COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA PUBLIC UTILITY COMMISSION
COMMONWEALTH KEYSTONE BUILDING
400 NORTH STREET, HARRISBURG, PA 17120

BUREAU OF
INVESTIGATION
&
ENFORCEMENT

January 30, 2023

Via Electronic Filing
Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street
Harrisburg, PA 17120

Re: Pennsylvania Public Utility Commission
Bureau of Investigation and Enforcement v.
KLH Engineers, Inc.
Docket No. C-2023-
I&E Formal Complaint (Damage Prevention)

Dear Secretary Chiavetta:

Enclosed for electronic filing please find the **Formal Complaint** in the above-referenced case on behalf of the Bureau of Investigation and Enforcement of the Pennsylvania Public Utility Commission. Copies have been served on the parties of record in accordance with the Certificate of Service.

Should you have any questions, please do not hesitate to contact me.

Sincerely,

Emily A. Farren

Emily A. Farren
Prosecutor
Bureau of Investigation and Enforcement
PA Attorney ID No. 322910
(717) 783-6150
efarren@pa.gov

EAF/jfm
Enclosures

cc: Per Certificate of Service

NOTICE

A. **You must file an Answer within 20 days of the date of service of this Complaint**. The date of service is the date as indicated at the top of the Secretarial Letter. *See* 52 Pa. Code §1.56(a). The Answer must raise all factual and legal arguments that you wish to claim in your defense, include the docket number of this Complaint, and be verified. You may file your Answer by mailing an original to:

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
400 North Street
Harrisburg, PA 17120

Or, you may eFile your Answer using the Commission's website at www.puc.pa.gov. The link to eFiling is located under the Filing & Resources tab on the homepage. If your Answer is 250 pages or less, you are not required to file a paper copy. If your Answer exceeds 250 pages, you must file a paper copy with the Secretary's Bureau.

Additionally, please serve a copy on:

Emily A. Farren, Prosecutor
Pennsylvania Public Utility Commission
Bureau of Investigation and Enforcement
400 North Street
Harrisburg, PA 17210
efarren@pa.gov

B. If you fail to answer this Complaint within 20 days, the Bureau of Investigation and Enforcement will request that the Commission issue an Order imposing the requested relief.

C. You may elect not to contest this Complaint by paying the administrative penalty within 20 days. Send only a certified check or money order made payable to the "Commonwealth of Pennsylvania," with the docket number indicated, and mail to:

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
400 North Street
Harrisburg, PA 17120

D. If you file an Answer which either admits or fails to deny the allegations of the Complaint, the Bureau of Investigation and Enforcement will request that the Commission issue an Order imposing the requested relief set forth in this Complaint.

E. If you file an Answer which contests the Complaint, the matter will be assigned to an Administrative Law Judge for hearing and decision. The Judge is not bound by the penalty set forth in the Complaint and may impose additional and/or alternative penalties as appropriate.

F. If you are a corporation, you must be represented by legal counsel. 52 Pa. Code § 1.21.

G. Alternative formats of this material are available for persons with disabilities by contacting the Commission's ADA Coordinator at 717-787-8714.

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission Bureau of Investigation and Enforcement	: :	
v.	:	Docket No. C-2023-
KLH Engineers, Inc.	:	

FORMAL COMPLAINT

NOW COMES the Bureau of Investigation and Enforcement ("I&E") of the Pennsylvania Public Utility Commission ("Commission"), by its prosecuting attorneys, and files this **Damage Prevention Complaint** ("Complaint") against KLH Engineers, Inc. ("Respondent"), pursuant to Sections 182.8(c)-(d) and 182.10 of the Underground Utility Line Protection Law, Act of October 30, 2017, P.L.806, No. 50 (hereinafter referred to as the "PA One Call Law"), 73 P.S. §§ 182.8(c)-(d) and 182.10.[1] In support of its Complaint, I&E respectfully represents the following:

I. COMMISSION JURISDICTION AND AUTHORITY

1. The Pennsylvania Public Utility Commission, with a mailing address of 400 North Street, Harrisburg, PA 17120, is a duly constituted agency of the Commonwealth of Pennsylvania empowered to, *inter alia*, enforce compliance by

[1] The purpose of the PA One Call Law is to protect the public health and safety by preventing excavation or demolition work from damaging underground lines used in providing electricity, communication, gas, propane, oil delivery, oil product delivery, sewage, water or other service; imposing duties upon the providers of such service and persons and other entities preparing drawings or performing excavation or demolition work; and prescribing penalties.

excavators, facility owners, designers, and other stakeholders pursuant to Section 182.10 of the PA One Call Law, 73 P.S. § 182.10.

2. Complainant is the Commission's Bureau of Investigation and Enforcement, which is the bureau established to take enforcement actions against public utilities and other entities subject to the Commission's jurisdiction pursuant to 66 Pa.C.S. § 308.2(a)(11); *See also Implementation of Act 129 of 2008; Organization of Bureaus and Offices,* Docket No. M-2008-2071852 (Order entered August 11, 2011) (delegating authority to initiate proceedings that are prosecutory in nature to I&E), including actions to enforce compliance of the PA One Call Law.

3. Complainant is represented by:

Emily A. Farren
Prosecutor
Pennsylvania Public Utility Commission
Bureau of Investigation and Enforcement
400 North Street
Harrisburg, PA 17120
(717) 783-6150
efarren@pa.gov

Michael L. Swindler
Deputy Chief Prosecutor
Pennsylvania Public Utility Commission
Bureau of Investigation and Enforcement
400 North Street
Harrisburg, PA 17120

4. Respondent is KLH Engineers, Inc., with a main mailing address of 5173 Campbells Run Road, Pittsburgh, PA 15205.

5. Respondent is a "designer" as that term is defined at 73 P.S. § 176 as it is "any architect, engineer or other person who or which prepares a drawing for a

construction or other project which requires excavation or demolition work as herein defined."

6. "Excavation work" is defined as "the use of powered equipment or explosives in the movement of earth, rock or other material, and includes, but is not limited to, anchoring, augering, backfilling, blasting, boring, digging, ditching, drilling, driving-in, grading, plowing-in, pulling-in, ripping, scraping, trenching and tunneling." 73 P.S. § 176.

7. "Powered equipment" is defined as "any equipment energized by an engine or motor and used in excavation or demolition work." 73 P.S. § 176.

8. "Line" or "facility" is defined as "an underground conductor or underground pipe or structure used in providing electric or communication service, or an underground pipe used in carrying, gathering, transporting or providing natural or artificial gas, petroleum, propane, oil or petroleum and production product, sewage, water or other service to one or more transportation carriers, consumers or customers of such service and the appurtenances thereto, regardless of whether such line or structure is located on land owned by a person or public agency or whether it is located within an easement or right-of-way. . . ." 73 P.S. § 176.

9. Respondent, as a designer, is subject to the power and authority of this Commission pursuant to Section 182.10 of the PA One Call Law, 73 P.S. § 182.10, which requires designers to comply with the PA One Call Law.

10. Sections 182.8(c)-(d) and 182.10 of the PA One Call Law, 73 P.S. §§ 182.8(c)-(d) and 182.10, authorize the Commission to*, inter alia*, hear and determine

complaints, arising from the rejection of an informal determination made by the Damage Prevention Committee, against designers for violations of the PA One Call Law and enforce the provisions of the PA One Call Law.

11. Section 182.10(a) of the PA One Call Law, 73 P.S. § 182.10(a), authorizes the Commission to impose administrative penalties on designers who violate the PA One Call Law. Section 182.10(b)(1)(i)-(ii) allows for the imposition of an administrative penalty not to exceed $2,500 for each violation or if the violation results in injury, death, or property damage of $25,000 or more, an administrative penalty not to exceed $50,000.

12. Pursuant to the provisions of the applicable Commonwealth statutes, the Commission has jurisdiction over the subject matter of this complaint and the actions of Respondent related thereto.

II. FACTUAL BACKGROUND

13. On or about December 30, 2020, Respondent prepared a drawing for an underground water line replacement near State Route 151 and Gringo Road, Hopewell Township, Beaver County, Pennsylvania, which required excavation, as defined by 73 P.S. § 176 ("Excavation Project").

14. At all material times hereto, Respondent was a "designer" as defined in Section 73 P.S. § 176.

15. Creswell Heights Joint Authority ("Creswell Heights") is the facility owner, as defined in 73 P.S. § 176, of the underground water line.

16. An underground water line is a "line" or "facility" as defined in 73 P.S. § 176.

17. During February 2021, Respondent released bidding documents, including a 174-page contract ("Contract") related to the execution and completion of the Excavation Project.

18. The Contract stated, in pertinent part:

> The Unit Price for Item 'L' Mis-Marked or Unmarked Utility Resolution shall include all labor, material, and equipment required to repair and resolve mis-marked and/or unmarked utility disputes including exploratory excavation, delays in construction and repair costs for the utility types and sizes identified or encountered during construction. Work under this item also includes backfill and restoration not identified for payment under a separate unit price. As a part of this pay item the Contractor shall be responsible for providing temporary service and reinstating permanent service which may have been interrupted during construction. This item shall apply to all unmarked and marked facilities beyond the tolerance zone as defined by the Pennsylvania One Call Act. Duct banks and clusters of similar facilities shall be considered one payment unit. This item shall be in lieu of the force amount payment provisions specified in the Pennsylvania One Call Act, Section 5, Item 14, and shall be considered as payment in full for this item.

The Contract is attached as I&E Exhibit 1, at p. H-5.

19. Based on the language above, the Contract attempts to limit an excavator's rights to additional compensation by considering the "Unit Price", as defined in Item L of the Contract, to be payment in full, even if additional labor, material, and equipment are required to repair and resolved mis-marked and/or unmarked utility disputes.

III. VIOLATION

20. Paragraphs 1-19 above are incorporated herein as if stated in their entirety.

21. Respondent released the Contract containing language which attempted to limit an excavator's compensation rights as outlined in Section 180(15) [2] the PA One Call Law.

If proven, this is a violation of Section 180(15) of the PA One Call Law, 73 P.S. § 180(15), prohibiting the provisions of any contract to attempt to limit the compensation rights of excavators when required to perform additional work.

Pursuant to the factors set forth in Section 182.10(b)(2)(i)-(vi) of the PA One Call Law, 73 P.S. § 182.10(b)(2)(i)-(vi), the Bureau of Investigation and Enforcement's proposed administrative penalty for this violation is One Thousand Dollars ($1,000).

WHEREFORE, the Bureau of Investigation and Enforcement of the Pennsylvania Public Utility Commission respectfully requests that the Commission:

(a) Find Respondent to be in violation of the PA One Call Law at Section 180(15), 73 P.S. § 180(15);

[2] This Section states: "When the information required from the facility owner under Section 2(5)(i) cannot be provided or, due to the nature of the information received from the facility owner, it is reasonably necessary for the excavator to ascertain the precise location of any line or abandoned or unclaimed lines by prudent techniques, which may include hand-dug test holes, vacuum excavation or other similar devices, the excavator shall promptly notify the project owner or the project owner's representative, either orally or in writing. If oral notification is given, the notice shall be reduced to writing within a reasonable time by the project owner or excavator. After giving such notice, the excavator shall be entitled to compensation from the project owner for this additional work as provided in the latest edition of the Pennsylvania Department of Transportation Form 408 specifications for extra work performed on a force account basis. The provisions of this subsection shall not be deemed to limit any other rights which the excavator has under its contract with the project owner or otherwise. Provisions in any contract, public or private, which attempt to limit the rights of excavators under this section shall not be valid for any reason, and any attempted waiver of this section shall be void and unenforceable as against public policy and any such attempted waiver shall be reported to the commission." 73 P.S. § 180(15).

(b) Impose an administrative penalty upon Respondent in the amount of One Thousand Dollars ($1,000); and,

(c) Order such other remedies as the Commission may deem appropriate.

Respectfully submitted,

Emily A. Farren
Prosecutor
PA Attorney ID No. 322910

Pennsylvania Public Utility Commission
Bureau of Investigation and Enforcement
Commonwealth Keystone Building
400 North Street
Harrisburg, PA 17120
(717) 783-6150
efarren@pa.gov

Date: January 30, 2023

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission Bureau of Investigation and Enforcement	: :	
v.	:	Docket No. C-2023-
KLH Engineers, Inc.	:	

VERIFICATION

I, Sara Andrade-Locke, Damage Prevention Supervisor, Damage Prevention Section, Bureau of Investigation and Enforcement, hereby state that the facts above set forth are true and correct to the best of my knowledge, information, and belief and that I expect the Bureau will be able to prove the same at any hearing held in this matter. I understand that the statements herein are made subject to the penalties of 18 Pa.C.S. § 4904 relating to unsworn falsification to authorities.

Date: January 30, 2023

Sara Andrade-Locke
Damage Prevention Supervisor
Damage Prevention Section
Bureau of Investigation and Enforcement
Pennsylvania Public Utility Commission
400 North Street
Harrisburg, PA 17120

I&E
EXHIBIT 1

ISSUED TO:

CRESWELL HEIGHTS JOINT AUTHORITY
BEAVER COUNTY, PENNSYLVANIA

BIDDING DOCUMENTS FOR

CONTRACT NO. 2021-02

S.R. 151 / GRINGO ROAD WATER LINE REPLACEMENT

RELEASED FOR BID
FEBRUARY 2021

KLH ENGINEERS, INC

5173 Campbells Run Road
Pittsburgh, PA 15205
Telephone: (412) 494-0510
Fax: (412) 494-0426
E-mail: info@klhengineers.com
Ref. No. 318-38

CRESWELL HEIGHTS JOINT AUTHORITY

CONTRACT NO. 2021-02
S.R. 151 / Gringo Road Water Line Replacement

TABLE OF CONTENTS

ADVERTISEMENT

Sealed bids will be received by the Creswell Heights Joint Authority, Beaver County, Commonwealth of Pennsylvania, for the following:

Contract 2021-02
S.R. 151 / Gringo Road Water Line Replacement

BID OPENING – Sealed bids shall be hand delivered or mailed to the Creswell Heights Joint Authority office at 3961 Jordan Street, P.O. Box 301, South Heights, PA 15081, until 10:00 AM local time Wednesday, March 24, 2021.

The public bid opening will be held at the Creswell Heights Joint Authority office, 3961 Jordan Street, South Heights, PA 15081 at 10:00 AM local time March 24, 2021. Bid envelopes shall be labeled as follows:

Sealed Bids for Creswell Heights Joint Authority
CONTRACT NO. 2021-02

Equipment and Services to be provided shall be according to the specifications which are on file at the office of KLH ENGINEERS, INC., 5173 Campbells Run Road, Pittsburgh, Pennsylvania, 15205, and at the Authority Office.

Copies of the plans and specifications are on file for review at the north Accu-Copy Reprographics location.

Pittsburgh – North
302 Thomson Park Drive
Cranberry Twp, PA 16066
Phone: 724-935-7055
Fax: 724-935-0250

Copies of the bidding documents may be purchased at this location or online www.accu-copy.com at a non-refundable cost of $75.00 per set plus the cost of shipping.

No Bid may be withdrawn for a period of sixty (60) days after the time of the opening of the bids.

Contractor shall submit an E-Verify Program Verification in compliance with the Public Works Employment Verification Act 127 of 2012.

BIDDER'S SURETY -- A certified check payable to the Creswell Heights Joint Authority or a bid bond on the bid form executed by the Bidder and a surety company approved by the OWNER, in an amount

equal to ten percent (10%) of the total amount of bid, must be submitted with each bid or bids will be considered nonresponsive and immediately rejected.

SUCCESSFUL BIDDING BIDDER awarded this contract shall provide a performance surety in the amount of one hundred percent (100%) of the Contract amount.

EQUAL OPPORTUNITY EMPLOYER -- the Creswell Heights Joint Authority fully complies with the provisions of this act. All qualified bidders are invited to submit a proposal.

CRESWELL HEIGHTS JOINT AUTHORITY BOARD RESERVES THE RIGHT TO AWARD OR TO REJECT ANY AND/OR ALL PORTIONS THEREOF PROPOSALS SUBMITTED, AND TO WAIVE INFORMALITIES IN THE BIDDING PROCESS IF IN THE BEST INTEREST OF THE AUTHORITY.

Richard Tranter
Chairman

Section B

INSTRUCTIONS TO BIDDERS

B1 Designation of Work

The work included under this Contract covers the furnishing of all plant, labor, materials, tools and equipment required to complete the work as described herein, shown on the Contract Drawings and necessary for complete operating facilities.

The Creswell Heights Joint Authority (CHJA) S.R. 151 / Gringo Road Water Line Replacement Project is construction of Ductile Iron Water lines located in Hopewell Township, Beaver County, Pennsylvania. The work under Contract No. 2021-02 includes construction of water system mains and encompasses the furnishing and installation of all plant, equipment, material, labor, utilities and services necessary for the complete construction of water mains including pipe, fittings, valves, hydrants, services and appurtenances.

The work under Contract No. 2021-02 generally consists of the construction of approximately 1,150 lineal feet of 10-inch ductile iron water main and appurtenances along S.R. 151 / Gringo Road. All new waterlines are installed via open cut construction methods and are located within the paving limits of S.R. 151 / Gringo Road and requires restoration of all disturbed areas.

The work under Contract No. 2021-02 is a Unit Price contract as identified in the Bid Form in Section C.

Those BIDDERS desiring to submit proposals for performing the Work under multiple waterline construction contracts, and at the same time will offer the OWNER (as an incentive to receive the award of the stipulated combinations of contracts set forth in Section C) a reduction in the aggregate sums of the amounts bid on the respective contract Bid Forms, are directed to complete the Combination Bid Form.

B2 Location of Construction Work

All construction work is proposed to be performed in Hopewell Township, Beaver County, Pennsylvania.

B3 Copies of Bidding Documents

Copies of the Bidding Documents for the described work may be obtained from Accu-Copy at the addresses shown on the Advertisement. The price for same is also stated in the Advertisement.

Complete sets of Bidding Documents shall be used in preparing Bids; neither OWNER nor ENGINEER assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

OWNER and ENGINEER in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

B4 Qualifications of Bidders

To demonstrate qualifications to perform the Work, each Bidder must be prepared to submit, within five days of OWNER's request, written information such as financial data, previous experience and evidence of authority to conduct business in the jurisdiction where the Project is located.

B5 Examination of Contract Documents and Site

Before submitting a Bid, each Bidder shall: (a) examine the Bidding/Contract Documents thoroughly, (b) visit the site to familiarize himself with local conditions that may in any manner affect access, cost, progress or performance of the work, (c) familiarize himself with federal, state and local laws, ordinances, rules and regulations that may in any manner affect access, cost, progress or performance of the Work; and (d) study and carefully correlate Bidder's observations with the Contract Documents.

Before submitting his Bid, each Bidder shall, at his own expense, make such investigations and tests as the Bidder may deem necessary to determine his Bid for performance of the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

On request, OWNER may assist each Bidder who desires access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of his Bid.

B6 Interpretations

All questions about the meaning or intent of the Contract Documents shall be submitted to ENGINEER in writing. Replies will be issued by Addenda mailed, faxed or delivered to all parties recorded as having received the Bidding Documents. Questions received less than five days prior to the date of bid opening may not be answered. Only interpretations written by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

B7 Bid Security

Bid Security shall be made payable to OWNER, in an amount of not less than ten percent (10%) of the Bidder's maximum Bid price in the form of either a certified bank check or a Bid Bond on the form attached in Section D, issued by a Surety meeting the requirements set forth at the bottom thereof. The bid bond must be uploaded when electronically submitting bid.

The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the Required Contract Security, whereupon it will be returned; if the successful Bidder fails to execute and deliver the Agreement and furnish the required Contract Security within 15 days of Notice of Award, OWNER may annul said Notice and the Bid Security of that Bidder will be forfeited. The Bid Security of any Bidder whom OWNER believes to have a reasonable consideration for receiving the award may be retained by OWNER until after the effective date of the Agreement.

B8 Contract Time

The number of calendar days within which, or the date by which, the Work is to be completed (the Contract Time) is set forth in the Bid Form and will be included in the Agreement.

B9 Employee Eligibility Verification

The CONTRACTOR shall include a Public Works Employment Verification Form, as provided by the Pennsylvania Department of General Services, and available at www.dgs.state.pa.us. The Public Works Employment Verification Form pertains to each employee hired by the CONTRACTOR after January 1, 2013, whether the employee will be working on or offsite of the Project, or otherwise. **The Public Works Employment Verification Form will be evaluated by the OWNER as part of establishing Bidder responsibility.**

B10 Liquidated Damages

Provisions for liquidated damages are set forth in the Agreement.

B11 Bid Forms

With the exception of the Public Works Employment Verification Form which must be obtained from the Pennsylvania Department of General Services website, www.dgs.state.pa.us, the Bid Forms are attached hereto; additional copies may be obtained from ENGINEER.

Bid Forms must be completed in ink or by typewriter. The total Bid price on the form must be stated in words and numerals; in case of a conflict, words will take precedence.

Bids by Corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address shall be shown below the signature.

Bids by Partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

All names must be typed or printed below the signature.

The Bids shall contain an acknowledgment of receipt of all Addenda (the numbers of which shall be filled in on the Bid Form by the Bidder).

The address to which communications regarding the Bid are to be directed must be shown.

B12 Submission of Bids

Bids shall be submitted at the time and place indicated in the Advertisement and in a sealed envelope, marked with the Project contract and title, the name and address of the Bidder and accompanied by the Bid Security and other required documents. If the Bid is sent by U. S. Mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face thereof. All bids must be received by the OWNER at or prior to the time indicated in the Advertisement.

Bids received prior to the advertised hour of opening will be securely kept sealed. The officer whose duty it is to open them will decide when the specified time has arrived, and no Bid received thereafter will be considered; except that when a Bid arrives by mail after the time fixed for opening, but before the reading of all other bids is completed, and it is shown to the satisfaction of the OWNER that the non-arrival on time was due solely to delay in the U.S. mail or other delivery system utilized for which the Bidder was not responsible, such Bid will be received and considered. Unless specifically authorized, facsimile transmissions or telegraphic bids will not be considered.

B13 Modification and Withdrawal of Bids

Bids may be modified or withdrawn at any time prior to the opening of Bids.

B14 Award of Contract

OWNER reserves the right to reject any and all Bids for whatsoever cause and to waive any and all informalities in the Bid. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated sum and/or the products shown as a result of extending unit prices and the correct sum and/or products thereof will be resolved in favor of the correct sum and/or products.

In evaluating Bids, OWNER shall consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements and alternates and unit prices (if requested) in the Bid forms.

OWNER may conduct such investigations as he deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of any or all Bidders.

If the contract is to be awarded, it will be awarded on the Base Bid or Alternate Bid Items selected by the OWNER which are those of the lowest responsive and responsible Bidder whose evaluation by OWNER indicates to OWNER that the award will be in the best interests of the Project.

B15 Performance and Other Bonds

The General Conditions and/or the Supplemental General Conditions set forth OWNER's requirements as to Performance and other Bonds. When the Successful Bidder delivers the executed Agreement to OWNER it shall be accompanied by the required Contract Security.

B16 Signing of Agreement

When OWNER advises of a Contract Award to the Successful Bidder, it will be accompanied by at least five unsigned counterparts of the Agreement and all other Contract Documents. Within fifteen (15) days thereafter, CONTRACTOR shall sign and deliver all counterparts of the Agreement to OWNER with all other Contract Documents attached. Within ten (10) days thereafter OWNER will deliver two fully signed counterparts to CONTRACTOR -- one each intended for the CONTRACTOR and the CONTRACTOR's Surety Company. The times set forth herein are of the essence and Bidder's failure to comply herewith may, at the discretion of the OWNER, result in forfeiture of the Bid Security.

B17 Existing Utilities, Structures, Materials and Subsurface Conditions

CONTRACTOR is directed to the provisions of the Underground Utility Line Protection Law Act 287 (1974), as amended by Act 181 December 2006, and full compliance therewith is required of the CONTRACTOR.

Certain information regarding the reputed presence, size, character and location of existing underground structures and public and private utilities such as pipes, drains, sewers, electrical lines, telephone lines, cable TV lines, gas lines, water lines, materials and/or subsurface conditions, has been shown on the Contract Drawings.

Neither the OWNER nor the ENGINEER makes any warranty or representation that the information obtained through the Pennsylvania One-Call system is accurate. To this end the CONTRACTOR shall perform due diligence in determining the actual location of the reputed facilities as required by Act 287 as amended.

The CONTRACTOR shall be responsible for and bear all costs of protecting all structures and utilities indicated on the drawings, both above the ground and below the ground, within and outside the right-of-way.

The CONTRACTOR shall have the responsibility of providing special means to brace and hold the utility lines, the telephone poles and the electrical power poles in place during the construction, and to reinforce and protect same from future displacement, disturbance or damage attributable to settlement of backfill or surface water erosion of restored areas.

B18 Buy American

In accordance with federal regulations and guidelines the CONTRACTOR agrees that preference will be given to domestic construction materials by the CONTRACTOR, subcontractors, materials and suppliers in the performance of this contract. The requirements of the “Steel Products Procurement Act” shall supersede the “Buy American” requirements.

B19 Pennsylvania Sales and Use Tax

Materials and equipment utilized under the contract may or may not be exempt from Pennsylvania sales tax. The CONTRACTOR shall make their own determination as to which, if any, of the materials and equipment utilized under the contract are exempt from sales tax. Beyond issuing a blanket sales tax exemption form, the OWNER and/or ENGINEER will provide no further assistance in this determination. Failure of the CONTRACTOR to make this determination will not be grounds for additional compensation under the contract.

B20 Steel Products

Each CONTRACTOR, equipment and material supplier on these contracts is notified that materials utilized under these contracts must comply with the provisions of the Act of March 3, 1978 (P.L.6 No. 3), known as the "Steel Products Procurement Act". The CONTRACTOR is required to submit Form SP (provided as the last page of Section B) with each initial shop drawing submittal as applicable.

All iron, steel and manufactured goods used in this project shall, pursuant to the allowances of the Steel Products Procurement Act, be produced in the United States unless:

i. The head of the Owner, in writing, determines that steel products as defined by the Steel Products Procurement Act are not produced in the United States in sufficient quantities to meet the requirements of the contract; or

ii. The steel products, as defined by the Steel Products Procurement Act, are included on a list, published on the Pennsylvania Department of General Services website, of exempt machinery and equipment steel products identified by the Pennsylvania Department of General Services as having not been produced in the United States in sufficient quantities in the previous calendar year.

The drawings and specifications have been prepared on an "or equal" basis indicating the names of manufacturers of certain major equipment items on which bidders may prepare and submit their Bids.

Bidders may also submit the name and respective deduction from the lump sum base bid price where spaces are provided on the proposal forms for alternate equipment bids which they propose to be considered.

End of Section B

Instructions to Bidders

FORM SP

This form must be executed by a Fabricator of any item containing BOTH FOREIGN AND U.S. MANUFACTURED STEEL. The Steel Products Procurement Act (73 P.S. S1881 et seq.) allows the use of steel products with both types of steel if seventy-five (75%) percent of the cost of the materials (including steel, rubber, wood, plastic, etc.) in the product are manufactured or produced, as the case may be, in the United States.

The Fabricator shall be herein defined as the firm that assembles the component parts of the item(s) to be purchased. The OWNER will accept the certification of firms that are earlier in the chain of purchase (i.e. manufacturers of components, steel, suppliers) in lieu of the Fabricator. This form must be submitted to the ENGINEER with the initial shop drawing submission and before the product may be incorporated as provided above.

TO BE COMPLETED BY THE FABRICATOR:

1. Contract No. _____ Contract Title:_____

2. Specification Paragraph No. _____ Specification Page:_____

3. Product: _____

4. Name of Supplier: _____

5. Address of Supplier:_____

6. Federal Employer I.D. No.:_____ Phone No. : (___) _____

7. Total cost of materials in the item listed in Item 3 that were manufactured/produced in the United States is greater than 75% of total cost of all materials.

   _____YES _____ NO

CERTIFICATION: I, the undersigned Officer of the above named firm, do certify that our firm assembled/manufactured the components to the steel products listed in Item 3, that the steel in said product is both foreign and domestically manufactured and that all the facts contained in this document are true. I further understand that this document is subject to the provisions of the Unsworn Falsification to Authorities Act (18 P.S. S4904) which provide penalties including, but not limited to, debarment from supplying and products for Commonwealth of Pennsylvania public works projects for a period of five (5) years for violations therein.

WITNESS:

_____ _____(SEAL)

Secretary or Treasure (Corporate Seal)

President or Vice President (Fabricator's Company)

Date:_____

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Section C

BID FORM
CONTRACT NO. 2021-02

Project Identification: S.R. 151 / Gringo Road Water Main Replacement

Contract Number: Contract No. 2021-02

This Bid is Submitted to: Creswell Heights Joint Authority
3961 Jordan Street, P.O. Box 301
South Heights, PA 15081

C1 The undersigned BIDDER proposes and agrees, if this Bid is accepted, to enter into an Agreement with OWNER in the form included in Section J of the Contract Documents and, to complete all Work as Specified and within the Contract Time indicated in this Bid, in accordance with the Contract Documents.

C2 BIDDER accepts all of the terms and conditions of the Instructions to Bidders and other components of the Contract Documents. This Bid may not be withdrawn for sixty (60) days after the day of Bid opening. BIDDER will sign the Agreement and submit the Contract Security and other documents required by the Contract Documents within fifteen days after the date of OWNER's Notice of Award.

C3 In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:

C3.1 Bidder has examined copies of all Contract Documents including Sections A through K and all Drawings, and the following Addenda designated as Section L (if any):

Date of Issuance	**Addenda Number**
_____	_____
_____	_____
_____	_____

receipt of all which is hereby acknowledged.

C3.2 BIDDER has examined the site and locality where the Work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the work and has made such independent investigations as BIDDER deems necessary. BIDDER has satisfied itself as to the

conditions to be encountered both overhead and on the surface of the ground and/or within existing structures and of the character, quality and quantities of work to be done, materials to be furnished, services required and all other terms of the Technical Specifications and other Contract Documents. BIDDER assumes all risks inherent in performing the work and arising from any deficiencies in the Drawings or Specifications or other Contract Documents and will make no claim against the OWNER or the ENGINEER because of any such alleged deficiency.

C3.3 This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation, BIDDER has not directly or indirectly induced any person, firm or a corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for himself any advantage over any other Bidder or over OWNER.

C4 BIDDER will complete the Work under Contract No. 2021-02, in accordance with the terms and conditions of the bidding and contract documents, for the following unit and lump sum prices:

Contract No. 2021-02
S.R. 151 / Gringo Road Water Line Replacement

	BID ITEM	QUANTITY	UNIT PRICE	TOTAL PRICE
A.	**Ductile Iron Pipe**			
	10″ Ductile Iron	1,160 LF	/LF	
	8″ Ductile Iron	20 LF	/LF	
	6″ Ductile Iron	10 LF	/LF	
B.	**Gate Valve, Valve Box, and Cover**			
	10″ Gate Valve	9 EA	/EA	
	8″ Gate Valve	1 EA	/EA	
	6″ Gate Valve	1 EA	/EA	
C.	**Ductile Iron Fittings**			
	10″ D.I. 45 Degree Bend	2 EA	/EA	
	10″ D.I. 22.5 Degree Bend	4 EA	/EA	
	10″ D.I. Cap	3 EA	/EA	
	10″ D.I. Plug w/ 2″ Outlet	3 EA	/EA	
	10″ Solid Sleeve	3 EA	/EA	
	10″x10″x10″ D.I. Anchor Tee	1 EA	/EA	
	10″x10″x8″ D.I. Anchor Tee	1 EA	/EA	
	10″x10″x6″ D.I. Anchor Tee	1 EA	/EA	
	8″ D.I. 22.5 Degree Bend	2 EA	/EA	
	8″ D.I. Cap	1 EA	/EA	
	8″ D.I. Plug w/ 2″ Outlet	1 EA	/EA	
	8″ Solid Sleeve	1 EA	/EA	
D.	**Service Connections**	5 EA	/EA	
E.	**3/4" Type K Copper Tube**	350 LF	/LF	
F.	**Concrete Driveway/Sidewalk Replacement**	20 SY	/SY	
G.	**Permanent Asphalt Trench Restoration**	650 SY	/SY	
	Temporary Asphalt Trench Restoration	100 SY	/SY	
H.	**Asphalt Wedge Curb Restoration**	20 LF	/LF	
I.	**Temporary Blow-Off Assembly**	3 EA	/EA	
J.	**Select Backfill**	650 CY	/CY	
K.	**Exploratory Excavation**			
	Open Cut Exploratory	5 EA	/EA	
	Vacuum Excavation Exploratory	2 EA	/EA	
L.	**Mis-Marked or Unmarked Utility Resolution**			
	Natural Gas	5 EA	/EA	
	Electric – Any Size or Voltage	5 EA	/EA	
	Telephone – Any Size	5 EA	/EA	
	Waterline – Any Size	5 EA	/EA	
M.	**Mobilization / Demobilization**	Lump Sum	Lump Sum	

TOTAL PRICE BID FOR CONSTRUCTION OF CONTRACT NO. 2021-02

$ _____

(IN FIGURES)

_____

(IN WORDS)

C5 BIDDER agrees that the Work will be completed within sixty (60) Calendar days after the date when the Contract Time commences.

C6 BIDDER understands and agrees to coordinate his construction activities with those of the OWNER, the ENGINEER and the other CONTRACTORS.

C7 BIDDER accepts the provisions set forth in the Agreement in Section J of the Contract Documents as to liquidated damages in the event of failure to complete the Work on time.

C8 BIDDER recognizes the problem in identifying exact locations of reputed underground utility pipelines, structures, and/or appurtenances and in classifying, during the bidding period, the subsurface conditions which will be encountered during construction and, in submitting this bid, has included any and all costs in connection therewith and shall not seek any extra compensation for performing the work because of those actual prevailing conditions.

C9 The required Bid Security set forth in Paragraphs B7 of the Instructions to Bidders in the form of a certified bank check, or a Bid Bond, the form for which is included as Section D of the Contract Documents, is in the amount of 10% of the Amount of the Bid.

C10 Communications concerning this Bid shall be addressed to the BIDDER at the address stated on the following page.

C11 The terms used in this Bid which are defined in the General Conditions of the Construction Contract included as part of the Contract Documents have the meanings assigned to them in the General Conditions.

C12 BIDDER recognizes that site safety, for all persons (including OWNER and ENGINEER PERSONNEL) who enter the work site, will be the complete responsibility of the BIDDER, if the BIDDER is awarded the Contract and enter into Agreement with the OWNER for the proposed work. The BIDDER certifies acceptance of the site safety responsibility by signing this Bid Form.

Submitted on _____ 20___.

(Execute the Bid Form on the following page)

IF BIDDER is:

An Individual

_____ by:_____
(Address and Telephone) (Attest)
_____ _____
(Printed Name)
SEAL

A Partnership

_____
(Name of Firm)
_____
(General Partner)
_____ by:_____ SEAL
(Address and Telephone) (Attest)
_____ _____
(Printed Name and Title)

A Corporation

_____
(Name of Corporation)
_____ by:_____
(Address and Telephone) (Attest)
_____ _____
(Printed Name and Title)
CORP SEAL
_____
(Witness)
_____
(Printed Name and Title)

A Joint Venture

_____ by:_____
(Address and Telephone) (Attest)
_____ _____
(Printed Name)
SEAL

_____ by:_____
(Address and Telephone) (Attest)
_____ _____
(Printed Name)
SEAL

(Each joint venturer must sign. The manner of signing for each individual, partnership and corporation that is a part to the joint venture should be in the manner indicated above.)

NON – COLLUSION AFFIDAVIT

I state that I am authorized to make the following statement on behalf of the bidder named below and its owners, directors, and officers. I am the person responsible for the Price(s) and the amount of this bid. I state that:

(1) The price(s) and amount of this bid have been arrived at independently and without consultation, communication or agreement with any other contractor, bidder or potential bidder.

(2) Neither the price(s) nor the amount of this bid, and neither the approximate price(s) nor approximate amount of this bid, have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before bid opening.

(3) No attempt has been made or will be made to induce any firm or person to refrain from bidding on this contract, or to submit a bid higher than this bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.

(4) This bid is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.

(5) The firm, business or organization of the bidder, its affiliates, subsidiaries, offices, directors and employees are not currently under investigation by any governmental agency and have not in the last four years been convicted or found liable for any act prohibited by State and Federal law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract, except as follows:

(6) The firm, business, or organization of the bidder understands and acknowledges that the above representations are material and important, and will be relied on by CRESWELL HEIGHTS JOINT AUTHORITY in awarding the contract(s) for which this bid is submitted. I understand and the Company named below understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from CRESWELL HEIGHTS JOINT AUTHORITY of the true facts relating to the submission of bids for this contract.

Proposal Submitted by:

Dated: _____ _____
Bidder

_____
Authorized Representative

(Notary Seal)

Section D

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____
_____
as Principal and _____
of _____, State of _____,
a corporation existing under the laws and the State of _____
_____, and authorized to transact business in
_____, as Surety, are held and firmly bound unto
_____
(OWNER)
_____
(Address)
hereinafter called the Obligee, in the sum of _____
_____Dollars ($_____).
lawful money of the United States of America, for payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying Proposal or Bid dated _____, 20___, for the _____
_____.

NOW THEREFORE, the condition of this Bond shall be such that if the Principal, upon due acceptance of said Proposal and award of the Contract to him by the Obligee, bonds with good and sufficient surety as may be required by the Contract Documents, and furnishes the Obligee proper evidence of effectiveness of insurance coverage, respectively, within the time, in the forms and in the amounts as appropriate, required by the Contract Documents, and enters into a Contract with the Obligee in accordance with the Contract Documents, then this Bond shall be void; otherwise, the Bond shall be and shall remain in full force and effect.

The Principal and Surety hereby stipulate and agree that if the Principal fails to perform all conditions of this Bond, they will pay the sum of the Bond to the Obligee as fixed, liquidated damages.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its Bond shall be in no way impaired or affected by any extension of time within which the OWNER may accept such bid; and said Surety does hereby waive notice of any extension.

It is the intention of the parties to be legally bound by this instrument.

IN WITNESS WHEREOF, the above bounded parties have executed this instrument under their several seals this ____ day of _____, 20___, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned and representative, pursuant to authority of its governing body.

ATTEST: DATE _____, 20_____

WITNESS:

_____
Name of Bidder, Corporation, Firm or Individual

_____ By_____

_____
(Title)

_____

_____
Business Address of Bidder

****

ATTEST:

_____ _____

_____
Surety

_____
Attorney-in-Fact

IMPORTANT - Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

Section E

GENERAL CONDITIONS

E1 Definitions

Wherever used in these General Conditions or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

Addenda
Written or graphic instruments issued prior to the opening of bids which clarify, correct or change the bidding documents or the Contract Documents and which will be included as Section L of the Contract Documents for award and construction.

Advertisement
The legally published and/or distributed notification to prospective Bidders and others of the Project and the OWNER's intent to receive bids on same. The Advertisement is included as Section A of these documents.

Agreement
The written agreement between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein. The Agreement is included as Section J of the Bidding/Contract Documents.

Application for Payment
The form accepted by ENGINEER which is to be used by CONTRACTOR in requesting progress or final payments and which is to include such supporting documentation as is required by the Contract Documents, Section H.

Bid
The offer or proposal of the bidder submitted on the prescribed Bid Form setting forth the prices for the Work to be performed. Bid Forms are Section C of these documents.

Bonds
Bid, performance, payment, labor and materialsmen, maintenance and special bonds and other instruments of security. The Bid Bond form is Section D; other Surety Bond forms are Section K of these documents.

Change Order
A document signed by CONTRACTOR and OWNER which authorizes an addition, deletion or revision in the Work or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Agreement.

Contract Documents
The Advertisement, Instructions to Bidders, Bid Form, Bid Bond, General Conditions, Supplemental General Conditions, Technical Specifications, Measurement and Payment, Agreement, Bonds, Addenda and Drawings together with all modifications and supplements issued as Change Orders on or after the Effective Date of the Agreement.

Contract Price
The moneys payable by OWNER to CONTRACTOR under the Contract Documents as stated in the Agreement.

Contract Time
The number of calendar days stated in the Bid Form and in the Agreement for the completion of the Work.

CONTRACTOR
The person(s), firm(s) or corporation(s) with whom OWNER has entered into the Agreement.

Drawings
The drawings, plans, details, supplemental details, graphics, diagrams, photo reproductions and other representations which show the character and scope of the Work to be performed and which have been prepared or approved by ENGINEER and/or the OWNER.

Effective Date of the Agreement
The date indicated in the Agreement on which it becomes effective, but if no such date is indicated it means the date on which the Agreement is signed and delivered by the last of the parties to sign and deliver.

ENGINEER
KLH Engineers, Inc.

General Conditions
Terms pertaining to the Contract and the performance of the Work thereunder that are of frequent and continuing applicability. The General Conditions are included as Section E of these documents.

Laws and Regulations
Laws, rules, regulations, ordinances, codes appertaining to the conduct of and/or location of the work.

Insurance
Protection provided to the parties to the Contract as required by the General Conditions and the Supplemental General Conditions and evidenced by either insurance policies or certificates of insurance coverages. Form of certificate and coverages is included under Section K.

Measurement and Payment
The conditions under which payments are to be determined and made to the CONTRACTOR for Work performed under the Contract or as an addition to or deduction from the Contract. The Measurement and Payment provisions are included as Section H.

Notice of Award
The written notice by the OWNER or ENGINEER to the apparent Successful Bidder stating that the Contract has been awarded to it.

Notice to Proceed
A written notice given by the OWNER or ENGINEER to CONTRACTOR fixing the date on which the Contract Time will commence. When such Notice to Proceed is not issued, the Contract Time will commence on the date appearing in the Agreement (Section J).

OWNER
The private or public agency with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be provided.

Partial Utilization
Placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work.

Project
The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

Resident Project Representative
The authorized representative of the ENGINEER or the OWNER who is assigned to the site or any part thereof, for the purpose of monitoring the construction of the work under this contract.

Shop Drawings
All drawings, diagrams, illustrations, schedules, catalog information and other data which are specifically prepared by or for CONTRACTOR to illustrate some portion of the Work and which are submitted by CONTRACTOR for review and/or approval for incorporation in the Work.

Technical Specifications
Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto. They are Section G of these documents.

Subcontractor
An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

Substantial Completion
The Work (or a specified part thereof) which has progressed to the point where, in the opinion of the OWNER and/or ENGINEER, it is sufficiently complete, in accordance with the Contract Documents, so that the WORK (or specified part) can be utilized for the purposes for which it is intended.

Supplemental Details
Certain drawings, plans, details, characteristic curves, graphics, diagrams, photo reproductions, tabular data or other representation respective to the Work and which are bound in the rear of the Bidding/Contract Documents Book as Section I.

Supplemental General Conditions
The part of the Contract Documents which amends or supplements these General Conditions (if any). They are Section F of these documents.

Supplier
A manufacturer, fabricator, supplier, distributor, materialman or vendor.

Unit Price Work
Work to be paid for on the basis of unit prices.

Work
The entire construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

E2 Preliminary Matters

E2.1 Delivery of Bonds
When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish in accordance with the Contract Documents. The Surety Bond forms are attached as Section K of these documents.

E2.2 Copies of Documents
The CONTRACTOR shall be responsible for purchasing all sets of Contract Documents to be used in the progress of the work. Specification documents will be available for purchase from Accu-Copy Reprographics at the address shown on the Advertisement for the cost of reproduction. Unauthorized reproduction of the drawings or the specifications by the CONTRACTOR shall not be permitted.

E2.3 Public Works Employment Verification Act
The Contractor and any Subcontractor(s) shall participate in the E-Verify Program operated by the United States Department of Homeland Security that electronically verifies employment eligibility for employees (“EVP”) and shall, subject to the requirements of federal law governing the use of EVP, use EVP to verify employment eligibility of each new employee hired after January 1, 2013, whether such employee will be working onsite or offsite of the Work or otherwise. Contractor and any Subcontractor(s) shall prove participation with EVP through providing the Owner with a fully completed and unaltered Public Works Employment Verification Form, as provided by the Pennsylvania Department of General Services, and available at www.dgs.state.pa.us, for each employee hired by the Contractor after January 1, 2013, whether the employee will be working onsite or offsite of the Project or otherwise. Each new employee hired by Contractor or Subcontractor(s) after January 1, 2013 shall be verified within 5 business days of his start date, whether such employee will be working onsite or offsite of the Project or otherwise.

A Subcontractor must submit to the Contractor, and the Contractor must submit to the Owner, a fully complete and unaltered Public Works Employment Verification Form prior to commencing work.

The Contractor and Subcontractor(s) shall maintain documentation of continued compliance with the Public Works Employment Verification Act by utilizing the EVP for new employees hired throughout the duration of the public works contract.

Neither the Contractor nor Subcontractor(s) shall discriminate against an employee on the basis of race, ethnicity, color or national origin while utilizing the EVP for verification purposes.

Contractors and Subcontractor(s) shall cooperate with the Pennsylvania Department of General Services and/or any other competent authorities during any investigation or audit arising under the Act.

Contracts between the Contractor and Subcontractor(s) and Subcontractor(s) with Subcontractor(s) shall contain provisions substantially similar to the following:

“This Agreement is subject to the requirements of the Public Works Employment Verification Act, Act 127 of 2012, 43 P.S. §§ 167.1-167.11, and applicable regulations and guidelines, 4 PA.Code Ch. 66 (the “Act”). Generally, the Act requires that prior to beginning work on a public works contract; Subcontractors are required to submit to the public body awarding the contract a fully completed and unaltered Public Works Employment Verification Form, as provided by the Pennsylvania Department of General Services, and available at www.dgs.state.pa.us. Each new employee hired by Subcontractor after January 1, 2013 shall be verified within 5 business days of his start date, whether such employee will be working onsite or offsite of a public work or otherwise.

The Subcontractor(s) shall maintain documentation of continued compliance with the Public Works Employment Verification Act, Act 127 of 2012, 43 P.S. §§ 167.1-167.11, by utilizing the E-Verify Program for new employees hired throughout the duration of the public works contract. Subcontractor(s) shall not discriminate against an employee on the basis of race, ethnicity, color or national origin while utilizing the E-Verify Program operated by the United States Department of Homeland Security for verification purposes. Subcontractor(s) shall cooperate with the Pennsylvania Department of General Services and/or any other competent authorities during any investigation or audit arising under the Act.”

E2.4 Commencement of Contract Time; Notice to Proceed
The Contract Time will commence on the effective date of the Agreement or, if a Notice to Proceed is given, on the date indicated in the Notice to Proceed. A Notice to Proceed may follow contract award by OWNER by no more than 45 days, unless otherwise specifically noted within Section B, Instructions to Bidders.

E2.5 Starting the Project
CONTRACTOR may start to perform the Work on the date when the Contract Time commences, but no Work shall be done at the site prior to the date on which the Contract Time commences. If scheduled by the Engineer, the CONTRACTOR will be required to attend a pre-construction meeting.

Within ten days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to OWNER or his designee, for review:

- A proposed progress schedule indicating the starting and completion dates of the various stages of the work;

- A schedule of values for all of the Work. This will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction.

Before any Work at the site is started, CONTRACTOR shall deliver to OWNER, with a copy to ENGINEER, certificates, and other evidence of insurance requested by OWNER which CONTRACTOR is required to purchase and maintain in accordance with the Contract Documents.

E3 Intent of the Contract Documents

E3.1 The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the law of the place of the Project.

If, during the performance of the Work, CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, CONTRACTOR shall so report to ENGINEER in writing at once, and

before proceeding with the Work affected thereby shall obtain a written interpretation or clarification from ENGINEER; any work performed by CONTRACTOR without reporting such conflicts, errors, or discrepancies, in writing, to the ENGINEER will be at the CONTRACTOR's risk.

In addition, the requirements of the Contract Documents may be supplemented and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

- ENGINEER'S approval of Shop Drawing(s) or sample(s)

- ENGINEER's written interpretation or clarification

E4 Availability of Lands; Report of Differing Conditions; Underground Facilities; Reference Points

E4.1 Availability of Lands
OWNER shall furnish the lands upon which the Work is to be performed and rights-of-way and easements which, in the opinion of the ENGINEER, are required for construction. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the Contract Documents. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities, specific access routes to the site of the work, or storage of materials and equipment.

E4.2 Report of Differing Conditions
If CONTRACTOR believes that any physical condition uncovered or revealed at the site differs materially from that indicated, reflected or referred to in the Contract Documents, he shall promptly, after becoming aware thereof and before performing any Work in connection therewith (except in an emergency), notify OWNER and ENGINEER in writing about the difference.

E4.3 Underground Facilities
The information and data shown or indicated in the Contract Documents with respect to existing underground utilities, structures and/or other facilities at or contiguous to the site, is based on information and data furnished to OWNER or ENGINEER by the owners of such underground facilities or by others. CONTRACTOR shall have full responsibility for: reviewing and checking all such information and data; for locating all underground facilities; and for coordination of the Work with the owners of such underground facilities during

construction and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price. PA One Call regulation will be used to determine compensation due to the Contractor if required by law.

E4.4 Definition of "Underground Facilities"
For the purposes of this paragraph, the term "underground facilities" includes without limitation: pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems, water, wastewater or stormwater.

E4.5 Reference Points
OWNER will provide certain reference points for construction which in ENGINEER's judgment are adequate to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for surveying and laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point is lost or destroyed or required relocation because of necessary changes in grades or locations and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

E5 Bonds and Insurance

E5.1 Performance and Other Bonds
CONTRACTOR shall furnish Bonds, each in an amount equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents; CONTRACTOR shall also furnish such other Bonds as are required by the Contract Documents. All Bonds shall be in the forms prescribed by the bidding documents or Supplemental General Conditions and be executed by such Sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U. S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

If the Surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of the above paragraph, CONTRACTOR shall within five days thereafter, substitute another Bond and Surety, meeting the OWNER's approval.

E5.2 Contractor's Liability Insurance

CONTRACTOR shall purchase and maintain such insurance as is appropriate for the Work being performed and furnished and will provide protection from claims which may arise out of or result from CONTRACTOR's performance and furnishing of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed or furnished by CONTRACTOR, by any Subcontractor, by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable.

The insurance required shall include the specific coverages and be written for not less than the limits of liability and coverages provided in the Supplemental General Conditions. The Certificate of Insurance included in Section K of these documents shall be required to be completed prior to the commencement of any construction work. All of the policies of insurance required to be purchased and maintained shall contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused, until at least ten days' prior written notice has been given to OWNER and ENGINEER. All such insurance shall remain in effect until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, maintaining, repairing or replacing defective Work.

E6 Certain Responsibilities of the CONTRACTOR

E6.1 Supervision and Superintendence

CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. CONTRACTOR shall be responsible to see that the finished Work complies with the requirements of the Contract Documents.

CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications during construction and before issuance of the Final Payment, given to the superintendent, shall be as binding as if given to CONTRACTOR.

E6.2 Labor, Materials and Equipment

CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Sunday or any legal holiday without OWNER's written consent.

CONTRACTOR shall furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water and sanitary facilities and all other facilities and incidentals necessary for the execution, testing, start-up and completion of the Work.

All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment.

All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable Supplier except as otherwise provided in the Contract Documents; but no provision of any such instructions will be effective to impose on ENGINEER responsibility for the means, methods, techniques, sequences or procedures of construction or for safety precautions or programs incident thereto.

E6.3 Adjusting Progress Schedule

CONTRACTOR shall submit to ENGINEER adjustments in the progress schedule to reflect the impact thereon of new developments; these will conform generally to the progress schedule then in effect and additionally will comply with any provisions of the Contract Documents applicable thereto. Progress schedules shall be updated on a monthly basis and be submitted for review and discussion at the regularly scheduled progress meetings.

E6.4 Substitutions

Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other Suppliers may be approved if sufficient information is submitted by CONTRACTOR to allow ENGINEER to determine that the material or equipment proposed is equivalent to that named. The OWNER's decision to accept or not accept substitutions (either conditionally or otherwise) will be final.

E6.5 Concerning Subcontractors, Suppliers and Others

CONTRACTOR shall not employ any Subcontractor, Supplier (including those who are to furnish the principal items of materials or equipment) or other person or organization to perform or furnish any of the Work whether initially or as a substitute, without the prior written approval of the OWNER. Acceptance of any such Subcontractor, Supplier or other person or organization by OWNER or ENGINEER shall not constitute a waiver of any right of OWNER or ENGINEER to reject defective Work or any Work which may otherwise not be in conformance with the Contract Documents. Contracts with Subcontractors shall contain the information required by Section E2.3, supra, and Subcontractors shall not be authorized to commence any of the Work without the Owner having received a fully completed and unaltered Public Works Employment Verification Form, available at www.dgs.state.pa.us.

CONTRACTOR shall be fully responsible to OWNER and ENGINEER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create any contractual relationship between OWNER or ENGINEER and any such Subcontractor, Supplier or other person or organization, nor

shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any Subcontractor, Supplier or other person or organization.

The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or delineating the Work to be performed by any specific trade.

All Work performed for CONTRACTOR by a Subcontractor will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor which specifically binds the Subcontractor to all terms and conditions of the Contract Documents.

E6.6 Indemnity

CONTRACTOR agrees to protect, defend, indemnify, exonerate and hold OWNER and ENGINEER harmless from and against any and all suits, claims, liability, losses, liens and demands, fines, costs, criminal and civil penalties, cause of action or any other obligations arising out of or in any manner connected with incidents involved in bodily injury, death, property damage or any violation or alleged violation of any federal, state, provincial or local law or regulation, except as solely caused by the OWNER and/or ENGINEER.

E6.7 Permits

Unless otherwise provided in the Supplemental Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids.

E6.8 Laws and Regulations

CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ENGINEER shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

If CONTRACTOR observes that the Specifications or Drawings are at variance with any Laws or Regulations, CONTRACTOR shall give ENGINEER prompt written notice thereof, and any necessary changes will be authorized. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to such Laws or Regulations and without such notice to ENGINEER, CONTRACTOR shall bear all costs arising therefrom.

E6.9 Taxes

CONTRACTOR shall pay all sales, consumer, use, business and occupation and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

E6.10 Use of Premises

CONTRACTOR shall confine its work on the Project site and land and areas to which the OWNER holds title, rights-of-way, permits, or easements. Contractor shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the Work. Should any claim be made against OWNER or ENGINEER or resulting from the acts and/or deeds of the CONTRACTOR, its agent and/or employees, or invitees, CONTRACTOR shall promptly attempt to settle with such other party by agreement or otherwise resolve the claim by arbitration or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold OWNER and ENGINEER harmless from and against all claims, damages, losses and expenses (including, but not limited to, fees of engineers, architects, attorneys and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any such other party against OWNER or ENGINEER arising in whole, or in part, out of CONTRACTOR's performance of the Work.

During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials, and shall leave the site clean and ready for occupancy by OWNER. CONTRACTOR shall restore the original condition all property not designated for alteration by the Contract Documents.

CONTRACTOR shall not impose any load nor permit any part of any structure or pipeline to be loaded in any manner that will endanger said structures or pipelines, nor shall CONTRACTOR subject any part of the work or adjacent property to stresses or pressures that will endanger it.

E6.11 Record Documents

In addition to any requirements imposed by law or regulations, CONTRACTOR shall maintain at the site one record copy of all Drawings, Specifications, Addenda, Change Orders, and written interpretations and clarifications in good order and annotated to show all changes made during construction. Said documents together with all approved Shop Drawings will be available to OWNER for reference. Upon completion of the Work, the documents, samples and Shop Drawings will be delivered to the OWNER.

E6.12 Safety and Protection

CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

- All employees on the Work and other persons who may be affected thereby.

- All the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, and

- Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and utility owners when prosecution of the Work may affect them, and shall cooperate with utility owners in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier or person directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR at CONTRACTOR's sole cost (except damage or loss caused solely by the negligent acts or omissions of OWNER or ENGINEER). Nothing herein shall be construed to impose any obligation upon the OWNER or ENGINEER to supervise, inspect or otherwise police the CONTRACTOR's

observance of these or any other safety standards or render either of them liable to third parties for any failure of the CONTRACTOR in observance of the requirements of this paragraph.

E6.13 Emergencies

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from ENGINEER or OWNER, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give ENGINEER prompt written notice if he believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If OWNER determines that a change in time or contract sum is required because of the action taken in response to an emergency, a Change Order will be issued to document the consequences of the changes.

E6.14 Shop Drawings and Samples

After checking and verifying all field measurements and compliance with applicable procedures specified in the Contract documents CONTRACTOR shall submit to ENGINEER for review and approval a minimum of six copies of all Shop Drawings. The data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance criteria, materials and similar data, as well as specification exceptions and deviations to enable ENGINEER to review the information with respect to requirements of the Contract Documents.

CONTRACTOR shall also submit to ENGINEER for review and approval with such promptness as to cause no delay in Work, all samples required by the Contract Documents. All samples shall be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended.

Before submission of each Shop Drawing or sample, CONTRACTOR shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each Shop Drawing or sample with other Shop Drawings and samples and with the requirements of the Work and the Contract Documents.

ENGINEER will review and return within twenty-one calendar days of the receipt thereof all Shop Drawings and samples, but ENGINEER's review and approval will be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend

to means, methods, techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence, or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit new samples as required for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

ENGINEER's review and approval of Shop Drawings or samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to each such variation at the time of submission. Any approval by ENGINEER shall not relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings or coordination with the detailed plans and/or other Shop Drawings.

No work associated with information provided with the shop drawings shall be permitted until the same information is returned approved by the ENGINEER. Any work performed without shop drawing approval shall be performed at the CONTRACTOR’s risk and responsibility.

E6.15 Continuing the Work
CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements.

E7 Other Work

E7.1 Related Work at Site
OWNER may perform other work related to the Project at the site by OWNER's own forces, have other work performed by utility owners or let other direct contracts therefore which shall contain General Conditions similar to these. If the fact that such other work is to be performed was not noted in the Contract Documents, notice thereof will be given to CONTRACTOR by the OWNER or his representative prior to starting any such other work; and, if CONTRACTOR believes that such performance will involve additional expense to CONTRACTOR or required additional time and the parties are unable to agree as to the extent thereof, CONTRACTOR may make a claim therefore.

CONTRACTOR shall afford each utility owner and other contractor who is a party to such a direct contract (or OWNER, if OWNER is performing the additional work with OWNER's employees), proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such work and shall properly connect and coordinate the Work with theirs. CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and the others whose work will be affected.

If any part of CONTRACTOR's Work depends upon proper execution or results on the work of any other contractor or utility owner, CONTRACTOR shall inspect and promptly report to ENGINEER in writing any delays, defects or deficiencies in such work that render it unavailable or unsuitable for proper execution and results. CONTRACTOR's failure to report will constitute an acceptance of the other work as fit and proper for integration with CONTRACTOR's Work except for latent or non apparent defects and deficiencies in the other work.

E7.2 Coordination

If OWNER contracts with others for the performance of other work on the Project at the site, the person or organization who will have authority and responsibility for coordination of the activities among the various prime contractors (the "Coordinating Contractor") may be identified in the Supplemental General Conditions and the specific matters to be covered by such authority and responsibility will be itemized and the extent of such authority and responsibilities will be provided in the Supplemental General Conditions. Notwithstanding any of the above, neither the OWNER nor the ENGINEER assumes any responsibility for the coordination of the activities or the work among the various prime contractors. In the event that any contractor is delayed by the coordinating contractor or any other contractor, it shall have no claim or cause of action against the OWNER or ENGINEER and its exclusive remedy for such delay shall be against the CONTRACTOR or coordinating contractor responsible for the delay. The ENGINEER's interpretation shall be final and binding upon all interested parties.

E7.3 Clarifications and Interpretations
ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents.

E8 Changes in the Work

E8.1 Without invalidating the Agreement and without notice to any surety, OWNER may, at any time order additions, deletions or revisions in the Work; these will be authorized by a Change Order. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the changes in the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

E8.2 OWNER and CONTRACTOR shall execute appropriate Change Orders covering:

- Changes in the Work which are ordered by OWNER pursuant to the foregoing paragraph; are required because of acceptance of defective Work at the Owner's option; or are agreed to by the parties;

- Changes in the Contract Price or Contract Time which are agreed to by the parties; and

- Changes in the Contract Price or Contract Time which embody the substance of any written decision rendered by ENGINEER; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable law, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule.

E9 Change of Contract Price

E9.1 The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at his expense without change in the Contract Price.

E9.2 The Contract Price may only be changed by a Change Order.

Any claim for an increase or decrease in the Contract Price shall be based on written notice outlining the bases for the claim and be delivered by the party making the claim to the other party promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty days after such occurrence and shall be accompanied by claimant's written statement that the amount claimed covers all known amounts (direct, indirect and consequential) to which the claimant is entitled as a result of the occurrence of said event.

E9.3 The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

- Where the Work is covered by unit prices contained in the Contract Documents, value shall be determined by application of unit prices to the quantities of the items involved.

- By mutual acceptance of an agreed price, if work is not covered by unit prices.

- If the Work is not covered by unit prices and the parties are unable to agree upon a price, the value shall be determined on the basis of the Cost of the Work, plus a Contractor's Fee for overhead and profit, the total amount of which shall be determined on the basis of the sum of the following items (1) through (6):

  (1) The actual cost to the CONTRACTOR or subcontractor, if employed by the CONTRACTOR, of labor, including foremen (but not including superintendence), said cost to include Base Wages, Social Security (FICA) payments, Federal and State Unemployment Compensation payments and Workmen's Compensation payments;

  (2) The actual cost to the CONTRACTOR or subcontractor of materials and equipment utilized or being installed permanently into the work; and, expendable materials necessary for the conduct and performance of the work (as approved prior to performance of the work) -- the cost of

all such approved permanent and expendable materials to be reconciled from suppliers' invoices;

(3) The rental cost of construction machinery and equipment during the time of use on the extra work, said rental rates to be 75% of those published in daily, weekly and/or monthly rate schedules of a recognized Contractors' association;

(4) The actual cost of power and any other necessary utility services;

(5) Business and occupation, sales and/or other applicable taxes;

(6) An allowance for Profit and Overhead -- to be determined by calculating the sum of the following:

(a) The resultant obtained by multiplying the Base Wages referred to in paragraph (1) above times a factor of 0.15;

(b) The resultant obtained by multiplying the actual cost of materials and equipment referred to in paragraph (2) above times a factor of 0.05;

(c) The resultant obtained by multiplying the cost of extra work if performed by subcontractor times a factor of 0.02.

E10 Change of Contract Time

E10.1 The Contract Time may only be changed by a Change Order. Any claim for an extension or shortening of the Contract Time shall be based on written notice outlining the basis for the claim and be delivered by the party making the claim to the other party and to ENGINEER promptly (but in no event later than thirty days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim with supporting data shall be delivered within sixty days after such occurrence and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to

believe it is entitled as a result of the occurrence of said event. Any failure to comply with the time limit set forth herein shall constitute a waiver of the CONTRACTOR's right to claim.

E11 Warranty and Guarantee; Access to Work; Tests and Inspections; Owner May Stop Work; Correction, Removal or Acceptance of Defective Work

E11.1 Warranty and Guarantee
CONTRACTOR warrants and guarantees to OWNER that all Work will be in accordance with the Contract Documents and is not defective. Notice of all defects shall be given to CONTRACTOR after the same are detected. All defective Work, whether or not in place, shall be rejected and promptly corrected in accordance with paragraph E11.5.

E11.2 Access to Work
ENGINEER and ENGINEER's representatives, other representatives of OWNER, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspection and testing. CONTRACTOR shall provide proper and safe conditions for such access.

E11.3 Tests and Inspections
CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals.

If Laws and Regulations of any public body having jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, CONTRACTOR shall assume full responsibility therefore, pay all costs in connection therewith and furnish OWNER the required certificates of inspection, testing or approval. CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with OWNER's or ENGINEER's acceptance of a Supplier of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work.

E11.4 Owner May Stop the Work
If the Work is defective or CONTRACTOR fails to supply sufficient skilled workmen or suitable materials or equipment, or fails to perform the Work in accordance with the Contract Documents, the OWNER acting through an authorized

representative, may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any other party.

E11.5 Correction or Removal of Defective Work

If required by ENGINEER, CONTRACTOR shall, as directed, either correct all defective Work, or work that does not comply with the Contract Documents, or remove it from the site and replace it with non defective Work or Work that does comply with the Contract Documents. CONTRACTOR shall bear all direct, indirect and consequential costs of such correction or removal (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby.

E11.6 Eighteen Month Correction Period

If within 18 months after the date of Substantial Completion, any Work is found to be defective, or not in compliance with the Contract Documents, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions, either correct such defective Work or work that does not comply with the contract documents or remove it from the site and replace it with non defective Work or work that does comply with the Contract Documents. If CONTRACTOR does not comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all direct, indirect and consequential costs of such removal and replacement (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) will be paid by CONTRACTOR. In special circumstances where a particular item of equipment is placed in continuous service before Substantial completion of all the Work, the correction period for that item may begin from an earlier date if so provided in the Technical Specifications. The rights and remedies of the OWNER hereunder are in addition to and not in limitation of all other rights and remedies of the OWNER for any breach by the CONTRACTOR of any provision of the Contract Documents regardless of when detected.

E11.7 OWNER May Correct Defective Work

If CONTRACTOR fails, within the specified time given in written notice by OWNER, to proceed to correct defective Work or to remove and replace rejected Work or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents or if CONTRACTOR fails to comply with any other provision of the

Contract Documents, OWNER may, after seven days' written notice to CONTRACTOR, correct and remedy any such deficiency. To the extent necessary to complete corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees such access to the site as may be necessary to enable OWNER to exercise the rights and remedies under this paragraph. All direct, indirect and consequential costs of OWNER in exercising such rights and remedies will be charged against CONTRACTOR, and OWNER shall be entitled to an appropriate decrease in the Contract Price. Such direct, indirect and consequential costs will include but not be limited to fees and charges of engineers, architects, attorneys and other professionals required and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR's defective Work. CONTRACTOR shall not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies hereunder.

E12 Termination

E12.1 Owner May Terminate the Work
Upon the occurrence of any one or more of the following events the OWNER may terminate the work:

(a) If CONTRACTOR commences a voluntary case under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect or if CONTRACTOR takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating to the bankruptcy or insolvency and the OWNER does not receive adequate assurances from the CONTRACTOR and Trustee in Bankruptcy, and the CONTRACTOR's surety that the CONTRACTOR will complete the Contract in accordance with the terms thereof and at the time specified therein within 20 days of the filing of such petition;

(b) If a petition is filed against CONTRACTOR under any chapter of The Bankruptcy Code as now or hereafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar relief against CONTRACTOR under any other federal or state law in effect at the time relating to bankruptcy or insolvency and the OWNER does not receive adequate assurances from the CONTRACTOR, any Trustee in Bankruptcy and the CONTRACTOR's Surety that the CONTRACTOR will complete the Contract in accordance with the terms thereof and at the time specified therein within 20 days of the filing of such petition;

(c) If CONTRACTOR makes a general assignment for the benefit of creditors;

(d) If a trustee, receiver, custodian or agent of CONTRACTOR is appointed under applicable law or under contract, whose appointment or authority to take charge or property of CONTRACTOR is for the purpose of enforcing a lien against such property for the general administration of such property for the benefit of CONTRACTOR's creditors;

(e) If CONTRACTOR admits in writing an inability to pay its debts generally as they become due;

(f) If CONTRACTOR, in the opinion of the ENGINEER, persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workmen or suitable materials or equipment or failure to adhere to the progress schedule as revised from time to time);

(g) If CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction.

OWNER may, after giving CONTRACTOR and Surety seven days' written notice and to the extent permitted by law, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR'S tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are

stored elsewhere, and finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price (less any liquidated damages which may be imposed because of the CONTRACTOR's failure to complete the Contract within the time period set forth in the Contract Documents) exceeds the direct, indirect and consequential costs of completing the Work such excess will be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER, plus any liquidated damages. Such costs incurred by OWNER will be reviewed as to reasonableness by ENGINEER, but when exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.

Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR or Surety Company then existing or which may thereafter accrue, including their liability to OWNER of liquidated damages because of CONTRACTOR's failure to complete the work within the contract time. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR or Surety Company from liability.

Upon seven days' written notice to CONTRACTOR, OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such case, CONTRACTOR shall be paid for all Work executed and expenses sustained plus reasonable termination expenses.

No payment will be paid to CONTRACTOR for profits applicable to the uncompleted work or for damages of any kind regardless of whether the termination is a termination for convenience or a termination for fault. If the OWNER terminates the CONTRACTOR for fault and a court, arbitrator, or other body having jurisdiction over this Contract determines that such termination was wrongful, the termination will be deemed a termination for convenience and the rights and remedies of the CONTRACTOR will be limited to such rights and remedies he would have had if the Contract had been terminated for the OWNER's convenience pursuant to Section E12.2 hereof.

E12.2 Owner May Terminate for Convenience

The OWNER reserves the right to terminate this Contract for its convenience, without any fault upon the part of the CONTRACTOR, at any time in its sole discretion. If termination for convenience occurs prior to commencement of work by the

CONTRACTOR, the OWNER will pay the CONTRACTOR reasonable mobilization costs the CONTRACTOR incurred prior to notice of termination, but no payment will be made for the CONTRACTOR's costs in bidding and entering into the Contract, loss of profits, or damages of any kind. If the OWNER terminates the contract for its convenience after the CONTRACTOR has commenced work, the OWNER will pay the CONTRACTOR any retentions due on previously approved estimates, the value of the work installed by the CONTRACTOR since the last approved estimate, and reasonable demobilization expenses. No payment will be made for any loss of profit on the omitted work or damages of any kind.

E12.3 Contractor May Stop Work or Terminate

If, through no act or fault of CONTRACTOR, the Work is suspended by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within forty-five days after it is submitted, or OWNER fails for thirty days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven days' written notice to OWNER terminate the Agreement and recover from OWNER payment for all Work executed and any expense sustained plus reasonable termination expenses, unless the OWNER cures the default within seven days of receipt of the written notice from the CONTRACTOR. In addition and in lieu of terminating the Agreement, if ENGINEER has failed to act on an Application for Payment or OWNER has failed to make any payment as aforesaid, CONTRACTOR may upon seven days' written notice to OWNER stop the Work until payment of all amounts then due. The provisions of this paragraph shall not relieve CONTRACTOR of his obligations to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with OWNER.

E13 Miscellaneous

E13.1 Giving Notice

Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

E13.2 Acceptance of Final Payment Constitutes Release

The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the OWNER of all claims and all liability to the Contractor for all things done or furnished in

connection with this work and for every act and neglect of the OWNER and the ENGINEER and others relating to or arising out of this work. No payment, however final or otherwise, shall operate to release the CONTRACTOR or his Sureties from any obligations under this Contract, under the Performance Bond or Payment Bond.

E13.3 Payments by Contractor

The CONTRACTOR shall pay: (a) for all transportation and utility services not later than the 15th day of the calendar month following that in which services are rendered; (b) for all materials, tools, and equipment not later than the 28th day of the calendar month following that in which such materials, tools and equipment are delivered at the site of the project and the balance of the cost thereof, not later than the 30th day following the completion of installation, and testing where applicable, of that part of the work in or on which such materials, tools and equipment are incorporated or used, and; (c) to each of his Subcontractors, not later than the 14th day following each progress, periodic or final payment to the CONTRACTOR, the respective amounts allowed the CONTRACTOR on account of the work performed by his Subcontractors to the extent of each Subcontractor's interest therein.

E13.4 Assignments

The CONTRACTOR shall not assign the whole or any part of this Contract or moneys due to become due hereunder without written consent of the OWNER. In case the CONTRACTOR assigns all or any part of the moneys due or to become due under this Contract, the instrument of assignment shall contain a clause substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the CONTRACTOR shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for the performance of the work called for in this Contract.

E13.5 Engineer's Decisions

While the ENGINEER will endeavor to interpret the Contract and render his decisions in a fair and unbiased manner, his exercise of such interpretation shall not give rise to any duty or responsibility to the CONTRACTOR or to any Subcontractor and he shall not be liable to the CONTRACTOR or any Subcontractor for any interpretation, decision or measurement made pursuant to Paragraph E3.1, E6.4 or any other provision of the Contract Documents.

E13.6 Work Hours/Schedule
The CONTRACTOR must provide the OWNER/ENGINEER with a written schedule of proposed activities prior to commencement of any work on the project. The written schedule shall include adequate detail to allow determination of work to be completed within any given week. The schedule shall be updated on a monthly basis throughout the length of the contract if work is not progressing as outlined in the original schedule. The schedule shall include the number of days per week and hours per day the CONTRACTOR proposes to work. The OWNER/ENGINEER shall be given a one week notice of any work schedule changes.

E13.7 Night and Weekend Work
The CONTRACTOR shall confine his work schedule to a Monday through Friday, dawn to dusk schedule. Any work the CONTRACTOR proposes to perform at night or on weekends must receive prior (3 days notice) written approval of the OWNER.

E14 Dispute Resolution

E14.1 Either owner or Contractor may request in writing mediation of any Claim submitted to Engineer for a decision before such decision becomes final and binding. If the parties agree to mediation, it shall be conducted by a single mediator mutually agreed upon by the parties. The parties shall share equally in the cost/fees /expenses in connection with the mediation. The mediation shall be conducted at a location in Beaver County agreed upon by the parties and if no agreement as to the location can be reached, the site of the mediation shall be the Beaver County Bar Association Building located at 788 Turnpike Street Beaver Pa 15009. Timely submission of the request to mediate shall stay the effect of Paragraph E13.5.

E14.2 Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of the making of the request to mediate. The date of the termination of the mediation shall be determined by the mediator.

E14.3 If the Claim is not resolved by mediation, Engineer's decision shall become final and binding 30 days after the termination of the mediation unless, within that time period, Owner or Contractor gives written notice to the other party of their intent to resolve the Claim thorough the civil court system in the Court of Commons Pleas of Beaver County, Pennsylvania.

E14.4 Arbitration is not an acceptable form of dispute resolution.

End of Section E

General Conditions

Section F

SUPPLEMENTAL GENERAL CONDITIONS

F1 Required Contractors Insurance Coverages

Under Section E5 of the General Conditions certain stipulations are set forth regarding Contractor's Liability Insurance, Property Insurance, Receipt and Application of Proceeds and Partial Utilization -- Property Insurance. All policies of insurance shall name the CONTRACTOR as the insured party. The CONTRACTOR and his insurance agent shall be required to complete the Certificate of Insurance appended in Section K of the Contract Documents prior to, or at the time that the Agreement is executed and the surety bonds are posted by the CONTRACTOR. OWNER and KLH Engineers, Inc. shall be an additional insured with respect to liability arising out of and from the work performed by CONTRACTOR for OWNER. Insurer waives all right of subrogation against OWNER, its clients, its employees, and/or KLH Engineers, Inc. The insurance coverage under the insurance contract is primary to any comparable liability insurance carried by the OWNER or its agent. The specific coverages required to be provided prior to commencement of construction by the CONTRACTOR and any and all subcontractors on this project shall be as follows:

F1.0 INSURANCE

CONTRACTOR shall obtain insurance of the types and in the amounts described below. The insurance shall be written by insurance companies with an A. M. Best rating of A- or better and on forms acceptable by OWNER.

F1.1 COMMERCIAL GENERAL AND UMBRELLA LIABILITY INSURANCE

CONTRACTOR shall maintain commercial general liability (CGL) and, if necessary, commercial umbrella insurance with a limit of not less than $2,000,000 each occurrence. If such CGL insurance contains a general aggregate limit, it shall apply separately to the Project.

F1.1.1 CGL insurance shall be written on ISO occurrence form CG 00 01 (or a substitute form providing equivalent coverage) and shall cover liability arising from premises, operations, independent contractors, products-completed operations, and personal injury and advertising injury.

F1.1.2 OWNER and KLH Engineers, Inc. shall be added by endorsement as named additional insureds under the CGL and under the commercial umbrella, if any. This insurance,

including insurance provided under the commercial umbrella, if any, shall apply as primary insurance with respect to any other insurance or self-insurance programs providing coverage to Owner and/or KLH Engineers, Inc. and shall at a minimum provide to Owner and KLH Engineers, Inc. the same coverage, as that provided to Contractor, including completed operations coverage and shall provide coverage to Owner and KLH Engineers, Inc. for any liability arising from or in any way related to Contractor's work, regardless of any alleged or actual apportionment of negligence or liability.

F1.1.3 There shall be no endorsement or modification of the CGL limiting the scope of coverage for liability arising from pollution, explosion, collapse, or underground property damage.

F1.1.4 Waiver of Subrogation Contractor waives all rights against Owner and/or KLH Engineers, Inc. and their agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the commercial general liability or commercial umbrella liability insurance maintained pursuant to paragraph F.1 of this Agreement.

F1.1.5 Continuing CGL Coverage Contractor shall maintain commercial general liability (CGL) and, if necessary, commercial umbrella liability insurance, with a limit of not less than $2,000,000 each occurrence for at least 3 years following substantial completion of the Work.

F1.1.5.1 Continuing CGL insurance shall be written on ISO occurrence form CG 00 01 (or substitute form providing equivalent coverage) and shall, at minimum, cover liability arising from products-completed operations and liability assumed under an insured contract.

F1.1.5.2 Continuing CGL insurance shall have a products-completed operations aggregate of a least two times its each occurrence limit or provide aggregate limits per location/project.

F1.1.5.3 Continuing commercial umbrella coverage, if any, shall include liability coverage for damage to the insured's completed Work equivalent to that provided under ISO form CG 00 01.

F1.2 OWNERS AND CONTRACTORS PROTECTIVE LIABILITY INSURANCE
The Contractor shall maintain Owners and Contractors Protective Liability (OCP) insurance on behalf of Owner, as named insured, with a limit of $2,000,000.

F1.3 PA DOT PROTECTIVE LIABILITY INSURANCE
If applicable to the Project, Contractor shall maintain PA DOT protective liability insurance on behalf of Creswell Heights Joint Authority, as named insured with a limit of the bid amount.

F1.4 BUSINESS AUTO AND UMBRELLA LIABILITY
Contractor shall maintain business auto liability and, if necessary, commercial umbrella liability insurance with a limit of not less than $2,000,000 each accident.

F1.4.1. Such insurance shall cover liability arising out of any auto (including owned, hired and non-owned autos).

F1.4.2 Business auto coverage shall be written on ISO form CA 00 01, CA 00 05, CA 00 12, CA 00 20, or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in the 1990 and later editions of CA 00 01.

F1.4.3 If the Contract Documents require Contractor to remove and haul hazardous waste from the Project site, or if the Project involves such similar environmental exposure, pollution liability coverage equivalent to that provided under the ISO Pollution Liability-Broadened Coverage for Covered Autos Endorsement (CA 99 48) shall be provided, and the Motor Carrier Act Endorsement (MCS 90) shall be attached.

F1.4.4 Waiver of Subrogation Contractor waives all rights against Owner and its agents, officers, directors and employees for recovery of damages to the extent these damages are covered by the business auto liability or commercial umbrella liability insurance obtained by Contractor pursuant to Paragraph F1.4 of this Agreement or under any applicable auto physical damage coverage.

F1.5 WORKERS COMPENSATION INSURANCE
Contractor shall maintain workers compensation and employers liability insurance.

F1.5.1 The employers liability, and if necessary commercial umbrella, limits shall not be less than $2,000,000 each accident for bodily injury by accident or $2,000,000 each employee for bodily injury by disease.

F1.5.2 Where applicable, U.S. Longshore and Harborworkers compensation Act Endorsement shall be attached to the policy.

F1.5.3 Where applicable, Outer Continental Shelf Lands Act Endorsement shall be attached to the policy.

F1.5.4 Where applicable, Maritime Coverage Endorsement shall be attached to the policy.

F1.6 PROPERTY INSURANCE

F1.6.1 Contractor shall purchase and maintain in force property insurance for the entire Work. Such insurance shall be written in an amount at least equal to the initial contract sum as well as subsequent modifications of that sum. The insurance shall apply on a replacement cost basis. If the insurance obtained in compliance with this Paragraph F1.6 is builders risk insurance, coverage shall be written on a completed value form.

F1.6.2 The insurance as required in Subparagraph F1.6.1 shall include the interests of the Owner, Contractor, and all subcontractors and sub-subcontractors on the Project. The insurance policy shall contain a provision that the insurance will not be canceled or allowed to expire until at least 30 days prior written notice has been given to Owner.

F1.6.3 The insurance as required in Subparagraph F1.6.1 shall cover the entire Work at the site identified in this Agreement and shall also cover portions of the Work located away from the site but intended for use at the site, and shall also cover portions of the Work in transit. The policy shall include as insured property scaffolding, false work, and temporary buildings located at the site. The policy shall cover the cost of removing debris, including demolition as may be made legally necessary by the operation of any law, ordinance, or regulation.

F1.6.4 Contractor shall purchase and maintain boiler and machinery insurance if such equipment is part of the Work identified in this Agreement required by the contract

documents or by law, covering insured objects during installation and until final acceptance by Owner. This insurance shall include the interests of the Owner, Contractor and all subcontractors and sub-subcontractors in the Work.

F1.6.5 The insurance as required by paragraph F1.6 shall be written to cover all risks of physical loss except those specifically excluded in the policy, and shall inure at least against the perils of fire, lightning, explosion, windstorm or hail, smoke, aircraft or vehicles, riot or civil commotion, theft, vandalism, malicious mischief, and collapse.

F1.6.6 Any deductible applicable to the insurance purchased in compliance with this Paragraph 6.6 shall be paid by Contractor.

F1.6.7 The insurance as required by this Paragraph F.6 shall be maintained in effect, unless otherwise provided for in the contract documents, until the earliest of the following dates:

(a) The date on which all persons or organizations who are insureds under the policy agree that it shall be terminated;
(b) The date on which final payment, as provided for in this Agreement, has been made;
(c) The date on which the insurable interests in the property of all insureds other than Contractor have ceased.

F1.6.8 Before the commencement of Work, Contractor shall provide to Owner a copy of the insurance policy obtained in compliance with this Paragraph F.6.

F1.6.9 Before the commencement of Work, Owner may declare to Contractor any decision on its part that the Owner will obtain any or all of the insurance coverage as required in this Paragraph F.6. Upon such declaration, Owner shall then have the right to obtain insurance equivalent in coverage to that required in this Paragraph F.6 and by appropriate change order, charge the cost of such insurance to Contractor.

F1.6.10 Waiver of Subrogation Owner and Contractor waive all rights against each other and each of their subcontractors, sub-subcontractors, officers, directors,

agents, and employees for recovery for damages caused by fire and other perils to the extent covered by builders risk or property insurance applicable to the Work.

F1.6.11 Partial occupancy or use of the Work shall not commence until the insurance company or companies providing insurance as required in this Paragraph F.6 have consented to such partial occupancy or use. Owner and Contractor shall take reasonable steps to obtain consent of the insurance company or companies, and agree to take no action, other than upon mutual written consent, with respect to occupancy or use of the Work that could lead to cancellation, lapse, or reduction of insurance.

F1.7 EVIDENCE OF INSURANCE

Prior to commencing the Work, Contractor shall furnish Owner with a certificate(s) of insurance, executed by a duly authorized representative of each insurer, setting out compliance with the insurance requirements set forth above.

F1.7.1 All certificates shall evidence the addition by endorsement of Owner and KLH Engineers, Inc. as “Additional Insured with respect to any claims and/or liability arising from, or in any way related to, the work performed by the insured, regardless of any alleged or actual apportionment of negligence or liability.”

F1.7.2 All certificates shall provide for 30 days written notice to Owner prior to the cancellation or material change of any insurance referred to therein.

F1.7.3 The words “endeavor to” and “but failure to mail such notice shall impose no obligation or liability of any kind upon the company, its agents or representatives” shall be deleted from the cancellation provision of all certificates provided by Contractor.

F1.7.4 Failure of Owner to demand such certificate or other evidence of full compliance with these insurance requirements or failure of Owner to identify a deficiency from evidence that is provided shall not be construed as a waiver of Contractor’s obligation to maintain such insurance.

F1.7.5 Owner shall have the right, but not the obligation, to prohibit Contractor or any subcontractor from entering the Project site until such certificates or other evidence that insurance has been placed in complete compliance with these requirements is received and approved by Owner.

F1.7.6 Failure to maintain the insurance as specified shall constitute an event of default pursuant to the terms of this Agreement and shall allow Owner to terminate this Agreement at Owner's option. If Contractor fails to maintain the insurance as set forth herein, Owner shall have the right, but not the obligation, to purchase said insurance at Contractor's expense.

F1.7.7 With respect to insurance maintained after final payment in compliance with a requirement above, an additional certificate(s) evidencing such coverage shall be promptly provided to Owner when requested.

F1.7.8 Contractor shall provide certified copies of all insurance policies required above with 10 days of Owner's written request for said copies.

F1.8 GENERAL INSURANCE PROVISIONS

F1.8.1 No Representation of Coverage Adequacy By requiring the insurance as set out in F. Insurance, Owner does not represent that coverage and limits will necessarily be adequate to protect Contractor, and such coverage and limits shall not be deemed a limitation on Contractor's liability under the indemnities provided to Owner in this Agreement, or any other provision of the Contract Documents.

F1.8.2 Cross-Liability Coverage If Contractor's liability policies do not contain the standard ISO separation of insureds provision, or a substantially similar clause, they shall be endorsed to provide cross-liability coverage.

F1.8.3 The insurance requirements set out in this specification are independent from all other obligations of Contractor under this Agreement and apply whether or not required by any other provision of this Agreement.

F1.8.4 Subcontractor's Insurance Contractor shall cause each subcontractor employed by Contractor to purchase and maintain insurance of the type specified. When requested by Owner, Contractor shall furnish to Owner copies of certificates of insurance evidencing coverage for each subcontractor.

F2 Photographs

Pre-construction and post construction video (DVD) records are required and are essential to completion of this project. Pre-construction photographs (CD) and video (DVD) shall be submitted with the shop drawing submittals. No payment shall be made until all preconstruction photographs and video (DVD) are provided to the OWNER. All photographs shall be submitted printed bound and in DVD and/or CD format.

CONTRACTOR shall take all still photographs of areas prior to, during, and at completion of project. Photographs are to be, identified and cataloged with a site plan indicating where the photograph was taken and which direction it was shot with a date and time stamp. Any notes the CONTRACTOR deems necessary should also be included on the photograph or on the photograph log.

CONTRACTOR shall video work area prior to, and at completion of the project. Documentation shall be color DVD format. Discs shall be submitted labeled (typewritten) as to their location, date and time of information filmed. All DVD’s shall be numbered referenced to contract drawings identifying location and contract drawing number and shall include close inspection of all equipment, structures and improved areas to be disturbed by construction activities, especially streets, roads, lanes, driveways, bridges, streams, improved scrubbed/planting bed, and lawns. Improved lawns are areas regularly maintained by a property owner regardless of the number of trees. Pre-construction video tapes of all construction through unimproved areas are required and shall be submitted prior to work commencing through those areas, and shall include video along the alignment of the construction stake out and identify topographic features/wooded areas to be disturbed.

All videos and photographs taken during or post construction shall be submitted at the conclusion of the project to the OWNER and will become the property of the OWNER.

F3 Construction Inspection

The day-to-day inspection work on this project will be performed by a Project Representative directly employed by the OWNER and/or the ENGINEER. Each contractor's superintendent shall coordinate all construction activities with that individual who shall refer such matters as he deems necessary to the OWNER and the ENGINEER, or others, as circumstances may be required.

F4 Progress Meetings on the Job Site

Periodic job progress meetings will be scheduled on at least a monthly basis for the purpose of coordinating the work of all

contractors, reconciling construction problems and/or discussing any other project related matters. The ENGINEER will call those meetings with advance notification of several days. CONTRACTOR's superintendents and/or other authorized administrative personnel will be expected to be present.

F5 Prevailing Minimum Wage Predetermination

The Pennsylvania State Department of Labor and Industry has made a minimum wage determination applicable to all construction work performed under this project. The "Decision of the Secretary"; the Contractor's or Subcontractor's Weekly Payroll Certification for Public Works Projects" form (which will be required to be properly sworn and submitted weekly to the OWNER during the Progress of the work); and the "Prevailing Minimum Wage Predetermination" dated February 25, 2021 follows Section F.

F6 Contract Close-out Documents

Upon completion of the contract, the CONTRACTOR and/or Contractor's surety shall be required to complete the following documents appended on Pages F-13 thru F-18:

Affidavit of Payment and Release of Liens
Acceptance of Final Payment and General Release
Consent of Surety Company to Final Payment

F7 Claims for Damages

Under this Contract, the CONTRACTOR shall not be entitled to seek additional compensation for delays, loss of anticipatory profits, or consequential damages.

F8 OWNER's Right of Audit

If a claim arises by the CONTRACTOR against the OWNER, the OWNER shall have access to all of the CONTRACTOR's books and records for auditing. The CONTRACTOR shall be required to maintain accurate books and records regardless of whether any claims arise.

F9 Substantial Completion

The CONTRACTOR is hereby notified that the Contract Technical Specifications are specific to construction of the Contract No. 2021-02 and to that end, the interpretation for Substantial Completion for this Contract is a point where the whole of the work for all items specified in Section G, herein, have reached a point whereby the OWNER and/or ENGINEER recognize that all parts of the specified work have progressed for utilization for the purposes which it is intended.

F10 Right-to-Know

The Pennsylvania Right-to-Know Law (the "RTKL"), 65 P.S, §§ 67.101-3104, applies to this Agreement.

Unless the Contractor provides the Owner, in writing, with the name and contact information of another person, the Owner shall notify the Contractor using the information provided by the Contractor in the contact information provided in this Agreement if the Owner needs the Contractor's assistance in any matter arising out of the RTKL. The Contractor shall notify the Owner in writing of any change in the name or the contact information within a reasonable time prior to the change.

Upon notification to the Contractor that the Owner has received a request for records under the RTKL, the Contractor shall fully assist the Owner in responding to the request. Such assistance shall include providing the Owner within three (3) days, access to, and copies of, any document or information arising out of the Agreement in the Contractor's possession that the Owner deems a Public Record ("Requested Information") and providing such other assistance as the Owner may request in order to comply with the RTKL. If the Contractor is unable to provide the Requested Information within three (3) days for one of the reasons specified in the RTKL, the Contractor must immediately notify the Owner that it will need up to an additional twenty-five (25) days and must provide in writing the reason the additional time is needed. If the Contractor fails to provide the Requested Information to the Owner within the period specified in this provision, the failure shall be considered an event of default and the Contractor shall pay, indemnify and hold the Owner harmless for any damages, penalties, detriment or harm that the Owner may incur as a result of the Contractor's failure. If the Office of Open Records or the Pennsylvania Courts determines that a record in the possession of the Contractor is a public record, liquidated damages of $200 per day will be assessed for each calendar day beyond the date the Contractor was required to provide the record by the Office of Open Records, or upon appeal, the Pennsylvania Courts.

The Owner's determination as to whether the Requested Information is a public record is dispositive of the question as between the parties. Contractor agrees not to challenge the Owner's decision to deem the Requested Information a Public Record. If the Contractor considers the Requested Information to be a Trade Secret or Confidential Proprietary Information, as those terms are defined by the RTKL, the Contractor will immediately notify the Owner as such, and will provide a written

statement signed by a representative of the Contractor explaining why the requested material is exempt from public disclosure under the RTKL within five (5) days of being notified of the request by the Owner. If, upon review of the Contractor's written statement, the Owner still decides to provide the Requested Information, Contractor will not challenge or in any way hold liable the Owner for such a decision.

The Owner will reimburse the Contractor for any costs associated with complying with this provision only to the extent allowed under the fee schedule established by the Office of Open Records or as otherwise provided by the RTKL if the fee schedule is inapplicable.

Contractor agrees to abide by any decision to release a record to the public made by the Office of Open Records, or by the Pennsylvania Courts. The Contractor agrees to waive all rights or remedies that may be available to it as a result of the Owner's disclosure of Requested Information pursuant to the RTKL. Contractor's duties relating to the RTKL are continuing duties that survive the expiration of this Agreement and shall continue as long as the Contractor has Requested Information in its possession.

End of Section F
Supplemental General Conditions

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AFFIDAVIT OF PAYMENT

AND

RELEASE OF LIENS

TO:

_____

_____

_____

I hereby certify that, to the best of my knowledge, all outstanding claims and indebtedness of any nature resulting from the performance of my contract have been fully paid, except for the following:

I hereby deliver to the OWNER, a complete release of all liens arising out of this Contract for unpaid material and labor, or other costs.

ATTEST:

_____

_____

CONTRACTOR:

_____

By _____

Title _____

Commonwealth of Pennsylvania)
) SS:
County of)

Before me a Notary Public in and for said County and Commonwealth, personally agreed _____ who, being duly sworn according to law, deposes and says that the facts set forth in the foregoing Affidavit and Release are true and correct to the best of his/her knowledge, information and belief.

_____

Sworn to and subscribed before me this
_____ day and _____, 20____.

_____

Notary Public
My Commission Expires:

Commonwealth of Pennsylvania)
) SS:
County of)

_____, being duly sworn according to law, deposes and says that he/she is the _____ of _____, a Pennsylvania Corporation, and that he/she makes this Affidavit on its behalf, being authorized to do so; and that the facts set forth in the foregoing Affidavit and Release are true and correct to the best of his/her information, knowledge and belief.

_____

Sworn to and subscribed before me this
____day of _____, 20___.

_____

Notary Public
My Commission Expires:

ACCEPTANCE OF FINAL PAYMENT

AND

GENERAL RELEASE

KNOW ALL MEN BY THESE PRESENTS, THAT _____ Contractor, of _____ Pennsylvania, by its acceptance of Final Payment of _____ Dollars ($_____), to it in hand paid by _____ the receipt of which is hereby acknowledged, has remised, released, quit-claimed, and forever discharged, and by these presents for it, its successors and assigns, does remise, release, quit-claim and forever discharge, the said _____ its successors and assigns, from all action and all manner of action, cause and causes of action, suits, debts, duties, sum or sums of money, variances, damages, claims and demands whatsoever, in law or equity or otherwise, which against _____ it ever had, now has, or which it, its successors or assigns, hereafter can, shall, or may have, for or by reason of a certain contract between _____ and _____ _____ dated _____, designated as Contract _____, _____ _____

No payment, however, final or otherwise shall operate to release _____, or its sureties from any obligation under said contract or under the Performance, Payment, and Maintenance Bonds furnished to the OWNER by it, under said contract.

ATTEST: CONTRACTOR:

_____ _____

_____ By _____

(SEAL) Title

Commonwealth of Pennsylvania)
) SS:
County of)

Before me a Notary Public in and for said County and Commonwealth, personally agreed _____ who, being duly sworn according to law, deposes and says that the facts set forth in the foregoing Affidavit and Release are true and correct to the best of his/her knowledge, information and belief.

_____

Sworn to and subscribed before me this
_____ day and _____, 20____.

_____

Notary Public
My Commission Expires:

Commonwealth of Pennsylvania)
) SS:
County of)

_____, being duly sworn according to law, deposes and says that he/she is the _____ of _____, a Pennsylvania Corporation, and that he/she makes this Affidavit on its behalf, being authorized to do so; and that the facts set forth in the foregoing Affidavit and Release are true and correct to the best of his/her information, knowledge and belief.

_____

Sworn to and subscribed before me this
____day of _____, 20___.

_____

Notary Public
My Commission Expires:

CONSENT OF SURETY COMPANY TO FINAL PAYMENT

Bond No. _____

Project _____

_____

OWNER: _____

CONTRACTOR: _____

In accordance with the provisions of the Contract between the OWNER and CONTRACTOR as indicated above, the

(insert name and address of Surety Company)

_____
_____
_____, Surety Company, on bond of

(insert name and address of Contractor)

_____
_____
_____, CONTRACTOR, hereby approves of the final payment to the CONTRACTOR, and agrees that final payment to the CONTRACTOR shall not relieve the Surety Company of any of its obligations to:

(insert name and address of OWNER)

_____
_____
_____, OWNER, as set forth in the said Surety Company's Bond.

IN WITNESS WHEREOF,
the Surety Company has hereunto set its hand this _____ day of _____ 20 ___.

_____
Surety Company

_____
Signature of Authorized Representative

ATTEST:
(SEAL)

_____
Title

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BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project Name:	S.R. 151 / Gringo Road Water Main Replacement
Awarding Agency:	Creswell Heights Joint Authority
Contract Award Date:	4/19/2021
Serial Number:	21-01531
Project Classification:	Heavy/Highway
Determination Date:	2/25/2021
Assigned Field Office:	Pittsburgh
Field Office Phone Number:	(412)565-5300
Toll Free Phone Number:	(877)504-8354
Project County:	Beaver County

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 21-01531 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	8/1/2017		$36.66	$24.25	$60.91
Asbestos & Insulation Workers	8/1/2018		$37.11	$24.80	$61.91
Asbestos & Insulation Workers	8/1/2019		$38.16	$25.75	$63.91
Asbestos & Insulation Workers	8/1/2020		$38.93	$26.98	$65.91
Boilermakers	6/1/2016		$40.90	$27.61	$68.51
Bricklayer (Stone Mason)	12/1/2017		$29.85	$22.07	$51.92
Bricklayer	6/1/2019		$30.91	$22.71	$53.62
Bricklayer	12/1/2019		$31.41	$22.91	$54.32
Bricklayer	6/1/2020		$32.21	$23.01	$55.22
Bricklayer	12/1/2020		$32.66	$23.51	$56.17
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2017		$33.01	$16.63	$49.64
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2018	5/31/2019	$33.75	$17.34	$51.09
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2019	5/31/2020	$34.72	$17.82	$52.54
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2020	5/31/2021	$35.48	$18.56	$54.04
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2021		$36.23	$19.31	$55.54
Cement Finishers	6/1/2016		$28.71	$17.85	$46.56
Cement Masons	6/1/2018		$28.74	$16.84	$45.58
Drywall Finisher	6/1/2017		$27.80	$19.14	$46.94
Drywall Finisher	6/1/2018		$28.10	$19.99	$48.09
Drywall Finisher	6/1/2019	5/31/2020	$29.10	$20.49	$49.59
Drywall Finisher	6/1/2020	5/31/2021	$30.10	$20.89	$50.99
Drywall Finisher	6/1/2021	5/31/2022	$31.00	$21.39	$52.39
Drywall Finisher	6/1/2022		$32.00	$21.89	$53.89
Electricians	1/1/2018		$37.55	$23.78	$61.33
Electricians	12/31/2018		$38.55	$24.48	$63.03
Electricians	12/30/2019		$40.55	$24.96	$65.51
Electricians	12/28/2020		$42.05	$25.85	$67.90
Electricians	12/27/2021		$43.55	$26.64	$70.19
Elevator Constructor	1/1/2018		$47.22	$33.00	$80.22
Glazier	9/1/2017		$28.00	$22.60	$50.60
Glazier	9/1/2018		$28.62	$23.23	$51.85
Glazier	9/1/2019		$30.50	$24.40	$54.90
Glazier	9/1/2020		$31.00	$26.05	$57.05
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	6/1/2017		$33.54	$30.24	$63.78
Iron Workers	6/1/2018		$34.49	$31.17	$65.66
Iron Workers	6/1/2019		$35.49	$32.30	$67.79
Iron Workers	6/1/2020		$37.29	$32.87	$70.16
Laborers (Class 01 - See notes)	1/1/2018		$22.32	$16.67	$38.99
Laborers (Class 01 - See notes)	1/1/2019		$23.37	$17.67	$41.04
Laborers (Class 01 - See notes)	1/1/2020		$26.42	$14.67	$41.09

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 21-01531 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Laborers (Class 01 - See notes)	1/1/2021		$21.47	$17.29	$38.76
Laborers (Class 01 - See notes)	1/1/2021		$22.82	$19.32	$42.14
Laborers (Class 02 - See notes)	1/1/2018		$22.47	$16.67	$39.14
Laborers (Class 02 - See notes)	1/1/2019		$22.52	$17.67	$40.19
Laborers (Class 02 - See notes)	1/1/2020		$26.57	$14.67	$41.24
Laborers (Class 02 - See notes)	1/1/2021		$22.97	$19.32	$42.29
Laborers (Class 02 - See notes)	1/1/2021		$22.22	$17.29	$39.51
Laborers (Class 03 - See notes)	1/1/2018		$22.60	$16.67	$39.27
Laborers (Class 03 - See notes)	1/1/2019		$22.65	$17.67	$40.32
Laborers (Class 03 - See notes)	1/1/2020		$26.70	$14.67	$41.37
Laborers (Class 03 - See notes)	1/1/2021		$23.10	$19.32	$42.42
Laborers (Class 03 - See notes)	1/1/2021		$22.32	$17.29	$39.61
Laborers (Class 04 - See notes)	1/1/2018		$23.07	$16.67	$39.74
Laborers (Class 04 - See notes)	1/1/2019		$23.12	$17.67	$40.79
Laborers (Class 04 - See notes)	1/1/2020		$27.17	$14.67	$41.84
Laborers (Class 04 - See notes)	1/1/2021		$20.47	$17.29	$37.76
Laborers (Class 04 - See notes)	1/1/2021		$23.57	$19.32	$42.89
Landscape Laborer (Skilled)	1/1/2018		$21.01	$15.31	$36.32
Landscape Laborer (Skilled)	1/1/2019		$21.44	$16.08	$37.52
Landscape Laborer (Skilled)	1/1/2020		$21.64	$16.98	$38.62
Landscape Laborer (Tractor Operator)	1/1/2018		$21.31	$15.31	$36.62
Landscape Laborer (Tractor Operator)	1/1/2019		$21.74	$16.08	$37.82
Landscape Laborer (Tractor Operator)	1/1/2020		$21.94	$16.98	$38.92
Landscape Laborer	1/1/2018		$20.59	$15.31	$35.90
Landscape Laborer	1/1/2019		$21.02	$16.08	$37.10
Landscape Laborer	1/1/2020		$21.22	$16.98	$38.20
Millwright	6/1/2017		$39.83	$18.57	$58.40
Millwright	6/1/2020		$41.68	$20.32	$62.00
Operators (Class 01 - see notes)	6/12/2017		$34.49	$20.15	$54.64
Operators (Class 01 - see notes)	6/1/2018		$35.09	$20.95	$56.04
Operators (Class 01 - see notes)	6/1/2019		$35.69	$21.75	$57.44
Operators (Class 01 - see notes)	6/1/2020		$36.39	$22.55	$58.94
Operators (Class 01 - see notes)	6/1/2021		$37.09	$23.35	$60.44
Operators (Class 02 -see notes)	6/12/2017		$29.58	$20.15	$49.73
Operators (Class 02 -see notes)	6/1/2018		$29.90	$20.95	$50.85
Operators (Class 02 -see notes)	6/1/2019		$30.22	$21.75	$51.97
Operators (Class 02 -see notes)	6/1/2020		$30.62	$22.55	$53.17
Operators (Class 02 -see notes)	6/1/2021		$31.02	$23.35	$54.37
Operators (Class 03 - See notes)	6/12/2017		$28.25	$20.15	$48.40
Operators (Class 03 - See notes)	6/1/2018		$28.46	$20.95	$49.41
Operators (Class 03 - See notes)	6/1/2019		$28.67	$21.75	$50.42
Operators (Class 03 - See notes)	6/1/2020		$28.95	$22.55	$51.50
Operators (Class 03 - See notes)	6/1/2021		$29.23	$23.35	$52.58
Painters Class 6 (see notes)	6/1/2017		$27.50	$18.66	$46.16

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Project: 21-01531 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Painters Class 6 (see notes)	6/1/2018		$28.00	$19.36	$47.36
Painters Class 6 (see notes)	6/1/2019		$28.50	$20.06	$48.56
Painters Class 6 (see notes)	6/1/2020		$28.80	$20.99	$49.79
Painters Class 6 (see notes)	6/1/2021		$29.15	$21.89	$51.04
Painters Class 6 (see notes)	6/1/2022		$29.50	$22.82	$52.32
Pile Driver Divers (Building, Heavy, Highway)	1/1/2018		$50.33	$18.55	$68.88
Pile Driver Divers (Building, Heavy, Highway)	1/1/2019		$51.45	$19.30	$70.75
Pile Driver Divers (Building, Heavy, Highway)	1/1/2020		$53.10	$19.70	$72.80
Pile Driver Divers (Building, Heavy, Highway)	1/1/2021		$54.75	$20.10	$74.85
Pile Driver Divers (Building, Heavy, Highway)	1/1/2022		$56.40	$20.50	$76.90
Piledrivers	1/1/2018		$33.55	$18.55	$52.10
Piledrivers	1/1/2019		$34.30	$19.30	$53.60
Piledrivers	1/1/2020		$35.40	$19.70	$55.10
Piledrivers	1/1/2021		$36.50	$20.10	$56.60
Piledrivers	1/1/2022		$37.60	$20.50	$58.10
Plasterers	6/1/2017		$28.79	$15.79	$44.58
Plasterers	6/1/2018		$28.74	$16.84	$45.58
Plasterers	6/1/2019		$29.78	$17.20	$46.98
Plasterers	6/1/2020		$29.78	$18.60	$48.38
plumber	6/1/2018		$40.85	$21.77	$62.62
plumber	6/1/2019		$43.00	$21.77	$64.77
plumber	6/1/2020		$45.15	$21.77	$66.92
plumber	6/1/2021		$47.25	$21.77	$69.02
plumber	6/1/2022		$49.35	$21.77	$71.12
Plumbers	6/1/2017		$39.20	$21.27	$60.47
Pointers, Caulkers, Cleaners	12/1/2017		$29.88	$18.73	$48.61
Pointers, Caulkers, Cleaners	6/1/2019		$31.38	$19.44	$50.82
Pointers, Caulkers, Cleaners	12/1/2019		$31.93	$19.64	$51.57
Pointers, Caulkers, Cleaners	6/1/2020		$32.63	$19.72	$52.35
Pointers, Caulkers, Cleaners	12/1/2020		$33.15	$19.97	$53.12
Roofers	6/1/2017		$31.00	$15.17	$46.17
Roofers	6/1/2018		$31.00	$16.42	$47.42
Roofers	6/1/2019		$34.83	$13.84	$48.67
Roofers	6/1/2020		$36.08	$13.84	$49.92
Sheet Metal Workers	7/1/2017		$33.70	$27.74	$61.44
Sheet Metal Workers	7/1/2018		$34.47	$28.08	$62.55
Sheet Metal Workers	7/1/2019		$36.21	$28.36	$64.57
Sheet Metal Workers	7/1/2020		$37.96	$28.63	$66.59
Sprinklerfitters	4/1/2017		$37.40	$21.74	$59.14
Sprinklerfitters	4/1/2018		$38.80	$22.74	$61.54
Sprinklerfitters	4/1/2020		$38.90	$26.42	$65.32
Steamfitters	6/1/2017		$41.71	$19.01	$60.72
Steamfitters	6/1/2018		$40.55	$22.67	$63.22
Steamfitters	6/1/2020		$42.25	$25.22	$67.47

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Stone Masons	6/1/2019		$33.72	$22.05	$55.77
Stone Masons	12/1/2019		$34.22	$22.25	$56.47
Stone Masons	6/1/2020		$35.02	$22.35	$57.37
Stone Masons	12/1/2020		$35.72	$22.60	$58.32
Terrazzo Finisher	12/1/2017		$31.08	$15.85	$46.93
Terrazzo Finisher	6/1/2019		$32.01	$16.52	$48.53
Terrazzo Finisher	12/1/2019		$32.37	$16.74	$49.11
Terrazzo Finisher	6/1/2020		$32.96	$16.90	$49.86
Terrazzo Finisher	12/1/2020		$33.46	$17.15	$50.61
Terrazzo Mechanics	12/1/2017		$30.57	$17.91	$48.48
Terrazzo Mechanics	6/1/2019		$31.31	$18.67	$49.98
Terrazzo Mechanics	12/1/2019		$31.79	$18.92	$50.71
Terrazzo Mechanics	6/1/2020		$32.32	$19.09	$51.41
Terrazzo Mechanics	12/1/2020		$32.82	$19.34	$52.16
Tile Finisher	12/1/2017		$25.16	$14.90	$40.06
Tile Finisher	6/1/2019		$25.69	$15.65	$41.34
Tile Finisher	12/1/2019		$26.00	$15.86	$41.86
Tile Finisher	6/1/2020		$26.47	$16.07	$42.54
Tile Finisher	12/1/2020		$26.86	$16.36	$43.22
Tile Setter	12/1/2017		$30.75	$19.05	$49.80
Tile Setter	6/1/2019		$31.47	$20.03	$51.50
Tile Setter	12/1/2019		$31.91	$20.24	$52.15
Tile Setter	6/1/2020		$32.58	$20.42	$53.00
Tile Setter	12/1/2020		$33.12	$20.73	$53.85
Truckdriver class 1(see notes)	1/1/2016		$27.62	$16.60	$44.22
Truckdriver class 1(see notes)	1/1/2020		$29.93	$20.21	$50.14
Truckdriver class 1(see notes)	1/1/2021		$30.68	$20.96	$51.64
Truckdriver class 1(see notes)	1/1/2022		$31.43	$21.71	$53.14
Truckdriver class 2 (see notes)	1/1/2016		$27.75	$16.69	$44.44
Truckdriver class 2 (see notes)	1/1/2020		$30.39	$20.52	$50.91
Truckdriver class 2 (see notes)	1/1/2021		$31.14	$21.27	$52.41
Truckdriver class 2 (see notes)	1/1/2022		$31.14	$21.27	$52.41
Truckdriver class 2 (see notes)	1/1/2022		$31.89	$22.02	$53.91
Truckdriver class 3 (see notes)	1/1/2016		$28.23	$16.98	$45.21
Window Film / Tint Installer	10/1/2019		$25.00	$2.63	$27.63

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Carpenter	1/1/2018	12/31/2018	$33.17	$17.77	$50.94
Carpenter	1/1/2019		$34.02	$18.42	$52.44
Carpenter	1/1/2020		$35.02	$18.92	$53.94
Carpenter	1/1/2021		$36.12	$19.32	$55.44
Carpenter	1/1/2022		$37.10	$19.84	$56.94
Carpenter Welder	1/1/2018	12/31/2018	$34.12	$17.77	$51.89
Carpenter Welder	1/1/2019		$34.97	$18.42	$53.39
Carpenter Welder	1/1/2020		$35.97	$18.92	$54.89
Carpenter Welder	1/1/2021		$37.07	$19.32	$56.39
Carpenter Welder	1/1/2022		$38.05	$19.84	$57.89
Cement Finishers	1/1/2017		$30.14	$19.40	$49.54
Cement Finishers	1/1/2018		$31.04	$19.90	$50.94
Cement Finishers	1/1/2019		$31.94	$20.50	$52.44
Cement Finishers	1/1/2021		$32.84	$22.60	$55.44
Cement Finishers	1/1/2022		$33.14	$23.80	$56.94
Cement Masons	1/1/2020		$32.84	$21.10	$53.94
Electric Lineman	5/29/2017		$45.24	$24.23	$69.47
Electric Lineman	5/28/2018		$46.29	$25.26	$71.55
Electric Lineman	5/27/2019		$47.38	$26.30	$73.68
Electric Lineman	6/1/2020		$48.51	$27.38	$75.89
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	6/1/2017		$33.54	$30.24	$63.78
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	6/1/2020		$37.29	$32.87	$70.16
Laborers (Class 01 - See notes)	1/1/2017		$24.85	$20.95	$45.80
Laborers (Class 01 - See notes)	1/1/2018		$24.85	$22.35	$47.20
Laborers (Class 01 - See notes)	1/1/2019		$24.85	$23.85	$48.70
Laborers (Class 01 - See notes)	1/6/2020		$26.10	$24.10	$50.20
Laborers (Class 01 - See notes)	1/6/2021		$26.90	$24.80	$51.70
Laborers (Class 01 - See notes)	1/6/2022		$27.70	$25.50	$53.20
Laborers (Class 02 - See notes)	1/1/2017		$25.01	$20.95	$45.96
Laborers (Class 02 - See notes)	1/1/2018		$25.01	$22.35	$47.36
Laborers (Class 02 - See notes)	1/1/2019		$25.01	$23.85	$48.86
Laborers (Class 02 - See notes)	1/6/2020		$26.26	$24.10	$50.36
Laborers (Class 02 - See notes)	1/6/2021		$27.06	$24.80	$51.86
Laborers (Class 02 - See notes)	1/6/2022		$27.86	$25.50	$53.36
Laborers (Class 03 - See notes)	1/1/2017		$25.40	$20.95	$46.35
Laborers (Class 03 - See notes)	1/1/2018		$25.40	$22.35	$47.75
Laborers (Class 03 - See notes)	1/1/2019		$25.40	$23.85	$49.25
Laborers (Class 03 - See notes)	1/6/2020		$26.65	$24.10	$50.75
Laborers (Class 03 - See notes)	1/6/2021		$27.45	$24.80	$52.25
Laborers (Class 03 - See notes)	1/6/2022		$28.25	$25.50	$53.75
Laborers (Class 04 - See notes)	1/1/2017		$25.85	$20.95	$46.80
Laborers (Class 04 - See notes)	1/1/2018		$25.85	$22.35	$48.20
Laborers (Class 04 - See notes)	1/1/2019		$25.85	$23.85	$49.70

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Laborers (Class 04 - See notes)	1/6/2020		$27.10	$24.10	$51.20
Laborers (Class 04 - See notes)	1/6/2021		$27.90	$24.80	$52.70
Laborers (Class 04 - See notes)	1/6/2022		$28.70	$25.50	$54.20
Laborers (Class 05 - See notes)	1/1/2017		$26.26	$20.95	$47.21
Laborers (Class 05 - See notes)	1/1/2018		$26.26	$22.35	$48.61
Laborers (Class 05 - See notes)	1/1/2019		$26.26	$23.85	$50.11
Laborers (Class 05 - See notes)	1/6/2020		$27.51	$24.10	$51.61
Laborers (Class 05 - See notes)	1/6/2021		$28.31	$24.80	$53.11
Laborers (Class 05 - See notes)	1/6/2022		$29.11	$25.50	$54.61
Laborers (Class 06 - See notes)	1/1/2017		$23.10	$20.95	$44.05
Laborers (Class 06 - See notes)	1/1/2018		$23.10	$22.35	$45.45
Laborers (Class 06 - See notes)	1/1/2019		$23.10	$23.85	$46.95
Laborers (Class 06 - See notes)	1/6/2020		$24.35	$24.10	$48.45
Laborers (Class 06 - See notes)	1/6/2021		$25.15	$24.80	$49.95
Laborers (Class 06 - See notes)	1/6/2022		$25.95	$25.50	$51.45
Laborers (Class 07 - See notes)	1/1/2017		$25.85	$20.95	$46.80
Laborers (Class 07 - See notes)	1/1/2018		$25.85	$22.35	$48.20
Laborers (Class 07 - See notes)	1/1/2019		$25.85	$23.85	$49.70
Laborers (Class 07 - See notes)	1/6/2020		$27.10	$24.10	$51.20
Laborers (Class 07 - See notes)	1/6/2021		$27.90	$24.80	$52.70
Laborers (Class 07 - See notes)	1/6/2022		$28.70	$25.50	$54.20
Laborers (Class 08 - See notes)	1/1/2017		$27.35	$20.95	$48.30
Laborers (Class 08 - See notes)	1/1/2018		$27.35	$22.35	$49.70
Laborers (Class 08 - See notes)	1/1/2019		$27.35	$23.85	$51.20
Laborers (Class 08 - See notes)	1/6/2020		$28.60	$24.10	$52.70
Laborers (Class 08 - See notes)	1/6/2021		$29.40	$24.80	$54.20
Laborers (Class 08 - See notes)	1/6/2022		$30.20	$25.50	$55.70
Millwright	6/1/2020		$41.68	$20.32	$62.00
Operators (Class 01 - see notes)	1/1/2017		$30.69	$19.98	$50.67
Operators (Class 01 - see notes)	1/1/2018		$31.29	$20.78	$52.07
Operators (Class 01 - see notes)	1/1/2019		$31.89	$21.68	$53.57
Operators (Class 01 - see notes)	1/1/2020		$32.89	$22.23	$55.12
Operators (Class 01 - see notes)	1/1/2021		$33.89	$22.73	$56.62
Operators (Class 01 - see notes)	1/1/2022		$34.79	$23.33	$58.12
Operators (Class 02 -see notes)	1/1/2017		$30.43	$19.98	$50.41
Operators (Class 02 -see notes)	1/1/2018		$31.03	$20.78	$51.81
Operators (Class 02 -see notes)	1/1/2019		$31.63	$21.68	$53.31
Operators (Class 02 -see notes)	1/1/2020		$32.63	$22.23	$54.86
Operators (Class 02 -see notes)	1/1/2021		$33.63	$22.73	$56.36
Operators (Class 02 -see notes)	1/1/2022		$34.53	$23.33	$57.86
Operators (Class 03 - See notes)	1/1/2017		$26.78	$19.98	$46.76
Operators (Class 03 - See notes)	1/1/2018		$27.38	$20.78	$48.16
Operators (Class 03 - See notes)	1/1/2019		$27.98	$21.68	$49.66
Operators (Class 03 - see notes)	1/1/2020		$28.98	$22.23	$51.21

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Operators (Class 03 - see notes)	1/1/2021		$29.98	$22.73	$52.71
Operators (Class 03 - See notes)	1/1/2022		$30.88	$23.33	$54.21
Operators (Class 04 - See notes)	1/1/2017		$26.32	$19.98	$46.30
Operators (Class 04 - See notes)	1/1/2018		$26.92	$20.78	$47.70
Operators (Class 04 - See notes)	1/1/2019		$27.52	$21.68	$49.20
Operators (Class 04 - See notes)	1/1/2020		$28.52	$22.23	$50.75
Operators (Class 04 - See notes)	1/1/2021		$29.52	$22.73	$52.25
Operators (Class 04 - See notes)	1/1/2022		$30.42	$23.33	$53.75
Operators (Class 05 - See notes)	1/1/2017		$26.07	$19.98	$46.05
Operators (Class 05 - See notes)	1/1/2018		$26.67	$20.78	$47.45
Operators (Class 05 - See notes)	1/1/2019		$27.27	$21.68	$48.95
Operators (Class 05 - See notes)	1/1/2020		$28.27	$22.23	$50.50
Operators (Class 05 - See notes)	1/1/2021		$29.27	$22.73	$52.00
Operators (Class 05 - See notes)	1/1/2022		$30.17	$23.33	$53.50
Operators Class 1-A	1/1/2020		$35.89	$22.23	$58.12
Operators Class 1-A	1/1/2021		$36.89	$22.73	$59.62
Operators Class 1-A	1/1/2022		$37.79	$23.33	$61.12
Operators Class 1-B	1/1/2020		$34.89	$22.23	$57.12
Operators Class 1-B	1/1/2021		$35.89	$22.73	$58.62
Operators Class 1-B	1/1/2022		$36.79	$23.33	$60.12
Painters Class 1 (see notes)	6/1/2016		$31.58	$17.58	$49.16
Painters Class 1 (see notes)	6/1/2017		$31.85	$18.66	$50.51
Painters Class 1 (see notes)	6/1/2017		$31.98	$18.43	$50.41
Painters Class 1 (see notes)	6/1/2018		$32.50	$19.36	$51.86
Painters Class 1 (see notes)	6/1/2019		$33.15	$20.06	$53.21
Painters Class 1 (see notes)	6/1/2020		$33.55	$20.99	$54.54
Painters Class 1 (see notes)	6/1/2021		$34.00	$21.89	$55.89
Painters Class 1 (see notes)	6/1/2022		$34.45	$22.82	$57.27
Painters Class 2 (see notes)	6/1/2016		$31.58	$17.58	$49.16
Painters Class 2 (see notes)	6/1/2017		$33.95	$18.66	$52.61
Painters Class 2 (see notes)	6/1/2017		$34.08	$18.43	$52.51
Painters Class 2 (see notes)	6/1/2018		$34.60	$19.36	$53.96
Painters Class 2 (see notes)	6/1/2019		$35.25	$20.06	$55.31
Painters Class 3 (see notes)	6/1/2016		$33.68	$17.58	$51.26
Painters Class 3 (see notes)	6/1/2017		$27.58	$18.48	$46.06
Painters Class 3 (see notes)	6/1/2017		$33.95	$18.66	$52.61
Painters Class 3 (see notes)	6/1/2018		$34.60	$19.36	$53.96
Painters Class 3 (see notes)	6/1/2019		$35.25	$20.06	$55.31
Painters Class 3 (see notes)	6/1/2020		$35.72	$20.99	$56.71
Painters Class 3 (see notes)	6/1/2021		$36.25	$21.89	$58.14
Painters Class 3 (see notes)	6/1/2022		$36.77	$22.82	$59.59
Painters Class 4 (see notes)	6/1/2016		$26.95	$17.58	$44.53
Painters Class 4 (see notes)	6/1/2017		$27.16	$18.66	$45.82
Painters Class 4 (see notes)	6/1/2017		$27.27	$18.43	$45.70

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 21-01531 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Painters Class 4 (see notes)	6/1/2018		$27.68	$19.36	$47.04
Painters Class 4 (see notes)	6/1/2019		$28.20	$20.06	$48.26
Painters Class 5 (see notes)	6/1/2016		$21.90	$17.58	$39.48
Painters Class 5 (see notes)	6/1/2017		$22.07	$18.66	$40.73
Painters Class 5 (see notes)	6/1/2017		$22.16	$18.43	$40.59
Painters Class 5 (see notes)	6/1/2018		$22.49	$19.36	$41.85
Painters Class 5 (see notes)	6/1/2019		$22.91	$20.06	$42.97
Pile Driver Divers (Building, Heavy, Highway)	1/1/2017		$49.13	$17.95	$67.08
Pile Driver Divers (Building, Heavy, Highway)	1/1/2018		$50.33	$18.55	$68.88
Pile Driver Divers (Building, Heavy, Highway)	1/1/2019		$51.45	$19.30	$70.75
Pile Driver Divers (Building, Heavy, Highway)	1/1/2020		$53.10	$19.70	$72.80
Pile Driver Divers (Building, Heavy, Highway)	1/1/2021		$54.75	$20.10	$74.85
Pile Driver Divers (Building, Heavy, Highway)	1/1/2022		$56.40	$20.50	$76.90
Piledrivers	1/1/2017		$32.75	$17.95	$50.70
Piledrivers	1/1/2018		$33.55	$18.55	$52.10
Piledrivers	1/1/2019		$34.30	$19.30	$53.60
Piledrivers	1/1/2020		$35.40	$19.70	$55.10
Piledrivers	1/1/2021		$36.54	$20.06	$56.60
Piledrivers	1/1/2022		$37.63	$20.47	$58.10
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2017		$40.98	$32.53	$73.51
Truckdriver class 1(see notes)	1/1/2017		$28.10	$17.42	$45.52
Truckdriver class 1(see notes)	1/1/2018		$28.52	$18.40	$46.92
Truckdriver class 1(see notes)	1/1/2019		$28.99	$19.43	$48.42
Truckdriver class 1(see notes)	1/1/2020		$29.93	$20.21	$50.14
Truckdriver class 1(see notes)	1/1/2021		$30.68	$20.96	$51.64
Truckdriver class 1(see notes)	1/1/2022		$31.43	$21.71	$53.14
Truckdriver class 2 (see notes)	1/1/2017		$28.24	$17.50	$45.74
Truckdriver class 2 (see notes)	1/1/2018		$28.66	$18.48	$47.14
Truckdriver class 2 (see notes)	1/1/2019		$29.13	$19.51	$48.64
Truckdriver class 2 (see notes)	1/1/2020		$30.39	$20.52	$50.91
Truckdriver class 2 (see notes)	1/1/2021		$31.14	$21.27	$52.41
Truckdriver class 2 (see notes)	1/1/2022		$31.89	$22.02	$53.91
Truckdriver class 3 (see notes)	1/1/2017		$28.71	$17.80	$46.51
Truckdriver class 3 (see notes)	1/1/2018		$29.13	$18.78	$47.91
Truckdriver class 3 (see notes)	1/1/2019		$29.59	$19.82	$49.41

Section G

TECHNICAL SPECIFICATIONS

CRESWELL HEIGHTS JOINT AUTHORITY

CONTRACT NO. 2021-02 S.R. 151 / GRINGO ROAD WATER LINE REPLACEMENT

The work included under this Contract covers the furnishing of all plant, labor, materials, tools and equipment required to complete the work as described herein, shown on the Contract Drawings and necessary for complete operating facilities.

The Creswell Heights Joint Authority (CHJA) S.R. 151 / Gringo Road Water Line Replacement Project is construction of Ductile Iron Water lines located in Hopewell Township, Beaver County, Pennsylvania. The work under Contract No. 2021-02 includes construction of water system mains and encompasses the furnishing and installation of all plant, equipment, material, labor, utilities and services necessary for the complete construction of water mains including pipe, fittings, valves, hydrants, services and appurtenances.

The work under Contract No. 2021-02 generally consists of the construction of approximately 1,150 lineal feet of 10-inch ductile iron water main and appurtenances along S.R. 151 / Gringo Road. All new waterlines are installed via open cut construction methods and are located within the road right of way limits of S.R. 151 / Gringo Road and requires restoration of all disturbed areas.

The work under Contract No. 2021-02 is a Unit Price contract as identified in the Bid Form in Section C.

Those BIDDERS desiring to submit proposals for performing the Work under multiple waterline construction contracts, and at the same time will offer the OWNER (as an incentive to receive the award of the stipulated combinations of contracts set forth in Section C) a reduction in the aggregate sums of the amounts bid on the respective contract Bid Forms, are directed to complete the Combination Bid Form.

All construction work is proposed to be performed in Hopewell Township, Beaver County, Pennsylvania.

The CONTRACTOR shall schedule his work so as to install, test, disinfect and reconnect services and complete all restoration. Prior to construction the CONTRACTOR shall prepare a schedule of

work for review and approval by the ENGINEER, CHJA and the municipalities affected by the project. Connections to existing mains, other than tapping connections shall only be made after the new main is approved and in service. Operation of existing valves and mains shall be done only by CHJA personnel upon adequate prior notice (minimum 24 hours) by the CONTRACTOR. The CONTRACTOR shall schedule and provide adequately sized taps for flushing and disinfection to conform to his schedule of construction.

G2 Rights-of-Way

G2.1 The proposed pipeline lies within public right-of-way or rights-of-way obtained by CHJA, however in any case the OWNER will obtain all rights-of-way and/or property which the ENGINEER deems necessary for construction of the pipeline and the CONTRACTOR shall confine all construction activities within the limitations of same. The CONTRACTOR, however, shall make his own arrangements for office space, materials storage yards, sanitary facilities, any utility services which may be desired and for ingress and egress over any private property or land which he desires to use which the OWNER has not obtained right-of-way.

G3 Existing Utility Lines - Location, Protection and Hazards

G3.1 The plans show those underground water lines, gas lines, electric lines, telephone lines, sanitary sewers, storm drains, conduits and other similar utility lines and appurtenances for which such location information was either made available to the ENGINEER or was observed by the ENGINEER in the field. Neither the number of such underground facilities nor their respective types, sizes and/or locations can be assured or guaranteed, and it is, therefore, the responsibility of the CONTRACTOR to obtain such additional information as is required to properly complete the work in compliance with the specifications and to contact the OWNER of the various utilities in the area prior to starting and during performance of the work.

G3.2 The approximate location of many power and telephone poles along the route of the work is shown on the drawings and the overhead lines supported by all such poles shall be observed and located by the CONTRACTOR prior to commencement of the work.

G3.3 The CONTRACTOR shall be completely and solely responsible and liable for any and all property damages, bodily injuries, financial losses and interruption of service that result from or are attributable to his construction activities, and, which affect water lines, gas lines, electric lines, telephone lines, drain

lines, sanitary and storm lines and all appurtenances and service facilities connected thereto. Restoration of all such damaged or disturbed facilities shall be accomplished immediately after incurrence thereto.

G3.4 Water, sewer, gas, power, and telephone service to dwellings or places of business shall be maintained with a minimum of interruption throughout the construction of the contract work. No such service shall be intentionally interrupted without the approval of the respective utility company concerned, and without first giving due warning to the occupants of said dwelling or business establishment.

G3.5 In some cases, it may be found that existing pipe lines are in a location where construction of the proposed work cannot reasonably proceed until the utility has been relocated. If, in the opinion of the ENGINEER, such a condition exists, the ENGINEER and/or OWNER will provide direction to the CONTRACTOR within 48 hours. However, the CONTRACTOR shall make all necessary sub-surface investigations and shall locate such utility mains far enough in advance of the trenching work so that the OWNER may arrange for the relocation before the CONTRACTOR commences work in such particular area. In the event an existing subsurface utility line is unmarked or mismarked through the PA One Call System, the work to accommodate that unmarked or mismarked utility line shall be completed by the CONTRACTOR and he shall be compensated in accordance with the PA One Call statute.

G3.6 Attention is directed to the fact that much of the proposed work is in close proximity to overhead power lines which transmit electric current at high voltages and which, if disturbed or contacted during construction, would be hazardous to construction personnel and/or other persons. The CONTRACTOR shall, therefore, properly protect such wires, pole supports or other power line appurtenances to avoid disturbances to those facilities and shall operate all machinery and conduct all other construction activities in a manner which will assure protection of all construction personnel and other persons against said hazards. Work in the vicinity of the existing underground gas lines and appurtenances is also hazardous because, under certain conditions, such materials are flammable and/or explosive, and the CONTRACTOR shall avoid disturbance and/or displacement of those facilities and shall provide all temporary and permanent supports and other required protection to prevent exposure of same to construction personnel and/or other persons. Where such lines are exposed during construction and leakage is detected, construction work in those areas shall be immediately suspended, the OWNER of the pipeline

shall be immediately advised of the condition, and the construction work shall not resume until all repairs have been properly completed.

G4 Line and Grade

G4.1 The drawings indicate certain topographical features on which the location and construction of the proposed pipelines shall be based. The CONTRACTOR shall provide any and all additional field surveying required to control either line and/or grade and to assure installation of the facilities according to plans and details shown and described on the drawings. Inasmuch as the waterline will operate under pressure, exact control of gradient will not be required, but the CONTRACTOR will be required to maintain positive grade along the waterline alignment to the high points as shown on the drawings. However, pipes shall be installed along the alignment and at the elevations indicated on the drawings.

G5 Clearing and Grubbing

G5.1 The areas along the alignment of the proposed waterline shall be cleared and grubbed to the extent necessary to accommodate the trenching, pipe laying and backfilling operations, however, the area is not to exceed the limitations of rights-of-way. No trees shall be cut and/or destroyed unless absolutely necessary. Trees in lawn and/or landscaped areas shall not be removed without the consent of the property owner. The CONTRACTOR shall make such arrangements as may be necessary for the removal and disposition of the various brush, trees, and other debris as are necessary. No such materials shall be included with trench backfill and prior to completion of all contract work; all materials shall be cleaned up, transported and removed from the site. All trees shrubs, landscape/improved areas, etc. disturbed during pipeline installation shall be replaced/restored as described in these technical specifications.

G5.2 At any location where a tree, shrub or plant must be trimmed, branches or roots, the Property Owner shall be notified in advance of trimming. Any and all trimming shall be done in a professional manner using the appropriate tools. All trimmed branches/roots shall be sealed/coated with an appropriate material manufactured for that purpose.

G6 Excavation and Backfill

G6.1 All pipeline and appurtenances under this contract may be constructed by the open trench excavation method except where boring is called for on the contract drawings or in the specifications. All highway crossings for service connections shall be bored or pushed. All excavation shall be unclassified, and no extra payment shall be made for hand excavation or for the removal of any rock, boulders, stumps, tree roots, shale, muck, masonry, curbing driveway surfacing, or other natural or man-made materials. Blasting is not permitted on the project.

G6.2 All pipelines shall be supported on bedding material consisting of concrete sand with a minimum thickness of 6" below the bottom of the pipe barrel; said material such as concrete sand shall also be placed on the sides of the pipe and to a horizontal plane located one foot above the top of pipe, identified as the pipe zone with the exception of backfill provisions under pavement areas as described hereinafter. (See SD-2-001C)

G6.3 The excavated material from the trench shall be hauled and disposed of off-site at a location to be determined by the CONTRACTOR.

G6.4 Backfill material utilized for restoration of open trenches excavated through permanent pavements and within 5 feet of paved surfaces, curbs, driveways, sidewalks or tar and chip or where such structures are undercut by the excavation shall consist of premium granular backfill 2-A Limestone per PENNDOT Specification. It shall be thoroughly compacted in 8" lifts for the full depth of the trench. Compact each 8″ layer of select granular backfill at 98% of the determined dry weight density with the top 3 feet of trench compacted to 100%. **In-place density or compaction will be determined in accordance with PTM No. 112 or PTM No. 402.** At the time of compaction, maintain the soil moisture content within plus or minus 2 percentage points of the optimum moisture content for that material. When the material is too coarse (more than 20% retained on the ¾ inch sieve) to satisfactorily use these methods, compaction will be determined on the basis of nonmovement of the material, under compaction equipment specified in PADOT form 408, Section 108.05(c)3.a, 3.e, 3.h, or 4. **The CONTRACTOR will be responsible for selection of PADOT approved laboratory/testing company and for all costs associated with the compaction testing.** Compaction test results shall be submitted to the OWNER within 48 hours of test completion. The location and frequency of compaction testing shall be one test for each 8″ thick compacted lift for each 100 feet section of pipe installed parallel to the roadway.

Compaction test results shall be furnished to ENGINEER within seven days of conducting testing. In addition, compaction testing frequency shall be one test for each 8” thick compacted lift for each perpendicular roadway crossing or isolated roadway opening regardless of length. The material placed in the pipe zone shall be carefully compacted to avoid displacement of the pipeline, valves, fittings and appurtenances. Backfill in any roadway shoulder shall be installed and backfilled and the surface restored in accordance with all PADOT requirements. All pipe under permanent pavements and within 5’ of paved street surfaces, curbs, driveways, sidewalks, etc. shall be properly backfilled with PA DOT 2-A Limestone select stone as shown on **SD-2-070 and SD-2-071**.

G6.5 No material shall be used for backfill at any location, which, in the opinion of the OWNER's representative, is too wet, frozen, mucky, or contains debris, tree stumps or an excessive amount of rock.

G6.6 All excess excavated material resulting from the construction of the pipelines, structures and appurtenances shall be removed from the site and disposed at a location and in a manner, which shall be the CONTRACTOR's responsibility to determine.

G6.7 No more than one hundred feet of trench shall be opened at any one time.

G6.8 All open trenches for construction of the pipeline shall be constructed in accordance with the provisions of the Occupational Safety and Health Act Regulations, as the same pertain to the shape of trenches above the pipe zone, trench side-wall supports, the construction methods employed, the general protection requirements, the general excavation requirements, the general trenching requirements and the minimum requirements for trench shoring. All sheeting and/or shoring shall be designed by the CONTRACTOR for the conditions encountered and, shall be structurally adequate to withstand the loads to be encountered and shall be compatible with assuring the protection against disturbance of adjacent facilities and/or grounds and, the safety of construction and other personnel. Removal of the sheeting and bracing shall be reasonably and carefully performed to avoid displacement of the entrenched pipe and/or adjacent ground facilities.

G6.10 Trenches at any and all locations where pedestrian or traffic hazards would result, shall not be left open during non-construction hours, unless they are suitably covered with a steel plate which is adequately anchored and reinforced to sustain

loads which may be imposed. Rules and regulations of the local, state and county authorities respecting safety provisions shall be observed.

G7 Warning Signs, Lights and Barricades

G7.1 A minimum of one lane of traffic shall be maintained on all streets, roadways, and other traveled ways at all time during construction of this project in order to accommodate the residents of the area as well as emergency fire, ambulance and similar vehicular traffic. Suitable and adequate barricades shall be erected and properly maintained by the CONTRACTOR at all times during the course of construction work to clearly and properly caution and protect traffic and pedestrians from open excavations, unstable filled areas, obstructions and other hazards directly or indirectly resulting from the construction activities. Warning signs, barricades and handrails shall be erected and a sufficient number of high intensity warning lights shall be appropriately located for use at night and at times when visibility is poor. An adequate number of flagmen shall be utilized to guide traffic along all areas where work is being performed or where hazardous driving conditions prevail. CONTRACTOR shall provide reasonable advance notice to Hopewell Township and the appropriate School District(s) (for scheduling alternative bus routes) and the appropriate fire department(s). Such notice shall be in the form of a schedule of activities which the CONTRACTOR shall update during progress of the work.

G7.2 Where the water main and other facilities are constructed along and where construction activities may otherwise impede normal vehicular traffic patterns on state highways, the control of traffic shall be accomplished in accordance with the details set forth in Publication 213 of the Pennsylvania Department of Transportation, the title of which is "Temporary Traffic Control Guidelines Publication". The position of work zone signs, erection of signs, sizes of signs, details and configuration of signs, traffic channelizing, tapered lengths/spacing, cones, drums, vertical panels, lighting devices, arrow boards and all flagging conduct and activities shall conform to the details described therein. The location and configuration of traffic control methods shall conform to those graphically illustrated on the appertaining Table 5 and Figures 5 through 23 shown in the publication. The CONTRACTOR shall submit a traffic control plan and procedures (conforming to the above referenced Publication 213) to the OWNER for approval, prior to commencing with field construction. State highways are illustrated on the detailed plans with the prefix SR and the state route identification number. (Also refer to PA DOT Figures 5, 7, 8, 10a & 10b).

G7.3 There are businesses/facilities located along the route of this project that may require continuous access for deliveries, shipments and customer access. The CONTRACTOR shall be required to contact and schedule work in areas that will affect these businesses/facilities. The CONTRACTOR will be required to accommodate access to these locations by scheduling work during off hours or coordinating work/business schedules to minimize impacts to local businesses/facilities.

G8 Dewatering

G8.1 All trenches shall be dewatered thoroughly in advance of the pipe installation construction activities. The dewatering operation may be accomplished by the use of pumps, well-points, wells or any combination of those systems, but in any event, the pipeline shall be constructed in a trench which will be required to be free of ground, surface or any other source of water inflow and/or infiltration. The proposed water pipeline may not be used for dewatering purposes under any circumstances and particular care shall be exercised to keep open pipe ends sealed with plugs which are fabricated for that purpose and to prohibit the entrance of any extraneous water. Where dewatering pumps are required to be used sufficient discharge hose and other appurtenances shall be provided so that the water is discharged into storm drains, creeks, streams or other suitable water courses intended for such purposes.

G9 Ductile Iron Water Pipe and Fittings

G9.1 All pipes to be furnished under this contract shall be Ductile Iron Pipe, centrifugally cast in metal molds or sand-lined molds, for water or other liquids as described in the specifications published by the American Water Works Association ANSI/AWWA C153/A21.53. Fittings shall conform to the applicable provisions of ANSI/AWWA C153/A21.53, most recent revision. The pipe shall be Thickness Class 52 furnished in 18 or 20 ft. lengths. Joints shall be restrained, Mega A Lug, or an approved equal, unless noted otherwise noted on the drawings and the joints at the fire hydrant assemblies and fittings shall be restrained and shall be of the restrained mechanical joint or lock gasket type. The manufacturer shall furnish a sworn statement that the inspection and all of the specified tests have been made and that the results comply with the above stated specification standards.

G9.2 All pipe and fittings shall be coated and shall be provided with a double cement lining in accordance with the latest revision of the ANSI/AWWA C104/A21.4 specification. All fittings shall have double cement lining meeting the latest revision of ANSI/AWWA C550 and C1161A.21.116 requirements.

G9.3 All necessary accessories including lock ring, bolts, etc., shall be furnished and installed to accommodate the restrained and mechanical joints. Field lock gaskets shall be installed at a minimum of five (5) joints of pipe prior to any tie-in connection or flush out assembly.

G9.4 Pipe and fittings shall be similar and equal to those products manufactured by Atlantic States Pipe Co., American Pipe Company or U.S. Pipe and Foundry Company. **All pipe and fittings used on this project shall conform to NSF Standard 61.**

G10 Installation of the Ductile Iron Water Pipe

G10.1 All pipe, valves and hydrants shall be installed in accordance with the alignments, profiles and elevations indicated on the drawings. Exploratory excavation at critical points of crossing and/or possible conflict with other utilities shall be made prior to laying any pipe.

G10.2 The ductile iron pipe, fittings and accessories shall be furnished and installed in general accordance with the applicable provisions of Standard ANSI/AWWA/C600 of the latest revision. The trench bottom shall be true and even and bell holes no larger than that required to make connections of the joints shall be provided. Pipe plugs shall be used at all times to protect the pipeline from the entrance of extraneous water, animals or other foreign material. Joints shall be deflected as required to conform with the alignments shown on the drawings, but in no event shall deflection angles exceed five degrees. Thrust restraints shall be installed at changes in pipeline alignment and wherever pipe restrained joints are not significant and as identified on the Contract Drawings. If necessary, the pipe shall be cut in the field to accommodate the alignment and/or the locations of fittings shown on the drawings.

G10.3 Care shall be exercised to properly install the gate valves and boxes and the hydrants so that they are readily accessible at the respective elevations of existing ground. The hydrants shall be located in the field where directed by the OWNER’s representative.

G10.4 After completion of all pipe installation and after sterilization has been accomplished in accordance with procedures outlined for disinfection of the pipe lines, the lines shall be flushed so that all dirt and debris and the sterilization solution will be thoroughly cleaned out of the pipes. Flushing shall be accomplished at a time satisfactory to the OWNER and the flushing water shall be conveyed to ditches or creeks in such a manner as to

avoid traffic or other hazards and erosion of public or private properties. Flushing water shall be dechlorinated as outlined in Exhibit “A” attached hereto.

G10.5 All nuts, bolts and washers used to connect valves to pipe or fittings, restrained joint fittings, ring kits, etc., that are exposed to direct bury conditions shall be low alloy steel. After assembly all nuts, bolts and washers shall be completely coated with spray on corrosion protection and bolts shall be equipped with sacrificial zinc anode caps as manufactured by Trumbull or approved equal. All hardware shall be clean and dry before applying the coating system.

G11 Utility Marking Tape

G11.1 Install detectable utility marking tape above all pipelines approximately 2 feet below final grade.

1. Minimum 2" wide, blue color, plastic foil with the words "CAUTION-Waterline Buried Below" printed in bold letters.

G12 Polyethylene Encasement

G12.1 All ductile iron pipe and fittings being installed under this contract shall be furnished with polyethylene encasement. The polyethylene encasement shall be V-BIO Enhanced Polywrap be manufactured by U.S. Pipe conforming to the following requirements of ASTM A674.

G12.2 The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely airtight or watertight enclosure. All clumps of clay, mud, cinders and so forth, on the pipe surface shall be removed prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or embedment material from becoming trapped between the pipe and the polyethylene.

G12.3 The polyethylene film shall be fitted to the contour of the pipe to affect a snug, but not tight, encasement with minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to the polyethylene due to backfilling operations. Overlaps and ends shall be secured with adhesive tape or plastic tie straps capable of holding the polyethylene encasement in place until backfilling operations are complete.

G12.4 For installations below the water table the CONTRACTOR shall provide for circumferential wraps of the tape or plastic tie straps be placed at 2-ft (0.6-m) intervals along the barrel of the pipe to help minimize the space between the polyethylene and the pipe.

G12.5 Cut the polyethylene tube to a length approximately 2 ft. (0.6-m) longer than the pipe section. Slip the tube around the pipe, centering it to provide a 1-ft. (0.3-m) overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears the pipe ends.

G12.6 Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole is necessary and shall be made at joints to facilitate installation of the polyethylene tube.

G12.7 After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the proceeding length of pipe, slip it over the end of the new length of pipe and secure it in place. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width at the top of the pipes to make a snug but not tight fit along the barrel of the pipe, securing the fold at quarter points.

G12.8 Pipe-Shaped Appurtenances - Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe.

G12.9 Odd-Shaped Appurtenances - When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in a tube, wrap with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges of the polyethylene sheet together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

G12.10 Repairs - Repair cuts, tears, punctures, or damage to polyethylene with adhesive tape or with a short length of polyethylene sheet or a tube cut open, wrapped around the pipe to cover the damaged area, and secured in place.

G12.11 Openings in Encasement - Provide openings for branches, service taps, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily folding

back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut and any other damaged areas in the polyethylene, with any resulting damaged areas being repaired as described previously. The preferred method of making direct service taps consists of applying two or three wraps of polyethylene adhesive tape completely around the pipe to cover the area where the tapping machine and chain will be mounted. This method minimizes possible damage to the polyethylene during the direct tapping procedure. After the tapping machine is mounted, the corporation stop is installed directly through the tape and polyethylene. Experience has shown that this method is very effective in eliminating damage to the polyethylene encasement by the tapping machine and chain during the tapping operation. After the direct tap is completed, the entire circumferential area shall be closely inspected for damage and repaired if needed.

G12.12 Junctions between wrapped and unwrapped pipe - Where polyethylene wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least 3 feet. Secure the end with circumferential turn of tape.

G12.13 Backfill for polyethylene-wrapped pipe - Use the same backfill material as that specified for pipe without polyethylene wrap, exercising care to prevent damage to the polyethylene wrapping when placing backfill. Backfill material shall be free from cinders, refuse, boulders, rocks, stones or other material that could damage polyethylene. In general, backfilling practice should be in accordance with the latest revision of ANSI/AWWA C600.

G13 Valves

G13.1 All valves 12” and smaller shall be resilient wedge, furnished with mechanical joints, as indicated and shall conform to the specifications set forth in the ANSI/AWWA C515 Standard of the latest revision. The valves shall be installed in the vertical position and at the bury locations shown on the drawings. Valves shall be ductile iron body, resilient wedge, open to the left counterclockwise, with 2" operating nut, designed for a working pressure of 250 psi. The larger than 12” valves shall be furnished with a bevel gear operator with a two-inch operating nut and shall be rated for 250 psi operating pressure meeting all requirements of AWWA C515 and C500. After assembly, all nuts, bolts and washers shall be completely coated with spray on corrosion protection and bolts shall be equipped with sacrificial zinc anode caps as manufactured by Trumbull or approved equal. All nuts, bolts, washers, etc. on valve exterior exposed to direct bury conditions

shall be stainless steel, coated as noted herein. Valves shall be similar to those as manufactured by Mueller or Kennedy. Each valve shall be equipped with a three-piece large bottom screw type 26T, 59B, and a #6 base with lid, cast iron 6860 Series box. All valve boxes must come complete with 5 ¼" lids. Lids shall have the word WATER forged into casting. All boxes must be produced in accordance with and meet provisions of most recent ASTM A-438, ASTM-A48 and AWWA C110/A21 and AWWA C104/A21 4-90 standards.

G13.2 All nuts, bolts, washers, etc. on all size valve exterior exposed to direct bury conditions shall be stainless steel.

G13.3 All nuts, bolts and washers used to connect valves to pipe or fittings, restrained joint fittings, ring kits, etc., that are exposed to direct bury conditions shall be low alloy steel. After assembly all nuts, bolts and washers on the valve and all connecting hardware shall be completely coated with spray on corrosion protection and bolts shall be equipped with sacrificial zinc anode caps as manufactured by Trumbull or approved equal. All hardware shall be clean and dry before applying the coating system.

G14 Hydrostatic Testing

G14.1 When the line has been completely filled with water and all air expelled, the Developer shall slowly increase the pressure in the line to 225 psi as measured at the low point of the test section and corrected to the elevation of the test gauge. When the pressure in the line has stabilized, and if the pressure drops 10 psi below the test pressure, the Developer shall again increase the pressure to the test pressure by pumping as required. This procedure shall be repeated as necessary to maintain these pressures for a period of one (1) hour. If the Developer must pump more than three (3) times during the one-hour test period, the section of line under test shall be considered to have failed the hydrostatic test. The Developer shall determine and correct the cause of excessive leakage and repeat the hydrostatic test as required until the above test conditions and repeat the hydrostatic test as required until the above test conditions have been met. The Developer shall then proceed with the leakage test.

G14.2 Leakage Test

When the hydrostatic test has been successfully completed, the Contractor shall slowly reduce the pressure to 10 to 20 psi as measured at the high point of the test section and corrected to the elevation of the test gauge. The pressure in the test section shall then be increased slowly to the "leakage test pressure", and this

pressure shall be maintained for at least two (2) hours by pumping water into the test section as required to maintain the leakage test pressure. The amount of water pumped into the test section shall be measured by such means as approved by the Inspector/Engineer and shall not exceed a rate of 23.3 gallons per day per mile of pipe per inch of pipe diameter or shall not exceed that specified in the following table:

Maximum allowable leakage in gallons for each 1,000 feet of test section in two (2) hours.

Pipe Diameter	4"	6"	8"	10"	12"	16"
Allowable Loss	1.5	2.2	2.9	3.7	4.4	5.9

If leakage exceeds that specified above, the section of line under test shall be considered to have failed the leakage test. The Developer shall determine and correct the cause for excess leakage and repeat the leakage test as required until the above test conditions have been satisfied.

“Leakage test pressure” as indicated herein shall be that pressure determined by the Engineer which approximates the normal working pressure in the test section when it has been placed in service.

G14.3 During both hydrostatic and leakage tests, any visible leaks and defects shall be repaired regardless of total leakage occurring during the tests.

G14.4 If the testing of any section of line discloses leakage greater than that amount, the CONTRACTOR shall, at his sole expense, locate the problem and make all necessary repairs and retest until the pipeline conforms to the specified allowance. Any and all visible leaks which are detected shall also be repaired, regardless of the amount of leakage. Water required for additional testing shall be at the expense of the CONTRACTOR.

G15 Disinfection

G15.1 All pipelines constructed under this Contract shall be disinfected in accordance with the "Tablet Method" as stipulated in AWWA C651-14-Section 5.1, appended hereto as Exhibit A. Final flushing and Bacteriological test shall conform to Section 6 and 7 of the AWWA C651.14. Improper disposal of highly chlorinated water resulting in environmental damage and consequential fines to the owner will be the sole responsibility of the Contractor. OWNER will collect and analyze samples for compliance with AWWA C651-92-Section 5.1. CONTRACTOR shall be responsible for OWNER costs, labor

and expenses, associated with bacterial chlorination testing including any overtime incurred to accommodate the Contractor's schedule. The location and number of bacteria tests shall be as determined by the OWNER.

G15.2 Bacteria tests must be scheduled to start on a Monday, Tuesday or Wednesday due to OWNER's staffing requirements. Chlorination tests can be scheduled to start Monday through Thursday. All tests must be scheduled with OWNER a minimum of forty-eight (48) hours in advance.

G16 Connection to Existing Water Lines - Plan and Schedule

G16.1 Connection to existing water main will not be permitted until the new water main is acceptably pressure tested and disinfected as described herein. Filling, flushing, etc., of a new line shall be through the proper number and size of taps in the new waterline connected to a hydrant or tap on the existing water system provided with backflow preventers. All disinfection feed equipment pumps, backflow preventers, valves, tapping equipment, piping, hoses, dechlorination facilities, etc., shall be furnished by the CONTRACTOR. The CONTRACTOR shall be required to prepare a written plan for flushing, pressure testing and disinfecting the new water mains. The plan must be submitted to the OWNER two weeks in advance of conducting any of the above-mentioned testing procedures and will be subject to review and comment by the OWNER. The OWNER or a representative of the OWNER will take samples for the chlorine and bacteriological tests (**must pass two consecutive bacteriological tests, 24 hours apart**). The OWNER will need three days notice for the acquisition of samples for the bacteriological tests. This project shall be segmented into work zones of maximum no longer than two City blocks (1,200 LF). All installation, pressure testing, disinfection, services, restoration, etc., must be complete on any segment of the project (no more than two City blocks or 1,200 linear feet) before moving to the next work zone. The CONTRACTORs schedule shall include details regarding the segmented approach. The OWNER will not collect or analyze samples for disinfection and/or bacteriological testing unless the flushing and disinfection procedures outlined herein are strictly followed.

G17 Thrust Restraints (Other than Restrained Joints)

G17.1 Concrete blocks shall be cast in place with formwork in accordance with the configurations shown on **SD-2-045** at all waterline bends. The concrete to be used may conform with mix proportions of water, cement and fine and coarse aggregates utilized locally, however, it shall have a minimum compressive

strength of 3,500 pounds per square inch and a maximum slump of five inches. The concrete shall be placed such that it is supported against undisturbed earth along the excavated trench wall and the trench bottom and shall be thoroughly worked and vibrated to ensure complete contact with the walls of the fittings being restrained. No trench backfill shall be placed at the locations of the thrust blocks until twenty-four hours after placement, and/or until the OWNER's representative on the site has inspected the installation.

G17.2 At all locations where Thrust Blocking is required, the Contractor shall install mechanical joint restraints and concrete thrust blocking in accordance with **SD-2-045**.

G17.3 Concrete thrust blocking shall be formed and installed at a location free of bolts and fittings.

G18 Roads, Walkways, Paving and Surface Restoration

G18.1 It is intended that all surfaces occupied, disturbed, damaged or used to accommodate or perform construction work or for access to any part of the site shall be restored, as nearly as is practicable, to the condition existing prior to construction. Signs, drainpipes, curbs, storm ditches, and any and all other existing public or private property items shall, where necessary be temporarily removed so that the work can be performed; said items shall, as soon as possible be properly replaced at a location and in accordance with the requirements of the respective owners. Driveway drainpipes shall conform to the specifications and requirements of the Municipality where the work is being performed and shall be a minimum of 12 inches in diameter, galvanized corrugated metal pipe and shall be installed at the exact elevations as those of the driveway drain removed to accommodate water main installation. When necessary to temporarily remove mailboxes so that the work can be performed, the mail box shall be restored in the shortest time to the requirements of the U.S. Postal Services and at the original location together with unrestricted access.

G18.2 The CONTRACTOR shall confine his material storage, excavation, topsoil storage and other work within the rights-of-way provided except when by written agreement between the CONTRACTOR and the OWNER of the property through which the right-of-way passes, permission is granted to occupy areas beyond that designated. When working on public or private highways, streets and alleys, the CONTRACTOR shall confine his operations as required by the Authorities having jurisdiction.

G18.3 The CONTRACTOR shall make his own arrangements with private individuals relative to storing materials or equipment on private lands.

G18.4 Where the construction work is across, along or through right-of-ways, roadways, streets or alleys, belonging to the State, Township, City or utility companies, the regulations and stipulations set up and required by those OWNERS shall be observed and all work shall be in conformance with the requirements set forth by that OWNER. Any and all permits required for opening roadways or streets except state roadways, shall be obtained by the CONTRACTOR at his own expense. A highway/roadway opening permit must be acquired from each affected Municipality by the CONTRACTOR prior to commencing work within their right of way. The cost of all inspection required by those OWNERS shall be borne by the CONTRACTOR. The expense of said inspection shall be paid by the CONTRACTOR even though the permits and inspection agreements may be issued to or be between the OWNER of the road or utility and the **CHJA**. If the **CHJA** is billed for these inspection services, the CONTRACTOR shall reimburse the **CHJA** at the time the bills are paid. All trenches within five feet of the edge of pavement or improved berm shall be backfilled with select 2-A Limestone material thoroughly compacted in 8" lifts and the pipe shall be bedded with concrete sand in accordance with **SD-2-001**. Municipal Street surface restoration for this water main replacement project will be completed in accordance with these technical specifications and standard details contained herein and shown on the Contract Drawings. Joints between existing and new asphalt surface shall be sealed. The edges of all trenches shall be saw cut for full depth prior to placing the binder course. As outlined previously herein, all work including pavement restoration must be complete in one work segment before commencing work on the next segment. All trench cuts shall be temporarily restored with a minimum 3″ thick lift of cold patch material until the permanent restoration can be completed. The cost of this temporary restoration shall be paid for under the temporary road restoration unit price item in the bid sheet. It will be the responsibility of the CONTRACTOR to maintain all street cuts until the issuance of the final completion certificate. Where noted on the contract drawings, the CONTRACTOR shall install temporary asphalt ADA ramps constructed with PA DOT Superpave (3″ compacted thickness) wearing course per section 450 of the PADOT Publication 408 no detectable warning surface required. All other ADA ramps shall be concrete and installed in accordance with the details in accordance with PADOT Publication 408 and RC-67M.

G18.5 Where the construction work is across, along or through right-of-ways, roadways, streets or alleys, belonging to the State, Borough or utility companies, the regulations and stipulations set up and required by those OWNERS shall be observed and all work shall be in conformance with the requirements set forth by that OWNER. Any and all permits required for opening roadways or streets except state roadways, shall be obtained by the CONTRACTOR. The cost of all inspection required by the State shall be borne by the CONTRACTOR. The extent of asphalt restoration associated with this project shall be trench restoration. The CONTRACTOR will be required to provide the associated bonds and pay all fees associated with acquisition of the required South Heights permits and inspection and degradation fees and any additional PADOT Bonding that may be required. The CONTRACTOR is cautioned that proper pre-construction photos of Municipal or PADOT roadways are necessary to depict the pre-construction condition of these surfaces. Any and all roadway markings removed or damaged as a result of construction activities shall be restored by replacement of the markings in accordance with the appropriate PADOT or Municipal Regulation.

Paved surface restoration shall be as follows at a minimum:

> All non-rigid bituminous surface paving shall be restored by neatly and uniformly cutting the edges and placing a base course and surface course over the trench fill in accordance with requirements of the Pennsylvania Department of Transportation Form 408.

CONTRACTOR shall contact the Hopewell Township/Public Works Department for all permit, insurance, bonding, inspection fees and/or requirements. Degradation fees will be the responsibility of the CONTRACTOR.

G18.6 Any concrete curb disturbed, damaged or removed as a result of water main installation work shall be replaced in accordance with **KLH SD-2-079.** All concrete curb/sidewalk being replaced at any crosswalk shall be replaced in accordance with all applicable ADA Standards or the most current PADOT ADA Ramp Standards.

G18.7 For bituminous paving, all materials and methods of construction shall comply with the requirements of Pennsylvania Department of Transportation, Form 408.

G18.8 Where the proposed water main crosses existing concrete driveways, walkways or sidewalks, all concrete paving shall be restored by neatly and uniformly cutting the edges and placing a 6"

thick reinforced concrete slab over the trench in driveway areas and 4″ thick reinforced concrete slab in sidewalk and walkway areas. The concrete shall be reinforced with 6x6x10 gauge wire mesh. If the proposed water line trench is within 3 feet of an existing joint in the concrete driveway or sidewalk the existing pavement shall be saw cut at the joint and replaced to that existing joint. If the proposed trench is not within 3 feet of an existing joint in the concrete surface the CONTRACTOR shall saw cut to the limits of the trench and replace the concrete as described above placing a new joint on one side of the new concrete paving where it matches the existing concrete.

G19 Service Connections

G19.1 The CONTRACTOR is responsible to tap the D.I. main and furnish and install copper service lines of the sizes indicated on the Contract Drawings to the right-of-way line for all indicated services, including the corporation stop, curb stop, stainless steel rod and box. The customer is responsible for the service line from the right-of-way line to their residence. All existing services shall be reconnected at the locations shown on the Contract Drawings. The following chart denotes the maximum size direct tap for various sized mains.

Water Main Size	Maximum Direct Tap Size
8″	1″
12″	1 1/4″
16″	2″
20″	2″
24″	2″

For all taps larger than denoted above, a ductile iron C153 Mechanical Joint Tapping Sleeve or a tee with a solid & tapped cap shall be used to accommodate the large service line.

G19.2 Service pipe shall be copper water tube, Type K, soft temper, for underground service, conforming to ASTM B-88 and B-251. The pipe shall be marked with the manufacturer's name or trademark and a mark indicative of the type of pipe. The outside diameter of the pipe and minimum weight per foot of the pipe shall not be less than that listed in ASTM B-251, Table 11.

G19.3 The CONTRACTOR shall provide all pipe, fittings, labor, to install service lines as shown on the construction drawings and described herein. For each installation the CONTRACTOR shall install a new corporation stop, new service line, new curb stop,

stainless steel curb box rod and curb box. The CONTRACTOR shall have the Creswell Heights Water Authority shut off existing service to the building and CONTRACTOR shall provide and install sufficient pipe to connect from new curb stop to a point on the customer's existing service line at the existing curb stop. Connections shall be made with compression couplings (Mueller 110 Compression or Ford Quick Joint). All existing curb boxes will be turned over to the Water Authority.

G19.4 The CONTRACTOR shall reconnect all existing service lines to the newly installed water main. No service line replacement shall result in excavation in roadway. All service connections shall maintain proper bury depth, install new corporation stop (according to Authority standards).

G19.5 The corporation stops designed for insertion into water mains under pressure shall be the Type B-25008N, as manufactured by the Mueller Company or FB 1000-3-Q-NL, as manufactured by Ford Meter Box Company, Inc. All corporation stops and associated hardware shall be lead free.

G19.6 The curb stops shall be Type B-25209N as manufactured by the Mueller Company, or approved equal. All stops shall be 1/4 turn ball valve type. All ¾" and 1" curb stops shall be provided with a tapered operating stem extension/curb box rod to extend the operating nut to within 18" of finished grade. The curb box rod shall be Trumbull Industries, Inc. Item No. 367-4520 or 367-4525 with rectangular top, or equal. All curb stops 1 ½" or larger shall be provided with a standard valve box, see Section G15, and no curb box rod. All curb stops and associated hardware shall be lead free.

G19.7 Connections to curb stop shall be compression style made by Mueller 110 Compression joints or Ford Quick Joints.

G19.8 Valve boxes for 1 1/2" and 2" services shall be three-piece large bottom screw type 26T, 59B, and a #6 base with lid, cast iron 6860 Series box with 5 1/4" drop lid. Lid shall be furnished with the word "WATER" forged into casting. Valve box shall be Tyler Union Model 562-S, 564-S, or 664-S or equal.

G19.9 Pipe couplings used for service line connections up to 2" shall be brass similar to that as manufactured by Mueller Company or approved equal. No coupling may be used on any service line. CONTRACTOR shall special order lengths of copper tube to accommodate all long services. No couplings will be permitted.

G19.10 The CONTRACTOR shall be required to provide to the OWNER a location drawing, on a separate 8-1/2" x 11" sheet of the exact location of each curb stop and corporation stop for each service line. The sketch shall include dimensions to the closest main line valve or intersection. These sketches shall be provided to the OWNER at project completion. Service lines shall be installed as close to perpendicular (90°) to the property lines/waterlines as possible. The curb stop and corporation stop shall also be dimensioned by triangulation to the building being serviced.

G19.11 All existing curb boxes that are being abandoned shall be removed by the CONTRACTOR and the area disturbed by the removal shall be restored.

G20 Erosion and Sediment Control

G20.1 The CONTRACTORS shall conduct their activities and shall program trenching and restoration operations in compliance with the Commonwealth of Pennsylvania, Title 25 (Clean Stream Law)Chapter 102 (Erosion and Sediment Control Rules & Regulations) and any rules and regulations by Federal, State, County and/or Municipal law or organization in such a manner as to minimize pollution of the creeks from erosion of the freshly excavated and/or backfilled materials during periods of excavation and surface water runoff. CONTRACTORS shall reduce the area and duration of exposure of all erodible soils by the greatest extent practicable and to that end, hydromulching, reseeding and other specified surface restoration shall be required to closely follow backfilling operations. The type of seeding/ restoration required for the various job locations is listed on the Erosion and Sedimentation Pollution Control Plan Drawing. Where the Erosion and Sedimentation Pollution Control Plan calls for runoff devices or the OWNER’s Representative so directs additional installation of controls in the field, such as silt fence, filter fabric socks, waterbars, sediment traps and/or other means to retard runoff rates shall be installed as specified. Installation of a Pumped Discharge Sediment Trap (“filter bag”) or other approved sediment trap arrangements shall also be required to be installed at the discharge of dewatering pumps as detailed on the Erosion and Sedimentation Pollution Control Plan. The Soil Erosion and Sediment Pollution Controls deemed as adequate or as approved by the County Soils Conservation Service and the Pennsylvania Department of Environmental Protection are identified in the contract drawings. The CONTRACTOR shall be responsible for all fines, fees, penalties and subsequent obligations related to violations, etc. imposed upon the OWNER as a result of the CONTRACTOR’s construction activities, methods/procedures and/or the lack of construction activities methods/procedures.

G20.2 Approved Plan

G20.2.1 The Contract Drawings contain the deemed as adequate or approved Erosion and Sediment Control Requirements pertaining to the project construction.

G20.2.2 The CONTRACTOR shall implement and maintain the Erosion and Sediment Controls or Best Management Practice (BMP) devices as shown upon the Contract Drawings.

G20.2.3 The CONTRACTOR shall have available at the project site at all times a copy of the approved plan.

G20.2.4 The CONTRACTOR is advised to become thoroughly familiar with the provisions of the Appendix 64, Erosion Control Rules and Regulations, Title 25, Part 1, Department of Environmental Protection, Subpart C, Protection of Natural Resources, Article III, Water Resources, Chapter 102, Erosion Control.

G20.2.5 CONTRACTOR shall secure approved Erosion and Sedimentation Pollution Control Plan or other required environmental permits for work outside the indicated NPDES Permit Boundary (limit of disturbance) such as CONTRACTOR dump sites, staging areas, etc.

G20.3 Seed and Sod

G20.3.1 Seed, sod, mulches, fertilizer, screened topsoil, soil conditioner, and other materials shall be as specified within the Contract Document and or the Erosion and Sedimentation Pollution Control Plan.

G20.3.2 Material for Erosion and Sediment Control Devices

G20.3.2.1 Geotextiles, silt fence, erosion control blankets, surge stone, rip rap, filter bags, silt fence post and other materials as may be specified on the approved drawings and chain link fence for super silt fence shall be in accordance with the Erosion and Sedimentation Pollution Control Plan and the requirements of Chapter 102 Erosion and Sediment Control. Any change from the Erosion and Sediment Control Plans must be approved by the appropriate controlling agency.

G20.4 Execution

G20.4.1 Implement all Best Management Practices (BMP’s), including General Notes, Sequencing and Staging of Construction as described on Erosion and Sedimentation Pollution Control Plan.

G20.4.2 Delineate project boundary limits, clearly marking all pertinent features in the field.

G20.4.3 Install sediment control or BMP devices as shown upon the Contract Drawings or as directed by the OWNER's Representative prior to initial clearing and grubbing operations.

G20.4.4 Clear only areas designated on drawings within such time limits as set forth on the Erosion and Sedimentation Pollution Control Plan and as designated by the NPDES Permit Boundary (limit of disturbance) and/or within areas such as rights of ways, easements or work limits as specified herein and as directed by the OWNER's Representative.

G20.4.5 Protect excavated material and disturbed areas from erosion into waters or onto adjacent land. Stockpile excavated material on high side of trench.

G20.4.6 The CONTRACTOR shall assure that the approved Erosion and Sedimentation Pollution Control Plan is properly and completely implemented.

G20.4.7 Until the site achieves final stabilization, the CONTRACTOR shall assure that the best management practices are implemented, operated, and maintained properly and completely. Maintenance shall include inspections in a time frame as specified on the Contract and Plans of all best management practice facilities. The CONTRACTOR shall maintain and make available to local Conservation District a complete, written inspection log of all those inspections. All maintenance work, including cleaning, repair, replacement and/or re-stabilization shall be the responsibility of the CONTRACTOR and shall be performed immediately. If erosion and sediment control BMP's fail to perform as expected replacement BMP's or modifications of those installed will be required.

G20.4.8 Immediately upon discovering unforeseen circumstances posing the potential for accelerated erosion and/or sediment pollution, the CONTRACTOR shall implement appropriate best management practices to eliminate potential for accelerated erosion and/or sediment pollution.

G20.4.9 Before initiating any revisions to the approved Erosion and Sedimentation Pollution Control Plan or revisions to other plans which may affect the effectiveness of the approved E&S Control Plan, the operator must receive approval of the revisions from the local Conservation District.

G20.4.10 All pumping of sediment laden water shall be through a sediment control BMP, such as a Pumped Discharge Sediment Trap (water filter bag) discharged on a well vegetated (grassy) or onto a stable, erosion resistant area and in strict accordance with the approved Contract Erosion and Sedimentation Pollution Control Plan.

G20.4.11 Immediately after earth disturbance activities cease, the CONTRACTOR shall stabilize any areas disturbed by the activities as set forth on the Erosion and Sedimentation Pollution Control Plan. During non-germinating periods, mulch must be applied at the specified rates in the Contract and Erosion and Sedimentation Pollution Control Plan. Disturbed areas which are not at finished grade must be stabilized in accordance with the permanent vegetative stabilization specifications.

G20.4.12 Sediment must be removed from the storm water inlet protection after each runoff event.

G20.4.13 Mulch must be applied as specified on the Contract Erosion and Sedimentation Pollution Control Plan.

G21.4.14 Erosion control blankets must be installed as specified on the Contract Erosion and Sedimentation Pollution Control Plan.

G20.4.15 Straw mulch shall be applied as set forth on the Contract Erosion and Sediment Control Plan.

G20.4.16 Sediment removed from BMP’s shall be disposed of in landscaped areas outside of steep slopes, wetlands, floodplains or drainage swales and immediately stabilized or placed in topsoil stockpiles.

G20.4.17 The CONTRACTOR shall remove from the site, recycle, or dispose of all building materials and waste in accordance with the Department’s Solid Waste Management Regulations at 25 Pa. Code 260.1 et seq., 271.1 et seq. The CONTRACTOR shall not illegally bury, dump, or discharge any building material or waste at the site.

G20.4.18 Upon completion of earth moving activities and establishment of a 70% uniform perennial vegetated cover, remove all temporary BMP’s in accordance with the Contract Plan unless otherwise directed by the OWNER’s Representative.

G20.4.19 An area shall be considered to have achieved final stabilization when it has a minimum uniform 70% perennial vegetative cover or other permanent non-vegetative cover with a density sufficient to resist sliding, erosion and other earth movements.

G20.5 Stabilization of Disturbed Areas

G20.5.1 Following initial disturbance, complete permanent or temporary stabilization according to restoration schedule on Erosion and Sedimentation Pollution Control Plan.

G20.5.2 Stabilization:

G20.5.2.1 Temporary: Shall consist of temporary seeding, anchored straw mulch, erosion control netting and/or blankets, mulch netting, jute, excelsior blankets, wood chips, stone rip rap and other temporary control BMP's as necessary to implement the intent of the Plans.

G20.5.2.2 Permanent: An area shall be considered to have achieved final permanent stabilization when it has a minimum uniform 70% perennial vegetative cover or other permanent non-vegetative cover with a density sufficient to resist sliding, erosion and other earth movements.

G21 Fire Hydrant

G21.1 Fire Hydrants shall meet or exceed AWWA Standard C-502 of the latest revision and the following detailed specifications and shall be Mueller Super Centurion 250 (A-423) or Kennedy Guardian K-81D. Fire hydrants shall be triple-listed, meeting or exceeding all fire hydrant standards established by the AWWA, Underwriters Laboratory, and Factory Mutual. Fire hydrants shall be furnished and installed in accordance with **SD-2-050**.

G21.2 Hydrants shall open counterclockwise and shall be of the compression type, closing with the line pressure, having a main valve opening of 5 1/4 inches, with an internal diameter barrel of 7 inches. All primary casting, bonnet, upper and lower barrel and shoe shall be either cast or ductile iron and all connecting parts of the same material. An arrow shall be cast on the bonnet flange to indicate the opening direction. After assembly, the low alloy steel nuts, bolts, washers, etc. on fire hydrant exterior exposed to direct bury conditions shall be completely coated with spray on corrosion protection and bolts shall be equipped with sacrificial zinc anode caps as manufactured by Trumbull or approved equal. All flanges shall be integrally cast. Operating nut and stem is to be well lubricated and closed hand tight only. Operating nut and hold down nut shall be cast from bronze, which complies with ASTM Standard B-584, latest revision. Operating nut shall be a one (1) piece casting and shall be pentagon in shape.

G21.3 Hydrants shall be designed with a traffic safety feature to break cleanly upon impact, consisting of a breakable safety flange and stem coupling. The design shall permit 360-degree rotation of the upper barrel without disassembly of the lower barrel or excavation. Depth of bury shall be as shown on the plans. Hydrants are to be extendible in six (6)" increments at the ground line without excavation. A maximum of one extension will be permitted for grade adjustment and a centering spider will be required if an extension is furnished. The breakable safety flange shall be located 2" to 4" above finished grade. The CONTRACTOR shall furnish fire hydrants with barrel length to accommodate depth of bury. No aftermarket parts will be accepted for grade adjustments. All extensions shall be Mueller or Ford.

G21.4 The hydrant bonnet shall be a one piece, ribbed and fluted casting, forming a sealed factory filled lubricant chamber filled with a non-toxic lubricating oil having a temperature range +150 degrees to -60 degrees, F.

G21.5 Hydrants shall be prime coated and receive two finish coats of paint, Sherwin-Williams Safety Yellow B54-YZ 437-6401-18683 or approved equal. The shoe connection shall be 6 inch mechanical joint complete with gland, bolts, nuts and gasket and shall be epoxy coated on the interior. All coating system damage from installation shall be repaired/coated prior to acceptance by the OWNER. Fire hydrants shall have the below grade portion completely polyethylene encased as detailed in Section G12 of these technical specifications. The CONTRACTOR shall not encase that area near the hydrant drains.

G21.6 Each hydrant shall be subjected to a hydrostatic test of at least 300 psi and shall be rated for a working pressure of 250psi, unless otherwise indicated on the drawings. The manufacturer shall furnish the OWNER a notarized statement that the hydrant(s) conform to all of the foregoing specifications.

G21.7 Fire hydrants shall be located as shown or as directed and in a manner to provide complete accessibility and also in such a manner that the possibility of damage from vehicle or injury to pedestrians will be minimized.

G21.8 Each hydrant shall be connected to the main with a 6 inch ductile branch controlled by an independent 6 inch gate valve located a minimum of 5'-0" from the hydrant barrel, except as otherwise directed. Each hydrant lateral valve shall be fastened to the main with a mechanical joint anchoring tee.

G21.9 A stone and cast in place concrete foundation, at least 6 inches thick and 18 inches square, shall be placed underneath the base of the hydrant. This foundation shall be placed on a firm subbase and shall be level so as to support the underbase of the hydrant. The hydrant base shall be braced and blocked, as indicated on **SD-2-050**. It is of utmost importance that solid bearing be obtained from the blocking and that such blocking be complete and adequate. The space around the slabs and above the base of the hydrant to a height of at least 18 inches and a distance of at least 12 inches from the hydrant around the entire circumference shall be filled with #57 coarse aggregate which shall be covered with 8-mil polyethylene. Not less than 12 cubic feet of broken stone or gravel shall, in all cases extend at least 6 inches above the waste opening in the hydrant. In locations where the hydrants are to be placed in a sloping area, a clear area shall be provided in back of and along the sides of the fire hydrants and the earth shall be supported by an adequate stone wall on all three sides.

G22 Wire Conductor

G22.1 Install 12 gauge, solid wire, direct burial, insulated wire as a continuous conductor 6″ above the pipe depth with a grounded loop around the hub of each line valve and hydrant valve. Trace wire is required for PVC water lines.

G22.2 Trace wire for direct bury installations shall be, #12 AWG solid Copper wire with a 30 mil High Density Polyethylene (HDPE) or High Molecular Weight Polyethylene (HMWPE) coating designed for direct burial. Color shall be blue.

G22.3 Direct Bury Wire Nuts (Dryconn DBSR Aqua manufactured by King Innovation or approved equal).

G22.4 Direct Bury Lug (DRYconn Direct Bury Lug Aqua as manufactured by King Innovation or approved equal).

G22.5 Installation: Trace wire shall be installed in a continuous fashion. Install trace wire 6″ above the water main. Bring trace wire to surface at every valve box. Trace wire shall be brought to the surface at least every one thousand (1,000) feet. Take care not to damage the wire coating. Repair damaged coating with electrical tape.

G22.6 Trace Wire Connections: Joining Ends of Trace Wire: Connections into existing trace wire, connections into trace wire used during water main bores, connections between one spool of trace wire to another, and other similar connections shall be made using a direct bury wire nut. When connecting trace wire ends

together, strip 5/8” of insulation from the end of each wire. Insert the two ends firmly into the direct bury wire nut. Insert the two ends firmly into the direct bury wire nut. Twist the wire nut clockwise while pushing the wires firmly into the nut. Do not over torque. Tie the wires in a knot as shown in the detail below.

G22.7 Joining Trace Wire: Branch to Main: Connections to trace wire at tees, crosses, and at locations where the trace wire will be brought to the surface shall be conducted using a direct bury lug.

G22.8 Trace Wire in a Valve Box: Trace wire shall be brought up in all valve boxes. The trace wire shall be brought to the surface according to **KLH SD-2-138** and **SD-2-138A.**

G22.9 Trace Wire at Hydrants: Trace wire shall be brought in fire hydrants branch valves per the detail above.

G22.10 Trace Wire at the end of the PVC Main: At all water main end caps, a minimum of 6 feet of tracer wire shall be extended beyond the end of the pipe, coiled and secured for future connections. The end of the tracer wire shall be spliced to the wire of a six pound zinc anode and is to be buried at the same elevations as the water main.

G22.11 Trace Wire at Services: At all services a trace wire shall be placed directly above the copper service line attached to the trace wire along the main with a direct bury lug and at the service line adjacent the curb box with a grounding clamp.

G23 Demolition

G23.1 All debris resulting from the demolition shall be removed from the site by the Contractor. The area shall be restored as outlined in the contract documents.

G24 Topsoil in Cultivated Areas

G24.1 In lawns and gardens, and in other improved areas (except for streets, roadways and traveled ways), the top of the backfill material shall be placed to an elevation approximately 4" below the finished ground surface. Screened topsoil shall then be obtained by the CONTRACTOR from a local garden supplier or nurseryman and, shall be placed and lightly rolled in the top 4" of all excavated areas and other places where construction equipment and activities incur damage to ground surfaces.

G25 Restoration of Property

G25.1 Where pipelines are proposed to be constructed through lawns, gardens, driveways and other improved property, a minimum of such areas shall be disturbed. All improved property and grounds shall be restored to a condition equivalent to that existing prior to construction, including the replacement and/or restoration of all lawns, shrubbery, bushes, trees, sidewalks, fences, ditches and drainage facilities, driveways, septic tanks, septic tank drainage fields and any other structures or facilities encountered during construction. Tree replacement required shall be from nursery stock having a minimum 2 inch diameter. Improved areas are defined as areas regularly maintained by a property owner such as lawns, maintained property boundaries and all other wooded areas where the property owner regularly maintains the immediate grounds free from scrub brush.

G25.2 So that disputes do not develop over restoration procedures, the entire project along the alignments of the proposed waterlines must be photographed (digital 4 mega pixel minimum) by the CONTRACTOR prior to commencing construction activities. Pre-construction video shall be furnished on a DVD. The photographs must be furnished in a printed bound format and digitally on compact disc indexed and each picture furnished with a location description. Preconstruction photographs and video must be submitted prior to commencement of water main installation.

G25.3 Any and all trees and shrubs that must be trimmed (branches or roots) shall be performed in a professional manner and all trimmed areas shall be provided with a coating to protect the damaged/trimmed roots or branches. The material shall be manufactured for the purpose of coating/protecting trimmed and or damaged roots or branches.

G26 Contractor's and Resident Observer's Office Facilities

G26.1 The CONTRACTOR shall provide and make his own arrangements for his field office facilities, change trailers, storage areas, sanitary facilities, etc., and provide space in the field office for the Owner’s resident observer.

G27 Clean Up

G27.1 Clean up work shall reasonably follow the progress installation of the pipe and appurtenances. After work has been completed, thorough cleaning of the surface of the ground of all disturbed and occupied areas shall be done to the satisfaction of the Owner's Representative on the site.

G28 Scheduling

G28.1 This project will involve shutdowns of distribution mains and the transfer of service lines from the existing main to the new main. This work will involve the discontinuance of water service for some period of time to those services affected by the shut down or service transfer. To minimize the inconvenience associated with the service interruption, the CONTRACTOR shall minimize the duration of shutdowns and schedule all shutdowns with the OWNER and the OWNER'S on-site resident observer. The CONTRACTOR shall submit a schedule of all mainline and service interruptions to the OWNER and Resident Observer by the end of the workday on Thursday for any work scheduled for the following week. That includes a service interruption to any customer of the Creswell Heights Joint Authority. The OWNER and Resident Observer must be notified 24 hours in advance if the submitted schedule is changed or revised. The OWNER shall be responsible for notifying all customers, at least 24 hours in advance, of any proposed service interruption. Shut down of distribution mains shall be completed Monday through Thursday with the prior approval of the CHJA Manager.

G28.2 There may be businesses within the project area that will require the CONTRACTOR to schedule service interruptions in advance. Any and all service interruptions must be minimized in duration. It is expected that the service interruptions for affected businesses and other facilities will need to be performed at night. The CONTRACTOR will be required to accommodate the schedule of the affected businesses and other facilities. No additional payment will be made for performing work at night or on weekends to accommodate schedules of project area residents or businesses.

G29 Exploratory Excavation

G29.1 Some of the proposed pipelines and appurtenant structures are somewhat flexible with respect to alignment. Therefore, in those areas expected to have a number of underground utility lines, where there are large trees which may be saved by realignment, and where the OWNER's Project Representative so directs, the CONTRACTOR shall

make appropriate exploratory excavations for the purpose of locating said lines prior to excavating. The OWNER's Project Representative will then confer with the CONTRACTOR regarding the method of construction proposed to be used for performing the contract work in said areas, and, if realignment of the proposed pipelines or appurtenances appears possible and/or reasonable without conflicting with the terms set forth elsewhere in the contract documents, said alignment adjustments shall be made. Each exploratory excavation shall be ten feet long by eight feet deep by two feet wide (minimum). Excavations of lesser dimensions shall be considered a partial exploratory excavation determined by the percentage of cubic yards excavated compared to the specific requirements.

G30 Disposal of Excess Material

G30.1 All materials resulting from either and/or both the open excavation, which materials are not replaced as backfill, shall be hauled from the site of the work and shall be disposed as determined by the CONTRACTOR to a DEP-approved dump site.

G31 Pipeline Commissioning

G31.1 General

G31.1.1 The CONTRACTOR shall provide, complete and ready for use, all of the pipe line system and appurtenances and shall perform such operations and tests, all as specified herein and as indicated on the drawings.

G31.1.2 All pipelines shall be installed by skilled mechanical erection labor in accordance with manufacturer's instructions.

G31.2 Inspection and Test

G31.2.1 Tests shall be performed on all piping, equipment and complete systems. The CONTRACTOR shall provide labor, materials, tools, air, water, power and supplies of any kind required for testing and adjusting of equipment and systems. Each CONTRACTOR is responsible for testing systems which he has furnished.

G31.2.2 Material and/or equipment damaged or shown to be defective shall be repaired or replaced to the satisfaction of the OWNER.

G31.2.3 All tests shall be made only after notification to and in the presence of the Creswell Heights Joint Authority’s Representative. Records shall be kept for each test showing the date, system and/or equipment were tested, method of test, test

results and approval signature of the Creswell Heights Joint Authority's Representative. Three copies of the test records, along with any certificates of final inspection or approval issued by the authorities having jurisdiction, shall be furnished to the Creswell Heights Joint Authority at the successful completion of each test.

G31.3 Commissioning

G31.3.1 Pipelines shall be put in operation upon successful testing and upon authorization by the Creswell Heights Joint Authority's Representative.

G31.4 Final Clean Up, Site Rehabilitation

G31.4.1 Before finally leaving the site, the CONTRACTOR shall wash and clean all exposed surfaces which have become soiled or marked. CONTRACTOR shall remove from the site of the work all accumulated debris and surplus materials of any kind which result from his operations, including construction equipment, tools, sheds, sanitary enclosures, etc. CONTRACTOR shall leave all equipment, fixtures and work, which he has installed, in a clean condition. The completed project shall be turned over to the OWNER in a neat and orderly condition.

G31.4.2 The site of the work shall be rehabilitated or developed in accordance with other Sections of the specifications and the Drawings. In the absence of any portion of these requirements, CONTRACTOR shall completely rehabilitate the site to a condition and appearance equal or superior to that which existed just prior to construction, except for those items whose permanent removal or relocation was required in the Contract Documents or ordered by the OWNER.

G31.5 Final Inspection

G31.5.1 Final cleaning and repairing shall be so arranged as to be finished upon completion of the construction work.

G31.5.2 The ENGINEER will make his final inspection of the work during the progress of final cleaning and repairing, and any portion of the work finally inspected and accepted by the ENGINEER shall be kept clean by the CONTRACTORs, until the final acceptance of the entire work.

G31.5.3 When the CONTRACTORs have finally cleaned and repaired the whole, or any portion of the work, they shall notify the ENGINEER that they are ready for final inspection of the whole or a portion of the work and the ENGINEER will thereupon inspect the work. If the work is not found satisfactory, the ENGINEER will order further cleaning, repairs or replacement.

G31.5.4 When such further cleaning or repairing is completed, the ENGINEER, upon further notice, will again inspect the work. The "Final Payments" will not be processed until the CONTRACTOR has complied with the requirements set forth and the ENGINEER has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

G32 Drawing Index

G32.1 The contract drawings as listed on Drawings G1-ES2 dated February 2021 prepared by the KLH Engineers, Inc. identify all Contract Drawings and accompany these specifications and are a part thereof. The drawings are the property of the ENGINEER and shall not be used for any purpose other than that intended by the specifications. The CONTRACTOR shall be responsible for purchasing all sets of drawings and specifications to be used in the progress of the work. Unauthorized reproduction of the drawings or the specifications by the CONTRACTOR shall not be permitted.

Sheet	Drawing No.	Title
1	G1	Title Sheet
2	C1	Plan & Profile
3	C2	Plan & Profile
4	D1	Details
5	D2	Details
6	D3	Details
7	ES1	E&S Control Plan - Details
8	ES2	E&S Control Plan - Details

G33 Submittals

G33.1 Shop Drawings

1. Each CONTRACTOR shall submit to the ENGINEER a Shop Drawing and information required for the work. All Drawings and information shall contain sufficient data to ascertain compliance with the Contract Documents. Incomplete, inadequate or unidentified submittals will be rejected. The ENGINEER will examine submittals only after they have been properly identified, as described later in this clause, and signed by the CONTRACTOR to indicate that he has reviewed and endorsed them.

2. The ENGINEER will review submittals only for conformance with the design concept of the project and with the information given in the Contract Documents. Review of submittals shall not relieve the CONTRACTOR from responsibility for deviation from the Contract Documents unless specifically noted in the submittal and no exception is taken by the ENGINEER. The CONTRACTOR is responsible for confirming and correlating all quantities, dimensions, fabrication details and techniques, installation methods and performance of the work. The CONTRACTOR shall check and verify all field measurements.

3. All submittals must be complete, accurate and provide sufficient detail to indicate item by item compliance with the Contract Documents. The ENGINEER will receive any submittal that the CONTRACTOR cares to present.

4. When shop drawings include wiring diagrams, piping, equipment or other data which must be coordinated with the work of other CONTRACTORs, additional copies of the submittal shall be furnished for review and for distribution by the ENGINEER.

5. To facilitate review, the CONTRACTOR shall number consecutively each submittal. This numbering system should be in order of submittal. Any resubmittal required shall have the same number as the original submittal, followed by notation signifying that it is a second (or third, etc.) submittal, e.g. #14 (2nd sub.). In addition, all submittals shall have the following information placed on them by the CONTRACTOR, and review of a particular submittal will be undertaken only if such information is provided:

   a. Shop Submittal Number _____
   b. Deviations: None_____: As Listed:____
   c. Reference Specification Number _____
   d. Reference Drawing Number _____
   e. Space Requirement: As Designed _____
   f. Different, as Listed _____
   g. Contractor has reviewed and submitted for review
   h. Signature _____
   i. Date _____

6. Make the corrections indicated on the returned shop drawings and resubmit corrected copies for final approval, furnishing such other copies that may be needed. **No work shown on shop drawings shall be started until same has been returned approved.**

G33.2 Instruction Manuals

G33.2.1 The CONTRACTOR shall furnish, prior to initial testing, three (3) copies of an indexed maintenance manual on all equipment and suppliers' brochures on all specialty equipment, including performance curves with size, model, figure number, etc., indicated to identify unit furnished. Maintenance manuals are to be of hardback, loose-leaf type and of a durable quality. Each set to include the following:

a. Manufacturer's parts list identified with the make, model and serial number of the equipment furnished.

b. Control and wiring diagrams.

c. Installation, operation, lubrication and maintenance instructions.

d. Manufacturer's recommended spare parts lists.

G33.2.2 The required instruction manuals shall be submitted to the OWNER or ENGINEER for review and approval in the same manner as shop drawings and additions, deletions, or modifications maybe required as a result of this review. The materials and equipment for which manuals are required will be determined by the OWNER and/or ENGINEER.

G33.3 Record Drawings

G33.3.1 The CONTRACTOR is responsible for maintaining two (2) sets of Record Drawings. One set of the Record Drawings shall be left with the OWNER at the completion of the project, while the other set shall be delivered to the ENGINEER before application for final payment.

G33.3.2 All records shall be kept by the CONTRACTOR for all deviations in location or elevation of any installation from that shown on the Contract Drawings. Record Drawings shall include but not be limited to the following: structural locations, piping locations, equipment locations, revisions to schematic diagrams, etc. Records shall also be kept of any significant changes from approved shop drawings or Contract Drawings. Records shall consist of marked shop or Contract Drawings and shall be submitted to the OWNER at any time upon request.

G33.3.3Each record drawing shall be certified by the CONTRACTOR as an accurate representation of the completed work.

G33.4 Photographs/Video Tape

G33.4.1 The CONTRACTOR shall photograph and video tape all work areas of the project. The still photographs and video tape shall be dated (month/day/year/time). The video shall be VHS or DVD format, color and voice narrated to indicate the activity and/or facilities being constructed. Two (2) copies of the photographs and video tape shall be submitted monthly to the ENGINEER and will become the property of the OWNER. Still photographs may be digital, and at least one (1) hard copy shall be supplied if digital photographs are submitted.

G33.5 Submittal Scope

G33.5.1 The CONTRACTORS shall furnish but are not limited to the following submittals:

- Construction schedule (must be submitted and approved prior to commencing construction activities).
- Schedule of values (must be submitted and approved prior to commencing construction activities).
- Concrete.
- Other miscellaneous materials of construction.

G34 Buy American

G34.1 CONTRACTORS are advised that domestic construction material and equipment must be used in preference to non-domestic materials if it is priced no more than six percent (6%) higher than the bid or offered price of the non-domestic material, including all costs of delivery to the construction site and any applicable duty whether or not assessed. Computations will normally be based on costs on the date of opening of bids. The “Steel Products Procurement Act” requirements supersede the “Buy American” requirements.

End of Section G
Technical Specifications

Section H

MEASUREMENT AND PAYMENT

H1 General

Payment for all completed work performed under this contract shall be made in the respective unit prices and lump sum amounts appearing on the Bid Forms, as may be amended in accordance with the General Conditions. The cost of performing all work shown on the drawings and/or described in the specifications shall be included within the amounts bid.

H2 Applications for Payment

Applications for Payment during construction progress shall be jointly developed each month by authorized representatives of the CONTRACTOR, OWNER and ENGINEER.

Progress payments shall be developed by use of the respective unit prices, lump sums and total prices submitted on the Bid Form indicating accepted construction quantities and respective unit prices aggregating the total.

The CONTRACTOR shall then have the Application for Payment form typed, reproduced in the number of copies directed by the ENGINEER and filed with the ENGINEER on or before the first day of the month. Said Application shall also be accompanied by all documentation as may be reasonably required, such as copies of invoices of materials properly stored on the site, but not incorporated in the work. Materials stored on the site will not be paid for without evidence of the actual purchase price and will not be eligible for payment unless it is properly stored on the site of the Work, or at some other location and under such conditions as the OWNER may require.

The amount of the progress payment shall be 90% of the value of the completed construction work.

The sum or sums withheld by the OWNER from the CONTRACTOR after the contract is 50% completed shall not exceed 5% of the value of completed work based on monthly progress payment request: provided, however, that in the event a dispute arises between the OWNER and any CONTRACTOR which dispute is based upon increased costs claimed by one CONTRACTOR, additional retainage in the sum of one and one-half times the amount of any possible liability may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless the CONTRACTOR causing the additional claim furnishes a bond satisfactory to the OWNER to

indemnify OWNER against the claim. However, all such moneys retained by the OWNER may be withheld from the CONTRACTOR until substantial completion of the contract.

The Applications for Payment shall be required to include such evidence of payment to suppliers and subcontractors by the CONTRACTOR, as the OWNER may require and shall also be accompanied by such lien or other releases as requested by the OWNER.

Progress payments based upon information developed on the Applications for Payment and supporting documentation, if approved by the ENGINEER, shall be made within 45 days following proper submission of the necessary papers to the ENGINEER. Any payments which are not made by the OWNER on that schedule will bear interest computed at the rate determined by the Secretary of Revenue for interest payments on overdue taxes or the refund of taxes as provided in sections 806, 806.1 of the act of April 9, 1929 (P.L. 343, No. 176) known as "The Fiscal Code" and any subsequent amendments to those sections.

H3 Final Payment

The making and acceptance of final payment shall constitute:

- A waiver of all claims by OWNER against CONTRACTOR, except those claims arising from unsettled liens, from defective work appearing after final inspection, or from failure to comply with terns of the contract documents; and

- A waiver of all claims by CONTRACTOR against OWNER other than those previously submitted in writing and still unsettled.

H4 Description of Work to be Included in the Unit Prices, Lump Sums and Total Prices Submitted on Bid Form for Contract No. 2021-01

The Prices bid for those Items listed on the Bid Form which have the item designation with the Suffix "A", shall include all work required for construction of all 10”, 8”, and 6” Ductile Iron Pipe. The Unit Price for ductile iron pipe shall be based upon a linear foot for installing the pipe after deducting the laying length of the fittings and valves. The work under this item shall include excavation and disposal of excess material, installation and bedding of pipe, restrained joints, tracer wire, testing, sterilization, safety provisions, polyethylene encasement, warning lights,

restoration and other contractors overhead. The trench width and depth shall be as stated in the Contract Documents for the respective pipe sizes. Special backfill, paving, concrete blocking/anchors, valves and fittings are covered under separate unit items.

The Prices bid for those items listed on the Bid Form which have the item designation with the suffix "B" shall include the cost to furnish and install all Gate Valves. The Unit Price for gate valves and boxes shall be on a per unit basis for each size of valve furnished and/or installed. Excavation and backfill is covered under the pipe item or special backfill item. The laying length of each valve furnished and installed shall be deducted from the total linear feet of pipeline in place. The work shall include the furnishing and installing of all restrained mechanical joint material required to complete the work and shall include the furnishing and installing of the concrete thrust block and valve box complete for each valve installed.

The Prices bid for Item "C" D.I. Fittings, shall include all bends, fittings, sleeves, couplings, plugs and caps. All fittings will be Ductile Iron. The work under this item shall include furnishing and installing all ductile fittings necessary to complete the work. The Unit Price for these items is self-explanatory and the work shall include all mechanical restrained joint material, bolts, nuts, follower ring and rubber gasket furnished with the fitting. Special backfill and concrete anchors are covered under other items. Excavation is included as a part of the pipe item. Restraining harness where called for on the Contract Drawings and required to complete the work shall be included under this item and paid for on a per unit basis. The laying length of each fitting furnished and installed shall be deducted from the total linear feet of pipeline in place.

The price bid for Item "D" Service Connections, Service Connections for 3/4" and 1 ½" Corporation Stop, Curb Stop, and curb box or valve box, shall include all labor, materials, tools and equipment for the furnishing and installation of a tap in the ductile iron main, Type K copper tubing, one corporation stop, one curb stop and one curb box, including the associated excavation and backfill and restoration as detailed on **SD-4** and **SD-2-060.**

The Prices bid for Item "E", 3/4" Type K Copper Tube, shall include all labor, materials, tools and equipment for the furnishing and installation of one (1) lineal foot of Type K copper tubing at 4 foot bury including excavation and backfill, pushing/boring all restoration not identified to be paid under a separate contingent unit price, testing and required fittings and couplings.

The Unit Price bid for Item "F" Concrete Driveway/Sidewalk Replacement, shall include all work required for the construction of concrete paving. Measurement and Payment therefore will be based upon the actual installed square yards of concrete paving in conformance with the Technical Specifications.

The prices bid for those items listed on the Bid Form which have the designation "G" shall include all work required for Asphalt Trench Restoration. All non-rigid bituminous surface paving shall be restored by neatly and uniformly cutting the edges 12 inches beyond the trench edge each side and placing and rolling minimum 5" depth of 25mm Superpave Base Course, minimum 3" depth of 19mm Superpave Binder Course, and 2" depth of 9.5mm Wearing Course in accordance with the requirements of the Pennsylvania Department of Transportation Publication 408. Seal edges with hot bituminous liquid. Under no circumstances, will Binder trench payment widths be greater than 6'-0" unless removal and replacement of existing pavement is directed by the OWNER's Representative.

Temporary Asphalt Trench Restoration shall include all labor, materials, tools, equipment, and services necessary to complete the work. Temporary Asphalt Trench Restoration shall consist of the placement of 3-inches of hot/cold asphalt mix. Temporary asphalt trench restoration shall only be utilized when requested by the OWNER and only if final asphalt road restoration cannot be completed in a timely manner.

The price bid for Item "H", Asphalt Wedge Curb Restoration, shall include all plant, labor, material, and utilities required for complete curb restoration to a condition equivalent to the existing pre-construction condition and in accordance with the contract specifications.

The price bid for Item "I", Temporary Blow Off Assembly, shall include all plant, labor, material, and utilities required for a complete working assembly. Excavation, backfill, valve and valve boxes shall also be included.

The price bid for Item "J" Select Backfill, shall cover payment for select backfill (2A Limestone, 2RC, modified 2A Limestone) and shall include the furnishing, placement and compaction of that material where it is specified. At those locations that material will be required between the top of the pipe zone backfill and the sub-grade of the berm surface. The payment width shall be four feet for all pipe, regardless of the actual trench width.

The Unit Price bid for Item "K" Exploratory Investigation shall include all plant, labor, material, equipment and utilities to conduct open cut exploratory excavation or Vacuum Excavation at the request or approval of the OWNER's Representative. Exploratory excavation and Vacuum Excavation shall be 10 feet long by 8 feet deep by two feet wide. Excavations of lesser areas shall be considered a partial excavation and payment therefore will be prorated based upon the square foot area of excavation.

The Unit Price for Item "L" Mis-Marked or Unmarked Utility Resolution shall include all labor, material, and equipment required to repair and resolve mis-marked and/or unmarked utility disputes including exploratory excavation, delays in construction and repair costs for the utility types and sizes identified or encountered during construction. Work under this item also includes backfill and restoration not identified for payment under a separate unit price. As a part of this pay item the CONTRACTOR shall be responsible for providing temporary service and reinstating permanent service which may have been interrupted during construction. This item shall apply to all unmarked and marked facilities beyond the tolerance zone as defined by the Pennsylvania One Call Act. Duct banks and clusters of similar facilities shall be considered one payment unit. This item shall be in lieu of the force amount payment provisions specified in the Pennsylvania One Call Act, Section 5, Item 14, and shall be considered as payment in Full for this item.

The price bid for Item "M" Mobilization, Demobilization, Insurance and Bonds, may be any lump sum amount up to a maximum of 7% of the Total Price Bid for the Contract. One half of the amount so bid for those items, however, shall be withheld until the issuance of the final Payment to the CONTRACTOR. The cost for any and all Insurance/Bonds/Permits/ Fees for work on City, PADOT or Railroad right-of-way shall be included in this item.

End of Section H
Measurement and Payment

Section J

AGREEMENT
CONTRACT NO. 2021-02

THIS AGREEMENT is dated as of the _____ day of _____ in the year of 20___ by and between _____hereinafter called OWNER and _____ hereinafter called CONTRACTOR.

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

J1 WORK

J1.1 CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

_____

_____

J2 CONTRACT TIME

J2.1 The Work will be substantially completed within sixty (60) calendar days after the date when the Contract Times commence to run as provided in Paragraph E2.4 of the General Conditions.

J2.2 Liquidated Damages OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and that OWNER will suffer financial loss if the Work is not complete within the time specified in paragraph J2.1 above, plus any extensions thereof allowed in accordance with the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal proceeding the actual loss suffered by OWNER if the Work is not complete on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER one thousand five Hundred Dollars ($1500.00) for each day that expires after the time specified in paragraph J2.1 for completion until the Work is substantially complete.

J3 CONTRACT PRICE

J3.1 OWNER shall pay CONTRACTOR for performance of the Work in accordance with the Contract Documents in the following lump sum amount:

_____

_____

J4 PAYMENT PROCEDURES

J4.1 CONTRACTOR shall submit Applications for Payment in accordance with Section H of the Contract Documents.

J4.2 Progress Payments OWNER shall make progress payments on the Contract Price on the basis of CONTRACTOR's Application for Payment. All payments will be on the basis of the progress of the Work measured by the schedule of values provided for in the Contract Documents.

J4.3 Prior to 50% completion of the Work, progress payments will be in an amount equal to:

- 90% of the Work completed, and
- 100% of materials and equipment not incorporated in the Work but delivered and suitably stored less in each case, the aggregate of payments previously made.

J4.4 After the work is at least 50% complete, and subject to satisfactory progress and compliance with the provisions of the Contract Documents, the OWNER may, at its discretion, elect to reduce the retainage to an amount equal to 5% of the completed work value.

J4.5 Final Payment Upon final completion and acceptance of the Work, OWNER shall pay the remainder of the Contract Price not previously paid.

J5 INTEREST

J5.1 All moneys not paid when due hereunder shall bear interest at the rate defined in Paragraph H2.

J6 CONTRACTOR’s REPRESENTATIONS

J6.1 CONTRACTOR represents that he has familiarized himself with the nature and extent of the Contract Documents, Work, locale and with all local conditions; federal, state and other laws, ordinances, rules and regulations that in any manner may affect cost, progress or performance of the Work; and, has made or caused to be made such examinations, investigations (including subsurface explorations) and tests and studies of such reports and related data as he deems necessary for the performance of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents; and no additional examinations, investigations,

tests, reports or similar data are or will be required by CONTRACTOR for such purposes, and that he shall be responsible to fully perform all work within the contract time and for the contract price(s) stated herein, regardless of the conditions actually encountered. All risks assumed hereunder have been included in the contract price.

J6.2 CONTRACTOR has correlated the results of all such observations, examinations, investigations, tests, reports and data with the terms and conditions of the Contract Documents.

J6.3 By signing this Agreement, CONTRACTOR accepts full responsibility for Site Safety for all people who enter the site.

J7 CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between OWNER and CONTRACTOR are attached to this Agreement, made a part hereof and consists of the following:

Section	Identification	Page No.
C	Contractor's Bid	C-1 to C-6
E	General Conditions	E-1 to E-30
F	Supplemental General Conditions	F-1 to F-18
G	Technical Specifications	G-1 to G-36
H	Measurement and Payment	H-1 to H-6
J	Agreement	J-1 to J-4
K	Surety Bonds/Insurance Certificates	K-1 to K-7
L	Addenda	L-1 to L-__ (if any)
	Exhibits attached to this agreement.	Appendix A
	Drawings (See Section G32 – Drawings Index.)	
	Change Orders duly issued with or after the effective date of this Agreement. _____ (if any)	

There are no Contract Documents other than those listed above in this Agreement, Section J. The Contract Documents may only be altered, modified, amended or repealed by appropriate execution of a Change Order.

J8 MISCELLANEOUS

J8.1 Terms used in this Agreement are defined in the General Conditions and shall have the meanings indicated in the General Conditions.

J8.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party to be bound; and specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without

such consent (except to the extent that the effect of this restriction may be limited by law) and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

J8.3 OWNER and CONTRACTOR each binds himself, his partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.

IN WITNESS WHEREOF, the parties hereto have signed this Agreement in five (5) copies. One counterpart each has been delivered to OWNER and the CONTRACTOR. All portions of the Contract Documents have been signed or identified by OWNER and CONTRACTOR.

This Agreement will be effective on _____ 20_____.

OWNER

_____

by _____

ATTEST _____
title _____

Address for Giving Notice

_____

_____

(CORPORATE SEAL)

****

CONTRACTOR

_____

by _____

ATTEST _____
title _____

Address for Giving Notice

_____

_____

(CORPORATE SEAL)

Section K

PAYMENT BOND

CONTRACT NO. 2021-02

KNOW ALL MEN BY THESE PRESENTS: that

_____

(Name of Contractor)

_____

(Address of Contractor)

a _____, hereinafter called Principal,
(Corporation, Partnership, Individual)

and _____

(Name of Surety)

_____

(Address of Surety)

Hereinafter called Surety, are held and firmly bound unto _____

_____

(Name of Owner)

_____

(Address of Owner)

hereinafter called Owner, in the penal sum of _____ _____ _____ Dollars ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the Owner, dated the _____ day of _____, 20___, a copy of which is hereto attached and made a part hereof for the construction of:

_____

_____

NOW, THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, oil, fuel, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such work, and all insurance premiums on said work and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in five (5) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20_____.

_____
(Principal)
_____ **by**_____
(Address)
_____ (ATTEST)
_____
(Principal) **(Secretary)**
_____
(Witness to Principal) (SEAL)

_____
(Address)

****

_____
(Surety)
_____
(Address) (ATTEST)
_____ _____
(Surety) **(Secretary)**

(SEAL)
_____
(Witness to Surety)

****

by: _____
(Attorney in Fact)
_____
(Address)
_____

NOTE: Date of Bond must be the same as the date of Agreement. If Contractor is Partnership, all partners should execute bond.

IMPORTANT: Surety companies executing bonds must appear on the U.S. Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

Section K

PERFORMANCE AND MAINTENANCE BOND

CONTRACT NO. 2021-02

KNOW ALL MEN BY THESE PRESENTS: that

_____

(Name of Contractor)

_____

(Address of Contractor)

a _____ , hereinafter called Principal,
(Corporation, Partnership, Individual)

and _____

(Name of Surety)

_____

(Address of Surety)

Hereinafter called Surety, are held and firmly bound unto _____

_____

(Name of Owner)

_____

(Address of Owner)

hereinafter called Owner, in the penal sum of _____ Dollars ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that Whereas, the Principal entered into a certain contract with the Owner, dated the _____ day of _____, 20___, a copy of which is hereto attached and made a part hereof for the construction of:

_____

_____

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said contract during the original term thereof, and any extensions thereof which may be granted by the OWNER, with or without notice to the Surety, and if he shall satisfy all claims and demands incurred under such contract, and shall remedy in accordance with the terms of the Contract any defects which may develop during a period of eighteen (18) months from the date of completion of the work performed under said

contract, and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which the OWNER may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect. Whenever CONTRACTOR shall be declared by OWNER to be in default under the Contract, the Surety shall promptly remedy the default. If the OWNER terminates the Contract for such default, the following shall govern the liability of the CONTRACTOR and the Surety hereunder. In the event of such termination, the CONTRACTOR and Surety shall remain fully liable to the OWNER for the CONTRACTOR's failure to timely complete the Contract, any additional costs incurred by the OWNER in completing the Contract, and liquidated damages from the required completion date to the date of the actual completion of the work by the OWNER. In the event of such termination, the Surety may elect to take over and complete performance of the Contract by giving written notice to the OWNER of such election within seven (7) days of the OWNER's mailing of notice of termination to the Surety and actually commencing completion within fourteen (14) days of the OWNER's notice to the Surety, time being of the essence. The Surety shall fully complete the work by the originally scheduled date of completion and the CONTRACTOR and the Surety shall remain liable to the OWNER for all damages.

PROVIDED, FURTHER, that the said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

PROVIDED, FURTHER, any suit under this bond may be instituted until the expiration of two years from the date on which final payment under the Contract falls due or before the expiration of one year from the end of the maintenance and guarantee obligation under the Contract, which ever is later, notwithstanding any statute of limitations setting forth a shorter limitation period.

IN WITNESS WHEREOF, this instrument is executed in _five_ (5) counterparts, each one of which shall be deemed an original, this the _____ day of _____, 20_____.

_____
Principal
_____ **by**_____
Address
_____ ATTEST
_____
Principal **(Secretary)**
_____
(Witness to Principal) (SEAL)

_____
(Address)

****

_____
Surety
_____
Address ATTEST
_____ _____
Surety **(Secretary)**

(SEAL)
_____
(Witness to Surety)

****

by: _____
(Attorney in Fact)
_____
(Address)
_____

NOTE: Date of Bond must be the same as the date of Agreement. If Contractor is Partnership, all partners should execute bond.

IMPORTANT: Surety companies executing bonds must appear on the U.S. Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the project is located.

ACORD®

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
	PHONE (A/C, No, Ext):	FAX (A/C, No):
	E-MAIL ADDRESS:	
	INSURER(S) AFFORDING COVERAGE	NAIC #
INSURED	INSURER A :	
	INSURER B :	
	INSURER C :	
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
	GENERAL LIABILITY						EACH OCCURRENCE	$
	☐ COMMERCIAL GENERAL LIABILITY	☐	☐				DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	☐ CLAIMS-MADE ☐ OCCUR						MED EXP (Any one person)	$
							PERSONAL & ADV INJURY	$
							GENERAL AGGREGATE	$
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$
	☐ POLICY ☐ PRO-JECT ☐ LOC							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	ANY AUTO						BODILY INJURY (Per person)	$
	ALL OWNED AUTOS ☐ SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	☐ HIRED AUTOS ☐ NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
	☐ UMBRELLA LIAB ☐ OCCUR	☐	☐				EACH OCCURRENCE	$
	☐ EXCESS LIAB ☐ CLAIMS-MADE						AGGREGATE	$
	☐ DED ☐ RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY						☐ WC STATU-TORY LIMITS ☐ OTH-ER	
	ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICE/MEMBER EXCLUDED? Y / N ☐ (Mandatory in NH)	N / A	☐				E.L. EACH ACCIDENT	$
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$
		☐	☐					

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

ACORD 25 (2010/05)

APPENDIX A

AWWA C651-14

ANSI/AWWA C651-14
(Revision of ANSI/AWWA C651-05)

American Water Works Association

Dedicated to the World's Most Important Resource™

AWWA Standard

Disinfecting Water Mains

Effective date: Feb. 1, 2015.
First edition approved by AWWA Board of Directors Sept. 30, 1947.
This edition approved June 8, 2014.
Approved by American National Standards Institute Nov. 18, 2014.

American Water Works Association STANDARD Since 1881

Approved American National Standard ANSI

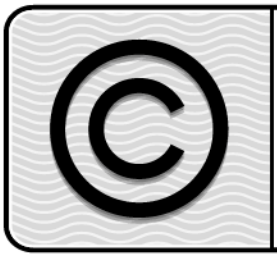
AWWA Standard

This document is an American Water Works Association (AWWA) standard. It is not a specification. AWWA standards describe minimum requirements and do not contain all of the engineering and administrative information normally contained in specifications. The AWWA standards usually contain options that must be evaluated by the user of the standard. Until each optional feature is specified by the user, the product or service is not fully defined. AWWA publication of a standard does not constitute endorsement of any product or product type, nor does AWWA test, certify, or approve any product. The use of AWWA standards is entirely voluntary. This standard does not supersede or take precedence over or displace any applicable law, regulation, or codes of any governmental authority. AWWA standards are intended to represent a consensus of the water supply industry that the product described will provide satisfactory service. When AWWA revises or withdraws this standard, an official notice of action will be placed in the Official Notice section of *Journal - American Water Works Association*. The action becomes effective on the first day of the month following the month of *Journal - American Water Works Association* publication of the official notice.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether that person has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review, and users are cautioned to obtain the latest editions. Producers of goods made in conformity with an American National Standard are encouraged to state on their own responsibility in advertising and promotional materials or on tags or labels that the goods are produced in conformity with particular American National Standards.

CAUTION NOTICE: The American National Standards Institute (ANSI) approval date on the front cover of this standard indicates completion of the ANSI approval process. This American National Standard may be revised or withdrawn at any time. ANSI procedures require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of ANSI approval. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036; 212.642.4900, or emailing info@ansi.org.



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Committee Personnel

The AWWA Standards Committee on Disinfection of Facilities, which reviewed and approved this standard, had the following personnel at the time of approval:

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* Liaison, nonvoting

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Contents

All AWWA standards follow the general format indicated subsequently. Some variations from this format may be found in a particular standard.

Tables

Foreword

This foreword is for information only and is not a part of ANSI/AWWA C651.*

I. Introduction.

I.A. *Background.* This standard describes methods of disinfecting newly constructed potable water mains; mains that have been removed from service for planned repairs or for maintenance that exposes them to contamination; mains that have undergone emergency repairs because of physical failure; and mains that, under normal operation, continue to show the presence of coliform organisms. The disinfecting agents discussed in this standard are chlorine solutions that may be derived from liquid chlorine (Cl_2), calcium hypochlorite ($Ca(OCl)_2$), or sodium hypochlorite (NaOCl). Combinations of free chlorine residual and contact time are provided. Chlorine dosage reference tables are provided as appendix B of this standard.

I.B. *History.* This standard was first approved on Sept. 30, 1947, by the AWWA Board of Directors and published as 7D.2-1948, A Procedure for Disinfecting Water Mains. Revisions were approved on Sept. 14, 1948; Mar. 6, 1953; May 27, 1954; June 2, 1968; and June 7, 1981. All were done under the designation ANSI/AWWA C601, Standard for Disinfecting Water Mains. In 1986, the designation of the standard was changed to ANSI/AWWA C651, and the subsequent editions were approved on Jan. 26, 1986; June 18, 1992; June 20, 1999; and Jan. 16, 2005. This edition was approved on June 8, 2014.

I.C. *Acceptance.* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the Water Research Foundation (formerly AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.† Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
† Persons outside the United States should contact the appropriate authority having jurisdiction.

effects of products and drinking water additives from such products, state and local agencies may use various references, including

1. An advisory program formerly administered by USEPA, Office of Drinking Water, discontinued on Apr. 7, 1990.
2. Specific policies of the state or local agency.
3. Two standards developed under the direction of NSF*: NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects.
4. Other references, including AWWA standards, *Food Chemicals Codex*, *Water Chemicals Codex*,† and other standards considered appropriate by the state or local agency.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI 60. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdictions. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, "Toxicology Review and Evaluation Procedures," to NSF/ANSI 60 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of "unregulated contaminants" are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA C651 does not address additives requirements. Thus, users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements including applicable standards.
2. Determine the status of certifications by parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

II. Special Issues.

II.A. *Information on Application of This Standard.* Generally, it is easier to disinfect a new main than one that has had emergency repairs in terms of access, sanitary control, and the time available for disinfection, sampling, and testing.

* NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

† Both publications available from National Academy of Sciences, 500 Fifth Street, NW, Washington, DC 20001.

For a new main, there is typically more time available for disinfection and testing since there is no immediate demand from customers. Given the often significant amount of time and materials involved in a new water main project, careful disinfection and testing of the main are reasonable and necessary to ensure public health protection.

Conditions for pipe repair projects vary tremendously in terms of the size of the repair, the sanitary conditions, and the time constraints resulting from immediate customer demands. It should be noted if the line is depressurized or opened to the environment prior to or during repair, the sanitary integrity of the pipe is compromised and it is critical to follow sanitary procedures throughout the repair—not just as it is being returned to service. Crews responsible for the repair of mains should be aware of the potential health hazards and be trained to carefully observe prescribed construction practices and disinfection procedures.

Because of the differences between initial installation and repair, the disinfection requirements for each situation are also different. The installation of new mains requires that two sets of samples for coliform analysis are collected at least 16 hr apart, or two sets collected 15 min apart after at least a 16-hr rest period. For repaired mains that are depressurized and/or wholly or partially dewatered, one set of samples may be required, and depending on the sanitary conditions, the line may be returned to service prior to the completion of bacteriological testing. For repaired mains that are maintained under pressurized conditions at all times, bacteriological testing is not required

When required, samples are now specified to be collected at least 16 hr apart, or 15 min apart after a 16-hr rest period. The purpose of this change is to consider the balance between public health, improved test methods, and timely work completion. This timing is sufficient to allow bacterial regrowth within the line if there was a contamination problem and provides more flexibility in the scheduling of various work activities.

Bacteriological testing in accordance with Sec. 5.1 is used to verify the absence of coliform organisms and is generally accepted as verification that disinfection of the pipeline has been accomplished; and following sanitary practices for handling and installation of pipe, valves, fittings, and accessories, coupled with adequate flushing of the line before disinfection, is necessary to ensure the disinfected pipeline will be ready for connection to the water system. Failure to pass the bacteriological test requires that the flushing or disinfection process be repeated. It must be remembered that the final water quality test is not the primary means for certifying the sanitary condition of a main. The sanitary

handling of materials, the practices during construction, and the continual inspection of the work are the primary means for ensuring the sanitary condition of the water main.

Four methods of disinfecting newly constructed water mains are described in this standard: the tablet method, the continuous-feed method, the slug method, and the spray method. The utility should decide which of these methods is most suitable for a given situation. Factors to consider when choosing a method should include the length and diameter of the main, type of joints present, availability of materials, equipment required for disinfection, training of the personnel who will perform the disinfection, and safety concerns. For example, if gas chlorination is the chosen chemical when either continuous-feed or slug methods are being used, use only properly designed and constructed equipment; makeshift equipment is not acceptable when liquid chlorine (gas) cylinders are used.

Thorough consideration should be given to the impact of highly chlorinated water flushed into the environment. If there is any question that damage may be caused by chlorinated-waste discharge (to fish life, plant life, physical installations, or other downstream water uses of any type), then an adequate amount of reducing agent should be applied to water being disposed of in order to thoroughly neutralize the chlorine residual remaining in the water.

The tablet method cannot be used unless the main can be kept clean and dry. It cannot be used in large-diameter mains if it is necessary for a worker to enter the main to grout joints or perform inspection because the tablets may release toxic fumes after exposure to moist air. When using the tablet method, the chlorine concentration is not uniform throughout the main because the hypochlorite solution is dense and tends to concentrate at the bottom of the pipe. The use of the tablet method precludes preliminary flushing. The tablet method is convenient to use in mains having diameters up to 24 in. (600 mm), and it requires no special equipment.

The continuous-feed method is suitable for general application. Preliminary flushing removes light particulates from the main but not from the pipe-joint spaces. The chlorine concentration is uniform throughout the main.

The slug method is suitable for use in large-diameter mains where the volume of water makes the continuous-feed method impractical and difficult to achieve for short attachments. The slug method results in appreciable savings of chemicals used to disinfect long large-diameter mains. Also, this method reduces the volume of heavily chlorinated water to be flushed to waste.

The spray method is suitable for use in large-diameter transmission lines where spray equipment can be used to disinfect all surfaces of the pipe. This method reduces the volume of heavily chlorinated water to be flushed to waste.

The purpose of all four chlorination methods is to disinfect water lines, resulting in an absence of coliforms as confirmed by laboratory analysis. As noted above, the four methods attempt to provide flexibility in responding to specific situations. The tablet and continuous-feed methods both have initial chlorine concentrations of 25 mg/L and a minimum contact time of 24 hr. Because the tablet method cannot be flushed and cleaned prior to disinfection, the required free chlorine residual must be detectable (≥0.2 mg/L) after 24 hr. Because the continuous-feed method can be used to flush particles, a higher free chlorine residual of 10 mg/L is required after 24 hr. To meet the needs of situations requiring reduced contact times, the slug method allows only a 3-hr contact time but requires a 100-mg/L initial chlorine dosage. For larger transmission lines, spray disinfection using 200 mg/L free chlorine may be a suitable option, minimizing discharges of highly chlorinated water. While the contact times of the methods may not be identical, the end result, absence of coliforms, is the same for all four methods.

Disinfectants other than chlorine may be appropriate to use. Although this standard describes only the use of liquid chlorine (gas), sodium hypochlorite solutions, and calcium hypochlorite, the applicability of other disinfectants should be evaluated. Ozone and chemical cleaners have been used, and these warrant further investigation. Whichever disinfectant or method is selected, approval from the local regulatory agency may be required.

III. Use of This Standard. It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives.* This standard is written as though the disinfection work will be performed by the purchaser's personnel. Where the work is to be performed using a separate contract or as part of a contract for installing mains,* appropriate provisions should be included in the purchase documents to ensure that the constructor is specifically instructed as to its responsibilities. The following information should be provided by the purchaser.

* Refer to other AWWA standards and manuals for design criteria and installation procedures for various pipe materials.

1. Standard used— that is, ANSI/AWWA C651, Standard for Disinfection of Water Mains, of latest revision.

2. Approval requirements before use.

3. Those procedures included in the standard that are designated as optional, that are to be included in the purchase documents.

4. Whether compliance with NSF/ANSI 60, Drinking Water Chemicals—Health Effects, is required.

5. Whether compliance with NSF/ANSI 61, Drinking Water System Components—Health Effects, is required.

6. Details of other federal, state or provincial, and local requirements (Section 4).

7. Form of chlorine to be used (Sec. 4.1.1, 4.1.2, and 4.1.3).

8. Method of chlorination (Sec. 4.3, 4.4, 4.5, and 4.6).

9. Flushing locations, rates of flushing, and locations of drainage facilities (Sec. 4.4.2, 4.9.1, and 4.9.2).

10. Responsibility for tapping existing mains and connections to new mains (Sec. 4.4.3[1], 4.4.3[2], and 4.10).

11. The number and frequency of samples for bacteriological tests (Sec. 5.1.1, 5.1.2, and 5.2).

12. Method of taking samples (Sec. 5.1.3).

III.B. *Modification to Standard.* Any modification of the provisions, definitions, or terminology in this standard must be provided by the purchaser.

IV. Major Revisions. Major revisions made to the standard in this edition include the following:

1. Clarified differences in the requirements between new and repaired mains (foreword II.A, Sec. 1.1, and 4.11).

2. Changed the requirement for bacteriological sampling in new mains from two sets of samples 24 hr apart to add two options for two sets of samples: Option A samples are 16 hr apart, and Option B samples are 15 min apart after a 16-hr rest period (foreword II.A and Sec. 5.1).

3. The flushing rate of 2.5 ft/sec has been increased to 3.0 ft/sec for a scour flush based on testing performed under Water Research Foundation Project No. 4307, which indicates the threshold velocity of 2.5 to 3.0 ft/sec for successful flushing (2.5- to 3.0-log removal) of sand particles. Since this is a threshold velocity, 3.0 ft/sec was chosen for the standard (Sec. 4.4.2 and Table 3).

4. Added spray disinfection method for large transmission mains (Sec. 4.6).

5. Appendix C has been deleted, and instead, a reference to ANSI/AWWA C655 is made for dechlorination (Sec. 4.7 and 4.9.2).

6. Developed a rationale for evaluating risk during pipe repairs and the level of disinfection and sampling needed under those conditions (Sec. 4.11).

V. Comments. If you have any comments or questions about this standard, please call the AWWA Engineering and Technical Services at 303.794.7711, FAX at 303.795.7603; write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098; or email the group at standards@awwa.org.

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ANSI/AWWA C651-14
(Revision of ANSI/AWWA C651-05)

American Water Works Association

Dedicated to the World's Most Important Resource™

AWWA Standard

Disinfecting Water Mains

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes essential procedures for the disinfection of new and repaired potable water mains. New water mains shall be disinfected before they are placed in service. Water mains taken out of service for inspection, repair, or other activities may or may not require disinfection and sampling, depending on the risk of contamination. This standard describes the process for evaluating the risk under different conditions.

Sec. 1.2 Purpose

The purpose of this standard is to define the minimum requirements for the disinfection of water mains, including the preparation of water mains, application of chlorine, and sampling and testing for the presence of coliform bacteria.

Sec. 1.3 Application

This standard can be referenced in the purchase documents for the disinfection of water mains and can be used as a guide for the preparation of water mains, application of chlorine, and sampling and testing for the presence of coliform bacteria. The stipulations of this standard apply when this document has been referenced and only to the disinfection of water mains.

SECTION 2: REFERENCES

This standard references the following documents. In their latest editions, they form a part of this standard to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.

ANSI*/AWWA B300—Hypochlorites.

ANSI/AWWA B301—Liquid Chlorine.

ANSI/AWWA C652—Disinfection of Water Storage Facilities.

ANSI/AWWA C655—Field Dechlorination.

APHA,† AWWA, and WEF.‡ *Standard Methods for the Examination of Water and Wastewater*.

AWWA Manual M12, *Simplified Procedures for Water Examination*.

NSF/ANSI 61—Drinking Water System Components–Health Effects.

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Available chlorine:* A measure of the amount of chlorine in chlorinated lime, hypochlorite compounds, chloramines, and other materials that are used for disinfection compared with the amount in elemental (liquid or gaseous) chlorine.

2. *Chlorine, combined:* The amount of chlorine combined with ammonia (NH_3) or other compounds in water.

3. *Chlorine, free:* Also called *free available chlorine*, the amount of chlorine available as dissolved gas (Cl_2), hypochlorous acid (HOCl), and hypochlorite (OCl^-) that is not combined with ammonia (NH_3) or other compounds in water that is available for disinfection.

4. *Chlorine residual:* Concentration of chlorine species present in water after the oxidant demand has been satisfied.

5. *Chlorine, total:* A combination of free chlorine, combined chlorine, and organochlorine species.

6. *Constructor:* The party that provides the work and materials for placement or installation.

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.
† American Public Health Association, 800 I Street NW, Washington, DC 20001.
‡ Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314.

7. *Liquid chlorine (gas):* the commercially available form of liquefied elemental chlorine gas. (The term *liquid chlorine* is sometimes used to describe a hypochlorite solution. This use of the term is discouraged. See ANSI/AWWA B300, Hypochlorites.)

8. *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.

9. *Purchaser:* The person, company, or organization that purchases any materials or work to be performed.

10. *Supplier:* The party that supplies material or services. A supplier may or may not be the manufacturer.

11. *Organochlorine:* Any organic compound containing chlorine as a constituent. Organochlorine compounds can form when chlorine reacts with organic substances.

SECTION 4: REQUIREMENTS

Materials shall comply with the requirements of the Safe Drinking Water Act and other federal regulations for potable water, wastewater, and reclaimed water systems as applicable.

Sec. 4.1 Forms of Chlorine for Disinfection

The forms of chlorine that may be used in the water main disinfection operations are liquid chlorine (gas), sodium hypochlorite solution, and calcium hypochlorite granules or tablets.

4.1.1 *Liquid chlorine (gas).* Liquid chlorine (gas) conforming to ANSI/AWWA B301 contains 100 percent available chlorine and is packaged in steel containers usually of 100-lb, 150-lb, or 1-ton (45.4-kg, 68.0-kg, or 907.2-kg) net chlorine weight. Liquid chlorine (gas) shall be used only (1) in combination with appropriate gas-flow chlorinators and ejectors to provide a controlled high-concentration solution feed to the water to be chlorinated; (2) under the direct supervision of someone familiar with the biological, chemical, and physical properties of liquid chlorine (gas) and who is trained and equipped to handle any emergency that may arise; and (3) when appropriate safety practices are observed to protect working personnel and the public. Makeshift equipment is not acceptable when liquid chlorine (gas) cylinders are used.

4.1.2 *Sodium hypochlorite.* Sodium hypochlorite conforming to ANSI/AWWA B300 is available in liquid form in glass, rubber-lined, or plastic containers typically ranging in size from 1 qt (0.95 L) to 5 gal (18.92 L). Containers of 30 gal (113.6 L) or larger may be available in some areas. Sodium hypochlorite contains approximately 5 percent to 15 percent available chlorine, and the storage conditions and time must be controlled to minimize its deterioration. (Available chlorine is expressed as a percent of weight when the concentration is 5 percent or less, and usually as a percent of volume for higher concentrations. Percent × 10 = grams of available chlorine per liter of hypochlorite.)

4.1.3 *Calcium hypochlorite.* Calcium hypochlorite conforming to ANSI/AWWA B300 is available in granular form or in 5-g tablets and must contain approximately 65 percent available chlorine by weight. The material should be stored in a cool, dry, and dark environment to minimize its deterioration.

CAUTION: Tablets dissolve in approximately 7 hr and must be given adequate contact time. Do not use calcium hypochlorite intended for swimming pool disinfection, as this material has been sequestered and is extremely difficult to eliminate from the pipe after the desired contact time has been achieved.

Sec. 4.2 General Considerations for All Methods of Chlorination

4.2.1 *General.* Four methods of chlorination are explained in this section: tablet, continuous feed, slug, and spray. The tablet method gives an initial chlorine dose of 25 mg/L; the continuous-feed method gives a 24-hr chlorine residual of not less than 10 mg/L; the slug method gives a 3-hr exposure of not less than 50 mg/L free chlorine; and the spray method gives a 30-min exposure of not less than 200 mg/L free chlorine. Caution should be used with highly chlorinated water when conducting hydrostatic pressure testing and with high-volume flushing of water.

4.2.2 *Flushing.* Potable water shall be used for disinfection, hydrostatic pressure testing, and flushing. Drainage should take place away from the construction or work area. Adequate drainage must be provided during flushing. If applicable, the valve(s) isolating the main from existing system should be locked out and tagged out to prevent unintentional release of the elevated chlorine residual water used for disinfection.

4.2.3 *Dechlorination.* When dechlorination is required, it is recommended that any high-velocity flushing be completed prior to disinfection. Dechlorination equipment may not be capable of handling high flows with high levels of chlorine.

Table 1 Weight of calcium hypochlorite granules to be placed at beginning of main and at each 500-ft (150-m) interval

Pipe Diameter (*d*)		Calcium Hypochlorite Granules	
in.	*(mm)*	*oz*	*(g)*
4	(100)	1.7	(48)
6	(150)	3.8	(108)
8	(200)	6.7	(190)
10	(250)	10.5	(298)
12	(300)	15.1	(428)
14 and larger	(350 and larger)	$D^2 \times 15.1$	$D^2 \times 428$

Where D is the inside pipe diameter, in feet $D = d/12$

Sec. 4.3 Tablet/Granule Method of Chlorination

4.3.1 *Tablet method.* The tablet method consists of placing calcium hypochlorite granules or tablets in the water main during installation and then filling the main with potable water to create a chlorine solution. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.

WARNING: This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

4.3.2 *Placement of calcium hypochlorite granules during construction.* Calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft (150-m) intervals. The quantity of granules at each location shall be as shown in Table 1.

4.3.3 *Placement of calcium hypochlorite tablets during construction.* Calcium hypochlorite tablets (5-grams) shall be placed in the upstream end of each section of pipe to be disinfected, including branch lines. Also, at least one tablet shall be placed in each hydrant branch and in other appurtenances. The number of 5-g tablets required for each pipe section shall be $0.0012\ d^2L$ rounded to the next higher integer, where d is the inside pipe diameter, in inches, and L is the length of the pipe section, in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. Calcium hypochlorite tablets shall be attached by an adhesive meeting the requirements of NSF/ANSI 61. There shall be adhesive only on the broadside of the tablet attached to the surface of the pipe. Attach tablets inside and at the top of the main. If the tablets are attached before the pipe section is placed in

Table 2 Number of 5-g calcium hypochlorite tablets required for dose of 25 mg/L*

Pipe Diameter		Length of Pipe Section, *ft (m)*				
		13 (4.0) or less	18 (5.5)	20 (6.1)	30 (9.1)	40 (12.2)
in.	*(mm)*	Number of 5-g Calcium Hypochlorite Tablets				
4	(100)	1	1	1	1	1
6	(150)	1	1	1	2	2
8	(200)	1	2	2	3	4
10	(250)	2	3	3	4	5
12	(300)	3	4	4	6	7
16	(400)	4	6	7	10	13

*Based on 3.25-g available chlorine per tablet

the trench, their positions shall be marked on the pipe exterior to indicate that the pipe has been installed with the tablets at the top.

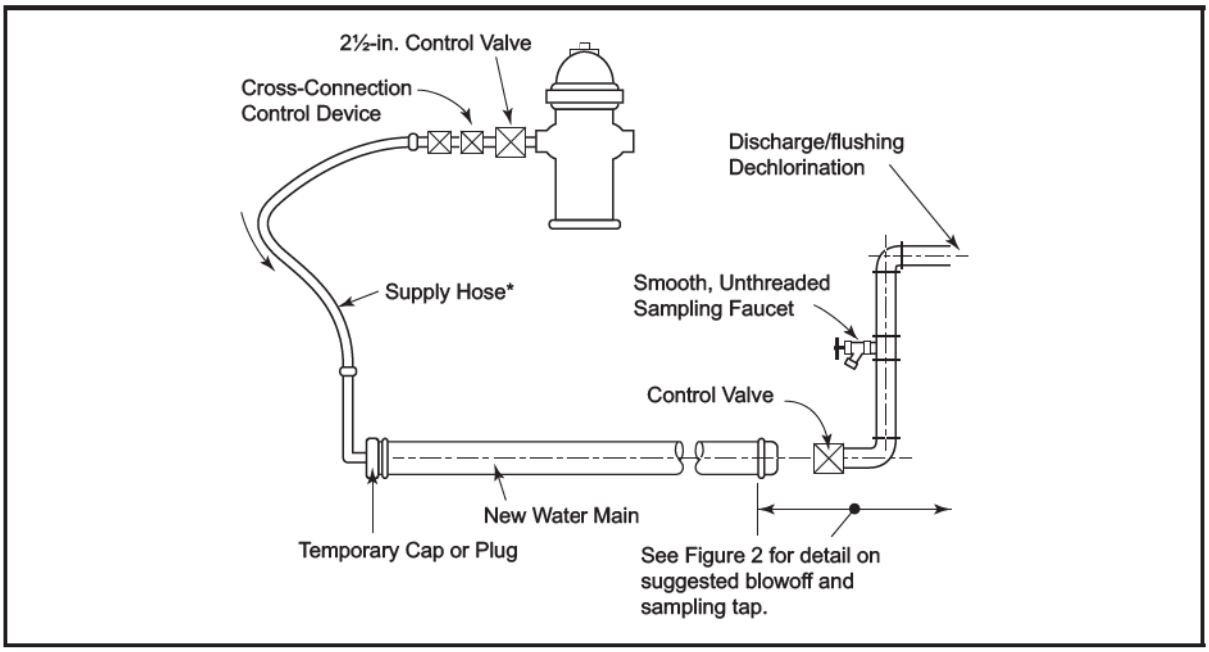
4.3.4 *Filling and contact time.* When installation has been completed, the main shall be filled with water such that the full pipe velocity is no greater than 1 ft/sec (0.3 m/sec). Fill rate must be carefully controlled to ensure tablets do not come loose from pipe. Precautions shall be taken to ensure that air pockets are eliminated. As an optional procedure, if required by the purchaser, water used to fill the new main shall be supplied through a temporary connection that shall include an appropriate cross-connection control device, consistent with the degree of hazard, for backflow protection of the active distribution system (see Figure 1).

The chlorinated water shall remain in the pipe for at least 24 hr. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 hr. A detectable free chlorine residual (≥0.2 mg/L) shall be found at each sampling point after the 24- or 48-hr period.

Sec. 4.4 Continuous-Feed Method of Chlorination

4.4.1 *Continuous-feed method.* The continuous-feed method consists of completely filling the main with potable water, removing air pockets, then flushing the completed main to remove particulates, and refilling the main with potable water that has been chlorinated to 25 mg/L. After a 24-hr holding period in the main there shall be a free chlorine residual of not less than 10 mg/L.

4.4.2 *Preliminary flushing.* Before the main is chlorinated, it shall be filled with potable water to eliminate air pockets and flushed to remove particulates. The flushing velocity in the main shall not be less than 3.0 ft/sec (0.91 m/sec) unless



NOTE: Figure 1 applies to pipes with diameters 4 in. (100 mm) through 12 in. (300 mm). Larger sizes must be handled on a case-by-case basis.

*Clean potable-water hose only. Size and number of taps per Table 3. This hose must be removed during the hydrostatic pressure test.

Figure 1 Suggested temporary flushing/testing connection

Table 3 Required flow and openings (either taps or hydrants) to flush pipelines at 3.0 ft/sec (0.91 m/sec) (40 psi [276 kPa] residual pressure in water main)*

Pipe Diameter		Flow Required to Produce 3.0 ft/sec (approx.) Velocity in Main		Size of Tap Used, *in. (mm)*			Number of Hydrant Outlets	
				1 (25)	1½ (38)	2 (51)		
in.	*(mm)*	*gpm*	*(L/sec)*	Number of Taps Required on Pipe†			2½-in. (64-mm)	4½-in. (114 mm)
4	(100)	120	(7.4)	1	—	—	1	1
6	(150)	260	(16.7)	—	1	—	1	1
8	(200)	470	(29.7)	—	2	—	1	1
10	(250)	730	(46.3)	—	3	2	1	1
12	(300)	1,060	(66.7)	—	—	3	2	1
16	(400)	1,880	(118.6)	—	—	5	2	1

*With a 40-psi (276-kPa) pressure in the main with the hydrant flowing to atmosphere, a 2½-in. (64-mm) hydrant outlet will discharge approximately 1,000 gpm (63.1 L/sec); and a 4½-in. (114-mm) hydrant outlet will discharge approximately 2,500 gpm (160 L/sec).

†Number of taps on pipe based on 3.0-ft/sec discharge through 5 ft (1.5 m) of galvanized iron (GI) pipe with one 90° elbow.

the purchaser determines that conditions do not permit the required flow to be discharged to waste. Table 3 shows the rates of flow required to produce a velocity of 3.0 ft/sec (0.91 m/sec) in commonly used sizes of pipe. (NOTE: flushing is no substitute for preventive measures during construction. Certain contaminants, such as caked deposits, resist flushing at any feasible velocity, and pigging of the main, or other suitable method acceptable to the purchaser, may be required.) Where such flow rates are not possible, flushing at the maximum expected flow rate for the line for 2–3 volumes may be acceptable. For larger mains, pigging (or other suitable method acceptable to the purchaser) is an option in place of high velocity flushing.

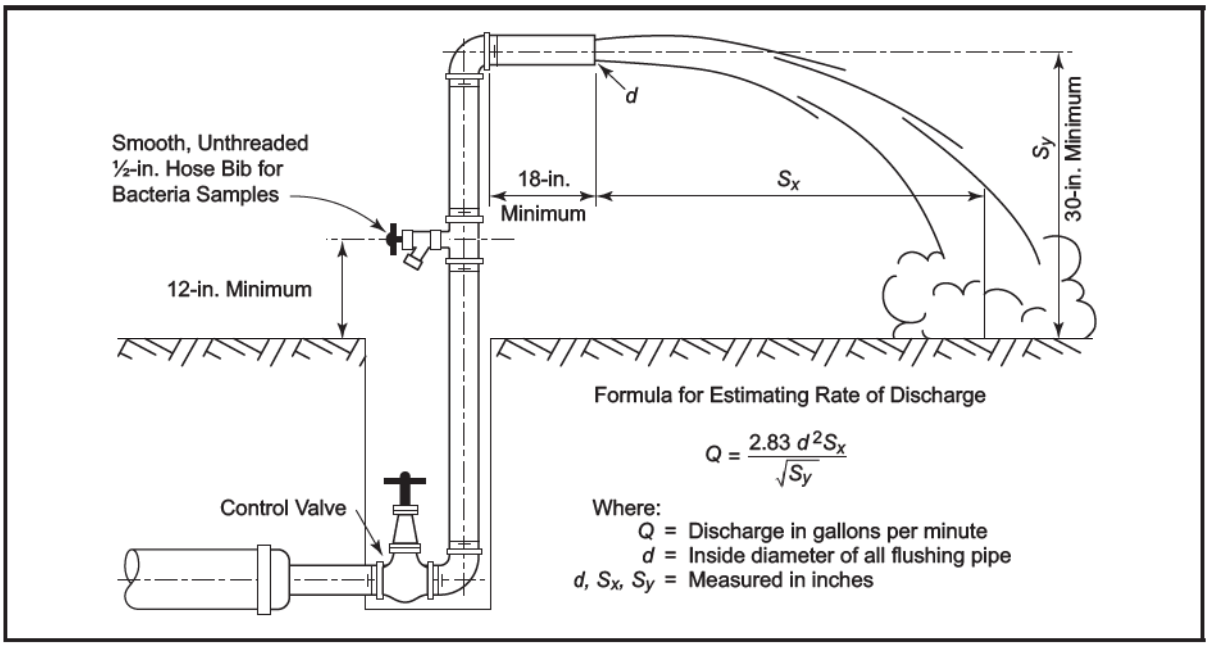
For 24-in. (600-mm) or larger diameter mains, an acceptable alternative to flushing is to broom-sweep the main, carefully removing sweepings prior to filling and chlorinating the main. WARNING: OSHA requirements for confined space need to be addressed before entering a pipeline.

4.4.3 *Procedure for chlorinating the main.*

1. Potable water may be supplied from a temporary backflow-protected connection to the existing distribution system or other supply source approved by the purchaser. The cross-connection control device shall be consistent with the degree of hazard for backflow protection of the active distribution system (see Figure 1). The flow shall be at a constant, measured rate into the newly installed water main. In the absence of a meter, the rate may be approximated using a Pitot gauge in the discharge, measuring the time to fill a container of known volume, or measuring the trajectory of the discharge and using the formula shown in Figure 2. The main should undergo hydrostatic testing prior to disinfection.

2. At a point not more than 10 ft (3 m) downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 25 mg/L free chlorine. To ensure that an appropriate concentration is achieved, the free chlorine concentration shall be measured at regular time intervals in accordance with the procedures described in *Standard Methods for the Examination of Water and Wastewater* or AWWA Manual M12, or using appropriate chlorine test kit (see appendix A).

Table 4 gives the amount of chlorine required for each 100 ft (30.5 m) of pipe for various pipe diameters. Solutions with a minimum 1 percent chlorine concentration may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires 1 lb (454 g) of calcium hypochlorite in 8 gal (30.3 L) of water.



NOTE: This figure applies to pipes up to and including 8-in. (200-mm) diameter.

Figure 2 Suggested combination blowoff and sampling tap

Table 4 Chlorine required to produce an initial 25-mg/L concentration in 100 ft (30.5 m) of pipe by diameter

Pipe Diameter		100% Chlorine		1% Chlorine Solution	
in.	*(mm)*	*lb*	*(g)*	*gal*	*(L)*
4	(100)	0.013	(5.9)	0.16	(0.6)
6	(150)	0.030	(13.6)	0.36	(1.4)
8	(200)	0.054	(24.5)	0.65	(2.5)
10	(250)	0.085	(38.6)	1.02	(3.9)
12	(300)	0.120	(54.4)	1.44	(5.4)
16	(400)	0.217	(98.4)	2.60	(9.8)

3. Chlorine application shall not cease until the entire main is filled with chlorinated water. The chlorinated water shall be retained in the main for at least 24 hr, during which time valves and hydrants in the treated section shall be operated to ensure disinfection of the appurtenances. At the end of this 24-hr period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L of free chlorine.

4. Direct-feed chlorinators, which operate solely from gas pressure in a chlorine cylinder, shall not be used for the application of liquid chlorine (gas). (The

danger of using direct-feed chlorinators is that water pressure in the main can exceed gas pressure in the chlorine cylinder. This allows backflow of water into the cylinder, resulting in severe cylinder corrosion and the escape of chlorine gas.)

The preferred equipment for applying liquid chlorine (gas) is a solution-feed, vacuum-operated chlorinator and a booster pump. The vacuum-operated chlorinator mixes the chlorine gas in solution water; the booster pump then injects the chlorine solution into the main to be disinfected. Hypochlorite solutions may be applied to the water main with a chemical-feed pump designed for feeding chlorine solutions. Feed lines shall be made of material capable of withstanding the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

Sec. 4.5 Slug Method of Chlorination

4.5.1 *Slug method.* The slug method consists of completely filling the main to eliminate air pockets; flushing the main to remove particulates; then slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/L. The slow rate of flow ensures that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hr.

4.5.2 *Preliminary flushing.* Same as Sec. 4.4.2.

4.5.3 *Procedure for chlorinating the main.*

1. Potable water may be supplied from a temporary backflow-protected connection to the existing distribution system or other supply source approved by the purchaser. The cross-connection control device shall be consistent with the degree of hazard for backflow protection of the active distribution system (see Figure 1). The flow shall be at a constant, measured rate into the newly installed water main. In the absence of a meter, the rate may be approximated using a Pitot gauge in the discharge, measuring the time to fill a container of known volume, or measuring the trajectory of the discharge and using the formula shown in Figure 2. The main should undergo hydrostatic testing prior to disinfection.

2. At a point not more than 10 ft (3 m) downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. To ensure that this concentration is achieved, the free chlorine concentration shall be measured at regular time intervals sufficient to guide the completion of the successful loading of the target chlorine concentration. The chlorine shall be applied

continuously and for a sufficient period to develop a solid column, or slug, of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 hr.

3. The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L, the flow shall be stopped; chlorination equipment shall be relocated at the head of the slug; and, as flow resumes, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.

4. As chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

Sec. 4.6 Spray Disinfection for Large Transmission Lines

For very large transmission mains (where personnel or equipment may safely enter the pipe), spray disinfection may be an appropriate and efficient means of achieving disinfection. For this method, refer to ANSI/AWWA C652, Sec. 4.3.2 (Disinfection of Water Storage Facilities; Chlorination Method 2). In general, once pipe is cleaned, spray a 200-mg/L free chlorine solution on all surfaces. After 30 min, fill line and sample as described in Sec. 5.1.

Sec. 4.7 Basic Disinfection Procedure for New Mains

The basic disinfection procedure consists of

1. Inspecting materials to be used to ensure their integrity.
2. Preventing contaminating materials from entering the water main during storage, construction, or repair and noting potential contamination at the construction site.
3. Removing, by flushing or other means, those materials that may have entered the water main or appurtenances.
4. Preventing contamination of existing mains from cross-connection during flushing, pressure testing, and disinfection.
5. Pressure testing the water main to ensure the main meets the purchaser's allowable leakage rate. Hydrostatic pressure tests should be conducted with potable water.
6. Chlorinating and adequately documenting the process used for disinfection.
7. Flushing the chlorinated water from the main. Refer to ANSI/AWWA C655 Field Dechlorination for dechlorination procedures, if dechlorination is required.

8. Determining the bacteriological quality of water samples collected from the pipe by laboratory test after disinfection.

9. Final connecting of the newly disinfected water main to the active distribution system without sacrificing sanitary practices and conditions.

Sec. 4.8 Preventive and Corrective Measures During New Construction

4.8.1 *General.* Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing these organisms. Therefore, the procedures of this section must be observed to ensure that a water main and its appurtenances have been thoroughly cleaned for the final disinfection by chlorination. Also, any connection of a new water main to the active distribution system before the receipt of satisfactory bacteriological samples may constitute a cross-connection. Therefore, the new main must be isolated until bacteriological tests described in Section 5 of this standard are satisfactorily completed.

4.8.2 *Keeping pipe clean and dry.* The interiors of pipes, fittings, and valves shall be protected from contamination.

4.8.2.1 Openings. Openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.

4.8.2.2 Stringing pipe. Pipe delivered for construction shall be strung to minimize the entrance of foreign material.

4.8.2.3 Delays. Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the lower the risk of contamination.

4.8.3 *Joints.* Joints of pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is free of standing water and mud that may enter the pipe.

4.8.4 *Packing materials.* Yarning or packing material shall consist of molded or tubular rubber rings, rope of treated paper, or other approved materials. Materials such as jute or hemp shall not be used. Packing material shall be handled in a manner that avoids contamination.

4.8.5 *Sealing materials.* No contaminated material or any material capable of supporting growth of microorganisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in

potable water meeting the requirements of NSF/ANSI 61 and shall not contribute odors. It shall be delivered to the job in closed containers and shall be kept clean and applied with dedicated clean applicators.

4.8.6 *Cleaning and swabbing.* If dirt enters the pipe, it shall be removed and the interior pipe surface swabbed with a minimum 1 percent free chlorine disinfecting solution. If, in the opinion of the purchaser, the dirt remaining in the pipe will not be removed using the flushing operation, the interior of the pipe shall be cleaned using mechanical means, such as a hydraulically propelled foam pig (or other suitable device acceptable to the purchaser) in conjunction with the application of a minimum 1 percent free chlorine disinfecting solution. The cleaning method used shall not force mud or debris into the interior pipe-joint spaces and shall be acceptable to the purchaser.

4.8.7 *Wet-trench construction.* If it is not possible to keep the pipe and fittings dry during installation, a scour flush at 3.0 ft/sec (0.91 m/sec) or greater for a minimum of three pipe volumes (see Table 3) followed by slug or continuous-feed chlorination and bacteria testing before release is required. For larger mains, pigging or other suitable method acceptable to the purchaser is an option in place of high-velocity flushing.

4.8.8 *Flooding by storm or accident during construction.* If the main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to the floodwater shall then be filled with a chlorinated potable water that, at the end of a 24-hr holding period, will have a free chlorine residual of not less than 25 mg/L. The chlorinated water may then be drained or flushed from the main. If chemical contamination occurs, such as a hydraulic oil leak or petroleum product spill, the pipe sections exposed to the contamination should be replaced and not reused for potable water applications. After construction is completed, the main shall be disinfected using the continuous-feed, slug, or spray methods.

4.8.9 *Backflow protection (optional).** As an optional procedure (if required by the purchaser), the new water main shall be kept isolated from the active distribution system using a physical separation (see Figure 1) until satisfactory bacteriological testing has been completed and the disinfection water flushed out.

Water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection between the

* Optional Sec. 4.8.9 is not included as part of the standard unless required by the purchaser.

distribution system and the new main or other supply source approved by the purchaser. The temporary connection shall include an appropriate cross-connection control device consistent with the degree of hazard (a double check valve assembly or a reduced pressure zone assembly) and shall be disconnected (physically separated) from the new main during the hydrostatic pressure test. It will be necessary to reestablish the temporary connection after completion of the hydrostatic pressure test to flush out the disinfectant water prior to final connection of the new main to the distribution system. NOTE: Exposure to high levels of chlorine or high pH can cause severe irritation to customers. Also, the chlorinated water can be high in disinfection by-products.

Sec. 4.9 Final Flushing for New Mains

4.9.1 *Clearing the main of heavily chlorinated water.* After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or to prevent corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or that is acceptable for domestic use.

4.9.2 *Disposing of heavily chlorinated water.* The environment to which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, a neutralizing chemical shall be applied to the water to be wasted to thoroughly neutralize the residual chlorine (see ANSI/AWWA C655 for neutralizing chemicals). Where necessary, federal, state, local, or provincial regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

Sec. 4.10 Final Connections to Existing Mains

Water mains and appurtenances must be completely installed, flushed, disinfected, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system. Sanitary construction practices must be followed during installation of the final connection so that there is no contamination of the new or existing water main with foreign material or groundwater.

4.10.1 *Connections equal to or less than one pipe length (generally ≤20 ft [6 m]).* The new pipe, fittings, and valve(s) required for the connection may be spray disinfected or swabbed with a minimum 1 percent solution of chlorine just

before being installed, if the total length of the connection from the end of a new main to the existing main is equal to or less than 20 ft (6 m).

4.10.2 *Connections greater than one pipe length (generally >20 ft [6 m]).* The pipe required for the connection must be set up aboveground, disinfected, and bacteriological samples taken, as described in Section 5, if the total length of the connection from the end of a new main to the existing main is greater than 20 ft (6 m). After satisfactory bacteriological sample results have been received for the predisinfected pipe, the pipe can be used in connecting the new main to the active distribution system. Between the time the satisfactory bacteriological sample results are received and the time that the connection piping is installed, the ends of the piping must be sealed with plastic wraps, watertight plugs, or caps.

Sec. 4.11 Disinfection Procedures When Cutting Into or Repairing Existing Pipe

4.11.1 *General.* The planned, unplanned, or emergency repair of a water main or appurtenance (e.g., valve) is time sensitive—an important goal is to minimize the disruption of water service to customers. Nonetheless, the repair work needs to be accomplished using sanitary and safe procedures by well-trained crews with proper supervision and guidance. Refer to preventive and corrective measures described previously in Sec. 4.8.2, 4.8.3, 4.8.4, and 4.8.5. Follow all personal protection precautions when working with chlorine solutions.

4.11.2 *Basic disinfection.* Work should follow basic disinfection and contamination prevention procedures:

1. Preventing contaminants from entering the existing pipe during the repair such as by maintaining positive pressure in the leaking pipe until the repair site on the pipe is fully exposed, by maintaining a dewatered trench, and by keeping all pipe materials being used in the repair in a clean and sanitary condition.
2. Inspecting and cleaning, followed by disinfection of spraying or swabbing with a minimum 1 percent chlorine solution:
   - Exposed portions of existing pipe interior surfaces
   - Pipe materials used in the repair
   - Handheld materials and tools used to make the repair
3. As appropriate, advising affected customers to adequately flush their service lines upon return to service.

4.11.3 *Selection of disinfection procedure.* The disinfection procedure selected should be determined by the conditions and severity of the main break. Many leaks or breaks can be repaired under controlled conditions without depressurizing the water main, such as when applying a clamp to a small crack or hole,

thus preventing contaminants from entering the water system. In most other situations, the water main can be maintained pressurized until the break site is secured and the pipe is fully exposed. Some circumstances (e.g., severe erosion of the local environment or icing of the roadway) that impact public safety may require that water pressure be substantially reduced prior to exposing the pipe in the area of the leak. In some cases, situations become catastrophic where there is a pipe blowout and a loss of water pressure prior to shutdown, requiring disinfection procedures equivalent to those of a new main installation. The procedures described in Sec. 4.11.3.1 through 4.11.3.3 describe the contamination risks and the associated disinfection and sampling requirements for different scenarios of pipeline repair. Specific situations not captured below need to be evaluated and the appropriate disinfection and sampling methods followed.

Note that the procedures explained in Sec. 4.11.3.1, 4.11.3.2, and 4.11.3.3 for distribution mains may need to be modified for large transmission mains. Large mains may need additional work (such as having a valve replaced or requiring a special order on a connection), may be out of service for more than a day, or may not be able to accommodate a scour flush. These modifications need to be made on a case-by-case basis but should still take into account the procedures outlined in ANSI/AWWA C651.

4.11.3.1 Controlled pipe repair without depressurization. In this situation, activities are well controlled and a full shutdown is not needed, thus maintaining positive pressure to the area of shutdown and around the break site at all times. The repair site is exposed and the trench is adequately dewatered so that the repair site can be cleaned and disinfected by spraying or swabbing with a minimum 1 percent chlorine solution. The water main is then returned to service with flushing to obtain three volumes of water turnover, making sure that the flushed water is visually clear. No bacteriological testing is necessary. It is advisable to check for a typical system chlorine residual, and if not found, to continue flushing until residuals are restored to levels maintained in the distribution system by the water utility—if the system operates with a disinfectant residual.

4.11.3.2 Controlled pipe repair with depressurization after shutdown. In this situation, after the repair site has been exposed and secured from trench soil/water contamination, the water main is depressurized by a shutdown to complete the repair. The repair site should be cleaned and disinfected by spraying or swabbing with a minimum 1 percent chlorine solution. The water main is then returned to service with flushing to scour the pipe and obtain three volumes of water turn-

over, making sure that the flushed water is visually clear. It is advisable to check for a typical system chlorine residual, and if not found, to continue flushing until residuals are restored to levels maintained in the distribution system by the water utility—if the system operates with a disinfectant residual.

When the existing pipe has to be opened and the interior surfaces of the water system exposed to the environment, additional procedures need to be followed. The existing pipe should be inspected and cleaned with the help of flushing water into the trench, where possible, until the flush water runs visually clear. The repair site should be accessible and the trench adequately dewatered so that the repair site can be cleaned and disinfected by spraying or swabbing with a minimum 1 percent chlorine solution. Additionally, any accessible upstream and downstream interior of the existing pipe should be disinfected by swabbing or spraying with a minimum 1 percent chlorine solution. If the repair requires a full pipe section replacement, the new pipe should be inspected, cleaned, and disinfected from both ends by swabbing with a minimum 1 percent chlorine solution. The water main may then be returned to service after flushing to scour the pipe and obtain three volumes of water turnover. The flushed water should run visually clear, have a measurable chlorine residual if the system operates with a residual, and be checked with bacteriological testing. The pipeline may be returned to service prior to obtaining bacteriological results.

4.11.3.3 Uncontrolled pipe break with a likelihood of water contamination or loss of sanitary conditions during repair. In situations in which the existing main to be repaired could not be protected and kept free of contamination and there are obvious signs of contamination (e.g., muddy trench water flowing into the broken pipe and a leaking sewer pipe in the trench, or catastrophic pipe failure where pipe is open and there is a likelihood that contamination was drawn into the active system) or when a controlled repair situation turns into a situation in which the internal pipe and water have become contaminated, the procedures outlined in Sec. 4.3, 4.4, 4.5, or 4.6 should be followed where practical. These methods specify chlorine doses of 25–300 mg/L; however, such levels may present greater harm if the line or services cannot be reliably isolated or shut down and exposure of customers to high concentrations of chlorine cannot be controlled. Free chlorine residuals up to 4 mg/L (based on annual averages) are allowed by federal drinking water regulations; therefore this level is suggested as a minimum to be maintained for at least 16 hr in conjunction with flushing, coliform sampling, and associated customer education. Such situations require careful review and need to balance the public health risks of the pipeline failure as well as the repair process.

Where practical and appropriate considering the risks of public exposure to high concentrations of chlorine, in addition to the procedures previously described in this standard, the section of pipe in which the break is located shall be isolated, all service connections shut off, and the section flushed and disinfected. If the slug chlorination method is employed, the dose may be increased to as much as 300 mg/L and the contact time reduced to as little as 15 min. After chlorination and repair, perform scour flushing at 3.0 ft/sec (0.91 m/sec) or greater for a minimum of three pipe volumes and continue until discolored water is not observed and the chlorine residual is restored to the levels maintained in the distribution system by the water utility.

For larger-diameter pipe (12 in. and greater), if a water velocity of 3.0 ft/sec (0.91 m/sec) cannot be achieved, it is desirable to flush at the maximum flow for the main until three pipe volumes have been displaced before returning the main to service. The flushed water should run visually clear, and have typical system chlorine residual (if the system operates with a disinfectant residual).

For very-large-diameter pipe (where personnel may safely enter the pipe), in lieu of flushing following disinfection, the interior of the pipe at the repair site may be cleaned by sweeping or high pressure wash using potable water before disinfection. Standing water and debris from the cleaning must be removed from the pipe prior to disinfection. The affected pipe shall be disinfected by swabbing or spraying with a minimum 1 percent chlorine solution.

After following the appropriate methods above, prior to returning the pipe to service, the efficacy of the disinfection procedure shall be verified by testing for the absence of coliform bacteria. If allowed by local regulations, the pipeline may be returned to limited service prior to obtaining bacteriological results with proper notification of the affected customers.

4.11.4 *Temporary service lines.* Temporary water service lines to customers during main repair activities shall be disinfected prior to use. Materials shall meet the NSF/ANSI 61 certification for potable water use. Disinfection should be accomplished by the procedures in Sec. 4.4 or 4.5 followed by scour flushing at 3.0 ft/sec (0.91 m/sec) or greater for a minimum of three pipe volumes (see Table 3), or until the water runs visually clear and preferably a measurable chlorine residual is restored.

SECTION 5: VERIFICATION

Sec. 5.1 Bacteriological Tests

5.1.1 *Standard conditions for new mains.* It should be recognized that the primary means of ensuring the sanitary integrity of a main are the sanitary handling of materials, the practices during construction, and continual inspection of work. After disinfection and final flushing such that typical system chlorine residuals are present, if the system operates with a residual, samples shall be collected as follows:

5.1.1.1 For new mains, the purchaser has two options for the bacteriological testing for total coliform analysis.

Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hr using the sampling site procedures outlined. Both sets of samples must pass for the main to be approved for release.

Option B: Before approving a main for release, let it sit for a minimum of 16 hr without any water use. Then collect, using the sampling site procedures outlined and without flushing the main, two sets of samples a minimum of 15 min apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release.

A set of samples includes all samples collected along the length of the pipeline, as described in Sec. 5.1.1.2.

5.1.1.2 For new mains, sets of samples shall be collected every 1,200 ft (370 m) of the new water main, plus one set from the end of the line and at least one from each branch greater than one pipe length.

5.1.1.3 If trench water has entered the new main during construction or if, in the opinion of the purchaser, excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft (61 m), and the sampling location shall be identified (see Sec. 5.1.3 for sampling location details). Samples shall be taken of water that has stood in the new main for at least 16 hr after final flushing has been completed.

5.1.1.4 A standard heterotrophic plate count (HPC) test may be required at the option of the purchaser because new mains do not typically contain coliform bacteria but often contain HPC bacteria. If sample results show HPC greater than 500 CFU/mL, flushing should resume and another set of HPC and coliform samples collected until no coliform are present and the HPC is less than 500 CFU/mL.

5.1.2 *Standard conditions for repaired mains.* It should be recognized that the primary means of ensuring the sanitary integrity of a main are the sanitary handling of materials, the practices during repair work, and continual inspection of work. After disinfection and final flushing, samples shall be collected as follows:

5.1.2.1 For repaired mains that were depressurized and/or wholly or partially dewatered, one set of samples may be required, and depending upon the sanitary conditions, the line may be reactivated prior to the completion of bacteriological testing. Samples shall be collected downstream of the repair site and at intervals of approximately 200 ft (61 m) within the length of pipe that was shut down. If direction of flow is not known, samples shall be collected on either side of the repair site. Refer to Sec. 4.11.

5.1.2.2 For repaired mains that were maintained under pressurized conditions at all times, disinfection and/or testing may not be required. Refer to Sec. 4.11.3.

5.1.2.3 However, under either main repair scenario, it is advisable where possible to provide a scour flush to clear before the release of the repaired section.

5.1.3 *Sampling procedure.* Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate, in accordance with Section 9060—Samples of *Standard Methods for the Examination of Water and Wastewater*. Hoses and fire hydrants are not recommended for the collection of samples that will be used to make decisions on the bacteriological quality of drinking water. However, if no sampling port is available, cleaned fire hydrants that have been cleared of standing water and/or other sanitized sampling apparatus (i.e., sanitized tubing, hose, gooseneck, spigot) may be used with the understanding that they do not represent optimum access to the water main for bacteriological sampling. A suggested combination blowoff and sampling tap used for mains up to and including 8-in. (200-mm) diameter is shown in Figure 2. There should be no water in the trench up to the connection for sampling. The sampling pipe must be dedicated and clean and disinfected and flushed prior to sampling. A corporation cock may be installed in the main with a copper-tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use and the corporation cock should be capped or taped for future reuse. If corporation cocks are placed at the 12 o'clock position, they may be struck more easily during future excavations.

5.1.4 *Sample results.* Samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater* and shall show the absence of coliform bacteria.

In addition, it is recommended that samples be tested for acceptable aesthetic quality (e.g., chlorine residual, pH, alkalinity, specific conductance, turbidity). Levels should be as expected or typical for the water system. For new mains, a standard heterotrophic plate count test may be required at the option of the purchaser because new mains do not typically contain coliform bacteria but often contain HPC bacteria. If sample results show HPC greater than 500 CFU/mL, flushing should resume and another set of HPC and coliform samples collected until no coliform are present and the HPC is less than 500 CFU/mL.

5.1.5 *Record of compliance.* The record of compliance shall be the bacteriological test results certifying that the water sampled is free of coliform bacteria contamination.

5.1.6 *Redisinfection.* If the initial disinfection fails to produce satisfactory bacteriological results, or if other results indicate unacceptable water quality, the main may be reflushed and shall be resampled. If check samples fail to produce acceptable results, the main shall be rechlorinated by the continuous-feed or slug method until satisfactory results are obtained—that being acceptable samples taken as described in Sec. 5.1.1.1.

NOTE: In the case of new mains, high velocities in the adjacent existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to sample water entering the new main to determine if excessive turbidity is present that could be interfering with results.

Sec. 5.2 Optional Sampling and Testing

If a pipeline is not promptly returned to service, the situation should be evaluated to determine if the water quality may have been impacted and if additional testing is warranted. Test results should confirm that the water quality is appropriate for distribution. Although this assessment is unique for each system, parameters considered for testing include disinfectant residual, total coliform bacteria, HPC, turbidity, pH, alkalinity, total chlorine, odor, and specific conductance.

SECTION 6: DELIVERY

This standard has no applicable information for this section.

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APPENDIX A

Chlorine Residual Testing

This appendix is for information only and is not a part of ANSI/AWWA C651.

SECTION A.1: DPD DROP DILUTION METHOD (FOR FIELD TEST)

The N, N-diethyl-p-phenylenediamine (DPD) drop dilution method of approximating total residual chlorine is suitable for concentrations above 10 mg/L, such as those applied in the disinfection of water mains or tanks.

Sec. A.1.1 Apparatus

1. A graduated cylinder for measuring distilled water.
2. An automatic or safety pipette.
3. Two dropping pipettes that deliver a 1-mL sample in 20 drops. One pipette is for dispensing the water sample, and the other is for dispensing the DPD and buffer solutions. The pipettes should not be interchanged.
4. A comparator kit containing a suitable range of standards.

Sec. A.1.2 Reagents

1. DPD indicator solution. Prepare as prescribed in *Standard Methods for the Examination of Water and Wastewater*.

Sec. A.1.3 Procedure

1. Add 10 drops of DPD solution and 10 drops of buffer solution (or 20 drops of combined DPD-buffer solution) to a comparator cell.
2. Fill the comparator cell to the 10-mL mark with distilled water.
3. With a dropping pipette, add the water sample one drop at a time; mix until a red color is formed that matches one of the color standards.
4. Record the total number of drops used and the final chlorine reading obtained (that is, the chlorine reading of the matched standard).
5. Calculate the milligrams per liter of free residual chlorine as follows:

$$\text{mg/L chlorine} = \frac{\text{reading} \times 200}{\text{drops of sample}}$$

SECTION A.2: HIGH-RANGE CHLORINE TEST KITS

Several manufacturers produce high-range chlorine test kits that are inexpensive, easy to use, and satisfactory for the precision required.

APPENDIX B

Chlorine Dosages

This appendix is for information only and is not a part of ANSI/AWWA C651.

Table B.1 Amounts of chemicals required to produce various chlorine concentrations in 100,000 gal (378.5 m^3) of water*

Desired Chlorine Concentration in Water		Liquid Chlorine Required		Sodium Hypochlorite Required						Calcium Hypochlorite Required	
				5% Available Chlorine		10% Available Chlorine		15% Available Chlorine		65% Available Chlorine	
mg/L		*lb*	*(kg)*	*gal*	*(L)*	*gal*	*(L)*	*gal*	*(L)*	*lb*	*(kg)*
2		1.7	(0.77)	3.9	(14.7)	2.0	(7.6)	1.3	(4.9)	2.6	(1.18)
10		8.3	(3.76)	19.4	(73.4)	9.9	(37.5)	6.7	(25.4)	12.8	(5.81)
50		42.0	(19.05)	97.0	(367.2)	49.6	(187.8)	33.4	(126.4)	64.0	(29.03)

*Amounts of sodium hypochlorite are based on concentrations of available chlorine by volume. For either sodium hypochlorite or calcium hypochlorite, extended or improper storage of chemicals may have caused a loss of available chlorine.

Table B.2 Amounts of chemicals required to produce chlorine concentration of 200 mg/L in various volumes of water*

Volume of Water		Liquid Chlorine Required		Sodium Hypochlorite Required						Calcium Hypochlorite Required	
				5% Available Chlorine		10% Available Chlorine		15% Available Chlorine		65% Available Chlorine	
gal	*L*	*lb*	*(g)*	*gal*	*(L)*	*gal*	*(L)*	*gal*	*(L)*	*lb*	*(g)*
10	(37.9)	0.02	(9.1)	0.04	(0.15)	0.02	(0.08)	0.02	(0.08)	0.03	(13.6)
50	(189.3)	0.10	(45.4)	0.20	(0.76)	0.10	(0.38)	0.07	(0.26)	0.15	(68.0)
100	(378.5)	0.20	(90.7)	0.40	(1.51)	0.20	(0.76)	0.15	(0.57)	0.30	(136.1)
200	(757.1)	0.40	(181.4)	0.80	(3.03)	0.40	(1.51)	0.30	(1.14)	0.60	(272.2)

*Amounts of sodium hypochlorite are based on concentrations of available chlorine by volume. For either sodium hypochlorite or calcium hypochlorite, extended or improper storage of chemicals may have caused a loss of available chlorine.

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BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission Bureau of Investigation and Enforcement	: :	
v.	:	Docket No. C-2023-
KLH Engineers, Inc.	:	

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of the foregoing **Formal Complaint** in the manner and upon the parties listed below, in accordance with the requirements of 52 Pa. Code § 1.54 (relating to service by a party).

Served via Electronic Mail

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Date: January 30, 2023