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Foreword

I. INTRODUCTION

a. Background

i. The Champlain Water District (CWD) is a regional water supplier supplying nine different communities consisting of twelve different municipal water systems: South Burlington, Jericho Village, Williston, Shelburne, Essex Town, Essex Junction, Colchester Town, Milton, Winooski, Colchester Fire District #1 and #3, and the Malletts Bay Water Company. CWD consists of two Divisions that are directly responsible for the Installation of Water Lines and Appurtenances. They are:

1. The CWD Wholesale Division, as transmitter (transporter) of potable water to various municipalities and water systems, owns and maintains all pipelines dedicated to that purpose. The CWD Wholesale Department is responsible for the supply of water to all member communities through transmission mains, storage facilities and pump stations.

2. The CWD Retail Division provides managerial and operational support services to CWD served communities, and manages and operates the Malletts Bay Water Company and Colchester Town water distribution systems that are owned by the District. Presently the CWD Retail Division is providing various services to five of twelve served municipal water systems.

b. History

i. In February of 2007 Champlain Water District Wholesale and Retail Divisions published the District’s first general specifications for the installation of water mains. Prior to February 2007 specifications were project specific.

ii. In the February 2007 specifications there was a stark difference in what was acceptable in Retail managed system and what was acceptable in the Wholesale transmission system.

iii. This revision of the specification has brought the guidelines of both the Wholesale and Retail Divisions together and will ease any confusion that Contractors and Vendors may have.
c. Use of these Specifications

i. The CWD Specifications shall apply to the CWD transmission system and water distribution systems owned or managed by the Champlain Water District. For the purposes of this document the term “Retail Superintendent” shall apply to the Malletts Bay Water Company and Colchester Town water systems, City of South Burlington Water Department, Village of Jericho, and Colchester Fire District #1.

ii. These CWD Specifications are considered the minimum acceptable standard specifications for the public water systems listed. The acceptability of any deviations from these standards shall be determined/approved by; in the case of the CWD Retail Division, the CWD Retail Superintendent; in the case of CWD transmission mains and appurtenances, the CWD Chief Engineer and/or the Transmission Systems Director; henceforth “appropriate CWD Division” (See www.champlainwater.org for current staff contact information).

iii. All products including “approved equal” alternatives shall be reviewed by the appropriate CWD Division. The submittal of any item shall include sufficient information for a determination of acceptability by the appropriate CWD Division. At a minimum, the information will include a description of the item, detailed materials information or reference to universally recognized standards (AWWA, ANSI, ASTM, etc.), a description of the methods to be used for construction and any testing necessary to verify the quality of the installation. The appropriate CWD Division may also require a list of locations and contact personnel where the item has previously been installed or the procedure used. It is not the intent of this document to prevent alternative solutions; however, the burden of proof for acceptability of alternate solutions lies with the party proposing the substitution.

iv. These specifications shall consist of policies, guidelines, and required procedural steps related to the excavation, installation, backfill, and testing required for water line construction. It shall also include detailed material specifications and typical details that are necessary for a complete water distribution/transmission system. Materials and installations shall be inspected and approved by the appropriate CWD Division before potable water is supplied to the project infrastructure.

v. All references to AWWA, ANSI, ASTM or the VT Water Supply Rule shall be to the most recent edition available, at the time of construction.
vi. The water systems included within these Specifications are defined below:

1. **CWD Owned Water Systems**

   a. **CWD Wholesale Transmission**: the water transmission system serving CWD consecutive member systems throughout Chittenden County.

   b. **The Malletts Bay Water Company (MBWC)**: a primarily residential area in Colchester, north of the Winooski/Colchester Town line off Malletts Bay Avenue.

   c. **The Colchester Town (CT) water system**: a primarily commercial area around I-89 Exit 16 and Water Tower Hill in Colchester.

2. **CWD Managed Water Systems**

   a. **City of South Burlington**: A mixed residential and commercial water system located within the City of South Burlington municipal boundary.

   b. **Colchester Fire District #1**: A mixed residential and commercial area along Route 15 in Colchester around the Saint Michaels College campus.

   c. **Village of Jericho**: A mixed commercial and residential area around Route 15 in Jericho, extending from the Essex/Jericho Town line up to Packard Road, and over to Browns Trace Road in Jericho.

II. **VARIATIONS**

   a. The Champlain Water District Specifications and Details for the Installation of Water Lines and Appurtenances (henceforth the “CWD Specifications”) are applicable to all new construction and reconstruction of water infrastructure. Variations from the CWD Specifications will not be permitted except as provided for herein.
1.00 PLANS AND DESIGN

1.01. One complete set of construction drawings and specifications for the proposed water system expansion or rehabilitation shall be prepared and submitted by a licensed Professional Engineer registered in the State of Vermont. Submit plans to the Champlain Water District Chief Engineer and/or Transmission System Director whenever the project will connect directly to or impact the CWD Wholesale transmission system. Submit plans to the Retail Superintendent for each CWD Retail Division managed water distribution system in accordance with that municipality’s plan review requirements whenever the project may impact the distribution system.

1.02. Drawings shall be submitted electronically in PDF. They shall be on a detailed, workable print (22" x 34"), and drawn to scale. Drawings shall contain a location map, plan and profile, type of materials to be used, locations of existing and proposed utilities, and necessary water system components required for a complete installation. Typical details and material and installation specifications shall be provided with all drawings.

1.03. At each stage of a project’s development, engineering plans are required to be reviewed to determine compliance with all water specifications and standards. The level of engineering detail required for approval generally increases with each stage of project approval. All construction drawings and specifications shall have a note stating, “All work to be performed in accordance with the Champlain Water District Specifications and Details for the Installation of Water Lines and Appurtenances.” Upon receipt of acceptable final engineering plans, the appropriate CWD Division will approve the plans for construction.

1.04. Any project involving tapping the water main for services one and one-half (1½) inches and larger shall have drawings submitted to the appropriate CWD Division for review.

1.05. No water main extensions or alterations will be constructed within the CWD Retail owned or managed water distribution systems without the written approval of the CWD Retail Superintendent. All contract documents shall meet these specifications as well as any of the applicable Rules and Regulations of the CWD Retail Division, the South Burlington Water Department (SBWD), Colchester Fire District #1 (CFD #1), or the Village of Jericho.
1.06. The applicant must state the purposes for which the water is required, and shall agree to conform to the Champlain Water District Retail Division’s, the City of South Burlington’s, Colchester Fire District #1, or the Village of Jericho’s Rules and Regulations or Water Ordinances, and these Specifications. No person supplied with water from any CWD managed system’s mains will be entitled to use it for any other purpose other than those stated. Requests for any other water use shall require a separate application.

1.07. The project shall be constructed, completed, maintained, and operated in accordance with the approved plans. No changes shall be made in the project without the written approval of the appropriate CWD Division.

1.08. In the case of conflict between the CWD Specifications, construction details, and specifications or codes or regulations of a municipality, the conflict shall be resolved to the satisfaction of the appropriate CWD Division.

1.09. All water mains, appurtenances and other materials, and construction methods shall conform to the most recent edition of all applicable AWWA, ANSI, ASTM, State and Local codes, standards and regulations, and the VT Water Supply Rule. In the case of conflict between these construction details and specifications, project drawings, and a code or regulation, it shall be resolved to the satisfaction of the appropriate CWD Division.

1.10. The applicant, developer or owner of record shall procure all permits, licenses, and easements that may be required to complete planned construction, including payment of all applicable fees, and shall comply with all conditions set forth in each permit in accordance with each water system’s project review requirements.

1.11. The applicant, developer or owner of record, beyond gaining approval of the contract documents by the appropriate CWD Division, shall also be responsible for any permit issued or work completed under these specifications. The project applicant, or owner shall keep the appropriate CWD Division advised of the address to which bills, notices, and other communications are to be delivered, and shall provide an emergency contact list effective throughout the construction period.

1.12. Approved Pipe Materials:

1.12.01. CWD Wholesale Transmission System: Ductile Iron pipe is required on all CWD transmission projects. HDPE may be used for limited installations, such as but not limited to:

- Remote undevelopable areas
- Unstable soil conditions
• Directional bores
• Intake lines.

1.12.02. CWD Owned Retail System: Ductile Iron pipe is approved for distribution projects. PVC and HDPE may be approved at the discretion of the Retail Superintendent depending on project specifics.

1.12.03. CWD Managed Retail System: Ductile Iron pipe is approved for distribution projects. PVC and HDPE may be approved at the discretion of the appropriate governing jurisdiction depending on project specifics.

1.13. All water mains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis has been developed based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow. The normal working pressure in the distribution system should be approximately 60 psi and not less than 35 psi (VT Water Supply Rule). The appropriate CWD Division may require the installation of main line Pressure Reducing Valves (PRVs) depending on system configuration.

1.14. All service connections and water mains shall be buried to a depth of six feet (6') to the top of the pipe, and no more than eight feet (8') unless waived by the appropriate CWD Division.

1.15. Looping of mains is required with the intent of avoiding dead-ends. Dead-ends should only be installed if (1) looping is impractical due to topography, geology, pressure zone boundaries, unavailability of easements or locations of users; or (2) the main will be extended in the near future, and the planned extension will eliminate the dead-end connection. In this condition the water main extension shall be continuous to the furthest property line of the project. A dead-end water main whether temporary or permanent shall have a fire hydrant installed at the end, unless approved otherwise by the Retail Superintendent.

1.16. In general, and unless stated otherwise in each Municipality's Rules, Regulations, Specifications, Ordinances, or Planning and Zoning requirements, easements of sufficient width shall be provided at locations acceptable to the Municipality if required. Easements for gas, telephone, electrical, and cable TV and private utilities should be located away from water lines and appurtenances wherever possible. The easement deed shall contain language that specifically indemnifies, and holds the water system owner harmless from any obligations, liabilities or claims arising from the existence of such easement or the construction of any utility within
the easement, as well as wording preventing the construction of buildings or structures above the water line or within the water line easement.

1.17. All construction documents shall consider adequate fire protection and domestic service pressure. In the event a new extension cannot meet those requirements, the applicant or developer shall loop the waterlines, add a storage tank, provide booster pumps, or make other approved provisions to meet the requirements. The requirement to install the above appurtenances does not imply that each water system shall take ownership of the required provisions. Ownership shall be determined within the course of plan reviews, in accordance with each water systems rules, regulations, specifications, ordinances, and planning and zoning requirements.

1.18. There shall be no connection between the water distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminating materials may be discharged or drawn into the system (VT Water Supply Rule, Appendix A, Chapter 21.8.8.1.).

1.19. Applications for irrigation purposes directly off of CWD Transmission mains shall not be approved. Applications for irrigation purposes off of distribution system mains shall be approved/rejected on a system by system basis, in accordance with each water systems rules, regulations, specifications, ordinances, and planning and zoning requirements.

1.20. There is a significant amount of Asbestos Cement (AC) water pipe within the CWD owned and managed water systems. There are a number of regulations that affect work involving AC pipe. The Professional Engineer and Contractor shall be responsible for adhering to the “Vermont Regulations for Asbestos Control” for removal and disposal of AC pipe. Costs associated with any and all labor and materials to properly handle and dispose of existing AC pipe is the responsibility of the Contractor.

1.21. No parallel underground utility (ex. phone, electric, cable, gas) shall be designed or installed within four feet (4’) of the water main from either side, or above the water main from the bottom of the main to finish grade. Storm sewer and sanitary sewer separations are only as allowed in these specifications and the VT Water Supply Rule. No building or structure shall be built above the water line or within the water line easement. All projects that may cross or impact existing transmission or water distribution lines shall include the requirement to field verify all water associated infrastructure that may be impacted.

1.22. All electrical installations shall at a minimum meet the requirements of the latest revision of the National Electric Code, National Electric Safety Code, the Vermont Utilities Electric Service Requirements Manual, and any other
requirements by CWD that are over and above the minimum requirements of the codes listed herein.

1.23. **Errors and Omissions**

1.23.01. The fact that specific mention of a fixture or of any part of the work is omitted in the specifications, whether intentionally or otherwise, when the same is clearly indicated on the plan drawings, or is usually and customarily required to complete fully such work as specified, will not entitle the contractor of the project to consideration in the matter of any claim for extra compensation. Said fixtures, work, or both shall be installed or done the same as if called for both by drawings and by the specifications.

1.23.02. All work indicated on the drawings and not mentioned in the project specifications, or vice versa, and all work and material usually necessary to make the work complete in all its parts, whether or not they are indicated on the drawings or mentioned shall be considered the same as if they were called for both by drawings and by the specifications.

2.00 **CWD CONNECTION POLICY**

2.01. These regulations shall apply to all those wishing to connect to any CWD owned water transmission pipeline. Since it is the policy of the CWD Wholesale Division to deal only with the municipal water system purchasing water from the CWD, CWD will only accept tapping applications from those served member communities.

2.02. These regulations shall also apply to all connections to distribution lines owned and/or maintained by the Champlain Water District Retail Division. CWD Retail owned and managed systems have individual forms that must be completed with the assistance of the Retail Division Superintendent.

2.03. **Definitions:** As used in these regulations the following definitions shall apply to both Wholesale and Retail Divisions:

2.03.01. Connection: the act of direct tapping an existing water main, “cutting in” a tee and valve, or connecting to a previously installed tee and/or valve; all connections are solely at the cost of the applicant.

2.03.02. Completed Connection: a connection that has passed all required testing which may entail but is not limited to; visually inspected, hydraulically pressure tested, suitably restrained, and substantially backfilled.
2.03.03. Municipality: shall be the political structure or organization responsible for the retail distribution of water in the area.

2.03.04. Connection Fee: shall be a charge levied for permission to connect to a water main owned and/or maintained by the Champlain Water District, and shall be prepaid by the applicant.

2.04. Those wishing to connect to or tap a water line within the Champlain Water District Transmission or Distribution systems must contact the municipality in which the water line is located.

2.05. Any connection to or tapping on a line shall be made only after:

2.05.01. Written application has been made to CWD by the appropriate municipality.

2.05.02. Written approval has been granted by CWD. Copies of respective Wholesale and Retail application forms can be found on the CWD website.

2.05.03. The assessed connection fee has been paid to the Champlain Water District and/or the appropriate municipality.

2.05.04. Appropriate prior notification; a minimum of five (5) working days, has been given to the appropriate CWD Division regarding the date and time that the connection is to take place.

2.06. The connection can only take place in the presence of a Champlain Water District employee.

2.07. No existing valves, hydrants, curb stops, etc. shall be operated without prior approval of the appropriate CWD Division. Any damage occurring after the use of any valve operated by the contractor shall be the contractor’s responsibility.

2.08. A connection shall not be made after November 15 or before April 1 without prior approval of the appropriate CWD Division, who may also restrict connections before November 15 and after April 1 during adverse weather conditions.

2.09. Connections shall be made by Champlain Water District approved contractors only. Work will only be allowed after a current certificate of insurance is provided by the tapping contractor.

2.10. Connections will only be permitted between the hours of 7:00am and 3:00pm on regular Champlain Water District business days, except Fridays. All connections must be completed by 3:00pm; connections that cannot be completed by 3:00pm may be suspended and completed the following
business day. A suspended tap may entail back filling the excavation until
the following day. CWD personnel have the authority to suspend
connections that they deem cannot be completed within the time period
stated above.

2.11. Excavations for connections shall comply with safety requirements outlined
in the section Protection of the Public and Work Personnel of these
specifications. CWD personnel have the authority to suspend
connections that they deem do not comply with applicable VOSHA Guidelines.

2.12. No connection or taps shall be located within 3 pipe diameters of any other
fitting or pipe joint. Example: If tapping a 12” water line the tapping saddle
must be a minimum of 36” away from the nearest joint in the 12” water line.

2.13. Connection fees shall be levied by the Champlain Water District and/or the
local municipality in accordance with the appropriate CWD schedule and/or
the local municipality’s regulations.

2.14. Wholesale Connection Fees:

2.14.01. No charge shall be made to connect an existing member water
system to a Champlain Water District transmission line in order to
transmit water to that system, or to transfer an existing water
service from a municipality owned water line to a Champlain Water
District line.

2.14.02. No charge shall be made wherein a connection is made so as to
solely create a loop in an existing system, provided no additional
water demand is added to the system.

2.14.03. No charge shall be made wherein a connection is made to provide
service solely to a new fire hydrant.

2.14.04. Charges associated with unique or unusual connection
applications shall be reviewed and determined by the Champlain
Water District.

2.14.05. The payment of a connection fee to the Champlain Water District
shall not preclude the right of a municipality to levy any additional
fee or cost item as a charge for said tap or supervision thereof.

2.14.06. The municipality shall be responsible for the payment of any fees
due. The amounts due shall be paid at least five (5) working days
prior to connection being made.

2.14.07. The municipality shall be responsible for the payment of any fees
due. The amounts due shall be paid at least five (5) working days
prior to connection being made.
2.15. Wholesale Connection Requirements:

2.15.01. All tapping corporations, tapping sleeves and tapping valves on the CWD transmission pipeline will be installed only after permission from the specific served municipal water system and CWD.

2.15.02. All tapping corporations, tapping sleeves and tapping valves of any size, become the property of CWD and the responsibility of operation, maintenance and/or replacement is the obligation of CWD. The CWD general warranty shall apply.

2.15.03. All pipe and appurtenances beyond the tapping corporations, tapping sleeves and tapping valves shall be owned, maintained and repaired by the host municipality and/or property owner, in accordance with each water systems’ rules, regulations, specifications, ordinances, and planning and zoning requirements.

2.15.04. All service connections made to CWD Transmission mains will be equipped with certified backflow devices that meet the requirements of the Municipality in which the connection is being made. If the Municipality does not require backflow devices the connection must be equipped with a backflow device that meets the requirements in these specifications.

3.00 SAFETY AT THE WORK SITE

3.01. The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in association with the work. Work personnel and the public shall be protected by the contractor, from any and all hazards connected with the construction work. Open trenches, materials, or equipment within the working limits of the public right of way are to be guarded by the use of adequate barricades, certified flag persons or both. All barricades left in position overnight shall have appropriate lights or reflectors from dawn to dusk. When work narrows the useable pavement, certified flag persons shall be used to aid the flow of traffic so that there will be no undue delays. Temporary construction signs shall be erected in accordance with State and local requirements.

3.02. The Contractor shall be held responsible for the safety of all work persons and the general public and all damages to property from the hazard of open trenches, materials, or equipment at any time of day or night within the working area. All work shall be in conformance with applicable VOSHA regulations, MUTCD guidelines, Highway Access, and Excavation permit approvals.

3.03. The contractor shall be solely responsible for any safety citations by State or Federal inspectors. CWD shall have the authority to suspend any activity
on CWD owned or managed infrastructure that does not conform to applicable regulations. Corrective action shall be taken by the Contractor.

4.00 PROTECTION AND REPAIR OF EXISTING UTILITIES

4.01. The contractor shall notify Dig Safe prior to excavation, and otherwise comply with all permit requirements of each municipality work is performed in. Wherever culverts, sewers, drains, manholes, catch basins, storm drains, water mains and services, water valves or curb stops, electric, gas, telephone or cable TV conduits, utility poles, overhead lines or other existing facilities are encountered, they shall be protected and firmly supported by the contractor at their expense, by methods approved by the authority having control of the utility structure, until excavation is backfilled and the affected structures are made secure. Injury to such structures caused by or resulting from the contractor’s operations shall be repaired at the contractor’s expense within a time period that will not place an unreasonable burden on the users. The authority having charge of any particular structure shall be notified promptly of injury to its structure.

4.02. Any water distribution component damaged during excavation shall be replaced with an in-kind material or a material approved by the appropriate CWD Division.

4.03. All materials used for the repair of an existing water main shall be disinfected in accordance with AWWA C651. Repairs shall be made so as to have the water service interrupted for as short a period of time as possible.

4.04. No CWD Transmission main or water distribution main excavation shall be left open and unattended. All unattended excavations shall be completely backfilled to grade with adequate protection around the excavation site, as approved by the appropriate CWD Division.

4.05. Approval for relocation of any existing facilities shall be obtained from the appropriate party and/or the respective municipality prior to relocation. The contractor shall be responsible for the work and for providing notice to users before planned interruptions of service.

4.06. In the case of reconstruction of existing facilities or disruption due to the installation of new utilities, the contractor/developer/owner shall be required to upgrade impacted portions of the existing water system to the standards outlined in these CWD Specifications. These upgrades shall also be required when new construction impacts existing infrastructure. It is the intent of CWD to address all conflicts during the design stage of a project, however field changes may be required at the discretion of the appropriate CWD Division.
5.00 WORK OUTSIDE OWNED PROPERTY LIMITS OR PUBLIC RIGHT OF WAYS

5.01. The contractor shall not, without written consent of a property owner, enter or occupy with persons, tools, materials or equipment, any private land without written consent of the property owner. In a similar manner, no excavation shall take place within the public right of way without first obtaining authorization from the Municipality or State, as applicable.

5.02. The contractor shall obtain permission from the appropriate CWD Division for any change to the approved plans of the project that may require work outside of the defined areas.

6.00 GENERAL CONSTRUCTION

6.01. At least fourteen (14) days before the start of actual construction of any utilities or improvements in each of the CWD managed water systems or owned transmission mains, the applicant, engineer, owner, or contractor shall notify the appropriate CWD Division of their intent to proceed, and shall arrange a pre-construction meeting with the appropriate CWD Division and/or water system owner, applicant, engineer, and the contractor to discuss the project. Pre-construction meetings shall take place a minimum of five (5) days prior to the start of the actual work.

6.02. Contractors shall notify the appropriate CWD Division for waterline mark out and Dig Safe at least five (5) working days prior to any work on the water system.

6.03. The contractor shall at all times be responsible for conduct and discipline of his employees and/or any subcontractor or persons employed by subcontractors. All workers must have sufficient knowledge, skill, and experience to perform properly work assigned to them. Tools shall be adequate for the work and in good condition so as to produce good, clean cut ends and threads of the correct size, pitch, and taper.

6.04. If at any time during construction the CWD Division or their designee feels that improper materials, equipment, labor, safety provisions or traffic control is being utilized he/she may direct verbally and/or in writing that the situation be corrected at once. If the situation is not corrected, CWD may implement a stop work order. This may cause further construction to be terminated pending compliance.

6.05. The applicant, developer, or owner of record shall provide construction inspection under the responsible charge of a Vermont-licensed professional engineer.

6.06. The appropriate CWD Division reserves the right to direct the contractor to “dig up” any installation not meeting these requirements or that have been installed without prior approval or inspection, at the contractor’s expense.
6.07. Any contractor who does not maintain local headquarters 24 hours per day must make satisfactory arrangements with the appropriate CWD Division to service emergencies or complaints which may occur at night, over the weekend, or when the job is shutdown (these arrangements shall include road maintenance and repairs). The contractor shall provide the appropriate CWD Division with emergency telephone numbers of the Superintendent and Project Manager.

6.08. The contractor shall make themselves fully aware of their responsibility under the CWD Water Main Tie-in and Repair SOP (Appendix C).

6.09. Temporary water lines may be required as appropriate for existing water customers and must remain in service until a new water main has been tested, disinfected, and accepted by the appropriate CWD Division.

6.10. Planned water outages during the course of project work that impact existing customers, shall first be coordinated with, and approved by the appropriate CWD Division, with a minimum of five (5) working days’ notice. All work shall be performed to minimize planned water outages to existing water customers to the greatest degree possible.

6.11. Upon final acceptance of the proposed water main, the temporary water mains shall be disconnected. At least five (5) working days in advance of a planned shutdown of any service line, notices must be delivered to all affected customers. Due to the nature of certain business activity, planned shut downs may be required to be scheduled after normal working hours of the affected customer.

6.12. Prior to the date of acceptance by the system owner, the contractor shall replace any new pipe or accessory found to be defective at any time, at no expense to the system owner.

6.13. There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, or tanks that are supplied with water that is, or may be, contaminated.

6.14. Excavated material shall be placed in a manner that will not obstruct the work nor endanger the workers or the public, or obstruct sidewalks, driveways, roadways or other structures. Excavated materials shall be placed in compliance with federal, state, or local regulations.

6.15. All surplus material and debris shall be removed as the project progresses, leaving all areas clean and presentable.

6.16. Unless otherwise required, all paving and sidewalks that may be damaged during construction shall be replaced with the same kind of material that previously existed, as required by the municipal authority.
6.17. All areas within the limits of a set of drawings shall be loamed and seeded as called for in the project specifications. This shall include areas of new construction, except as the actual area occupied by structures, roads, parking areas, and walks, and shall include areas of established landscape and flora through which the work may pass where grassed areas are affected. Areas to be seeded may have subgrade placed at any time of the year. However, placement and preparation of loam (topsoil) and seeding shall be performed only between the dates of April 20 and October 15, or as approved otherwise by the appropriate CWD Division. Eroded areas shall be graded to specific contours prior to loaming or seeding.

6.18. No water lines shall be installed after November 15 or before April 1 without prior approval of the appropriate CWD Division. The appropriate CWD Division may restrict work before November 15 and after April 1 during adverse weather conditions. CWD does not allow excavating for water mains during the winter months except by special permission.

6.19. The contractor will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees and other persons who may be affected thereby, materials or equipment to be incorporated therein, whether in storage on or off the project site, and other property at the project 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.

6.20. The contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction within the project area. The contractor will erect and maintain all necessary safeguards for safety and protection. He will notify owners and adjacent utilities or properties when prosecution of the project may affect them. The contractor will remedy all damage, injury or loss to any property caused, directly or indirectly by work associated with the project. In emergencies affecting the safety of persons or the project, or property at the site or adjacent thereto, the contractor shall act to prevent threatened damage, injury, or loss.

6.21. Prior to commencement of any project, the contractor shall provide construction signage and traffic control plans in accordance with the Manual of Uniform Traffic Control Devices to the appropriate public works official of each community. Adequate notification must also be given to landowners that may be affected by traffic changes.

6.22. If petroleum hydrocarbon and/or chlorinated solvent contaminated soils are encountered during any phase of construction, distribution main pipe materials must be ductile iron pipe with fluorocarbon elastomer gaskets, water service piping must be copper pipe, and all other appurtenances shall
be of material resistant to contamination. The Permittee shall notify the Waste Management Division within 12 hours of encountering contaminated soils.

7.00 PRESSURE TESTING AND DISINFECTION

7.01. All water mains shall be pressure tested in accordance with AWWA Standards C-600 (D1 Pipe), C-605 (PVC Pipe), and AWWA M55 (HDPE Pipe). All water mains shall be disinfected in accordance with AWWA Standard C-651 and the Vermont Water Supply Rule.

7.02. The project engineer and/or contractor shall notify the appropriate CWD Division no less than five (5) working days in advance of any proposed testing of any completed mains. Attendance of all testing is at the discretion of the CWD Division; however, the absence of CWD representatives does not relinquish any of the above requirements. No testing shall be performed on weekends or legal holidays.

7.03. All tests shall be conducted by and at the expense of the contractor. The project engineer will give direction pertaining to the test methods and observe the field-testing.

7.04. All fire service lines shall be pressure tested and disinfected (including testing for coliform organisms) in accordance with these specifications.

7.05. Pressure Testing

7.05.01. Minimum testing pressure shall be 1.5 times the working pressure of the installed line or 200 psi, whichever is greater, and will be monitored at the lowest elevation in the length of the pipeline being tested. The longest length of test pipe shall be 1,000 feet unless waived by the appropriate CWD Division. Pressure tests shall be up to the curb stop with corporations fully open.

7.05.02. Maximum allowable leakage will be \[ L = \frac{SD\sqrt{P}}{148,000} \]

7.05.03. Where:

\[ L = \text{allowable leakage, in gallons per hour} \]
\[ S = \text{length of pipe tested, in feet} \]
\[ D = \text{nominal diameter of the pipe, in inches} \]
\[ P = \text{average test pressure during the leakage test, in PSI (gauge).} \]

See attached Champlain Water District - Water Main Pressure Test Inspection Record
7.06. **Disinfection**

7.06.01. Flush the pipeline to wash out all dirt, debris, etc. which may have accumulated in the pipeline during construction.

7.06.02. Hoses and fire hydrants are not recommended to be used in collection of samples. A corporation stop shall be installed in the main with a copper gooseneck assembly for testing. After testing is completed and samples have been collected, the corporation on the test line shall be shut off and disconnected and the gooseneck assembly removed.

7.06.03. All water flushed during charging and sampling of the water main shall be dechlorinated.

7.06.04. Following flushing to clean clear water, the contractor will add chlorine to the entire pipeline volume of water such that the water will have not less than 25 mg/L free chlorine, and let the mixture set for at least 24 hours.

7.06.05. After the 24-hour duration, the water in the pipeline shall be tested for residual free chlorine and must contain a minimum of 10 mg/L chlorine. If less than 10 mg/L are found, then the disinfection procedure shall be repeated until at least 10 mg/L chlorine residual is indicated by test.

7.06.06. Upon successful completion of the previous steps, the pipeline shall be flushed again until the chlorine concentration in the pipeline is no higher than that prevailing in the supply system.

7.06.07. After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 16 hours apart, shall be collected from the new main, and submitted to the Vermont Health Department for analysis. At least one set of samples shall be collected from every 1,000 feet of the new water main, plus one set from the end of the line and at least one set from each branch. The first sample (or first set of samples) shall be taken immediately following flushing, the second sample (or second set of samples) shall be taken after the new water main has sat idle for at least 16 hours, without any water use and without any flushing. Samples shall show the absence of coliform organisms and, if required the presence of a chlorine residual. If the initial disinfection fails to produce samples, which pass the V.S.H.D. requirements for potable drinking water, then the new main shall be re-flushed and shall be resampled until satisfactory test results are obtained.
7.06.08. Upon satisfactory results by the Vermont State Health Department or State certified laboratory, the pipeline may be placed in service. All costs for water, materials, equipment and labor to perform the required testing disinfection, and flushing of the pipeline shall be paid by the contractor.

7.07. **Submittal of Test Results**

7.07.01. The applicant or project engineer shall be responsible for submittal of test results to the appropriate CWD Division. The applicant or project engineer shall also provide a letter to the appropriate CWD Division certifying that the water system has passed all tests, is constructed in accordance with the approved plans, except as may have been modified by approved change order, and is in condition to be placed into service. **Submittal of all test results shall be required prior to the water main being placed into service.**

8.00 **FINAL ACCEPTANCE**

8.01. At the end of construction, the appropriate CWD Division will conduct a preliminary walk-through inspection of the construction project and prepare a “punch-list” of identified deficiencies. The contractor shall correct any punch list items accumulated during the inspection after receipt of this list. Incomplete work on the system shall not be included in the initial inspection, but shall be inspected as the project continues.

8.02. A **FINAL INSPECTION** shall be conducted by the appropriate CWD Division and include but not be limited to:

- Valves, hydrants, and curb stops operating properly.
- Valve boxes and covers set plumb and at proper elevations.
- Proper hydrant nozzle height above grade.
- Proper hydrant opening direction, nozzle thread, and barrel color.
- Proper distance from the face of the curb of hydrant nozzles.
- Hydrant flags meeting the CWD specifications installed on each fire hydrant at the time of installation.
- Static and residual hydrant pressures and flow rates, if requested.
- Curb boxes inside ROW, set to grade, containing stainless steel operating rod, and plumb.
- Tie information on record drawings complete and correct.
- Material testing results, lab reports, manufacturer’s certificates, and leakage test results complete and on file.
- General appearance and restoration.
8.03. **Record Drawings**

8.03.01. Upon completion of the construction project or any Phase of the project, “Record Drawings” shall be supplied to the appropriate CWD Division in the form of one (1) hard copy, one (1) .pdf copy and one (1) electronic copy in Auto-CAD Version 2010 Format (.DWG) or newer. Record drawings shall be supplied within 60 days of FINAL INSPECTION of the project.

8.03.02. Record drawings shall be prepared by a Vermont-licensed Professional Engineer responsible for observation of construction and shall depict the system as it was constructed, including any field modifications.

8.03.03. All Record Drawings shall include valves, bends, and curb stop ties and valve, bends, and curb stop coordinates to sub-meter accuracy. Location of all other buried utilities and structures and accurate depths to waterlines.

8.03.04. On all projects, CWD requires that approved submittals and O&M manuals be submitted in paper format and electronic Adobe Acrobat Reader (.pdf) format.

8.04. **Warranty**

After final inspection the project warranty period will begin. The project warranty period will be determined by each system owner, but shall be no less than one year from project completion. The project warranty shall cover all new and existing infrastructure that was constructed, repaired or replaced as part of the project. The developer/contractor will be responsible for any necessary repairs or corrections as part of the project warranty. Repairs made during the warranty period will carry a minimum warranty of one year from the time that the repair was completed. The contractor shall repair, replace, or retest promptly as directed by the appropriate CWD Division and without further charges, all work equipment, materials or parts, which may fail during the warranty period.

8.05. At the end of the warranty period, and after Record Drawings have been submitted, a WARRANTY INSPECTION will be performed by the appropriate CWD Division prior to the system owner assuming ownership of any of the lines and appurtenances.

8.06. **FINAL ACCEPTANCE** shall not take place until after the warranty period is complete and the appropriate CWD Division has determined that complete record information has been received and all required improvements have been satisfactorily completed.
9.00 WATERLINE INSTALLATION

9.01. Installation of all water mains shall be in accordance with the latest version of AWWA C600, AWWA C605, or AWWA Manual 55 as applicable.

9.02. Materials and equipment shall be stored as to insure the preservation of their quality and fitness for the work. Stored materials and equipment to be incorporated into the work shall be located so as to facilitate prompt inspection by authorized CWD personnel.

9.03. When unexpected subsurface conditions or conflicts with underground infrastructure are encountered that could affect the designed water line project, the contractor must report the changed conditions to the design/project engineer and the appropriate CWD Division before the work is allowed to proceed.

9.04. The appropriate CWD Division shall be notified in advance to inspect all mechanical joint fittings, main line taps, appurtenances, thrust blocks, and water line crossings prior to occurrence of back filling.

9.05. The minimum inside pipe diameter shall be 8” unless otherwise approved by the appropriate CWD Division.

9.06. The water main shall be laid and maintained on lines and grades established by the contract documents for the project, or as defined within these Specifications. Fittings and appurtenances shall be installed at the required locations unless approved otherwise by the appropriate CWD Division. Prior to excavation, an investigation may be required to determine the location of existing underground structures and conflicts.

9.07. All pipes, fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for final disposition.

9.08. All pipes showing cracks shall be rejected. If cracks occur in the pipe, the contractor may, at his own expense and after approval of the appropriate CWD Division, cut off cracked portions at a point at least twice the pipe diameter from the visible limits of the crack and use the sound portion of the pipe.

9.09. Care shall be taken to prevent damage to valves and other appurtenances during handling and installation. All debris and foreign material shall be cleaned out of valve openings, etc. All operating mechanisms shall be operated to check their proper functioning, and all other nuts and bolts checked for tightness.
9.10. Valves and other equipment, which do not operate easily, or are otherwise
defective, shall be replaced. All valves shall be carefully incorporated into
the water main and supported in their respective positions free from all
distortion and strain.

9.11. Valves and valve boxes shall be set plumb. Valve boxes, besides being
plumb, shall be centered directly over the valves.

9.12. Repairs on any damaged newly installed pipe shall include two restrained
couplings and an appropriate length of pipe of the same material as that
which was broken, or approved equal.

9.13. All water mains shall have no less than six feet (6’) of cover unless waived
by the appropriate CWD Division. Each pipe shall be laid so as to form a
close joint with the next adjoining pipe and to bring the inverts continuously
to the required grade. In no cases shall the waterline have less than four
feet (4’) of cover over the top of the pipe.

9.14. Temporary support, adequate protection, and maintenance of all
underground structures, drains, sewers, and other obstructions
encountered in the progress of the work shall be provided at all times. If
utility service is interrupted as a result of work for the project, the contractor
shall immediately restore service by repairing the damaged utility at the
contractor’s expense.

9.15. Foreign material shall be prevented from entering the pipe while it is being
placed in the trench. No debris, tools, clothing or other materials shall be
placed in the pipe at any time.

9.16. At all times, when pipe laying is not actually in progress, the open ends of
the pipe shall be closed by temporary watertight plugs or by other approved
means. If water is in the trench when work is resumed, the plug shall not
be removed until all danger of water entering the pipe has passed and
water levels are at least one foot (1’) below the invert of the pipe. During
construction, the contractor shall conduct operations so as to prevent the
accumulation of water, ice, and snow in the vicinity of excavations or in the
vicinity of excavated areas, and to prevent water from interfering with the
progress and quality of the work. Under no conditions shall water be
allowed to rise in open trenches after pipe has been laid.

9.17. Accumulated water, ice, and snow shall be promptly removed and disposed
of by pumping or other approved means. Disposal shall be carried out in a
manner that will not create a hazard to public health, nor cause injury to
public or private property, work completed or in progress, or public streets.
Disposal shall not cause any interference in the use of streets and roads by
the public. Disposal may also require protection of storm drain facilities.
Pipes under construction shall not be used for drainage of excavations.

9.18. When a pipe material is specifically noted on the approved project
drawings, the contractor/developer shall not have the option of utilizing any
other pipe material.

9.19. Galvanized pipe or fittings shall not be used in any water system managed
or owned by the CWD Retail Division, or the CWD Transmission System.

9.20. Any lead service lines or appurtenances including goosenecks encountered
during construction shall be replaced with lead-free components.

9.21. Temporary PVC markers shall be supplied at all gate valves, curb boxes,
and at the end of water lines to a minimum of twelve inches (12") above
finish grade until accepted by the appropriate CWD Division. PVC markers
shall be removed prior to Final Inspection of the project.

9.22. If the trench passes over a previous excavation, the trench bottom shall be
sufficiently compacted to provide support equal to that of the native soil or
conform to other regulatory requirements in a manner that will prevent
damage to the existing installation.

9.23. When the excavated material is found to include ashes, cinders, refuse,
organic material, or other unsuitable material, this material shall be
removed to a minimum of at least twelve-inches (12") below the bottom and
each side of the pipe. The removed material shall be replaced with clean,
stable, compacted backfill material as approved by the appropriate CWD
Division.

9.24. The proper implements, tools, and facilities shall be provided and used for
the safe and convenient performance of pipe installation. All pipe, fittings,
valves, and hydrants shall be lowered carefully into the trench using a
backhoe, crane, tagged lifting chains, or other suitable tools or equipment,
in such a manner as to prevent damage to water main materials and
protective coatings and linings.

9.25. All dead ends of new mains shall be closed with plugs or caps; such dead
ends shall be equipped with suitable blow off facilities and thrust restraints.

9.26. Any deflection of joints in pipe shall be within the limits specified by the
manufacturer.

9.27. All new water mains shall be filled at a maximum velocity of 1ft/sec while
venting air.
9.28. Restrained joint pipe systems shall be designed by a Professional Engineer. Combined thrust block and restrained joint systems shall be designed independent of the other.

9.29. 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, 8.1.2. 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)

**10.00 DUCTILE IRON PIPE**

10.01. Ductile iron pipe shall comply with AWWA C151/ANSI A21.51. Ductile iron pipe shall be minimum thickness class 52.

10.02. Ductile iron pipe shall be given an exterior petroleum asphaltic coating in accordance with ANSI AWWA C151/ANSI A21.51. The pipe shall be cement mortar lined on the inside in accordance with ANSI A21.4 and AWWA C104 except that the cement lining thickness shall not be less than one-eighth inch (1/8”). A plus tolerance of one-eighth inch (1/8”) will be permitted.

10.03. The installation of ductile iron water lines shall conform to AWWA Standard C600, current edition.

10.04. Four-inch (4”) and six-inch (6”) DI pipe shall have no less than two (2) bronze wedges installed at each joint. Eight-inch (8”) and larger DI pipe shall have no less than three (3) bronze wedges installed at each pipe joint.

10.05. All Ductile Iron water pipe shall be poly wrapped with V-Bio Enhanced Polyethylene Encasement and installed in accordance with Method A of AWWA Specification C105 / ANSI A21.5, unless approved otherwise by the appropriate CWD Division.

**11.00 POLYVINYL CHLORIDE (PVC) PIPE**

11.01. PVC water pipe shall comply with AWWA C900 with minimum Pressure Class 235, DR18.

11.02. The installation of PVC pipe shall comply with installation procedures in AWWA C605.

11.03. Only tapping saddles manufactured specifically for PVC pipe shall be used. The service saddle shall be designed to provide a drip tight connection. The body shall be teflon or epoxy coated Ductile Iron with double stainless-steel straps, bolts, nuts, and mechanism for attaching to the pipe barrel (see Section 8.10). The maximum outlet size with a service saddle shall be two-
inch (2”). Narrow U-bolt-type straps and saddles having lugs that dig into the pipe wall shall be prohibited.

11.04. A tracer wire is required for all PVC pipe installations. Tracer wire shall be 12AWG high strength copper clad steel conductor with blue polyethylene insulation by Copperhead Industries High Strength or approved equal. Tracer wire shall terminate at approved locations in valve boxes and covers designed for wire termination, Copperhead Access Point or equal. Tracer wire shall not be terminated in valve boxes designated for gate valve operation.

11.05. Any ferrous materials incorporated in the installation of PVC pipe shall be polyethylene encased.

12.00 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

12.01. HDPE pipe and fittings will meet and be installed in accordance with ANSI AWWA specification C906 current edition. HDPE shall be minimum Pressure Class 200, DR 9.0.


12.03. A tracer wire is required for all HDPE pipe installations. Tracer wires shall be installed with directional drilling. Tracer wire shall be 10AWG high strength copper clad steel conductor with blue polyethylene insulation for use in directional drilling by Copperhead Industries SoloShot or approved equal. Tracer wire shall terminate at approved locations and in access covers designed for wire termination, Copperhead Access Point or equal. Tracer wire shall not be terminated in valve boxes designated for gate valve operation.

12.04. Any ferrous materials incorporated in the installation of HDPE pipe shall be polyethylene encased.

12.05. No services or laterals will be installed on any runs of HDPE pipe, except as approved by the appropriate CWD Division.

13.00 PIPE BEDDING AND BLANKET

13.01. All excavated installations of pipeline shall be installed in accordance with AWWA C600, C605 Type 5 Laying Condition. In all cases clearances surrounding the pipe shall be at least twelve inches (12”) below and eighteen inches (18”) on all sides for nominal pipe sizes up to 24”. Bedding and blanket material shall be granular sand. A twelve inch (12”) layer of blanket material shall be placed above the pipe. See the Typical Trench Detail.
13.02. No pipe shall be laid directly on ledge, hard shale or a very compact glacial till. When excavation of rock is necessary, all rocks shall be removed to provide a clearance below all pipes, valves, and fittings. When excavation is completed, a layer of appropriate backfill material shall be placed on the bottom of the trench to the appropriate depths, then leveled and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris that may be encountered during excavation. In all cases the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of material of sufficient size that could cause a fulcrum point or point load.

13.03. When an unstable trench bottom is encountered and the appropriate CWD Division 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.

13.04. Pipeline trenches shall be dry during the laying of pipe. Wood supports under pipe shall be removed prior to back filling.

13.05. Blanket material shall be tamped in layers around the pipe to at least twelve inches (12") above the pipe in order to adequately support and protect the pipe.

13.06. Any ferrous materials incorporated in the installation of PCV pipe shall be polyethylene encased.

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

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14.00 ROCK EXCAVATION

14.01. Areas of known or suspected ledge may require subsurface investigation to determine its extent prior to job commencement, at the contractor's expense. A pre-blast survey is required and shall be conducted prior to any blasting, and a written blasting plan shall be provided to the appropriate CWD Division and requesting municipal official prior to any blasting.
14.02. Rock shall be excavated, when encountered, to the lines and grades indicated on the drawings or as directed by the appropriate CWD Division. Excavated material shall be disposed of and acceptable material shall be furnished for backfill in the space voided by the excavated rock.

14.03. Rock in pipe trenches shall be removed to provide a clearance below the pipe, valves, and fittings of twelve inches (12”) and on all sides of at least eighteen inches (18”), see typical detail. When so specified or indicated, or when laying the pipe in an excavated rock area, the trench shall be backfilled with satisfactory material listed and approved under Pipe Bedding and Blanket (see typical Pipe Trench detail). Specified clearances shall be maintained between the bottom of the pipe and any part, projection, or point of rock, boulder, or stone of sufficient size and placement that could cause a fulcrum point or point load.

14.04. Blasting shall be in full compliance with all State and Federal laws and local ordinances. Blasting contractors shall provide a certificate of insurance and take all possible care to avoid injury to persons and damage to property. Blast areas are to be completely covered with blasting mats and sufficient warning given to all persons in the vicinity of the work before blasting. Care shall be taken to avoid damages to utilities or other structures above and below ground.

14.05. All blasting shall be conducted by persons qualified and experienced in drilling and controlled blasting procedures for rock excavation of the types required. Persons responsible for blasting shall be licensed blasters in the State of Vermont and shall have had acceptable experience in similar excavations in rock and controlled blasting techniques. Drillers shall have demonstrated proficiency in collaring and drilling holes precisely. The appropriate CWD Division shall be notified in advance of all drilling and blasting around existing transmission and distribution mains.

14.06. No blasting will be permitted under or adjacent to any street, road, or highway unless permission has been received in writing by the municipal authority having jurisdiction.

14.07. Blasting contractors shall comply with all municipal, State, Federal and other ordinances and codes relating to the storage and handling of explosives. Particular attention is called to adherence of requirements of the electric, gas and other utilities that may be located in the project area.

14.08. Damages and cost of whatever nature resulting from blasting operations shall be borne solely by the blasting contractor.

14.09. If rock below grade is shattered by blasting, caused by holes drilled too deep, or too heavy charges of explosives, or any other circumstance due to blasting, and if such shattered rock does not provide suitable foundation,
the rock shall be removed and the excavation refilled with acceptable material by and at the expense of the contractor.

15.00 BACKFILLING

15.01. Trenches shall be backfilled above blanket material to subgrade with, wherever possible, material excavated from the trench, provided the material consists of loam, sand, gravel or other suitable material and shall be done only after the approval of the appropriate CWD Division. Material for backfilling shall be free of roots, stumps, and frost. Backfill shall not be placed on frozen material. Materials used for backfilling trenches shall be free of stones weighing more than thirty (30) pounds. No stones measuring over three inches (3”) in the longest dimension shall be placed within one foot (1’) of the pipeline being backfilled. Stones found in the trench shall be removed for a depth of at least twelve inches (12") below the bottom of the pipe. In general, use of blasted rock, as trench backfill will not be permitted. Any materials excavated from the site not conforming to these Specifications, shall be disposed of and replaced with approved material by the contractor, as required.

15.02. Backfill for pipelines under roadways shall be placed in six inch (6") lifts, each lift being compacted to not less than 95% of maximum dry density as determined by the AASHTO-T-99 Standard Proctor. Pipelines outside of roadways or in cross country routes shall be compacted to 90% maximum density as determined by the AASHTO-T-99 Standard Proctor. If conditions warrant, the backfilling of trenches may be done with mechanical equipment. Particular precautions shall be taken in the placement and compaction of the backfill material in order not to damage the pipe, pipe coating or structure. The backfill shall be brought up evenly. Around valve boxes, the backfill shall be tamped to a distance of four feet (4’) on all sides of the box, or to the undisturbed trench face, if less than four feet (4’). Backfilling in all public roadways shall be so compacted as to leave no depression in the road. Additional backfill requirements may apply within State or local Municipal Highway Right-Of-Ways. All public road surfaces shall be restored to a condition at least equal to that, which existed prior to the start of construction unless approved otherwise by the appropriate public works or street department authority. Precautions shall be taken against undue damage to existing surface materials.

15.03. No compacting shall be done when the material is too wet to be compacted properly. At such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions are taken as may be necessary to obtain proper compaction.
15.04. Surplus excavated materials shall be disposed of in a satisfactory manner. Surplus material or spoil shall be removed promptly and disposed of so as not to be objectionable to abutters or the general public.

15.05. Trenches that have been improperly backfilled, enclosed or covered before inspection of fittings and joints shall be reopened and re-backfilled at the contractor’s expense.

16.00 PIPELINE INSULATION

16.01. Approved waterlines with less than five feet (5’) of cover over the crown, that cross a storm sewer, where indicated on the plans, or as required by the appropriate CWD Division, shall be protected against freezing by the installation of insulation board which is to be closed cell, extruded Polystyrene foam meeting ASTM 578, Type VI, 40 psi compressive strength (ASTM D1621) 0.1% max. water absorption (ASTM C272).

16.02. A minimum of two layers of sheets shall be placed twelve inches (12”) above the crown and extend twelve inches (12”) beyond each side. Side sheets shall extend six inches (6”) below the invert of the pipe (see typical Pipe Insulation Detail). The area between the pipe and insulation shall be filled with clean medium or coarse sand. No less than four inches (4") of clean medium or coarse sand shall be placed directly over the insulation sheets after they are installed. Joints shall be overlapped (or staggered) so there is no joint or 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. In no cases shall the waterline have less than four feet (4’) of cover over the top of the pipe. The depth of Stone Fill or Rip Rap is not considered in the minimum requirement of cover over a waterline.

17.00 POLYETHYLENE PIPE ENCASEMENT

17.01. V-Bio Enhanced Polyethylene pipe encasement is required for all ductile iron pipe installations and shall conform to the current AWWA C105/ANSI A21.5 standard.

17.02. 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 AWWA/ANSI standard. Lumps of clay, mud, cinders, etc., on the pipe shall be removed prior to installation of the polyethylene encasement. During installation, soil or embedment material shall not be trapped between the pipe and polyethylene. Overlap and ends shall be secured with polyethylene adhesive tape. All cuts, tears, punctures, or damage to the polyethylene shall be repaired with polyethylene adhesive tape or with a short length of polyethylene sheet, wrapped around the pipe to cover the damaged area,
and secured in place. Backfilling around polyethylene-wrapped pipe shall be in accordance with ANSI/AWWA C600.

18.00 FITTINGS

18.01. All fittings shall be Ductile Iron with a 350 psi working pressure, and shall conform to AWWA/ANSI C110/A21.10.

18.02. Pipe shall be inserted squarely into all fittings. No deflection will be allowed from any hydrant, tee, valve, or bend.

18.03. Anchor tees (aka: Hydrant tees and Swivel tees) shall be Class 350 ductile iron, cement lined, conforming to AWWA/ANSI C110/A21.10, C111/A21.11, and C104/A21.4. In lieu of Anchor tees, Mechanical Joint tees may be used if a Foster Adaptor is used to secure the valve directly to the branch of the tee. If a Mechanical Joint tee is to be used, it shall conform to the above referenced specifications.

18.04. Mechanical Joint restraints conforming to AWWA/ANSI C111/A21.11 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. Glands shall be manufactured of ductile iron, and have a minimum working pressure of 350 psi. Twist off nuts shall be used to ensure proper actuating of the restraining devices. Torque wrenches shall be used to tighten all bolts to manufacturer’s specifications.

18.05. Mechanical joint retainer glands shall be either EBAA Iron MegaLug, Ford Uniflange Series 1400, Romac RomaGrip, or approved equal.

18.06. Nuts and bolts shall be Cor-Blue (or approved equal) and shall conform to AWWA/ANSI C111/A21.11.

18.07. Foster adapters shall be installed in all close-coupled connections of mechanical joint fittings and valves where a positive restraint mechanism is required. Foster adapters shall not be installed directly on hydrant shoes.

18.08. Pipeline couplings shall conform to AWWA 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 appropriate CWD Division. Solid sleeve couplings shall be used when joining new pipes or like materials. Hymax couplings may be allowed when joining dislike pipe materials or new and old pipe connections.

18.09. All fittings shall be restrained; double poly wrapped and have concrete thrust blocks poured in place as defined herein.
18.10. Fittings located on the interior of vaults are to be ASME B16.1 Class 125 Flange fittings unless otherwise approved in writing by the appropriate CWD Division. Fasteners and pipe stands on the interior of vaults shall be 316 stainless steel.

19.00 TAPPING SLEEVES AND TAPPING VALVES

19.01. The appropriate CWD Division shall be notified whenever a proposed tap is to be made on any CWD owned or managed water main.

19.02. Only approved tapping companies shall be allowed to perform wet taps on any CWD owned or managed water main. A current list of approved companies can be obtained from a CWD Supervisor.

19.03. All tapping sleeves shall be provided with a \(\frac{3}{4}''\) NPT test plug, for Hydrostatic testing of the valve and sleeve assembly. The test pressure shall be at 200 psi or not exceed the rated working pressure of any of the fittings. The sleeve and valve assembly shall hold the determined test pressure for a minimum of 30 minutes without any pressure drop. Any leaks or other problems must be remedied before the pipe is tapped. Air testing is NOT allowed on any tapping sleeve.

19.04. All Tapping Sleeves and Tapping Valves shall be poly wrapped with V-Bio poly in accordance with AWWA Specification C105, unless approved otherwise by the appropriate CWD Division.

19.05. Direct taps over eight inches (8") in diameter shall NOT be allowed. Connections that require taps larger than eight inches (8") in diameter shall be tee and valve cut ins, unless otherwise approved by the appropriate CWD Division.

19.06. Size on size direct taps are NOT allowed. The maximum branch size for a water main direct tap shall not be greater than one standard pipe diameter less than the water main size.

19.07. All contractors (or others) who apply to CWD for transmission water line taps shall submit complete specifications of the tapping material they intend to use at the time the CWD Tapping Application Form is submitted.

19.08. All materials used when tapping for a branch connection or interconnection from any CWD owned or managed water main shall be as specified below:

19.09. **Ductile Iron Tapping Sleeves:**

19.09.01. AWWA C110/C153 (latest version) compliant Ductile Iron tapping sleeves are approved for use on CWD Wholesale Division Ductile Iron water mains when the tap is 4" in diameter or larger.
19.09.02. 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.

19.09.03. 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 (latest version).

19.09.04. 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 (latest version).

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

19.10. **Stainless Steel Tapping Sleeves:**

19.10.01. ANSI/AWWA C223 (latest version) compliant stainless steel tapping sleeves are approved for use on CWD Wholesale Ductile Iron and Asbestos Cement pipe. Stainless Steel tapping sleeves shall be used on all CWD owned and managed Retail Division pipe.

19.10.02. Stainless steel tapping sleeves shall have mechanical joint outlets and a working pressure of at least 250 psi. The stainless steel tapping sleeve shall be TPS Triple Tap or approved equal.

19.11. **Tapping Saddles (3/4” through 2”):**

19.11.01. Bodies shall be Ductile Iron per ASTM A536.

19.11.02. Bodies shall have a fusion bonded epoxy or approved equal finish.

19.11.03. Body threads shall be CC per AWWA C800.

19.11.04. Bands are to be constructed of grade 304 stainless steel and have a minimum width of 2”.

19.11.05. Bolts and nuts are to be constructed of grade 304 stainless steel.

19.11.06. Tapping Saddles shall be used only for the following: Ductile Iron and Cast Iron pipe for taps 1 ½” or 2” in size, and all PVC and
AC pipe. Direct taps shall be used for ¾” and 1” taps on Ductile Iron and Cast Iron.

19.11.07. A connection made to a pipe that requires a tapping saddle or that is not ductile iron will have a body with a suitable outlet, seal, and suitable means for attachment to the main. The body shall be made to conform to the outside configuration of the main. The service saddle shall be designed to provide a drip tight connection. The body shall be Teflon or Epoxy coated with stainless steel strap(s), bolts, nuts, and mechanism for attaching to the pipe barrel. Service saddles with a two inch (2") outlet shall not be used on a two inch (2") main. Service saddles must meet manufacturers’ guidelines and recommendations for specific pipe materials.

20.00  GATE VALVES- RESILIENT SEAT

20.01. Valves shall be manufactured to meet all requirements of AWWA C509 or C515 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 (left) and provide a two inch (2") square operating nut with an arrow cast in the metal indicating direction of opening. Each valve shall have the maker’s name, pressure rating and year in which it was manufactured cast on the body. Valves shall be mechanical joint on each end, and secured to the adjoining pipe with an approved retainer gland. 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, M&H or approved equal on water distribution mains and Mueller, AFC, or approved equal on CWD Transmission mains.

20.02. Gate valves used to convey or dispense water for human consumption shall comply with the Vermont Law (Act 193) An Act Relating to Prevention of Lead Poisoning By Exposure to Lead in Consumer Products, and shall contain no more than 0.25% lead by weighted average. Fixtures containing brass must comply with NSF/ANSI 61 Annex G.

20.03. Buried gate 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 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 five feet (5’), a valve stem riser shall be provided and installed such that the depth from the valve stem riser nut to grade is from four feet to five feet (4'-5’). Valve stem risers shall be of high strength stainless steel and of welded construction (see Valve Stem Extension Detail).
20.04. Gate valves shall normally be placed a maximum of five hundred feet (500’) apart. Tee intersections shall have three (3) gate valves directly connected to all branches with the use of foster adapters (See also Fittings Section). Mechanical joint cross connections (four way intersections) shall have a minimum of four (4) valves. On longer runs of pipe, or for long runs of transmission main, valve separation of >500’ may be approved on a case-by-case basis.

20.05. All gate valve bolts, studs and nuts shall be made from corrosion resistant stainless steel.

20.06. Tapping valve inlet 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.

20.07. Gate valves over twelve inch (12”) diameter shall NOT be allowed.

21.00 BUTTERFLY VALVES

21.01.01. Valves 16” and larger are to be butterfly valves meeting AWWA Specification C-504 (latest version) Class 250B.

21.02. Butterfly valves are manufactured by Mueller, Pratt or approved equal.

21.03. Iron Body Rubber Seated Butterfly Valves (buried application) at a minimum shall meet the following:

- **Valve body**: Ductile Iron ASTM A536, Grade 65-45-12, 70-50-05, or 80-55-06 or ASTM A395, Grade 60-40-18.
- **Valve Disc**: Stainless Steel ASTM A240
- **Valve Stem**: Stainless Steel ASTM A240
- **End Connection**: Mechanical Joint
- **Operation**: Open counterclockwise (left) and provide a two inch (2”) square operating nut with an arrow cast in the metal indicating direction of opening
- **Coating**: Interior and exterior to be coated with epoxy (fusion bonded).
- All valve body bolts and nuts shall be stainless steel.

21.04. Buried butterfly 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 access to the valve operating nut at all times. In installlations where the depth from grade to top of valve operating nut is greater than five feet (5’), a valve stem riser shall be provided and installed such that the depth from the valve stem riser nut to grade is from four feet to five feet (4’-5’). Valve stem risers shall be of high strength stainless steel and of welded construction (see Valve Stem Extension Detail).
22.00 **VALVE BOXES**

22.01. Valve boxes shall be of the three-piece cast iron slide type with a minimum inside shaft diameter of five and one quarter inches (5¼”) and a six foot (6’) trench depth.

22.02. Valve boxes shall not transfer loads onto the valve.

22.03. Valve boxes shall have a cast iron cover marked “WATER”.

22.04. The boxes shall be dirt tight with the top of the cover flush with the top of the box rim.

22.05. Valve boxes located in roadways shall have one non-adjustable 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.

23.00 **FIRE HYDRANTS AND HYDRANT BRANCHES**

23.01. Fire Hydrants shall be Kennedy K-81 D or Waterous Pacer and shall conform to AWWA C502 with the following specifications. Note: Waterous Pacer hydrants shall be installed with a Boston Operating Nut.

23.02. Main Valve Opening: 5 ¼ inches

23.03. **Nozzle Arrangement:**

23.03.01. Two (2) 2½ inch Hose Nozzles with National Standard Thread (NST).

23.03.02. The Pumper Nozzle shall be a Storz outlet installed by the manufacturer. Within South Burlington, CFD #1, MBWC and CT water systems, a four inch (4”) Storz Connection is required. In Jericho a five inch (5”) Storz Connection is required.

23.04. Inlet Connection: Six inch (6”) Mechanical Joint, “Mega-Lug” or equivalent retaining gland, and concrete thrust block. Foster adaptors shall not be used on hydrant inlet connections.

23.05. Operating Nut: Standard 1 ½ inch Pentagon

23.06. Direction of Opening: Counterclockwise

23.07. 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 pumper cap and the ground. No more than one (1) hydrant extension is allowed.

23.08. Hydrant Drain: The hydrant shall be non-draining or have the drains permanently plugged.
23.09. Color: Color shall be Red enamel.

23.10. Other: Hydrants shall be compression type closing with the pressure. Hose and pumper nozzles shall be ¼ turn type secured by stainless steel or corrosion resistant pins or screws. Pressure seals behind nozzle flanges shall be “O” rings. A breakable coupling retained in place by stainless steel or corrosion resistant pins shall make the union between the upper and lower stems. The two-piece traffic flange shall be held in place by nuts and bolts. The upper barrel shall be able to rotate 360 degrees without removing any bolts. Approved hydrant flags shall be required and placed on each hydrant at the time of installation (see detail). Wherever a traffic hazard appears to exist, curbing and/or bollards shall protect the hydrant except within municipal Right-Of-Ways.

23.11. For single-family house subdivisions, there will be at least one hydrant at each intersection and a maximum of five hundred feet (500’) between hydrants with a minimum water flow of 500 gallons per minute (gpm) at the flow hydrant with a 20-psi residual pressure at the residual hydrant. Municipal hydrants should be located immediately adjacent to street property lines. A 20’ x 20’ easement will be required around all hydrants. No structures or plantings are to be placed within a 20’ x 20’ area of any hydrant. All approved subdivisions shall be installed with the same brand, make, and model of fire hydrant within the project limits.

23.12. Where dead-end mains occur they shall be provided with a fire hydrant if flow and pressure meet minimum requirements. If flows and pressure are not sufficient, then an approved flushing hydrant or blow off shall be installed for flushing purposes.

23.13. When set in lawn space between the curb and sidewalk no portion of the hydrant or nozzle cap will be less than one foot (1’) off the gutter face of the curb or edge of the sidewalk. Hydrants shall be a minimum of four feet (4’ ) and a maximum of six feet (6’) from the edge of the sidewalk to the closest point on the hydrant when placed behind the sidewalk. Hydrants shall be located so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians, as approved by the appropriate CWD Division.


Fire hydrants, tapping sleeves and tapping valves may be installed on CWD transmission lines under the following conditions:

23.14.01. Fire hydrant assemblies (hydrant and isolation valve) may be furnished and installed on any portion of CWD transmission mains for use either as “blow offs” at low points in the system, manual air relief, to flush the mains, and/or for firefighting purposes.
23.14.02. All hydrant assemblies furnished and installed by CWD, as well as others which are furnished and installed by the local water systems may be used by CWD for line flushing or other purposes. Such hydrant assemblies shall become the property of the municipal water system and remain so for purposes of operation, maintenance and/or replacement.

23.14.03. Hydrants connected directly to a CWD Transmission main shall be owned and maintained by the municipality in which they are located. Ownership shall be from the outlet side of the hydrant isolation valve (See Hydrant Assembly Detail). Hydrants designated as “private” within a municipal water distribution system shall be owned and maintained according to that water system’s water ordinance or rules and regulations.

23.15. **Hydrant Flow Test**

23.15.01. Prior to acceptance by the municipality, contractors/owners shall provide a fire flow test for each installed hydrant.

23.15.02. No flow tests shall be conducted without permission from the appropriate CWD Division.

23.15.03. Fire flow tests shall be witnessed and documented by a Professional Engineer and reports submitted to the appropriate CWD Division.

23.15.04. The required standard form is located in Appendix B.

24.00 **HYDRANT ASSEMBLIES**

24.01. Hydrant assemblies shall consist of either a tapping sleeve and valve or an anchor tee, a six inch (6”) mechanical joint gate valve conforming to the above specifications, the appropriate length of pipe secured to the gate valve with an approved retainer gland, all necessary anchor couplings and approved retaining glands, the fire hydrant with hydrant flag, and appropriate thrust block.

24.02. Care shall be taken to prevent damage to hydrants and appurtenances during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of the hydrant bowl; all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. All hydrants shall be carefully incorporated in the water main and supported in their respective positions free from distortion and strain. Hydrants shall be set plumb. All hydrants shall be oriented to most efficiently allow fire truck access and connection for emergency purposes. Traffic model hydrants shall be installed so that the bury line is no more than two inches
(2") above or below established grade. Generally, fire hydrants shall not be installed within ten-feet (10’) of any new or existing light pole, telephone/power pole, gas line, utility box or other utility structure. Hydrant locations are subject to the approval of the appropriate CWD Division and the appropriate municipality’s fire department. Installation procedures for fire hydrants can be found in AWWA C600.

25.00 BLOW-OFF ASSEMBLIES

25.01. Large diameter (4” or greater) blow-off assemblies shall consist of an anchor tee, a mechanical joint gate valve, the appropriate length of Ductile Iron Cement lined, Class 52 pipe, all necessary anchor couplings, approved retaining glands, thrust block, MJ and flanged fittings, and butterfly valve with hand lever. The open end of a large diameter blow-off shall terminate at least forty eight inches (48") above grade (See Blow-off Detail).

25.02. The appropriate CWD Division may require the installation of a Kupferle MainGuard Model 77 two inch (2") self-draining blow-off/flushing hydrant at various points on a water distribution line. Blow-off/flushing hydrants are typically required at the end of small diameter water lines that are not designed to support a fire hydrant. Blow-off/flushing hydrants shall be installed according to manufacturer recommendations (See Flushing Hydrant Detail).

25.03. Blow-offs shall not be connected to any sewer, submerged in any stream or ditch, or installed in any manner that will permit back siphonage into the distribution system.

26.00 SERVICE CONNECTIONS

26.01. Service lines on all CWD Transmission water mains shall be copper from the corporation to the curb stop. Service lines connected to CWD Transmission mains beyond the curb stop shall follow municipal specifications.

26.02. Service lines on CWD Retail owned or managed water mains shall be copper from the corporation to the curb stop. Beyond the curb stop HDPE CTS is allowed for 1 ½" and 2” service lines.

26.03. Service lines shall be installed so as to run perpendicular, in a straight line from the water main to the curb stop (See Water Service Connection Detail).

26.04. Where fire services are required, there shall be a separate domestic service shutoff outside the building being served. Fire services shall be stubbed 3' above the building floor grade.
26.05. Service lines for single family homes with sprinkler systems shall be a minimum of 1”.

26.06. Each service shall consist of a corporation, curb stop, copper tubing and an Erie style curb box with a stainless-steel service rod.

26.07. Copper tubing shall be type “K”, soft temper, conforming to ASTM B88. The name or trademark of the manufacturer and type shall be stamped at regular intervals along the pipe.

26.08. Copper service pipe shall be one piece from the corporation to the curb stop.

26.09. The minimum service size for a single-family residence shall be three-quarter inch (¾”). The minimum service size for a duplex shall be one inch (1”). Service lines for single family homes and duplexes with fire sprinkler systems shall be sized appropriately for sprinkler system and domestic demands.

26.10. All underground service line valves, fittings, corporations, curb stops, meter tail setters, elbows, and angle valves shall be manufactured in accordance with AWWA Standard C-800, latest edition, and as further specified in these specifications. All service line components used to convey or dispense water for human consumption shall comply with the Vermont Law (Act 193) and must also comply with NSF/ANSI 61 Annex G hereafter referenced as Low-Lead Brass.

26.11. Low-Lead brass fittings shall be AY McDonald or Cambridge, or CWD Division approved equal. All Low-Lead brass fittings shall have the manufacturer’s name or trademark integrally stamped or cast on it. Another marking, identifying the “Low-Lead” brass alloy shall also be cast or stamped on the fitting.

26.12. Corporations shall have threads per AWWA C800 Table 7 / Figure 2 at the inlet, and a compression type fitting at the outlet, per AWWA C800, Figure 4. Both inlet and outlet shall be the same size. In no instance, except when a tapping sleeve and valve is used, shall a tap be made without a corporation. Corporations shall be AY McDonald or Cambridge Brass Low-Lead, or Division approved equal. Corporations shall be ball valve type with minimum allowable pressure rating of 300 psi.

26.13. Curb stops shall be a ball valve type with a minimum allowable pressure rating of 300 psi and manufactured in accordance with AWWA C800. The curb stop shall open left, have a positive stop, be full port, provide a drip-tight shutoff in the closed position, and be of the tee design or flat design. No curb stop shall have the ability to drain the service line. Both the inlet and outlet of the curb stop shall have compression type fittings. The tee head of the curb stop shall have the provision for the connection of a
service rod. Curb stops shall be AY McDonald or Cambridge Brass Low-Lead, or CWD Division approved equal. The curb stop shall rest on a four inch by eight inch by sixteen inch (4” x 8” x 16”) solid concrete block for support. Curb stops shall be installed just inside the municipal R.O.W unless otherwise approved by the appropriate CWD Division. The distance between finish grade and the top of the stainless-steel service rod shall not exceed four feet (4’).

26.14. Curb boxes shall be of sliding adjustable type capable of adjusting from five feet to six feet (5’-6’) (Erie Style). The base of the box shall be arch type so as to prevent the box from resting on the curb stop. The adjustable upper section shall be one inch (1”) diameter for use with ¾” and 1” curb stops. For larger curb stops, the curb box shall be installed over a heavy foot piece. Stationary rods affixed to the key of the curb stop with a brass pin shall be thirty inches (30”) in length for ¾” and 1” curb stops and twenty four inches (24”) for large curb stops. Curb box rods shall be stainless steel. The word “WATER” shall be inscribed on the cover of the box. The cover of the box shall have countersunk brass pentagon plug for all locations including paved, concrete, and 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 a ferrous type metal locator. All boxes shall be plumb, accessible and operational prior to final inspection.

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

26.16. The maximum distance from the corporation to the curb stop on a tap of a CWD transmission main shall be three feet (3’).

26.17. Service connections shall be made by installing the approved service line from the curb stop/gate valve through the cellar wall or floor. In accordance with the water system’s rules and regulations or water ordinances a meter shall be installed after a ball valve or angle valve on the incoming service. The contractor shall be required to perform all plumbing off the downstream meter connection, including a shut off, appropriate backflow device, and recommended pressure regulator, all installed in accordance with standard plumbing practices or municipal requirements. Meters shall be installed horizontally at the point of entry into a building and before any lateral. Meters shall be installed between 12” and 48” from the floor, and 12” from any wall. Reasonable space for access shall be provided around the water meter and valving to allow for maintenance.

27.00 BACKFLOW PREVENTION DEVICES

27.01. No water service connection shall be approved or maintained by the CWD Wholesale and Retail Divisions, unless the water supply is protected as
required by State laws, and local water system regulations and ordinances. The type of protective device shall depend on the degree of hazard that exists or may be created. Approved backflow prevention devices shall be located so as to provide containment protection at a minimum, and may be supplemented with the installation of internal protection backflow protection devices. In general, protection shall be provided by an air gap or an approved RPZ or DCV as a complete unit, installed in all commercial buildings, and a Dual Check Valve installed in residential buildings unless approved otherwise by the appropriate Division.

27.02. Only the following types of backflow prevention devices shown below shall be used for the containment of commercial on-premise hazards for low and high hazard situations respectively:

<table>
<thead>
<tr>
<th>Low Hazard</th>
<th>High Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air gap</td>
<td>Air gap</td>
</tr>
<tr>
<td>Atmospheric vacuum breaker</td>
<td>Reduced pressure/ backflow device</td>
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<tr>
<td>(Where bacteria hazards aren’t present)</td>
<td>Or combination of the above</td>
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<tr>
<td>Pressure vacuum breaker</td>
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<tr>
<td>Double check valve assembly</td>
<td></td>
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<tr>
<td>Reduced pressure backflow device</td>
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<tr>
<td>Or combination of the above</td>
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</table>

27.03. In the absence of municipal backflow requirements, any domestic, commercial, institutional, and fire protection service lines, including each line of a multiple service line, and a multifamily building serving more than two units shall be equipped with an approved backflow device or an approved air gap separation on each line. All other connections to any water main, including standpipes leading to elevated tanks, temporary connections, hose connections, and irrigation systems shall be equipped with approved backflow prevention devices.

27.04. All new residential buildings will be required to install at a minimum an approved dual check valve immediately downstream of the water meter (i.e. Watts Series LF7R or approved equal).

27.05. Provisions shall be made by the builder to provide for thermal expansion within a closed loop internal plumbing system (i.e. the installation of thermal expansion devices and/or pressure relief valves).

**28.00 CHECK VALVES**

28.01. Check valves may be required in certain parts of the transmission / distribution system.

28.02. Where required, check valves shall:
- Be rated for a 250 psig working pressure.
- Have a Ductile Iron body, bonnet and disc that exceeds ASTM A-536 66-45-12.
- Have a fusion bonded epoxy coating inside and out.
- Not have outside lever and weights or springs.
- Have the disc as the only moving part.
- Have a drip tight shutoff pressure as low as 5 psig.
- Be suitable for buried service.
- Have a 100% unobstructed flow area that is free of pockets which can trap debris.
- Have a factory installed flushing actuator that can be furnished as an option.
- Have a ductile iron disc fully encapsulated with Buna N rubber.
- Have disc travel to closure that shall not be more than 35 degrees.
- Have stainless steel hardware.
- Be Pratt RD Series, or approved equal.

29.00 AIR RELEASE VALVES

29.01. The primary function of air release valves is to automatically release small pockets of air as they accumulate at local high points within the water system. Air release valves must also discharge high velocity air during main filling and admit air during drainage. Air release valves are to be provided at required locations as shown on drawings.

29.02. Air release valves shall be designed to open positively and vent air to the atmosphere at system working pressures up to 250 psi.

29.03. Apco style valves shall have epoxy coated ductile iron bodies, a stainless steel float and stainless steel or bronze trim.

29.04. ARI style valves shall have reinforced nylon bodies, foamed Polypropylene float and E.P.D.M seals.

29.05. Piping: the upstream connecting piping shall consist of two brass ball valves, one brass tee and brass connection piping; all shall be one inch (1”) in diameter unless otherwise specified. Downstream discharge piping shall be two inch (2”) galvanized piping with appropriate fittings (See Air Release Manhole Detail).

29.06. The open end of an above grade air release venting pipe shall terminate at least forty eight inches (48”) above grade and be fitted with an insect screen on the end.

29.07. Automatic air relief valves shall NOT be used in situations where flooding of the access-way or chamber may occur.
29.08. Valves shall be A.R.I D-040, APCO No. 200A, or approved equal. All air release valves shall conform to ANSI/AWWA C512 and be installed according to the VT Water Supply Rule, A-8.4.

30.00 PRESSURE REDUCING VALVES

30.01. Pressure Reducing Valves (PRVs) shall be; Cla Val 90-01/690-01 with positioning stems, containing the check valve feature (unless otherwise stated); Flomatic Model C101 with position indicator stem; or approved equal (See Pressure Reducing Valve Vault Details).

30.02. Pressure reducing valves shall be set horizontally and be connected to a flanged pipe on the incoming side and a dismantling coupling on the downstream side.

30.03. Pressure reducing valves are to be installed in precast concrete vaults that allow adequate space for removal and maintenance. Vaults shall also have access hatches that are sized appropriately for the insertion and removal of all components. Vault designs shall be subject to approval by the appropriate CWD Divisions.

30.04. To prevent fouling of the pressure reducing valves during water main filling and flushing, a temporary spool piece may be installed in place of the PRV.

30.05. The adjustment range for the pressure reducing valve must be approved by the appropriate CWD Division prior to ordering.

31.00 MANHOLES AND VAULTS

31.01. Precast manholes and vaults shall conform to ASTM Designation C478.

31.02. All manholes and vaults shall be designed by a professional engineer addressing design criteria, such as, but not limited to: wheel loading, thrust restraint, buoyancy, soils, wall penetrations, access, etc.

31.03. Sections shall have tongue and groove joints with butyl mastic rope installed between sections.

31.04. The exterior of all sections shall have a bituminous coating.

31.05. Drainage from the manhole or vault shall be designed to run to daylight whenever possible.

31.06. Manhole top sections shall be eccentric except that the concentric flat top sections shall be used where shallow cover requires a top section less than three feet (3’) deep.
31.07. Vault top sections shall have a site-specific design and be appropriate for the application.

31.08. Precast bases, cast-in-place bases, or precast bases integral with base sections may be used.

31.09. Cement shall be Type II Portland Cement, conforming to ASTM Designation C150.

31.10. Ships ladders shall be required for vaults.

31.11. Ladder rungs for manholes shall be aluminum alloy 6061-T6 in accordance with ASTM designation B221, by Aluminum Company of America or Washington Aluminum Company or equal, conforming to Washington Aluminum Company Model T-14-OR. Rungs shall be set in precast sections during casting of section or grouted with a non-shrink grout. Plastic coated steel ladder rungs secured in the walls of the precast structure shall also be acceptable. Rungs shall be aligned so as to allow access from the top of the manhole to the base in a vertical line.

31.12. All manholes and vaults shall be equipped with an approved “ladder-up” safety device.

31.13. Brick or masonry shall NOT be used to raise the manhole or vault frame cover to grade. Only concrete grade rings shall be allowed for this function.

31.14. All sections shall be cured by an approved method. Sections shall not be shipped or manhole rungs subjected to loading until the concrete has attained a compressive strength of 3,000 psi or until 5 days after fabrication, whichever is the longer.

31.15. Precast concrete manhole and vault manufacturers shall incorporate flexible pipe sleeves within the construction of the manhole in such size to accommodate the size pipe being used. Link seal may be required in place of flexible pipe sleeves.

31.16. In no case shall a manhole be constructed such that it bears directly or indirectly on the pipeline or any appurtenances thereof.

31.17. All joints, lift holes, and other openings inside and outside the manhole shall be filled with water plug to prevent leakage.

32.00 MANHOLE AND VAULT FRAME AND LID

32.01. All manholes shall be provided with ductile iron manhole frames and lids of the size and type as required in the drawings, unless covers of another material are required by the appropriate CWD or Municipal supervisor.
32.02. Frame and lid shall be one of the following:

32.02.01. **Standard frame and lid:** Non-rocking design with a solid infiltration resistant lid.

32.02.02. **Waterproof frames- bolted lids:** Waterproof frames shall have a solid lid with machined bearing surfaces, and sealed with a rubber gasket. Lid shall fasten securely to the frame with countersunk bronze hexagonal-head cap screws. Frame shall be supplied with anchor bolts and bolt holes. Manhole frame and lid shall be Neenah No. R-1915-F (Type L) or equal.

32.02.03. **Hinged frame and cover:** Hinged frames and covers shall incorporate a blocking feature to prevent accidental closure. The cover must be removable if required. Hinged frames and covers may be used in off road locations, or in traveled ways with approval of the Municipal Engineer. Hinged frame and cover units shall be Pamrex, Bilco or approved equal.

32.02.04. Manhole lids for manholes on buried water mains shall have the word “WATER” cast into the top surface.

**33.00 CONCRETE THRUST BLOCKS**

33.01. Concrete shall be Portland Cement concrete of 3000 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 4 inches will be allowed (See Thrust Block Detail).

33.02. Concrete shall be clean and not mixed with other material, including previously prepared concrete products.

33.03. Thrust blocks shall be installed on caps, tees, hydrants, and bends of 22.5 degrees and greater. All other bends less than 22.5 degrees shall be restrained by use of retainer glands on each end of each bend.

33.04. Concrete thrust blocks shall be used in conjunction with “Mega-Lug” restraining glands or equivalent.

33.05. Thrust block bearing surface shall meet the minimum design specifications listed in Table A-1. A Professional Engineer shall design thrust restraint for waterlines greater than 16 “.

33.06. Poured-in-place thrust blocks shall be and neatly formed with wooden side forms. Thrust blocks shall be formed against undisturbed soil.
33.07. Precast thrust blocks may be approved by the appropriate CWD Division on a case-by-case basis. The bearing surfaces of precast thrust blocks shall be filled with compacted crushed gravel to undisturbed soil.

33.08. Blocking shall be placed on all sides of each fitting in the direction of thrust and not underneath for use as a foundation or support.

33.09. Thrust blocks shall be cured for a minimum of 5 days before being subjected to line pressure.

33.10. All fittings shall be poly-wrapped prior to pouring any concrete. Concrete shall not overlap any joints and/or glands, hence restricting future access to nuts and bolts. Adequate form work shall be employed to prevent such overlap.

33.11. Where directed by the appropriate CWD Division and engineer, concrete in-line thrust restraint may be required. In-line thrust restraint shall be designed by a licensed professional engineer where required on the plans or as directed by the appropriate CWD Division.

33.12. The appropriate CWD Division shall inspect all thrust blocks prior to backfilling.

34.00 WATER/SEWER SEPARATION

34.01. Water mains crossing sewers shall be laid to provide a minimum vertical distance of eighteen inches (18") between the outside of the water main and the outside of the sewer line. This shall be the case where the water main is either above or below the sewer. At crossings, one full length of pipe shall be located so both joints will be as far from the sewer as possible. This vertical separation shall be maintained for that portion of the water main located within ten feet (10') horizontally of any sewer it crosses. Water mains must be laid at least five feet (5') horizontally from any existing or proposed storm sewer and ten feet (10') from any existing or proposed sanitary sewer (See Water/Sewer Crossing Details).

34.02. When it is impossible to obtain horizontal and vertical separation on new water installations, exceptions may be allowed by the appropriate CWD Division in accordance with the Vermont WSR. No water main shall pass through or come in contact with any part of a sewer manhole.

34.03. Distribution lines shall not be placed closer than fifty feet (50') horizontal distance from any septic tank or leach field unless approved by the VT Water Supply Rule Provisions under Chapter 21.8.6.4. Supplemental protective measures shall be required in the event of a variance in the 50' separation requirement.
34.04. Sewer and waterline separation shall conform to all VT Water Supply Rule requirements, and installed in accordance with the latest edition of the “Ten States Standards - Recommended Standards for Water.”

35.00 JACK AND BORE

35.01. Steel Sleeve

35.01.01. Before beginning operations related to excavation by jacking, the contractor shall submit to the appropriate CWD Division a detailed, written description of the equipment and methods he/she proposes to use and acceptable sketches showing details of the jacking pit, head, frame, reaction blocks, and arrangement of the jacks. The contractor shall not proceed with work until authorized by the appropriate CWD Division. All requests to construct new water lines across existing municipal streets shall be reviewed by the appropriate CWD Division and the appropriate municipal official responsible for highway maintenance and permits (See Steel Sleeve Details).

35.01.02. All work to construct highway crossings as indicated on the drawings shall be performed by a contractor with at least three (3) years’ experience in jacking. Three (3) weeks prior to start of work, the contractor shall furnish the appropriate CWD Division a Statement of Experience and Welding Certification for such work for the entity doing the jacking.

35.01.03. The wall thickness of the steel casing pipe shall be 3/8” as indicated on the drawings and steel plate for steel casing pipe shall conform to ASTM A36. The steel plate shall be rolled and welded to the diameter size as indicated on drawings. Welding shall be done by approved standard welding practice. When more than one section of casing is to be used, the ends of the section to be joined shall be welded in accordance with approved standard welding practices for the use intended.

35.01.04. Services up to two inches (2”) may use PVC pipe or HDPE for a sleeve with approval of the appropriate CWD Division. PVC service sleeves shall be Schedule 80 and HDPE sleeves shall be DR9.

35.02. Execution of Sleeve Jack and Bore

35.02.01. The jacking pit shall be of adequate size to accommodate the sheeting, shoring or trench box, jacking head, frame, jacks, reaction blocks, added section of pipe, and other material and equipment, and to provide sufficient working space. The pit
shall be excavated by suitable methods as specified for normal excavations and shall be kept free of water.

35.02.02. Sleeves shall be at the same elevation as the water main.

35.02.03. The jacking head shall be of suitable bearing pieces to protect the pipe from damage due to the thrust from the jack to the pipe, and to transfer that thrust from the jack to the pipe.

35.02.04. The jacking frame, upon which the pipe being jacked will rest, shall be on railroad rails or suitable steel or wooden members set to correct line and grade to act as guides for the true alignment of the pipe.

35.02.05. The jacks shall be of ample capacity to provide more than the anticipated jacking capacity needed.

35.02.06. The reaction blocks shall be suitable to provide resistance to, and distribution of, the reaction from the jacks.

35.02.07. It is extremely important that the jacking apparatus be strongly constructed, set, and maintained in proper relative position and alignment in order to minimize forces that would tend to bend the pipe, cause it to deflect from true alignment, or displace the reaction blocks.

35.02.08. Joints of steel casing pipe shall be welded before being subjected to the jacking operation.

35.02.09. All welds shall conform to the AWWA C206 for Field Welding of Steel Water Pipe Joints.

35.02.10. When excavating from within the jacking pipe, extreme care shall be used to avoid the loss of material from outside the limits of the pipe in the final position. Excavation shall be carried ahead of the pipe only to the extent possible without the loss of material. Should material, either earth or rock, be lost outside the limits of the pipe in its final position, pressure grout shall be applied outside the casing with such equipment as may be directed.

35.02.11. Should rock or boulders be encountered after jacking has commenced and blasting is necessary, blasting shall be done only after required permits have been approved and then in such a manner that neither the jacked casing nor the road above the blast will be damaged. The size of the blast and the procedures for blasting shall be acceptable to the agency controlling the road.
35.02.12. Once jacking has started, it shall be a continuous operation until completion of the jacking operation in order to reduce the possibility of a so-called “stuck” pipe, even though this may involve working outside the normal workday.

35.02.13. Care shall be taken during excavation and jacking operations to ensure that the jacked pipe remains true to line and grade. Maximum deviation from line and grade shall be ½”/100’ for carrier pipe and casing pipe. Guided boring equipment utilizing a pilot tube for steering to the target with an LED illuminated target within the tube should be utilized to ensure the accuracy of the jacking process. Steel sleeve jacking and boring shall be performed in such a manner so as to avoid any bends or extra fittings on the water main.

35.02.14. During jacking operations, voids shall be prevented outside of the sleeve being jacked. If they occur they shall be filled with a lean grout to the satisfaction of the appropriate CWD Division.

35.02.15. The carrier pipe shall be installed in the sleeve, using casing spacers described below, two (2) per each section of pipe. Pipe shall be Tyton-Joint or approved flexible restrained joint pipe.

35.02.16. Following installation, the carrier pipe shall be tested for leakage in accordance with testing procedures outlined in the Pressure Testing and Disinfection Section.

35.02.17. The sleeve ends shall be plugged using hydraulic cement or concrete or otherwise sealed.

35.02.18. A weep hole shall be installed in the lower end of the sleeve for drainage.

35.03. Casing Spacers

35.03.01. Casing spacers shall be bolt on style with a two-piece shell made from T-304 stainless steel of a minimum 14-gauge thickness. Each shell section shall have bolt flanges and/or a hinged side; bolt flanges shall be formed with ribs for added strength. Connecting flange shall have a minimum of three (3) 5/16” T-304 bolts. The shell shall be lined with ribbed PVC extrusion with a retaining section that overlaps the edge of the shell and prevents slippage. Bearing surfaces (runners) made from UHMW polymer with a static coefficient of friction of 0.11-0.13 shall be attached to support structures (risers) at appropriate positions to properly support the carrier pipe within the casing pipe and to ease installation. The runners shall be attached mechanically by T-304 threaded fasteners that are inserted through the punched
riser section and TIG welded for strength. Risers shall be made of T-304 stainless steel of a minimum 10 gauge. All risers over six inches (6") in height shall be reinforced. Risers shall be MIG welded to the shell. All metal surfaces shall be fully chemically passivated (See Casing Spacer Detail).

35.03.02. Casing spacers shall be model CCS as manufactured by Cascade Waterworks Mfg. Co. or prior approved equal.

35.03.03. Annular space may remain void as directed by the appropriate CWD Division when casing spacers fit tightly within the casing. However, sleeve ends shall be plugged using hydraulic cement or concrete.

36.00 EROSION CONTROL

36.01. The contractor shall construct and maintain all erosion control measures in accordance with Municipal standards. In the case of no standard, then erosion control measures shall conform to the “Vermont Handbook for Soil Erosion and Sediment Control on Construction Sites”, current edition. The contractor shall carry out project construction in such a manner as to give adequate protection of water courses and minimize surface erosion.

36.02. The contractor shall perform all erosion control measures as indicated on approved plans and specifications, including installation, maintenance and removal of temporary dams and inlet protection.

36.03. Dust shall be controlled through the application of calcium chloride or water, as required by the municipality.
Appendix A
## Specifications Details Index

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TYPICAL TRENCH DETAIL

NOTES:
1) ALL TRENCHES SHALL MEET VOSHA STANDARDS PRIOR TO ANY PERSONNEL ENTERING A TRENCH.
2) PAVEMENT REQUIREMENTS PER MUNICIPALITY SPECIFICATIONS
3) SEE INSULATION DETAIL IF 6’ MIN COVER IS NOT MET
NOTES: 1) SEE SPECIFICATIONS FOR TAPPING SADDLE, CORPORATION, AND CURBSTOP REQUIREMENTS
2) SEE DETAIL A-3 FOR SYSTEM/SERVICE OWNERSHIP BOUNDARIES
3) TRANSMISSION INSTALLATIONS REQUIRE MAXIMUM DISTANCE OF 3’ BETWEEN CORP AND CURB STOP

WATER SERVICE CONNECTION

NOT TO SCALE
TRANSMISSION SYSTEM OWNERSHIP BOUNDARIES

NOTE:
TRANSMISSION INSTALLATIONS REQUIRE MAXIMUM DISTANCE OF 3' BETWEEN CORP AND CURB STOP

DISTRIBUTION SYSTEM OWNERSHIP BOUNDARIES

SERVICE CONNECTION OWNERSHIP
SEE DETAIL A–2 FOR SERVICE CONNECTION DETAIL

CHAMPLAIN WATER DISTRICT
Specifications Detail
SERVICE CONNECTION OWNERSHIP

CHAMPLAIN WATER DISTRICT
405 QUEEN CITY PARK ROAD
SOUTH BURLINGTON, VT 05403

DATE: April 2019
DRAWING NO.: A-3
ADJUSTABLE CAST IRON VALVE BOX SET WITH "WATER" ON THE COVER

CURB

ANCHOR TEE OR M.J. TEE W/ FOSTER ADAPTER

GATE VALVE

THRUST BLOCK

3/4" CRUSHED STONE BEDDING MIN. 12" THICK

NOTE: DOMESTIC WATER SERVICE SHALL BE RUN SEPARATE FROM THE FIRE SERVICE

TYPICAL FIRE SERVICE CONNECTION DETAIL
NOT TO SCALE
NOTES:

1) WET TAPS SHALL BE PERFORMED BY PRE-APPROVED FIRMS ONLY, POSSESSING A CURRENT CERT. OF INSUR.

2) ALL FITTINGS THAT ARE TO HAVE CONCRETE POURED AROUND THEM ARE TO BE WRAPPED WITH 4 MIL. POLYETHYLENE PRIOR TO CONCRETE PLACEMENT.

3) WHEN TAPPING CWD TRANSMISSION MAIN THE INDICATED OWNERSHIP DESIGNATION SHALL APPLY.

TAPPING SLEEVE AND VALVE DETAIL

NOT TO SCALE
NOTES: 1) CONTRACTOR SHALL SUBMIT A TIE-IN PLAN THAT PROTECTS THE INTEGRITY OF THE WATER SYSTEM

TIE-IN DETAIL
CONCRETE THRUST BLOCK AGAINST UNDISTURBED SOIL
SEE THRUST BLOCK SIZING DATA DETAIL

MECHANICAL JOINT CAP WITH APPROVED RETAINER GLAND

HYDRANT AND HYDRANT ASSEMBLY

GATE VALVE

MIN. LENGTH 3 PIPE DIAMETERS

3/4" CRUSHED STONE BEDDING MIN. 12" THICK

TYPICAL END OF LINE PIPE ANCHOR
STAINLESS STEEL VALVE STEM EXTENSION

NOTES:
1. REQUIRED WHEN TOP OF NUT TO GROUND SURFACE IS GREATER THAN 5'
2. TRUMBULL TOP NUTS AND BOTTOM COUPLINGS OR EQUAL

BOLT NOT TO EXTEND BEYOND 1''
NOTES:
1) AFTER USE TURN OFF CORPORATION AND REMOVE COPPER TO CORPORATION, AND CAP CORPORATION
2) AFTER USE PLACE INSULATION BOARD ABOVE ABANDONED CORPORATION

TEMPORARY
CHLORINATION INJECTION INSTALLATION

NOT TO SCALE
NOTES:
1. INSULATION BOARD TO BE CLOSED CELL, EXTRUDED POLYSTYRENE FOAM MEETING ASTM 578, TYPE VI, 40 PSI COMRESSING STRENGTH (ASTM D1621), 0.1% MAX. WATER ABSORPTION (ASTM C272).
2. BACKFILL MATERIAL AROUND INSULATION MUST BE FINE SAND FREE FROM ROOTS, ORGANIC WASTE, OR OTHER INJURIOUS MATERIALS.
3. OVERLAP ALL INSULATION BOARD JOINTS.

PROVIDE INSULATION WHEN DEPTH OF COVER IS LESS THAN 6 FEET

PROVIDE INSULATION WHEN WATER MAIN CROSSES ABOVE OR BELOW STORM DRAIN

WATER MAIN INSULATION

NOT TO SCALE
CONCRETE / FLOWABLE FILL ENCASEMENT

2500 psi CONCRETE OR FLOWABLE FILL ENCASEMENT
6" CLEAR FOUR SIDES

WATER MAIN

WRAP IN 4 MIL. POLY

CONCRETE / FLOWABLE FILL ENCASEMENT
NOTES:
1) CONCRETE ENCASE FIRST SEWER PIPE JOINTS EITHER SIDE OF WATER MAIN IF SEWER IS OVER WATER IN ACCORDANCE W/ VT WATER SUPPLY RULE
2) VARIANCES FROM THESE STANDARDS SHALL BE APPROVED BY THE APPROPRIATE CWD DIVISION

WATER / SEWER LINE CROSSING
WATER UNDER SEWER LINE CROSSING

- DETAIL TO BE EMPLOYED WHEN WATER CANNOT CROSS ABOVE SEWER LINE

- PRIOR TO POURING THRUST BLOCKS, ALL FITTINGS ARE TO BE WRAPPED WITH 4 MIL POLYETHELENE

"MEGALUG" OR APPROVED EQUAL RETAINER GLANDS

SEWER MAIN (CONCRETE ENCASE NEAREST JOINTS)

NEW DUCTILE IRON WATER MAIN

#5 REBAR REINFORCEMENT

CLASS 3000 CONCRETE THRUST BLOCKS PLACED AGAINST UNDISTURBED EARTH

LENGTH VARIES CENTER SEWER ON FULL PIPE

45° MJ BENDS

18" MINIMUM

10'

NOT TO SCALE
ALL NATIVE MATERIALS
EXCAVATED FROM THE TRENCH
ARE TO BE STORED AND
REUSED TO FILL TRENCH

NOTE:
WATER MAIN SHALL BE RESTRAINED JOINT PIPE

RIVER CROSSING TRENCH DETAIL
NOT TO SCALE
NOTES:

1) ALL FITTINGS ARE TO HAVE WEDGE STYLE RETAINER GLANDS

2) PRIOR TO POURING THRUST BLOCKS ALL FITTINGS ARE TO BE WRAPPED WITH 4mil. POLYETHYLENE.

3) THE ABOVE OWNERSHIP LINE REFERENCES HYDRANTS ON CWD TRANSMISSION MAINS. REFER TO SPECIFICATIONS FOR MORE INFORMATION.

HYDRANT ASSEMBLY

NOT TO SCALE
HYDRANT REMOVAL

NOT TO SCALE

ADJUSTABLE IRON VALVE BOX WITH COVER MARKED "WATER"
INSTALL DEBRIS PLUG UNDER COVER

LOWER BOX TOP TO DEPTH AS DIRECTED BY AUTHORIZED CWD PERSONNEL

REMOVE HYDRANT ASSEMBLY COMPLETELY TO VALVE

INSTALL 4'x4'x4' PRECAST CONCRETE BLOCK W/LIFT HOOKS ONCE HYDRANT ASSEMBLY IS REMOVED

6" MJ PLUG

CHAMPLAIN WATER DISTRICT
Specifications Detail
HYDRANT REMOVAL DETAIL
Post Hydrant shall be non-freezing, self-draining type with a 5' bury. These hydrants will be furnished with a 2" FIP horizontal, vertical or 2" MJ inlet. A non-turning operating rod and shall open left. Bronze operating mechanism and aluminum plunger design, and be serviceable from above grade with no digging. The outlet shall also be bronze and be 2 1/2" NST or smaller. Hydrants shall be lockable to prevent unauthorized use as manufactured by Kupferle Foundry Co., St. Louis, MO or approved equal.

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<td>803</td>
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NOTES:

1) PRIOR TO POURING THRUST BLOCKS, ALL FITTINGS ARE TO BE WRAPPED IN 4 MIL. POLYETHYLENE
2) MEGA–LUG RETAINER GLANDS OR APPROVED EQUAL ARE TO BE USED ON ALL MJ FITTINGS.
3) THIS ASSEMBLY IS TYPICAL OF TRANSMISSION SYSTEM

6" or 8" BLOWOFF ASSEMBLY

NOT TO SCALE
EXTEND VENTLINE TO APPROVED LOCATION AS DIRECTED BY THE ENGINEER.

36" MIN.

30" MANHOLE FRAME WITH HINGED COVER

GRADE

30" CLEAR OPENING

ALL RISERS ARE TO BE PRECAST CONCRETE

MANHOLE TO HAVE MIN. 72" INSIDE DIAMETER

STEPS 12" O.C.

MAINTAIN POSITIVE GRADE

9
RETURN BEND WITH INSECT SCREEN
8 2" GALVANIZED RISER
7 GALVANIZED PIPE SUPPORTS 12" O.C. HILTI INTO MANHOLE
6 2" x 90 DEG ELBOW
5 INCREASER 1" COPPER TO 2" GALVANIZED
4 5/8" COPPER TUBING
3 AIR RELEASE VALVE
2 1" BRASS BALL VALVES
1 1" CORPORATION DIRECT TAP INTO DUCTILE IRON PIPE ON TOP OF PIPE

4" PVC MANHOLE DRAIN TO DAY LIGHT OR TO STORM DRAIN WITH RODENT SCREEN ON DISCHARGE END

PRECAST INTERGRAL BASE SECTION WITH FLEXIBLE MANHOLE SLEEVES

NOTES:
1) ALL 1" PIPE & FITTINGS TO BE BRASS AND COPPER
2) ALL 2" PIPE & FITTINGS TO BE GALVANIZED UNLESS OTHERWISE NOTED.
3) ALL MH PENETRATIONS TO BE PRECAST WITH RUBBER PIPE BOOTS.

AIR RELEASE MANHOLE
NOT TO SCALE

CHAMPLAIN WATER DISTRICT
Specifications Detail
AIR RELEASE MANHOLE

DATE: JUNE 2019
DRAWING NO. A-20
1. All interior fittings and valves shall be flanged. No flange or fitting shall be within 18" of any wall or floor.
2. Buried fittings shall be mechanical joint with wedge style retainer glands.
3. To prevent fouling of the pressure reducing valves during water main filling and flushing, a temporary spool piece shall be installed in place of the pressure reducing valve.
4. PRVs shall be Cla-Val 90-01/690-01 with positioning systems or approved equal.
5. Check valves shall be Pratt Rd or approved equal.
PRESSURE GAUGE WITH TAPPED OUTLET, BRONZE PETCOCK, SNUBBER AND BLOWOFF (TYP. OF 4)

ADJUSTABLE S.S. PIPE SUPPORT STAND (TYP.)

3/4" CRUSHED STONE

PLASTIC COATED MANHOLE STEPS OR SHIP'S LADDER W/ LADDER UP

PRECAST CONCRETE VAULT

PRECAST RISER WITH ACCESS DOOR CAST IN BY PRECAST MANUFACTURER

2% RIGID INSULATION, MASTIC ALL JOINTS (TYP.)

6" TOPSOIL, SEED AND MULCH

TOP OF ACCESS

SLOPE FINISH GRADES AWAY FROM ACCESS DOOR

GRANULAR BACKFILL

CONCRETE FILL DRAIN TO SUMP 2% MINIMUM SLOPE

FLOW METER AS REQUIRED

FLOW METER AS REQUIRED

CHECK VALVE AND PRESSURE REDUCING

VALUE VAULT PROFILE

NTS

COPYRIGHT CHAMPLAIN WATER DISTRICT 2022

403 QUEEN CITY PARK ROAD
SOUTH BURLINGTON, VT   05403

A-22 PREV Vault Profile.DWG

SHEET 2 OF 2
### Minimum Area in Square Feet, of Bearing Surface Required for Concrete Thrust Blocks

<table>
<thead>
<tr>
<th></th>
<th>4”</th>
<th>6”</th>
<th>8”</th>
<th>12”</th>
<th>16”</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENDS &amp; TEES</td>
<td>90°</td>
<td>45°</td>
<td>22.5°</td>
<td>90°</td>
<td>45°</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
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<tr>
<td>1</td>
<td>2</td>
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<td>3</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Note:**

Thrust blocks on pipe larger than 16” dia. shall be designed by a professional engineer.
NOTES:

1) BEARING SURFACE SHOULD, WHERE POSSIBLE BE PLACED AGAINST UNDISTURBED SOIL. WHERE IT IS NOT POSSIBLE, THE CRUSHED GRAVEL BETWEEN THE BEARING SURFACE AND UNDISTURBED SOIL MUST BE COMPACTED TO AT LEAST 90% STANDARD PROCTOR DENSITY.

2) BLOCK HEIGHT SHOULD BE CHOSEN SUCH THAT THE CALCULATED BLOCK WIDTH VARIES BETWEEN ONE AND TWO TIMES THE HEIGHT.
### Gravity Thrust Block Details

#### No Scale (for vertical bends only)

**Recommended 180° End Hook Dims**

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>J (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#6</td>
<td>6</td>
</tr>
<tr>
<td>#7</td>
<td>7</td>
</tr>
<tr>
<td>#8</td>
<td>8</td>
</tr>
<tr>
<td>#9</td>
<td>11 1/4</td>
</tr>
<tr>
<td>#10</td>
<td>12 3/4</td>
</tr>
<tr>
<td>#11</td>
<td>14 1/4</td>
</tr>
</tbody>
</table>

**Detaining Dimension**

- Hook
- Min D = 6d for #3 through #8
- Min D = 8d for #9, #10, and #11

- 4d or 2 1/2” Min
- 180° Hook

**ACI Standard Hooks**

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>J (in)</th>
<th>Recommended 180° End Hook Dims</th>
</tr>
</thead>
<tbody>
<tr>
<td>#6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>#7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>#8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>#9</td>
<td>11 1/4</td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>12 3/4</td>
<td></td>
</tr>
<tr>
<td>#11</td>
<td>14 1/4</td>
<td></td>
</tr>
</tbody>
</table>

**Blocking for 22 1/2 & 45 Vertical Bends**

<table>
<thead>
<tr>
<th>VB</th>
<th>S</th>
<th>d</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>22 1/2</td>
<td>16</td>
<td>2.5</td>
</tr>
<tr>
<td>45</td>
<td>29</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>6&quot;</td>
<td>22 1/2</td>
<td>59</td>
<td>3.9</td>
</tr>
<tr>
<td>8&quot;</td>
<td>22 1/2</td>
<td>32</td>
<td>3.2</td>
</tr>
<tr>
<td>10&quot;</td>
<td>22 1/2</td>
<td>102</td>
<td>4.7</td>
</tr>
<tr>
<td>12&quot;</td>
<td>22 1/2</td>
<td>118</td>
<td>4.9</td>
</tr>
<tr>
<td>16&quot;</td>
<td>22 1/2</td>
<td>205</td>
<td>5.9</td>
</tr>
<tr>
<td>45</td>
<td>378</td>
<td>7.2</td>
<td></td>
</tr>
</tbody>
</table>

* For 60 KSI Threaded Rebar

---

**FOR DI BENDS ONLY**

---

**Champlain Water District**

Specifications Detail

Gravity Thrust Block

**Date:** April 2019

A-28 Gravity Thrust Block.dwg
NOTES:
1) SEE JOINT WELD DETAIL
2) MINIMUM LENGTH OF CASING ON HIGHWAY BORES IS DETERMINED FROM SHOULDER POINT OF ROAD AT A ONE ON ONE SLOPE
3) SEAL BOTH ENDS OF SLEEVE TO PREVENT INFILTRATION
4) A WEEP HOLE SHALL BE INSTALLED IN THE LOWER END OF THE SLEEVE FOR DRAINAGE

STEEL SLEEVE ENCASEMENT
SLEEVE DIAMETER VARIES

CARRIER PIPE DIAMETER VARIES

ANNULAR SPACE MAY REMAIN VOID WHEN SO DIRECTED BY THE ENGINEER

CARRIER PIPE CENTERED INSIDE SLEEVE

SLEEVE CASING SPACER DETAIL

NOTE: SEAL BOTH ENDS OF THE SLEEVE TO PREVENT INFILTRATION

FIELD WELD ALL AROUND

SLEEVE WALL 3/8" THICK A-36 PLATE

SHOP WELD ALL AROUND

1/4" x 4" A-36 BAR WELDED TO INTERIOR OF SLEEVE

STEEL SLEEVE JOINT WELD DETAIL
100A 14-3W METER SOCKET
AND 100A MAIN BREAKER PER
UTILITY CO. STANDARDS

BLACK PLASTIC
POST CAP (TYP)

39" H x 36" W, 10 GAUGE
GALVANIZED STEEL
PLATE, EACH SIDE

SURGE PROTECTOR

(4) 3" x 3"
LAG BOLTS

SLIP JOINTS
<MIN 16" ABOVE
GRADE>

2" x 4" PRESSURE
TREATED FOR SOIL
CONTACT W/ STAINLESS STEEL
FASTENERS

36" MIN

6"-0"

6X6 PRESSURE
TREATED POSTS
RATED FOR SOIL
CONTACT

(TO POLE)

36" RADIUS
SWEEP ELBOWS

(2) 8" x 8"
GROUND RODS
6"-0" APART

NOTES:

1) INSTALLATION SHALL COMPLY WITH ALL UTILITY COMPANY STANDARDS.
   REFER TO THE VERMONT UTILITIES ELECTRIC SERVICE REQUIREMENTS
   MANUAL.
   2) REFER TO SITE PLAN FOR LOCATION, FIELD VERIFY FINAL LOCATION
      WITH CMD AND UTILITY REPRESENTATIVE
   3) CONTRACTOR RESPONSIBILITY TERMINATES IN ELECTRIC PANEL
   4) ALL FASTENERS SHALL BE STAINLESS STEEL.
Appendix B
Champlain Water District
Water Main Pressure Test Inspection Record

Contract # / Job Name: ____________________________________________

Date: ____________ Time: ____________ Test #: ____________

Location: ________________________________________________________

Tester: Name __________________________ Others Present: __________________________

Company __________________________

Test Pressure (psi): __________________________ Test Duration: ____________

(1.25 times the working pressure at high points; or 1.5 times the
working pressures at low points; or 200 psi whichever is greater.)

Test Pressure (psi): ____________

Test Duration: ____________ (Minimum 2 hours)

Testing Leakage Allowance

\[
\text{Testing Allowance} = \frac{\text{Length of pipe (ft)} \times \text{Diameter of Pipe (inches)} \times \sqrt{\text{Test Pressure (psi)}}}{148,000} = \text{Gallons/Hour}
\]

\[
= \frac{\text{Length of pipe (ft)} \times \text{Diameter of Pipe (inches)} \times \sqrt{\text{Test Pressure (psi)}}}{148,000} = \text{Gallons/Hour}
\]

Total Testing Allowance = Testing Allowance (gal./hr.) \times Test Duration (hr.) = Gallons

Test Start Time: ____________ Test Start Pressure: ____________

Pressure Dropped to: ____________ Water used: ____________

Re Pump Time: ____________

Pressure brought back to: ____________

Pressure Dropped to: ____________ Water used: ____________

Re Pump Time: ____________

Pressure brought back to: ____________

Pressure Dropped to: ____________ Water used: ____________

Test Finish Time: ____________

Pressure brought back to: ____________

Total Water Used: ____________

Test Approval: Approved / Failed

(Circle one)

Inspector: __________________________

Signature: __________________________

Revision 11/27/2006

M/OWD Specification Revision 2019/March 2013 specs in MS Word/Pressure Test Inspection Form 2013.docx
MEASUREMENTS:

USE A 2½" HYDRANT OUTLET (Indicate if other than 2½")

FLOW HYDRANTS:

FLOW HYDRANT STATIC PRESSURE:

Hydrant #1 ______ psi  
Hydrant #2 ______ psi  
Hydrant #3 ______ psi

FLOW HYDRANT RESIDUAL PRESSURE:

Hydrant #1 ______ psi (P)  
Hydrant #2 ______ psi (P)  
Hydrant #3 ______ psi (P)

FLOW READINGS: (Use Formula #1 To Calculate Flows (Q))

Hydrant #1 ______ GPM(Q₁)  
Hydrant #2 ______ GPM(Q₂)  
Hydrant #3 ______ GPM(Q₃)

Total Flow (Q₁ + Q₂ + Q₃) _______ (Qᵣ)

RESIDUAL HYDRANTS:

RESIDUAL HYDRANT STATIC PRESSURE:

Hydrant #1 ______ psi  
Hydrant #2 ______ psi  
Hydrant #3 ______ psi

RESIDUAL HYDRANT RESIDUAL PRESSURE: (Residuals Must Be At Least 10 psi Below Static)

Hydrant #1 ______ psi  
Hydrant #2 ______ psi  
Hydrant #3 ______ psi

DISCHARGE AT 20 psi RESIDUAL ______ GPM (Qᵣ) (Use Formula #2 below)

FORMULAS:

1) \[ Q = 29.83 \, C \, d^2 \, \sqrt{P} \]

\[ Q = \text{Discharge in GPM} \]
\[ C = \text{Hydrant Coefficient (SEE BACK)} \]
\[ d = \text{Diameter of outlet in inches} \]
\[ P = \text{Vel. Pressure in psi.} \]

2) \[ Q_{20} = \frac{Q_R}{H_R^{0.54}} \]

\[ Q_{20} = \text{Discharge at 20 psi} \]
\[ Q_R = \text{Actual Test Discharge (total flow)} \]

(Use the worst case residual hydrant info. for the following values)

\[ H_R = \text{Drop from original static pressure to 20 psi residual} \]
\[ H_f = \text{Pressure drop during test in psi} \]

Draw Sketch and Other Information On Back (ie: tank, tank level, pumps, ex...)

H:\AMIPRO\FIREFLOW.SAM  

10/30/95
To determine $C$ for formula #1
match the hydrant outlet to one below

C = 0.9
C = 0.8
C = 0.7
Appendix C
1 DEFINITIONS AND ACRONYMS

AWWA American Water Works Association
EAM enterprise asset management
OSHA Occupational Safety and Health Administration
PPE personal protective equipment
mg/L milligram per liter

2 KEY PERSONNEL AND RESPONSIBILITIES

- Wholesale/Retail Supervisor:
  - Oversee main repair and disinfection
  - Determine and implement any follow-up activities
- Maintenance Technician:
  - Operate system valves and hydrants
  - Collect and analyze samples for disinfectant
  - Collect bacteriological samples and deliver to the water quality laboratory for analysis
  - Document the repair, including the type, repair conditions and activities, process used for disinfection and all sampling results.
- Water Quality Specialist:
  - Analyze bacteriological samples and report results to Wholesale/Retail Supervisor
- Contractor
  - Excavate and perform repair

3 SCOPE/PURPOSE

The purpose of this SOP is to outline the procedures for water main repair due a break or planned connection/construction, including any necessary flushing, disinfection and water quality testing to be conducted before a main is placed back into service. The procedures presented herein are based on the Water Research Foundation Report #4307 – Effective Microbial Control Strategies for Main Breaks and Depressurization (2014) and should be used in conjunction with AWWA Standard C651 – Disinfecting Water Mains. Not all repairs occur in the same manner and crews should use their best judgment when implementing the procedures below.

4 POTENTIAL HAZARDS

Main repair often involves several types of hazards, including:

- Traffic Hazards: The field team should use trucks, temporary signs, and traffic cones, barricades, and flashers to prevent automotive accidents and injury to staff. In
addition, a flag crew may be needed to direct traffic in some locations. Trucks should be parked between oncoming traffic and the work area when possible to provide a barrier.

- **Heavy Construction / Mechanized Equipment Hazards:** Heavy or mechanized equipment may be needed for excavation, trenching, grading, etc. Staff operating the equipment must have the proper training and licensure. Ensure proper distances from the equipment are maintained. Use hand signals / radios to communicate with the operator and spotters as needed when moving equipment. Make eye contact with the operator before coming in the vicinity of the equipment.

- **Trenching and Confined Space Entry:** If trench work is required, consult the relevant excavation procedures for benching, sloping and shoring depending on depth and conduct work in accordance with the Occupational Safety and Health Administration (OSHA) standards for trenching and excavation. Where applicable, staff working in the trench must have the proper confined space entry training and certification.

- **Hazardous Chemicals:** Disinfection procedures involve the use of chlorine, which can present various hazardous to staff and the public. Staff should be trained in the use of the specific chemicals to be used and how to address any emergencies that may arise. In addition, staff should follow all precautions when working with chlorine solutions.

Contractors and CWD Staff should be able to recognize and respond to the potential hazards, and must have the proper training, including knowledge of proper sanitary procedures during repair, and certifications to the complete the applicable tasks. In addition, proper PPE should be worn at all times and will vary depending on the specific repair activity. PPE may include:

- Chemical resistance apron
- Face Shield
- Hard hat
- High visibility safety vest
- Safety glasses
- Steel-toed boots
- Work gloves and/or chemical resistant gloves

**5 PROCEDURE**

**Contractor Personnel/Equipment Required:**

1. **Minimum Crew**
   a. Foreman, Equipment Operator, 2 Pipe Layers

2. **Traffic Control**
   a. Traffic cones, barricades, and flashers
   b. Temporary signs/arrow boards (warning lights, arrow boards, traffic maintenance signs)
   c. Light towers
   d. Flaggers and UTO as required
3. Excavation
   a. Permit
   b. Trench Box, Ladders, etc. to meet VOSHA Excavation Requirements
   c. Heavy Equipment as required

4. Dewatering
   a. 3 Pumps:
      i. 1 min 2” self-priming trash pump with strainer
      ii. 1 submersible pump with generator (gas can)
      iii. 1 extra pump
   b. Trench Sump
   c. Clean Stone
   d. Pumpage Discharge Hose
   e. Surface runoff diversionary equipment (sandbags, trench covers, etc.)

5. Pipe Work
   a. Thrust Blocks/Support Blocks as Required
   b. Pipe Grease
   c. Water tight pipe plug sized for pipe being repaired
   d. Field tools (e.g., gas saw, grinder, pry bar, pipe wrenches, torque wrench, buckets, shovels, flashlights, etc.)

6. Trench Repair
   a. Pipe Bedding Material (sand, crushed stone)
   b. Road Repair Materials (gravel)
   c. Plate Compactor

7. Decontamination
   a. Clean water source
   b. Clean rags
   c. Clean swab with the ability to extend and clean full pipe length
   d. 1% solution chlorine spray bottle disinfectant
   e. 12.5% hypochlorite liquid form for pipe disinfection at 20 mg/l if required

CWD Equipment Required
   a) Valve key
   b) Hydrant Wrenches
   c) DeChlorination pucks
   d) Field Chlorine test kit
   e) Sterile sample bottles treated with sodium thiosulfate, transport cooler, ice packs

Procedure:
An overview of the procedure based on repair type is summarized in Table 1. As not all breaks will fall into these categories and as site conditions (i.e., ability to locate and operate appropriate valves and hydrants) impact the ability to implement the procedures below, crews should use their best judgment when modifying the procedures below and ensure practices.
comply with AWWA Standard C651. Additional details are provided below.

Table 1: Categories of Main Break/Repair Types and Response Procedures (Adapted from Kirmeyer et al., 2014 and AWWA Standard C651-15)

<table>
<thead>
<tr>
<th>Main Break /Repair Type</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Controlled pipe repair without depressurization</td>
<td>Controlled pipe repair with depressurization after shutdown</td>
<td>Uncontrolled pipe break with possible water contamination or loss of sanitary conditions during repair</td>
<td>Uncontrolled pipe break with a likelihood of water contamination or loss of sanitary conditions during repair</td>
</tr>
<tr>
<td>Description</td>
<td>Pressure maintained during break and repair</td>
<td>Pressure maintained during break and excavation, followed by controlled shutdown for repair</td>
<td>Loss of pressure at break site / possible local depressurization (less than 20 psi) adjacent to the break (e.g., severe erosion requires pressure to be reduced prior to exposing the pipe)</td>
<td>Loss of pressure at break site / widespread depressurization (less than 20 psi) in the system (e.g., pipe blowout and loss of pressure prior to shutdown)</td>
</tr>
<tr>
<td>Risk of Microbiological Contamination</td>
<td>No signs of contaminant intrusion</td>
<td>No signs of contaminant intrusion</td>
<td>Possible contaminant intrusion</td>
<td>Possible / actual contaminant intrusion</td>
</tr>
<tr>
<td>Main Break Type</td>
<td>Type 1</td>
<td>Type 2</td>
<td>Type 3</td>
<td>Type 4</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Assess Break</strong></td>
<td>Excavate to at least 1’ below the pipe invert</td>
<td>Excavate to at least 1’ below the pipe invert</td>
<td>Uncontrolled shutdown</td>
<td>Immediate or uncontrolled shutdown</td>
</tr>
<tr>
<td></td>
<td>No shutdown needed; maintain pit water level below break</td>
<td>Perform controlled shutdown after pipe is exposed and secured from trench soil/water contamination and maintain pit water level below break</td>
<td>Document possible contamination</td>
<td>Document likely contamination</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shut-off customer services in affected area</td>
<td>Shut-off customer services in affected area</td>
</tr>
<tr>
<td><strong>Repair</strong></td>
<td>Repair pipe under positive pressure</td>
<td>Repair pipe following controlled shutdown</td>
<td>Repair pipe following partial or uncontrolled shutdown</td>
<td>Repair pipe following uncontrolled or immediate shutdown</td>
</tr>
<tr>
<td></td>
<td>Disinfect repair parts</td>
<td>Disinfect repair parts</td>
<td>Disinfect repair parts</td>
<td>Disinfect repair parts</td>
</tr>
<tr>
<td></td>
<td>Swab accessible components with 1% chlorine solution</td>
<td>Swab accessible components with 1% chlorine solution</td>
<td>Swab accessible components with 1% chlorine solution</td>
<td>Swab accessible components with 1% chlorine solution</td>
</tr>
<tr>
<td><strong>Disinfection</strong></td>
<td>Not required</td>
<td>Not required</td>
<td>Conduct slug chlorination (CT of 100 mg/L-min)¹</td>
<td>Conduct slug chlorination (CT of 100 mg/L-min)¹</td>
</tr>
<tr>
<td><strong>Flushing</strong></td>
<td>Conduct scour flush at 3 fps for a minimum of 3 pipe volumes and confirm water is visually clear Dechlorinate if needed</td>
<td>Conduct scour flush at 3 fps for a minimum of 3 pipe volumes and confirm water is visually clear Dechlorinate if needed</td>
<td>Conduct scour flush at 3 fps for a minimum of 3 pipe volumes and confirm water is visually clear Dechlorinate if needed</td>
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<td>Main Break Type</td>
<td>Type 1</td>
<td>Type 2</td>
<td>Type 3</td>
<td>Type 4</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>disinfectant residual sampling</td>
<td>Check free chlorine level at break site; continue flushing until residual levels have returned to typical levels&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Check free chlorine level at break site; continue flushing until residual levels have returned to typical levels&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Check free chlorine level at break site; continueflushing until residual levels have returned to typical levels&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Check free chlorine level at break site; continue flushing until residual levels have returned to typical levels&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>public notification</td>
<td>No boil water advisory needed</td>
<td>No boil water advisory needed</td>
<td>Instruct customers to flush premise plumbing upon return to service</td>
<td>Instruct customers to flush premise plumbing upon return to service</td>
</tr>
<tr>
<td>bacteriological sampling</td>
<td>No sampling needed</td>
<td>If a full pipe section is required during the repair, collect one set of samples; however, the pipeline may be returned to service prior to obtaining the results</td>
<td>Collect bacteriological samples; main may be returned to service prior to completion of the testing depending on the depressurization extent and presence of contamination&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Collect bacteriological samples; await confirmation of sample results before placing line back into service</td>
</tr>
</tbody>
</table>

1. In highly tuberculated pipes, a higher CT should be considered to compensate for possible lower flushing efficiency. If exposure of customers to high levels of chlorine cannot be controlled, a minimum free chlorine level of 4 mg/L must be maintained for at least 16 hours in conjunction with flushing, coliform sampling and public notification.

2. If depressurization is limited to the pipe section, or area flushed or disinfected, then a boil water advisory is not needed and main can be returned to service prior to receiving the bacteriological sample results. However, if the area of depressurization is larger than the treated area, then a precautionary boil water advisory should be considered and/or the main should not be released for service until the sample result is confirmed to be absent of coliforms.

3. Residual levels should be at least 90% of ambient or pre-break levels and not more than 4.0 mg/L as required by State and Federal regulations.
1. Contractor will call for Dig Safe prior to planned excavation. Set up the appropriate traffic control measures. This may include: warning lights, arrow boards, traffic maintenance signs, cones, flaggers, and UTO (if necessary).

2. CWD will call in emergency Dig Safe if unplanned excavation. Locate and mark water lines and valves in the vicinity. Check for potential contamination sources, such as septic systems, underground storage tanks, service connections without proper backflow prevention devices, and presence of buildings with fire suppression systems.

3. CWD will isolate the pipe section by slowly adjusting valve settings, maintaining positive pressure to reduce backflow or runoff contamination. Where possible, service disruptions should be minimized; however, it may be necessary to isolate certain areas to minimize the potential for contamination. Close or throttle valves, particularly service connections that do not have proper backflow prevention, as needed, to isolate the repair area. If possible, notify impacted customer of the potential disruption. Use caps or covers to protect existing mains or service connections.

4. Contractor will excavate for the repair. Provide the necessary benching, sloping and/or shoring depending on depth and conduct work in accordance with the Occupational Safety and Health Administration (OSHA) standards for trenching and excavation. Install temporary devices to divert surface water runoff around the repair site. Use portable dewatering pumps to maintain water levels at least one foot below the pipe invert during repair.

Contractor will repair the pipe using the appropriate materials (i.e., fittings, joints, gaskets, clamps), sizes and other necessary repair equipment. During the repair:

   a. Maintain positive pressure, where possible, to prevent contamination from backflow into the pipe. At the start of, at least once during and at the end of the repair, confirm and document if positive pressure is maintained in the immediately vicinity of the repair site by visually observing a steady flow or spray of water coming from the pipe, or observation of a hose bib or hydrant located near and at a higher elevation than the break site. Pressure above 20 psi should be maintained outside the immediate repair area. If pipe cannot be repaired under pressure, do no depressurize the pipe until the pipe is exposed.

   b. Maintain a dewatered trench to at least 1’ below the pipe invert.

   c. Visually inspect the interior and exterior of all new materials (pipes, fittings, valves, etc.) to ensure there is no visible damage, debris or contamination.

   d. Remove any visible debris from exposed areas of the existing pipe.

   e. Keep all parts, tools and materials used in the repair in a clean and sanitary condition. Clean and disinfect prior to use or installation with a 1 percent chlorine solution. If any interior areas of the pipe were exposed to the environment during the repair, spray or swab any accessible upstream and downstream interior of the existing pipe areas with a 1 percent chlorine solution. If the repair requires new piping to be installed in any section, the new pipe must be inspected, cleaned and disinfected from both ends by swabbing with 1 percent chlorine solution.

   f. Maintain pipe caps, plugs or other protective coatings until materials are ready to be installed.
g. Complete all pipe and fitting joints in the trench before stopping work. If work requires more than one day, store materials on-site in a secure area.

5. If needed, the Contractor will disinfect the pipe in accordance with the described outlined in AWWA Standard C651. For disinfection of repaired mains, the following methods can be used:
   
a. Tablet method: involves the use of calcium hypochlorite tablets in the repaired or replaced pipe section and contact time with an initial free chlorine concentration of 25 milligrams per liter (mg/L). Note that pipe materials must be evaluated for compatibility and that this method may only be used when pipes and appurtenances are kept clean and dry during construction. Cleaning and flushing of the main prior to disinfection cannot be performed with this method.
   
b. Continuous feed method: involves filling the main with potable water to remove air pockets, then flushing to remove particulates, and refilling the main with chlorinated water at a dose of 25 mg/L until stable concentrations are reached within the pipe (i.e., a free chlorine residual of not less than 10 mg/L after a holding period of 24 hours).
   
c. Slug method: involves filling the main with potable water to remove air pockets, flushing to remove particulates, followed by slow flush with a high concentration of chlorine – 100 mg/L – for at least 3 hours. The use of cross connection control and backflow prevention must be used to ensure the high chlorine concentration does not affect the distribution system.
   
d. Spray method: involves a 30-minute exposure to free chlorine at not less than 200 mg/L. Refer to chlorination method 2 in AWWA Standard C652 – Disinfection of Water Storage Facilities.

The slug method may be preferable as it requires reduced contact time. However, alternative methods (tablet method, continuous feed method, or spray disinfection) are available. Evaluate the scene and select the best method for disinfection based on site conditions, length and diameter of the main, type of joints present, available materials and equipment, type of break and associated risk for microbiological contamination. If highly chlorinated water is likely to impact fish or plant life or other downstream users), dechlorination must be performed to neutralize the remaining chlorine residual prior to discharge. If dechlorination is necessary, follow the procedures outlined in AWWA Standard C655 – Field Dechlorination.

6. Target a unidirectional flush towards the water main break. Open the necessary hydrants to complete the flush. **Flush with potable water at a velocity of 3.0 feet per second (fps) in the pipe for a minimum of three pipe volumes to remove debris and verify that the discharge is visually clear.**

7. CWD will check for typical system chlorine residual in the main using a field chlorine test kit and flush the pipe section until typical system residuals are detected (i.e., to at least 90% of ambient or pre-break levels and not more than 4.0 mg/L as required by State and Federal regulations). Collect samples from the immediate and surrounding areas around the repair site.

8. For high risk repairs (Types 3 and 4), CWD will notify affected customers about the repair, schedule, and concerns, as well as instructing customers to flush their home plumbing after repairs.
are completed. If contamination was likely to occur, CWD will issue a precautionary boil water notice. In the event that a boil water advisory is needed, the Wholesale/Retail Supervisor should immediately contact the appropriate staff at the DEC to notify them of the situation and to coordinate the public notification.

9. For medium risk repairs (Type 2) where a full pipe section was required and high risk repairs (Types 3 and 4), conduct coliform sampling in accordance with AWWA Standard C651. For Type 2 and some Type 3 breaks, the main may be returned to service prior to the completion of the bacteriological results. For Type 4 results, wait until sample results are received and show the absence of coliforms. In the event that coliform organisms are detected, repeat the flushing and resample for coliforms. If the confirmation coliform sample also shows the presence of coliforms, repeat disinfection using the continuous-feed or slug method until no coliform organisms are present. For any positive coliform results, the Wholesale/Retail Supervisor should immediately notify the DEC and follow any required procedures.

10. Flush hydrants, if needed, to remove any debris.

11. Return the main to service by opening any closed valves, using a sequence that avoids low or negative pressures.

12. The Contractor will backfill and compact pipe bedding per applicable AWWA pipe installation standard.

13. The contractor will repair ground surface to at least original conditions.

6 DATA RECORDING AND MANAGEMENT

Following a main repair CWD personnel will record the following information.

- Date and approximate type of repair
- If break, nature of break (i.e., circumferential, longitudinal, both, shear, hole, split, blowout, joint, sleeve, other)
- Apparent cause of break (i.e., water hammer, defective pipe, corrosion, deterioration, improper bedding, operating pressure, temperature, differential settlement, improper installation, other)
- Type of break/repair (based on Table 1 above)
- Location and field conditions (paved/unpaved, traffic conditions, type of soil, side of street, weather conditions,)
- Pipe data (type of main, class, length, diameter, bedding, backfill, compaction)
- Type of repair (clamp, sleeve, etc.)
- Repair materials used
- Potential contamination issues (e.g., muddy trench water flowing into broken pipe, leaking sewer pipe in trench, catastrophic pipe failure where pipe is open)
- Problems encountered
- Water quality test results
- Field observations, including inoperable valves or hydrants or incorrect locations of mains, valves, hydrants, underground utility locations, service connections, etc.
• Estimate the cost associated with the repair (materials, manpower, contractor equipment and time onsite).

The Wholesale/Retail Supervisor shall assign work orders for any follow-up items, such as valve replacements.

7 REFERENCES

AWWA. (2015). C651-14 Disinfecting Water Mains. AWWA
