remains in line.

The valve shall be the AMES Model 960-13G / 660G-13 (Globe) or 960A-13 / 660A-13 (Angle) One Way Flow Altitude Control Valve as manufactured by AMES Company, Inc.

Operation

The AMES Model 960-13 / 660-13 One Way Flow Altitude Control Valve is designed to accurately control the high water level in a tank or reservoir. It is a non-throttling device that opens fully when tank head pressure is below the adjustable setpoint of the altitude control. Reservoir filling can be delayed until water level falls 1-15 feet (adjustable) below desired shut-off point to increase water circulation through the tank. The 960-13 / 660-13 closes drip tight when the desired shutoff point is reached (Tank Fill). When reservoir level falls below the adjustable "low level" setpoint of the 960-13 / 660-13, the altitude pilot commands the main valve cover chamber to be vented to atmosphere (wet drain) opening the valve, re-filling the tank. When the desired shutoff point of the 960-13 / 660-13 is reached, the altitude pilot commands the main valve cover chamber to be connected to upstream (inlet) pressure, closing the valve.

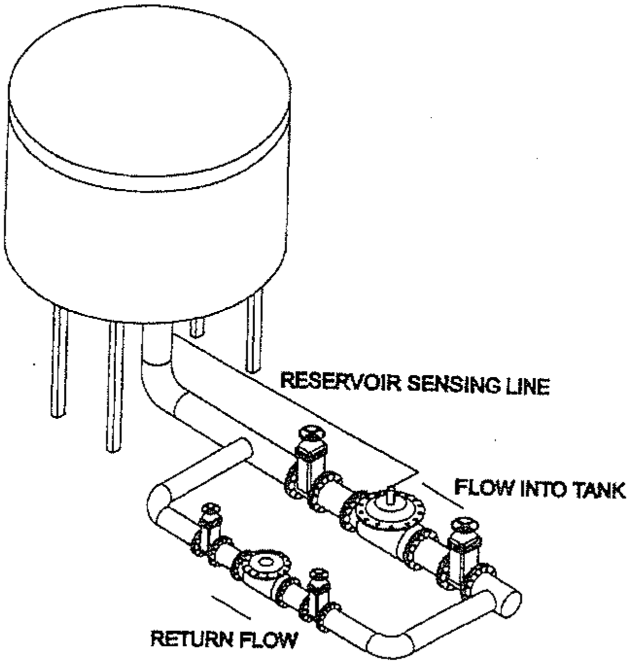
The altitude pilot is connected directly to the reservoir by a sensing line (not supplied). **For optimum control sense line should be: 1)** Installed with an approximate two degree upward angle (towards reservoir) to avoid air accumulation, **2)** Connected no further than forty-five pipe diameters from the reservoir, and **3)** A minimum of 3/4" diameter.

AMES Company, Inc. • 8550 Hansen Road • Houston, Texas 77075 • Ph. (713) 943-0688 • Fax (713) 944-9445

AMES CO.
FLUID CONTROL SYSTEMS

Typical Installation

The AMES Model 960-13 / 660-13 One Way Flow Altitude Control Valve with Delayed Opening Feature is designed to accurately control the high water level in a tank or reservoir. The 960-13 / 660-13 senses tank head pressure, and opens, filling reservoir, when water falls 1 – 15 feet (adjustable) below the adjustable high level setpoint. Water returns into the system through a check valve by-pass or separate tank discharge line.



Other AMES Altitude Control Valves

960 / 660	One Way Flow (Tank Fill)
960-15 / 660-15	One Way Flow w/ Solenoid On-Off Feature (Tank Fill)
960-17 / 660-17	Two Way Flow (Tank Fill & Discharge)
962 / 662	One Way Flow w/ Pressure Sustaining Feature (Tank Fill)

Installation Guidelines

- Prior to installation, flush line to remove debris.
- Install valve horizontally "in line" (cover facing UP), so flow arrow matches flow through the line. Avoid installing valves 6" and larger vertically. Consult factory **prior** to ordering if installation is other than described.
- Install using inlet and outlet isolation valves. NOTE: When using butterfly valves, insure disc does not contact control valve. Damage or improper valve seating may occur.
- Provide adequate clearance for valve servicing and maintenance.
- Install pressure gauges to monitor valve inlet, outlet, and tank head pressure.
- Install sensing line not smaller than 3/4" at a two degree upward slope, directly sensing reservoir head pressure, no further than forty-five pipe diameters from the reservoir.

When Ordering Please Specify:

A. AMES Model 960-13 or 660-13
B. Valve Size
C. Body Material
D. Body Style (globe or angle)
E. End Connections
F. Trim (seat) Material (Bronze or Stainless)
G. Tank Height (in feet from valve centerline)

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Submittal Package

Engineering Specification, Installation, Operation and Maintenance

Series LF960GD-13 / LF660GD-13

One-Way Flow Altitude Control Valve with Delayed Opening Feature

Sizes: 1¼" to 24"

⚠ WARNING

THINK SAFETY FIRST

Read this Manual BEFORE using this equipment.

Failure to read and follow all safety and use information can result in death, serious personal injury, property damage, or damage to the equipment.

Keep this Manual for future reference.

⚠ WARNING

Local building or plumbing codes may require modifications to the information provided. You are required to consult the local building and plumbing codes prior to installation. If the information provided here is not consistent with local building or plumbing codes, the local codes should be followed. This product must be installed by a licensed contractor in accordance with local codes and ordinances.

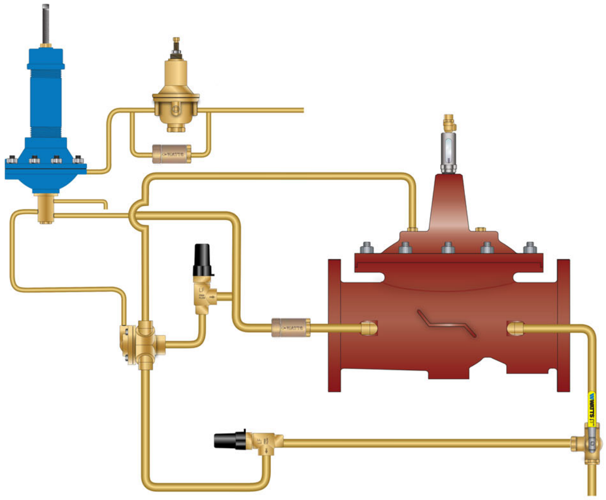
⚠ WARNING

Need for Periodic Inspection/Maintenance: This product must be tested periodically in compliance with local codes, but at least once per year or more as service conditions warrant. All products must be retested once maintenance has been performed. Corrosive water conditions and/or unauthorized adjustments or repair could render the product ineffective for the service intended. Regular checking and cleaning of the product's internal and external components helps assure maximum life and proper product function.

NOTICE

For Australia and New Zealand: Pipeline strainers should be installed between the upstream shutoff valve and the inlet of the backflow preventer.

It's important that this device be tested periodically in compliance with local codes, but at least once per year or more as service conditions warrant. If installed on a fire sprinkler system, all mechanical checks, such as alarm checks and backflow preventers, should be flow tested and inspected internally in accordance with NFPA 13 and NFPA 25.



LF960GD-13

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Engineering Specifications

Installation, Operation and Maintenance

AMES FIRE & WATERWORKS

A WATTS Brand

Engineering Specification

LEAD FREE*

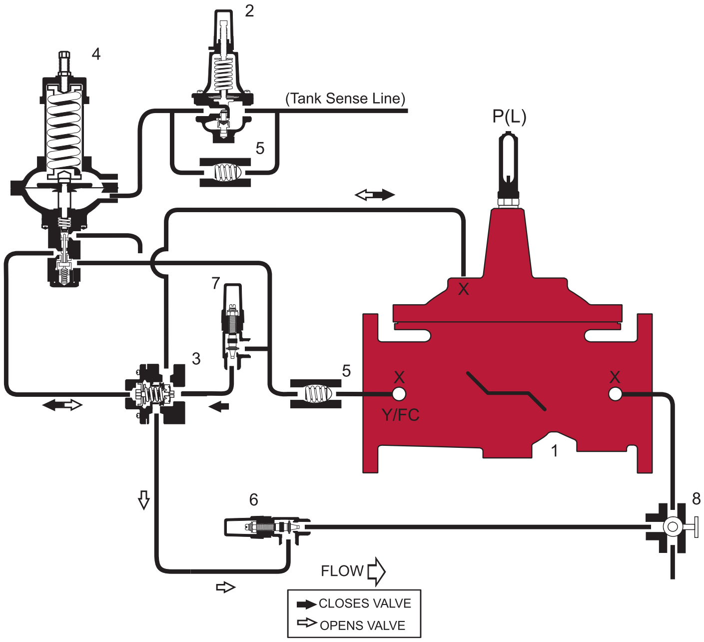
Series LF960GD-13

One-Way Flow Altitude Control Valve with Delayed Opening Feature

Full Port Ductile Iron Single Chamber Valve

Features

- Designed for Tank Fill applications
- Opens when Tank head pressure is below setpoint
- Closes when Tank head pressure is above setpoint
- Delayed Opening Feature allows calculated Tank turnover
- Tank Sense Line is field installed (connected to reservoir or standpipe)
- Adjustable Opening and Closing Speed
- Altitude and Delayed Opening setpoints are separately adjustable



Standard Components

1 – Main Valve (905GD - Single Chamber)
2 – Delayed Opening Control
3 – Model 22-1 Accelerator Control
4 – Altitude Control
5 – Check Valve
6 – Adjustable Opening Speed
7 – Adjustable Closing Speed
8 – 3-Way Ball Valve
P – Position Indicator
X – Isolation Cocks

Options and Accessories

○ FC – Flo-Clean Strainer
○ Y – Y-Strainer (Replaces Flo-Clean)
○ L – Limit Switch

Operation

The One Way Flow Altitude Automatic Control Valve (ACV) with Delayed Opening Feature is designed to open, allowing flow into a reservoir or elevated storage tank (tank fill), and close drip tight when high water level is achieved. The valve also has an adjustable delayed opening feature, allowing a calculated "draw-down" of water level, before opening for tank fill operation. The Altitude Pilot remotely senses static tank head pressure (water level) through a field installed sensing line, and directs pressure into and out of the cover chamber of the 3-way Accelerator Pilot. When the cover of the Accelerator Pilot is pressurized, the main valve cover chamber is vented downstream (dry drain) or to atmosphere (wet drain), causing the valve to open fully. When the cover of the Accelerator Pilot is de-pressurized, the main valve cover chamber is connected to upstream pressure, causing the valve to close drip tight.

As water level decreases, static tank head pressure falls below the adjustable setpoint of the Altitude Pilot, causing it to pressurize the cover of the Accelerator Pilot, opening the valve. As water level increases, static tank head exceeds the adjustable setpoint of the Altitude Pilot, causing it to depressurize the cover of the Accelerator Pilot, closing the valve drip tight. Valve opening and closing speeds are separately adjustable. The Position Indicator with Air Bleed Petcock allows for visual indication of valve position, and easy venting of air entrapped in the main valve cover chamber.

The adjustable Delayed Opening Feature "holds" high level static tank head pressure in the Altitude Pilot, causing the main valve to remain closed as water level decreases. When static tank head pressure falls below the setpoint of the Delayed Opening Pilot, the Altitude Pilot commands the main valve to open for tank fill operation. Reservoir filling can be "delayed" until water level falls 3-15 feet (adjustable) below desired shut-off point to increase water circulation through the tank.

Specify Tank height PRIOR to ordering.

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

APPENDIX M

Refer to *Specification Section 250500.00 – Control System Description MEGASITE – Water Plant* for the sequence of operation for the water plant and instrument list.

APPENDIX N

APPENDIX I-D-2

PRELIMINARY DESIGN SUBMISSION REVIEW GUIDANCE – ENGINEERING REPORT - CHECKLIST

LEGEND: SEE APPENDIX 1-D

II.		ENGINEERING REPORT (BASIS OF DESIGN OR DESIGN MEMORANDUM): PURPOSE: DEMONSTRATE DUE DILIGENCE WITH RESPECT TO INFLUENT CHARACTERIZATION AND CONFORMANCE TO *CRITERIA* OR JUSTIFICATION FOR DEPARTURES; DEFINE START-UP AND DEMONSTRATION CONDITIONS; RESOLVE ISSUES OF OPERATIONAL AND PERFORMANCE INTENT IN FUTURE YEARS AS PLANT APPROACHES EXPANSION; PROVIDE OWNER-ENGINEER-REGULATOR UNDERSTANDING OF EXPECTATIONS OF PERFORMANCE FOR FINAL DESIGN AND CONSTRUCTED FACILITY; PROVIDE DOCUMENATION BASIS FOR OPERATOR TRAINING AND OPTIMIZATION.									
			4-step process req'd				**4-step process optional**				
			Treatment				**Non-treatment**				
	ITEM	**DESCRIPTION**	**TF**	**DC**	**IW**	**LA**	SLS	FM	GR	RH	RU
		Cover Letter including: Description of the project; utility and design contact persons (name, organization name, address, email, phone number and fax number); project location (county and city); associated NPDES or SOP number and treatment plant name; enclosures, e.g., plan sheets (format), engineering report (format), fee worksheet (format), engineering report check fee. Cover letter must be signed by utility representative or submitted "on behalf of "the utility and an appropriate representative of the utility copied.	**X**	**X**	**X**	**X**	X	X	X	X	X
		Cover letter continued: linear feet, diameter, and type (force main, gravity sewer, low pressure sewer);						X	X		
		Cover letter continued: treatment/pumping capacity in MGD	**X**	**X**	**X**	**X**	X				X
		Cover letter continued: for line rehabilitation: linear feet and size by activity, e.g., replacement, pipe-bursting, cured-in-place, slip-line, TV inspection, smoke testing; number of manhole or service lateral rehabs								X	
	A.	Basis for influent flow characterization (e.g. estimates from *Design Criteria*-Chapter 2, flow monitoring or other current data, sampling, pretreatment program, industrial owner projections, population trends, population predictions, etc.)	**X**	**X**	**X**	**X**	X	X	X	X	X
	B.	Characterization of flow (diurnal patterns, ADDWF, ADF, Design Flow, Peak Flow; organic and industrial inorganic loads (CBOD5, NH3-N, pH, TN, TP, (COD), alkalinity, metals, toxic/hazardous materials); grit and trash loading estimates or data	**X**	**X**	**X**	**X**	X	X	X	X	X
	C.	Unit process design parameters (referenced to *Design Criteria* chapters 2-17; or pertinent data on systems not covered by Design Criteria); equipment selection rationale should demonstrate appropriateness of capacity and capability throughout range of operation currently (ADDWF-Peak Flow) and existing to 20 year design flow in order to meet discharge permit, land application conditions or reuse conditions. Conformance to manufacturers' hydraulic or	**X**	**X**	**X**	**X**	?	?	?	?	?

		nutrient loading parameters. (Life cycle alternative analyses for process or equipment selected if not previously provided in PER or as requested at time of preliminary discussion.)									
	D.	Pump hydraulics (System curves superimposed on pump curves for minimum and maximum head conditions and at least C=130 Hazen-Williams friction coefficient); one set of system curves should match hydraulic profile flows and head conditions; others should be defined by extremes.	**X**	**X**	**X**	**X**	X	X			X
	E.	Chemical feed pump selection data demonstrating ability to meet range of target concentrations over process flow rates	**?**	**?**	**?**	**?**					?
	F.	Chemical storage volumes and environments to meet safety and compatibility requirements	**?**	**?**	**?**	**?**	?				?
	G.	Reliability levels for equipment and power supplies; appropriate redundancy and ability to isolate for maintenance and operational conditions	**X**	**X**	**X**	**X**	X				X
	H.	Energy saving solutions considered (e.g., variable speed drives on pumps and blowers, denitrification capability, timers on blowers based on DO or ORP instrumentation, power factor correction, pump soft start controls)	**X**			**X**	X				?
	I.	Odor control consideration	**X**			**?**	X	X		?	?
	J.	Corrosion control consideration	**X**			**?**	X	X		?	?
	K.	Velocities in gravity sewers and mitigation if required							X	X	
	L.	Calculations for nutrient and hydraulic loading for land application areas; emergency storage for spray application systems, crop management				**X**					X
	M.	Flow data (from temporary or permanent flow meters, pump run-times, pump power consumption, overflows as a function of rainfall events, influent flow meters at pump stations or wastewater treatment plant versus rainfall events) in existing collection system	**X**			**X**	X				X
	N.	Justification for rehabilitation methodology, scope and site selection; methods to be used to ensure quality control and to reduce failures of rehab pipe at connection to manholes; method to measure reduction in flows								X	
	O.	Potential reuse sales; required quality; example reuse contracts; meter locations and sampling plan to determine delivery of appropriate quality reclaimed water.	**X**								X
	P.	Status and coverage of all required/anticipated permits including state, federal, and local, outlined	**X**	**X**	**X**	**X**	?	?	?	?	?
	Q.	Tables demonstrating unit process conformance to the appropriate *Design Criteria* requirements or justification for systems not addressed or whose performance is outside the *Design Criteria* accepted performance. (Checklists being developed and included in *Design Criteria* may be used for this purpose.)	**X**	**X**	**X**	**X**	X	?	?	?	X
	R.	Recommend inclusion of cut sheets for equipment and instrumentation and checklists from Design Criteria (as available) as appendices to ER to expedite reviews	**X**	**X**	**X**	**X**	X	?	?	?	X