

New London-Springfield Water System Precinct

**GENERAL SPECIFICATIONS  
FOR  
INSTALLATION OF WATER  
MAINS AND APPURTENANCES**



New London-Springfield Water System Precinct  
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# Table of Contents

**Section 1 – Earthwork for Water Mains and Services**

**Section 2 – Water Mains and Services**

**Section 3 – Pavement Repairs**

**Figures: Trench Detail**

**Thrust Block Detail**

**Hydrant and Bollard Details**

**Service Connection Detail**

**Chlorine Injection Tap and/or Manual Air Release Detail**

**Insulation Detail for Culvert Crossings**

**SECTION 1**  
**EARTHWORK FOR WATER MAINS AND SERVICES**

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:

1. All excavation shall be classified as earth or ledge/rock.
2. Removing and disposing of ledge and rock required for the installation of pipes and/or structures.
3. Performing a pre-blast survey on all structures in the blasting area prior to the commencement of blasting or breaking by use of a hoe-ram.
4. Depending upon the location of the work, the work may also have to meet the requirements of the Town of New London, Town of Springfield, and/or NHDOT. Where conflicts exist between the different requirements, the most stringent requirement shall govern.

B. Definitions:

1. Unsuitable Material: Loam or topsoil, peat, silty soils, clayey soils, muck, rock or piece of ledge over 6" in maximum dimension and less than 2 cubic yards, concrete or other rubble, asphalt, broken pipe, debris or trash, or, in the opinion of the Precinct, Town, and/or NHDOT, any other material that does not provide adequate support for structures or pipelines or does not allow for adequate compaction of excavations.
2. Ledge: "Ledge" shall be defined as any natural compound, natural mixture, and chemical element (e.g. solid piece of rubble concrete or masonry) required to be excavated that, in the opinion of the Precinct, Town, and/or NHDOT, can be removed from its existing position and state only by blasting, drilling and blasting, wedging, drilling and wedging, wedging, hoe-ramming, and breaking with power hand tools, or by extending the use of an approved excavating machine beyond normal and design wear and tear.
3. Rock: "Rock" shall be defined as single pieces of rock that are greater than two cubic yards. No boulder, ledge, slab, or other single piece of excavated material less than two cubic yards in total volume shall be considered to be rock unless, in the opinion of the Precinct, Town, and/or NHDOT, it must be removed from its existing position by one of the methods mentioned above.

1.2 REFERENCE STANDARDS

- A. Sieve Analysis of Fine and Coarse Aggregates: ASTM C136
- B. Sampling Aggregates: ASTM D75
- C. Moisture Density Relations of Soils (Modified Proctor): ASTM D1557
- D. Density of Soil In-Place by Nuclear Methods: ASTM D2922
- E. State of New Hampshire Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction (latest edition)
- F. Town of New London road specifications

- G. Town of Springfield road specifications
- H. Manual of Accident Prevention issued by the Associated General Contractor’s of America, Inc.
- I. United States Bureau of Mines

1.3 QUALITY ASSURANCE

A. Granular Materials:

1. The Contractor shall obtain and pay for all services of a geotechnical testing firm to perform the necessary soil and compaction tests. The independent soils laboratory shall be approved by the Precinct, Town, and/or NHDOT prior to testing.
2. The Contractor shall make necessary arrangements to allow compaction testing to be performed at a time, place and elevation determined by the Precinct, Town, and/or NHDOT.
3. Pre-placement testing:
  - a. The Contractor shall take one sample of each material proposed to be used on the project. The samples shall be taken in the presence of the Precinct/Town and in accordance with ASTM D75.
  - b. Select and Borrow Materials: Sieve and modified proctor density tests shall be performed on all select and borrow material in accordance with the following schedule and in accordance with ASTM C136 and ASTM D1557 Method “B”:
    - 1) Before any materials are brought to the site.
    - 2) One after every 5,000 cubic yards has been brought to the site.
    - 3) Whenever the source changes.
  - c. The result shall be submitted to the Precinct, Town, and/or NHDOT for approval prior to placement.
4. Post-placement testing:
  - a. The trench and/or excavation shall be prepared using the normal backfill technique employed by the Contractor. No special or additional preparation will be allowed.
  - b. Determine in-place density in accordance with ASTM D2922 or by other methods as approved by the Precinct, Town, and/or NHDOT.
  - c. Compaction tests shall be made in accordance with the following table:

Material	Testing Frequency	Percent Compaction
<b>In Trenches:</b>		
Native material or borrow material	From the blanket material to the underside of the gravel or loam. See Note #1 Below	95% 12” lifts
Gravels or loam	See requirements for Under paved Areas and Grassed Areas for requirements below	See below

Under Paved Areas:			
	Native material or borrow material	One for every 10,000 s.f. of surface area for every 2 lifts of material placed.	95% 12" lifts
	Gravel	One for every 10,000 s.f. of surface area for every lift of material placed.	95% 6" lifts
	Crushed Gravel	One for every 10,000 s.f. of surface area for every lift of material placed.	95% 6" lifts
Under Grassed or Landscaped Areas			
	Native material or borrow material	One for every 20,000 s.f. of surface area for every 2 lifts of material placed.	90% 12" lifts

Notes:

1. *The Contractor shall propose a method for backfill at the preconstruction meeting (including a description of the method to be used around manhole, catch basins, and other structures), which shall be confirmed in the field when work is initiated. This proposed method will be tested and modified as required to meet the compaction requirements noted in the above table. The first day of testing shall include testing of a minimum of 4 lifts. This compaction method shall be used until the soil characteristics have changed in the opinion of the Precinct, Town, and/or NHDOT. At that point new compaction tests shall be performed to determine if the requirements are still being met. If they are, the method shall continue, if they are not, the method shall be modified until the requirements are met. Even if the soil characteristics have not changed, confirmatory compaction tests shall be taken every 3 weeks. Confirmatory testing shall include testing of a minimum of 2 lifts. The Precinct, Town, and/or NHDOT shall determine the location of all tests.*

- d. Should compaction tests fail to meet the specified densities, the Contractor shall modify backfill methods as necessary to obtain passing results. The modified method shall be used from that point on. If tests continue to fail, additional testing above what is noted above will be required.

B. Blasting:

1. Pre-blast Survey:

- a. The Contractor shall submit a plan at the preconstruction conference as to the intended pre-blast survey. The plan shall sufficient detail to inform the Owner, Precinct, Town, and NHDOT as to the scope of the survey.
- b. The Contractor shall hire a subcontractor having no affiliation (other than working relationship) with the Contractor or Blasting Subcontractor to perform the pre-blast surveys.

- c. The surveys shall include, but not be limited to, examination of the interior and exterior of all public and private buildings, structures, and water supplies.
  - d. If entry into building is not allowed by the property owner, then a survey refusal form must be signed by that individual.
  - e. The surveys shall have sufficient detail as to identify pre-blast conditions and meet the requirements of the Blasting Subcontractors. The survey shall include, but not be limited to, photographs and/or video of all preexisting damage. The pictures and video shall clearly define the existing conditions.
  - f. The Owner, Precinct, Town, and NHDOT shall not be held responsible for the completeness and accuracy of the survey. The Contractor shall be responsible for all damage to properties whether they were surveyed or not.
  - g. Blasting shall not commence until the Owner, Precinct, Town, and NHDOT has received written certification that the pre-blast surveys have been completed.
2. Seismographic monitoring shall be used on all blasts.

#### 1.4 SUBMITTALS

##### A. Granular Materials:

1. The Contractor shall submit at the preconstruction meeting his proposed compaction technique which shall include compaction around field structures (i.e manholes, catch basins, etc.) and valve boxes.
2. The Contractor shall submit sieve and proctor curves to the Precinct, Town, and/or NHDOT for approval 7 days before any material is brought to the site.
3. The Contractor shall submit compaction test result sheets to the Precinct, Town, and/or NHDOT no later than 7 days after the test were performed.
4. The Contractor shall submit a copy of the intended pre-blast survey plan at the preconstruction conference.

##### B. Blasting:

1. The Contractor shall submit to the Precinct a certification that the pre-blast surveys and videos have been completed (along with any survey refusal forms) 2 days prior to the commencement of blasting or hoe-ramming operations.
2. If damage claims arise due to the blasting operations, the Contractor shall submit a copy of the post-blast survey to the Precinct within 10 days from notification of said damage.
3. At the end of each working day, the Contractor shall submit to the Precinct the daily blasting log.
4. Blasting Logs:
  - a. The Contractor shall provide the Precinct with a blasting log for all blasting work. The blasting log shall contain the following information:
    - 1) Location.
    - 2) Time and date.
    - 3) Location of explosives.

- 4) Amount of type of explosives used at each location.
- 5) Seismic reading.
- 6) The names of persons, companies, corporations or public utilities that own, lease or occupy property or structures in proximity to the site of the work and were contacted about the Contractor's intention to use explosives.

## 1.5 JOB CONDITIONS

### A. Utilities:

1. The information about known utilities was collected from the owning agency of the utility and may or may not have been supplemented by additional field survey or investigation.
2. The approximate locations of known buried and overhead utilities are shown on the Drawings. No guarantee is made as to the accuracy or correctness of the locations shown and to the completeness of the information given. The Contractor is responsible for confirming the location of utilities in the field prior to commencement of work.
3. Discontinue excavation by machinery when the excavation approaches pipes, conduits, or other underground structures of which the approximate locations are known. Use manual excavation methods to locate the utilities.

### B. Existing Structures:

1. Perform excavation in such a manner that will prevent any possibility of undermining or disturbing existing structures, utilities, and work previously completed under this Contract.
2. Where existing buildings and other structures are in close proximity to the proposed construction, exercise extreme caution and utilize sheeting, bracing, and all other precautionary measures that may be required.

### C. Repairing Damage: Repair all damage to existing utilities, structures, grassed, or paved areas which results from construction operations, to the complete satisfaction of the Owner, the Precinct, the utility company and the property owner.

### D. Unless authorized otherwise in writing by the Precinct, Town, and/or NHDOT, all roadways shall be opened to full width two-lane traffic at the end of each day.

### E. Erect a fence around all structure excavations to prevent the entry of unauthorized individuals.

### F. The Contractor shall obtain permission from the authority having jurisdiction on the street, road, or highway prior to commencement of blasting.

### G. Seismographic monitoring shall be used on all blasts.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Unsuitable Material:

1. If, in the opinion of the Precinct/Town, the material encountered above the indicated grade as shown on the Drawings for excavation is unsuitable the Contractor shall remove the material to the widths and depths as directed by the Precinct/Town. Replace this material with Precinct/Town-approved material.
2. If, in the opinion of the Precinct, the material encountered at or below the indicated invert or grade shown on the Drawings for excavation is unstable (as determined by the Precinct), the Contractor shall remove the material. Replace this material with thoroughly compacted bankrun gravel or crushed stone bedding material or as directed by the Precinct.
3. Materials made unsuitable by Contractor's construction methods shall be suitably dried for reuse or removed from the site and replaced with suitable materials.
4. Materials determined unsuitable only due to moisture content shall be aerated and stockpiled and may be used as suitable backfill with the approval of the Precinct/Town.

B. Disposal of Material:

1. Disposal of material shall be the responsibility of the Contractor.
2. Dispose of material in accordance with applicable environmental law.
3. The property owners where the material is disposed of shall sign a release form indemnifying all the Precinct, Town, and Contractor from any liability of disposal of the said material.

C. Excavated Material Suitable for Reuse:

1. Material shall be friable natural material comprised of gravels, sand, silts, or clayey gravel and sands.
2. Material shall be free from peat, muck, other organic matter, frozen material, ice, and/or snow.
3. Material shall be free from stones, ledge/rock fragments, and asphalt over 8" in the largest dimension.
4. The material shall not have a moisture content over 2% of its optimum moisture content.

D. Select and Borrow Materials:

1. Crushed Stone (Bedding Material):
  - a. Crushed stone shall be well graded in size from 1/4 inch to 3/4 inch and conform to ASTM C33 stone size No. 67.
  - b. Clean, hard, and durable particles or fragments.



c. Sieve Analysis:

<u>Sieve Designation</u>	<u>% Passing by Weight Square Opening</u>
1"	100
3/4"	90 - 100
3/8"	20 - 55
No. 4	0 - 10
No. 8	0 - 5
No. 200	1% Max.

2. Sand (Sand Blanket or Bedding):

- a. Clean, hard and durable particles or fragments.
- b. Sieve Analysis:

<u>Sieve Designation</u>	<u>% Passing by Weight Square Opening</u>
3/8"	100
No. 4	95 - 100
No. 16	50 - 85
No. 50	10 - 30
No. 100	2 - 10

3. Crushed Gravel or Structural Fill (Crushed Gravel Base Course):

- a. Well graded granular crushed gravel material for use as a crushed gravel base.
- b. Material shall be hard and durable, free from frost, organic material, loam, debris and other unsuitable material.
- c. At least 50% of material retained on the 1 inch sieve shall have a fractured face.
- d. Sieve Analysis:

<u>Sieve Designation</u>	<u>% Passing by Weight Square Opening</u>
3"	100
2"	95 - 100
1"	55 - 85
No. 4	27 - 52
No. 200	0 - 12 (of the sand portion)

4. Bank Run Gravel or Granular Gravel Borrow (Gravel Subbase Course):
  - a. Well graded granular bank-run gravel material for use as gravel subbase.
  - b. Material shall be hard and durable, free from frost, organic material, loam, debris and other unsuitable material. Shall not have excess amounts of clay or silt and shall be so sized that the material can be laid out and graded in smooth uniform 8" lifts.
  - c. Sieve Analysis:

<u>Sieve Designation</u>	<u>% Passing by Weight Square Opening</u>
6"	100
No. 4	25 - 70
No. 200	0 - 12 (of the sand portion)

5. Common Borrow (i.e. Sand):
  - a. Consist of earth suitable for embankment construction; free from frozen material, perishable rubbish, peat and other unsuitable material.
  - b. The moisture content shall be sufficient to provide the required compaction and stable embankment. In no case shall the moisture content exceed 4 percent above optimum.
  - c. The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D.
  - d. 100% shall pass the 3" sieve and 70-100% shall pass the No. 4 sieve.
6. Gravel Borrow (i.e. Gravel):
  - a. Well graded granular material suitable for placement in authorized excavations below the bottom of the bedding layer to replace deficient excavated material, for road construction, pipeline construction, and other designate uses.
  - b. 95-100% shall pass the 3" sieve and 25-70% shall pass the No. 4 sieve.

### PART 3 -- EXECUTION

#### 3.1 PERFORMANCE

- A. General Requirements:
  1. Contractor shall obtain all necessary trench permits.
  2. Contractor shall contact Dig-Safe and all other non-member (i.e. of Dig-Safe) companies before work commences.
  3. The Contractor must inspect the site prior to work and assume all responsibility as to the nature and behavior of the soil and of groundwater which may be encountered in the excavation.
  4. The Contractor shall use extreme care while working near existing trees, shrubs, fences, walks, utilities, etc. Any damage that occurs shall be repaired to the satisfaction of the owner of the damage property.

B. Backfilling:

1. Provide and place all necessary backfill material.
2. Do not allow large masses of backfill to be dropped into the excavation, as from a grab bucket, in such a manner that may endanger pipes and structures.
3. Place material in a manner that will prevent stones and lumps from becoming nested.
4. Completely fill all voids between stones with fine material.
5. Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.
6. Place backfill material evenly in the trench in an effort to maximize compaction.
7. Do not backfill with, or on, frozen materials.
8. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.
9. Do not mechanically or hand compact material that is, in the opinion of the Precinct, Town, and/or NHDOT, too wet. Fill material that is too wet to be properly placed back in the trench its current state shall be dried (disced, harrowed, etc.) to within 2% of optimum moisture content. This material shall not be classified as unsuitable material and ineligible for payment as such.
10. Material made unsuitable by the Contractor's construction methods shall be replaced with Gravel Borrow.
11. Fill that is too dry shall be uniformly watered. The water shall be placed over a loose lift to allow for the water to migrate through the entire lift before compaction.
12. Do not continue backfilling until the previously placed and/or new materials have dried sufficiently to permit proper compaction.
13. When original excavated material is, in the opinion of the Precinct, Town, and/or NHDOT, unsuitable, use only approved gravel borrow for backfilling.
14. Backfill excavation/trench as early as possible to allow for the maximum time for natural settlement.
15. The Contractor shall remove excess fill material from the site.
16. Perform work such that the ledge removal operations do not interfere with existing structures or utilities and other work being performed under this Contract.
17. When rock or ledge is encountered, the Contractor shall notify the Precinct/Town to witness pre-blast elevations.

C. Backfilling Around Trench Obstacles:

1. Material must be properly compacted around trench obstacles (i.e. manholes, catch basin, valve boxes, etc.). Uncompacted fill will not be allowed to be placed around these obstacles.
2. The Contractor shall provide adequate excavation supports to allow for a safe work environment in which to properly compact the excavation/trench.
3. The Contractor shall use methods that compensate for the space limitations in the immediate area around these obstacles.

D. Backfilling in Paved Areas:

1. Backfill trenches in streets and other paved areas by maintaining a moisture content within 2% of optimum.
2. In an effort to allow the road to heave uniformly, backfill material that was removed from the top portion of the trench shall be replaced back into the top of the trench. Similarly, the material removed from the middle of the trench shall be replaced back into the middle of the trench. Existing material removed from the bottom of the trench (i.e. where the pipe box is located) shall be stockpiled for later use.
3. Backfill in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value for paving immediately after backfilling is completed.
4. Where required, place excavated material, that is acceptable to the Precinct/Town for surfacing or pavement subbase, at the top of the backfill to the depths as needed to adequately support pavement.

E. Backfilling Trenches in Nonpaved Areas:

1. Grade the ground to a reasonable uniformity.
2. Leave the mounding over the trenches in a uniform and neat condition, satisfactory to the Precinct.

F. Bedding & Backfilling of Pipelines:

1. Install pipe bedding and cushion and primary backfill in accordance with the requirements noted herein, in the specific pipe Specification Section, and on the Drawings.
2. Deposit and thoroughly compact the remainder of the backfill as noted herein.

G. Placing and Compacting Backfill:

1. Water Jetting: Shall not be allowed without the approval of the Precinct, Town, and/or NHDOT.
2. Puddling: Shall not be allowed without the approval of the Precinct, Town, and/or NHDOT.
3. Tamping:
  - a. Deposit and spread the backfill material in uniform parallel layers not exceeding the lift thicknesses noted herein.
  - b. Tamp each layer as required to obtain a thoroughly compacted mass.
  - c. If necessary, furnish and use an adequate number of power driven tampers, each weighing at least 150 lbs.
4. Rolling:
  - a. Compact material by rolling only when the width and depth of the excavation are sufficient to accommodate the rollers, dozers, mechanical tampers, or other similar powered equipment, as may prove to be acceptable, and when it can be performed without causing damage to pipes and structures installed in the excavation.
  - b. Deposit and spread the backfill material in uniform parallel layers not exceeding the lift thicknesses noted herein.
  - c. Roll each layer as required to obtain a thoroughly compacted mass.

5. Other placing and compacting methods may be employed only when approved by the Precinct, Town, and/or NHDOT.
- H. Improper Backfill:
1. When, in the opinion of the Precinct, Town, and/or NHDOT, excavation and trenches have been improperly backfilled, or if settlement occurs, the Contractor shall reopen the excavation to the depth required, as directed by the Precinct, Town, and/or NHDOT.
  2. Refill and compact the excavation or trench with suitable material and restore the surface to the required grade and condition.
  3. Excavation, backfilling, compacting work and testing performed to correct improper backfilling shall be performed.
- I. Tree Removal:
1. Designated trees shall be removed and satisfactorily disposed of.
  2. The Contractor shall use all means to protect trees that are designated to remain.
- J. Sheeting, Shoring and Bracing:
1. As trench excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the Local, State and OSHA safety standards.
- K. Dewatering:
1. All work under this section shall be done in accordance with all federal, state, and local regulations, laws, and rules which may apply and any individual permits that have been obtained for the project.
  2. The Contractor shall build, maintain, and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protection works needed to divert streamflow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, stream diversion must discharge into the same natural drainageway in which its headworks are located. Storm runoff from disturbed areas must discharge into a sedimentation pond prior to discharge into a natural drainageway.
  3. The discharge from pumping operations during dewatering operations shall be contained by a device so constructed as to prevent silt from spreading off-site.
  4. The Contractor shall provide an excavation dewatering system that will effectively lower the groundwater table to a minimum point 24 inches below the lowest point of the excavation prior to excavation to that elevation.
  5. The Contractor is responsible for developing the means and methods required to properly dewater the excavation. No addition payment or addition time will be granted for required modification to the dewatering system.
  6. The dewatering system shall in no way cause damage to or interfere with the work on this project.
  7. If the dewatering system threatens to damage structures or utilities, the Contractor shall immediately modify the system to eliminate the threat.

8. Dewatering shall be maintained around new structures until a time that damage to the structure will not occur due to the rising of the groundwater table. If damage occurs, the Contractor shall be required to rectify the damage, including removal and replacement of the damaged component.
  9. Prior to removal of all sediment control devices all retained silt or other materials shall be removed.
- L. Temporary Trench Surface:
1. The Contractor shall make all streets passable once the trench has been backfilled. Additional work shall be performed by the Contractor until the condition of the road is acceptable to the Precinct, Town, and/or NHDOT.
- M. Fencing:
1. If the end of the trench is allowed to be left open during non-working hours by the Precinct, Town, and/or NHDOT, the Contractor shall place fences to prevent entry of unauthorized personnel.
  2. Place fences around equipment and material to prevent damage, theft, and injury to individuals.

**END OF SECTION 1**

**SECTION 2**  
**WATER MAINS AND SERVICES**

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Furnish and install water pipe, valves, hydrants, and services as shown on the Precinct-approved drawings and as specified herein.
2. Testing.
3. Payment for the Precincts consultant to review the drawings if so desired by the Precinct.

1.2 REFERENCE STANDARDS

- A. Ductile iron fittings (standard fittings): ANSI A21.10/AWWA C110.
- B. Rubber gasket joints: ANSI A21.11/AWWA C111.
- C. Cement-mortar lining for water: ANSI A21.4/AWWA C104.
- D. Polyethylene encasement: ANSI/A21.5/AWWA C105
- E. Ductile iron pipe thickness: ANSI A21.50/AWWA C150.
- F. Ductile iron pipe, centrifugally cast: ANSI A21.51/AWWA C151.
- G. Ductile iron fittings (compact fittings): ANSI 21.53/AWWA C153
- H. Pipe flanges and fittings: ANSI B16-1, ANSI A-21.12.
- I. Glands: ASTM A536-80.
- J. Bolts: COR-TEN ASTM A588.
- K. Seamless copper water tube: ASTM B88.
- L. Polyethylene Encasement: ASTM D1248
- M. Gaskets: ASTM F477
- N. Dry-Barrel Fire Hydrants: AWWA C502
- O. Resilient-Seated Gate Valves: AWWA C509
- P. Fusion Bonded Epoxy: AWWA C550
- Q. Pressure Testing: AWWA C600
- R. Disinfection: AWWA C651
- S. ANSI/AWWA C800.
- T. Polyethylene Tubing: AWWA C901
- U. Factory Mutual Research Corporation and Underwriters' Laboratories' UL246 Standard.

1.3 QUALITY ASSURANCE

- A. Provide all labor necessary for the Precinct to inspect pipe, fittings, gaskets, and other materials.
- B. The Contractor shall carefully inspect all materials at the time of delivery and just prior to installation.

- C. The Contractor shall carefully inspect all pipe and fittings for:
  - 1. Defects and damage.
  - 2. Deviations beyond allowable tolerances for joint dimensions.
  - 3. Removal of debris and foreign matter.
- D. The Contractor shall examine areas and structures to receive piping for:
  - 1. Defects, such as weak structural components that adversely affect the execution and quality of work.
  - 2. Deviations beyond allowable tolerances for pipe clearances.
- E. All materials and methods not meeting the requirements herein will be rejected.
- F. The Contractor shall immediately remove all rejected materials from the project site.
- G. Start work only when conditions are corrected to the satisfaction of the Precinct.

#### 1.4 SUBMITTALS

- A. Drawings:
  - 1. Submit two copies of the design drawings for review.
  - 2. No work shall be performed until the design drawings have been approved by the Precinct.
  - 3. The design shall include the following at a minimum:
    - a. At all intersection, a three-cluster valve configuration shall be used.
    - b. Hydrants spacing shall not be more than 500' unless approved by the Precinct and local Fire Department.
    - c. Shut-off valves on all branch line (service and fire).
- B. Shop drawings:
  - 1. Submit four copies of shop drawings to the Precinct. Three copies will be returned to the Contractor.
  - 2. Delivery of material shall not be made until the shop drawings have been approved.
  - 3. If requested by the Precinct, submit manufacturer's "Certification of Conformance" that pipe and pipe fittings meet or exceed the requirements of these Specifications.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Exercise care during loading, transporting, unloading, and handling to prevent damage of any nature to interior and exterior surfaces of pipes and fittings.
- B. Pipe shall never be dropped or transported on trucks without being placed on wooden blocks.
- C. Assure that materials are kept clean.
- D. Do not store materials directly on the ground.
- E. Store pipe on level ground free of foreign objects that could damage the pipe.
- F. Pipe shall only be stored one tier high.
- G. Exercise extra care when handling cement lined pipe and fittings because damage to the lining will render it unfit for use. All pipe that has damaged lining shall be replaced with new pipe at no cost to the Owner.
- H. Use only manufacture-approved slings and straps to move the pipe.
- I. The pipe shall not be dragged.



**PART 2 -- PRODUCTS**

**2.1 MATERIALS**

**A. Ductile Iron Pipe:**

1. All ductile iron pipes shall conform to the latest AWWA specification C151 and meet the following requirements:
  - a. Shall be Class 52 with push-on joints.
  - b. Shall have cement lining of double thickness.
  - c. Shall have bituminous exterior coating.
  - d. Shall have the pressure, class, and weight conspicuously marked on the exterior of the pipe.
  - e. Shall be furnished in uniform lengths of either 18 or 20 feet.
2. Two brass wedges shall be furnished at each push-on joint.
3. Acceptable manufactures:
  - a. US Pipe
  - b. Griffin

**B. Pipe Lubricant:**

1. Use only lubricants suitable for the type of pipe and application.
2. For potable water pipe use only lubricants clearly marked “For Use with Potable Water”.

**C. Marking Tape:**

1. Shall be coded in accordance with the NPWA Standards.
2. Shall be indelibly marked indicating the type of utility it is placed over.
3. Shall be three (3) inches wide Terra Tape Sentry Line 1350 (Detachable) by Reef Industries, Houston, TX, or approved equal.

**D. Polyethylene Encasement:**

1. All polyethylene encasement shall conform to the latest requirements of ASTM D1248 and meet the following requirements:
  - a. Shall have a minimum tensile strength of 1,200 psi.
  - b. Shall have a minimum elongation of 300%.
  - c. Shall have a minimum dielectric strength of 800 v/mil thickness.
  - d. Shall have a minimum nominal thickness of 8 mils with a minus tolerance of not more than 10%.
  - e. Shall have a tube width as noted below:

Nominal Pipe Size (inches)	Polyethylene Flat Tube Width (inches)
4	16
6	20
8	24
10	27
12	30
16	34

**E. Fittings:**

1. All fittings shall conform to the latest ANSI A21.10/AWWA C110 (standard fittings) or ANSI 21.53/AWWA C153 (compact fittings) and meet the following requirements:
  - a. Shall be constructed from ductile iron.
  - b. Shall have a 350 psi pressure rating.
  - c. Shall have the same interior cement lining, and same exterior coating as the pipe.
2. Acceptable manufactures:
  - a. Tyler
  - b. US Pipe
3. Couplings:
  - a. All couplings shall be ductile iron or 14 mil fusion-bonded epoxy coated steel type coupling with two stainless steel bolts.
  - b. Have a working pressure rating of 260 psi
  - c. Acceptable manufacturers:
    - 1) Hymax 2000
    - 2) Romac – Macro
4. Glands: All fittings shall be furnished with retainer type glands. Glands shall be made of ductile iron conforming to ASTM A536-80. Joints and gaskets shall conform to ANSI A21.11/AWWA C111.
  - a. Acceptable manufactures:
    - 1) Megalug as manufactured by EBAA Iron Sales, Inc.
    - 2) Wedge Action as manufactured by Uni-Flange.
5. Thrust Blocks: All fittings (except couplings) shall be provided with a cast-in-place concrete thrust block. The size of the thrust block shall be as noted in the typical detail attached. Precast concrete thrust blocks are not acceptable without prior written approval from the Precinct.
6. Treaded rod shall be used where deemed appropriate by the Precinct.
7. All rods and bolts shall be stainless steel.

**F. Gate Valves:**

1. All gate valves shall conform to the latest AWWA specification C509 and meet the following requirements:
  - a. Iron body bronze mounted (IBBM), coated inside and out with fusion bonded epoxy (AWWA C550). If a ductile iron body is provided, the body thickness shall meet the requirements of AWWA C153.
  - b. Shall have a non rising stem (NRS).
  - c. Shall have a resilient seat gate.
  - d. Shall have mechanical joints except where a tapping sleeve is used.
  - e. Shall have a working pressure of 250 psi.
  - f. Shall have a 2-inch square operating nut securely fastened to shaft.
  - g. Stem Sealing:
    - 1) Rust-proofed bolting.
    - 2) "O" ring design.
    - 3) Capable of replacing under pressure with valve open.

- h. Arrow showing direction of opening plainly cast on valve bonnet.
- i. Valve operation: **Open LEFT**.
- 2. Acceptable manufacturers:
  - a. American Flow Control – AFC-2500
  - b. Mueller P-2360
- 3. When tapping sleeves are used, the sleeve shall be stainless steel.

**G. Valve Boxes:**

- 1. All valve boxes shall meet the following requirements:
  - a. Boxes shall be heavy-pattern cast iron, slide-adjustable type, thoroughly coated with bitumastic paint, and have a diameter of not less than 5-1/4”.
  - b. The upper section shall have a top flange that would be integrated into the pavement to prevent settlement.
  - c. The lower section shall have a belled base to totally enclose the valve operating nut.
  - d. Middle (or extension) sections shall be bell and spigot type to maintain overlap of sections to prevent soil from entering the box.
  - e. All box sections shall be either constructed from cast or ductile iron and the cover shall have the word "WATER" cast in it.
- 2. Acceptable Manufacturers:
  - a. Tyler
  - b. Bibby Ste-Croix
- 3. The top section of the box shall be set in a 12” x 12” x 6” bed of 4,000 psi concrete.

**H. Fire Hydrants:**

- 1. All fire hydrants shall conform to the latest AWWA specification C502 and meet the following requirements:
  - a. Shall be dry barrel-type with a 5-1/4 inch minimum Teflon-coated valve.
  - b. Shall have two (2) 2-1/2 inch hose connections and one (1) 4-1/2 inch pumper connection that meet the following requirements.
    - 1) 2-1/2 inch outlets: 60 degree V threads, 7-1/2 threads to the inch, external threads 3-1/16 inches, O.D. National Standard threads.
    - 2) 4-1/2 inch outlet: 4 threads to the inch, external threads 5-3/4 inches, O.D. National Standard threads.
  - c. Shall be capable of withstanding 200 psi working pressure and 400 psi hydrostatic test pressure.
  - d. Shall have bronze working parts and **open LEFT**.
  - e. Shall have a five-sided operating nut, 1 1/2 inch point to flat.
  - f. Shall be designed with a standpipe breaking ring or breakable sections.
  - g. Caps shall be attached to hydrant body by chains.
  - h. Hydrants shall be painted RED.
  - i. All drain holes shall be **PLUGGED**.
  - j. Hydrant extensions shall be provided to bring the hydrant to the proper grade. Hydrant extension shall be manufactured by the same manufacturer as the hydrant.

2. Acceptable Manufacturers:
  - a. Mueller Super Centurion 250
  - b. American Darling B-62-B
3. Hydrants shall comply with Factory Mutual Research Corporation and Underwriters' Laboratories UL246 Standard.
4. Bollards shall be furnished adjacent to hydrants as determined by the Precinct.

**I. Corporation Stops:**

1. All corporation stops shall meet the following requirements:
  - a. Shall be constructed of brass (85-5-5-5).
  - b. Shall be ball valve-type with a PTFE-coated brass ball.
  - c. Shall have a blow-out proof stem design.
  - d. Shall have a 300 psi rating.
  - e. Shall have a compression pack joint (CPPJ) outlet for CTS O.D.
  - f. Shall have AWWA (cc) Tapered Pipe Threads inlet.
2. Acceptable Manufacturers:
  - a. Mueller
  - b. Ford
  - c. McDonald

**J. Service Saddles:**

1. All service saddles shall meet the following requirements:
  - a. The body shall be ductile iron with a fusion bonded epoxy coating (10 mils min.)
  - b. The straps shall be 304 stainless steel wrap-around-type with a double strap.
  - c. The gasket shall be NBR compound.
  - d. The bolts, washers and nuts shall be heavy hex constructed of type 304 (18-8) stainless steel.
  - e. The threads shall be AWWA (cc) Tapered Pipe Threads.
2. Acceptable Manufacturers:
  - a. Smith-Blair
  - b. Dresser
  - c. Romac

**K. Copper Service Pipe:**

1. All copper pipe shall conform to the latest AWWA specification B88 and shall meet the following requirements:
  - a. The minimum size shall be 3/4-inch.
  - b. All pipe shall be Type K soft annealed copper.
  - c. All copper pipe shall have the manufacturers trademark and type stamped on the pipe at continuous interval not exceeding 2'.
2. Copper pipe shall be used from the corporation to the curb stop; however, 200 psi polythene piping may be used between the curb stop and the house. If polythene tubing is used it shall conform to the latest AWWA specification C901 and have the manufacturers trademark and type stamped on the pipe at continuous interval not exceeding 2'.

**L. Curb Stops:**

1. All curb stops shall meet the following requirements:
  - a. Shall be constructed of brass.
  - b. Shall be ball valve-type with a PTFE coated brass ball and double O-ring seal.
  - c. Shall have a blow-out proof stem design.
  - d. Shall have a 300 psi rating.
  - e. Shall have a compression pack joint (CPPJ) ends for CTS O.D.
  - f. Shall be non-draining.
  - g. Curb stops shall **open LEFT**.
2. Acceptable Manufacturers:
  - a. Mueller
  - b. Ford
  - c. McDonald

**M. Curb Boxes:**

1. All curb stops shall meet the following requirements:
  - a. Shall be Eric-style.
  - b. Shall be cast iron with a base that fits over the curb stops to prevent entry of soil.
  - c. The upper section shall be adjustable and shall be furnished to meet the depth of burial as shown on the plan.
  - d. The operating rod shall be ½” diameter by 36” long stainless steel.
  - e. The cover shall be plug-type with rope threads.
2. Acceptable Manufacturers:
  - a. Mueller
  - b. Bibby Ste-Croix

**N. Adaptor Coupling for Copper and Polyethylene Pipe:**

1. All adaptor couplings shall meet the following requirements:
  - a. Shall be constructed of brass.
  - b. Shall have a 300 psi rating.
  - c. Shall have a compression pack joint (CPPJ) ends for CTS O.D.
  - d. Curb stops shall **open LEFT**.
2. Acceptable Manufacturers:
  - a. Mueller
  - b. Ford
  - c. McDonald

**O. Specialty Components:**

1. All specialty components shall be furnished as chosen by the Precinct.

**2.2 SUBSTITUTIONS**

- A. Products of equal or better quality, function and performance may be proposed for substitution by submitting appropriate back data. Sufficient data shall be provided to make a comparison.
- B. Even if sufficient data is provided, the Precinct has the option to reject any product proposed for substitution.

- C. If the Precinct wants to have their consultant review product proposed for substitution, the applicant/contractor must pay for the consultant's services.

### PART 3 -- EXECUTION

#### 3.1 INSTALLATION

##### A. General:

1. Install all pipe and fittings in strict accordance with the manufacturer's instructions and recommendations and as instructed by the Precinct.
2. Install all pipes and fittings in accordance with the lines and grades shown on the Drawings and as required for a complete installation.
3. Ductile iron pipe and fittings are furnished with a cement lining that is brittle; therefore, the Contractor shall take all precautions not to damage the lining during handling and installation. All pipe that has damaged lining shall be replaced with new pipe.

##### B. **Ductile Iron Pipe and Fittings:**

1. Installation and Trenches:
  - a. Firmly support the pipe and fittings on bedding material.
    - 1) Where, in the opinion of the Engineer or Precinct, the subgrade material is unsuitable to support the pipe, over-excavate the unsuitable material and replace the same with suitable gravel or granular borrow.
    - 2) If the subgrade material encountered consists of saturated clays or silts, the Engineer or Precinct may direct the installation of the bedding material and pipe inside a construction fabric wrap.
  - b. Do not permanently support the pipe or fittings on saddles, blocking stones, wooden blocks, or any material which does not provide firm and uniform bearing along the outside length of the pipe.
  - c. Only use manufacturer-approved cutting tools to cut the pipes.
  - d. Thoroughly compact the material under the pipe to obtain a substantial unyielding bed shaped to fully support the pipe.
  - e. Excavate suitable holes for the joints so that only the barrel of the pipe receives bearing pressure from the supporting material after placement.
  - f. When cutting of pipe is required, the Contractor shall make a square cut in the pipe using an approved cutting tool that will not damage the pipe lining. After the cut has been made, the Contractor shall grind a bevel around the pipe with a hand-held mechanical grinder.
  - g. Lay each pipe length so it forms a close joint with the adjoining length and bring inverts to the required grade.
  - h. During installation of the pipe, the Contractor shall make available to the Precinct, rodman to assist in checking grades.
  - i. Set the pipe true to line and grade.
  - j. Do not drive the pipe down to grade by striking it with a shovel handle, timber, rammer or any other unyielding object.

- k. Make all pipe joints watertight with no sand, silt, clay or soil of any description entering the pipeline at the joints.
  - l. Immediately after making a joint, fill the hole around the joint with bedding material, and compact.
  - m. When each pipe length has been properly set, place and compact enough of the bedding material between the pipe and the sides of the trench to hold the pipe in correct alignment.
  - n. After filling the sides of the trench, place and lightly tamp bedding material to complete the bedding as shown on the Drawings.
  - o. Take all necessary precautions to prevent flotation of the pipe in the trench.
2. Temporary Plugs:
- a. When pipe installation work in trenches is not in progress, close open ends of the pipe with temporary watertight plugs.
  - b. If water is in the trench when work is resumed, do not remove plugs until all danger of water entering the pipe is eliminated.
  - c. Do not use the pipe lines as conductors for trench drainage during construction.
3. Assembling Joints:
- a. Push-on Joints:
    - 1) Insert the gasket into the groove of the bell.
    - 2) Uniformly apply a thin film of special lubricant over the inner surface of the gasket that will contact the spigot end of the pipe.
    - 3) Insert the chamfered end of the plain pipe into the gasket and push until it seats against the bottom of the socket.
    - 4) Insert serrated brass wedges at all joints to assure continuity. Use two wedges per joint for 2" through 12" diameter pipe and four wedges for pipes greater than 12" diameter. Each wedge shall be driven into the opening between the plain end and the bell end.
  - b. Mechanical Joints:
    - 1) Prior to installing a mechanical joint, adjust the laying length of previous pipes to ensure that the closest push-on joint is at least 18' on either side of the fitting. The Contractor shall relay pipe as required to meet this requirement.
    - 2) Thoroughly clean, with a wire brush, surfaces that will be in contact with the gaskets.
    - 3) Lubricate the gasket, bell, and spigot.
    - 4) Slip the retainer gland and gasket, in that order, over the spigot and insert the spigot into the bell until properly seated.
    - 5) Evenly seat the gasket in the bell at all points, center the spigot, and firmly press the retainer gland against the gasket.
    - 6) Insert the bolts, install the nuts finger tight, and progressively tighten diametrically opposite nuts uniformly around the joint to the proper tension with a torque wrench.

- 7) The correct range of torque (as indicated by a torque wrench) and the length of wrench (if not a torque wrench) shall not exceed:
    - i) Range of Torque: 60-90 Ft.-lbs.
    - ii) Length of Wrench: 10 inches.
  - 8) If effective joint sealing is not attained at the maximum torque specified above, disassemble, thoroughly clean, and reassemble the joint. Do not overstress the bolts to tighten a leaking joint.
  - 9) Once the retainer gland has been properly tightened, the retainer gland set screws shall be set. Hand-tighten all screws so that are in contact with the pipe and set diametrically opposite screw to the manufactured-specified torque.
  - 10) Retainer glands and thrust block shall be used on all joints.
  - 11) Place a sheet of roofing felt or plastic over all fittings and retainer glands prior to placement of the concrete. Install wooden forms to control the size of the thrust block. Place the concrete such that the bearing area of the concrete against undisturbed soil meets the minimum bearing areas as noted on the drawings.
- c. Couplings:
- 1) Prior to installation of couplings, the contractor shall determine to outside diameter of the pipe to make sure that the selected coupling gasket is adequately sized.
4. Pipe Deflection:
- a. Push-on and Mechanical Joints:
    - 1) The maximum permissible deflection of alignment at joints, in inches for 18 foot lengths:

Size of Pipe	Push-On	Mechanical
6	19	27
8	19	20
10	19	20
12	11	20
14	11	13.5
16	11	13.5

- 2) The maximum permissible deflection for other lengths shall be in proportion of such lengths to 18 feet.
  - b. Flexible Joints: The maximum deflection in any direction shall not exceed the manufacturer's instructions and recommendations.
5. Protection of Water Supplies:
- a. There shall be no physical connection between a public or private potable water supply system and a sewer.
  - b. Sewer shall be a minimum of 10' horizontally and 18" vertically unless shown otherwise on the drawings.



- c. Whenever sewers must cross water mains or the above-noted separations cannot be maintained, the sewer shall be constructed as follows (unless shown otherwise on the Drawings):
  - 1) Sewer pipe shall be class 52 ductile iron or PVC pressure rated pipe (DR-25 min. or SDR-32.5 min.) for a minimum distance of 9 feet each side of the crossing.
  - 2) Joints shall be mechanical type water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1-1/2 times working pressure for force mains and joints shall not be located within 9 feet of the crossing.

**C. Polyethylene Encasement:**

- 1. General:
  - a. Polyethylene encasement needs to be used where there are aggressive soils.
  - b. The polyethylene encasement shall prevent contact between the pipe and surrounding backfill and bedding material but is not intended to be a completely airtight and watertight enclosure. Overlaps shall be secured by the use of adhesive tape, plastic string, or any other material capable of holding the polyethylene in place until backfilling operations are completed.
- 2. Installation:
  - a. Cut polyethylene tube to a length approximately two (2) feet longer than the length of the pipe section. Slip the tube around the pipe, centering it to provide a one (1) foot overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends.
  - b. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole shall be made in the pipe bed to facilitate installation of the polyethylene tube at the joints.
  - c. After assembling the pipe joint, make the overlap of the poly-ethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure it in place., Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.
  - d. Repair any rips, punctures, or other damage to the polyethylene with adhesive tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place. Proceed with installation of the next section of pipe in same manner.
- 3. Pipe-Shaped Appurtenances: Bends, reducers, offsets and other pipe- shaped appurtenances shall be covered with polyethylene in the same manner as the pipe.
- 4. Odd-Shaped Appurtenances: Valves, tees, crosses and other odd- shaped pieces which cannot be wrapped practically in a tube shall be wrapped with a flat sheet

or split length of polyethylene tube. The sheet shall be passed under the appurtenance and brought up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Slack width and overlaps at joints shall be handled as described above. Tape polyethylene securely in place at valve stem and other penetrations.

5. Openings in Encasement: Openings for branches, service taps, blow-offs, air valves, and similar appurtenances shall be made by making an X-shaped cut in the polyethylene and temporarily folding the film back. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene, with tape.
6. Junctions Between Wrapped and Unwrapped Pipe: Where polyethylene wrapped pipe joins a pipe which is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least two (2) feet. Secure the end with circumferential turns of tape.
7. Backfill for Polyethylene Wrapped Pipe: Backfill material shall be the same as specified for pipe without polyethylene wrapping. Special care shall be taken to prevent damage to the polyethylene wrapping when placing backfill material. Backfill material shall be free of materials that could damage the polyethylene wrapping.

**D. Valves:**

1. Connect valves to pipe using retainer glands. Install glands as noted about for mechanical joint connections.
2. Buried Valves shall be installed such that the:
  - a. Stem is vertical.
  - b. Box vertical and centered over operating nut.
  - c. Thrust blocks installed as shown on the Drawings.
  - d. Gate box supported during backfilling and maintained.
  - e. Gate box shall not transmit shock load or stress to valve.

**E. Valve Boxes:**

1. When installation is complete, no pressure shall be exerted by valve box on the water main or on the valve.
2. Boxes shall be installed such that the center of the box is installed directly over the operating nut.
3. Boxes shall be of such length as required without full extension. Minimum lap 6 inches. Provide extensions as required to maintain the above-noted minimum overlap.
4. Boxes shall be installed plumb with no deflection between joints.
5. The top of the valve box shall be set in a 12"x 12" x 6" bed of 4,000 psi concrete.
6. Install so covers are 1/4 inch lower than the final pavement. Use of riser rings to adjust the grade of the boxes is not acceptable.
7. Following installation, the Contractor shall make all cover accessible and verify that the box is centered over the operating nut and does not have any deflection between sections. Boxes that do not meet these requirements shall be adjusted by the Contractor.

**F. Hydrants:**

1. Install hydrants as shown in the details and using manufacturer's written instructions.
2. Plug all drain openings with brass plugs where required.
3. No hydrant assembly shall be backfilled until approved by the Precinct.
4. Provide thrust blocks as shown on the detail.
5. Provide barrel extensions as required for hydrant to be installed at proper grade.
6. Painting:
  - a. The Contractor shall touchup paint all hydrants after installation.
  - b. If required the Contractor shall repaint the hydrants or portions of the hydrants to the Owner's standard as noted in Part 2 above.
  - c. All paint shall be furnished by the hydrant manufacturer.
  - d. All painting shall be performed in accordance with the manufacturer's requirements.
7. Where required by the Precinct, the Contractor shall install bollards adjacent to the hydrant for protection.
8. Testing: All hydrants shall be pressure and leak testing with the water main. The isolation valve shall be left open during the test. No additional leakage will be allowed.

**G. Corporation Stops:**

1. Install at locations shown on the Drawings and as specified in accordance with manufacturer's instructions.
2. Service saddles shall be required as noted on the drawings, on all PVC and AC mains, as required below, and as specified by the pipe and saddle manufacturers.

Pipe Size	Class 52 Ductile Iron Pipe
6"	Taps > 3/4"
8"	Taps > 3/4"
10"	Taps > 1"
12"	Taps > 1-1/4"
16"	Taps > 2"

3. Tap pipe with tools and methods specifically furnished by pipe manufacturer.
4. Completely spiral-wrap the thread area with Teflon tape prior to insertion.
5. Install corporation stops at the 2 and 10 o'clock positions on the pipe.
6. A minimum of one and a maximum of three threads of the installed corporation stop must be showing outside the water main. Care shall be taken not to over-tighten the stops.
7. Testing:
  - a. Check for visual leaks prior to backfilling.
  - b. Check and adjust all corporation stops for smooth operation.
  - c. For new main construction, install all corporation stops prior to pressure and leakage testing of water main.

**H. Service Pipe:**

1. Install copper pipe from the new corporation stop to the new curb stop or connect to the existing service pipe.
2. A “goose-neck” shall be placed in the copper pipe at the corporation stop as shown on the drawings.
3. Bend pipe with suitable tools and provide smooth bend free of any kinks, cracks or buckles.
4. Place sand below, adjacent, and above the pipe as shown on the drawings.
5. Joining:
  - a. Ream or file the pipe to remove burrs.
  - b. Slip compression nut over pipe and slide pipe into corporation.
  - c. Tighten compression nut.
  - d. Inspect for cracks, splits or other damages and replace if necessary.
  - e. Adapters: Use as required to connect to existing services.
6. Testing:
  - a. Services shall be installed after the water main has been successfully tested; therefore, a formal pressure test will not be performed.
  - b. After installation, the Contractor shall visually inspect all connection for visual leakage. Any leakage whatsoever shall be corrected prior to backfilling.

**I. Curb Stops:**

1. Install at locations shown on the Drawings and as specified in accordance with manufacturer's instructions.
2. Testing:
  - a. Check for visual leaks prior to backfilling.
  - b. Check and adjust all curb stops for smooth operation.

**J. Curb Boxes:**

1. When installation is complete, no pressure shall be exerted by the curb box on either the curb stop or the service pipe.
2. Curb boxes shall be installed vertically, centered over the operating nut, with the elevation of the top adjusted to conform to the finished grade and as shown on the drawings.
3. Following installation, the Contractor shall make all cover accessible and verify that the box is centered over the operating nut and does not have any deflection between sections. Boxes that do not meet these requirements shall be adjusted by the Constructor.

3.2 CLEANING AND TESTING

A. General:

1. Thoroughly clean all piping prior to testing. Remove all dirt, dust, oil, grease and other foreign material. Exercise care while cleaning to avoid damage to linings and coatings.
2. When the installation is complete, test all pipelines, in the presence of Precinct staff and the plumbing or building inspector in accordance with the requirements of the local and state plumbing codes and the appropriate sections of these Specifications.
3. Equipment: Supply all labor, equipment, materials, gages, and pumps required to conduct the tests. Additionally, make all taps and furnish all required caps, plugs, couplings, etc. necessary to perform the work noted in this Section.
4. Retesting: Perform all retesting required due to failure to the complete satisfaction of the Precinct. Valves and hydrants shall be pressure and leak tested with the water main against the full test pressure. No additional loss or leakage is allowed.
5. All corporation stops must be installed prior to leakage testing of the water main.

B. Outside Potable Water Piping (When Applicable)

1. Pressure Test:
  - a. Perform testing in accordance with AWWA Standard C600.
  - b. Pressure and leakage tests are required and shall be run concurrently. Acceptance of the pipeline will be based on successfully passing both the leakage and pressure tests; however, all visual leaks shall be repaired.
  - c. Testing Requirements:
    - 1) Test Duration: 2 hours
    - 2) Test Pressure: 1-1/2 times maximum system pressure (i.e. the low point as determined by the Precinct) or 100 psi, whichever is greater
    - 3) Allowable Pressure Drop: 5 psi
    - 4) Allowable Leakage:

$$\text{Allowable Leakage} = (T L D (P)^{0.5})/133,200$$

where: T = Test Duration, in hours  
L = Length of Main, in feet  
D = Nominal Diameter of Main, in inches  
P = Average Test Pressure, in psi

2. Chlorination of Pipelines:
  - a. Chlorination shall only be done after successful pressure/leak testing.
  - b. Chlorinate all new potable water lines in accordance with the procedure outlined in AWWA C651, latest revision.
  - c. Locate chlorination and sampling points as approved by the Precinct.

- d. Prior to chlorination, the pipe line shall be flushed to remove all sediment and discolored water from the main.
  - e. Use a dosage which will produce not less than 10.0 ppm chlorine residual. The contact period shall not be less than 24 hours.
  - f. During the chlorination period, exercise care to prevent the contamination of water in existing water mains.
  - g. After chlorination, flush the piping with clean potable water until there is only background chlorine residual.
  - h. Chlorinated effluent shall be **dechlorinated** prior to release to the environment.
  - i. Segments of pipes at tie-in locations that cannot be chlorinated by the above-noted procedure as determined by the Precinct shall be swabbed-down with a solution of chlorine prior to their installation.
3. Bacteriological Testing:
- a. Test all new potable water lines for total and fecal Coliform bacteria. The samples shall be taken 16 hours after the chlorine has been successfully flushed from the main.
  - b. The length of pipe to be tested and the time of the test shall be as approved by the Precinct.
  - c. The Precinct will observe the taking of samples.
  - d. Have all samples tested by a laboratory approved by the State and submit written test results to the Precinct.
  - e. Any segment of a potable water line shall be considered unsuitable for service if a Coliform bacteria count is obtained from those samples.
  - f. Re-disinfect all segments of piping considered unsuitable and retest. Continue to disinfect and test until no Coliform bacteria are present.
- C. Place piping into service when it has been successfully tested for pressure, leakage and total and fecal Coliform bacteria.
- D. Perform all specialized cleaning as specified or required by system.
- E. Upon successful testing, all chlorine injection taps and manual air releases shall be removed with the exception of the corporation stop and 12” section of copper pipe. The copper pipe shall be left in the corporation stop and the end shall be crimped.

**END OF SECTION 2**

**SECTION 3**  
**PAVEMENT REPAIR**

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Remove bituminous asphaltic and/or portland cement pavement, and replace pavement, subgrade, base courses and surface courses, including temporary pavement, within the area(s) shown on the Drawings.
2. Keep pavement removal to a minimum width suitable for the required construction.
3. Depending upon the location of the work, the work may also have to meet the requirements of the Town of New London, Town of Springfield, and/or NHDOT. Where conflicts exist between the different requirements, the most stringent requirement shall govern.

B. Work Included, But Not Eligible for Payment:

1. Removal and replacement of paving for the convenience of the Contractor.
2. Removal and replacement of pavement due to damage by the operation of the Contractor, but not required as part of the project.

1.2 REFERENCE STANDARDS

- A. State of New Hampshire Department of Transportation (NHDOT) Standard Specifications for Road and Bridge Construction (latest edition). Measurement and Payment and Pay Factor Sections shall not apply
- B. Town of New London road specifications
- C. Town of Springfield road specifications

1.3 QUALITY ASSURANCE

- A. Materials: Use only materials furnished by a bulk bituminous concrete producer regularly engaged in the production of hot mixed, hot laid bituminous concrete.
- B. Exercise extreme care in the removal of pavement so that pavement will not be unnecessarily disturbed or destroyed. Mechanically cut pavement to be removed to a straight line, unless otherwise directed by the Precinct/Town.
- C. All work shall be performed to the satisfaction of the Precinct, Town, and NHDOT (if applicable).
- D. The Contractor shall obtain and pay for all services of a bituminous concrete testing firm to perform the necessary compaction, gradation, and other testing required under Tier 2 testing, as specified in the NHDOT Specifications for Road and Bridge Construction (latest edition).

## PART 2 -- PRODUCTS

### 2.1 MATERIALS

- A. Aggregate subbase courses shall be in accordance with Section 1 – Earthwork for Water Mains and Services.
- B. Materials shall conform to Division 700 Materials; Section 702, Bituminous Materials and Section 703, Aggregates of the N.H.D.O.T. Standard Specifications, latest edition.
- C. Bituminous binder and wearing course pavements shall be as shown on the Drawings and shall conform to Division 400, Section 401 "Plant Mix Pavements - General" of the N.H.D.O.T. Standard Specifications, latest edition.
- D. Binder pavement shall be NHDOT 3/4" mix.
- E. Wearing pavement shall be NHDOT 1/2" mix.
- F. Temporary pavement shall be NHDOT 3/4" mix.
- G. Emulsified asphalt shall meet the requirements of NHDOT Section 401.
- H. Overlay pavement shall be NHDOT 1/2" mix.

## PART 3 -- EXECUTION

### 3.1 GENERAL

- A. The subgrade shall have been properly installed and shall have been approved by the Precinct/Town.
- B. Place pavement in accordance with NHDOT requirements and as specified herein. Upon discrepancy between the two requirements, the more stringent requirement shall govern.
- C. Unless otherwise approved in writing, the overlay (if applicable) shall be placed the following construction year.
- D. The following equipment shall be used to place the pavement:
  1. Pavers: For trenches that are 8' wide and wider, the pavers shall be self-contained, self-propelled long-body pavers capable of spreading the required thickness and width of pavement. Short-body pavers, drag boxes, and hot boxes shall not be allowed. For trenches less than 8' wide, the pavement shall be hand-placed or other Precinct/Town-approved placement method.
  2. Rollers: Shall be 8-12 ton self-propelled tandem-drum rollers.
  3. Trucks: Shall be clean with a heated bed.
  4. Hand-tools: As required.
- E. All equipment shall be well maintained and in good working condition.
- F. Trucks that have just discharged their load shall be cleaned at a designated cleanup area. **Disposal of cleanup material from trucks shall not be allowed to be placed in front of the paver.**



### 3.2 INSTALLATION

- A. Methods of construction shall be in accordance with Division 400, Pavements; Section 403, Hot Bituminous Pavement of the N.H.D.O.T. Standard Specifications, latest edition. See Drawings for payment limits.
- B. Bituminous pavement shall be placed at a temperature range between 260 and 350 degrees F.
- C. Place the permanent pavement only when the underlying surface is dry, frost-free, when the surface temperature is above 40 degrees F for pavement courses greater than 1-1/4" in compacted depth and above 50 degrees F when the pavement course is less than or equal to 1-1/4" in compacted depth, and when the weather is not foggy, rainy, or when wind conditions are such that rapid cooling will prevent satisfactory compaction, provided however, that the Precinct or Town may permit in case of sudden rain, the placing of the mixture then in transit from the plant, if laid at the proper temperature and if the roadbed is free from pools of water. Such permission shall in no way relax the requirements for quality of the pavement and smoothness of surface.
- D. Placement of any course shall be as nearly continuous as possible, keeping the number of transverse joints to a minimum. Stopping of the paver shall only be done in emergencies. If the Precinct/Town determines that the paving operations result in excessive stopping of the paver, they may suspend all paving operations until the Contractor makes arrangements to synchronize the rate of paving with the rate of delivery of material.
- E. All courses shall be rolled until all roller marks have been eliminated.
- F. Temporary Pavement Repairs
  - 1. Temporary pavement repairs shall be made when deemed necessary by the Precinct/Town in order to assure safety of the traveled way or when permanent repairs cannot be made immediately.
  - 2. Temporary pavement shall be as shown on the Drawings.
  - 3. The Contractor shall maintain and repair the trench as required to maintain a smooth driving surface. Repairs shall immediately be made upon notice by the Precinct/Town.
  - 4. Temporary pavement shall remain in the trench for a minimum period of 30 days and a maximum period of 50 days, unless otherwise noted by the Precinct/Town.
- G. Permanent Pavement Repairs - Final Patch @ Trench
  - 1. After suitable exposure, the existing pavement shall be mechanically cut on either side of the trench to provide overlap of final patch on undisturbed material as shown on the Drawings. Existing pavement that is less than 2' wide once the pavement has been cut-back shall be removed and replaced with new pavement at the Contractor's expense.
  - 2. The cut-back area noted above shall include removal of all humps caused by blasting operations.
  - 3. Within the cut limits of the final patch, the existing pavement, temporary patch, and/or base material shall be removed and replaced as shown on the Drawings.

4. If the wearing course is not placed on the same day as the binder course, the Contractor shall mechanically sweep the entire trench surface prior to placement of the wearing course.
- H. Full-Width Permanent Pavement Overlay
1. When ordered by the Precinct/Town, the Contractor shall furnish a full-width overlay from curb to curb or edge of traveled way to edge of traveled way as shown on the Drawings.
  2. The overlay shall be completed after the roadway has been in place for one freeze / thaw cycle, unless otherwise ordered by the Precinct/Town.
  3. Work shall include:
    - a. At the overlay limits, mechanically grind (cold-plane) a 2' wide joint in the existing pavement to provide overlap of base course on undisturbed material as shown on the Drawings. Place an 18" wide strip of emulsified asphalt at all joints.
    - b. Remove all temporary paving and existing paving within the cut limits of the trench repair area.
    - c. All driveways shall be mechanically ground (cold planed) or saw cut prior to installation of pavement overlays. Feathering will not be acceptable. Place a 6" wide strip of emulsified asphalt at all joints.
    - d. The trench shall be shimmed as required to remove all settlement. Shimming shall be considered subsidiary to the overlay item unless otherwise noted.
    - e. The Contractor shall mechanically sweep the entire roadway prior to placement of the overlay.
    - f. Contractor shall be responsible for raising all utility covers and boxes prior to placement of the overlay. The final elevation of the fixtures shall be ¼" below the final pavement elevation.
    - g. The full width permanent pavement overlay shall consist of hot bituminous concrete wearing course over the existing pavement and trench repair base course.
    - h. After placement of the overlay, the Contractor shall pour a bead of emulsified asphalt in all tie-in joints and cover with a layer of sand.
- I. Maintaining Permanently Placed Surfaces
1. Maintain permanently placed surfaces for a 1-year guarantee period.
  2. Should an area that the Contractor has permanently paved settle, the Contractor shall repair the area using one of the following methods. The repair method must be approved by the Precinct/Town.
    - a. Remove and Replace:
      - 1) Remove the entire pavement in the area.
      - 2) Add the necessary subgrade material as specified and shown on the Drawings to the depth of the applicable pavement course.
      - 3) Replace the base course as specified
      - 4) Replace the wearing course as specified.
      - 5) Do not feather edges, except where shown on the Drawings.
      - 6) Infra-red heat the joints along the edge of the repair and recompact.

- b. Shim:
  - 1) Infra-red heat the repair area.
  - 2) Add addition bituminous pavement.
  - 3) Recompact the material.

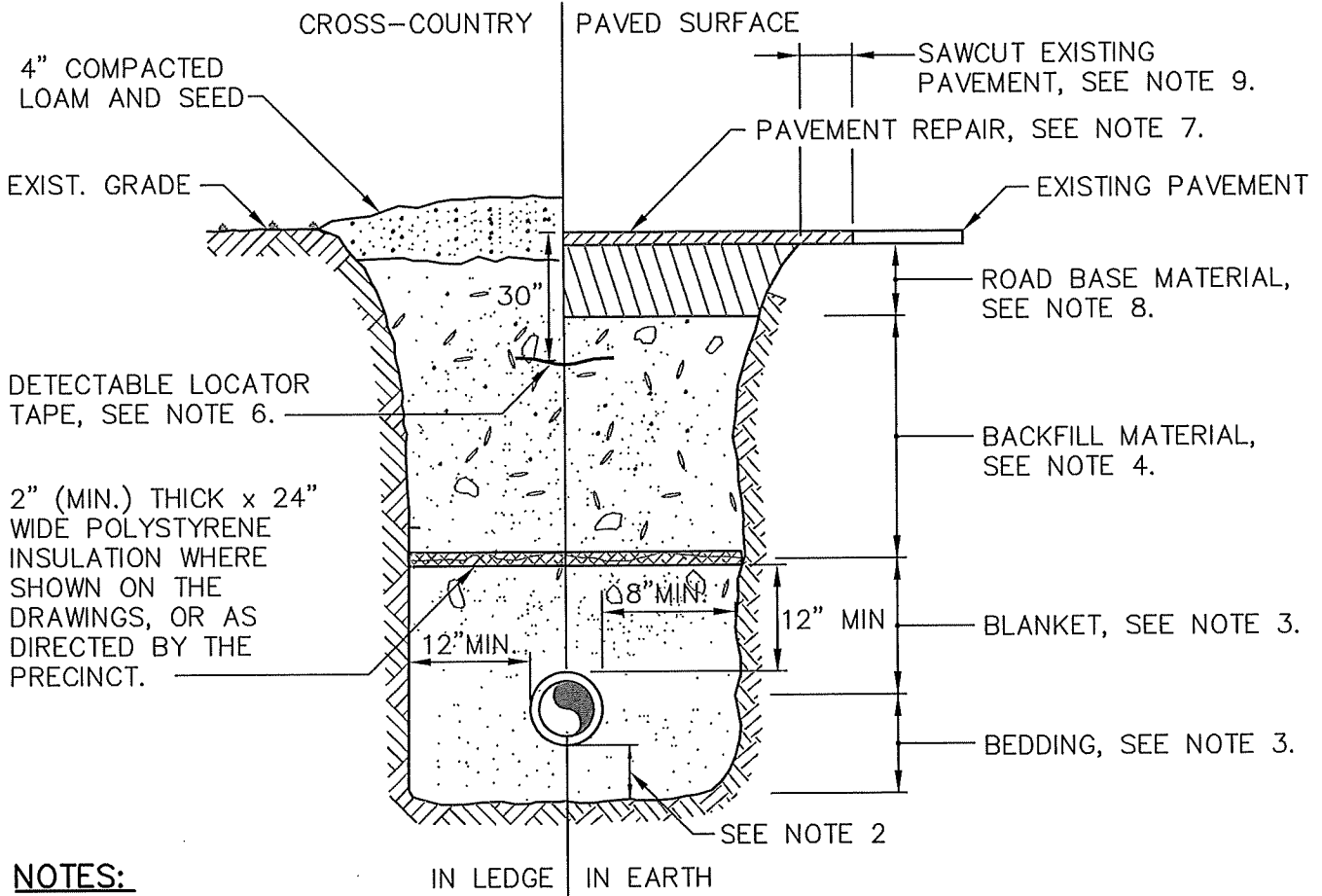
3.3 PAVEMENT PAINT MARKINGS

- A. Pavement markings shall be furnished and installed per NHDOT Section 708 and be non-reflective traffic paint.
- B. Temporary stick-on markings shall be immediately placed and maintained on the binder course until such time as the wearing course is placed. The markings shall be installed at 50' intervals. Temporary markings shall also be placed on the wearing course until such time that the permanent markings are placed.
- C. The Contractor shall replace all permanent paint marking disturbed during construction.

3.4 CLEANUP

- A. All bituminous material remaining on exposed surfaces of curbs, sidewalks, masonry structures, or other surfaces shall be removed by the Contractor.
- B. All material left at truck cleanup areas shall be removed and properly disposed of.

**END OF SECTION 3**



**NOTES:**

1. ORDERED EXCAVATION OF UNSUITABLE MATERIAL BELOW GRADE: BACKFILL AS STATED IN SECTION 1 OR AS SHOWN ON THE DRAWINGS.
2. 6" MINIMUM IN NON-BLASTED AREAS AND 12" MINIMUM IN BLASTED AREAS.
3. BEDDING AND BLANKET: CLEAN SAND AS SPECIFIED IN SECTION 1.
4. BACKFILL MATERIAL: BACKFILL MATERIAL AS SPECIFIED IN SECTION 1.
5. PIPE COVER: SHALL NOT BE LESS THAN 6.0' OR MORE THAN 8.0', UNLESS TO AVOID EXISTING AND PROPOSED STRUCTURES OR PIPES. INSTALLATION DEEPER THAN 8.0' SHALL ONLY BE DONE WITH PRIOR APPROVAL BY THE PRECINCT.
6. LOCATOR TAPE TO BE TERRA TAPE SENTRY LINE OR EQUAL.
7. PAVEMENT REPAIR: MATCH EXISTING OR A MINIMUM OF 3" (2" BINDER AND 1" WEARING).
8. ROAD BASE MATERIAL: MATCH EXISTING OR A MINIMUM OF 15" CRUSHED GRAVEL.
9. SAWCUTTING EXISTING PAVEMENT: SAWCUT THE EXISTING PAVEMENT AT LEAST 12" BEYOND THE EDGE OF THE TRENCH. THE FINAL CUT SHALL BE SMOOTH, WITH NO JAGGED EDGES. REMOVE AND DISPOSE OF EXISTING PAVEMENT FROM THE TRENCH CUT.

SCALE: NOT TO SCALE

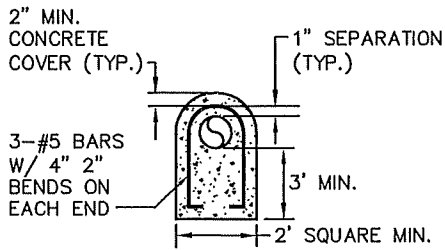
TRENCH DETAIL  
 NEW LONDON/SPRINGFIELD  
 WATER SYSTEM PRECINCT

**Underwood  
 Engineers, Inc.**

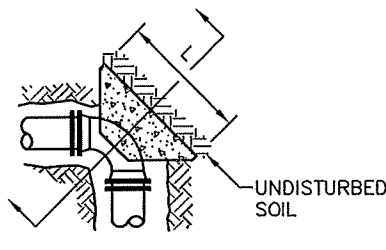
DATE  
 JULY 2010

FIGURE

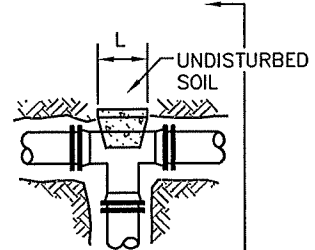
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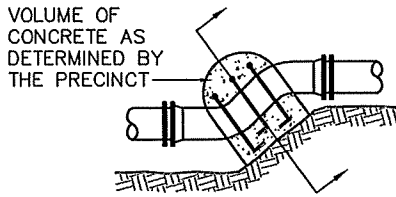
**SECTION**



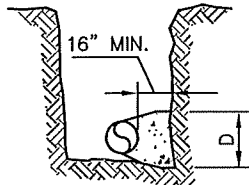
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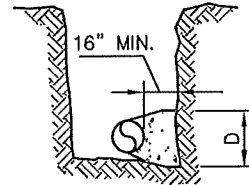
**PLAN**



**ELEVATION**  
**OFFSETS OR**  
**VERTICAL BENDS**



**SECTION**  
**ALL BENDS**



**SECTION**  
**TEE OR TAPPING SLEEVE**

**THRUST BLOCK SCHEDULE**  
MINIMUM BEARING AREA (SQUARE FEET)

Nominal Dia. (in)	PIPE SIZE							
	4	6	8	10	12	16	20	24
Tees, Caps, Plugs, & Tapping Sleeves	1.05	2.32	4.15	6.37	9.15	16.23	25.44	36.58
90 Degree Bends	1.48	3.29	5.86	9.01	12.93	22.96	35.97	51.73
45 Degree Bends	0.80	1.78	3.17	4.88	7.00	12.42	19.47	28.00
22½ Degree Bends	0.41	0.91	1.62	2.49	3.57	6.33	9.92	14.27
11¼ Degree Bends	0.21	0.46	0.81	1.25	1.79	3.18	4.99	7.17
System Pressure:		100 psi						
Safety Factor:		1.5						
Soil Bearing Capacity:		2,000 psf						

**THRUST BLOCK NOTES:**

- THRUST BLOCKS ARE REQUIRED ON ALL FITTINGS.
- USE OF THRUST BLOCKS DOES NOT ELIMINATE THE REQUIREMENT OF RETAINER GLANDS.
- THRUST BLOCKS SHALL BE 3,500 PSI CAST-IN-PLACE CONCRETE (NO PRECAST BLOCKS).
- THE MINIMUM BEARING AREAS SHOWN ABOVE ARE BASED ON A SYSTEM PRESSURE OF 100 psi. IF THE SYSTEM PRESSURE IS ABOVE 100 psi, INCREASE THE NOTED AREAS PROPORTIONAL TO THE ACTUAL SYSTEM PRESSURE. FOR EXAMPLE, IF THE ACTUAL SYSTEM PRESSURE IS 160 psi, MULTIPLY THE ABOVE VALUES BY 160%.
- PLACE THRUST BLOCKS SUCH THAT THE LENGTH (L) OF THE BLOCK IS APPROX. TWICE AS LONG AS THE DEPTH (D).
- PLACE THRUST BLOCKS AGAINST UNDISTURBED SOIL.
- PLACE THRUST BLOCKS ALONG THE FULL LENGTH OF THE FITTING TO MAXIMIZE BEARING AREA.
- PLACE 2 LAYERS OF POLYETHYLENE OR ROOFING PAPER AROUND FITTINGS PRIOR TO PLACEMENT OF THE CONCRETE TO CREATE A BOND BREAK & PROTECT THE BOLTS.
- PLACE A 12" LONG STEEL HORSESHOE-SHAPED PICKUP HOOK IN ALL PLUG AND CAP THRUST BLOCKS. DIAMETER OF HOOK SHALL BE A MINIMUM OF 5/8".
- PLACE A SOLID CONCRETE BLOCK BETWEEN CAP/PLUGS AND THRUST BLOCKS.

SCALE: NOT TO SCALE

THRUST BLOCK DETAIL  
NEW LONDON/SPRINGFIELD  
WATER SYSTEM PRECINCT

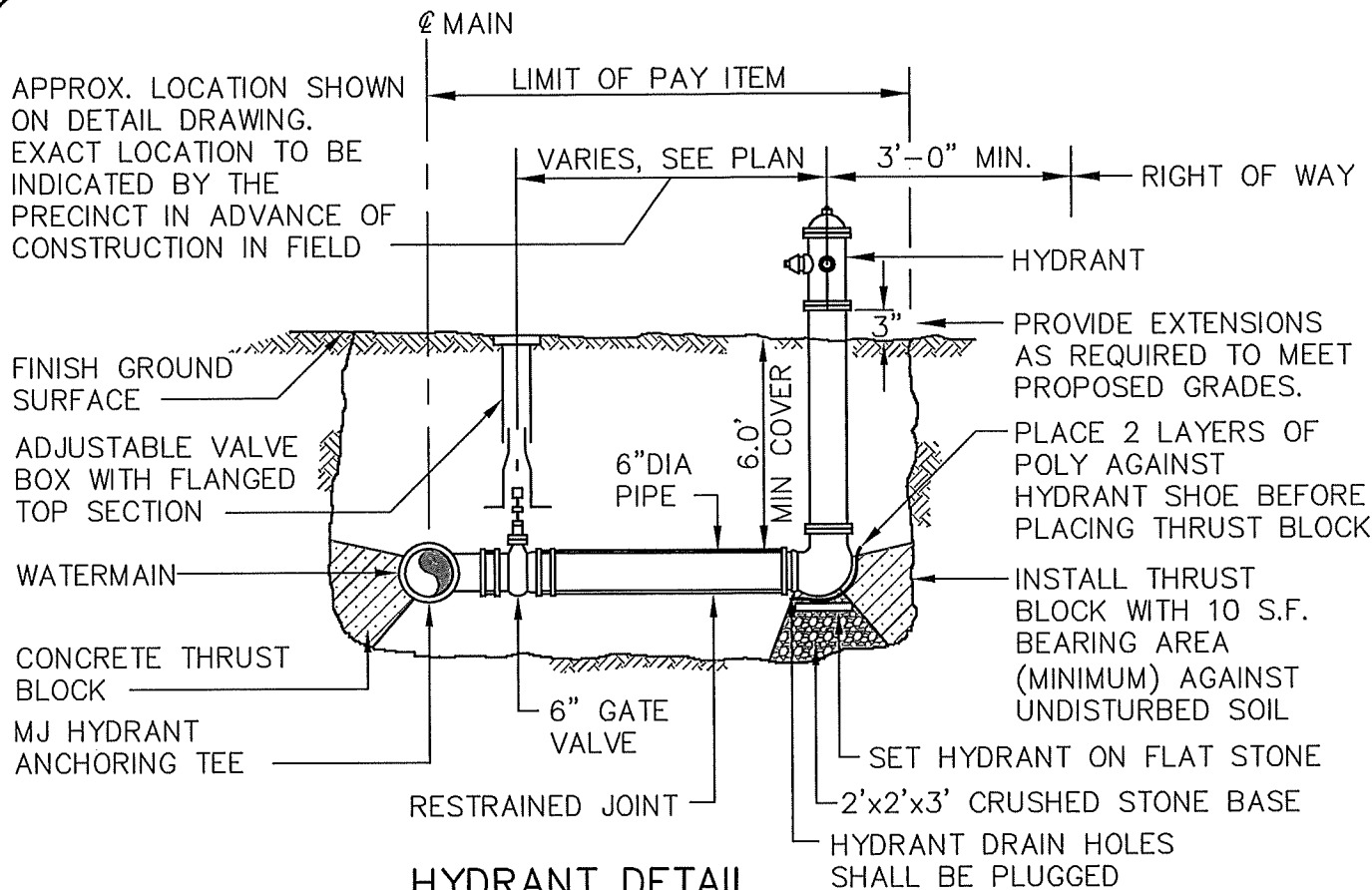
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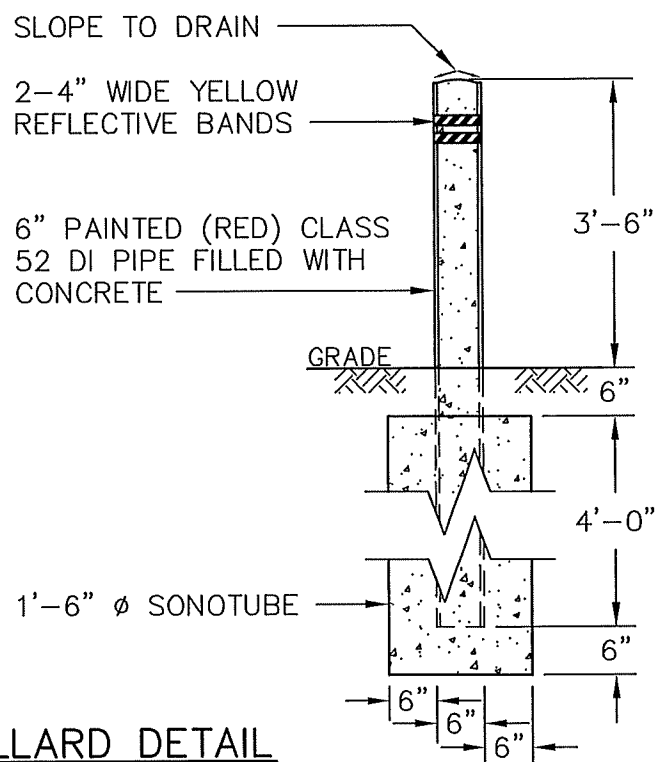
FIGURE

2

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**HYDRANT DETAIL**



**NOTE:**  
BOLLARDS ARE TO BE PLACED ADJACENT TO HYDRANT AS DETERMINED BY THE PRECINCT.

**STEEL BOLLARD DETAIL**

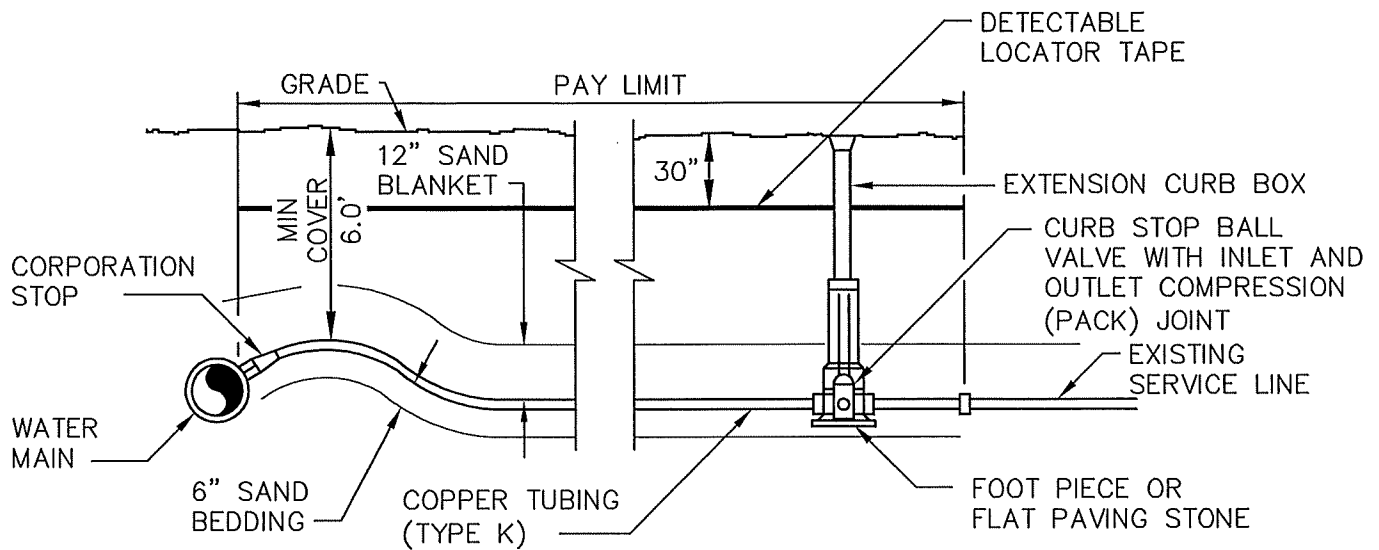
SCALE: NOT TO SCALE

HYDRANT AND BOLLARD DETAIL  
NEW LONDON/SPRINGFIELD WATER  
SYSTEM PRECINCT

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FIGURE  
3



**TYPICAL SERVICE CONNECTION NOTES:**

1. PROVIDE NEW LINE USING CONTINUOUS LENGTHS OF COPPER. NO COUPLING ALLOWED IN ROADWAY WITHOUT APPROVAL OF PRECINCT.
2. TAPS TO BE MADE AT APPROX. 3:00 AND 9:00.
3. PROVIDE FOR SERVICE LINE CONTRACTION AND EXPANSION BY INSTALLING "S" IN SERVICE LINE NEAR MAIN.
4. IF SERVICE IS INSTALLED WITH LESS THAN 6.0' COVER, INSULATE OVER LINE.
5. CONNECT CURB STOP TO EXISTING SERVICE LINE AT PROPERTY LINE OR AT LOCATION APPROVED BY THE ENGINEER (NO COUPLING WITHOUT APPROVAL OF ENGINEER) AFTER PRESSURE TESTING AND DISINFECTION.
6. CURB STOPS TO BE LOCATED 2' BEHIND ALL SIDEWALKS.
7. INSTALL 2"X2'X4' INSULATION AT DRAINAGE CROSSINGS. MAINTAIN 18" SEPARATION.
8. SERVICE SIZE SHALL BE AS NOTED ON THE DRAWINGS.

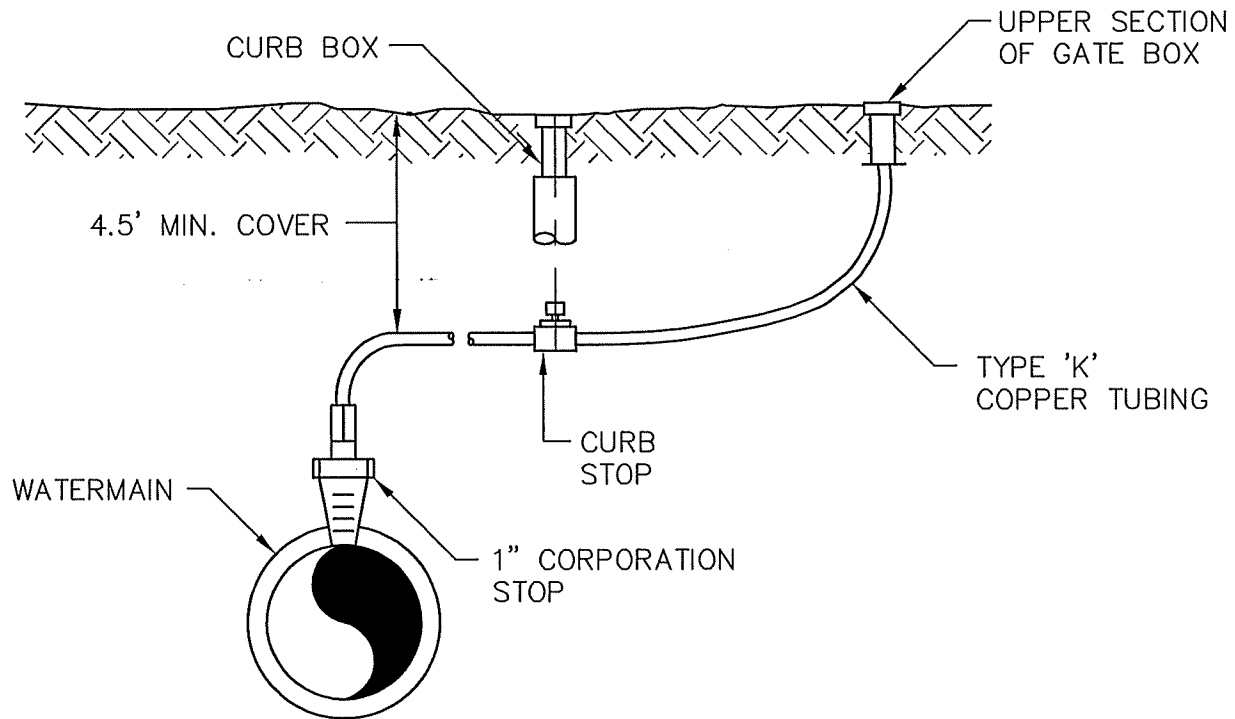
SCALE: NOT TO SCALE

SERVICE CONNECTION DETAIL  
 NEW LONDON/SPRINGFIELD WATER  
 SYSTEM PRECINCT

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FIGURE  
 4



**NOTES:**

1. DIRECT PIPING AWAY FROM ROADWAY.
2. CHLORINE INJECTION AND MANUAL AIR RELEASE ASSEMBLIES ARE TO BE REMOVED IMMEDIATELY FOLLOWING A SUCCESSFUL BACTERIA TEST. LEAVE THE CORPORATION STOP AND 12" LENGTH OF TUBING (WITH A CRIMPED END) IN PLACE.

SCALE: NOT TO SCALE

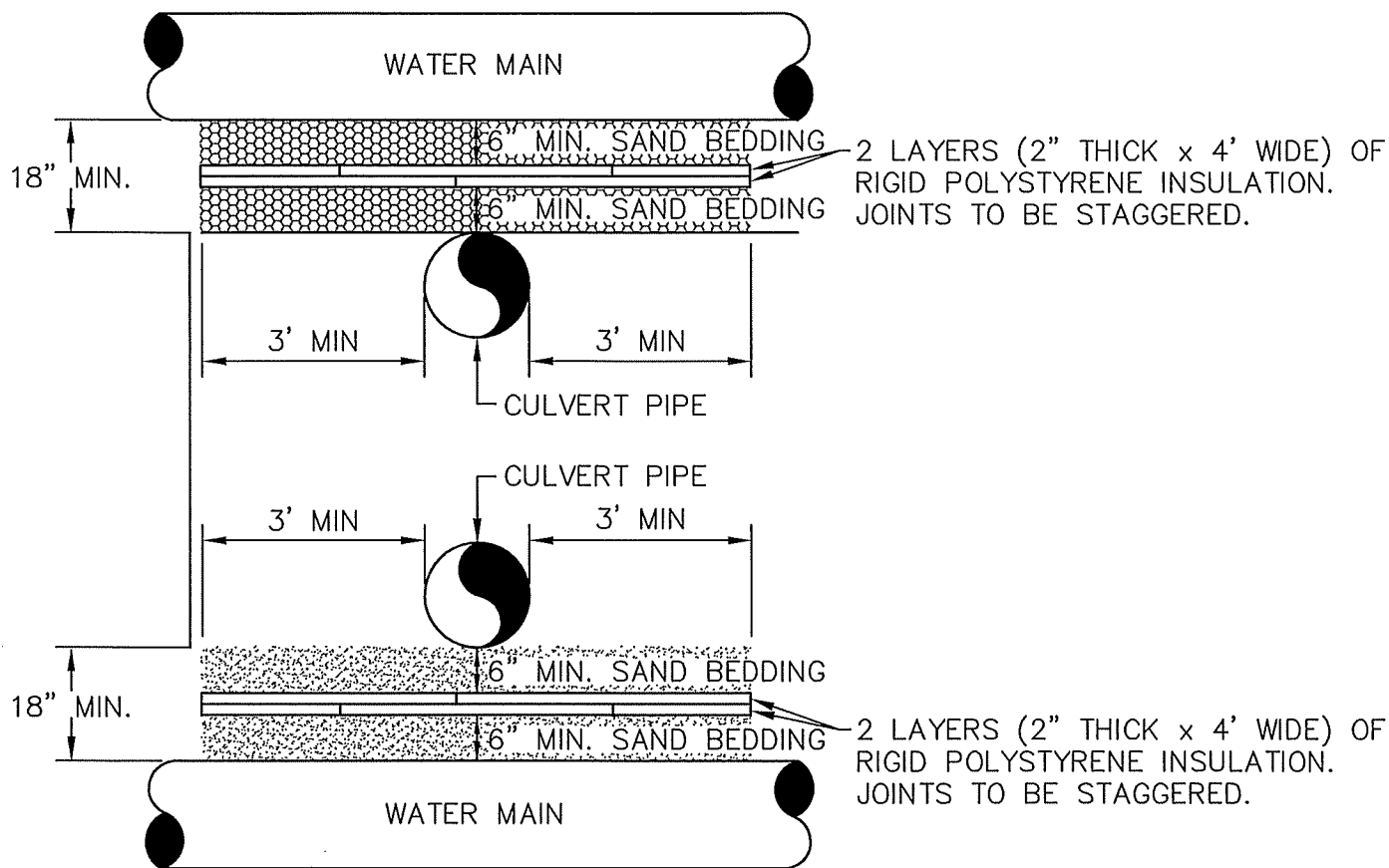
CHLORINE INJECTION TAP  
AND/OR MANUAL AIR RELEASE DETAIL  
NEW LONDON/SPRINGFIELD  
WATER SYSTEM PRECINCT

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Engineers, Inc.**

DATE	JULY 2010
FIGURE	5



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**NOTES:**

1. INSULATION TO BE USED WHERE PIPE SEPARATION IS 24" OR LESS.
2. INSTALL 45° MJ BENDS WITH RESTRAINED JOINT FITTINGS IF NECESSARY TO ADJUST WATER MAIN PROFILE

SCALE: NOT TO SCALE

INSULATION DETAIL FOR  
CULVERT CROSSING  
NEW LONDON/SPRINGFIELD  
WATER SYSTEM PRECINCT

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FIGURE  
6