4.01 O & M MANUALS

A. Installation of all mechanical equipment shall be done in accordance with written instructions provided by the manufacturer. Installation instructions shall be delivered with the station.

B. The manufacturer shall provide 5 copies of a complete and detailed operating and maintenance manual. This manual shall provide all design criteria, general operating procedures, maintenance and servicing procedures for all major components, and as–built drawings of the contributory gravity sewer system, the pumping station and force main. All instructions and parts lists shall be prepared for the specific equipment furnished and shall not refer to similar equipment. Operating manuals must be submitted to the Town prior to final acceptance of the station.

4.02 POLYETHYLENE (PE3408) SANITARY SEWER FORCE MAINS

A. This specification covers requirements for PE3408 high density polyethylene sanitary sewer force mains. All work shall be performed in accordance with these specifications and manufacturer requirements.

B. Referenced Standards. All standard specifications, i.e., Federal, ANSI, ASTM, etc., made a portion of these Specifications by reference, shall be the latest edition and revision thereof.

C. Warranty and Acceptance. The Contractor shall warrant all work to be free from defects in workmanship and materials for a period of one year from the date of completion of all construction. If work meets these specifications, a letter of acceptance, subject to the one year warranty period, shall be given at the time of completion. A final acceptance letter shall be given upon final inspection at the end of the one year warranty period, provided the work still complies with these specifications. In the event deficiencies are discovered during the warranty period, they shall be corrected by the Contractor without additional charge to the owner before final acceptance. During the warranty period, the Project Engineer shall determine if warranty repairs or replacement work shall be performed by the Contractor. The decision of the Project Engineer shall be binding upon the Contractor.

D. Polyethylene Pipe and Fittings

1. Qualification of Manufacturers. The Manufacturer shall have manufacturing and quality control facilities capable of producing and assuring the quality of the pipe and fittings required by these Specifications. The manufacturer's production facilities shall be open for inspection by the Owner or his Authorized Representative. Qualified manufacturers shall be approved by the Project Engineer.

2. Materials. Materials used for the manufacture of polyethylene pipe and fittings shall be PE3408 high density polyethylene (SDR 11 or better) meeting cell classification 345444C or 345444E per ASTM D 3350; and shall be listed in the name of the pipe and fitting manufacturer in Plastics Pipe Institute's TR–4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fitting

Compounds, with a standard grade HDB rating of 1,600 psi at 73°F. The manufacturer shall certify that the materials used to manufacture pipe and fittings meets these requirements.

3. Polyethylene Pipe. Polyethylene pipe shall be manufactured in accordance with ASTM F 714, Polyethylene (PE) Plastic Pipe (SDR–11 rating or better) Based on Outside Diameter, and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, % carbon, (from pipe) dimensions and ring tensile strength.

4. Polyethylene Fittings & Custom Fabrications. Polyethylene fittings and custom fabrications shall be molded or fabricated by the pipe manufacturer. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom fabrications and connections shall be fully rated for the same internal pressure as the mating pipe. Pressure de–rated fabricated fittings are prohibited.

5. Molded Fittings. Molded fittings shall be manufactured in accordance with ASTM D 3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (IPE) Plastic Pipe and Tubing, and shall be so marked. Each production lot of molded fittings shall be subjected to the tests required under ASTM D 3261.

6. Fabricated Fittings. Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe.

7. Polyethylene Flange Adapters. Flange adapters shall be made with sufficient through–bore length to be clamped in a butt fusion joining machine without the use of a stub–end holder.

8. Back–up Rings & Flange Bolts. Flange adapters shall be fitted with back–up rings pressure rated equal to or grater than the mating pipe. The back–up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 6 or higher (stainless steel).

9. Compliance Tests. Manufacturer's inspection and testing of the materials. In case of conflict with manufacturer's certifications, the Contractor, Project Engineer, or Owner may request retesting by the manufacturer or have retests performed by an outside testing service. All retesting shall be at the requestor's expense, and shall be performed in accordance with the Specifications.

E. Joining

1. Heat Fusion Joining. Joints between plain end pipes and fittings shall be made by butt fusion, electrofusion couplings and joints between the main and saddle branch fittings shall be made using saddle fusion procedures that are recommended by the pipe and fitting manufacturer. The Contractor shall ensure that persons making heat fusion joints have received training in the manufacturer's recommended procedure. The Contractor shall maintain records of trained personnel and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.

2. Butt Fusion of Unlike Wall Thicknesses. Fusions of different wall thickness are acceptable, as long as the difference is limited to a one SDR difference, i.e. SDR 11 to SDR 9. Transitions between unlike wall thicknesses greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means.

3. Joining by Other Means. Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and backup rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, or (c) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be followed. All connections shall maintain the total pressure rating of the force main.

4. Mechanical Joint Installation. Mechanical joints shall be installed in accordance with the manufacturer's recommended procedure. When an OD compression mechanical coupling is used, a stiffener shall be installed in the bore of the polyethylene pipe.

5. Branch Connections. Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe.

4.03 HORIZONTAL DIRECTIONAL DRILLING W/ POLYETHYLENE PIPE

A. Directional boring with PE3408 pipe shall be completed in accordance with the manufacturer's requirements and shall not in any way affect the joint connections or the overall strength characteristics of the pipe.

B. References:

"Mini–Horizontal Directional Drilling Manual" published by North American Society for Trenchless Technology (NASTT).

"Guidelines for a Successful Directional Crossing Bid Package" published by Directional Crossing Contractors Association (DCCA).

"Polyethylene Pipe for Horizontal Directional Drilling" of the Plastic Pipe Institute's Handbook of Polyethylene Piping.

C. Quality Control. All directional boring shall be completed in such a way as not to jeopardize the existing infrastructure/facilities, such as the roadway, utility poles, subsurface utilities, structures/foundations, or significant landscaping. Prior to directional drilling, all potential conflicts shall be field verified.

D. General

1. Directional drilling shall be performed in a manner required to install HDPE utility line as indicated on the drawings. Furnish all manpower and equipment required to perform the pipeline installation. The operation shall include all excavation and dewatering, drilling calculations, pilot hole, and pullback operations. Contractor shall be responsible for type of reamer, diameter, and other pertinent operations required for a complete installation. Contractor shall be responsible for mobilizing on–site with a full range of drill stems and reaming heads to allow for various factors which may occur. Drill stems shall be of proper size and diameter to allow for full thrust and torque capabilities of the drilling machines.

2. Contractor shall perform utility survey to locate information concerning existing utility lines located in the areas of the directional drilling work.

3. Directional drilling shall be accomplished by drilling from one side of the crossing to the other using an approved method. One method shall be drilling a small diameter pilot hole along the proposed utility route. Steering shall be accomplished by using drilling mud which is pumped into the drill pipe to provide rotational energy in a drill bit at the end of the drill pipe. A jet bit shall force the mud through small orifices and jet away the earth and to allow the drilled path to curve in the proper direction as the drill pipe is thrust forward. An electronic survey instrument shall be placed inside the drill pipe head. The instrument shall signal a computer of the drilled paths magnetic azimuth, vertical inclination, and orientation of the bend. This data shall be used by the drilling contractor to calculate location of the drill bit and allow steering adjustments to be made.

4. After completing the pilot hole, larger diameter reaming heads shall be pulled back in order to enlarge the hole as required to allow for the pipe pullback. The Contractor shall be responsible for multiple reaming operations as required to complete the work. Pull back operations shall be carried out as soon as possible following the final preream. During this phase of the work, the Contractor shall continue his work operations without interruption regardless of the day of week or hour of the day. A pullback head shall be attached to the pipe to allow fastening to the swivel head reamer. The head shall be closed to prevent drilling mud from entering the main during the pullback operation.

5. Upon completion of the drilling operations, the equipment and materials used shall be removed from the site and the areas disturbed shall be restored to original conditions. The main shall be tested in accordance with Section 02730 of the Specifications. If the main fails the testing, it shall be removed and the work repeated at no additional cost to the Owner.

WATER SUPPLY SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:

1. Pipe Materials
2. Hydrants
3. Valves
4. Fittings
5. All other appurtenances necessary to complete the water main system as shown on the Contract Plans.

1.02 SUBMITTALS

A. Product Data: Submit published data from manufacturers of products and accessories specified, indicating compliance with requirements to the Engineer and local municipality.

1.03 QUALITY ASSURANCE

A. All materials and the installation procedure shall be in accordance with the Department of Environmental Conservation, Water Supply Division and the applicable construction ordinances of the local municipality.

PART 2 – PRODUCTS

2.01 GENERAL

A. Furnish ells, tees, reducing tees, wyes, couplings, increasers, crosses, transitions and end caps of the same type and class of material as the conduit, or of material having equal or superior physical and chemical properties as acceptable to the Engineer as necessary to complete the water system.

2.02 WATER MAIN MATERIAL

C–900 PVC WATER MAIN

A. Pipe shall be C–900 (DR–14 200 psi) PVC (sizes as shown on the plans) conforming to current AWWA C–900, latest revision and shall be UL and FM approved. Larger size mains will be required if necessary to allow withdrawal of the required fire flow while maintaining the minimum pressure specified in the VT Water Supply Rule, Chapter 21, 8.1.1. Any proposed departure from minimum requirements shall be justified by hydraulic analysis and future water use assessment, and will be considered only in special circumstances (VT Water Supply Rule, Chapter 21 8.1.4). Push–on joint accessories shall conform to applicable requirements of ANSI/AWWA C111/A21.11.

B. When a pipe material is specifically noted on the contract drawings,the contractor/developer shall not have the option of utilizing any other pipe material. Galvanized pipe or fittings shall not be used in any water system owned or maintained by the Town. The Town Water Department requires the use of polyethylene pipe sleeve encasements and/or alternate pipe materials in known or suspected corrosive soil conditions.

DUCTILE IRON WATER PIPE

A. Pipe shall be Tyton Ductile Iron Class 52 (sizes as shown on the plans) conforming to current ANSI/AWWA C151/A21.51 latest revision. Push–on joint pipe shall be minimum thickness Class 52. Push–on joint accessories shall conform to applicable requirements of ANSI/AWWA C111/A21.11.

B. Pipe shall be cement mortar lined on the inside in accordance with ANSI Specification A21.4 except that the cement lining thickness shall not be less than 1/8 inch. A plus tolerance of 1/8 inch will be permitted.

C. Pipe shall be given an exterior petroleum asphaltic coating in accordance with ANSI/AWWA Specification C151/ASNI A21.51.

D. Pipe shall be poly wrapped with a minimum thickness of 4 mil poly in accordance with AWWA Specification C105 / ANSI A21.5, unless approved otherwise.

2.03 FITTINGS

A. Ductile iron fittings shall conform to ANSI/AWWA C110/A21.10, 350 PSI working pressure. Ductile iron fittings larger than twelve inches (12") shall have a standard body length equal to Class 250 Cast Iron fittings. Cast Iron Class 250 fittings will be allowed in lieu of ductile iron fittings larger than twelve inches (12"). Ductile iron fittings shall be rated for 250 p.s.i. However, twelve inch (12") and smaller may be rated for 350 p.s.i. with the use of special gaskets. All ductile iron compact fittings shall conforming to AWWA/ANSI C153/A21,53 standards.

B. Anchor tees shall be standard mechanical joint tees except that the branch is plain Class 250 cast iron or Class 350 ductile iron, cement lined, conforming to ANSI/AWWA C110/ A21.10, C111/A21,11, and C104/A21.4. Anchor tees shall be Clow F–1217, U.S. Pipe U5–92 or equal.

C. Mechanical Joint restraints shall be incorporated into the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron, and have a minimum working pressure of 350 psi. Twist off nuts (i.e. mega–lug) or equal shall be used to ensure proper actuating of the restraining devices. Contractors may also use approved grip ring (or equal) retainer glands.

D. Bolts shall conform to ANSI Specification A21.10.

E. Pipeline couplings shall conform to AWWA Standards C110 and ANSI A21.10. Mechanical joint connecting pieces of proper diameter shall be installed in accordance with the manufacturer recommendations and at locations directed by the plans or the Town Water Department.

F. All fittings shall be restrained; double poly wrapped and have concrete thrust blocks poured in place as defined herein.

2.04 TAPPING SLEEVES AND VALVES

A. The Town Water Department shall be notified whenever a proposed tap is to be made on any transmission main within the municipal system.

B. Only approved tapping companies shall be allowed to perform wet taps on any Town Water Department water mains.

C. All materials used when tapping for a branch connection or interconnection from any Town Water Department water transmission or distribution pipelines shall be specified below

2.05 TAPPING SLEEVES

For use on existing asbestos cement, gray cast iron, ductile iron or PVC C–900 pipe:

A. Tapping sleeves shall be of the split sleeve design, constructed with two solid half–sleeves bolted together. Sleeves shall be constructed of ductile iron, shall have a working pressure of at least 250 psi, and shall have mechanical joint ends with end and side gasket seals.

B. All iron body tapping sleeves shall be provided with a 3/4" NPT test plug, or other provisions must be made for air testing the valve and sleeve at maximum working pressure, prior to tapping.

C. All bolts and nuts for mechanical joints of tapping sleeves shall be of high–strength cast iron or high–strength, low–alloy steel conforming to ANSI/AWWA C111/A21.11.

D. All bolts and nuts for flanged joints of tapping sleeves shall be of high–strength, low carbon steel conforming to ANSI/AWWA C110/A21.10.

E. All bolts and nuts shall be sound, clean, and coated with a rust–resistant lubricant; their surfaces shall be free of objectionable protrusions that would interfere with their fit in the made–up mechanical or flanged joint.

2.06 TAPPING VALVES

A. Tapping valves shall conform to ANSI/AWWA C509 Standard for Resilient–Seated Gate Valves for Water and Sewage Systems, except as modified herein. Valves shall open counterclockwise and shall have a minimum working pressure of 200 psi. Inlet flanges shall be Class 125 conforming to ANSI Specification B16.1 or ANSI/AWWA C110/A21.10, and outlet connection shall be Standardized Mechanical Joint unless specified otherwise on the drawings for the type of pipe required for the branch or lateral pipeline.

B. Tapping valves over sixteen inches (16") diameter shall be installed with their stems horizontal, shall be equipped with rollers, tracks and scrapers, and shall be provided with bypass valves unless otherwise specified.

C. Buried tapping valves shall be provided with a two inch (2") square wrench nut and shall be installed with a cast iron valve box as required to allow positive access to the valve operating nut at all times. In installations where the depth from grade to top of valve operating nut is greater than 5'0", a valve stem riser shall be provided and installed such that the depth from valve stem riser nut to grade is from four feet to five feet (4'–5'), (minimum length of valve stem riser is two feet (2')). Valve stem riser shall be of high strength steel and of welded construction.

D. All contractors (or others) who apply for water line tapping permits shall submit complete specifications of the tapping material they intend to use at the time the tapping permit application is submitted on 8 1/2" x 11" shop drawing sheets

E. All bolts and nuts used with all pipe sleeves shall, upon final tightening and testing, be brush coated heavily with bitumastic cold–applied material to thoroughly cover all exposed surfaces of the bolts and nuts.

2.07 GATE VALVES–RESILIENT SEAT

A. Valves shall be manufactured to meet all requirements of AWWA Specification C509, latest edition. Valves twelve inches (12") and smaller shall be bubble tight, zero leakage at 200 psi working pressure. Valves shall have non–rising stems, open counter clockwise, and provide a two inch (2") square operating nut with arrow cast in the metal indicating direction of opening. Each valve shall have maker's name, pressure rating and year in which manufactured cast on the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure. Gate valves shall be Mueller, Kennedy, AFC, or approved equal.

B. Buried valves shall be installed with a gate valve box.

C. Gate valves shall normally be placed a maximum of five hundred feet (500') apart. Tee intersections shall have a minimum of three (3) gate valves. Cross sections (four way intersections) shall have a minimum of four (4) valves.

D. The Town Water Department may require all bolts, studs and nuts be made from a corrosion resistant–material stainless steel.

2.08 VALVE BOXES

A. Valve boxes shall be of the three–piece Cast iron slide–type with a minimum inside shaft diameter of five and one quarter inches (5 1/4") and a six foot (6') trench depth. Valve boxes shall not transfer loads onto the valve.

B. Valve boxes shall have a cast iron cover, marked "WATER". The boxes shall be dirt tight with the top of the cover flush with the top of the box rim.countersunk brass pentagon plug for paved or concrete areas, and standard two holes for grass areas. Curb box couplings and extensions will be the same material as the curb box. Both cover and upper section of the box shall be able to be located with an aqua type metal locator.

C. All service connections shall be installed to the curb stop for all building lots before the street is paved.

D. Valve boxes located in roadways shall have one non–adjusting paving riser of a height ranging from one and a half inches (1.5") to six inches (6") as needed to be brought to final pavement grade.

2.09 BACKFLOW PREVENTION DEVICES

A. No water service connection shall be approved or maintained by the Town Water Department unless the water supply is protected as required by State laws, regulations and ordinances. The type of protective device shall depend on the degree of hazard that exists. In general, backflow devices designed to protect potable water supplies in accordance with national plumbing codes for non–health hazard cross connections and continuous pressure applications shall be used, i.e. Watts Series 007 or approved equal. Watts Series 709 Double Check Valve Assembly or approved equal shall be installed on all sprinkler systems. A shop drawing detail assembly showing backflow devices and meter placements shall be required by the Town Water Department.

2.10 PIPE BEDDING

A. Water lines shall be laid and maintained on lines and grades established by the plans for the project. Pipeline trenches shall be excavated to the width and depths shown on the plan typicals. Pipeline trenches in which pipe is to be laid directly on the trench bottom shall not be excavated entirely by machinery, but shall be finally excavated by hand tools such that the trench shall have a bottom shaped to support the pipe throughout its entire length by firm and undisturbed material. Pipeline trenches, for which bedding is required, may be excavated to the required depths using machinery. No pipe shall be laid directly on ledge, hard shale or a very compact glacial till. When an unstable trench bottom is encountered and the Town Water Department determines that it cannot support the pipe adequately, an additional depth shall be excavated and refilled to the pipe invert with approved material at the contractor's expense. Pipeline trenches shall be dry during the laying of pipe. Wood supports under pipe shall be removed prior to backfilling. Pipeline installation procedures can be found in AWWA Standard C600.

B. Bedding material shall consist of crushed or natural stone conforming to ASTM D2321.

Sieve	Percent Passing
1" Screen	100%
¾" Screen	100%
½" Screen	90 – 100%
⅜" Screen	40 – 70%
No. 4 Sieve	0 – 15%

C. Bedding and blanket material shall be Class II material (ASTM D2321) consisting of clean, granular material (sand), particle size limits described as follows:

Sieve	Percent Passing
No. 4	100%
No. 100	30%
No. 200	12%

2.11 PIPELINE INSULATION

A. Approved waterlines with less than six feet (6'–0") of cover over the crown, that cross a storm sewer, or where indicated on the plans, shall be protected against freezing by the installation of two inch (2") thick highest available density extruded polystyrene insulating sheets or equivalent. Sheets shall be the the lesser of 3' or 2 x diameter of the pipe. The sheets shall be placed six inches (6") above the crown after placement of four to six inches (4" – 6") of clean medium or coarse sand below the pipe bottom and four to six inches (4" – 6") above the crown. Joints shall be overlapped so there is no gap that will allow frost to penetrate. Care shall be exercised during backfill and compaction over the polystyrene sheets to prevent damage to the sheets. The polystyrene sheets shall meet the comprehensive strength requirements of ASTM D1621–73. In no cases shall the waterline have less than four feet (4') of cover over the top of the pipe.When water line passes within 5 feet of a catch basin install 2" min. rigid insulation, polystyrene sheets, between water line and cb.

2.12 POLYETHYLENE PIPE ENCASEMENT

A. Polyethylene pipe encasement may be required in areas of corrosive soils and shall conform to current ANSI/AWWA C105/A21.5 Specifications. Minimum material requirements for the polyethylene film shall be high density, cross laminated virgin polyethylene 4 mil film. The Town Water Department reserves the right to specify Polyethylene pipe, C–900, in areas of corrosive soils.

B. The polyethylene encasement shall prevent contact between the pipe or fittings and the surrounding backfill and bedding material and shall be installed as outlined in Section 4.1 of the above ANSI/AWWA standard.

2.13 CONCRETE FOR THRUST BLOCKS

A. Concrete shall be Portland Cement concrete of 3,000 psi minimum 28 day compressive strength. ASTM C–94 specification for transit mixed concrete shall control the concrete quality. A maximum water cement ratio of 6 gallons per sack and a maximum slump of four inches (4") will be allowed.

2.14 FIRE HYDRANTS AND HYDRANT BRANCHES

A. Fire hydrants shall be Mueller Super Centurion 250, Figure A–423, Kennedy K–81 D, or Waterous Pacer Hydrant and shall conform to AWWA C502 with the following specifications:

1. Main Valve Opening: 5 1/4 inches
2. Nozzle Arrangement: Two 2 1/2 inch Hose Nozzles with National Standard Thread (NST)
3. One 4 1/2 inch Pumper Nozzle with National Standard Thread (NST)
4. Inlet Connection: 6 inch Mechanical Joint, "Mega–Lug" or equivalent retaining gland and concrete thrust block
5. Operating Nut: Standard 1 1/2 inch Pentagon
6. Direction of Opening: Counterclockwise
7. Depth of Bury: Six–foot cover. The hydrant shall have at least 15 inches and no more than 21 inches between the bottom of the steamer cap and the ground.
8. Drain: The hydrant shall be non–draining or have the drains permanently plugged.
9. Color: Red enamel
10. Other: Hydrants shall be compression type closing with

SITE ENGINEER:

CIVIL ENGINEERING ASSOCIATES, INC.
10 MANSFIELD VIEW LANE, SOUTH BURLINGTON, VT 05403
802-864-2323 FAX: 802-864-2271 web: www.cea-vt.com

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DRAWN: SAL
CHECKED: DSM
APPROVED: DSM

OWNER:

PHILO RIDGE, L.L.C.

2766 MT. PHILO RD.
CHARLOTTE, VT.

PROJECT:

SITE IMPROVEMENTS

2766 MT. PHILO RD.
CHARLOTTE, VT.

DATE	CHECKED	REVISION

SITE SPECIFICATIONS

DATE: OCT., 2016
SCALE: NONE
PROJ. NO.: 16107
DRAWING NUMBER: C4.3