



To: All Plan Holders of Record

From: Verdantas LLC
For the Owner

**Re: Addendum No. 2
Water Tower Project
Village of Lyons**

Date: October 31, 2025

This Addendum forms a part of the contract documents and modifies the original bidding documents dated October 2025 and all previous addenda, if any. Acknowledge receipt of this addendum in the space provided in the bid forms. Failure to do so may subject the bidder to disqualification.

QUESTIONS AND ANSWERS

Q1. Sheet 01C-02 shows a lot of line tie in for new tank.

A1. That is correct there are several water mains that extend from this Village parking lot to various points of the distribution system.

Q2. Sheet 01C-01 is the old tank.

- a. Demo note 5 states to abandon the line and plug - plug with what? (flowable fill?) Where? (open end at the tank?)
- b. Note 6 states the same, abandon and plug. Plug with what and where?
- c. Note 8 on sheet 01C-01 states to remove the 90 degree angle. Sheet 01C-02 indicates to install a 12" MJ plug - who removes the 90 degree and who caps? Does the line #5 get capped?
- d. Note 9 states to remove the 12" main and cap it. Sheet 01C-02 shows a bunch of tie in for new tank.
 - i. Are we correct that the capping would be the new tank contractor responsibility
 - ii. Do you really want another contractor to come in after the new line is installed and remove the old line so close to it? Can this line be abandoned as well? Or will the new tank contractor installing the new line also remove the old?

A2.

- a. Lines designated for abandonment shall be disconnected and sealed using mechanical joint plugs or caps. Flowable fill is not required unless otherwise directed. Plug locations should be at the point of disconnection from the active system, at the nearest valve as shown in detail drawings. Thrust blocks shall be installed where necessary at direction of ENGINEER. Refer to Section 024116 – 1 for utility abandonment procedures.
- b. Please see A2a for this response and further clarification in Detail 1 & 2.
- c. The line referenced in Note 5 shall be capped at the tee as part of this scope. This would be expected to be conducted after the current tank has been constructed after it has been

disinfected and tested. All abandonment should be conducted in conjunction with “Construction Sequence 7: tie into existing water mains” on plan set 01C-02.

- d. This is correct. The existing 12-in watermain to the 90 degree bend will be abandoned and capped. It is the intent of the design to abandon the existing 12-in running south from the Note 8 on 01C-01 and cap at Note 9. On 01C-02 a new 12-in main is being installed parallel to the existing main being abandoned and capped.
 - i. This is a lump sum contract and would be expected to be determined by the successful contractor.
 - ii. The contractor is not required to remove the entire buried 12" main unless it conflicts with new work. Pipe segments not interfering with new construction may be abandoned in place after proper disconnection and capping. Final removal and permanent capping of lines near new tie-ins will be the responsibility of the contractor. Coordination between contractor and his subcontractor(s) will be required to avoid redundant work.

Q3. Do you have as built's of the foundation piers? The tank is welded but stand on beam legs not pipe legs. We want to know if the foundation piers are pyramid in shape or top hat in shape.

A3. As-built drawings of the existing tank foundation piers are not available. All available data on the existing tank has been provided as the original design was conducted in 1940s. Based on standard construction practices, the tank likely rests on individual concrete piers beneath each leg. These piers shall be removed to a minimum depth of 3 feet below finished grade per Section 024116 – 1. Backfill and surface restoration shall be completed in accordance with the specifications.

Q4. Can you confirm water main pipe material and fitting materials?

A4. Please refer to Spec Section 331113.01 Water Utility Distribution System Master. The spec shall govern all watermain pipe material and appurtenances selections.

Q5. Based on note 1 / 02C-01 it appears you want boltless restrained joint (DIP) like TR-Flex. And per watermain notes on 00G-05 250 PSI rating. Also per 00G-05, MJ fittings with megalugs are allowed.

A5. Please refer to Spec Section 331113.01 Water Utility Distribution System Master.

Q6. Also please confirm job is AIS, but not BABA

A6. Per Section 8 Special Requirements – EPA (WSRLA Funding) AIS does apply – See Contract Form CF.EPA.8 – American Iron and Steel Acknowledgement. BABA does not apply for this funding.

However, for the CDBG funding, BABA does apply – See Bid Form CDBG.BF.1 - Build America, Buy America (BABA) Compliance Certification.

Q7. Would like some additional clarification on addendum 1. 1.4 Protection is demo section 024116-1; C.1 refers to abatement. Page 4, 3.6.D states to collect and contain dislodged paint.

- a. Are you requiring paint abatement on the cut lines prior to torch cutting?

A7.

- a. No, the specifications do not require pre-abatement (removal of paint at cut lines) prior to torch cutting. Contractors may proceed with torch cutting of painted steel provided all work conforms to OSHA 29 CFR 1926.354 and 1926.62, including use of PPE and engineering controls and other lead abatement standard practices.

Q8. Is it acceptable to submit bid sketches with our bid, with the understanding that all the tank and foundation details referenced in 1.5.D and 1.5.E would come at a later date during drawing submittal phase?

A8. This is acceptable. Refer to SPECIFICATIONS in addendum #2 below.

Q9. In reference to specification 464146.02 Section 2.05 (Control System), IXOM does not offer an integrated PLC based control system. Instead, they offer dedicated controls for each individual piece of equipment.

We are requesting that you remove the PLC requirement from the specification.

A9. The Control panel(s) needed for the equipment is currently specified as an integrated control panel for all components. This project will allow separate dedicated panels for each individual pieces of equipment if full functionality of equipment is as specified.

Q10. Can you confirm that Sections 464146.01 & 464146.02 for THM equipment will both be required to provide a single integrated control panel that will control all provided equipment?

A10. This has been clarified in A9.

Q11. Section 464146.01 2.01 A and 2.01 D mention two different THM removal percentages, can you please confirm which is the correct removal required?

A11. THM removal percentage is to be a minimum of 25% per 2.01B in Section 464146.01 2.01 A. Please disregard the 24%.

Q12. Section 464146.01 2.05 A.1 mentions motor starters for the THM equipment, while 2.05 D.4.b 2. c. 1 shows VFD faults. Please confirm if VFD can also be used?

A12. This is acceptable.

Q13. The single line diagram on DWG. No.E-03 (pg.17 of 21) shows only motor controllers for the THM equipment. In comparison, Section 464146.01 2.05 of the specifications shows an Integrated Control Panel. Can you please clarify that an Integrated Control Panel is included in this scope?

A13. Please refer to clarification in A9. A fully integrated control panel is no longer required, however full functionality of the equipment is expected.

Q14. Is a new RTU-1 & RTU-2 to be provided by the integrator as a part of this project scope? If so can the specifications or standard design for the RTU's be provided prior to bid?

A14. New RTUs will not be required of this project unless the existing Tower's RTU is not applicable to be moved to the new tower and confirmed with ENGINEER.. Please see updated specification section 269001 SCADA & Telemetry System, specifically Section 1.2 Description OF WORK.

Q15. It also appears that this will be a new SCADA system, correct? With only the water tower supply system included in the SCADA scope, correct?

A15. The existing SCADA/Telemetry unit is to be relocated to the New Tower from the existing Tower. Please refer to updated specification section 269001 SCADA/Telemetry System.

Q16. Will the THM Aeration system local OIT screens need to be replicated on the SCADA system for remote operation or will the SCADA system be utilized for remote monitoring only?

A16. SCADA/Telemetry will be used solely for remote monitoring. All controls for the THM removal system will remain localized, consistent with the configuration currently implemented on the existing tower and planned for the new tower.

Q17. Can you please provide the height to the overhead electrical lines Entering the parking lot facing south on Cleveland Street. Can you also provide the height to the overhead electrical lines

A17. Facing the Parking Lot (facing south) from Cleveland Street the electrical lines are approximately 18 ft from grade. Facing the Parking Lot (facing east) from N Adrian Street the electrical lines are approximately 18 ft from grade.

REPORTS

1. **Replace** the Geotechnical Subsurface Investigation report dated March 3, 2023 provided with the bid book with the enclosed Geotechnical Subsurface Investigation report dated October 27, 2025 by CT Consultants, Inc.
2. **Add** enclosed TTHM DBP Info.pdf provided by Village on current TTHM levels when design occurred.

SPECIFICATIONS

Replace Section "269001 - SCADA AND TELEMETRY SYSTEM" with enclosed Section "269001 - SCADA AND TELEMETRY SYSTEM_A"

Add the enclosed Section 33113.01 - WATER UTILITY DISTRIBUTION SYSTEM.

Section 331619 - ELEVATED STEEL TANKS: **Change** “Section 1.5 INFORMATION TO BE SUBMITTED WITH BID” to “Section 1.5 INFORMATION TO BE SUBMITTED AFTER AWARD.”

PLANS

On plan sheet 00G-05 **Remove** the following note: 1) 4” THRU 12” DIA. PIPES SHALL BE COLOR BLUE POLYVINYL CHLORIDE PRESSURE PIPE PER AWWA C909 PVCO DR 14 WITH TRACER WIRE; JOINTS SHALL BE RESTRAINED.

On plan sheet 01C-01 **Remove** DEMOLITION CODED NOTE #7, “Remove existing 6”x6”x8” Tee. Cap 6” watermain” with 7) Replace existing tee with 6” Cross and reconnect existing watermain per detail 2 on 01C-02.

BM/AF:mep

Enclosures

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Proposed Elevated Water Tank

Lyons, Ohio

Geotechnical Subsurface Investigation

**The Village of Lyons
Ohio**

October 27, 2025

CT Project No. 220792

CT Consultants, Inc.

**8150 Sterling Court
Mentor , OH 44060
440-951-9000**

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LEADING THROUGH THE NEXT 100 YEARS
www.ctconsultants.com

October 27, 2025

CT Project No. 220792

Village of Lyons
26 W Morenci Street
Lyons, Ohio 43533

**Geotechnical Subsurface Investigation
Proposed Elevated Water Tank
Village of Lyons, Ohio**

Following is the report of the geotechnical subsurface investigation performed by CT Consultants, Inc. (CT) for the referenced project. This study was performed for the Village of Lyons in support of design services for the Proposed Elevated Water Tank Project.

This final report contains the results of our study, our engineering interpretation of the results with respect to the project characteristics, and our recommendations for foundation support.,.

Soil samples collected during this investigation will be stored at our laboratory for 90 days from the date of this report. The samples will be discarded after this time unless you request that they be saved or delivered to you.

Should you have any questions regarding this report or require additional information, please contact our office.

Sincerely,

CT Consultants, Inc.



A handwritten signature in blue ink, appearing to read "Imad El Hajjar".

Imad El Hajjar, El
Geotechnical Project Manager



A handwritten signature in blue ink, appearing to read "C. Roupe".

Curtis E. Roupe, P.E.
Vice President

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GEOTECHNICAL SUBSURFACE INVESTIGATION
PROPOSED ELEVATED WATER TANK
VILLAGE OF LYONS, OHIO

FOR

VILLAGE OF LYONS
26 W MORENCI STREET
LYONS, OHIO 43533

SUBMITTED

OCTOBER 27, 2025
CT PROJECT NO. 220792

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PLATES

Plate 1.0 Site Location Map

Plate 2.0 Test Boring Location Plan

Appendices

A Logs of Test Borings B-1 through B-3

B Legend Key

C Tabulation of Test Data

D Laboratory Test Results

1.0 INTRODUCTION

This geotechnical subsurface investigation report has been prepared for the proposed elevated water tank in the Village of Lyons, Ohio. The general area of the project is shown on the attached Site Location Map (Plate 1.0).

This report summarizes our understanding of the proposed construction, describes the investigative and testing procedures, presents the findings, discusses our evaluations and conclusions, and provides our design and construction recommendations for tank foundations.

This study was performed for the Village of Lyons in support of design services for the Proposed Elevated Water Tank Project.

The purpose of this investigation was to evaluate the subsurface conditions and laboratory data relative to the design and construction of foundations at the referenced site. This investigation included three (3) test borings, field and laboratory soil testing, and a geotechnical engineering evaluation of the test results.

This report includes:

- A description of the subsurface soil and groundwater conditions encountered in the borings.
- Design recommendations for foundations related to the proposed elevated water tank.
- Recommendations concerning soil- and groundwater-related construction procedures such as site preparation, earthwork, foundation construction, as well as related field testing.

This investigation did not include an environmental assessment of the subsurface materials at this site.

2.0 INVESTIGATIVE PROCEDURES

This subsurface investigation included three (3) test borings drilled by CT on January 3, 2023. The test borings were located in the field by CT and were generally performed within the proposed elevated tank footprint. The approximate locations of the borings and an aerial background are shown on the Test Boring Location Plan (Plate 2.0). The approximated ground surface elevations, termination depths and elevations for the borings are summarized in Table 2.0 at the end of this section.

The test borings were performed in general accordance with geotechnical investigative procedures outlined in ASTM Standard D 6151. The test borings performed during this investigation were drilled with a track-mounted drill rig with utilizing 3¼-inch inside diameter hollow-stem augers. Ground Surface Elevations were depicted from Google Earth and reported to the nearest foot.

During auger advancement, soil samples were collected at 2½-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter. Split-spoon (SS) samples were obtained by the Standard Penetration Test (SPT) Method (ASTM D 1586), which consists of driving a 2-inch outside diameter split-barrel sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments with the number of blows per increment being recorded. The sum of the number of blows required to advance the sampler the second and third 6-inch increments is termed the Standard Penetration Resistance (N-value) and is presented on the Logs of Test Borings attached to this report. The samples were sealed in jars and shipped to our laboratory for further classification and testing.

All of the recovered samples of the subsoils were visually or manually classified in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 and D 2488) and were tested in our laboratory for moisture content (ASTM D 2216). Dry density determinations and unconfined compressive strength tests by the constant rate of strain method (ASTM D 2166) were performed on select samples. Unconfined compressive strength estimates were obtained for the remaining intact cohesive samples using a calibrated hand penetrometer. A particle size analysis (ASTM D 6913 and D 7928) and an Atterberg limits test (ASTM D 4318) were performed on a representative sample from Boring B-2 (SS-2) to determine soil classification and soil

index properties. The test results are presented on the Logs of Test Borings, Tabulation of Test Data sheets, and Grain Size Distribution sheet attached to this report.

Soil conditions encountered in the test borings are presented in the Logs of Test Borings, along with information related to sample data, SPT results, water conditions observed in the borings, and laboratory test data. It should be noted that these logs have been prepared on the basis of laboratory classification and testing as well as field logs of the encountered soils.

Experience indicates that the actual subsoil conditions at a site could vary from those generalized on the basis of test borings made at specific locations. Therefore, it is essential that a geotechnical engineer be retained to provide soil engineering services during the site preparation, excavation, and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

As previously mentioned, test boring data is provided in the following table.

Table 2.0 Test Boring Data			
Boring Number	Ground Surface Elevation (Ft)	Termination Depth (Ft)	Approximate Termination Elevation (Ft)
B-1	769	35	734
B-2	769	50	719
B-3	769	35	734

3.0 PROPOSED CONSTRUCTION

The proposed project consists of construction of a new elevated water tank within the parking area located northeast of the exiting tower, which is proposed to be demolished. The site is located within the southeast quadrant of the intersection of Cleveland Avenue and N. Adrian Street

Loads associated with the structure were not available at the time of preparing this proposal. It was indicated that the proposed water tank is to have a diameter of 30 feet. It was indicated that desired allowable bearing pressures were on the order of 4,000 to 5,000 pounds per square foot (psf). We have assumed that the structure will be supported on a ringwall foundation.

We have assumed that the final grades at the site will approximate existing grades.

4.0 GENERAL SITE AND SUBSURFACE CONDITIONS

4.1 General Site Conditions

At the time of our investigation, the project area consisted of an asphalt parking lot. Ground surface elevations at the boring locations were on the order of Elevs. 769 feet.

A summary of the encountered surface materials is presented in the following table.

Table 4.1. Encountered Surface Materials		
Location	Asphalt Thickness (inches)	Crushed Stone Thickness (inches)
B-1	5	9
B-2	5	7
B-3	4	14

4.2 General Site Geology

Published geologic maps from the Ohio Department of Natural Resources (ODNR) indicate that the project site is located within the glaciated portion of Ohio. Quaternary soil deposits consist of a restively thin mantle of lacustrine sand, deposited in glacial lakes as shallow-water deltas or nearshore bars and sheets; includes many small areas of dunes. These deposits are underlain by clayey till deposits.

Bedrock at the site consist of lower Mississippian aged shale of the Coldwater Shale Formation which is anticipated at depths greater than 150 feet below existing grades.

4.3 General Soil Conditions

Based on the results of our field and laboratory tests, the subsoils encountered underlying the surface material can be generally described as a stratum of lacustrine deposits underlain by two strata of predominantly cohesive till soils with varying strength and moisture characteristics

Summaries of the encountered conditions are provided below and additional descriptions of the soil stratigraphy encountered in the borings are presented on the Logs of Test Borings attached to the report.

Stratum I consisted of predominantly medium stiff native lacustrine cohesive soils encountered underlying the above noted surface materials to depth ranging from approximately 2½ to 3½ feet (Elev. 766± to 765±). Stratum I consisted of sandy lean clay (CL) mixed with trace amounts of organics. SPT N-values ranged from 7 to 8 blows per foot (bpf). Unconfined compressive strengths within Stratum I ranged from 860 to 5,000 pounds per square foot (psf). Moisture contents ranged from 15 to 21 percent.

Stratum II consisted of predominantly stiff to very stiff native cohesive till soils encountered underlying Stratum I to a depth ranging from approximately 24 to 33 feet (Elev. 745± to 736±). Stratum II consisted of lean clay (CL) mixed with sand and trace amounts of gravel. SPT N-values ranged from 11 to 28 bpf. An isolated layer exhibiting hard consistency (SPT N-Value of 31bpf) was encountered in Boring B-2. Unconfined compressive strengths within Stratum II ranged from 6,600 to 9,160 psf. Moisture contents ranged from 15 to 21 percent.

A Liquid limit of 28 percent and plasticity index of 9 percent were determined for a Stratum II sample obtained from Boring B-2 (SS-2). These values along with gradation results, are indicative of Lean Clay with Sand (CL) in accordance with USCS designations.

Stratum III consisted of predominantly very stiff to hard native cohesive till soils encountered underlying Stratum II to the planned boring termination depth ranging from approximately 35 to 50 feet (Elev. 734± to 719±). Stratum III consisted of lean clay (CL) mixed with sand and trace amounts of gravel, as well as silty clay (CL-ML) mixed with sand and trace amounts of gravel. SPT N-values ranged from 19 to 50 bpf. A split-spoon refusal (SSR, 50 or more blows for 6 inches or less penetration) was reported in Boring B-3 at approximately 24 feet, indicating the possible presence of boulders and/or cobbles. An isolated seam of sandy silt (ML) was encountered in Boring B-2 from 39 to 43½ feet. Unconfined compressive strengths within Stratum II ranged from 7,000 to greater than 9,000 psf (maximum reading obtainable using a hand penetrometer). Moisture contents ranged from 13 to 23 percent.

Additional descriptions of the stratigraphy encountered in the borings are presented on the Logs of Test Borings.

4.4 Groundwater Conditions

Groundwater was generally not encountered during drilling nor observed upon completion of drilling operations in any of the borings. Ground water trapped within the stone subbase was reported in Boring B-1 at ½ feet below exiting grades. It should be noted that the boreholes were drilled and backfilled within the same day, and stabilized water levels may not have occurred over this limited time period.

Based on the limited data available, such as the soil characteristics and the groundwater conditions encountered in the borings, it is our opinion that the “normal” groundwater level may be generally encountered at depths on the order of 13 to 15 feet below existing grade. However, this investigation did not include research of possible hydrological influences at the project site. It should be noted that groundwater elevations can fluctuate with seasonal and climatic influences. In particular, “trapped” water may be encountered in stone sub base materials that are underlain by relatively impermeable cohesive soils. Therefore, the groundwater conditions may vary at different times of the year from those encountered during this investigation.

5.0 DESIGN RECOMMENDATIONS

The following conclusions and recommendations are based on our understanding of the proposed construction and on the data obtained during the field investigation. If the project information or location as outlined is incorrect or should change significantly, a review of these recommendations should be made by CT. These recommendations are subject to the satisfactory completion of the recommended site and subgrade preparation and fill placement operations described in Section 6.0, "Construction Recommendations".

5.1 Shallow Foundations

It was indicated that the proposed elevated water tank will be supported on a ringwall and would have a load that would result in a bearing pressure on the order of 4,000 to 5,000 pounds per square foot (psf) over the foundation footprint. The foundation will be constructed to support the proposed water tank with an expected diameter on the order of 30 feet.

Based on the results of the field and laboratory testing for the borings performed for this investigation, we recommend that the foundation bear in the Stratum II Stiff to very stiff cohesive soils at a depth of a minimum 3½ feet below existing grades (approximate Elev. 763±). These soils are considered generally suitable for support of the proposed foundations. In any case, an inspection of the footings should be completed prior to placement of steel reinforcement or foundation concrete.

It should be noted that a medium stiff cohesive lacustrine soils were present overlying Stratum II in all the borings and extending to depths ranging from 2½ to 3½ feet below existing grade. These medium stiff cohesive soils are not considered suitable for support of the foundations based on the anticipated bearing pressures associated with the elevated tank foundation. If these soils are present within a depth below the foundation bearing elevation equal to the foundation width, they should be removed and replaced with new engineered fill as described later in this section.

Following the satisfactory completion of the site preparation and footing excavation inspections outlined in Section 6.0 of this report, the proposed structure may be supported on a ringwall foundation. It should be noted that bearing capacity and associated settlement is affected by the foundation width since it affects the stress influence from the foundation pressure on the underlying soils. Our evaluations are based on a ringwall with a width of 10 feet or less. Please contact CT for additional evaluation if the foundation width is greater than 10 feet.

For the ringwall foundation bearing at a depth of a minimum 3½ feet below grade in Stratum II cohesive soils, an average gross allowable bearing pressure of 4,500 psf may be utilized for design. **In using a gross allowable soil pressure, the weight of the footings, backfill over the footings, or slabs needs to be included in the structural loads for dimensioning footings.** The bearing materials should be field-verified as being native lean clay (CL) or silty clay (CL/ML) with a minimum unconfined compressive strength of 4,500 psf.

We strongly recommend that the bearing surface at the bottom of all footing excavations be inspected during construction by a CT geotechnical engineer or qualified representative. Inspection should be performed to verify that the exposed soil conditions at the bearing elevations are consistent with the subsurface conditions encountered in the test borings and are suitable for foundation bearing. Inspection should include test holes at regular intervals as described above. Additionally, the presence of our engineer will help facilitate the timely remediation of unsuitable soil conditions. Suitable unconfined compressive strength of the bearing soils may be verified using a hand penetrometer.

If the results of hand penetrometer or other strength tests indicate the exposed soil conditions are not suitable for the design bearing pressure, it will be necessary to over-excavate the unsuitable soils. The base of the over-excavation should be widened one foot for every foot of depth and centered along the footing. The over-excavated areas should be backfilled with dense-graded aggregate, placed in controlled lifts, and compacted to not less than 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor). Alternatively, the over-

excavated areas could be backfilled with lean concrete having a minimum compressive strength of 1,500 pounds per square inch (psi) or other flowable controlled-density fill having a minimum compressive strength of 300 psi.

The footing should be constructed at a minimum frost penetration depth of 3½ feet below finished exterior grades. Although much wider foundations are anticipated, based on the relatively high recommended allowable bearing pressure, the minimum width of ringwall footings should be at least 4 feet, regardless of sizing based on design loads and the allowable bearing pressure, to avoid punching or localized shear failure.

A wider foundation may be required to account for shear and moment in the foundation system. Additionally, moments in the foundation system may create an unbalanced foundation bearing pressure. If accentuated “toe” pressures due to overturning conditions exceed 5,985 psf, CT should review the bearing pressure in light of settlement considerations. Typically, these higher pressures are associated with wind loads or seismic loads, for which an increase of one-third of the “normal/average” bearing pressure is allowed for these transient loads (i.e., a maximum allowable pressure of 5,985 psf may be used for transient loading). However, the average bearing pressure over the whole footing width should not exceed the gross allowable bearing pressure of 4,500 psf. This allowable bearing pressure is based on a nominal factor of safety of 3 applied to the calculated ultimate value.

Utilizing the above bearing pressure and proper foundation inspection techniques, the total settlement associated with the structure with a foundation width of 10 feet or less was calculated to be on the order of 1 inch using a ringwall foundation and differential settlement should not exceed ¾ inch.

For sliding resistance, a friction factor of 0.35 may be assumed for a footing poured against undisturbed native clay soils. For undisturbed native cohesive soils, a passive earth pressure coefficient (k_p) of 3.0 may be utilized for the portion of the footing that is below a frost protection depth of 3½ feet. We recommend a maximum passive

earth pressure for the native cohesive soils of 300 pounds per square foot per foot of depth. These values are based on footings poured in intimate contact with at least medium stiff lean clay. It should be noted that a slight amount of soil strain and possibly accompanying wall/foundation movement is needed to mobilize the full passive pressure of the soil. Because of this consideration, some design methods incorporate a higher factor of safety (e.g., F. S. = 2.0) when using passive pressure contribution to stability, as compared to sliding resistance on the base only (typically, F.S. = 1.5).

5.2 Seismic Considerations

We have reviewed seismic design parameters in accordance with the Ohio Building Code (OBC) criteria, which references ASCE 7-10. It should be noted that the OBC seismic site characterization is based on the upper 100 feet of the geologic profile and the borings performed for this investigation extended only to a maximum depth of 50 feet below existing grade. Based on review of available information, bedrock in the vicinity of the site is mapped deeper than 100 feet below existing grade. Therefore, we considered the soil conditions at the termination depth of the borings extending to 100 feet.

For the N_{ch} -method an SPT N-value of 100 blows per foot (bpf) [split-spoon refusal] was modeled for the bedrock portion of the subsurface profile. Using the N_{ch} -method, the average SPT N-value (N_{ch}) was calculated to be greater than 15 bpf and less than 50 bpf, which is indicative of a Site Class D “stiff soil” designation in accordance with ASCE 7-10 Table 20.3-1 criteria. As such, a Site Class D “stiff soil” designation may be utilized for this site.

5.3 Groundwater Control and Drainage

Encountered groundwater conditions were previously discussed in Section 4.3. Based on the limited data available, such as the soil characteristics and the moisture conditions encountered in the borings, it is our opinion that the “normal” groundwater level may be encountered at depths on the order of 13 to 15 feet below existing grade. It should be noted that “perched” water may be encountered in exiting

stone subbase materials that are underlain by relatively impermeable native cohesive soils.

It is our experience that adequate control of groundwater seepage, “perched” water, or surface water run-off into shallow excavations should be achievable by minor dewatering systems, such as pumping from prepared sumps. In the event excessive seepage is encountered during construction, CT may be notified to evaluate whether other dewatering methods are required.

5.4 Excavations and Slopes

The sides of temporary excavations for building foundations, utility installations, and other construction should be adequately sloped to provide stable sides and safe working conditions. Otherwise, the excavation must be properly braced against lateral movements. In any case, applicable Occupational Safety and Health Administration (OSHA) safety standards must be followed.

Based on the test borings, it is likely that excavations will encounter a range of soil conditions that include the following OSHA designations:

- Type A soils (cohesive soils with unconfined compressive strengths of 3,000 pounds per square foot (psf) or greater),
- Type B soils (cohesive soils with unconfined compressive strengths greater than 1,000 psf but less than 3,000 psf, and dry rock that is not stable), and
- OSHA Type C soils (cohesive soils with unconfined compressive strengths of 1,000 psf or less).

For temporary excavations in Type A, B and C soils, side slopes must be no steeper than $\frac{3}{4}$ horizontal to 1 vertical ($\frac{3}{4}$ H:1V), 1H:1V, and 1½H:1V, respectively. For situations where a higher strength soil is underlain by a lower strength soil and the excavation extends into the lower strength soil, the slope of the entire excavation is governed by that required for the lower strength soil. In all cases, flatter slopes may

be required if lower strength soils or adverse seepage conditions are encountered during construction.

For permanent excavations and slopes, we recommend that grades be no steeper than 3H:1V without a more extensive geotechnical evaluation of the proposed construction plans and site conditions.

6.0 CONSTRUCTION RECOMMENDATIONS

6.1 Site and Subgrade Preparation

Prior to proceeding with construction operations, all pavements, vegetation and other deleterious non-soil materials should be removed from the proposed construction areas.

Although not evaluated as part of this project, if the site development will include slabs-on-grade or pavements, dark soils having the appearance of topsoil, but exhibiting only root “hairs” or trace organics less than approximately five percent, may not require stripping for the full depth of the darkly colored zone, provided the subgrade can be satisfactorily proof rolled as described below. Conversely, the site may contain areas where additional excavation will be required beyond the darkly colored zone due to organics in order to provide a stable subgrade for construction.

Upon completion of stripping and clearing, the areas intended to support pavements, floor slabs, and new fill should be carefully inspected by a geotechnical engineer. At that time, the engineer should observe proof rolling of the cohesive subgrade soils utilizing a 20- to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. Subgrade soils may consist of granular soils (i.e., existing crushed stone aggregates) in some areas. Subgrade preparation in these areas may require proof rolling/compaction of the granular subgrades utilizing a smooth-drum roller. The roller or truck should make a minimum of two passes in each of two perpendicular directions covering the proposed development area, with additional passes as necessary to achieve required compaction and/or subgrade stabilization.

The purpose of proof rolling the cohesive subgrades is to locate any weak, soft, or excessively wet soils that may be present at the time of construction. The purpose of the proof rolling/compaction of the granular soils is to densify zones of loose materials that are encountered in the upper portion of the soil profile, thereby providing more uniform subgrade support. We recommend a roller with a minimum dead weight on the drums of 8 tons, and traveling at speeds not exceeding approximately 4 feet per second (about 3 miles per hour). These operational criteria

should provide sufficient dynamic compaction energy to alleviate loose soil conditions within the zone of influence for subgrade support.

Any unsuitable materials observed during the inspection and proof-rolling operations should be undercut and replaced with compacted fill or stabilized in place utilizing conventional remedial measures such as discing, aeration, and re-compaction. Once the site has been proof rolled, inspected, and stabilized, the proof-rolled or inspected subgrades should not be exposed to wet conditions. It should be recognized that during periods of wet weather, the silty/clayey soils that will be exposed at design subgrades will tend to pond water for short periods of time, with the potential to deteriorate the prepared subgrade.

The results of the inspection and proof-rolling operations will be partially dependent on construction operations, the moisture content of the soil, and the weather conditions prevalent at the time. If pumping or rutting is encountered and difficulty is experienced in the operation of construction equipment, CT should be notified in order to determine which method of subgrade modification may be best suited for the conditions encountered. Should such conditions be experienced, we may recommend that a small test area be used to determine the necessary depth of undercutting and stone replacement or other remedial action necessary to achieve a stable subgrade condition.

6.2 Fill

Material for engineered fill or backfill required to achieve design grades may consist of any non-organic soils having a maximum dry density as determined by the Standard Proctor (ASTM D 698) of 90 pounds per cubic foot (pcf) or greater. On-site soils may be used as engineered fill materials provided that they are free of organic matter, debris, excessive moisture, and rock or stone fragments larger than 3 inches in diameter. Depending on seasonal conditions, the on-site soils may be wet of optimum and may require scarification and aeration to achieve satisfactory compaction. If the construction schedule does not allow for scarification and aeration activities, it may be more practical or economical to utilize imported granular fill.

Fill should be placed in uniform layers no more than 8 inches thick (loose measure) and adequately keyed into stripped and scarified soils. All fill within the building areas and pavement subgrades should be compacted to not less than 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor).

The soils at the site consist of cohesive soils. The contractor should be prepared to use a sheepsfoot roller to provide effective compaction of the clays. If granular soils are utilized as engineered fill, a vibratory smooth-drum roller should be utilized for compaction.

Scarified subgrade soils and all fill material should be within 3 percent of the optimum moisture content to facilitate compaction. Furthermore, fill material should not be frozen or placed on a frozen base. It is recommended that all earthwork and site preparation activities be conducted under adequate specifications and properly monitored in the field by a qualified geotechnical testing firm.

6.3 Foundation Excavations

As mentioned in Section 5.1, foundations used to support the structures should have a detailed footing inspection performed for each foundation. A geotechnical engineer or qualified representative should perform these inspections to verify that the exposed materials are similar to those encountered in the borings, that the exiting fill material has been removed and replaced and that engineered fill has been properly placed and compacted such that it is capable of supporting the design bearing pressure.

We recommend that the foundation excavations be concreted as soon as practical after they are excavated and that water not be allowed to pond in any excavation. If it is necessary to leave the bearing surface open for any extended period of time, we recommend that a thin mat of lean concrete be placed over the bottom of the excavation to reduce damage to the surface from weather or construction. Foundation concrete should not be placed on frozen or saturated subgrade.

Additional foundation subgrade inspection and modification recommendations are provided in Section 5.1.

7.0 QUALIFICATION OF RECOMMENDATIONS

Our evaluation of foundations design and construction conditions has been based on our understanding of the site and project information and the data obtained during our field investigation. The general subsurface conditions were based on interpretation of the subsurface data at specific boring locations. Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. This is especially true for previously developed sites. Therefore, experienced geotechnical engineers should observe earthwork and foundation construction to confirm that the conditions anticipated in design are noted. Otherwise, CT assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

The design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, a qualified geotechnical engineer should be permitted to determine whether the recommendations must be modified. The findings of such a review will be presented in a supplemental report.

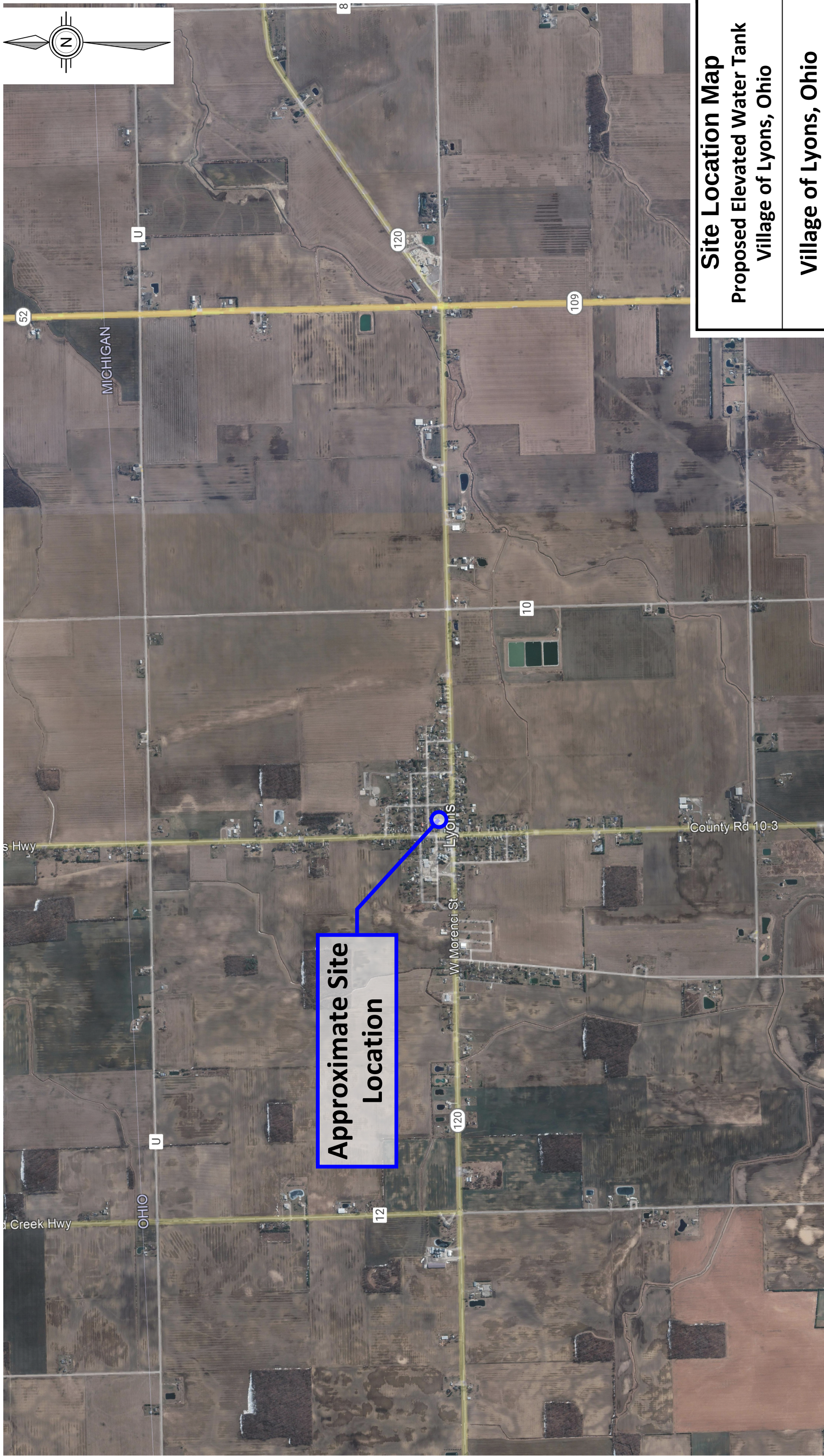
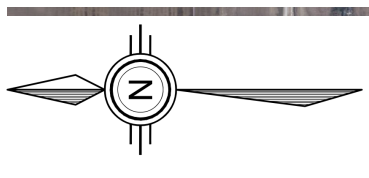
The nature and extent of variations between the borings may not become evident until the course of construction. If such variations are encountered, it will be necessary to reevaluate the recommendations of this report after on-site observations of the conditions.

Our professional services have been performed, our findings derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. CT is not responsible for the conclusions, opinions, or recommendations of others based on this data.

Plates

Plate 1.0 Site Location Map

Plate 2.0 Test Boring Location Plan



**Approximate Site
Location**

Site Location Map

Proposed Elevated Water Tank
Village of Lyons, Ohio

Village of Lyons, Ohio

DRAWN: IJH 02/17/23

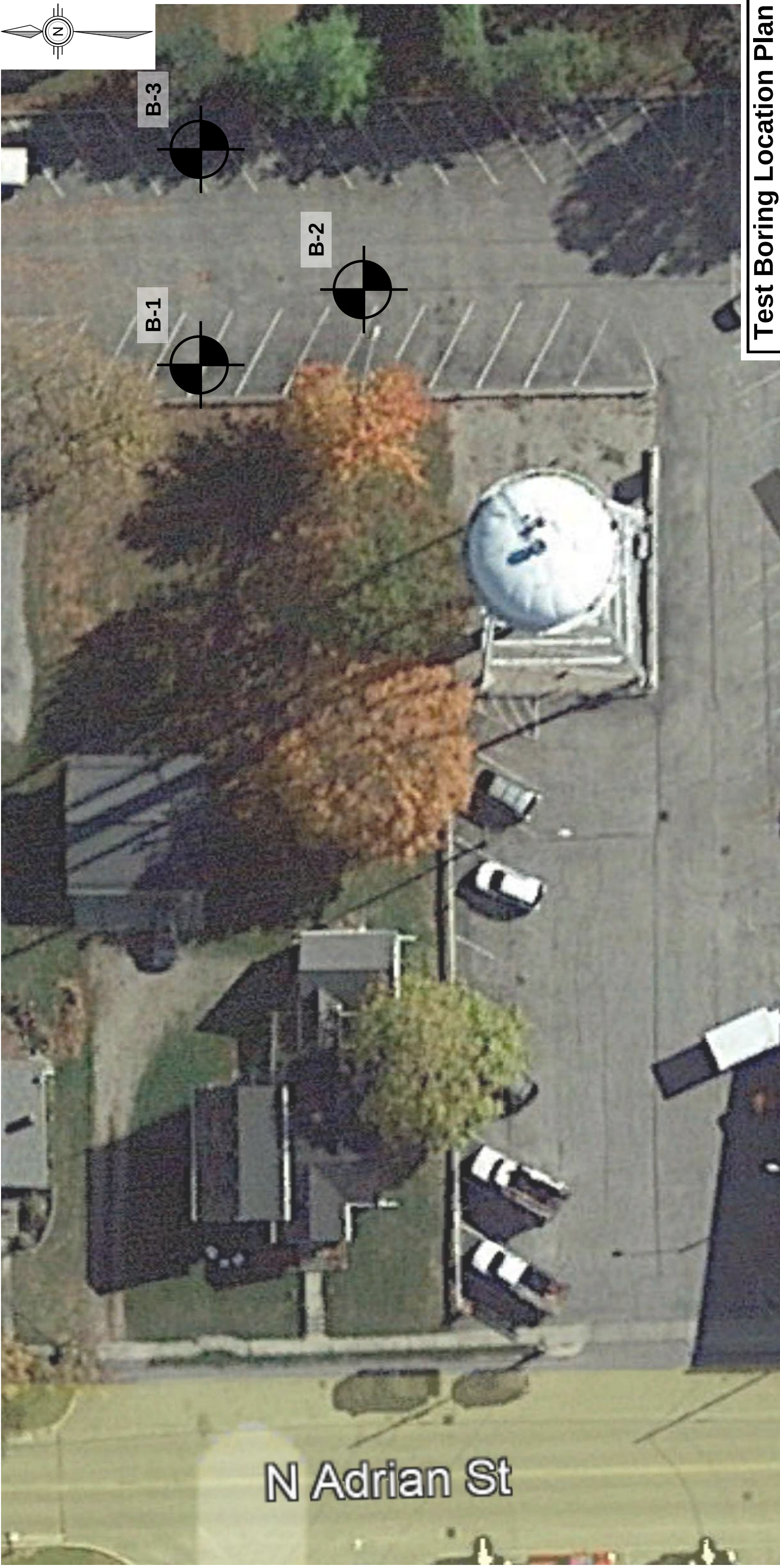
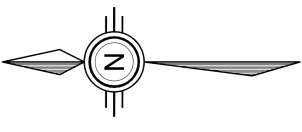
REVISED: ---

Project No.: 220792

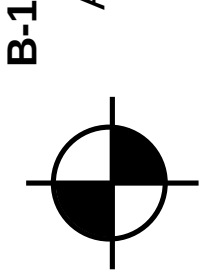
Drawing No.: Plate 1.0

LEADING THROUGH
100 YEARS
www.cccconsultants.com

Notes: Aerial Basemap obtained From Google Earth and dated 03/07/2021



Legend:



Notes: Aerial Basemap obtained From Google Earth and dated 10/25/2015

Test Boring Location Plan Proposed Elevated Water Tank Village of Lyons, Ohio			
Village of Lyons, Ohio			
DRAWN:	IJH 02/17/23		
REVISED:	---		
Project No.:	220792		
Drawing No.:	Plate 2.0		

APPENDIX A

Logs of Test Borings



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BORING NUMBER B-1

PAGE 1 OF 2

CLIENT Village of Lyons	PROJECT NAME Proposed Elevated Water Tank
PROJECT NUMBER 220792	PROJECT LOCATION Lyons, OH
DRILLING CONTRACTOR TTL Associates, Inc. TB EM	RIG NO. D70 GROUND ELEVATION 769 ft
DRILLING METHOD 3-1/4 in. HSA	GROUND WATER LEVELS:
DATE STARTED 1/3/23 COMPLETED 1/3/23	AT TIME OF DRILLING None
LOGGED BY KKC CHECKED BY IJH	AT END OF DRILLING None
NOTES	0hrs AFTER DRILLING Backfilled w/Cuttings, Chips, and Patch

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL 20 MC 40 LL 80 ▲ SPT N VALUE ▲
	0		ASPHALT - 5 Inches						
			CRUSHED STONE - 9 Inches						
			Moist Medium Stiff Dark Gray SANDY LEAN CLAY w/Trace Organics (CL)	SS 1	67	3-2-3 (5)	0.43	94	21
765			Moist Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL)	SS 2	78	4-6-6 (12)	>4.5		15
5			@6': Very Stiff	SS 3	78	10-12-15 (27)	>4.5		17
760			@8.5': Very Stiff, Brown/Gray. w/Trace Iron Oxide Stain Seam	SS 4	100	7-12-16 (28)	>4.5		15
10									
755			@13.5': Gray	SS 5	100	4-7-9 (16)	3.00		16
15									
750				SS 6	100	5-7-10 (17)	3.00		16
20									
745				SS 7	89	6-8-10 (18)	3.25		16
25									

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(Continued Next Page)



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BORING NUMBER B-1

PAGE 2 OF 2

CLIENT Village of Lyons **PROJECT NAME** Proposed Elevated Water Tank
PROJECT NUMBER 220792 **PROJECT LOCATION** Lyons, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
740	30			SS 8	100	5-11-15 (26)	>4.5		14 ● ▲
			31.8'						
735	35		Moist Hard Gray SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 9	100	9-15-30 (45)	3.50		14 ● ▲
			35.0'						
			Bottom of hole at 35.0 feet.						



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BORING NUMBER B-2

PAGE 1 OF 2

CLIENT	Village of Lyons	PROJECT NAME	Proposed Elevated Water Tank
PROJECT NUMBER	220792	PROJECT LOCATION	Lyons, OH
DRILLING CONTRACTOR	TTL Associates, Inc. TB EM	RIG NO.	D70
DRILLING METHOD	3-1/4 in. HSA	GROUND ELEVATION	769 ft
DATE STARTED	1/3/23	COMPLETED	1/3/23
LOGGED BY	KKC	CHECKED BY	IJH
NOTES			
GROUND WATER LEVELS:		▽ AT TIME OF DRILLING 0.4 ft / Elev 768.6 ft	
		AT END OF DRILLING None	
		0hrs AFTER DRILLING Backfilled w/Cuttings, Chips, and Patch	

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL 20 MC 40 LL 80 ▲ SPT N VALUE ▲
	0		▽ ASPHALT - 5 Inches						
			CRUSHED STONE - 7 Inches						
			Moist Medium Stiff Dark Gray SANDY LEAN CLAY w/Trace Organics (CL)	SS 1	78	3-3-5 (8)	2.50		15
765			Moist Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL)	SS 2	100	4-6-7 (13)	>4.5	114	17
	5		Moist Hard Gray/Brown LEAN CLAY w/Sand and Trace Gravel (CL)	SS 3	100	13-14-17 (31)	3.30	126	14
760			Moist Very Stiff Brown/Gray LEAN CLAY w/Sand, Trace Gravel, and Iron Oxide Stain Seam (CL)	SS 4	89	9-10-15 (25)	3.50		16
	10		@13': Stiff, Gray	SS 5	100	3-5-7 (12)	3.00		16
755			@18.5': Very Stiff	SS 6	100	5-8-12 (20)	4.25		16
750			Moist Hard Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 7	100	7-17-14 (31)	>4.5		13
745									
	25								

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(Continued Next Page)



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BORING NUMBER B-2

PAGE 2 OF 2

CLIENT Village of Lyons

PROJECT NAME Proposed Elevated Water Tank

PROJECT NUMBER 220792

PROJECT LOCATION Lyons, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
740	30		Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) 27.5'	SS 8	100	6-8-11 (19)	>4.5		15
735	35		Moist Very Stiff Gray SILTY CLAY w/Sand and Trace Gravel (CL-ML) 33.7'	SS 9	100	10-14-15 (29)	3.00		16
730	40		Moist Hard Gray SANDY SILT (ML) 39.0'	SS 10	100	7-25-25 (50)	NI		23
725	45		Moist Very Stiff Gray LEAN CLAY w/Sand and Trace Gravel (CL) 43.6'	SS 11	100	6-9-13 (22)	>4.5		15
720	50		Bottom of hole at 50.0 feet. 50.0'	SS 12	100	5-7-12 (19)	3.75		17



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BORING NUMBER B-3

PAGE 1 OF 2

CLIENT	Village of Lyons	PROJECT NAME	Proposed Elevated Water Tank
PROJECT NUMBER	220792	PROJECT LOCATION	Lyons, OH
DRILLING CONTRACTOR	TTL Associates, Inc. TB EM	RIG NO.	D70
DRILLING METHOD	3-1/4 in. HSA	GROUND ELEVATION	769 ft
DATE STARTED	1/3/23	COMPLETED	1/3/23
LOGGED BY	KKC	CHECKED BY	IJH
NOTES			
GROUND WATER LEVELS:		AT TIME OF DRILLING	
		None	
		AT END OF DRILLING	
		None	
		0hrs AFTER DRILLING	
		Backfilled w/Cuttings, Chips, and Patch	

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL 20 MC 40 LL 80 ▲ SPT N VALUE ▲
	0		ASPHALT - 4 Inches						
			CRUSHED STONE - 14 Inches						
			Moist Medium Stiff Dark Gray SANDY LEAN CLAY w/Trace Organics (CL)	SS 1	78	5-3-4 (7)	1.50		18
765			Moist Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL)	SS 2	89	2-5-7 (12)	>4.5		15
	5		@4': Very Stiff						
				SS 3	89	9-11-14 (25)	4.58	121	15
760			@8.5': Brown/Gray	SS 4	89	6-10-15 (25)	>4.5		15
	10								
			@13.2': Stiff, Gray	SS 5	100	4-5-6 (11)	2.00		17
755									
	15								
				SS 6	100	3-5-6 (11)	4.00		16
750									
	20								
			@23.6': Very Stiff	SS 7	100	3-7-10 (17)	>4.5		15
745									
	25								

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(Continued Next Page)



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BORING NUMBER B-3

PAGE 2 OF 2

CLIENT Village of Lyons PROJECT NAME Proposed Elevated Water Tank
PROJECT NUMBER 220792 PROJECT LOCATION Lyons, OH

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80			
									▲ SPT N VALUE ▲ 20 40 60 80			
740	30			SS 8	100	6-10-13 (23)	>4.5				15	▲
735	35		Moist Very Hard Gray SILTY CLAY w/Sand (CL-ML) 32.7'	SS 9	100	27-43- 50/5"	3.50				18	▲
			Bottom of hole at 35.0 feet. 35.0'									>>▲

APPENDIX B

Legend Key

LEGEND KEY

Unified Soil Classification System Soil Symbols

	GW - WELL GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.		GP - POORLY GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.		GM - SILTY GRAVEL Includes Gravel-Sand-Silt mixtures.		GC - CLAYEY GRAVEL Includes Gravel-Sand-Clay mixtures.
	SW - WELL GRADED SAND Includes Gravelly Sands, little or no fines.		SP - POORLY GRADED SAND Includes Gravelly Sands, little or no fines.		SM - SILTY SAND Includes Sand-Silt mixtures.		SC - CLAYEY SAND Includes Sand-Clay mixtures.
	ML - SILT Includes Silt with Sand and Sandy Silt.		CL - LEAN CLAY Includes Sandy Lean Clay and Lean Clay with Sand and Gravel.		MH - ELASTIC SILT Includes Sandy Elastic Silt and Elastic Silt with Sand.		CH - FAT CLAY Includes Sandy Fat Clay and Fat Clay with Sand.
	CL-ML - SILTY CLAY Includes Clayey Silt of low plasticity.		OL - ORGANIC SILT and ORGANIC CLAY of low plasticity.		OH - ORGANIC SILT and ORGANIC CLAY of medium to high plasticity.		Pt - PEAT Includes humus, swamp and other soils with high organic content.
	FILL MATERIAL - Includes controlled and non-controlled soil and non-soil materials.		TOPSOIL		ASPHALT - Bituminous Asphalt		CONCRETE - Includes broken concrete rubble.

Sample Symbols

	SS - Split Spoon		ST - Shelby Tube		RC - Rock Core		GS - Geoprobe Sleeve
			AU - Auger Cuttings		GB - Grab		

Notes:

1. Exploratory borings were drilled on January 3, 2023. The borings were advanced utilizing 3¼ -inch inside diameter hollow-stem augers.
2. These logs are subject to the limitations, conclusions, and recommendations in the report and should not be interpreted separate from the report.
3. The borings were located in the field by CT within the footprint of the proposed tank location.
4. Ground Surface Elevations were depicted from Google Earth and reported to the nearest foot.
5. Unconfined Compressive Strength (tsf):
NI = Not Intact

APPENDIX C

Tabulation of Laboratory Test Data



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SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

CLIENT Village of Lyons

PROJECT NAME Proposed Elevated Water Tank

PROJECT NUMBER 220792

PROJECT LOCATION Lyons, OH

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Classification	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio
B-1	1.0							20.6	93.5		
B-1	3.5							15.3			
B-1	6.0							16.8			
B-1	8.5							15.1			
B-1	13.5							16.0			
B-1	18.5							16.3			
B-1	23.5							16.3			
B-1	28.5							13.8			
B-1	33.5							14.5			
B-2	1.0							15.5			
B-2	3.5	28	19	9	9.5	74	CL	16.6	114.4		
B-2	6.0							13.5	125.5		
B-2	8.5							16.3			
B-2	13.5							16.0			
B-2	18.5							15.6			
B-2	23.5							12.7			
B-2	28.5							15.3			
B-2	33.5							16.3			
B-2	38.5							23.4			
B-2	43.5							14.8			
B-2	48.5							17.3			
B-3	1.0							18.1			
B-3	3.5							15.3			
B-3	6.0							15.0	120.9		
B-3	8.5							14.9			
B-3	13.5							16.9			
B-3	18.5							15.9			
B-3	23.5							15.1			
B-3	28.5							14.6			
B-3	33.5							17.8			

APPENDIX D

Laboratory Test Results

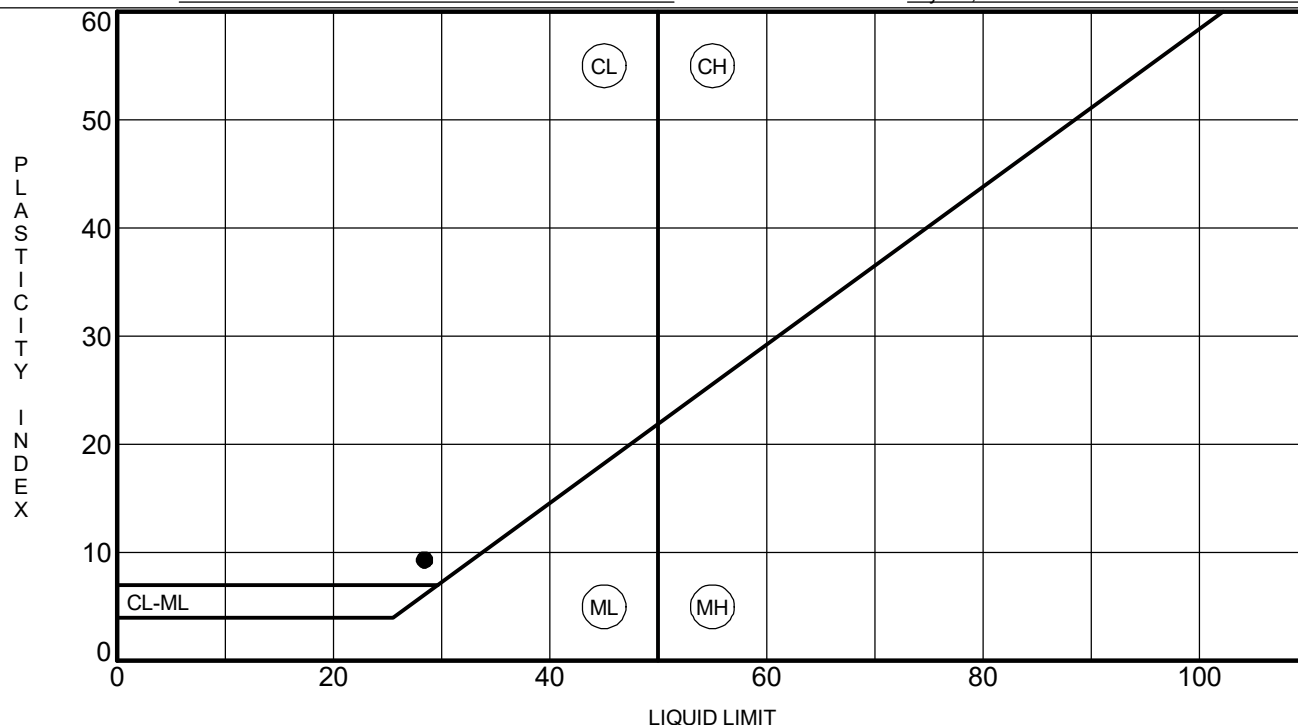
ATTERBERG LIMITS' RESULTS

CLIENT Village of Lyons

PROJECT NAME Proposed Elevated Water Tank

PROJECT NUMBER 220792

PROJECT LOCATION Lyons, OH

[illegible]



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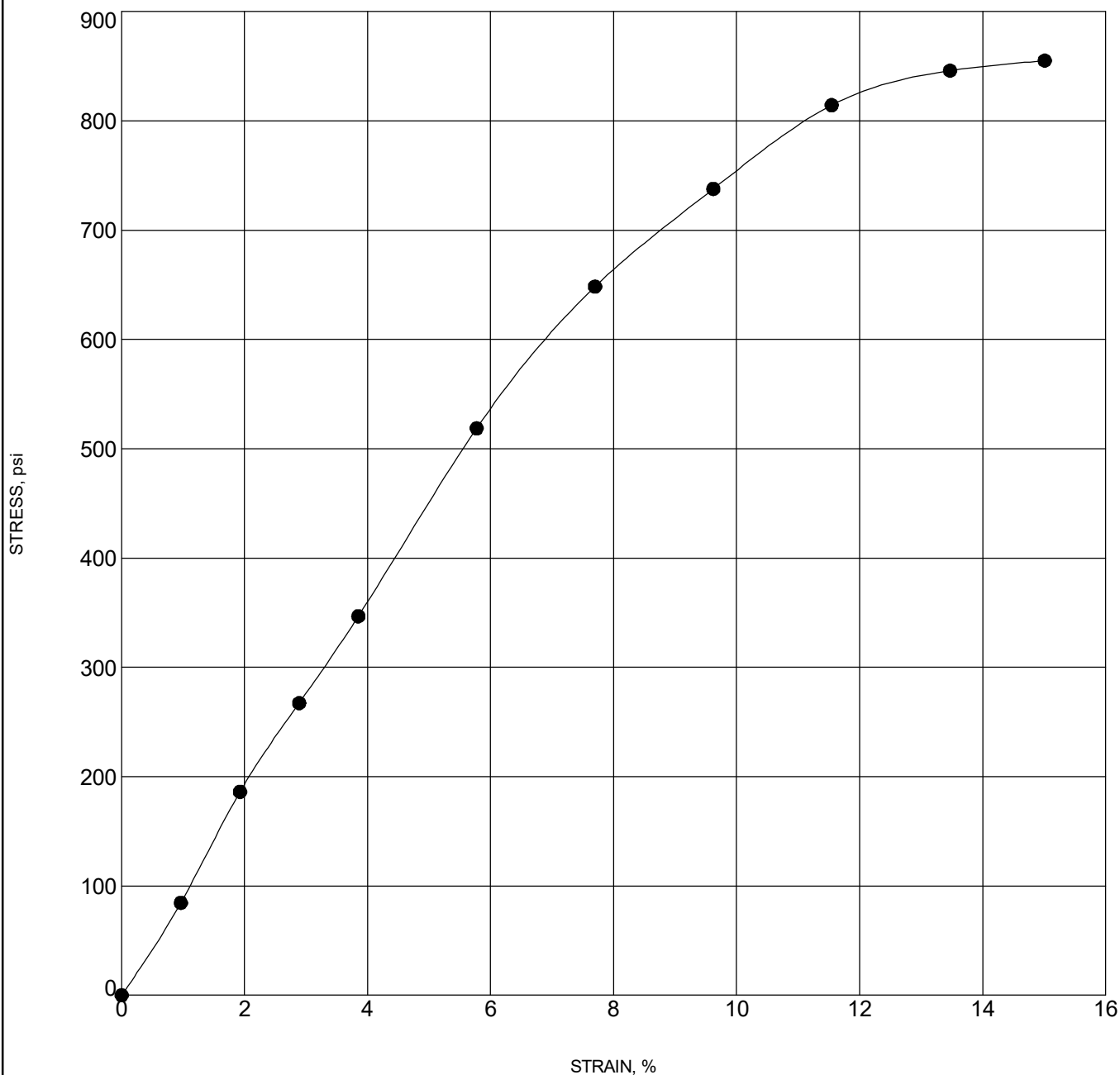
UNCONFINED COMPRESSION TEST

CLIENT Village of Lyons

PROJECT NAME Proposed Elevated Water Tank

PROJECT NUMBER 220792

PROJECT LOCATION Lyons, OH



Specimen Identification		Classification	γ_d	MC%
●	B-1	1.0	94	21



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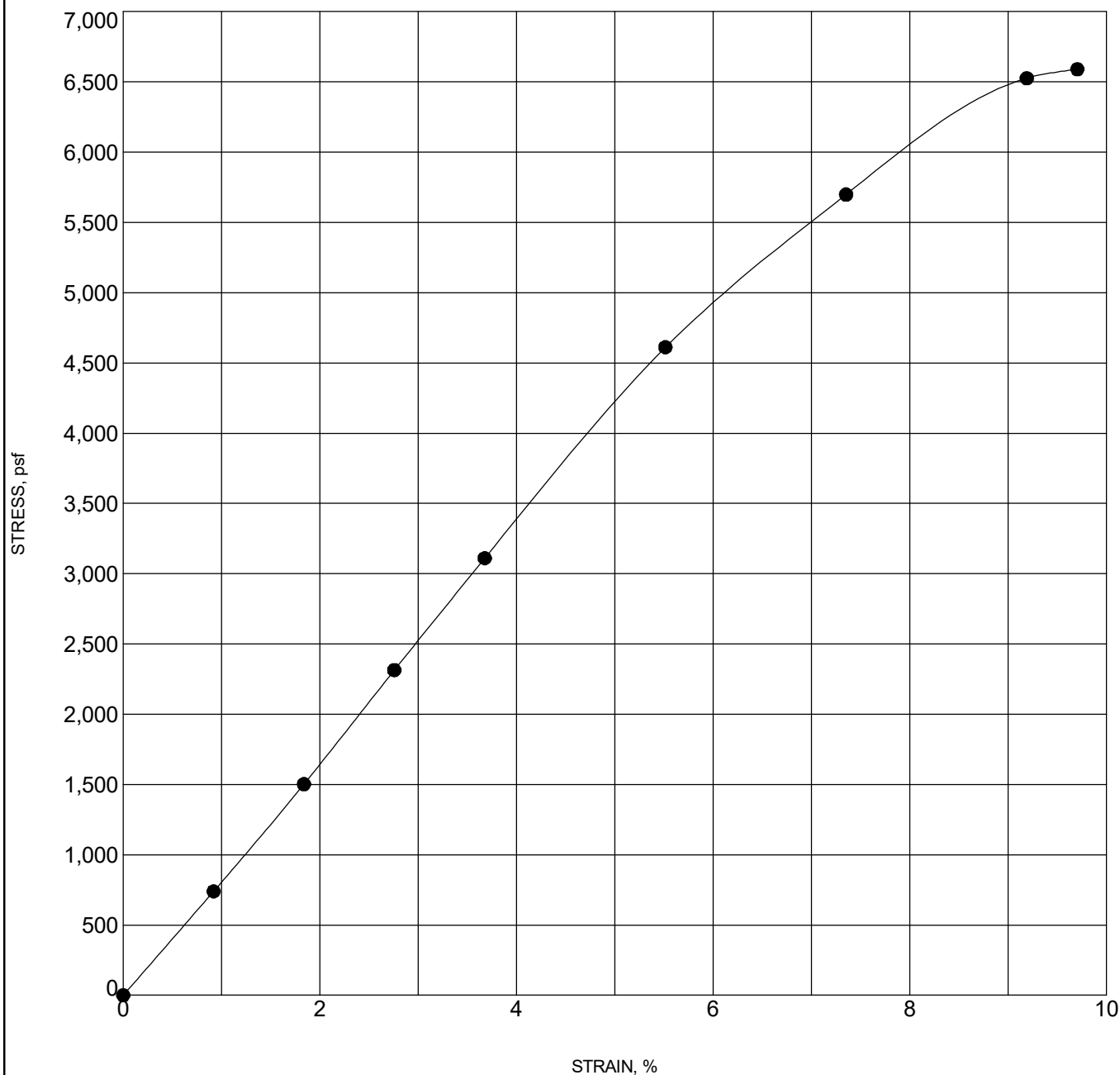
UNCONFINED COMPRESSION TEST

CLIENT Village of Lyons

PROJECT NAME Proposed Elevated Water Tank

PROJECT NUMBER 220792

PROJECT LOCATION Lyons, OH



Specimen Identification		Classification	γ_d	MC%
●	B-2	6.0	126	14



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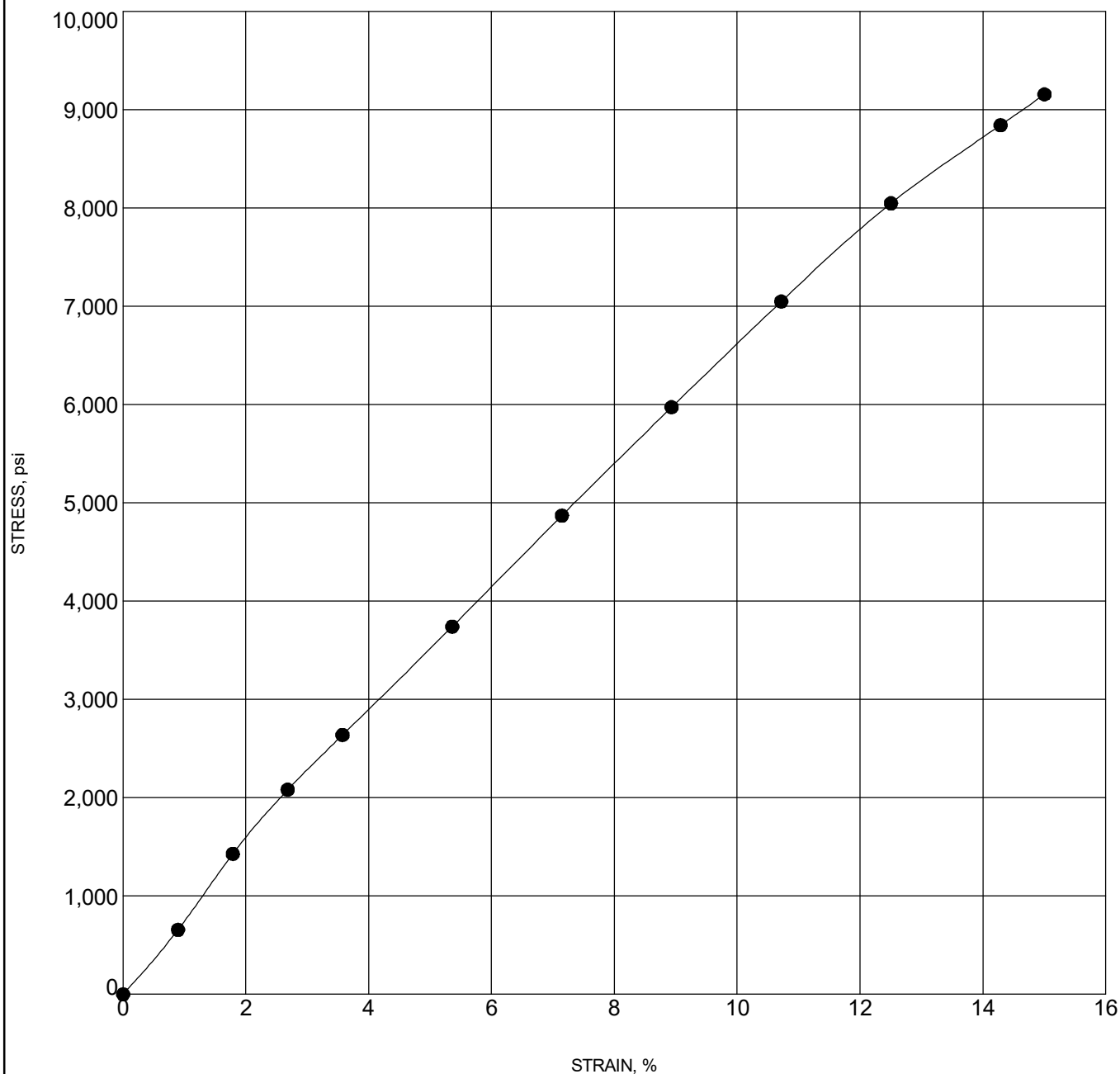
UNCONFINED COMPRESSION TEST

CLIENT Village of Lyons

PROJECT NAME Proposed Elevated Water Tank

PROJECT NUMBER 220792

PROJECT LOCATION Lyons, OH



Specimen Identification		Classification	γ_d	MC%
●	B-3 6.0		121	15

Lyons Ohio

TTHM Stage 2 80 ug/l average limit

all results are ug/l

Water Tower DS201

Date	Result	Average	OEL
2/8/2018	70	44	
5/8/2018	40.9	46.8	
8/9/2018	57.9	50.9	
11/8/2018	40.8	52.4	
2/8/2019	45.7	46.3	
5/8/2019	34.4	44.7	
8/8/2019	33.4	38.6	
11/11/2019	36.9	37.6	
2/11/2020	49.3	38.5	
5/8/2020	28.7	37.1	
8/11/2020	33.4	37.1	
11/10/2020	36.9	37.1	
2/9/2021	77.6	44.2	
5/10/2021	27.7	43.9	
8/10/2021	43.7	46.5	
11/9/2021	39.7	47.2	
2/9/2022	69.9	45.2	
5/9/2022	19.7	43.3	
8/9/2022	49.7	44.8	

Pump House DS202

Date	Result	Average	OEL
2/8/2018	62.7	46.7	
5/8/2018	59.6	55.6	
8/9/2018	93.3	63	77
11/8/2018	91.6	76.8	84
2/8/2019	56.8	75.3	74.6
5/8/2019	53.8	73.9	64
8/8/2019	54.5	64.2	
11/11/2019	52.5	54.4	
2/10/2020	56.9	54.4	
5/8/2020	53	54.2	
8/11/2020	51.9	53.6	
11/10/2020	50.5	53.1	
2/9/2021	79	58.6	
5/10/2021	63.3	61.2	
8/10/2021	63	64	67
11/8/2021	92.6	74.5	77.9
2/8/2022	62.5	70.4	
5/9/2022	44.1	65.6	
8/9/2022	90.9	72.5	72.1



- LEAK DETECTION SERVICES -

1-888-GET LEAK

NORTHEAST WATER SYSTEM

	8871 ST Rt 120	251 MILL ST.
2-12-20	55.0	64.1
5-8-20		
8-		
11-9-20	26.7	40.4
2-10-21	18.9	27.0
5-10-21	47.7	33.3
8-11-21	70.9	82.8
11-9-21	72.6	95.5
2-9-22	116.0	55.7
5-11-22	17.3	16.9
8-10-22	92.4	103

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SECTION 269001 –SCADA AND TELEMETRY SYSTEM _A

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. General. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this section.
- B. Related Sections include the following:
 - 1. Division 01 – General Requirements
 - 2. Division 26 – Electrical Specifications

1.2 DESCRIPTION OF WORK

- A. This specification details the provisions for the pump station control system including the following (see also Y-series drawings):
 - 1. The existing Telemetry/SCADA is being relocated from the existing old water tower to the new water tower, once the new tower has been disinfected and ready for service.
 - 2. Contractor and Integrator are to coordinate with the Village to reconnect existing control/monitoring equipment set-up at the new tower base and verify booster station operations for the existing tower are to be reconnected to the new tower.
- B. Provisions for new equipment:
 - 1. New equipment is not anticipated as part of this design. However, if new equipment is required the remainder of these specifications would govern.
 - 2. The cost for new equipment has not been included in this design. If new equipment were to be required, and appropriate change order would be executed at that time.

1.3 GENERAL REQUIREMENTS

- A. The specifications and drawings outline certain characteristics of the monitoring and control system but do not set forth all the details of system design and the various functions and equipment required. All equipment shall be complete with all necessary software, accessories, and appurtenances required for a properly operating system including all items recommended by respective manufactures and not herein specified.
- B. The Contractor shall assume complete system responsibility through a system integrator, and provide all necessary coordination with any and all subcontractors.
- C. The Contractor shall coordinate the work of the system integrator for the installation, interconnection, testing, and calibration of the instruments, and the scheduling of the system integrator's personnel. The system integrator shall be responsible for assuring that this equipment properly meets the functional intent of the specifications. Substitutions on functions specified are subject to review and approval.

- D. The system integrator shall be required to demonstrate a minimum of five years recent, past experience in the design, integration, and commissioning of SCADA, instrumentation and control system, at least five projects of comparable size, type, and complexity to the proposed project.
- E. The system integrator shall have in his employ the capable personnel for detailed engineering, coordination, drafting, procurement and expediting, scheduling construction, testing, inspection, installation, start-up service for calibration and commissioning, and warranty compliance for the period specified.

1.4 QUALITY ASSURANCE

- A. Codes and Standards. Perform all work in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with the plans and as specified herein.
 - 1. National Electrical Manufacturers Association (NEMA) Compliance.
 - 2. National Electric Code (NEC) Compliance.
 - 3. Instrument Society of America (ISA).
 - 4. Institute of General Construction and Electronic Engineers (IEEE).
 - 5. Underwriters' Laboratories, Inc. (UL) Compliance and Labeling. Comply with provisions of UL safety standards pertaining to process controller equipment. Provide products and components which have been UL listed and labeled.

1.5 SUBMITTALS

- A. Submit shop drawings if new RTU panels, networking equipment, and information on the proposed server/operator work-station hardware and software is required.

1.6 TESTING AND TRAINING REQUIREMENTS

- A. Job Site Demonstration
 - 1. Following final installation and calibration of the system, the Integrator shall perform a demonstration of system performance. Satisfactory performance shall require the system to perform control functions, monitoring and display functions, alarming, and printout functions for a period of not less than one (1) month of continuous operation. During this demonstration, any system failure or software-related problem shall be corrected and the demonstration resumed. Acceptance of the control system by the Owner shall require that the system operates continuously for a period of one (1) month without non-field or field repairable hardware or software interruption. Substantial completion shall not be awarded until after the Integrator has successfully completed the above required test.
- B. System Calibration and Start-up

1. The Integrator shall provide the initial calibration and startup of the control system by providing personnel to perform the following:
 - a. Supervise the installation and verify the final connections of all new signal wiring to and from the control system.
 - b. Perform all hardware calibration and diagnostic tests, and make all necessary equipment connections.
 - c. Perform all configuration system tests, including diagnostics.
 - d. Perform the acceptance test as described in the “Job Site Demonstration” section of this specification.
 - e. Test the operation of the Communications Control System and Input/Output Subsystem.

1.7 NEW EQUIPMENT/SIGNALS FOR INTEGRATION

- A. See E and Y-series drawings for detailed description of proposed signals.
- B. Contractor is responsible for all instrumentation, control, and data wiring associated with the I/O shown on Y-series drawings. Verify all wire counts with approved shop drawings and terminate per System Integrator’s instructions.
- C. Unless otherwise noted on drawings, utilize the following specifications for i&c wiring:
 - For each Digital Input or Output provide a pair of #14 copper wires (multiconductor cable of lower gauge is acceptable when utilizing 24V signaling)
 - For each Analog Input or Output provide a 2-conductor #18 twisted shielded cable
 - For each Ethernet Data Connection provide a CAT5E or CAT6 shielded cable.

1.8 SCADA AND PLC PROGRAMMING – GENERAL PROVISIONS

- A. The SCADA computer human/machine interface (HMI) shall be configured to allow the operators to perform data acquisition functions such as report generation, alarm management, trending, graphic presentation of process in real-time basis and control functions such as equipment on/off, set point changes, etc. for the process equipment. The computer shall also allow the override functions of control blocks upon the operator’s command. Failure of the SCADA computers shall not interrupt the operation of the PLC system in performing control and monitoring functions.
- B. The SCADA system shall allow the plant personnel to monitor all associated processes and to change set points as required. It shall also provide status conditions, alarm conditions, display of trend and selected loop display. The system shall perform totalizing the recording functions of selected process variables.
- C. The system shall have the capability of storing all new process variables such as pressure, flow and level and shall provide either daily, weekly, or monthly printouts as selected by the operator. Status conditions, display of trends and selected loop display shall be provided.

- D. It shall be possible to manually toggle the “Out of Service” status within the SCADA system for all of the process equipment, instrumentation and areas.
- E. For those processes that include automated operation, as described below, manual remote operation shall always also be allowed. Toggling between manual and automatic operation shall be possible on the related control screen.

1.9 FUNCTIONAL DESCRIPTION

- A. The following set of control descriptions will be incorporated into the proposed SCADA System by the system integrator. The existing descriptions for the tower will be utilized. The new tower is at the same location hydraulically and will utilize same levels as existing tower. The system integrator shall work with the Village Operator to determine if any change in tower level controls are deemed necessary. The system integrator shall modify this document as required to accommodate actual approved equipment shop drawings.

PART 2 - PRODUCTS

2.1 SYSTEM HARDWARE

A. General Panel Requirements

1. Panels shall be completely fabricated, equipment installed, and wired in the manufacturer's factory. All wiring shall be completed and tested prior to shipment. All external connections shall be by way of numbered terminal blocks. Panels shall be UL listed, standard construction, as manufactured by Hoffman or approved equal.
2. In addition to all NEMA standards, the panel shall conform to NEC Article 409 and to the following requirements:
 - a. Minimum metal thickness shall be 14-gauge.
 - b. All doors shall be rubber-gasketed with continuous hinge.
 - c. Wherever practical, enclosures shall be a manufactured item.
 - d. All panels manufactured or fabricated shall be summarized, and the summary together with catalog cuts and/or shop drawings shall be submitted to the Engineer for review and marked by the Engineer to the effect that resubmittal is not required prior to purchase or fabrication.
 - e. Smaller panels shall be so sized as to adequately dissipate heat generated by equipment mounted in or on the panel.
 - f. Where panels are mounted outside or in unheated areas, they shall be provided with thermostatically controlled heaters that will maintain their inside temperature above 40 F.
 - g. Provide a door switch controlled, LED light and a breaker protected, 120 V 15A amp duplex receptacle within panel.

B. Panel Electrical

1. Power Distribution Within Panels
 - a. Each panel will be provided with a 120V ac, 60-Hz feeder circuit from the associated circuit breaker distribution panel provided under Electrical. On

each panel, make provisions for feeder circuit conduit entry and provide a terminal board for termination of the wires. Panel shall have a surge protection device.

- b. Provide master circuit breaker and a circuit breaker on each individual circuit distributed from the panel as shown. The circuit breakers shall be grouped on a single subpanel. Provide subpanel placement so that there is a clear view of and access to the breakers when the door is open. Opening the main breaker will interrupt all 120 VAC circuits (there shall be no 120 VAC on terminal blocks from remote devices).

C. Wiring

1. All electrical wiring shall be in accordance with the applicable requirements of the NEC. Wires shall be 600-volt class, PVC insulated stranded copper and shall be of the sizes required for the current to be carried, but not below 12 AWG enclosed in either sheet metal raceway or plastic wiring duct. Wiring for 4 to 20 mA signal circuits shall be twisted shielded pairs not smaller than No. 18 AWG, and be separated at least 6 inches from any power wiring.
2. All interconnecting wires between panel mounted equipment and external equipment shall be terminated at numbered terminal blocks.
3. All panel wiring shall be routed in plastic raceway as manufactured by Carlon or equal.

D. Terminal Blocks

1. Terminal blocks shall be one-piece molded plastic blocks with screw type terminals and barriers rated for 300 volts. Terminals shall be double sided and supplied with removable covers to prevent accidental contact with live circuits. Terminals shall have permanent, legible identification, clearly visible with the protective cover removed.
2. Wires shall be terminated at the terminal blocks with crimp type, pre-insulated, ring-tongue lugs. Lugs shall be of the appropriate size for the terminal block screws and for the number and size of the wires terminated.
3. Terminal blocks shall be Allen-Bradely Bulletin 1492, Style CD-3 or approved equal.

E. PLC

1. The PLC shall include memory and software to allow customer configurable programming in the field. Reprogramming shall be either by downloading from the SCADA computer over the communications channel or through the use of the programming unit to all PLC's.
2. The PLC shall control its local process through the use of an integral processor and modular real-time process control software.
3. The PLC shall be capable of communicating with the master PLC in continuous polling mode and shall be provided with built-in communication modem.

4. The PLC shall have the ability to have its programming and configuration software updated or replaced by download through the network communications port; either locally, or remotely (via the network) without local operator intervention.
5. The PLC shall perform all on-line local control functions by means of a control program maintained within the unit's memory. In the event of a system or communications failure, it shall continue to control its assigned process and shall store all necessary data for transmission when communication resumes.
6. Each PLC shall be supplied with the sufficient number of I/O modules per the approved I/O schedule plus 10% spare capacity. All analog inputs shall be fully isolated differential types, capable of rejecting General Construction interference normally associated with industrial equipment including, but not limited to, transformers, motor starters contactors, and General Construction heaters. The analog outputs shall be configured for current loop operation (4-20 mA).

F. PLC Software:

1. PLC software shall consist of automatic analog monitoring logic, operator interface logic, alarm logic, and computer interfaces.
2. PLC software shall include arrangement of storage registers to hold necessary data to update displays, initiate alarms, and store comments and set points from the data input device. The data shall be organized to provide optimum data transmission time and system response time.
3. All PLC software shall be written in an easily understandable, organized manner resulting in efficient use of memory and rapid scan time.
4. The system shall be configured to ensure that all controlled variables and output signals are updated at an interval not greater than once every half-second.

G. Lightning/Surge Protection:

1. General:
 - a. Lightning/surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines. The protection systems shall be such that the protective level shall not interfere with normal operation.
2. Signal line:
 - b. All signal lines shall be protected through the use of UTB protectors. These shall be provided at both ends of the signal lines and as close to the instruments as possible.

2.2 SCADA SERVER/ OPERATOR STATION

- A. The operator station shall consist of Desktop PC and existing printer. Provide all misc. hardware and software required for a complete and functioning system.

- B. The operator station Desktop PC/SCADA Server shall be the most current state of the art equipment (as approved by owner) as required for latest software to operate properly and as a minimum have the following:
 - 1. Processor - Intel 3.0GHz, Quad Core
 - 3. Memory – 16 GB DDR4
 - 4. Keyboard and Mouse - wireless
 - 5. Internal Hard drive – RAID1 (2x500 GB Solid State Drive)
 - 6. Monitor – (1) 27” Full HD
- C. The SCADA system functions shall include as a minimum the following:
 - 1. Allow operators to precisely monitor and control plant processes.
 - 2. Allow operators to manage unlimited alarm areas, alarming priorities and remote management of alarms.
 - 3. Collect and manage data, store historical data, export data to and from data base, and distribute data to reports.
 - 4. Trend both historical and real time data.
 - 5. Define levels of secure authorization to various users and operators.
- E. Software
 - 1. The following software packages shall be provided:
 - a. SCADA software – VTScada, FactoryTalk or equal; minimum 1000 points; capable of remote access to the SCADA screens through web browser interface of a mobile device.
 - b. Alarm Callout - Win911 Pro
 - c. Custom Reports – XL Reporter Professional
 - 2. All software packages shall be compatible with the hardware and operating system specified.

2.3 UNINTERRUPTIBLE POWER SUPPLY (UPS)

- A. Control Panel shall be protected electrically by an on-line UPS. During normal operation the UPS shall convert line power into clean, regulated, on-line, computer grade power. When line power is unacceptable or gone completely, the UPS shall have battery backup to create pure sine wave power with no interruption to the computer.

2.4 ETHERNET SWITCHES

- A. The system integrator shall provide industrial ethernet switch/firewall as manufactured by NTRON or approved equal.
- B. Provide switch complete with power supply, ups, and enclosure for wall mounting.

2.5 SYSTEM SOFTWARE

- A. General:
 - 1. The system supplier shall provide all programming necessary to provide a full operational system for the new process equipment. Software configuration

required shall consist of all programs and systems necessary to perform the functions specified.

2. The Contractor, via the supplier, shall assume complete responsibility for successful operation of the system. All programs shall be completely debugged and operable prior to the delivery of the system equipment.
3. System software shall provide for addition, modification, or deletion of application detail without interruption of the processes.

B. Alarm System:

1. The alarm system shall monitor and report all alarm conditions from new equipment and systems. Alarms and return-to-normal transition reports from the remote process controllers shall be collected at the operator's console. Upon receipt of these alarm reports, the console shall perform several automatic operations, which provide an interface for allowing the operator to interact with these alarm conditions.
2. Alarm classes shall be established at system configuration for those analog or logical signals that are assigned alarm limits, marginal or failed communication link and failure of a hardware device such as input/output module or other major devices. The alarm system will have three classes of alarms; critical, non-critical and process.
3. An audible alarm shall be activated whenever the operator's console receives an alarm report that must be acknowledged by the operator. To silence the audible alarm, the operator depresses the audible silence function key on the work station keyboard. Silencing the alarm, however, does not constitute alarm acknowledgement.

C. Real-time Trending:

1. Real-time trend displays shall plot samples of the selected points in an x-y format. A trend page shall consist of at least four trend plots with each plot using its unique color. The user shall be able to request exact numeric values for any point in the trend by moving an arrow to the point in the graphic.
2. Trends shall be offered in line, bar and text form.
3. Provisions shall be made so that the points and scan frequency shall be assignable by the operator from display.

D. Historical Trending:

1. Provisions shall be made for storing historical data and to recall that data for historical trending and display purposes.
2. Capability to average values to permit longer trending periods shall be provided.
3. The signal, its remote name, as well as maximum, minimum, and engineering units shall be displayed.

E. Display System: Displays will include all process equipment and systems.

1. The system shall be designed to provide for the display of process equipment. These displays shall be the primary means by which real time process information shall be presented to the operator at the operator's console. The displays shall be generated by collecting data from the PLCs.
2. The displays of process graphics are to be configured during the shop drawing phase of the work in conjunction with the Owner and Engineer.
3. All graphic pictures and characters must be editable by the operator from the operator station while the system remains on line. Graphic pages shall be called to the screen by their number, name, or from a menu of available pages.
4. Graphic editor must be menu driven, and contain standard geometric symbols, and making creation, modification, and copying of graphics a simple task.
5. An alarm history display shall be provided which allows the operator to examine the current alarm conditions throughout the entire system. All alarms shall be logged on the alarm printer when they are received, and when they return to normal.
6. The alarm system shall execute three operations whenever an alarm report is received.
 - a. An audible alarm shall be actuated if the alarm report must be acknowledged by the operator.
 - b. Alarms with a priority of "critical," "non-critical," or "process" shall be added to the alarm history buffer.
 - c. All alarms are logged on the alarm printer. Alarm information shall be conveyed by changing color of the single value as following:
 - 1) Flashing Green – Unacknowledged Normal
 - 2) Steady Green – Acknowledged Return to Normal
 - 3) Flashing Red – Unacknowledged Alarm
 - 4) Steady Red – Acknowledged Alarm
7. The most recent alarm reports in the alarm history file shall be presented on the display monitor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prior to all work of this section, carefully inspect the existing facilities and installed work of all other trades and verify that all such work is complete to the point where installation may properly commence.
- B. The equipment shall be installed in accordance with the system integrator's instruction and located as shown on the drawings, or as approved by the Engineer. Local General Construction shutoffs for power supplies to equipment shall be provided.
- C. Discrepancies:
 1. In the event of a discrepancy, immediately notify the Engineer.
 2. Do not proceed with installation in areas of discrepancy until all such discrepancies are have been fully resolved.

3.2 SYSTEM INTEGRATOR'S SERVICES

- A. The system integrator shall furnish the services of the serviceman, all special tools, calibration equipment and labor required for the following:
 - 1. Checking the installation of all components before power is applied.
 - 2. Placing the software and hardware into operation and making necessary adjustments.
- B. Should the equipment fail to operate in accordance with the specifications and manufacturer's data, corrective measures shall be taken by the System Integrator or the defective equipment shall be removed and replaced with equipment which will satisfy the specified conditions.
- C. When all required approvals of this portion of the work have been obtained, and at a time designated by the Owner, thoroughly demonstrate to the Owner's personnel the operation and maintenance of all items installed under the work of this section.

3.3 INSPECTION

- A. Installation: Supervision and assistance to ensure that proper procedures are following during installation of the system.
- B. Start-up: Energize and verify correct and satisfactory operation of all components of the system. This operation shall include verification of the accuracy of all inter-equipment wiring.
- C. Subsystem Commissioning: Place into operation all component subsystems. This operation shall include loading and placing into operation all software and calibration of all system inputs and outputs. Simulation of system inputs and outputs that are not operational during this subsystem commissioning phase shall be allowed provided that all of these simulated inputs/outputs shall be subsequently verified during the system commissioning operation.

END OF SECTION 269001

SECTION 331113.01 – WATER UTILITY DISTRIBUTION SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

- A. Furnishing all labor, materials, tools, equipment, and services for all waterlines as shown on the Drawings.
- B. Although such is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a functional and complete installation.

1.2 RELATED DOCUMENTS AND SECTIONS

- A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions (if included), and Division 1 Specifications Sections, apply to this Section.
- B. Section 013543 – Environmental Protection
- C. Section 013319 – Field Testing Reporting
- D. Section 016600 – Product Handling and Protection
- E. Section 031000 – Earthwork

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Granular pipe bedding and cover material specified in Section 310000 – Earthwork.
- B. Special backfill material specified in Section 310000 – Earthwork.

1.4 DEFINITIONS

- A. Bedding: Material placed under, beside and directly over pipe for the full width of the trench up to a distance of 6 inches over the top of the pipe barrel prior to subsequent backfill operations.

1.5 SUBMITTALS

- A. Manufacturer's Affidavit: The manufacturer shall furnish an affidavit indicating that all pipe, fittings, valves, fire hydrants, and appurtenances have been manufactured and tested in accordance with the requirements of the applicable referenced Standards. A copy of the affidavit indicating the Project on which the material is to be used, shall be forwarded to ENGINEER prior to construction.

- B. Method of construction with detailed drawings and written descriptions of the entire construction procedure to insert the pipe, and connections to water services, fire hydrants, and intersecting water mains. Drawings shall show, but are not limited to, excavation locations, access pits, dimensions, shoring, method of dewatering, adjacent utilities, and traffic control.

1.6 REFERENCES

- A. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
- B. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems
- C. AWWA C110 - Ductile-Iron and Gray-Iron Fittings
- D. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- E. AWWA C116 - Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
- F. AWWA C150 - Thickness Design of Ductile-Iron Pipe
- G. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast
- H. AWWA C153 - Ductile-Iron Compact Fittings
- I. AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
- J. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type
- K. AWWA C400 - C400-03: AWWA Standard for Asbestos-Cement Pressure Pipe, 4 In. through 16 In. (100 mm through 400 mm), for Water Distribution Systems
- L. AWWA C502 - Dry-Barrel Fire Hydrants
- M. AWWA C504 - Rubber-Seated Butterfly Valves
- N. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
- O. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
- P. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
- Q. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances
- R. AWWA C651 - Disinfecting Water Mains
- S. AWWA C800 - Underground Service Line Valves & Fittings
- T. AWWA C810 – Replacement and Flushing of Lead Service Lines

- U. ASTM A36 - Standard Specification for Carbon Structural Steel
- V. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings
- W. ASTM A48 - Standard Specification for Gray Iron Castings
- X. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- Y. ASTM A181 - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
- Z. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts
- AA. ASTM A307 -Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
- BB. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings
- CC. ASTM B88 - Standard Specification for Seamless Copper Water Tube
- DD. ASTM B124 - Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes
- EE. ANSI B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
- FF. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))

1.7 QUALITY ASSURANCE

- A. Comply with all provisions of Section 014323 – Qualifications of Tradesmen.
- B. Comply with all provisions of Section 014126 – General Regulations and Permits.
- C. Field samples shall comply with Section 013319 – Field Test Reporting and Section 013326 – Product Testing and Certifying.
- D. Before and during installation, the Contractor shall comply with provisions under Section 013119 – Project Meetings.
- E. All pipes, fittings, valves, fire hydrants and appurtenances shall be appropriately marked for identification purposes. The materials and methods of manufacture, and completed pipes, fittings, valves, and appurtenances shall be subject to inspection and rejection at all times. OWNER and ENGINEER have the right to make inspections.

1.8 PROJECT CONDITIONS

- A. Environmental Requirements

1. Comply with all provisions of Section 013543 – Environmental Protection at all times.

B. Existing Conditions

1. Verify locations of underground utilities.
2. Protect existing structures and utilities from damage. Repair if damaged by this work.
3. Do not change pipe sizes without securing written approval of Engineer.

C. Field Measurements

1. If it becomes necessary to change location of waterlines due to underground utility interference, secure approval of Engineer.
2. If Contractor initiated, make changes approved by the Engineer without added cost to Owner.

1.9 DELIVERY STORAGE AND HANDLING

- A. Deliver products to the site, store and protect under provisions of Section 016600 – Product Handling and Protection.
- B. Comply with all provisions of Section 013543 – Environmental Protection

1.10 SEQUENCING AND SCHEDULING

- A. Perform no pipe work in fill areas until embankment or fill has been completed to at least two (2) feet above proposed top of pipe and fill has been properly compacted.

PART 2 – PRODUCTS

2.1 WATER MAIN PIPE AND FITTINGS

A. Ductile Iron Pipe and Fittings

1. Pipe shall be designed in accordance with AWWA C150, minimum Thickness Class 52 when buried; except Thickness Class 56 for river crossing pipe; manufactured in accordance with AWWA C151; furnish in minimum nominal 18 foot laying lengths, except river crossing pipe to be in full length joints with shorter lengths required to facilitate installation supplied by pipe manufacturer (no field cutting permitted).
2. Fittings: AWWA C110 or C153, with fittings to be polyethylene encased when buried.
3. Exterior Coating: Asphaltic material. Fittings may be coated with a fusion-bonded epoxy coating in accordance with AWWA C116.
4. Interior Lining: AWWA C104 cement mortar with seal coat, or AWWA C116 fusion-bonded epoxy coating.
5. Joints: AWWA C111, rubber gasket, push-on or mechanical type, with restrained type joints and river crossing pipe joints to be provided within the lengths noted on Drawings.

- a. For all bolted joints, bolt length shall be such that all threads of the nut will be engaged.
- b. Restrained push-on joints shall be provided within the lengths noted on the drawings; shall be completely boltless; McWane Super-Lock, American Flex-Ring, U.S. Pipe TR Flex, or as approved. Restrained mechanical joints shall be MEGALUG with Mega-Bond Coating System as manufactured by EBAA Iron, Inc., or as approved, of ductile iron and with a working pressure of at least 250 psi and a minimum safety factor of 2:1.
- c. River crossing pipe joints shall be boltless, self-restraining, push-on type, gasketed ball and socket joints; Clow Ball and Socket Pipe, American Flex-Lok Boltless Ball Joint Pipe, U.S. Pipe USIFLEX, or as approved.

2.2 VALVES

A. Materials

- 1. Valves bodies shall be of either gray or ductile cast iron and shall have the name, monogram, or initials of the manufacturer cast thereon.
- 2. Valves shall have nonrising stems, open by turning left or counter-clockwise and be provided with either a 2-inch square nut for buried valves or handwheel for exposed valves unless otherwise noted. The direction of opening shall be indicated by an arrow cast on the body and/or the actuator.
- 3. All body bolts and nuts shall be bronze or stainless steel for buried, submerged or nonprotected applications and Type 304 stainless steel for exposed or interior applications that will receive protective finish coatings.

B. Tapping sleeves

- 1. Type: Mechanical joint made in two halves for assembly around main.
- 2. Branch Flange: Accommodate tapping valve.
- 3. Materials: Cast iron with gaskets extending entire length of sleeve to form water-tight joints.

C. Gate or Tapping Valves

- 1. AWWA C509 cast iron, bronze-mounted. or AWWA C515 ductile iron, bronze-mounted, polyethylene encased when buried installation; designed for 200 psi working water pressure; mechanical joint ends, AWWA C111, except for tapping valves; non-rising stem type with standard AWWA nut; stem seal consisting of at least two Buna-N rubber O-rings; open by turning left (counterclockwise); bolts, nuts, and washers used by manufacturer to assemble valves to be Type 304 stainless steel.
- 2. The valve shall have a smooth, unobstructed waterway free from any sedimentation pockets. Valve shall provide a 100% port of nominal pipe size when fully open. Tapping valve port shall be sized to permit a full pipe port tap.
- 3. Verify direction of valve with OWNER.
- 4. Body style shall be mechanical joint type for buried service, flange joint type for exposed service and when required, to include special end connections for tapping requirements or otherwise if indicated on the contract drawings.
- 5. Stuffing boxes shall be O-ring seal type with two (2) rings located in stem above thrust collar.

6. Thrust bearings shall be of the low friction torque reduction type, located both above and below the stem collar.
7. Valves shall be as manufactured by; Mueller Co., American-Darling, Clow, M & H, Stockham, U.S. Pipe or an approved equivalent.

D. Protective Coatings

1. All iron parts of valve assemblies shall be painted before leaving the shop.
2. All exterior and internal waterway ferrous surfaces of each valve, except finished or bearing surfaces shall be shop painted with a liquid or powder epoxy coating of approximately 10 mils dry film thickness conforming to AWWA C550.

E. Extension Stems and Stem Guides

1. When required by drawings, schedule or project details, provide an extension stem made of cold-rolled steel material and the same size as the stem of the valve it operates. If the extension is more than 8 ft. long, intermediate stem guides shall be installed and supported from the wall by suitable brackets at a maximum spacing of 8 ft.
2. Brackets and stem guides shall be made of cast iron and fully adjustable. The guide block shall be bronze bushed where it contacts the extension stem. Stem guides shall be as manufactured by the Eddy Valve Co., Rodney Hunt, or equal. Secure stem guides to walls with stainless steel bolts. In the event of off-set of misalignment, provide off-set extension rod with universal end fittings at valve actuator and stem drop connection.
3. Extension stem shall have connecting socket for 2-inch square nut and pin socket to lock on valve operating nut.

F. Valve Boxes

1. Valve boxes shall be cast iron, 5-1/4" shaft, three-piece screw type, adjustable boxes. The top section to have a drop lid of which to be marked for service which it is used cast thereon. Cover and boxes shall be round pattern.
2. Provide proper base size and shape to straddle the valve bonnet without touching or being supported by the valve mechanism. Use No. 6 base size for 6-inch and 8-inch gate valves or typical butterfly valve operators, No. 160 oval base size for 12-inch and larger gate valves or other size necessary to suit a particular valve manufacturer's requirements.
3. Extension sections shall be provided where the depth of trench is such that they are needed to bring the top of the box to finished grade. The valve box shall be installed so that it is perfectly vertical and centered on the valve operating nut.

2.3 BLOW-OFF ASSEMBLIES

A. Assemblies includes mainline tee, piping from main, gate plug valve, and manhole.

B. Ball Valve

1. Ball valve shall be constructed of Bronze with Buna-N rubber seats, and O-ring stem seals

2. Ends shall have one end female IPS and one end flanged with rubber face gaskets and cadmium-plated bolts.
3. Valve shall open at 1.0 psi differential and seal at 0.25 psi differential.
4. Operations shall be that valve requires a 90 degree turn, 2 inch operating nut with extension stem terminating 6 inches below grade.

C. Check Valve

1. Check valve shall be constructed of red brass with stainless steel springs and Buna-N rubber discs.
2. Ends shall have one end female IPS and the other end flanged.
3. Valve shall open at 1.0 psi differential and seal at 0.25 psi differential.
4. Ball valve shall be manufactured by; Ford Meter Box Co., No. BF13-777W, or as approved equivalent.

D. All piping shall be in accordance with ASTM D1785 Schedule 80 PVC plastic pipe and ASTM D2464 threaded fittings.

E. Valve box shall be constructed as specified in Article 2.2.

2.4 FIRE HYDRANT ASSEMBLIES

A. Includes fire hydrant, watch valve and valve box, piping, and appurtenances.

B. Fire Hydrant:

1. Manufacturers: American Flow Control, Kennedy, Mueller, or as approved, to match rest of water system
2. AWWA C502, compression type, 5-1/4-inch valve opening, open by turning left (counterclockwise); traffic model with frangible barrel section and stem coupling; positive operating drain valve installed in open position; 6-inch mechanical joint base, designed so water hammer will be prevented when properly operated. If drain valve, install with drain valve plugged.
3. Two 2-1/2 inch hose nozzles, and one 4-1/2 inch pumper nozzle.
4. Suitable for setting in trenches of depths and in locations shown; CONTRACTOR responsible for determining hydrant depth of bury based on locations shown.
5. Verify that the direction of opening, hydrant pumper nozzle, operating nut, outlet nozzle cap nuts and hose threads conform to those in the system before the new hydrants are shipped.

C. Watch Valves and Valve Boxes: Watch valves and valve boxes shall be gate valves and valve boxes as specified in Article 2.2, with valves to have ends suitable for receiving the spigot end of 6 inch anchoring pipe.

D. Piping:

1. Ductile Iron Pipe: AWWA C150, AWWA C151; asphaltic material, or AWWA C116 fusion-bonded epoxy exterior coating, AWWA C104 cement mortar with seal coat, or AWWA C116 fusion-bonded epoxy interior lining.
2. AWWA C110 or C153 mainline tees with standard mechanical joint branch for connecting to anchoring pipe and fittings, and mechanical joint anchoring type

- branch when connecting to a watch valve; coated and lined as specified for pipe. C153 fittings to be polyethylene encased when buried.
3. Anchoring pipe, plain end mechanical joint type incorporating an integral cast shoulder and follower gland.
 4. Anchoring Pipe Manufacturers: American Cast Iron Pipe Company, Clow Corporation, United States Pipe and Foundry Company, or as approved.

2.5 POLYETHYLENE ENCASEMENT

- A. AWWA C105, 8 mil linear low-density polyethylene tube or 4 mil high density, cross-linked polyethylene tube; 2 inch wide plastic-backed, adhesive tape, bond to both metal surfaces and polyethylene film.

2.6 JOINT BOLTS AND NUTS

- A. Unless otherwise specified or noted, bolts and nuts on buried piping shall be low alloy steel cathodic to pipe with a minimum yield strength of 45,000 psi, and all other bolts and nuts shall be low carbon steel, ASTM A307, Grade B, zinc-plated.

PART 3 – EXECUTION

3.1 ALIGNMENT AND GRADE

- A. Horizontal and Vertical Control
 1. All horizontal and vertical control required for the complete layout and performance of the Work under this contract shall be done by a registered surveyor at the Contractor's expense, and any observations by the Engineer of the Contractor's methods will not relieve the Contractor of his responsibility.
 2. The Contractor shall be solely responsible for the accuracy of all horizontal and vertical control.
- B. Alignment and grade shall be established by means of a laser beam.

3.2 PREPARATION

- A. String pipe sections along the route of the mains so as to interfere least with pedestrian and vehicular traffic and to protect the pipe.
- B. Excavate trench for Work of this Section; follow Section 310000.
- C. Location of service connections and insertion valves indicated are approximate. Final locations will be established during construction by OWNER.
- D. Do not install service connections until new mains have been successfully tested, disinfected, and placed in service.
- E. Prior to ordering tapping sleeve assembly, expose existing main and verify circumference of existing pipe.

- F. Prior to ordering insertion valve and sleeve assembly, expose existing main at point of installation and verify circumference, actual caliper diameter and roundness of existing pipe. In addition, identify the exterior condition of the pipe with respect to pitting, scaling, electrolysis, or other defects which would affect manufacturing dimensions or exact location of the insertion.
- G. For river crossing pipe, inspect trench just prior to laying pipe to ensure that it is in suitable condition.

3.3 BEDDING

- A. Place bedding material at trench bottom and shape for accurate placement and proper support of pipe.
- B. Place in 6 inch layers, loose measurement, and compact by hand or mechanical tamping to not less than 95 percent of maximum density as determined in accordance with ASTM D698 (Standard Proctor).
- C. Carefully place and tamp so as not to damage or displace joints or pipe. Do not drop material directly on pipe.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.
- E. Construct thrust blocks at fittings, dead ends, and valves as shown. Place against firm, undisturbed soil. Provide straps and anchors as indicated; repair cuts and other damage to galvanized surfaces by applying two coats of cold galvanizing compound. Securely strap or block plugs and caps. Thrust blocks shall meet all applicable requirements of ODOT Item 638:
 - 1. Concrete: Class C conforming to ODOT 499.
 - 2. Straps and Anchors for Thrust Blocks: Galvanized steel.
 - 3. Cold Galvanizing Compound: ZRC Products Company, or as approved.

3.4 PIPE INSTALLATION

- A. The Contractor shall furnish all of the proper tools and equipment required for the safe, proper handling and laying of all pipe, fittings, and specials that are to be installed in this work. All storage, handling, laying, and backfill methods shall be performed so as to avoid damaging either the interior or the exterior surfaces of all pipe fittings, specials, joint materials, or other appurtenances, and any such damage shall be remedied at the Contractor's expense.
- B. Before any pipe is lowered into the trench, it shall be inspected for damage, and any unsatisfactory lengths shall be rejected. Cast metal pipe and fittings shall be inspected for cracks by ringing with a light hammer while suspended. The interior and exterior of each pipe length used shall be cleaned as necessary to remove all dirt or other foreign material before it is inspected. The interior of the pipe shall be kept clean until the work is accepted.

- C. No pipe shall be laid in water, mud or when trench conditions or weather is unsuitable for such work.
- D. If mud, surface water, leaves and/or other debris have been permitted to enter the strung-out pipe, the inside shall be cleaned with a strong hypochlorite solution after all such foreign materials are completely cleaned from the pipe and before the pipe is lowered into the trench.
- E. Pipe shall not be pushed off the bank nor shall it be permitted to fall into the trench. Each type of pipe, fitting, special or other appurtenances shall be handled in strict accordance with recommendations of its respective manufacturer.
- F. No rocks, stones, metal, concrete, bricks, pavement pieces, wood, soil lumps or other hard materials too big to pass through a six (6") inch screen shall be permitted within six (6") inches of the pipe after it is laid in the trench. Any pipe endangered by such debris shall be subject to removal and disposal at the Contractor's expense.
- G. When pipe laying is not in progress, the open ends of installed pipe shall be closed by appropriate means to prevent the entrance of dirt and water. In the event ground water, sewage water or other potential contaminants enter any portion of the pipeline, after it is laid, cleaning and preliminary disinfection with a strong hypochlorite solution shall be done.
- H. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- I. Use suitable fittings, usually 1/8 bends, when abrupt grade changes of the pipe are necessary to avoid existing utilities or other obstructions, so as to secure and easy flow of liquid and to provide sufficient cover below same unless noted otherwise.
- J. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- K. Deflect pipe joints in strict accordance with the pipe manufacturer's instructions. For river crossing pipe, in no case shall joint deflection exceed 15 degrees during installation and 12 degrees after installation unless otherwise approved by manufacturer.
- L. With push-on joints, wipe surfaces that contact rubber gasket clean and dry just prior to making joint. Use lubricant in accordance with the manufacturer's instructions when making joint.
- M. With mechanical joints, brush surfaces that contact rubber gasket with soapy water to remove all sand and grit just prior to making joint.

3.5 VALVES

- A. Installation
 - 1. Valves shall be carefully handled and placed so as not to permit any damage to the interior coatings, disc or seat. Internal type lifting devices shall not be permitted. Do not use handwheels or stems as lifting of rigging points.

2. All valves shall be carefully installed in their respective positions free from distortion and stress. Connecting joints shall conform to applicable requirements of the specifications.
 3. Stem guides shall be accurately aligned.
 4. If the valve box is tipped or otherwise not centered on the valve operating nut or not installed at the proper elevation, the Contractor shall, at his own expense, make whatever correction is required to remedy the defect promptly, upon notice to do so by the Engineer.
- B. Testing
1. All valves shall be tested in place by the Contractor as far as practicable under conditions for the pipelines, in which they are placed, and defects revealed in valves or connections under test shall be corrected at the expense of the Contractor to the satisfaction of the Engineer.
- C. Operation and Maintenance Manuals
1. Prior to or with the delivery of equipment, the manufacturer shall provide copies of an operation and maintenance manual including storage, installation, start-up, operating and maintaining instructions, and a complete parts and recommended spare parts list. The O & M Manuals shall be in compliance with the General Requirements of these specifications.

3.6 JOINTING

- A. The particular method of making up pipe joints shall be governed by the type of pipe material and type of joint in accordance with the drawings and/or specifications.

3.7 CONNECTION TO AND INSERTIONS INTO EXISTING MAINS

- A. Existing mains into which valves are to be inserted cannot be shut down or taken out of service. The entire operation of installing the valves shall be accomplished below 100 psig at the point of installation.
- B. Connect new mains to existing mains using proper fittings and in a manner acceptable to OWNER and ENGINEER.
- C. Expose existing mains at connection points 10 days prior to making connections to determine elevation, verify type of pipe, confirm outside diameter of pipe, and identify type of restraints existing.
- D. No cut-ins or connections to existing mains shall be made unless at least 48 hours notice is given to OWNER and ENGINEER.
- E. Plan all connecting work to reduce number of shutoffs.
- F. Two days prior to shutting valves on existing lines, notify all affected property owners, local official in charge of the water works system, and ENGINEER of such shutoff.

- G. Keep shutoff time to a minimum and do at off-peak hours.
- H. A representative of OWNER shall operate existing valves. CONTRACTOR shall not operate existing valves.
- I. OWNER and ENGINEER assume no responsibility for any delay occasioned by special requirements or conditions which must be met in making connections.
- J. Take extreme care in making connections to prevent contamination of existing mains.
- K. Before making cut-ins or connections to existing mains, wash all fittings, valves, and pipe with clean water, and then disinfect by washing with a chlorine solution having a residual chlorine strength of not less than 50 ppm.
- L. Plugs removed from existing mains that are not damaged may be reused within the Project, and those remaining after completion of construction shall remain the property of OWNER.
- M. Connections to AC pipe shall be made with appropriate fittings specifically designed for AC pipe connections, and shall be acceptable to OWNER. All connections to AC pipe shall be via pad adapters. AC pipe must not be cut with a saw. All cuts shall be accomplished by snap cut.

3.8 ANCHORAGE

- A. All hydrants, plugs, caps, tees and bends shall be provided with a reaction backing or shall be restrained by attaching suitable metal rods, clamps, anchored fittings or harnessed joints, as shown on the plans or as specified so as to prevent movement.
- B. Reaction backing shall be of concrete, with steel reinforcement as required, unless otherwise shown on the drawings. Backing shall be placed between solid ground and the fitting or other part of the pipeline to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that as indicated on the plans. The backing shall be so placed unless otherwise directed, that the pipe and fitting joints will be accessible for repair.
- C. Steel tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing. Steel tie rods or clamps shall be used to connect the hydrant watch valves to the main and to connect the hydrant to the water valves when shown on the drawings. Steel rods or clamps shall be painted with three coats of an approved bituminous paint or coat tar enamel.

3.9 BACKFILLING

- D. Backfilling shall be accomplished in a two-step procedure as follows: 1) partial backfill before leakage tests, and 2) completion of backfill after tests. Departure from this procedure due to traffic or other conditions shall be approved by the Engineer.

3.10 MAINTENANCE OF EXISTING DITCHES

- A. The Contractor shall use the utmost care in maintaining ditches and other waterways, and, if either bottoms or banks of such ditches are disturbed, they shall be promptly restored and maintained for the life of the guaranty period. Similar care shall be used in preventing damage to existing pavement by caving of trench walls and undermining such pavement. If pavement is damaged, the Contractor shall repair same at his own expense.

3.11 CLEARING SITE AND RESTORING DAMAGED SURFACES

- A. Upon completion of the backfill work, the Contractor shall immediately remove and dispose of all surplus materials including dirt and rubbish.
- B. Unless otherwise called for on the plans, the Contractor shall replace all pavement, sidewalks, sod, or other surfaces disturbed to a condition equal to that existing before the work was started, furnishing all materials, labor, equipment, etc., at no additional cost to the Owner.

3.12 LEAKAGE TESTS

- A. All pipeline construction shall be subjected to hydrostatic leakage testing of each valve section, as it is completed, unless otherwise directed by the Engineer. All pipes, valves, fittings, etc. shall be laid in such a manner as to leave all joints watertight.
- B. Each section of pipe being tested shall be filled slowly with water, and, before applying the specified test pressure, all air shall be expelled from the pipe. The method of obtaining and placing test water(s) into the pipeline shall be approved by the Engineer.
- C. The test shall be observed by the Engineer or his designate. The Owner will furnish a pressure gauge for measuring the pressure on the water main. The Contractor shall furnish a suitable pump, pipes, bulkheads and all appliances, labor, fuel, and other appurtenances necessary to make these tests.
- D. The test pressure shall be maintained for sufficient length of time to allow for a thorough examination of joints and elimination of leakage where necessary. The pipeline shall be made absolutely tight under the test pressure.
- E. The Contractor shall drain each section of the waterline piping after it has been tested. If the drains are connected to valve or drain vaults, then, within a reasonable period of time after the test has been completed, the Contractor shall pump all water out of the vaults.
- F. In cold weather, immediately after testing a section of the waterline piping, the Contractor shall open all valves, air cocks, by-passes, and drains; shall drain that section of the pipeline, including the bonnets of all valves contained therein, and shall take all other precautions necessary to prevent injury due to freezing to the water main, piping and appurtenances.
- G. Every precaution must be taken to remove, valve-off, or otherwise protect delicate control equipment in or attached to pipelines to prevent damage or injury thereto.

- H. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, as required to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled as herein required.
- I. In calculating leakage, the Engineer will not make allowance for any leakage at the valves, the removable bulkheads, etc.
- J. The evaluation of actual leakage to standard pressure leakage is calculated by the application of the ratio determined from the square root of respective pressures, other factors being equal.
- K. The test pressure shall be 250 psi unless otherwise specified elsewhere in these specifications. Testing procedure shall be as specified herein for the particular pipe material contained in the section tested and shall be subject to modification as required by a particular pipeline material specification or part thereof, as contained elsewhere in these specifications.
- L. For cast iron pipe (CIP) or ductile iron pipe (DIP), AWWA C600 shall govern the test, except that the allowable leakage rate shall be 12 gpd per mile of pipe per inch of diameter.
- M. All defective materials and construction found in the pipeline as a result of leakage tests shall be corrected by removal of the defective materials and reconstruction with sound materials and construction. The entire section shall then be retested in accordance with the foregoing.
- N. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.
- O. The lack of hydrants, branch shutoff valves, or any other attachments to the line being tested shall not preclude the testing of each valved section as it is completed. In the event that hydrants, branch shutoff valves or any other attached appurtenances are not available for installation prior to testing of each valved section, then plugs or other approved means of containing line pressure must be utilized so as to test each valved section of main line as it is completed. A retest of each valved section will then be necessary after all appurtenances are installed. There will be no additional payment for any such retests.
- P. The Contractor shall provide all pressure test equipment. The Owner shall provide all test water required and shall provide test gauges.

3.13 DISINFECTION

- A. Prior to disinfection, all pipeline construction shall be flushed to remove any foreign material. Flushing shall be performed after completion and approval of the leakage tests. The minimum requirements for flushing are as follows:

<u>Pipe Size</u>	<u>Minimum GPM Required</u>
6"	220
8"	390
10"	610
12"	880
14"	1,200
16"	1,565
18"	1,980
20"	2,450
24"	3,500

- B. Flushing at these rates shall be continued for at least five (5) minutes. In the event the foregoing requirements cannot be met due to the Owner's facilities being inadequate, alternate rate(s) and duration(s) of flushing shall be used.
 - C. Disinfecting water mains shall be in accordance with AWWA C651 and as specified herein.
 - D. The following disinfectants may be used: Chlorine or chlorine water; calcium hypochlorite; sodium hypochlorite solution, or chlorinated lime-water mixture. Chlorine shall be applied at one extremity of a pipe section via a corporation stop (installed in the top of the pipe by the Contractor) and bled at the opposite extremity of a properly segregated section. Precautions shall be taken to prevent dosed water from flowing into the potable water supply. All high points on the section treated shall be properly vented for air escape.
 - E. The rate of applying the disinfectant shall provide at least 25 ppm (mg per liter) chlorine dose at the outlet end of the line section being treated. The disinfecting period shall be twenty-four (24) hours, and, at the end of this period, a chlorine residual of at least 10 mg per liter shall exist at the outlet end of the line.
- In the event of unfavorable or unsanitary conditions of installation, poor packing, or high pH, the period of disinfection may be extended. For shorter periods of disinfection, higher dosages shall be required.
- F. Sterilizing water shall be disposed of in a satisfactory manner by the Contractor. If the foregoing disinfection procedure fails to provide thorough disinfection of the line, it shall be repeated as necessary in the pipeline for a period of 20 - 30 days after it is placed into operation.
 - G. Tests for efficacy of sterilization shall be made by the Owner, and repeated sterilization shall be carried out by the Contractor when required.
 - H. Contractor shall provide all disinfectants and disinfection equipment. Owner shall provide all test waters needed.

END OF SECTION 331113.01