# **BELMONT PUBLIC LIBRARY**

336 CONCORD AVENUE, BELMONT, MA 02478



#### **OWNER:**

TOWN OF BELMONT 19 MOORE STREET BELMONT, MA 02478 T.617.993.2640

#### **PROJECT MANAGER:**

DAEDALUS PROJECTS, INC. 150 1 FANEUIL HALL MARKETPLACE SOUTH MARKET BUILDING SUITE 4195 BOSTON, MA 02109 T. 617.451.2717

# 100% SCHEMATIC DESIGN SET

DECEMBER 13, 2019

#### CIVIL ENGINEER NITSCH ENGINEERING 2 CENTER PLAZA, SUITE 430 BOSTON, MA 02108 T. 617.338.0063

#### LANDSCAPE ARCHITECT

STIMSON 288 NORFOLK ST. CAMBRIDGE, MA 02139 T. 617.876.8960

#### STRUCTURAL ENGINEER

LeMESSURIER 1380 SOLDIERS FIELD RD. BOSTON, MA 02135 T. 617.868.1200

#### MEP / FP ENGINEER

WSP 75 ARILINGTON ST. BOSTON, MA 02116 T. 617.426-7330

#### CODE / LIFE SAFETY

CODE RED CONSULTANTS 154 TURNPIKE RD., SUITE 200 SOUTHBOROUGH, MA 01772 T. 617.500.7633

#### COST ESTIMATOR

A. M. FOGARTY & ASSOC. 175 DERBY ST. HINGHAM, MA 02043 T. 855.393.5808

#### SPECIFICATIONS

KALIN ASSOCIATES 1121 WASHINGTON ST. NEWTON, MA 02465 T. 617.964.5477



OUDENS ELLO ARCHITECTURE LLC 46 WALTHAM STREET, SUITE 4A BOSTON, MA 02118 T.617.422.0980

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\* Trade bid required

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Refer to SD Design Narrative from WSP attached at the end

#### **DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING**

Refer to SD Design Narrative from WSP attached at the end

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Refer to SD Design Narrative from WSP attached at the end

#### DIVISION 27 - COMMUNICATIONS (PART OF DIVISION 26 TRADE BID)

Refer to SD Design Narrative from WSP attached at the end

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#### SECTION 011000 - SUMMARY

- A. PROJECT DESCRIPTION
  - 1. Project: Belmont Public Library, 336 Concord Ave, Belmont, MA.
  - 2. Work Includes: Construction of a new 2-story, approx 42,000 GSF public library, 42-stall parking lot and related site improvements. Includes demolition of the existing building, approx 28,000 GSF.
  - 3. Sustainable Design: Goals are Net Zero energy performance.
  - 4. List of Pricing Alternates: Issued separately.

#### B. CONTRACT FORMS, TESTING, COORDINATION

- 1. Public Bidding: CM-at-Risk, MGL Chapter 149A, trade bids required.
- 2. Testing Agency: Independent testing agency paid for by Owner.
- 3. Commissioning Agency: Independent commissioning agency paid for by Owner.
- 4. Coordination: Coordination of site work, utilities, and building construction.
- 5. Field Office: Required for the Owner's Project Manager, on-site.
- 6. Schedule: Bar-chart type project schedule, indicating critical path items.
- 7. Mock-Ups: Freestanding visual mock-up of exterior wall required.

#### C. PROJECT MEETINGS

- 1. Pre-Construction Conference: Attendance by Owner, Architect, Engineers, Construction Manager, major subcontractors, and suppliers as applicable.
- 2. Progress Meetings: Regular weekly meetings as required; attendance by Owner, Architect, Engineer, Construction Manager, subcontractors and suppliers as applicable.

#### D. SUBMITTALS

- 1. Project Submittals: Electronic submittal review using Procore or similar. Electronic copies plus one printed copy of shop drawings, one printed copy for product data and warranties, two representative units for samples. One electronic copy of submittals will be returned to the Construction Manager.
- 2. Record Documents, Maintained and Continually Updated by the Construction Manager Record drawings, record specifications, maintenance manuals, and final property survey.

#### E. TEMPORARY FACILITIES

- 1. Temporary Utility Service: Paid for by Construction Manager.
- 2. Temporary Facilities: Temporary construction, support facilities, and security measures; including construction fencing, portable toilets.

#### SECTION 023000 - SUBSURFACE INVESTIGATION

- A. PROJECT INCLUDES
  - 1. A geotechnical report will be available to bidders.

#### SECTION 024100 - DEMOLITION

- A. PROJECT INCLUDES
  - 1. Demolition of the existing building and selective demolition of existing site improvements as required for new construction.
    - a. Salvage of war memorial stone panels and stained glass windows.
- \* Trade bid required

- b. Disconnection, capping, and removal of site utilities.
- c. Pollution control, including dust and noise control.
- d. Legal disposal and recycling of waste materials.
- e. Removal of hazardous materials; Owner will provide a survey.

SECTION 033000 - CAST-IN-PLACE CONCRETE - Refer to structural narrative

SECTION 040001 - MASONRY WORK (Trade bid Required)

- A. PROJECT INCLUDES
  - 1. Trade bid section includes the following:
    - a. Section 042000 Unit Masonry.

<u>SECTION 042000 – UNIT MASONRY</u> (part of 040001 trade bid required)

- A. PROJECT INCLUDES
  - 1. Exterior brick veneer.
- B. PRODUCTS
  - 1. Brick Type and Size: Two types; as selected by Architect.
  - 2. Mortar and Grout:
    - a. Mortar Mix: ASTM C 270, Type N, colored mortar.
    - b. Mortar Materials: Portland cement, ASTM C 150, Type I or II.
    - c. Mortar Aggregate: Natural color, ASTM C 144.

#### SECTION 050001 - MISCELLANEOUS AND ORNAMENTAL IRON (Trade bid Required)

- A. PROJECT INCLUDES
  - 1. Trade bid sections include the following:
    - a. Section 055000 Metal Fabrications.
    - b. Section 055100 Metal Stairs and Railings.
    - c. Section 057300 Decorative Railings.

SECTION 051200 - STRUCTURAL STEEL FRAMING – Refer to structural narrative

SECTION 053100 - STEEL DECKING – Refer to structural narrative

#### SECTION 054000 – COLD-FORMED METAL FRAMING

- A. PROJECT INCLUDES
  - 1. Cold-formed metal framing at exterior walls.
- B. QUALITY ASSURANCE
  - 1. Standards: AISI, Specification for Design of Cold-Formed Steel Structural Members.
  - 2. Deflection Criteria: L/600 at masonry.
  - 3. Fabrication Tolerances: 1/8 inch in 10 feet.
  - 4. Erection Tolerances: 1/16 inch.
  - 5. Engineering: Systems engineered and stamped by contractor's professional engineer.
- C. PRODUCTS

- 1. Cold-Formed Metal Framing Materials:
  - a. Wall Framing: C-shaped load-bearing steel studs.
  - b. Units 16 gage (.0598 inch): ASTM A 446, yield point 50,000 psi.
  - c. Finish: Galvanized, ASTM A 525, G90.
- 2. Framing Accessories:
  - a. Supplementary framing.
  - b. Bracing, bridging, and solid blocking.
  - c. Web stiffeners.
  - d. Deflection track and vertical side clips.
  - e. Reinforcement plates.
  - f. Anchors, clips, and fasteners.
  - g. Screw strips.

#### SECTION 055000 - METAL FABRICATIONS (part of 050001 trade bid required)

- A. PROJECT INCLUDES
  - 1. Metal Fabrications:
    - a. Galvanized loose steel lintels at exterior locations.
    - b. Primed loose steel lintels at interior locations.
    - c. Elevator sill support angles.
    - d. Steel supports for overhead doors.
    - e. Steel supports for operable partitions.
    - f. Steel ladders, including elevator pit ladders.
    - g. Metal gratings.
    - h. Concrete-filled galvanized steel bollards.

#### B. PRODUCTS

- 1. Ferrous Materials:
  - a. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).
  - b. Cold-Formed Steel Tubing: ASTM A 500.
  - c. Hot-Formed Steel Tubing: ASTM A 501.
  - d. Zinc-Coating: Hot-dip galvanized coating for materials in exterior assemblies or exterior walls.
- 2. Auxiliary Materials:
  - a. Shop Primer: Alkyd primer, FS TT-P-645.
  - b. Galvanizing Repair Paint: SSPC Paint 20.
- 3. Fasteners: Corrosion-resistant, suitable for use.

#### <u>SECTION 055100 - METAL STAIRS AND RAILINGS</u> (part of 050001 trade bid required)

- A. PROJECT INCLUDES
  - 1. Interior steel-framed stairs and railings with concrete infill in treads.
- B. QUALITY ASSURANCE
  - 1. Handrail and Railing Structural Performance: ASTM E 985.
  - 2. Accessibility Requirements: ADAAG, MAAB and local regulations.
- C. PRODUCTS
  - 1. Materials:
    - a. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).
    - b. Cold-Formed Steel Tubing: ASTM A 500.
    - c. Hot-Formed Steel Tubing: ASTM A 501.
- \* Trade bid required

- d. Steel Pipe: ASTM A 53, standard weight (Schedule 40).
- e. Fasteners: Plated fasteners, ASTM B 633, zinc-coated.
- 2. Grout: Factory-packaged, nonshrink, nonmetallic, ASTM C 1107.

SECTION 057300 - DECORATIVE RAILINGS (part of 050001 trade bid required)

#### A. PROJECT INCLUDES

1. Interior glass and stainless steel railings.

#### B. QUALITY ASSURANCE

- 1. Handrail and Railing Structural Performance: ASTM E 985.
- 2. Accessibility Requirements: ADAAG and local regulations.

#### C. PRODUCTS

- 1. Materials:
  - a. Stainless Steel: ASTM A666, No. 4 with satin finish.
  - b. Glass: Tempered and laminated; minimum 1/2 inch thick.
  - c. Steel Plates, Shapes, and Bars: ASTM A 36 (ASTM A 36M).
  - d. Cold-Formed Steel Tubing: ASTM A 500.
  - e. Hot-Formed Steel Tubing: ASTM A 501.
  - f. Steel Pipe: ASTM A 53, standard weight (Schedule 40).
  - g. Fasteners: Plated fasteners, ASTM B 633, zinc-coated.

#### SECTION 061000 - ROUGH CARPENTRY

#### A. PROJECT INCLUDES

- 1. Rough Carpentry:
  - a. Wood grounds, nailers, and blocking.
  - b. Wood furring.
  - c. Backing panels at utility closets.
- 2. Composite nailboard/insulation.

## B. QUALITY STANDARDS

- 1. Lumber Standards and Grade Stamps: PS 20, American Softwood Lumber Standard and inspection agency grade stamps.
- 2. Construction Panel Standards: PS 1, U.S. Product Standard for Construction and Industrial Plywood; APA PRP-108.
- 3. Preservative Treatment: AWPA C2 for lumber and AWPA C9 for plywood; waterborne pressure treatment.
- 4. Fire-Retardant Treatment: AWPA C20 for lumber and AWPA C27 for plywood; noncorrosive type.

#### C. PRODUCTS

- 1. Miscellaneous Lumber:
  - a. Moisture Content: 19 percent.
  - b. Grade: Standard grade light framing.
- 2. Construction Panels:
  - a. Backing Panels and Plywood Sheathing: APA C-D Plugged Exposure 1 with exterior glue, fire-retardant treated.
- 3. Auxiliary Materials:
  - a. Framing Anchors and Fasteners: Non-corrosive, suitable for load and exposure.

\* Trade bid required

#### SECTION 061600 - SHEATHING

- A. PROJECT INCLUDES
  - 1. Exterior sheathing over metal studs at exterior wall.

#### B. PRODUCTS

- 1. Gypsum Sheathing:
  - a. Manufacturer: DensGlass by Georgia Pacific or equal.
  - b. Thickness: 5/8 inch.
- 2. Cementitous Sheathing:
  - a. Manufacturer: USG or equal.
  - b. Thickness: 5/8 inch.

#### SECTION 062010 - EXTERIOR FINISH CARPENTRY

- A. PROJECT INCLUDES
  - 1. Exterior standing and running trim.
  - 2. Exterior wood decking.
- B. PRODUCTS
  - 1. Exterior Standing and Running Trim:
    - a. Material: Alaskan yellow cedar.
    - b. Finish: Transparent finish.
  - 2. Exterior Decking:
    - a. Material: Ipe.
    - b. Finish: Transparent finish.

#### SECTION 064023 – INTERIOR ARCHITECTURAL WOODWORK

#### A. PROJECT INCLUDES

- 1. Interior Architectural Woodwork:
  - a. Custom reception desk.
  - b. Tiered seating.
  - c. Wood paneling with transparent finish.
  - d. Wood door frames and trim with transparent finish.
  - e. Wood casework.
  - f. Plastic laminate casework and countertops.
  - g. Solid surfacing countertops.
  - h. Stone countertops.
  - i. Closet specialties.
- B. QUALITY ASSURANCE
  - 1. Standards: Architectural Woodwork Institute (AWI) "Architectural Woodwork Quality Standards" Premium Grade.
  - 2. Accessibility Requirements: ADAAG and local regulations.
- C. PRODUCTS
  - 1. Wood Veneer Paneling, Casework and Trim:
    - a. Material: Clear hard maple.
- \* Trade bid required

- b. Paneling: Slip match.
- c. Finish: Transparent.
- 2. Interior Plastic Laminate Clad Casework and Countertops:
  - a. Laminate: High pressure decorative laminate, NEMA LD-3.
    - b. AWI Grade: Premium.
    - c. Face Style: Flush overlay.
    - d. Countertop Core: Plywood.
- 3. Solid Surfacing for Countertops: DuPont Corian or equal.
- 4. Stone for Countertops: As selected by Architect.
- 5. Casework Hardware and Auxiliary Materials:
  - a. Hardware Standard: ANSI/BHMA A156.9.
  - b. Hardware Finish and Base Metal: Satin stainless steel.
- 6. Closet rods and shelves.

#### SECTION 066400 - FRP PANELING

- A. PROJECT INCLUDES
  - 1. Fiberglass reinforced plastic paneling at janitor's closets.
- B. PRODUCTS
  - 1. FRP Panels: Kemlite, Marlite or equal.

#### SECTION 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING (Trade bid Required)

- A. PROJECT INCLUDES
  - 1. Trade bid sections include the following:
    - a. Section 071100 Bituminous Dampproofing.
    - b. Section 071300 Self-Adhering Sheet Waterproofing.
    - c. Section 071600 Cementitious Waterproofing.
    - d. Section 072700 Air and Vapor Barrier Membrane.
    - e. Section 079200 Joint Sealants.

SECTION 070002 - ROOFING AND FLASHING (Trade bid Required)

- A. PROJECT INCLUDES
  - 1. Trade bid section includes the following:
    - a. Section 075400 Thermoplastic Membrane Roofing.
    - b. Section 076200 Sheet Metal Flashing and Trim.
    - c. Section 077200 Roof Accessories.

<u>SECTION 071100 – BITUMINOUS DAMPPROOFING</u> (part of 070001 trade bid required)

- A. PROJECT INCLUDES
  - 1. Bituminous dampproofing at foundations not requiring waterproofing.
- B. PRODUCTS
  - 1. Dampproofing: 60 mils cold-applied asphaltic membrane.
  - 2. Protection Board: Asphaltic board.
  - 3. Insulation: Extruded polystyrene.

#### SECTION 071300 – SELF-ADHERING SHEET WATERPROOFING

\* Trade bid required

#### A. PROJECT INCLUDES

1. Foundations walls and drainage board.

#### B. PRODUCTS

- 1. Sheet Waterproofing: Grace Bituthene or equal; self-adhering rubberized asphalt and polyethylene sheet membrane, 56 mils thick.
- 2. Underslab Waterproofing: Grace Preprufe or equal.
- 3. Insulation: Extruded polystyrene.
- 4. Drainage Board: Compatible with membrane waterproofing.
- 5. Flashing Materials: Compatible with membrane waterproofing.

#### SECTION 071600 - CEMENTITIOUS WATERPROOFING

- A. PROJECT INCLUDES
  - 1. Cementitious waterproofing on interior side of concrete floors and walls at elevator pits and sump pits.
- B. PRODUCTS
  - 1. Cementitious Waterproofing: Cement and polymer based waterproofing suitable for negative side waterproofing.

#### SECTION 072100 - THERMAL INSULATION

- A. PROJECT INCLUDES
  - 1. Mineral wool insulation at exterior cavity walls.
  - 2. Extruded polystyrene insulation board at foundation walls.
  - 3. Spray foam insulation at gaps in exterior wall assemblies.

#### B. PRODUCTS

- 1. Mineral Wool: Roxul, Thermafiber or equal.
- 2. Board Insulation: Extruded polystyrene, rigid, ASTM C 578.
- 3. Spray Foam Insulation: Closed cell type.

#### SECTION 072700 - AIR AND VAPOR BARRIER MEMBRANE (part of 070001 trade bid required)

#### A. PROJECT INCLUDES

- 1. Vapor retarding membrane at exterior wall assemblies and at transitions between different materials.
- B. PRODUCTS
  - 1. Membrane: 40 mils, foil-faced bituminous membrane, NFPA 285 compliant.
  - 2. Accessories: Silicone strips at seal to windows and penetrations.

#### SECTION 072800 - LIQUID APPLIED INSULATIVE COATING

- A. PROJECT INCLUDES
  - 1. Insulative coating where steel penetrates the exterior envelope, including canopies.
- \* Trade bid required

- B. PRODUCTS
  - 1. Insulative Coating: Aerolon by Tnemec.

#### SECTION 074215 – INSULATED METAL WALL PANELS

- A. PROJECT INCLUDES
  - 1. Insulated metal wall panels.
- B. PRODUCTS
  - 1. Insulated Metal Panels:
    - a. Basis-of-Design: Kingspan or equal.
    - b. Type: Painted steel.
    - c. Steel Finish: 2-coat kynar.
    - d. Support Framing: Thermally broken.

#### SECTION 075400 - THERMOPLASTIC MEMBRANE ROOFING (part of 070002 trade bid required)

- A. PROJECT INCLUDES
  - 1. PVC membrane roofing system.
  - 2. Vegetated green roof trays (lower roof).
- B. QUALITY ASSURANCE
  - 1. Membrane Roofing Warranty: Manufacturer's 20 year warranty.

#### C. PRODUCTS

- 1. Membrane Roofing:
  - a. Manufacturer: Sika Sarnafil or equal.
  - b. Type: PVC, white color, 60 mils.
- 2. Auxiliary Materials:
  - a. Vapor Barrier: Reinforced polyethylene.
  - b. Insulation: Polyisocyanurate, tapered and cricketed.
  - c. Protection Board Over Insulation: DensDeck by Georgia Pacific.
  - d. Sheet Metal Accessories: SMACNA and NRCA recommendations.
  - e. Walkway Protection Board: Compatible with membrane.

#### SECTION 076200 - SHEET METAL FLASHING AND TRIM (part of 070002 trade bid required)

- A. PROJECT INCLUDES
  - 1. Flashing and Sheet Metal:
    - a. Metal copings.
    - b. Metal flashing and counterflashing.
    - c. Metal gutters and downspouts.
    - d. Sheet metal accessories.
- B. PRODUCTS
  - 1. Aluminum: 0.040 inch thick aluminum, 3-coat kynar finish.
  - 2. Through-Wall Flashing: ASTM A666, stainless steel drip edge; elastomeric counterflashing.
- \* Trade bid required

- 3. Fabricated Units: Compliance with SMACNA Architectural Sheet Metal Manual.
- 4. Auxiliary Materials:
  - a. Bituminous isolation coating.
  - b. Mastic and elastomeric sealants.
  - c. Epoxy seam sealer.

SECTION 077200 - ROOF ACCESSORIES (part of 070002 trade bid required)

- A. PROJECT INCLUDES
  - 1. Elevator vents.
- B. PRODUCTS
  - 1. Elevator Vents:
    - a. Type: Automatic dampers.
    - b. Material: Extruded aluminum.

#### SECTION 078100 - FIREPROOFING

- A. PROJECT INCLUDES
  - 1. Fireproofing for building structure.
- B. QUALITY ASSURANCE
  - 1. Fire Performance: ASTM E 119, and local regulations.
- C. PRODUCTS
  - 1. Sprayed-On Fireproofing:
    - a. Type: Medium density cementitious fireproofing, cement-aggregate formulation.
    - b. Auxiliary Materials: Primers, adhesive, lath, and reinforcing fabric.

#### SECTION 078413 - PENETRATION FIRESTOPPING

- A. PROJECT INCLUDES
  - 1. Fireproofing for designated portions of building structure.
- B. QUALITY ASSURANCE
  - 1. Fire Performance: ASTM E 119, and local regulations.
- C. PRODUCTS
  - 1. Concealed Sprayed-On Fireproofing:
    - a. Type: Cementitious, 15 pounds per cubic foot dry density, ASTM E 605.
    - b. Auxiliary Materials: Primers, adhesive, lath, and reinforcing fabric.

#### SECTION 078443 - JOINT FIRESTOPPING

- A. PROJECT INCLUDES
  - 1. Penetrations through fire-resistance-rated floor and roof construction.
  - 2. Penetrations through fire-resistance-rated walls and partitions.
  - 3. Penetrations through smoke barriers and construction enclosing compartmentalized

\* Trade bid required

areas.

4. Sealant joints in fire-resistance-rated construction.

#### B. QUALITY ASSURANCE

1. Fire Performance: ASTM E 119, ASTM E 814, and local regulations.

#### C. PRODUCTS

- 1. Through-Penetration Firestop Systems: Subject to compliance with requirements, provide one of the following:
  - a. Endothermic, latex sealant and compounds.
  - b. Intumescent latex sealant, putty and wrap strips.
- 2. Fire-Resistive Elastomeric Joint Sealants:
  - a. Single-component, neutral-curing, silicone sealant.

#### <u>SECTION 079200 - JOINT SEALANTS</u> (part of 070001 trade bid required)

- A. PROJECT INCLUDES
  - 1. Joint sealers at interior and exterior vertical and horizontal joints.
- B. QUALITY ASSURANCE
  - 1. Field-Constructed Mock-Ups: Each joint type.
- C. PRODUCTS
  - 1. Silicone Elastomeric Joint Sealants:
    - Exterior Type and Application: Multi-part nonacid-curing silicone sealant, ASTM C 920, for joints in vertical surfaces, modulus as required for application, exterior use.
    - b. Interior Type and Application: One-part mildew-resistant silicone sealant, ASTM C 920, for sanitary applications, interior use.
  - 2. Latex Joint Sealants:
    - a. Type: Acrylic-emulsion, ASTM C 834.
    - b. Application: Interior joints in vertical and overhead surfaces with limited movement.
  - 3. Paving Joint Fillers:
    - a. Type: Bituminous fiber.
    - b. Application: Filler for exterior paving joints.
  - 4. Auxiliary Materials:
    - a. Plastic foam joint fillers.
    - b. Elastomeric tubing backer rods.
    - c. Bond breaker tape.

#### SECTION 080002 - GLASS AND GLAZING (Trade bid Required)

- A. PROJECT INCLUDES
  - 1. Trade bid section includes the following:
    - a. Section 088000 Interior Glazing.

## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

- A. PROJECT INCLUDES
- \* Trade bid required

- 1. Steel Doors and Frames:
  - a. Interior steel doors and frames.
  - b. Exterior steel doors and frames.

#### B. QUALITY ASSURANCE

- 1. Standards: ANSI/SDI-100, Recommended Specifications for Standard Steel Doors and Frames.
- 2. Performance Standards:
  - a. Fire-Rated Assemblies: NFPA 80, and acceptable testing agency listing.
  - b. Thermal-Rated Assemblies at Exterior: ASTM C 236 or ASTM C 976.
  - c. Sound-Rated Assemblies at Mechanical Rooms: ASTM E 90, and ASTM E 413.

#### C. PRODUCTS

- 1. Steel Doors:
  - a. Door Type: Standard steel doors with composite construction.
  - b. Interior Doors: ANSI/SDI-100, Grade II, heavy-duty, minimum 16 gage cold-rolled steel, 1-3/4 inches thick, seamless.
  - c. Exterior Doors: ANSI/SDI-100, Grade III, extra-heavy-duty, minimum 16 gage galvanized sheet steel, 1-3/4 inches thick, seamless.
  - d. Accessories: Sightproof stationary louvers and glazing stops.
  - e. Finish: Factory primed and field painted
- 2. Steel Frames:
  - a. Interior Frames: Welded, 16 gage sheet steel, mitered or coped corners.
  - b. Exterior Frames: Welded 14 gage galvanized steel, mitered or coped corners.
  - c. Accessories: Door silencers and plaster guards.
  - d. Finish: Factory primed and field painted.

#### SECTION 081416 - FLUSH WOOD DOORS

#### A. PROJECT INCLUDES

- 1. Interior flush wood doors for transparent and painted finish/
- 2. Sound control door at sound studio.

#### B. QUALITY ASSURANCE

- 1. Quality Standards: NWWDA I.S. 1A, and AWI Architectural Quality Standards.
- 2. Fire Rated Wood Doors: Meeting ASTM E 152 requirements.

## C. PRODUCTS

- 1. Wood Doors:
  - a. Grade: AWI Custom grade.
  - b. Species: Clear maple for transparent finish.
  - c. Core: Solid core.
  - d. Thickness: 1-3/4 inches.
  - e. Construction: 5-ply construction with particleboard core.
  - f. Finish: AWI Premium grade.

#### SECTION 083110 - ACCESS DOORS AND FRAMES

- A. PROJECT INCLUDES
  - 1. Access doors for walls and ceilings.
- \* Trade bid required

#### B. PRODUCTS

- 1. Access Doors:
  - a. Frames: 16 gage sheet steel with flange suitable for adjacent material.
  - b. Doors: 14 gage sheet steel.
  - c. Door Type: Flush panel.
  - d. Locking Devices: Cylinder locks, keyed alike.

#### SECTION 084110 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONT

#### A. PROJECT INCLUDES

1. Aluminum-framed entrances and storefront.

#### B. PRODUCTS

- 1. Entrances and Storefront:
  - a. Manufacturer: Kawneer Tri-Fab VG 451 at clerestory, 500 Series for doors; thermal break.
  - b. Material: Aluminum, ASTM B221.
  - c. Glass and Glazing: Tempered glazing.
  - d. Door Hanging Devices: Ball-bearing hinges.
  - e. Aluminum Finish: 2-coat kynar.
- 2. Auxiliary Materials:
  - a. Push/pulls, door stops, overhead holders, and deadlocks.
  - b. Weatherstripping and thresholds.
  - c. Exit devices.
  - d. Electric-strike release.

#### SECTION 084410 - GLAZED ALUMINUM CURTAIN WALLS

#### A. PROJECT INCLUDES

- 1. Structural sealant glazed aluminum-framed curtain walls.
- B. PRODUCTS
  - 1. Curtain Walls:
    - a. Manufacturer: Kawneer 1600 System 2 or equal; thermal break system.
    - b. Material: Aluminum, ASTM B221.
    - c. Glass and Glazing: Tempered glazing.
    - d. Aluminum Finish: 2-coat kynar.

#### SECTION 087100 - DOOR HARDWARE

- A. PROJECT INCLUDES
  - 1. Hardware for doors.
  - 2. Automatic openers at designated exterior entrances for accessibility.
- B. QUALITY ASSURANCE
  - 1. Hardware for Fire-Rated Openings: NFPA 80, and local requirements.
  - 2. Handicapped Accessibility: Local regulations; ADAAG.
  - 3. Materials and Application: ANSI A156 series standards.

#### C. PRODUCTS

- 1. Door Hardware:
  - a. Quality Level: Commercial type.
  - b. Hardware Finishes: Brushed stainless steel on exposed surfaces.
  - c. Hinges: 4-1/2 by 4-1/2 inch, ball bearing hinges.
  - d. Exit Devices: Rim type, Von Duprin.
  - e. Closers: LCN.
  - f. Locksets: Mortise type.
  - g. Keying: Removable cores for all exit locksets and exit devices.
  - h. Finish: US32D.
- 2. Auxiliary Materials:
  - a. Door Trim Units: Kickplates and related trim.
  - b. Stops.
  - c. Overhead door holders.
  - d. Flush bolts.
  - e. Coordinators.
  - f. Soundstripping and gaskets.
  - g. Weatherstripping and thresholds.

#### SECTION 088000 - EXTERIOR GLAZING

#### A. PROJECT INCLUDES

- 1. Glass and Glazing:
  - a. Aluminum entrances and storefront.
  - b. Glazed aluminum curtain wall.
- B. QUALITY ASSURANCE
  - 1. Field-Constructed Mock-Up: Each type of glazing.
  - 2. Testing: Glazing performance.

#### C. WARRANTY

1. Insulating Glass Warranties: Manufacturer's 10 year warranty.

#### D. PRODUCTS

- 1. Glass:
  - a. Primary Glass Products: Clear float glass, ASTM C 1036.
  - b. Heat-Treated Glass Products: Heat-strengthened, tempered, ASTM C 1048.
  - c. Mirrors: Silvering and protective coatings.
- 2. Glazing:
  - a. Elastomeric glazing sealants.
  - b. Preformed glazing tapes.
  - c. Setting blocks, spacers, and compressible filler rods.
- 3. Glazing Schedule:
  - a. Insulating Exterior Glazing: Viracon VE1-2M or equal by PPG or Guardian.

#### <u>SECTION 088010 – INTERIOR GLAZING</u> (part of 080002 trade bid required)

A. PROJECT INCLUDES

- 1. Glass and Glazing:
  - a. Interior glass partition system.
  - b. Interior doors and sidelites.
  - c. Unframed mirrors at toilet rooms.
  - d. Sound control glazing at stound studio.

#### B. QUALITY ASSURANCE

- 1. Field-Constructed Mock-Up: Each type of glazing.
- 2. Testing: Glazing performance.

#### C. PRODUCTS

- 1. Glass:
  - a. Primary Glass Products: Clear float glass, ASTM C 1036.
  - b. Heat-Treated Glass Products: Heat-strengthened, tempered, ASTM C 1048.
  - c. Mirrors: Silvering and protective coatings.
- 2. Glazing:
  - a. Elastomeric glazing sealants.
  - b. Preformed glazing tapes.
  - c. Setting blocks, spacers, and compressible filler rods.
- 3. Glazing Schedule:
  - a. Interior glass partition system: 1/2 inch thick tempered glass.
  - b. Interior doors and sidelites: 1/4 inch thick tempered glass.
  - c. Unframed mirrors at toilet rooms: 1/4 inch thick mirror glass.
  - d. Sound control glazing: 5/16 inch laminated glass.

## SECTION 089000 - LOUVERS AND VENTS

- A. PROJECT INCLUDES
  - 1. Fixed metal wall louvers.

#### B. PRODUCTS

- 1. Aluminum Louvers:
  - a. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T51.
  - b. Blades: Horizontal drainable blades.
  - c. Blade Type: Fixed.
  - d. Aluminum Finish: 2-coat kynar finish.
  - e. Accessories: Bird screens.

## SECTION 090002 – TILE (Trade bid Required)

- A. PROJECT INCLUDES
  - 1. Trade bid section includes the following:
    - a. Section 093000 Tiling.

#### SECTION 090003 - ACOUSTICAL TILE

- A. PROJECT INCLUDES
  - 1. Trade bid section includes the following:
    - a. Section 095113 Acoustical Panel Ceilings.

## SECTION 090005 - RESILIENT FLOORS

\* Trade bid required

#### A. PROJECT INCLUDES

- 1. Trade bid section includes the following:
  - a. Section 096519 Resilient Flooring.

#### SECTION 090007 - PAINTING

#### A. PROJECT INCLUDES

- 1. Trade bid section includes the following:
  - a. Section 099000 Painting and Coating.

#### SECTION 092116 - GYPSUM BOARD ASSEMBLIES

- A. PROJECT INCLUDES
  - 1. Gypsum Drywall Systems:
    - a. Gypsum board for walls and ceilings with GA Level 4 finish and Level 5 at lobby and areas to receive dry erase coatings (quiet study rooms).
    - b. Cement backer board at tile.
    - c. Abuse-resistant boards in corridors.
    - d. Steel framing systems to receive gypsum board.
    - e. Acoustic insulation in gypsum drywall systems.
    - f. Installation of access panels in gypsum board assemblies.

#### B. PRODUCTS

- 1. Gypsum Board:
  - a. Gypsum Wallboard: ASTM C 36, fire-rated and moisture-resistant types, 5/8 inch typical thickness.
  - b. Ábuse-Resistant Board: USG Fiberock or equal.
  - c. Joint Treatment: ASTM C 475 and ASTM C 840, 2-coat system.
  - d. Installation Standard: ASTM C 840.
- 2. Trim Accessories:
  - a. Material: Metal cornerbead, edge trim, and control joints.
- 3. Steel Framing for Walls and Partitions:
  - a. Steel Studs and Runners: ASTM C 645, 20 gage with manufacturer's standard corrosion-resistant coating.
  - b. Furring Channels: ASTM C 645, 20 gage with manufacturer's standard corrosion-resistant coating.
  - c. Auxiliary Framing Components: Furring brackets, resilient furring channels, Z-furring members, and non-corrosive fasteners.
  - d. Installation Standard: ASTM C 754.
- 4. Steel Framing for Suspended and Furred Ceilings:
  - a. Furring Channels: ASTM C 645, 20 gage channels with manufacturer's standard corrosion-resistant coating.
  - b. Accessories: Hangers and inserts.
  - c. Installation Standard: ASTM C 754.
- 5. Auxiliary Materials:
  - a. Concealed acoustical sealant at top and bottom of all partition walls.
  - b. Mineral fiber sound attenuation blankets.

#### SECTION 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. PROJECT INCLUDES

1. Gypsum board shaft-wall assemblies.

#### B. QUALITY ASSURANCE

1. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities.

#### C. PRODUCTS

- 1. Cavity Shaft Wall Assemblies:
  - a. Studs: I, C-H or double E studs, 20 gauge.
- 2. Gypsum Board Shaft Wall Materials:
  - a. Steel Framing: ASTM C 645.
    - b. Gypsum Shaftwall Board: ASTM C 442, Type X.
- 3. Auxiliary Materials:
  - a. Cornerbeads, edge trim, and control joints.
    - b. Laminating adhesive.
    - c. Gypsum board screws, ASTM C 1002.
    - d. Concealed acoustical sealant.
    - e. Mineral fiber sound attenuation blankets.

SECTION 093000 - TILING (part of 090002 trade bid required)

- A. PROJECT INCLUDES
  - 1. Ceramic, porcelain and stone tile and accessories.
- B. QUALITY ASSURANCE
  - 1. Tile Materials: ANSI 118 series standard specifications.
  - 2. Tile Installation: ANSI 108 series standard specifications and Tile Council of North America, Handbook for Ceramic Tile Installation.
  - 3. Accessibility Requirements: ADAAG and local regulations.
- C. PRODUCTS
  - 1. Wall and Floor Tile: Ceramic, porcelain and stone tile as selected by Architect.
  - 2. Tile Accessories:
    - a. Matching trim units.
    - b. Marble thresholds.
  - 3. Setting Materials: Thinset latex-portland cement mortar, except mortar set where required.
  - 4. Grout: Latex-portland cement grout.
  - 5. Waterproofing: Laticrete or equal at toilet rooms.
  - 6. Elastomeric Sealants: Multi-part pourable urethane sealant for traffic areas.

SECTION 095113 - ACOUSTICAL PANEL CEILINGS (part of 090003 trade bid required)

- A. PROJECT INCLUDES
  - 1. Mineral fiber ceilings, trim, and metal suspension systems.
- B. QUALITY ASSURANCE
  - 1. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities. Acoustical performance based on project requirements.

## C. PRODUCTS

- 1. Acoustical Ceilings:
  - a. Type: Suspended acoustical tile, concealed grid, mold-resistant; high-reflectance, high-acoustic value, Armstrong, USG or equal.
  - b. Grid: Exposed grid, intermediate duty.
  - c. Trim: Prefinished aluminum.

#### SECTION 096400 - WOOD FLOORING

- A. PROJECT INCLUDES
  - 1. Wood strip flooring and sound control underlayment.
  - 3. Moisture mitigation at areas of wood flooring.
- B. QUALITY ASSURANCE
  - 1. Performance: Fire, structural, and seismic performance meeting requirements of building code and local authorities.
- C. PRODUCTS
  - 1. Wood Flooring:
    - a. Type: Clear maple, 3/4 inch thick.
    - b. Site Finish: Bona or equal.

#### <u>SECTION 096519 - RESILIENT FLOORING</u> (part of 090005 trade bid required)

#### A. PROJECT INCLUDES

- 1. Resilient flooring.
- 2. Resilient wall base.
- 3. Moisture mitigation at areas of resilient flooring.
- B. QUALITY ASSURANCE
  - 1. Accessibility Requirements: ADAAG and local regulations.
- C. PRODUCTS
  - 1. Resilient Flooring: Tile and sheet as selected by Architect.
  - 2. Wall Base:
    - a. Rubber Wall Base: FS SS-W-40, Type I, 0.125 inches thick.
    - b. Base Height: 4 inches typical.
  - 3. Installation Accessories:
    - a. Concrete Slab Primer: Nonstaining type.
    - b. Trowelable Underlayments and Patching Compounds: Latex-modified, portlandcement- based formulation.
    - c. Adhesives: Water-resistant type.

#### SECTION 096800 - CARPETING

- A. PROJECT INCLUDES
  - 1. Carpet tile and floor preparation.
  - 2. Moisture mitigation at carpet tile.

#### B. QUALITY ASSURANCE

- 1. Performance: Fire performance meeting requirements of building code and local authorities.
- C. PRODUCTS
  - 1. Carpet Tile: \$ 35./sq.yd materials only, as selected by Architect.
  - 2. Auxiliary Materials:
    - a. Edge guards.
      - b. Adhesives, cements and fasteners for direct glue-down installation.

#### SECTION 098430 - SOUND ABSORPTIVE WALL PANELS

- A. PROJECT INCLUDES
  - 1. Sound absorptive panels for sound control in sound studio/lab only.

#### B. PRODUCTS

1. Sound Absorptive Panels: Decoustics or equal.

<u>SECTION 099000 - PAINTING AND COATING</u> (part of 090007 trade bid required)

#### A. PROJECT INCLUDES

- 1. Painting and surface preparation for interior surfaces as scheduled.
- 2. Painting and surface preparation for exterior surfaces as scheduled.
- 3. Field-painting and surface preparation of exposed mechanical and electrical piping, conduit, ductwork, and equipment.

#### B. PRODUCTS

1. Manufacturer: Sherwin-Williams, Benjamin Moore or equal, first-line commercial-quality products for all coating systems.

#### C. EXTERIOR PAINT SCHEDULE

1. Zinc-Coated Metal to Receive High-Gloss Alkyd Enamel Finish: 1 coat galvanized metal primer, 2 coats alkyd gloss enamel.

#### D. INTERIOR PAINT SCHEDULE

- 1. Drywall Walls: 1 coat interior latex-based primer, 2 coats interior eggshell acrylic latex.
- 2. Drywall Ceilings: 1 coat latex-based interior primer, 2 coats latex-based interior flat acrylic latex.
- 3. Drywall to Receive Dry Erase Coating (Quiet Study Rooms): 1 coat primer, 1 coat IdeaPaint, waber-based.
- 4. Interior Woodwork, Opaque Finish: 1 coat latex-based interior primer, 2 coats semi-gloss acrylic latex.
- 5. Interior Woodwork, Transparent Finish: 1 coat stain, 2 coats satin polyurethane sealer.
- 6. Ferrous Metal to Receive Semigloss Enamel Finish: 1 coat synthetic rust-inhibiting primer, 1 coat interior enamel undercoat, 1 coat interior semigloss odorless alkyd enamel.
- 7. Concrete and Concrete Masonry Units to Receive Semigloss Alkyd Enamel Finish: 1 coat high-performance latex block filler, 1 coat interior enamel undercoat, 1 coat interior semigloss odorless alkyd enamel.

#### SECTION 101100 - VISUAL DISPLAY UNITS

- A. PROJECT INCLUDES
  - 1. Markerboards and tackboards.
- B. PRODUCTS
  - 1. Markerboards:
    - a. Materials: Porcelain enamel face for liquid-type markers, core material, and backing.
    - b. Operation: Fixed.
    - c. Trim: Aluminum frame and tray.
  - 2. Tackboards:
    - a. Materials: Plastic-impregnated cork.
    - b. Operation: Fixed.
    - c. Trim: Aluminum frame and tray.

#### SECTION 101400 - SIGNAGE

- A. PROJECT INCLUDES
  - 1. Code required signage.
  - 2. Wayfinding signage.
  - 3. Exterior building signage.
- B. QUALITY ASSURANCE
  - 1. Accessibility Requirements: ADAAG and local regulations.

#### C. PRODUCTS

- 1. Signage and Graphics:
  - a. Type: Unframed.
  - b. Material: Aluminum.
  - c. Copy: Raised lettering.
  - d. Aluminum: Baked enamel.
- 2. Building Signage:
  - a. Type: Custom individual letters.

#### SECTION 102113 - TOILET COMPARTMENTS

- A. PROJECT INCLUDES
  - 1. Toilet compartments and urinal screens.
- B. QUALITY ASSURANCE
  - 1. Accessibility Requirements: ADAAG and local regulations.
- C. PRODUCTS
  - 1. Type and Mounting:
    - a. Compartments: Floor-mounted, overhead-braced.
    - b. Screens: Wall-hung.
    - c. Style: Standard privacy style.
  - 2. Toilet Compartment Materials: Solid phenolic.

\* Trade bid required

#### SECTION 102813 - TOILET ACCESSORIES

- A. PROJECT INCLUDES
  - 1. Toilet accessories.
- B. QUALITY ASSURANCE
  - 1. Accessibility Requirements: ADAAG and local regulations.

#### C. PRODUCTS

- 1. Toilet Accessories:
  - a. Electric hand dryers.
  - b. Toilet tissue dispensers.
  - c. Waste receptacles.
  - c. Grab bars.
  - d. Soap dispensers, deck mounted.
  - e. Sanitary napkin vendors.
  - f. Sanitary napkin disposal units.
  - g. Mop and broom holders.
  - h. Baby changing stations.
- 2. Mirrors and Frames:
  - a. Glazing: Mirror glass, 1/4 inch thick (6 mm), ASTM C 1036.
  - b. Frames: Stainless steel.
  - c. Type: Standard wall unit.
- 3. Materials and Finishes:
  - a. Stainless Steel: AISI Type 302 or 304, No. 4 polished finish.

## SECTION 104100 - AED CABINETS

- A. PROJECT INCLUDES
  - 1. Defibrillator cabinets.
- B. PRODUCTS
  - 1. Defibrillator Cabinets: Equipment and wall mounted cabinet.

#### SECTION 104400 - FIRE-PROTECTION SPECIALTIES

- A. PROJECT INCLUDES
  - 1. Fire extinguishers and cabinets.
- B. QUALITY ASSURANCE
  - 1. Standards: UL listed products.
- C. PRODUCTS
  - 1. Fire Extinguishers:
    - a. Type: Multipurpose dry chemical type.
    - b. Rating: Sized for project requirements.
    - c. Public Area Mounting: Cabinet mounted.
    - d. Service Area Mounting: Metal brackets.

\* Trade bid required

- 2. Cabinets:
  - a. Mounting: Recessed.
  - b. Trim: Trimless with hidden flange.
  - c. Doors: Baked enamel on steel.
  - d. Door Style: Duo-panel.
  - e. Accessories: Glass breaker or fire handle.

#### SECTION 105110 - LOCKERS

- A. PROJECT INCLUDES
  - 1. Wood lockers.
- B. PRODUCTS
  - 1. Wood Lockers:
    - a. Mounting: Floor mounted on leg.
    - b. Type: Single-tier and double-tier wardrobe lockers.
    - c. Locking: User padlock.
    - d. Number Plates: Required.
    - e. Tops: Sloping.

#### SECTION 105626 - COMPACT STORAGE SHELVING

- A. PROJECT INCLUDES
  - 1. Archival storage shelving in Claflin Room.
- B. PRODUCTS
  - 1. Compact Shelving: Spacesaver or equal.

#### SECTION 113100 - APPLIANCES

- A. PROJECT INCLUDES
  - 1. Kitchenette appliances.
- B. PRODUCTS
  - 1. Appliances:
    - a. Kitchen Appliances: Refrigerators, microwave ovens.

#### SECTION 115210 - PROJECTION SCREENS

- A. PROJECT INCLUDES
  - 1. Projection screens.
- B. PRODUCTS
  - 1. Projection Screens:
    - a. Type: Ceiling recessed.
    - b. Operation: Electric.

#### SECTION 115100 – LIBRARY EQUIPMENT

- A. PROJECT INCLUDES
  - 1. Library equipment FF&E contract, not part of CM work.
- B. PRODUCTS
  - 1. Library Equipment:
    - a. Automated Book Return: Ultrasort Automated Materials Handling System by Tech Logic.
    - b. Book Drop: Building mounted, two slots, stainless steel, fireproof.
    - c. Library Security Detection System: At entry.
  - 2. Coordination with library bookshelves and furniture, furnished and installed by Owner.

#### SECTION 115300 - SPECIALTY EQUIPMENT

- A. PROJECT INCLUDES
  - 1. Maker space equipment and ceiling mounted power supply.
- B. PRODUCTS
  - 1. Equipment: As selected by Architect.

#### SECTION 122400 - WINDOW TREATMENT

- A. PROJECT INCLUDES
  - 1. Roller shades at exterior glazing.

#### B. PRODUCTS

- 1. Roller Shades:
  - a. Manufacturer: MechoShade or equal.
  - b. Type: Open weave and room darkening types.
  - c. Operation: Manual and electric.

#### SECTION 124813 - ENTRANCE MATS

- A. PROJECT INCLUDES
  - 1. Entrance mats.
- B. QUALITY ASSURANCE
  - 1. Accessibility Requirements: ADAAG and local requirements.
- C. PRODUCTS
  - 1. Entrance Mats:
    - a. Manufacturer: Construction Specialties, Mats Inc. or equal.
    - b. Type: Aluminum extrusions with carpet inserts.
    - c. Mounting: Recessed.

#### SECTION 140001 – ELEVATORS (Trade bid Required)

#### A. PROJECT INCLUDES

- 1. Trade bid section includes the following:
  - a. Section 142100 Holeless Hydraulic Elevators.

#### SECTION 142400 - HOLELESS HYDRAULIC ELEVATORS (part of 140001 trade bid required)

- A. PROJECT INCLUDES
  - 1. Holeless hydraulic elevator.
- B. QUALITY ASSURANCE
  - 1. Safety Code: ASME/ANSI A17.1 and local regulations.
  - 2. Accessibility Requirements: ADAAG and local requirements.

#### C. PRODUCTS

- 1. Holeless Hydraulic Passenger Elevator: One 3500 pound passenger elevators, 3 stops, 150 fpm.
- 2. Cabs: Custom interior finish; stainless steel entrances.

#### REFER TO NARRATIVES FOR:

- Division 21 \* Fire Suppression
- Division 22 \* Plumbing
- Division 23 \* Heating Ventilating And Air Conditioning
- Division 26 \* Electrical; includes photovoltaics
- Division 27 Communications (part of Division 26 trade bid)
- Division 28 Electronic Safety And Security (part of Division 26 trade bid)
- Division 31 Earthwork
- Division 32 Exterior Improvements
- Division 33 Utilities

End

SECTION 312500

#### EROSION AND SEDIMENTATION CONTROLS

#### PART 1-GENERAL

- 1.1 GENERAL PROVISIONS
  - A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

#### 1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Control measures to prevent all erosion, siltation, and sedimentation of wetlands, waterways, construction areas, adjacent areas and off-site areas.
  - 2. Control measures shall be accomplished adjacent to or in the following work areas:
    - a. Soil stockpiles and on-site storage and staging areas.
    - b. Cut and fill slopes and other stripped and graded areas.
    - c. Constructed and existing swales and ditches.
    - d. Retention ponds.
    - e. At edge of wetlands areas, if applicable, as shown on Drawings.
  - 3. The Contract Drawings indicate the minimum requirements for sedimentation and erosion control. The Contractor shall install all measures needed to control sediment and erosion as required by the Contractor and Sub-contractor's construction methods and operations, the weather conditions, and as directed by the Engineer.
  - 4. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional cost to the Owner.
  - 5. Periodic maintenance of all sediment control structures shall be provided to ensure intended purpose is accomplished. Sediment control measures shall be in working condition at the end of each day.
  - 6. After any significant rainfall, sediment control structures shall be inspected for integrity. Any damaged device shall be corrected immediately.
- B. Alternates: Not Applicable.
- C. Items to Be Installed Only: Not Applicable.
- D. Items to Be Furnished Only: Not Applicable.
- E. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
  - 1. Section 311000 SITE CLEARING for protection of existing trees and other vegetation to remain.
  - 2. Section 312000 EARTH MOVING for soil materials, excavating, backfilling, and site grading and removal of site utilities.

#### 1.3 SUBMITTALS

- Refer to Section 013300 SUBMITTAL PROCEDURES, for submittal provisions and procedures.
  OR General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. (If SWPPP is provided by the Contractor) At least 20 days prior to the start of the project, the Contractor shall submit a Storm Water Pollution Prevention Plan (SWPPP) indicating project phasing, Contractor operation areas, work areas, stockpile locations, construction staging/sequencing, and sedimentation/erosion control measures to be used. The SWPPP shall be prepared to meet the requirements of the United States Environmental Protection's (EPA) National Pollutant Discharge Elimination System (NPDES) Construction General Permit for Stormwater Discharges from Construction Activities (CGP). The Contractor shall also submit the EPA "Notice of Intent for Storm Water Discharges Associated with CONSTRUCTION ACTIVITY Under a NPDES General Permit." (NOI) form. This form shall be submitted to the EPA at least 14 days prior to the start of any construction activity and placing a signed copy along with proof of mailing in the SWPPP.

#### <mark>OR</mark>

(If SWPPP is provided in the Construction Documents) At least 20 days prior to the start of the project, the Contractor shall submit an Appendix by a qualified person to the Draft Stormwater Pollution Prevention Plan (SWPPP) indicating project phasing, Contractor operation areas, work areas, stockpile locations, construction staging/sequencing, and sedimentation and erosion control measures to be used. This Appendix shall become part of the SWPPP that is to be updated and maintained by the Contractor.

- 2. As part of the Contract Closeout procedures, the Contractor is responsible for filing a Notice of Termination with the EPA once the project has been completed and is permanently stabilized. Stabilization is complete when all temporary storm water and erosion controls have been removed, all permanent storm water and erosion controls are in place and functional and all vegetated areas are at least 70% viable.
- 3. The Contractor shall provide the manufacturer's literature, material specification, and installation instructions for sedimentation and erosion control materials and devices for approval. Do not order materials until approval of certifications or test results has been obtained. Delivered materials shall match the approved submittals.
- 4. LEED Supporting Documentation: Submit LEED supporting documentation as outlined in Section 018110 SUSTAINABLE DESIGN REQUIREMENTS for materials and products that have been extracted, harvested, or recovered, as well as manufactured within 500 miles of the project site.

#### 1.4 QUALITY ASSURANCE

- A. When applicable, comply with the requirements of Stormwater Pollution Prevention Plan prepared for the NPDES permit, which are incorporated herein by reference, and all other applicable requirements of governing authorities having jurisdiction. The specifications and drawings are not represented as being comprehensive, but rather convey the intent to provide complete slope protection and erosion control for both the project site and adjacent property.
  - 1. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to a sediment and erosion control plan specific to the site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- B. Erosion control measures shall be established at the beginning of construction and maintained during the entire period of construction. On-site areas which are subject to severe erosion, and off-site areas which are especially vulnerable to damage from erosion and/or sedimentation, are to be identified and receive special attention.

- C. The Contractor shall install and maintain sedimentation control devices during construction to prevent the movement of sediment from the construction site to off site areas, into adjacent water bodies via surface runoff or into underground drainage systems. Measures to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at no additional cost to the Owner.
- D. All land-disturbing activities are to be planned and conducted to minimize the size of the area to be exposed at any one time, and the length of time of exposure.
- E. Surface water runoff originating upgrade of exposed areas should be controlled to reduce erosion and sediment loss during the period of exposure.
- F. When the increase in the peak rates and velocity of storm water runoff resulting from a landdisturbing activity is sufficient to cause accelerated erosion of the receiving stream bed, provide measures to control both the velocity and rate of release so as to minimize accelerated erosion and increased sedimentation of the stream.
- G. All land-disturbing activities are to be planned and conducted so as to minimize off-site sedimentation damage.
- H. The Contractor is responsible for cleaning out and disposing of all sediment once the storage capacity of the sediment facility is reduced by one-half.
- I. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- J. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

#### 1.5 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
  - 1. "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials", prepared by the Massachusetts Department of Environmental Protection, Bureau of Resource Protection, dated March 1997, reprinted May 2003.

#### 1.6 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

#### 1.7 PERMITS, CODES, AND REGULATIONS

- A. Comply with all rules, regulations, laws, and ordinances of the City and State, and all other authorities having jurisdiction over the project site. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.
- B. Comply with all applicable regulations of the Commonwealth of Massachusetts Department of Environmental Protection (DEP) and the EPA.

C. The Contractor shall comply with the requirements of the NPDES CGP for this project.

## 1.8 STORM WATER POLLUTION PREVENTION PLAN

## (DELETE SECTION IF SWPPP BY CONTRACTOR)

- A. A professional engineer has prepared a Draft Storm Water Pollution Prevention Plan (SWPPP). The Contractor shall locate the SWPPP and review its contents thoroughly. Upon the award of the Contract, the Contractor becomes responsible for implementing the SWPPP and meeting the requirements and standards detailed within the SWPPP. The Contractor is also responsible for all record keeping associated with maintaining the SWPPP and for maintaining in good operating condition all SWPPP controls. The Contractor shall modify the SWPPP as necessary to reflect changes in project scope, schedule, or approach. All labor, materials, equipment, and services necessary to make the work comply with such requirements shall be provided by the Contractor without additional cost to the Owner.
- B. The Contractor shall fill out all pertinent information within the SWPPP.
- C. The Contractor shall locate the EPA "Notice of Intent for Storm Water Discharges Associated with CONSTRUCTION ACTIVITY Under a NPDES General Permit" (NOI) form in the SWPPP. The Contractor is responsible for signing and filing his copy of the NOI at least 14 calendar days prior to the start of any construction activity and placing a signed copy along with proof of mailing in the SWPPP.
- D. The Contractor is responsible for obtaining a copy of the Owner's filed copy of the NOI form and proof of mailing and placing it in the SWPPP.
- E. The Contractor is responsible for filling in the Contractor and Sub-Contractor information in the areas indicated within the SWPPP and for completing the Contractor's Certification portion of the SWPPP.
- F. The Contractor is responsible for maintaining the following records on site:
  - 1. Completed SWPPP as indicated in sections B, C, D, and E.
  - 2. Completed Inspection Reports
  - 3. Completed Maintenance Reports
  - 4. Construction Activity Reports
  - 5. Spill Records
  - 6. Other Materials relevant to the NOI Permit and SWPPP
  - 7. A copy of the Notice of Termination
- G. The Contractor is responsible for filing a Notice of Termination once the project has been completed and is permanently stabilized. Stabilization is complete when all temporary storm water and erosion controls have been removed, all permanent storm water and erosion controls are in place and functional and all vegetated areas are at least 70% viable.
- H. All labor, materials, equipment, and services necessary to make the work comply with the above requirements shall be provided by the Contractor without additional cost to the Owner.

#### PART 2-PRODUCTS

#### 2.1 MATERIALS

- A. Straw Bales: Wire or nylon bound bales of straw, oriented around sides, rather than over and under.
- B. Stakes: Stakes for bales shall be one of the following materials: Wood stakes of sound hardwood 2 by 2 inches in size or steel reinforcing bars of at least No. 4 size. Lengths shall be approximately three feet.
- C. Straw Wattles
  - 1. Straw wattles shall consist of weed free rice straw inside biodegradable netting. Straw wattles shall measure at least nine (9) inches in diameter.
  - 2. Stakes for wattles shall be one of the following materials. Lengths shall be approximately two feet (2').
    - a. Wood stakes of sound hardwood, one inch by one inch (1" x 1") in size.
    - b. Steel reinforcing bars of at least No. 4 size.

#### D. Siltation Fence

1. Fabricated or prefabricated unit consisting of the following filter fabric properties:

a.	Grab Tensile Strength (lbs)	124	ASTM D4632
b.	Elongation at Failure (%)	15	ASTM D4632
C.	Mullen Burst Strength (PSI)	280-300	ASTM D3786
d.	Puncture Strength (lbs)	60-65	ASTM D4833
e.	Water Flow Rate (gal/min/sf)	8-10	ASTM D4491
f.	Apparent Opening Size (Sieve)	30	ASTM D4751
g.	Ultraviolet Radiation Stability (%)	70-80	ASTM D4355

- 2. Use only commercially available fabric that is certified in writing by the manufacturer for the purpose intended.
- 3. Acceptable fabric materials include "Mirafi Envirofence" by Mirafi Construction Products, "Style 2130" by Amoco Fabrics Co., and "IVI 3617C Silt Fence" by Indian Valley Industries, Inc., or approved equal by the Engineer.
- 4. Silt fence posts: Posts may be wood or metal. Wood post shall be a minimum 1¼ inch by 1¼ inch by 5 feet long hardwood stakes commonly used to support siltation fabric. Metal posts shall be a minimum of 1 inch wide and 5 feet long. Posts shall be spaced at a maximum distance of 8 feet on center.
- 5. Provide suitable heavy nylon cord for securing abutting silt fence posts.
- E. Fencing: Steel posts shall be standard 6-foot long metal stamped drive stakes commonly used to support snow fences. Fencing shall be new four-foot height wood lath snow fencing. Provide suitable steel staples or heavy nylon cord for securing filter cloth to support system.
- F. Crushed Stone: Crushed Stone: Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

Percent Passing by Weight			
Sieve Size	1 1/2-inch Stone	3/4-inch Stone	
2-inch	100		
1 1/2-inch	95-100		
1 1/4-inch			
1-inch	35-70	100	
3/4-inch	0-25	90-100	
1/2-inch		10-50	
3/8-inch		0-20	
No. 4		0-5	

- G. Protective Measures: As temporary coverings on ground areas subject to erosion, provide one of the following protective measures, and as directed by the Designer with concurrence of the Owner's Representative:
  - 1. Hay or straw temporary mulch, 100 pounds per 1,000 square feet.
  - 2. Wood fiber cellulose temporary mulch, 35 pounds per 1,000 square feet.
  - 3. Tackifier for anchoring mulch or straw shall be a non-petroleum based liquid bonding agent specifically made for anchoring hay or straw.
  - 4. Provide natural (jute, wood excelsior) or man-made (glass fiber) covering with suitable staples or anchors to secure to ground surface. Note that wire staples and non-biodegradable coverings shall not be used for any area that will be mown turf.
  - 5. Temporary vegetative cover for graded areas shall be undamaged, air dry threshed straw or hay free of undesirable weed seed.
- H. Temporary Covers for Drainage Structures
  - 1. Filter fabric for use as temporary covers for drainage structures shall be the same as noted above for siltation fence.
  - 2. Wire mesh for use at temporary drainage structure covers shall be 6" x 6", W2.9 welded wire mesh.
  - 3. Crushed stone shall be as specified herein before.
  - 4. Silt-Sac, Hydro-FloGard + Plus Catch Basin Insert, Ultra-DrainGuard Insert, or approved equal, may be used in lieu of hay bales and filter fabric at catch basins.

#### PART 3-EXECUTION

#### 3.1 GENERAL REQUIREMENTS

- A. The Contractor shall provide suitable and adequate means of sedimentation and erosion control during construction. Control measures shall prevent all erosion, siltation, and sedimentation of waterways, drainage systems, construction areas, adjacent areas and off-site areas. Work shall be accomplished on and/or adjacent to the following work areas:
  - 1. Earthwork stockpiles and on-site storage and staging areas.
  - 2. Cut and fill slopes and other stripped and exposed graded areas.
  - 3. Constructed and existing swales and ditches.
  - 4. Unestablished lawns and seeded embankments.

- B. Means of protection as noted on the Contract Drawings indicate the minimum provisions necessary. Additional means of protection shall be provided by the Contractor as required for continued or unforeseen erosion problems, at no additional expense to the Owner.
- C. Periodic maintenance of all sediment control installations shall be provided to ensure intended purposes are accomplished. Sediment control measures shall be in working condition at the end of each day.
- D. After any significant rainfall, sediment control devices shall be inspected for integrity. Any damaged device shall be corrected immediately.
- E. The Contractor shall provide adequate means of control of runoff, as to not detrimentally impact downstream conditions during construction. The Contractor shall plan his operations so that permanent drainage mitigation systems such as detention/retention/infiltration basins and chambers are in place and properly functioning prior to connecting upland drainage flows to these systems. The Contractor shall plan his operations such that downstream drainage mitigation measures are in place and functioning before attempting to tie in upgradient drainage systems.
- F. In the event that the Contractor is unable to sequence the work so that construction of the permanent drainage mitigation systems precedes the upland work, then the Contractor shall submit a plan indicating his proposed methods of otherwise controlling runoff from the site.
- G. The "Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas" should be consulted as a guide for the selection and installation of Best Management Practices to suit the conditions encountered.

#### 3.2 STRAW BALE BARRIERS

- A. Excavation shall be to the width of the bale and the length of the proposed barrier to a minimum depth of 4 inches.
- B. Bales shall be placed in a single row, lengthwise on proposed line, with ends of adjacent bales tightly abutting one another. In swales and ditches, the barrier shall extend to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale.
- C. Staking shall be accomplished to securely anchor bales by driving at least two stakes or rebars through each bale to a minimum depth of 18 inches.
- D. The gaps between bales shall be filled by wedging straw in the gaps to prevent water from escaping between the bales.
- E. The excavated soil shall be backfilled against the barrier. Backfill shall conform to ground level on the downhill side and shall be built up to 4 inches on the uphill side. Loose straw shall then be scattered over the area immediately uphill from a straw barrier.
- F. Inspection shall be frequent and repair or replacement shall be made promptly as needed.
- G. Bales shall be removed when they have served their usefulness so as not to block or impede stormwater flows or drainage.

#### 3.3 STRAW WATTLE BARRIERS

- A. Install straw wattles in locations as shown on Contract Drawings and as directed.
  - 1. Wattles shall be placed in a row with ends overlapping a minimum of two (2) feet.
  - 2. Each wattle shall be embedded in the soil a minimum of two (2) and a maximum of six (6) inches.

- 3. Wattles shall be securely anchored in place by stakes or rebars driven through the wattles and a minimum twelve (12) inches into the soil. Stakes shall be placed four (4) feet on center.
- B. Inspection shall be frequent and repair or replacement shall be made as needed.
- C. Wattles shall be removed when they have served their usefulness so as not to block or impede stormwater flows or drainage.
- 3.4 STABILIZED CONSTRUCTION ENTRANCE AND STONE BERMS
  - A. Stone size: Use ASTM designation C-33, size No. 2 (1-1/2" to 2-1/2"). Use crushed stone.
  - B. Length: As effective, but not less than 50 feet.
  - C. Thickness: Not less than eight inches.
  - D. Width: Not less than full width of all points of ingress or egress, but not less than 25 feet.
  - E. Washing: When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch, or watercourse through the use of sand bags, gravel boards or other approved methods.
  - F. Maintenance: The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spoiled, dropped, washed or tracked onto public rights-of-way must be removed immediately.
  - G. Place crushed stone berms in locations required and as directed. Berms shall have side slopes of 1:3 or less.
  - H. Inspect stone berms periodically and replace and/or regrade crushed stone as required.

#### 3.5 SILT FENCING

- A. Excavate a 6-inch trench along the upstream side of the desired fence location.
- B. Drive fence posts a minimum of 1'-6" into the ground. Install fence, well-staked at maximum eight-foot intervals in locations as shown on Drawings. Secure fabric to fence and bury fabric end within the six-inch deep trench cut.
- C. Lay lower 12 inches of silt fence into the trench, 6 inches deep and 6 inches wide. Backfill trench and compact.
- D. Overlap joints in fabric at post to prevent leakage of silt at seam.
- E. Inspect siltation fence after major storm events and periodically and remove accumulated sediment and debris. If a breach or failure of the siltation fence occurs, the fence shall immediately be restored.
- 3.6 EROSION CONTROL GRASSING
  - A. Grassing shall be applied according to the Massachusetts Erosion and Sedimentation Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials.

#### 3.7 INLET PROTECTION

- A. Install silt fence or straw bales around inlet as specified herein.
- B. Install temporary covers at drainage structure locations that may be subject to erosion infiltration and as directed by the Engineer.
- C. Inspect drainage structures periodically. Remove sediment accumulation and regrade or replace materials as required.

#### 3.8 DUST CONTROL

- A. Throughout the construction period the Contractor shall carry on an active program for the control of fugitive dust within all site construction zones, or areas disturbed as a result of construction. Control methods shall include the following: Apply calcium chloride at a uniform rate of one and one-half (1 ½) pounds per square yard in areas subject to blowing. For emergency control of dust apply water to affected areas. The source of supply and the method of application for water are the responsibility of the contractor.
- B. The frequency and methods of application for fugitive dust control shall be as directed by the Designer with concurrence by the Owner's Representative.

#### 3.9 TEMPORARY PROTECTIVE COVERINGS

- A. Place temporary soil coverings to control erosion and sedimentation on all disturbed or graded areas as required by the construction methods employed and as directed by the Engineer. Erosion control matting shall be installed in all areas seeded or hydroseeded with slopes of one vertical foot to three-foot horizontal, or steeper, immediately after such areas have been seeded and a hay mulch applied as follows:
  - 1. The area to receive matting shall have been recently seeded and shall have a smooth surface free front stones, clods or depressions.
  - 2. Roll out of the matting perpendicular to the slope, do not stretch the fabric. In drainage swales, center the fabric along the flow line. Install the matting in a check slot at the top and bottom of the slope and at the edges of the area to be covered. Check slots shall be six inches deep and six inches wide. Fabric shall extend down one wall of the check slot and across the full width of the base. Overlap edges of matting rolls four (4) inches minimum and overlap the ends eighteen (18) inches minimum.
  - 3. Install staples in check slots, edges, center, and ends of rolls by driving specified steel staples two feet on center over the entire area to be covered except at check slots and ends of rolls, where staples shall be placed six inches on center. All staples shall be driven below finished grade.
  - 4. Fill check slots with loam and tamp firmly.
  - 5. Reseed check slots and all disturbed areas per Specifications.
  - 6. Following matting installation, roll the entire area with a smooth drum roller weighing between fifty and seventy-five (50-75) pounds per linear foot of roller. The finished installation of matting shall be firmly in contact with the seeded area and provide a smooth, finished appearance free from lumps or depressions.
- B. Install erosion control matting as a temporary ground cover in all disturbed or graded areas subject to erosion and as directed by the Engineer. The temporary ground cover shall protect the site from erosion until a full permanent lawn can be installed. Install and anchor in place temporary erosion control matting in accordance with manufacturer's printed instructions or as directed by the Engineer and remove all temporary erosion control matting prior to installation of a permanent lawn.
C. Inspect protective coverings periodically and reset or replace materials as required.

# 3.10 TEMPORARY PROTECTIVE COVERINGS (AFTER GROWING SEASON)

- A. Place temporary covering for erosion and sedimentation control on all areas that have been graded and left exposed after October 30. Contractor shall have the choice to use either or both of the methods described herein.
- B. Hay or straw shall be anchored in-place by one of the following methods and as approved by the Designer with concurrence by the Owner's Representative: Mechanical "crimping" with a tractor drawn device specifically devised to cut mulch into top two inches of soil surface or application of non-petroleum based liquid tackifier, applied at a rate and in accordance with manufacturer's instructions for specific mulch material utilized.
- C. Placement of mesh or blanket matting and anchoring in place shall be in accordance with manufacturer's printed instructions.
- D. Inspect protective coverings periodically and reset or replace materials as required.
- 3.11 REMOVAL AND FINAL CLEANUP
  - A. Once the site has been fully stabilized against erosion, and with the approval of the Owner's Representative remove sediment control devices and all accumulated silt. Dispose of silt and waste materials offsite. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated.

END OF SECTION

#### **SECTION 330505**

## SELECTIVE SITE UTILITY DEMOLITION

#### PART 1 – GENERAL

#### 1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

#### 1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Protection of Existing Utilities.
  - 2. Utility Demolition as required to accommodate new construction.
  - 3. Protection and Abandonment of Utilities
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
  - 1. Section 310000 EARTHWORK for soil materials, excavating, backfilling, and site grading and removal of site utilities.
  - 2. Section 312500 SEDIMENTATION AND EROSION CONTROL for required erosion and sedimentation control measures.

#### 1.3 SUBMITTALS

- A. Refer to Section 013300 SUBMITTAL PROCEDURES, for submitted provisions and procedures. OR General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. Schedule indicating proposed sequence of operations for demolition work for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise protection.
    - a. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
    - b. Coordinate with Owner's continuing occupation of portions of existing building, adjacent buildings, and with Owner's partial occupancy of completed portions of proposed building or additions.
  - 2. Preconstruction survey photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations are recommended. File with Owner's Representative prior to start of work.

# 1.4 EXAMINATION OF SITE AND DOCUMENTS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed

because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.

- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.
- PART 2 PRODUCTS

(Not applicable to work of this section.)

- PART 3 EXECUTION
- 3.1 GENERAL REQUIREMENTS
- 3.2 DISPOSAL OF WASTE MATERIALS
  - A. Removal from Owner's Property: Remove waste materials offsite in a legal manner.
- 3.3 SITE UTILITIES
  - A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
    - 1. Arrange with utility companies to shut off indicated utilities. The Contractor is responsible for coordinating and scheduling with the authorities having jurisdiction the removal and/or abandonment of existing utilities as required to complete the work.
  - B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner's Representative or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
    - 1. Notify the Owner's Representative not less than two days in advance of proposed utility interruptions.
    - 2. Do not proceed with utility interruptions without the Owner's Representative's written permission.
  - C. Utility pipes designated to be abandoned in place shall be plugged at their ends with watertight brick masonry or cement mortar with a minimum thickness of 8 inches.
  - D. Utility pipes designated to be removed shall consist of the complete removal and disposal of the entire length of pipe and backfill and compaction of the void with ordinary borrow. When the void is within the footprint of the new building, gravel borrow shall be used to backfill the void.
  - E. Utility structures designated to be abandoned in place shall have their cast iron castings removed and disposed, inlet and outlet pipes plugged, the bottom of the structures shall be broken, the void of the structure shall be backfilled and compacted with ordinary borrow, and the top of the structure shall be removed so that it is at least 36 inches below finished grade.

- F. Utility structures designated to be removed shall consist of the removal and disposal of cast iron castings, plugging of inlet and outlet pipes, removal of the structure, and backfill and compaction of the void with ordinary borrow. When the void is within the footprint of the new building, gravel borrow shall be used to backfill the void.
- 3.4 DISPOSAL, CLEANUP, AND REPAIR
  - A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off the Owner's property.
    - 1. Burning on site is prohibited.
    - 2. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.
  - B. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site.
  - C. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by site utility demolition work.

END OF SECTION

# SECTION 331000 WATER UTILITIES

#### **PART 1-GENERAL**

- 1.1 GENERAL PROVISIONS
  - A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

#### 1.2 DESCRIPTION OF WORK

- A. Provide labor, materials, and equipment necessary to construct the exterior water system complete, including connections to existing pipelines and testing, all as indicated on the Drawings and as specified, including but not limited to the following:
  - 1. Installation of ductile iron pipe, fittings, accessories, and appurtenant work, at the locations and to the lines and grades indicated on the Contract Drawings.
  - 2. The installation of hydrants, gate valves and boxes and concrete thrust blocks.
  - 3. Furnishing and installation of all materials required to connect to existing water mains, replace existing services, install new gate valves, remove existing gate valves, install corporation cocks, saddles, curb stops, service boxes, and abandoning of the existing water system (if applicable), all as shown on the Contract Drawings. All valves, 24 inches and larger shall be butterfly valves. All abandoned pipes shall be cut and capped at the main.
  - 4. In accordance with 528 CMR 11.00, work on the fire protection system, including hydrants and exterior underground piping, shall be performed by a Licensed Fire Protection Sprinkler Systems Contractor. The fire protection exterior underground piping will terminate at the valved tee connection to the water distribution system. The tee and valve will not be considered part of the fire protection system work.
- B. Unless otherwise indicated on the Drawings, exterior water lines shall be installed from a point 10 feet outside the building foundation walls to the potable water source
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections.
  - 1. Section 312000 EARTH MOVING for excavation, backfill, and compaction requirements.
  - 2. Section 211000 FIRE PROTECTION for fire protection service piping.
  - 3. Section 221000 PLUMBING for potable water service piping.

## 1.3 SUBMITTALS

- A. Refer to Section 013300 SUBMITTAL PROCEDURES, for submitted provisions and procedures. OR General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. Descriptive literature showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
  - 2. Product Data: Submit manufacturer's technical product data and installation instructions for potable water system materials and products.

- 3. Shop Drawings: The Contractor shall submit for review shop drawings or descriptive literature for potable water system, showing piping, fittings, couplings, valves, hydrants, materials, dimensions, restrained joint calculations, joints and other details, blocks, and anchors. All hydrants and valves furnished under the Contract shall be manufactured only in accordance with the Specifications and the approved Shop Drawings.
- 4. At project closeout, submit record drawings of installed potable water system piping and products, in accordance with requirements of Division 1. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor or Licensed Professional Engineer. The asbuilt plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher).
- 5. Maintenance Data: Submit maintenance data and parts lists for water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual in accordance with requirements of Division 1.

## 1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
  - 1. ASTM: American Society for Testing and Materials.
  - 2. ANSI: American National Standards Institute.
  - 3. AWWA: American Water Works Association.
  - 4. AASHTO: American Association of State Highway and Transportation Officials.
  - 5. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
  - 6. MassDOT, Construction Standards, latest Edition with amendments, hereinafter referred to as the "Construction Standards."
  - 7. Commonwealth of Massachusetts State Plumbing Code, latest edition.
  - 8. Commonwealth of Massachusetts Regulations 528 CMR 12.00 Sprinkler Contractor Licensing Regulations.
  - 9. Town Water Department Regulations.

## 1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of potable water systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- B. Installer's Qualifications: Firm with at least three years of successful installation experience on projects with potable water piping work similar to that required for this project.
- C. Water Purveyor Compliance: Comply with requirements of Purveyor supplying water to project, obtain required permits and inspections.

#### 1.7 PROJECT CONDITIONS

- A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that water system piping may be installed in compliance with Contract Drawings and referenced standards.
- B. Interruption of Existing Water Distribution System: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to the requirements indicated:
  - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Architect's written permission.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate with interior building domestic water and fire protection system piping.
- B. Coordinate with other utility work.
- C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.
- D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

## PART 2-PRODUCTS

# 2.1 DUCTILE IRON PIPE AND FITTINGS

- A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Engineer to comply with installation requirements. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
  - 1. Ductile iron pipe shall be that of a manufacturer who can demonstrate at least five years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push on type, restrained joint, or mechanical joints, as required.
  - 2. All ductile iron water pipe shall conform to American Water Works Association (AWWA) C150 and AWWA C151.
  - 3. The ductile iron pipe shall be Class 52 Class and furnished in minimum nominal 18-foot lengths, with Push-on or Mechanical Joints as manufactured by U.S. Pipe and Foundry Company, Atlantic States Cast Iron Pipe Co., Clow Corporation, or approved equal with

gaskets conforming to AWWA C111 "Rubber Gasket Joints". A minimum of two brass wedges per joint shall be used to maintain conductivity and facilitate lock-on.

- 4. All ductile iron pipes shall be rated for a minimum operating pressure of 350 psi.
- 5. The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer asphaltic topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils. with a local minimum not less than 2 mils. The zinc coating system shall conform to ISO 8179-1 "Ductile iron pipes-External zinc-based coating-Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01."
- 6. The ductile iron water pipe shall be double cement lined inside and then asphalt seal coated in accordance with AWWA C104 and AWWA C151. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.
- 7. All water pipe shall be encased in polyethylene film when the trench is backfilled with control density fill.
- 8. Fittings shall be ASTM A-536 ductile iron with mechanical joint fittings. All fittings 3 inches through 48 inches in diameter shall meet or exceed the requirements of AWWA C110. Compact fittings shall be ductile iron meeting or exceeding the requirements of AWWA C153. Fittings shall have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. All fittings 4 through 24 inches shall be Class 350. All fittings greater than 24 inches shall be as specified above except they shall be Class 250. Compact fittings shall only be used in sizes 4 through 24 inches. Fittings shall conform to the weights, excluding accessories, and dimension shown in the latest edition of the Handbook of Ductile Iron Pipe and come complete with all joint accessories as required. All accessories (gland, gaskets, T-bolts, and nuts) shall be in accordance with AWWA C111. All mechanical joint bolts (T-bolts) shall be Cor-Ten or equal.
- 9. In order to provide positive joint restraint, valve anchor tees/valves and restrained joints shall be used on fire services and on the 6-inch branch connections for hydrants.
- 10. Caps and plugs installed in all new work as indicated on the Contract Drawings shall be provided with a threaded corporation or bleeder valve so that air and water pressure can be relieved prior to future connection.
- 11. Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross connections, whether or not specifically stated in the Contract Drawings and Specifications.
- 12. All pipe shall be marked with the class, thickness designation, and initials of the manufacturer.
- 13. If required the manufacturer shall supply the Engineer with certificates of compliance with these Specifications and certification that each piece of ductile iron pipe has been tested at the foundry with the Ball Impression Test, Ring Bending, or equal.
- 14. Thrust blocks shall be used at all bends and fittings as shown on the details. In addition, all bends and fittings shall be restrained with Megalug Series 1100 mechanical joint restraint. In the event that the use of thrust blocks is not practical or allowed, the Contractor shall provide an alternate method of joint restraint, at no additional cost to the owner, as approved and/or as directed by the Engineer. Restraint length calculations and restrained joint locations shall be provided by the contractor and submitted to the engineer for review. Restraint length values shall be calculated per the manufacturer's standards.
  - a. Restraint for standardized mechanical joints shall be incorporated in the design of the follower gland and shall impart multiple wedging action against the pipe,

increasing its resistance as the pressure increases. The assembled joint shall maintain its flexibility after burial and shall maintain its integrity by a controlled and limited expansion of each joint during the wedging action. Restraining glands shall be manufactured of high strength ductile iron conforming to the requirements of ASTM A536, Grade 65-45-12. Wedging mechanisms shall be manufactured of ductile iron, heat treated to a hardness of 370 BHN minimum. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee head bolts conforming to the requirements of ANSI/AWWA A21.53/C153 of latest revision. Twist-off nuts shall be incorporated in the design of the wedge activation screws to ensure proper torque. The mechanical joint restraining device shall have a water working pressure rating of 350 psi minimum (in sizes 4" thru 16") with a safety factor of at least 2:1 against separation when tested in a dead-end situation.

- b. Restraint for push-on ductile iron pipe shall consist of a wedge action restraint ring on the spigot joined to a split ductile iron ring behind the bell. The restraint ring shall have individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. The restraint ring and its wedging components shall be made of minimum grade 65-45-12 ductile iron conforming to ASTM A536. The wedges shall be heat treated to a minimum hardness of 370 BHN. Torque limiting twist off nuts shall be used to ensure proper actuation of the restraining wedges. The split ring shall be made of a minimum grade of 65-45-12 ductile iron conforming to ASTM A536. The connecting tie rods that join the two rings shall be made of low alloy steel that conforms to ANSI/AWWA C111/A21.11. The assembly shall have a rated pressure with a minimum two to one safety factor of 350 PSI in the sixteen-inch size and below 250 PSI in the eighteen through thirty-six-inch sizes. Push on joints on ductile iron pipe shall be restrained with Megalug Series 1700 restraint harness.
- 15. Pipe for use with split couplings shall be as specified except that the ends shall not have bells or beads but shall have cast or machined shoulders or grooves as necessary for the couplings to be used and shall conform to the specifications of the manufacturer of the couplings. If split couplings are used with grooved ductile-iron pipe, the minimum pipe wall thickness shall be as follows:

Nominal Pipe Size (In.)	Thickness Class	
4-12	53	
14-18	54	
20	55	
24	56	

16. Pipe for use with sleeve-type couplings shall be as specified except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.

# B. COUPLINGS AND ADAPTERS FOR DUCTILE IRON PIPE

- 1. Sleeve type couplings for plain end pipe shall be provided with plain rubber gaskets and steel, tee head bolts with nuts. Couplings shall be Dresser style 38 or 138, furnished preassembled, as manufactured by Dresser Industries, Inc., Smith Blair, Coupling Systems, Inc., or equal.
- 2. Couplings or adapters as required for connecting existing pipe to new pipe or new pipe to new pipe shall be furnished as required and designed for compatibility with the pipe and operating pressures encountered. Couplings shall be Dresser Style 162 as manufactured by Dresser Industries Inc., or equal. Flanged adapters shall be Dresser Style 128, or equal. Couplings for ductile iron to cast iron pipe shall be Style 53, and for

ductile iron to transite pipe shall be style 153, as manufactured by Dresser Industries, Inc., or as manufactured by Smith Blair, Coupling Systems, Inc. or equal. Transition couplings shall be Style 162 as manufactured by Dresser Industries, Inc. or approved equal.

- 3. Split couplings may be used for connecting gray cast iron or ductile iron. If split couplings are used with grooved ductile iron pipe, the minimum pipe wall thickness shall be as specified. Split couplings shall be made of malleable iron and shall be suitable for use with grooved-end or shouldered-end, cast iron pipe. They shall be Victaulic couplings made by the Victaulic Company of America, Elizabeth, New Jersey; Gruvagrip couplings made by Gustin-Bacon Manufacturing Company, Kansas City, Missouri; Groove couplings made by Eastern Malleable Iron Company, Pittsburgh, Pennsylvania; or equal products.
- 4. Flexible Couplings: Sleeve type couplings for plain end ductile iron pipe shall be provided with plain rubber gaskets and steel, track head bolts with nuts.
- 5. Couplings shall be furnished pre-assembled by the manufacturer.
- 6. Couplings shall be given a shop coat compatible with the same outside coating as the pipe specified above.
- 7. All couplings shall be furnished with the pipe stop removed.
- 8. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe. The gaskets shall have metallic tips to provide electrical continuity through the joint.
- 9. The Contractor shall provide suitable filling rings where the layout of the flanged piping is such as to necessitate their use. In materials, workmanship, facing, and drilling, such rings shall conform to the 125-pound ANSI Standard. Filling rings shall be of suitable length with nonparallel faces and corresponding drilling, if necessary, to ensure correct assembly of the adjoining piping or equipment.
- 10. Couplings for exposed pipe shall be of steel and shall be Dresser Style 38, Smith-Blair Style 411, Baker Allsteel, or equal. The couplings shall be provided with steel bolts and nuts.
- 11. At the Contractor's option, flexible connections in the piping shall be sleeve-type couplings, split couplings or mechanical joint pipe as herein specified.
- C. INSPECTION, TESTS, AND ACCEPTANCE FOR DUCTILE IRON PIPE
  - 1. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to "AWWA Standard for Ductile Iron Pipe, for Water and Other Liquids" (AWWA H3) and (AWWA C151).
  - 2. All tests shall be made in accordance with the methods prescribed by the above mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.
  - 3. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor.
  - 4. All ductile iron pipe to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of the inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.
- D. FLANGED JOINTS FOR DUCTILE IRON PIPE

- 1. For flanged joints, gaskets shall be ring gaskets of rubber with cloth insertion. Gaskets twelve (12)-inches in diameter and smaller shall be 1/16-inch thick, gaskets larger than twelve (12)-inch shall be 3/32-inch thick.
- 2. Flanged joints shall be made with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same ANSI Standard as the flanges. Bolts and nuts shall, except as otherwise specified or noted on the Contract Drawings, be Grade B conforming to the ASTM Standard Specification for Carbon Steel, Externally and Internally Threaded Standard Fasteners, Designation A307. Bolts and studs shall be of the same quality as machine bolts. Flanged ductile iron pipe from 3 to 48-inches in diameter shall be classified by Underwriters Laboratories Inc. in accordance with AWWA C115.

## 2.2 BUTTERFLY VALVES

- A. Butterfly valves shall be cast iron ASTM A 126 Class B body and shall have integrally cast mechanical joint ends, and Type 304 stainless steel body seat made integral with the valve body. Valves and components shall meet all requirements of AWWA C504.
- B. Valve vane shall be constructed of high strength cast iron ASTM A48 Class 40.
- C. Valve shafts for sizes up to and including 12-inch shall be one-piece stainless steel extending full size through the disc and bearings. Valve shafts for 14 inches and larger shall be 18 8 stainless steel stub shaft design keyed to the vane with stainless steel taper pins.
- D. Valve seats shall be Buna N vulcanized mechanically secured to the vane with an integral stainless-steel seat retaining ring and self-locking Series 300 stainless steel screw fasteners. Valve seats located in the body on the valve shall be retained by mechanical means without rings, screws, etc. All seats shall provide full 360 coverage and be field adjustable and replaceable.
- E. Valve bearings shall be sleeve type, corrosion resistant, and self-lubricating with load not to exceed 2,500 pounds per square inch.
- F. Valve operator shall be traveling nut type suited for buried service. Operator shall produce required operating torque to seat, unseat or hold the vane steady in any intermediate position. Operator shall produce required operating torque with a maximum input of 150 ft. lbs. on the wrench nut. All actuator components between input and stops shall withstand without damage an input torque of 300 ft. lbs. minimum. It must be fully gasketed and grease packed and designed to withstand submersion in water to 10 pounds per square inch. Valves shall have 2-inch standard AWWA operating nuts. All valves shall open [right] [left].
- G. Valves shall have hydrostatic and leakage tests conducted in accordance with AWWA C504. Valves 12-inch and less shall be tested bubble-tight at a rated working pressure of 200 psi. Valves 14-inch and larger shall have a rated working pressure of 150 psi.
- H. Butterfly valves shall be as manufactured by M & H Valve Company, Dresser, Clow, or approved equal.

## 2.3 RESILIENT WEDGE GATE VALVES

- A. Resilient wedge gate valves shall be iron body, resilient seated type. The valves shall be designed for 250 psi working pressure and 400 psi test pressure
- B. Valves are to have O ring seals and a nonrising stem. Valves shall have a 2-inch operating nut. Valves shall open [left] [right].

- C. Resilient gate valves shall meet the most recent version of the AWWA standard specification AWWA C509.
- D. Resilient wedge valves shall have mechanical joint ends.
- E. Valves shall be as manufactured by U.S. Pipe and Foundry Company Metroseal 250, American Flow Control Model AFC2500, or Mueller Resilient Wedge Gate Valves.
- F. Valve boxes shall be cast iron, asphalt coated, sliding, heavy pattern type, consisting of three (3) pieces; a flanged bottom piece, a flanged top piece, and a cover with two (2) lifting holes and the word "water" cast on the top. A minimum 6-inch overlap is required between sliding sections. The valve box shall be designed and constructed to prevent direct transmission of traffic loads to the pipe or valve. The inside diameter of boxes shall be at least 4 1/2 inches and lengths shall be as necessary to suit ground elevation. The top of the cover shall be flush with the top of the box rim. Box covers shall be round frame and cover.
- G. Valves shall be connected directly to valve anchor tees at all hydrant branches.

# 2.4 TAPPING SLEEVES AND VALVES

- A. Tapping sleeves shall be of ductile iron construction, meeting ASTM A536 Grade 65-45-12. Side flange seals shall be O-Ring type of round, oval or rectangular cross-section shape. Sizes 12" and smaller must be capable of working on Class ABCD pipe diameters without changing either half of sleeve. Sizes 14" and larger must be specified to which class is needed. All sleeves are to include the end joint accessories and split glands necessary to assemble sleeve to pipe. Sleeve shall be coated with asphaltic varnish in compliance with NSF-61.
- B. Tapping valves shall conform to the requirements specified above for gate valves except that all Tapping sleeves and valves shall consist of a ductile iron flanged by mechanical joint sleeves and a tapping type gate valve with one flange and one mechanical joint end. The Contractor shall be responsible for verifying the outside diameter of the pipe to be tapped.
- C. The valve shall be provided with an oversized seat to permit the use of full-size cutters. Before backfilling, all exposed portions of any bolts used to hold the two halves of the sleeves together shall be heavily coated with two coats of bituminous paint comparable to Inertol No. 66 Special Heavy. Sleeves shall be of ductile iron furnished with O-ring gaskets.
- D. Bolts on bonnet and stuffing box shall be stainless steel (316 stainless steel), stuffing boxes shall be "O" ring type as indicated. Gaskets shall cover the entire flange surface.

## 2.5 SIAMESE CONNECTION (IF REQUIRED)

- A. Siamese shall be a "two-way" Siamese 4 x 2-1/2 x 2-1/2. Shall be installed with pin lug caps and chains, sleeves, escutcheon plate, and shall be polished chrome. Piping from Siamese connection into the building shall be restrained joint ductile iron.
- 2.6 SERVICE TUBING, CORPORATIONS, STOPS, SADDLES, AND VALVE BOXES
  - A. Service tubing shall meet the requirements of Federal Specification WW-T 7996 and shall conform to ASTM specification B75, B68 and B88 as they apply to Type K Copper Tubing.

- B. Copper Tube Size (CTS) Polyethylene Tubing for domestic water uses shall conform to AWWA C901, ASTM D3350, and ASTM D2737 and shall have a working pressure rating of 200 psi. Tracer wire shall be attached to the tubing and connected to upstream piping of the associated water meter for the water service, as applicable.
- C. The Contractor shall furnish and install, including necessary taps and connections, corporation stops, CTS Polyethylene Tubing, curb stops and wastes.
- D. The corporation stops shall meet the most recent revision of the AWWA standard "Threads for Underground Service Line Fittings." (AWWA C800).
- E. Corporation stops shall be sized as shown on the drawings and be brass compression-type with CC thread (Mueller Brand with compression nut with set screw). Corporation stops shall open [right] [left].
- F. Curb Stops: Curb stops shall be sized as shown on the drawings and be brass compressiontype with drain (Mueller Brand with compression nut with set screw). Curb stops shall open [right] [left].
- G. Tapping Saddles: Service connections shall be tapped with Size 2" X 8" double strap service saddles.
- H. Fittings and Boxes: Service boxes shall be cast iron. Extension service boxes of the required length and having slide-type adjustment shall be installed at all service box locations. The boxes shall have housings of sufficient size to completely cover the curb stop and shall be complete with identifying covers
- I. Service boxes shall be 2 ½" Buffalo Style, heavy cast iron, tar coated, sliding type, consisting of three (3) pieces; a flanged bottom piece, a flanged top piece and bolted cover with the word "water" cast on the top. A minimum 6-inch overlap is required between sliding sections. The boxes lengths shall be as necessary to suit ground elevation.

## 2.7 IDENTIFICATION

A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils. minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility		
Safety Red	Electric		
High Visibility Safety Yellow	Gas, Oil, Steam		
Safety Alert Orange	Telephone, Communications, Cable		
	Television		
Safety Precaution Blue	Water System, Irrigation		
Safety Green	Sanitary Sewer, Storm Sewer		

# **PART 3-EXECUTION**

- 3.1 INSPECTION
  - A. General: Examine areas and conditions under which potable water system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Engineer.
  - B. The Contractor is responsible for the provisions and all test requirements specified in herein. In addition, all pipe and appurtenances may be inspected at the plant for compliance with these specifications by an independent testing laboratory.
  - C. All tests shall be made in accordance with the methods prescribed by the above-mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.
  - D. Inspection of the pipe and appurtenances may also be made after delivery. The pipe and appurtenances shall be subject to rejections at any time on account of failure to meet any of the specifications requirements, even though samples may have been accepted as satisfactory at the place of manufacture.
  - E. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor at no cost to the Owner.

## 3.2 HANDLING PIPE

- A. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.
- B. Pipe shall be stored above ground at a height no greater than 5-feet, and with even support for the pipe barrel.
- C. Only nylon protected slings shall be used for handling the pipe. No hooks, chains or bare cables will be permitted.
- D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

#### 3.3 INSTALLATION OF PIPE AND PIPE FITTINGS

- A. The Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross connections, whether or not specifically stated in the Contract Drawings and Specifications.
- B. Care shall be taken in loading, transportation, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before placement, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer or Owner's Representative.
- C. If any defective pipe is discovered after it has been placed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense. All pipe and fittings shall be kept clean until they are used in the work, be thoroughly cleaned before placement, and when placed, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm even bearing throughout the length of the pipe shall be constructed by compacting sand gravel borrow around the pipe and up to 18 inches above the pipe.
- D. Blocking will not be permitted.

- E. A minimum horizontal separation of ten (10) feet shall be maintained between and existing, proposed or relocated sewer and the new water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, it is permitted to install a water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located eighteen (18) inches above the top of sewer. Where the horizontal clearance is less than ten (10) feet or the vertical clearance is less than eighteen (18) inches and the sewer crosses under the water main, both water main and sewer main shall be constructed of mechanical joint cement lined ductile iron pipe for 10-feet on either side of the crossing. One (1) full length of water pipe shall be centered over the sewer at the crossing. If the sewer crosses over the water main, regardless of the vertical separation, both pipes shall be concrete encased for a distance of ten (10) feet to either side of the respective centerline.
- F. Provide minimum cover over piping of 5-feet below finished grade.
- G. Extend water systems from the water main located within the public way and terminate potable water piping 10-feet 0-inches from the building foundation. Provide temporary pipe plug for piping extension into building if required by construction progress.
- H. All pipes shall be sound and clean before placement. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be temporarily closed by watertight plug or other acceptable means. Alignment shall be maintained during placement. The deflection at joints shall not exceed sixty percent of that recommended by the manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities, which may be encountered upon opening the trench. Solid sleeves shall be used only where allowed by the Engineer.
- I. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on type bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be inspected for damage and shall be re-mortared as required to ensure a continuous lining.
- J. Mechanical joint restraints shall be used for all valves, bends, hydrants and piping section less than 50 feet. The contractor shall restrain all pipe runs to the lengths indicated on the approved restrained joint calculation shop drawings.
- K. Jointing of ductile iron push on pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8 inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to ensure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
  - 1. Jointing Ductile Iron Pipe (Push-On Type): Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
  - 2. Jointing Mechanical Joint Fittings: Mechanical joints at valves, fittings, and where designated shall be installed in accordance with the "Notes on Method of Installation" under ANSI Specification A 21.11 and the instructions of the manufacturer. To assemble the joints in the field, the Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified

torque. Under no condition shall extension wrenches or pipes over handles or ordinary ratchet wrenches be used to secure greater leverage.

- L. Installation and jointing of ductile iron pipe shall be in accordance with AWWA C600, Sections 9b and 9c, latest revision, as applicable.
- M. Service tubing shall be installed with minimum 6-inches of sand bedding and 12-inches sand cover. Service tubing shall have a minimum total cover of 5 feet.

# 3.4 INSTALLATION OF VALVES AND APPURTENANCES

- A. Cleaning and Prime Coating Valves and Appurtenances (Except Epoxy Coated Valves)
  - 1. Prior to shop prime coating, all surfaces of the valves and appurtenances shall be thoroughly clean, dry, and free from all mill-scale, rust, grease, dirt, paint and other foreign substances to the satisfaction of the Engineer or Owner's Representative.
  - 2. All ferrous surfaces shall be sand blasted or pickled according to SSPC-SP6 or SSPC-SP8, respectively.
  - 3. All gears, bearing surfaces and other surfaces not to be painted shall be given a heavy coat of grease or other suitable rust resistant coating unless otherwise specified herein. This coating shall be maintained as required to prevent corrosion during any period of storage and installation and shall be satisfactory through the time of final acceptance.
- B. Installation
  - 1. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired before they are installed.
  - 2. Care shall be taken to prevent damage to valves 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 valve openings, etc., and all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment that does not operate easily, or are otherwise defective, shall be repaired or replaced.
- C. Shop Painting Valves and Appurtenances
  - 1. Interior and exterior surfaces of all valves which are not factory epoxy coated shall be given two coats of shop finish of an asphalt varnish conforming to AWWA C504 for Varnish Asphalt. The pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.
- D. Buried Valves
  - 1. Install valves as indicated with stems pointing up. Provide valve box over underground valves. Buried valves and boxes shall be set with the operating stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve.
- E. Valve Boxes
  - Valve boxes shall be installed vertically, centered over the operating nut, and if they are within the limits of the roadway or within limits where the plowing of snow will take place in the winter, the tops of the boxes shall be set ½" below the top of the finished grade. In locations where these boxes are not likely to be disturbed, the tops shall be set flush with the adjoining ground. Boxes shall be adequately supported during backfilling to maintain vertical alignment.
- F. Corporation Cocks

1. The tapping machine shall be rigidly fastened to the pipe as near the horizontal diameter as possible. The length of travel of the tap should be so established that when the stop is inserted and tightened with at 14" wrench, not more than one to three threads will be exposed on the outside. When a wet tapping machine is used, the corporation stop shall be inserted and tightened in accordance with the manufacturer's specifications.

# 3.5 INSTALLATION OF HYDRANTS

- A. Hydrants and hydrant branches shall be tested at 175 psi and chlorinated as specified in this specification.
- B. Hydrants shall be installed in conformance to AWWA C 600, Section 11, latest revision, using thrust blocks and restrained joints in accordance with the details shown on the Contract Drawings.
- C. Hydrants, as detailed on the Contract Drawings, shall be set at the locations designated by the Engineer and shall be bedded on a firm foundation. A drainage pit 2-feet 6-inches in diameter and to the limits shown on the Contract Drawings shall be filled with crushed stone and satisfactorily compacted. During backfilling, additional crushed stone shall be brought up around, and 6-inch over the drain port. Each hydrant shall be set in true vertical alignment and shall be properly braced. Thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Hydrant shall be set upon a slab of concrete not less than 4-in thick and 15-in square.
- D. Hydrants shall be set plumb with the steamer nozzle facing the roadway and the center of the operating nut located 18-inches back from the face of curb or edge of pavement.
- E. Hydrants shall be set such that the bottom of the breakaway feature shall be a minimum of 2-inches and a maximum of 4-inches above finish grade.
- F. Once installed, hydrants shall be painted once again by the Contractor. Hydrants shall be painted in accordance with the Owner's requirements.
- G. All iron work to be set below ground, after being thoroughly cleaned, shall be painted with two coats of asphalt varnish as specified in AWWA C502, latest revision and iron work to be left above ground shall be shop painted with two coats of paint.
- H. Thrust Blocks: Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Contract Drawings. Felt paper shall be placed as shown on the Contract Drawings. Care must be taken to ensure that concrete does not plug the drain ports.

# 3.6 BACKFILLING

- A. General: Conduct excavation and backfill operations for utility installations in accordance with Section 312000 EARTH MOVING, local requirements, and the contract documents.
- B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

# 3.7 FIELD QUALITY CONTROL

- A. Testing of Water Main/Service:
  - 1. Prior to pressure testing, the entire line shall be water jetted to remove any rocks or debris that may have inadvertently entered the pipe during construction.
  - 2. The Contractor in accordance with AWWA C651-99 specifications or latest revision will make pressure and leakage tests thereof, to determine that the ductile iron pipe is

structurally safe and free of excess leakage. Pipeline shall be subject to a hydrostatic test of 150 pounds per square inch (psi) or 150% of the static pressure, whichever is greater. The Contractor shall furnish all equipment, materials, and labor for testing. Testing shall be done between valved off sections in approximately 1000-foot maximum section of the main. The Contractor shall furnish at his own expense the water needed for all water main testing.

3. Once the pipeline section has been filled at normal pressure and all entrapped air removed from the line, the Contractor shall raise the pressure to the approved test pressure by a special pressure pump taking water from a small tank of proper dimensions for satisfactorily measuring the rate of pumpage into the pipeline. The pipe shall maintain this pressure, within 5 psi, for a minimum of two hours during which time the line shall be checked for leaks. The measured water leakage shall not exceed the maximum allowed leakage as determined by the following equation for the section under test:

 $L = SDP^{1/2} / (133.200)$ 

Where:	L = Allowable leakage, gallons per hour
	S = Length of pipe section tested, feet
	(1,000-foot maximum)
	D = Nominal pipe diameter, inches.

Should leakage exceed this rate, the Contractor shall immediately locate the leak or leaks and repair same at his expense. Pipe shall be flushed and chlorinated when leakage does not exceed above standard. Approval does not absolve the Contractor from his responsibility if leaks develop within the new main or water services (to curb box) later within the period of warranty.

P = Average test pressure (psi)

- B. Testing of Fire Protection Service:
  - 1. Testing of fire protection services shall conform to the most current NFPA requirements.
- C. Chlorinating and Flushing:
  - Prior to chlorination, the Contractor shall properly flush mains. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 2.5-feet per second (approximately 900 GPM in a 12-inch diameter main and 400 GPM in 8-inch diameter main). Flushing shall be performed for a sufficient period of time to allow for a minimum of 3 volume changes of water in the main (approximately 20 minutes per 1,000-foot of 8-inch main at the above flow rate).
  - 2. Chlorinating shall be accomplished by pumping a chlorine solution into the mains. Water shall be allowed to enter the new water mains until the mains are full of a solution containing 25-ppm available chlorine. The valves shall then be closed and the chlorinated water allowed to stay in the mains for 24 hours. At the end of this period, the chlorine residual shall be at least 10 mg/l. If it is less than 10 mg/l measured, Contractor shall flush and rechlorinate the mains at no cost to the Owner. All valves and hydrants shall be operated to ensure their proper disinfection and shall be manipulated to prevent superchlorinated water from entering the existing distribution system. After this period, the Contractor shall flush the mains until clear, clean water is being discharged.
  - 3. Chlorinating and flushing shall be done in accordance with AWWA C651-99 Specifications.
  - 4. Twenty-four hours after the main has been flushed of chlorinated water, bacteriological samples shall be taken. Water samples shall be taken from corporation stops along the

length of the water main. A minimum of two (2) samples shall be taken, per 3,000 foot of pipe or on each street, whichever is greater, each in duplicate, in sterile bottles and sent to a State approved private laboratory for analyses. The Contractor shall perform all necessary work including delivery of samples to a certified laboratory, and shall include the cost of sampling and analysis in his bid price. The results of the tests on these samples will determine the acceptance of the work and allow these new mains to be connected to the District's system. The failure of any sample to pass the laboratory tests shall require the Contractor to reflush and rechlorinate the mains and resample and test the water until acceptable results are obtained, all at no additional cost to the Owner.

- 5. The Contractor shall submit a Disinfection report detailing the following:
  - a. Type and form of disinfectant used.
  - b. Date and time of disinfectant injection start and time of completion.
  - c. Test locations.
  - d. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
  - e. Date and time of flushing start and completion.
  - f. Disinfectant residual after flushing in ppm for each outlet tested.
- 6. The Contractor shall submit a Bacteriological Report detailing the following:
  - a. Date issued, project name, and testing laboratory name, address, and telephone number.
  - b. Time and date of water sample collection.
  - c. Name of person collecting samples.
  - d. Test locations.
  - e. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
  - f. Coliform bacteria test results for each outlet tested.
  - g. Certification that water conforms, or fails to conform, to bacterial standards.
- 7. Contractor shall note that work under this Contract shall NOT be considered completed until satisfactory installation and testing of the water mains have been completed.

# 3.8 FINAL INSPECTION

- A. Final inspection and acceptance of pipe, valves, appurtenances, and hydrants shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system. Prior to placing the systems in service, all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean and flush piping.
- B. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

# END OF SECTION 331000

# SECTION 333000 SANITARY SEWERAGE UTILITIES

#### PART 1-GENERAL

#### 1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of Specifications.

#### 1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to construct the sanitary sewer system complete, including connection to existing structures and testing, as indicated on the Drawings and as specified.
- B. Unless otherwise indicated on the Drawings, building sewer service lines shall be installed from a point 10 feet outside the building foundation walls to the point of disposal.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
  - 1. Section 311000 SITE CLEARING for site clearing, removal of trees, stumps and other vegetation, topsoil stripping, stockpiling, clearing and grubbing, and removal of site surface and utility improvements.
  - 2. Section 312000 EARTH MOVING for excavation, backfill, and compaction required for sanitary sewerage system piping and structures.
  - 3. Section 221316 SANITARY WASTE AND VENT PIPING for building sanitary drain and vent requirements.

## 1.3 SUBMITTALS

- A. Refer to Section 013300 SUBMITTAL PROCEDURES, for submitted provisions and procedures. OR General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. Product Data: Submit manufacturer's technical product data and installation instructions for sanitary sewer system materials and products.
  - 2. Submit descriptive literature for piping, fittings, couplings, and appurtenances showing dimensions, pipe and joint materials, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
  - 3. Shop Drawings: The precast concrete structure shop drawing submittals for the manholes, septic tanks, dosing chambers, tight tanks, grease traps, wet wells, and valve pits shall contain erections drawings showing connections, cast-in items, waterproofing details, lifting hooks, and productions drawings showing elevations, sections, and details indicating sizes and quantities of reinforcement.
  - 4. Submit shop drawings for structure hatches and frames and covers.
  - 5. The Contractor shall submit buoyancy calculations for sanitary sewerage structures assuming groundwater is one (1) foot below finish grade. If buoyancy is an issue the structure(s) shall be modified to prevent uplift. All buoyancy calculations and precast concrete structure designs shall be prepared and stamped by a professional Civil Engineer licensed in the Commonwealth of Massachusetts.

- 6. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds specified requirements.
- 7. Prior to the acceptance of the sanitary sewerage system, the Contractor shall submit to the Engineer, for review and approval, As-Built Drawings that indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor or Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher).
- 8. sewerage system, the Contractor shall submit the results of the leakage tests, pipe deflection measurements, and the video inspection reports.

## 1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
  - 1. ASTM: American Society for Testing and Materials.
  - 2. ANSI: American National Standards Institute.
  - 3. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
  - 4. MassDOT Construction Standards, latest edition with amendments, hereinafter referred to as the "Construction Standards".
  - 5. Town Sewer Department Regulations.

#### 1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation on the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

#### 1.6 QUALITY ASSURANCE

- A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems.
- B. Utility Compliance: Comply with the Town of Belmont Department of Public Works regulations, standards, and guidelines pertaining to sanitary sewerage system installation and inspections.
- C. Sanitary sewerage system installation shall be in conformance with the latest edition of TR-16, Guides for the Design of Wastewater Treatment Works.

- D. Plumbing Code Compliance: Comply with the applicable portions of the latest editions of the Massachusetts Plumbing Code and National Standard Plumbing Code pertaining to the selection and installation of sanitary sewerage system materials and products.
- E. Subsurface Disposal System Code Compliance: Comply with the applicable portions of the Commonwealth of Massachusetts State Environmental Code Title V, 310 CMR 15.00, latest revision and the local Board of Health Regulations pertaining to the installation of sanitary sewerage system materials and products.
- F. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of sanitary sewer system products of type, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- G. Installer's Qualifications: Firms with at least three years of successful installation experience on projects with sanitary sewer work similar to that required for the project.

## 1.7 PROJECT CONDITIONS

- A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that sewerage system structures and piping may be installed in compliance with Contract Drawings and referenced standards.
- B. Interruption of Existing Sanitary Sewer Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to the requirements indicated:
  - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Architect's written permission.

## 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate with interior building sanitary sewerage system piping.
- B. Coordinate with other utility work.
- C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.
- D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

# PART 2-PRODUCTS

## 2.1 PRECAST CONCRETE MANHOLES

- A. General: Provide precast reinforced concrete structures as indicated and complying with ASTM C 478.
- B. Manhole Top: Precast concrete of concentric cone, eccentric cone, or flat slab top type, as necessary for the installation as indicated in the Contract Drawings. Tops shall be designed to meet H20 loadings.
- C. Base and Riser Sections: Precast concrete, with base riser section with integral floor. Diameter, base and riser thicknesses shall be as indicated on the Contract Drawings.

- D. Cement: Type II.
- E. Concrete strength: 4,000 psi minimum.
- F. Precast concrete sections shall have tongue and groove joints.
- G. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a flexible, watertight joint, made with preformed butyl rubber joint sealant conforming to ASTM C990 or with a rubber gasket joint conforming to ASTM C443. Sealants and/or gaskets shall be installed in accordance with the manufacturer's written instructions.
- H. Manhole Steps: Steps for manholes shall be non-skid raised edge-front steel reinforced polypropylene plastic type with at least 13-inch-wide stepping surface. Steps shall meet the requirements of ASTM C-478 and AASHTO M-199. Steel shall be 1/2-inch grade 60 conforming to ASTM A615 encapsulated with molded copolymer polypropylene. The polypropylene shall conform to ASTM D-4101. Rungs shall protrude no more than 6 inches from the wall. The portion of the legs to be embedded in the precast section shall have fins and be tapered to ensure a secure bond. Steps shall start a foot above the shelf of the manhole floor and continued twelve inches on center spacing up through the completed height of the unit. The steps shall finish no lower than twenty-four (24)-inches below the rim elevation. Placement into precast walls shall be by a method recommended by the supplier of the precast manhole sections. Steps shall be installed per the manufacturer's specifications.
- I. Pipe Connections: Sewer manhole shall have pipe openings to accept the type of pipe specified. Pipe opening shall be minimum size require to receive the pipe and shall be accurately set to conform to the required line and grade. Sewer pipe shall be joined to the wall of the concrete manhole with flexible manhole sleeves as indicated on the drawings. Flexible manhole sleeves shall be cast in the walls of the manholes during the manufacturing process. Flexible manhole sleeves shall be NPC Kor-N-Seal Pipe-to-Manhole Connector as manufactured by Trelleborg Pipe Seals Milford, Inc., Milford, NH; Z-Lok as manufactured by A-Lok Products, Inc., Tullytown, PA; Tylox CIB Series Cast-In Boot Connector as manufactured by Hamilton Kent, Winchester, TN; or approved equal.
- J. Waterproofing: The exterior surfaces of precast structures shall be given two heavy coats of waterproofing concrete sealer. The material shall be Aqua-Safe Concrete Sealer as manufactured by Bay Oil Company, Chicopee, MA; Bitumastic 300M as manufactured by Carboline Company, St. Louis, MO; Sonoshield HLM 5000 as manufactured by BASF Corporation Building Systems, Shakopee, MN; ConSeal CS-1800 as manufactured by Concrete Sealants, Inc., Tipp City, OH; or acceptable equivalent products. The waterproofing material shall be applied by brush or spray and in accordance with the instructions of the manufacturer. Time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first coat.
- K. Sanitary Sewer Brick Masonry: Bricks shall be sound, hard, uniformly burned, regular, and uniform in shape and size. Underburned or salmon brick shall not be acceptable. Only whole brick shall be used.
  - 1. Bricks for channels and shelves shall conform to ASTM C32, Grade SS except that the mean of five tests for absorptions shall not exceed 8 percent and no individual brick exceed 11 percent.
  - 2. Brick for raising manhole frames to finished grade shall conform to ASTM C32, Grade MS.
  - 3. Mortar shall be in conformance with ASTM C270, Type M. The mortar shall be composed of one-part Portland cement, 3-1/2 parts sand, and ¼ parts hydrated lime,

by volume. Portland cement shall be ASTM C150, Type II; hydrated lime shall be Type S conforming to ASTM D207.

- 4. Sand shall be washed, cleaned, screened, well-graded with all particles passing a No. 4 sieve, and conform to ASTM C33.
- L. In sewer manholes, the invert channel within the structure shall be an inverted arch with bricks laid as stretchers and on edge and so constructed as to conform in shape to the lower half of the pipe. The shelf in manholes shall consist of bricks laid flat and the top of the shelf shall be at the elevation of the top of the pipe, as indicated on the Contract Drawings, and shall be sloped to flow toward the channel.
- M. Inverts in sewer manholes shall conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipe lines.
- N. Sewer manholes shall be constructed with drop connections when the proposed invert of the connection is at least 2 feet above the manhole invert. All drop connections will be of the external type. The drop pipe shall be constructed of SDR 35 PVC sewer pipe. The drop piping and horizontal cleanout sections will be sized the same as the sewer main piping and shall enter the manhole at the invert elevation of the main. The drop portion of the piping shall be secured with anchor straps. The drop piping shall be encased with control density fill.
- O. For all manhole depths greater than 10 feet, the inside diameter of the manholes shall be at least 5'-0".
- P. Safety landings shall be installed inside manholes greater than 16-feet in depth.
- Q. When installing manholes on existing lines and when flows cannot be diverted, drop-over manholes shall be used. Drop-over manholes shall be precast with openings cast in the sidewalls of sufficient size to fit over the existing line(s) to remain in service. Drop-over manholes shall be set on a precast or cast-in-place concrete base slab. Drop-over manholes shall be manufactured to the same requirements and dimensions as standard manholes.

# 2.2 MANHOLE FRAMES AND COVERS

A. Frames and covers shall be of cast iron conforming to the requirements of ASTM A48, Class No. 30 and shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Manhole covers shall be machined to fit securely and evenly on the frame. Frames and covers shall be designed to accept H20 loads, have a diamond surface finish, and frame height of 6 to 9-inches. Covers shall bear the word "SEWER" in 3-inch high letters. Covers shall be equal to Item Numbers 12665 and 12685 (6" and 8-1/8" frame heights, respectively) as manufactured by General Foundries Inc. Catalog numbers are provided to establish a standard of quality and configuration of castings.

# 2.3 PVC PIPE

A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

- B. PVC Sewer Pipe
  - 1. PVC (Polyvinyl Chloride) Gravity Sewer Pipe and Fittings: ASTM D3034, SDR 35, for elastomeric gasket joints. Pipe 18 to 36 inches in diameter shall conform to ASTM F679, T-1 heavy wall. The pipe shall have a SDR ration of 35 and a pipe stiffness of 46 psi.
  - 2. Joints: PVC pipe shall have an integral wall bell and spigot push-on joint with elastomeric gaskets secured in place in the bell of the pipe. The bell shall consist of an integral wall section with solid cross section elastomeric gasket, factory assembled, securely locked in place to prevent displacement during assembly. Pipe joints shall conform to ASTM D3212 and elastomeric gaskets shall conform to ASTM F477.
  - 3. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper joining of the two pipes.
  - 4. PVC gravity sewer fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and spigot configurations compatible with that of the pipe.
- C. PVC Conduit
  - 1. PVC Schedule 40: Provide PVC Pipe, Schedule 40, where shown on the Contract Drawings. Pipe shall comply with ASTM D1785 and be manufactured from virgin PVC plastic conforming to ASTM D1784. Pipe shall be Underwriter's Laboratories listed for use in underground installations.
  - 2. Joints and solvent cements shall conform to ASTM 2564.

# 2.4 CLEANOUTS

- A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.
- B. The sewer cleanouts shall be minimum 6-inch diameter or sized to match the service pipe, whichever is greater. The cleanout shall be complete with a flush mount over. The cleanout cover shall be clearly marked "SEWER" and shall be minimum eight inches in diameter or two inches greater than the cleanout size, whichever is greater. Cleanouts shall include a watertight cap.

# 2.5 SEWER COUPLINGS

A. Sewer Couplings shall be pressure rated at least equal to that of the pipe. The coupling sleeve shall be 1/4-inch minimum thickness elastomeric polyvinylchloride with a minimum tensile strength of 1500 psi. The sleeve shall fit snugly onto the pipe to be joined and be resistant to common chemicals present in sewerage. Adjustable pipe clamps shall consist of a slotted band that mate with the worm gear screw and a screw housing all manufactured of stainless steel, and suitable for underground service.

#### 2.6 IDENTIFICATION

A. Detectable Underground Warning Tapes: Acid and alkali-resistant, polyethylene plastic film warming tape, 6-inches wide by 4-mils. minimum thickness, with continuously printed caption in black letters "CAUTION – xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5 feet deep.

Color	Utility	
Safety Red	Electric	
High Visibility Safety Yellow	Gas, Oil, Steam	
Safety Alert Orange	Telephone, Communications, Cable	
	Television	
Safety Precaution Blue	Water System, Irrigation	
Safety Green	Sanitary Sewer, Storm Sewer	

## PART 3-EXECUTION

- 3.1 GENERAL INSTALLATION
  - A. General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground sanitary sewer system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the sewer system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.
  - B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner's requirements. Maintain swab or drag in line and pull past each joint as it is completed.
  - C. All piping shall be laid in the dry. Adequate measures shall be taken to prevent floatation of pipe in the trench.
  - D. Whenever encountered within the trench, existing abandoned water, sewer, and/or drain lines shall be removed within the trench limits, unless otherwise noted. The remaining portion of the abandoned lines shall be plugged at all open ends.
  - E. When bell and spigot pipes are used, bell holes shall be dug in the bedding to accommodate the bells. They shall be deep enough to ensure that the bell does not bear on the bottom of the hole but shall be excessively wide in the longitudinal direction of the installation.
  - F. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.
  - G. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without the written approval of the Engineer.
  - H. Install piping pitched down in direction of flow as indicated on the Contract Drawings.
  - I. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated on the Contract Drawings.
  - J. Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
  - K. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of

manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.

- L. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- M. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.
- N. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.
- O. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
- P. Alignment and Placement: All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
  - 1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
  - 2. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
- Q. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water, and debris from entering any existing sewer system.
  - 1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
  - 2. Flush lines between manholes to remove collected debris.
- R. Review of Completed Sanitary Sewer System: The completed sewer system shall be visually inspected by the Owner's Representative. If the visual observation of the completed sewer or any part thereof shows any pipe, manhole, or joint to be of defective work or material, the defect shall be replaced or repaired as directed by the Engineer or the Owner's Representative. The Contractor shall coordinate and provide site access for inspection. All repairs or replacement of deficient or incomplete work shall be performed by the Contractor at no cost to the Owner.

# 3.2 INSTALLATION OF SEWER MANHOLES

A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.

- B. The Contractor shall install the manholes as soon as the pipe laying reaches the location of the manhole.
- C. The Contractor shall accurately locate each manhole and set accurate templates to conform to the required line and grade. Any manhole which is not installed in the correct location or oriented improperly shall be removed and rebuilt in its proper location, alignment, and orientation at no additional cost to the Owner.
- D. Manhole risers and tops shall be installed using approved butyl rubber sealant or rubber gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints.
- E. Openings shall be provided in the precast concrete manhole risers to receive entering pipes and these openings shall be made at the place of manufacture. Connection of sanitary pipes to manholes shall be made by means of a flexible rubber sleeve/boot cast integral with the structure sidewall.
- F. Care shall be taken to ensure the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so the manhole steps shall be in alignment.
- G. All holes used for handling shall be thoroughly plugged with non-shrink grout.
- H. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted without approval of the Engineer.
- I. All interior manhole joints where the sealing material is not flush with the inside wall shall be grouted with non-shrink mortar and finished by hand/wet-brush.
- J. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

#### 3.3 INSTALLATION OF PRECAST CONCRETE TANKS AND VAULTS

- A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.
- B. The precast base shall be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations. Structure sections shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints.
- C. Adjustment of the structure can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the structure has been constructed, any lift holes shall be plugged watertight with mortar or non-shrink grout. Any precast structure which is not installed in the correct location or oriented improperly shall be removed and rebuilt in its proper location, alignment, and orientation at no additional cost to the Owner.

- D. Inlet and outlet pipes should be securely set into the structure using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Care shall be taken to ensure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted.
- E. Grade rings shall be installed to set the frame and cover at the required elevation. The grade rings shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover shall be set in a full bed of mortar at the elevation specified.
- F. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

# 3.4 STRUCTURE REBUILT

- A. When in the opinion of the Engineer or Owner's Representative, an existing masonry structure walls show deterioration, the structure shall be rebuilt. The casting and deteriorated masonry shall be removed in a careful and neat manner until only a sound condition remains. Concrete blocks shall be used to rebuild the structure. The new masonry construction, replacing of the casting, and other incidental work shall be performed as specified above.
  - 1. The Contractor's base bid shall include rebuilding [] vertical linear feet of existing manhole structures.

## 3.5 SETTING MANHOLE FRAMES AND COVERS

- A. Manhole frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface as indicated on the Contract Drawings or as directed.
- B. Brick shall be used to bring the frame and cover to the required elevation.
  - 1. Frames shall be set concentric with the opening in the top of the manhole on two to four courses of brick in a full bed of mortar. A thick ring of mortar extending to the outer edge of brick or concrete shall be placed all around the bottom flange of the cast iron frame. The mortar shall be smoothly finished to a height of 5 inches above the flange for 8-inch frames and sloped to shed water away from the frame.
  - 2. Completed brick installation shall be coated with mortar at least a <sup>3</sup>/<sub>4</sub> inch thick on the outside to provide a fully sealed and watertight collar between the top manhole section and the cover frame.
  - 3. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.
- C. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all other casting shall be performed at the proper stage of construction.
- D. Manhole covers shall be left in place in the frame until completion of other work at the manholes.
- 3.6 PVC PIPE
  - A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
  - B. PIPE HANDLING

- 1. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material especially on the inside. Joint ends of pipe shall especially be kept clean.
- 2. Pipe stored on site shall be protected from direct sun light and suitably ventilated.
- 3. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

# C. ALIGNMENT AND PLACEMENT OF PVC PIPE

- 1. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade.
- 2. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.
- 3. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.
- 4. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.
- 5. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
- 6. Full lengths of pipe shall be used in the installation except that partial lengths may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
- 7. Pipe entrances to structures shall be cut flush with the inside face of the structure, and cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the sewage flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
- 8. The Contractor shall protect the installation at all times during construction. The movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's own risk.
- 9. Sewer pipes shall be laid to the required grades by use of a laser and target system, unless otherwise specifically approved by the Engineer.
- 10. Separation Between Sewer Lines and Water Lines:
  - a. A minimum horizontal separation of ten (10) feet shall be maintained between proposed sewer lines and existing water lines. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, it is permitted to install a sewer line closer to a water line, provided that the sewer line is laid in a separate trench or on an undisturbed earth shelf located eighteen (18) inches above the top of sewer. In either case, the elevation of the top of the sewer shall be at least 18 inches below the bottom of the water line.
  - b. Whenever sewers must cross under water lines, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water line. When the elevation of the sewer cannot be varied to provide the 18 inches of vertical clearance, the water line shall be relocated to provide this separation or reconstructed with mechanical –joint pipe for a distance of 10 feet on each side of the sewer. One full length of water pipe shall be centered over the sewer so that both joints will be as far from the sewer as possible.

- c. When it is impossible to obtain horizontal and/or vertical separation as indicated above, both the water line and sewer line shall be constructed of mechanical joint ductile iron pipe for a distance of ten (10) feet to either side of the respective centerline. The water line shall be cement lined and the sewer line shall be provided with ceramic epoxy lining for sewer applications. Both pipes shall be pressure tested by an approved method to assure water-tightness or both pipes shall be centered over the sewer at the crossing.
- 11. Jointing of PVC sewer pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to ensure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
- 12. PVC pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, is not acceptable.
- 13. Field-cut pipe ends shall be cut square and the pipe surface beveled to the size and shape of a factory-finished beveled end. All sharp edges shall be rounded off.
- 14. Detectable warning tape shall also be installed 2-feet below the existing ground surfaces for later use in locating the pipe's exact position.

# 3.7 PLACEMENT OF DUCTILE IRON PIPE AND FITTINGS

- A. Care shall be taken in loading, transportation, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before placement, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer.
- B. If any defective pipe is discovered after it has been placed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense. All pipe and fittings shall be kept clean until they are used in the work, be thoroughly cleaned before placement, and when placed, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm even bearing throughout the length of the pipe shall be constructed by compacting gravel borrow around the pipe and up to the springline.
  - 1. Blocking will not be permitted.
- C. All pipes shall be sound and clean before placement. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be temporarily closed by watertight plug or other acceptable means. Alignment shall be maintained during placement. The deflection at joints shall not exceed sixty percent of that recommended by the manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities, which may be encountered upon opening the trench. Solid sleeves shall be used only where allowed by the Engineer.
- D. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on type bell shall be beveled to conform to the manufactured spigot end.
- E. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.

- F. Pipe shall be stored above ground at a height no greater than 5 feet and with even support for the pipe barrel.
- G. Only nylon protected slings shall be used for handling the pipe. No hooks, chains or bare cables will be permitted.
- H. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.
- I. Jointing of ductile iron push on pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8 inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to ensure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
  - 1. Jointing Ductile Iron Pipe (Push-On Type): Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
  - 2. Jointing Mechanical Joint Fittings: Mechanical joints at valves, fittings, and where designated shall be installed in accordance with the "Notes on Method of Installation" under ANSI Specification A 21.11 and the instructions of the manufacturer. To assemble the joints in the field, the Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipes over handles or ordinary ratchet wrenches be used to secure greater leverage.
- J. Installation and jointing of ductile iron pipe shall be in accordance with AWWA C600, Sections 9b and 9c, latest revision, as applicable.
- K. Ductile iron pipe installed within 5-feet of gas lines shall be fully encased with polyethylene material. Polyethylene shall be 8 millimeters thick and comply with AWWA C 105.

# 3.8 CLEANOUTS

A. Install cleanouts and extensions from sewer pipe to grade as indicated on the Contract Drawings. Set cleanout frame and cover in concrete 18 by 18 by 6-inches deep, except where location is in bituminous or concrete paving. Set top of cleanout 1-inch above surrounding earth grade or flush with grade when installed in paving.

## 3.9 SEWER COUPLINGS

A. Couplings which are factory manufactured shall be installed at all connections from existing pipe to proposed pipe unless the existing pipe is the same material as the proposed pipe and the bell and spigot end of the pipes to be connected are compatible and free from defects. All sewer couplings shall be installed in accordance with the manufacturer's recommendations for the types of pipe to be connected.

# 3.10 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so that finished work will conform as nearly as practicable to the requirements specified for new work. The contractor shall verify the location, size, invert, and type of existing pipes at all points of connection prior to make the connections.
- B. Make branch connections from side into existing piping by installing a wye or T-wyes, and couplings manufactured for use with the same type of pipe as indicated on the Contract Drawings. The Contractor shall install a 45° wye branch or 90° tee fittings in the sewer pipe at all locations where building sewer service pipe connections are shown on the Drawings. Connections of the sewer service pipes shall be made into the wye branches or tees by means of 45° bends. The connections shall be made thoroughly watertight and concrete shall be placed under each connection to bear on undisturbed earth and firmly support the connection.
- C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.
- D. Connections into existing sewer facilities shall be performed in accordance with the requirements of the Town of Belmont. The Contractor shall comply with all such requirements, including securing of all required permits and paying the costs thereof.

#### 3.11 INSTALLATION OF PUMP SYSTEM

- A. General: Install all equipment in accordance with manufacturer's instructions.
- B. Wet Well and Valve Vault: Install precast pump chamber and precast valve vault on a compacted level foundation of structural fill a minimum 12 inches thick over the compacted subgrade. Crushed stone may be substituted for structural fill if field conditions at the bottom of the excavation are wet. The chambers shall be set level and plumb.
- C. Equipment: Install all chamber equipment in accordance with manufacturer's instructions. Seal chamber penetration with modular, mechanical seals, consisting of rubber links shaped to continuously fill the annular space between the pipe and the wall openings.
- D. Force Main: Install force main as shown on the Contract Drawings. Lay piping at slopes that will not create high or low points between the valve vault and the receiving sewer manhole. Concrete thrust blocks shall be installed at all fittings and other locations as indicated on the Contract Drawings and as directed by the Engineer. Minimum bearing area shall be as shown on the Contract Drawings. Thrust blocks shall bear against undisturbed material, and shall be provided with wooden side forms. In the event that the use of thrust blocks is not practical, the Contractor shall provide an alternate method of joint restraint, at no additional cost, as approved and/or as directed by the Engineer.
- E. Testing: Provide the services of a manufacturer's trained technician to start-up and test the system. Pumps shall be throttled with the gate valves to create sufficient TDH to reduce discharge rate to 120 gallons per minute. The performance of the system for lead pump, lag pump, high water alarm, and alternation, and reset shall be demonstrated to the approval of the Engineer.

# 3.12 INSTALLATION OF IDENTIFICATION

- A. Install continuous plastic underground warning tape during back-filling of trench for underground sanitary sewerage system piping. Locate tape two-feet below finished grade, directly over piping.
- 3.13 BACKFILLING
  - A. General: Conduct excavation and backfill operations for structure and pipe installations in accordance with Section 312000 – EARTH MOVING, local requirements, and the contract documents.
  - B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

# 3.14 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction and the following:
  - 1. Testing shall be witnessed by the Owner's Representative and the local authority.
  - 2. The test shall be by vacuum or by water exfiltration as described herein:
  - 3. Vacuum Testing of Precast Concrete Manholes
    - a. The vacuum test shall be conducted on each manhole in accordance with ASTM C1244. Test results will be judged by the length of time it takes for the applied vacuum to drop from 10 inches of mercury to 9 inches. If the time is less than that listed in Table 1 of ASTM C1244, the manhole will have failed the test. Test times from Table 1 are excerpted below.

## TABLE 1

Minimum Test Times for Various Manhole Diameters

	Diameter (Inches)			
Depth (Feet)	48	60	72	
	<u>Times (Seconds)</u>			
0-12	30	39	49	
12-16	40	52	67	
16-20	50	65	81	
20-24	59	78	97	
26-30	74	98	121	

- b. If the manhole fails the initial test, the Contractor shall locate the leaks and make the proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material. If the manhole should again fail the vacuum test, additional repairs shall be made, and the manhole water tested as specified below.
- 4. Water Exfiltration Testing of Precast Concrete Manholes
  - a. After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent flow out.

The test shall be made prior to placing the shelf and invert. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test.

- The manhole shall be filled with water to the top of the cone section. If the b. excavation has not been backfilled and observation indicates no visible leakage. that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily water tight. If the test, as described above, is unsatisfactory as determined by the Owner's Representative and/or the Town of Belmont's Inspector or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption by the manhole. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary, and a measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour loss rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as required by the Owner's Representative and/or Town of Belmont's Inspector to bring the leakage within the allowable rate of one gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallons per vertical foot per day shall be cause for rejection of the manhole. It shall be the Contractor's responsibility to uncover the rejected manhole as necessary and to disassemble, reconstruct or replace it as required by the Owner's Representative. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.
- c. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc. It shall be assumed that all loss of water during the test is a result of leaks through joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Owner's Representative and/or Town of Belmont's Inspector that the water table is below the bottom of the manhole throughout the test.
- d. If the groundwater table is above the highest joint in the manhole, and there is no leakage into the manhole, as determined by the Owner's Representative and/or the Town of Belmont's Inspector, such a test can serve to evaluate water-tightness of the manhole. However, if the Owner's Representative and/or the Town of Belmont's Inspector is not satisfied with the results, the Contractor shall lower the water table and carry out the test as described hereinbefore.
- 5. Leakage Testing of Gravity Sewer Piping and Fittings
  - a. On completion of a section of sewer, including building connections, the Contractor shall install suitable bulkheads as required, dewater and test the sewer for leakage.
  - b. Unless otherwise approved, the section shall be tested using low-pressure air test procedures. If circumstances permit, the Owner's Representative and/or the Town of Belmont's Inspector may allow testing by infiltration or exfiltration in lieu of air testing.
  - c. The air test procedures shall conform to the Uni-Bell Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe, UNI-B-6. The starting air pressure for the test shall be 4 psig (greater than the average groundwater back pressure of any groundwater above the pipe, but not greater than 9.0 psig). The minimum duration permitted for the prescribed low-pressure air exfiltration pressure drop between two consecutive manholes shall not be less than provided in Table I or Table II of UNI-B-6. Note that UNI-B-6 suggests that use of the 0.5

psig pressure drop is more efficient since the time requirements are half of the 1.0 psig-pressure drop.

- d. Using the air pressure test, if there has been no leakage (zero psig drop) after one hour of testing, the section undergoing test shall have passed.
- e. If either infiltration or exfiltration testing is permitted by the Engineer, the test shall be conducted for at least 24 hours. The amount of infiltration or exfiltration shall not exceed 100 gallons per inch diameter per mile of sewer per 24 hours.
- f. The infiltration test measures leakage into a section of sewer and may be used only where the groundwater level is one foot or more above the crown of the section of sewer pipe at its upper end and at least one foot above the top of building connections and chimneys. For making the infiltration tests, underdrains, if used, shall be plugged and other groundwater drainage shall be stopped to permit the groundwater to return to its normal level insofar as practicable. Allowances shall be made for water that may enter the sewer through pipe connections and inlets during the infiltration test.
- g. Where the groundwater level is less than 1 foot above the top of the pipe at its upper end, the exfiltration test may be used. The sewers shall be subjected to an internal pressure by plugging the pipe at the lower end and then filling the pipelines and manholes with clean water to a height of 2 feet above the highest point in the system to be tested, including main pipeline, service connections, and chimneys. When slopes between manholes are steep, the Contractor shall ensure that this test can be accomplished without danger of forcing stoppers from wye or tee branches.
- h. The rate of exfiltration from the sewers shall be determined by measuring the amount of water required to maintain the water level at the elevation established at the beginning of the test
- i. The Contractor shall construct such weirs or other means of measurements as may be required, shall furnish water, and shall do all necessary pumping to enable the test to be properly made.
- j. The Contractor shall be responsible for the satisfactory water-tightness of the entire section of sewer. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing leaks and retesting as the Engineer may require without additional compensation. A plan of the method of repairing any leaks that are found shall be submitted to the Engineer for review.
- 6. Pressure sewers (force mains) shall be hydro-tested to a pressure of [XX psi which should be 1.5 times the working pressure]. Testing procedure shall be as specified in AWWA C600-99 and C900-97 (or latest revisions)-Standard Hydrostatic Test Method of (CIP/DIP and PVCP) Sewer Force Mains, further as modified by the required test time shall be one (1) hours, the required pressure shall be 1.5 times the working pressure of the pipe and the allowable leakage shall not exceed "A" in the following formula:

A=DL(P<sup>0.5</sup>)/1333,200

Where: A=The allowable leakage in gallons

D=The Diameter of pipe in inches being tested

L=The Length of pipe in feet being tested
P=The Pressure in pounds per square inch utilized for the test

- 7. Pipe Deflection Measurement
  - a. In accordance with ASTM D3034, no less than 30 days after completion of the PVC sewer pipe installation, the Contractor shall test the pipeline for deflection using a "go/no go" deflection mandrel having a minimum of nine evenly spaced arms or prongs. The "go/no go" gauge shall be hand pulled through all sections of the pipeline by the Contractor. The Contractor shall submit drawings of the "go/no go" gauge to the Owner's Representative and/or the Town of Belmont's Inspector for approval prior to testing. Complete dimensions of the gauge for each diameter of pipe to be tested shall be in accordance with ASTM D3034.
  - b. Any section of pipe found to exceed 7.5 percent deflection shall be deemed a failed pipe and shall be excavated and replaced by the Contractor at his own expense.
- 8. Video Inspections: Seven days after the completion of the backfilling of each section of new pipe, as defined as a length of pipe between two manholes, the Contractor shall provide a televised inspection of the pipe to be submitted to the Designer. The Owner's Representative shall be present during the recording. The recording shall be in DVD color format with audio and shall show a clear picture of the inside of the new pipe. If the Designer determines that the DVD is unacceptable for review the contractor shall re-televise the line until an acceptable DVD has been submitted. In the event that the pipe is not acceptable for any reason relating to the proper construction of the pipe according to these specifications, the Contractor will be responsible to re-excavate and repair the defects to the satisfaction of the Designer at no additional cost.
- B. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
  - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
  - 2. Place watertight plugs in ends of uncompleted pipe at end of day or whenever work stops. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.
  - 3. Flush piping between manholes to remove collected debris.
- C. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
  - 1. Make inspections after pipe between manholes has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
  - 2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects and reinspect.
- D. Prior to acceptance of the sanitary sewerage system, the Contractor shall submit the following to the Architect and to the local authority:
  - 1. System As-Built Plan stamped by a Professional Land Surveyor or Engineer Registered in the Commonwealth of Massachusetts.
  - 2. Video inspection DVDs and report: The report shall document the observations of the video inspections.
  - 3. Deflection test report: The report shall fully describe the test procedures and list the test results. The report shall be signed by the Contractor's superintendent.

4. Leakage test report: The report shall fully describe the test procedures and list the test results. The report shall be signed by the Contractor's superintendent.

#### 3.15 FINAL INSPECTION

- A. Final inspection and acceptance of the sanitary sewer system shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system.
- B. Prior to placing the systems in service, all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.
- C. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

#### END OF SECTION 33 33 00

#### SECTION 334000 STORM DRAINAGE UTILITIES

#### PART 1 – GENERAL

- 1.1 GENERAL PROVISIONS
  - A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all SECTIONS within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made a part of this section of Specifications.

#### 1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to construct the storm drainage system complete, including connections to existing structures and testing, as indicated on the Drawings and as specified.
- B. Unless otherwise indicated on the Drawings, building drain service lines shall be installed from a point 10 feet outside the building foundation walls to the point of disposal.
- C. Related Work: The following items are noted and included in this Section and will be performed under the designated sections:
  - 1. Section 312000 EARTH MOVING for excavation, backfill, & compaction requirements.
  - 2. Section 221400 FACILITY STORM DRAINAGE for building storm drainage piping.

#### 1.3 SUBMITTALS

- A. Refer to Section 013300 SUBMITTAL PROCEDURES, for submittal provisions and procedures. OR General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. Product Data: Submit manufacturer's technical product data and installation instructions for storm drain system materials and products.
  - 2. Submit descriptive literature for piping, fittings, couplings, and appurtenances showing pipe dimensions, pipe and joint materials and dimensions, and other details for each class or type of pipe or product to be furnished for this contract. All pipe furnished under the contract shall be manufactured in accordance with these Specifications.
  - 3. Submit shop drawings for storm drain systems, showing piping and manhole materials and sizes.
  - 4. Submit shop drawings of complete layout of detention/retention structures, including all fittings and appurtenances.
  - 5. The precast concrete structure shop drawing submittals for the manholes, catch basins, vaults, and tanks shall contain erection drawings showing connections, cast-in items, waterproofing details, lifting hooks, and production drawings showing elevations, sections, and details indicating sizes and quantities of reinforcement.
  - 6. Submit shop drawings for structure frames, grates, and covers.
  - 7. Filter fabric: Submit the manufacturer's information.
  - 8. For trench drains submit shop drawings showing a schematic plan of the entire trench drain system, listing all parts being provided with exact centerline dimensions suitable for installation. Copies of the manufacturer's recommended method of installation and assembly shall be submitted for review.
  - 9. For water quality structures and stormwater quality filter treatment structures submit shop drawings for the structure and performance. Shop drawings shall detail the structures precast concrete components, inserts, and castings. Where an external

bypass is required, the manufacturer shall provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

- 10. The Contractor shall submit buoyancy calculations for storm drainage structures assuming groundwater is one (1) foot below finish grade. If buoyancy is an issue the structure(s) shall be modified to prevent uplift. All buoyancy calculations and precast concrete structure designs shall be prepared and sealed by a professional Civil Engineer licensed in the state of Massachusetts.
- 11. Prior to the acceptance of the storm drainage system, the Contractor shall submit to the Engineer, for review and approval, As-Built Drawings that indicate the true measurement and location, horizontal and vertical, of all new construction. As-Built drawings shall be stamped and signed by a Massachusetts Licensed Land Surveyor or Licensed Professional Engineer. The as-built plans shall also be submitted electronically as an AutoCAD drawing file (release 2010 or higher).
- 12. Prior to acceptance of the storm drainage system, the Contractor shall submit the results of the pipe deflection measurements and the video inspection reports.

#### 1.4 REFERENCE STANDARDS

- A. The following standards are applicable to the work of this Section to the extent referenced herein:
  - 1. ASTM: American Society for Testing and Materials.
  - 2. ANSI: American National Standards Institute.
  - 3. AASHTO: American Association of State Highway and Transportation Officials.
  - 4. Reference is made herein to the Commonwealth of Massachusetts, Department of Transportation (MassDOT), Formerly Massachusetts Highway Department (MHD) Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the "Standard Specifications". All references to method of measurement, basis of payment, and payment items in the "Standard Specifications" are hereby deleted. References made to particular sections or paragraphs in the "Standard Specifications" shall include all related articles mentioned therein.
  - 5. MassDOT Construction Standards, latest Edition with amendments, hereinafter referred to as the "Construction Standards."

#### 1.5 EXAMINATION OF SITE AND DOCUMENTS

- A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of a lack of knowledge of existing conditions as indicated in the Contract Documents, or obvious from observation of the site.
- B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct, but the Contractor shall have examined them for himself during the bidding period and formed his own conclusions as to the full requirements of the work involved.

#### 1.6 QUALITY ASSURANCE

- A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm drain systems.
- B. Utility Compliance: Comply with the Town of Belmont regulations, standards, and guidelines pertaining to storm drainage system installation and inspections.

- C. Plumbing Code Compliance: Comply with applicable portions of Massachusetts Plumbing Code and National Standard Plumbing Code, latest editions, pertaining to selection and installation of storm drain system's materials and products.
- D. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of storm drain system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- E. Installer's Qualifications: Firms with at least three years of successful installation experience on projects with storm drain work similar to that required for the project.

#### 1.7 PROJECT CONDITIONS

- A. Site Information: Perform site inspection and survey, research utility records, and verify existing utility locations and elevations. Verify that storm drainage system structures and piping may be installed in compliance with Contract Drawings and referenced standards.
- B. Interruption of Existing Storm Drainage System: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to the requirements indicated:
  - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Architect's written permission.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate with interior building storm drain system piping.
- B. Coordinate with other utility work.
- C. The Contractor is responsible for developing a sequence of work to maintain existing services in operation until the new services are operational.
- D. The Contractor is responsible for coordinating and scheduling the inspection of the work by the jurisdictional authority. All permits and inspection costs and fees shall be included in the bid prices and no additional costs will be paid to the Contractor.

#### PART 2 – PRODUCTS

- 2.1 MANHOLES AND CATCH BASINS
  - A. General: Provide precast reinforced concrete structures as indicated and complying with ASTM C 478.
  - B. Manhole Top: Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated in the Contract Drawings. Tops shall be designed to meet H20 loadings.
  - C. Base and Riser Sections: Precast concrete, with base riser section with integral floor. Diameter, base and riser thicknesses shall be as indicated on the Contract Drawings.
  - D. Cement: Type II.
  - E. Concrete strength: 4,000 psi minimum.
  - F. Precast concrete sections shall have tongue and groove joints.
  - G. Horizontal Joints: Joints between sections of concrete structures shall be sealed with a flexible, watertight joint, made with preformed butyl rubber joint sealant conforming to ASTM

C990 or with a rubber gasket joint conforming to ASTM C443. Sealants and/or gaskets shall be installed in accordance with the manufacturer's written instructions.

- H. Manhole Steps: Steps for manholes shall be non-skid raised edge-front steel reinforced polypropylene plastic type with at least 13-inch-wide stepping surface. Steps shall meet the requirements of ASTM C-478 and AASHTO M-199. Steel shall be 1/2-inch grade 60 conforming to ASTM A615 encapsulated with molded copolymer polypropylene. The polypropylene shall conform to ASTM D-4101. Rungs shall protrude no more than 6 inches from the wall. The portion of the legs to be embedded in the precast section shall have fins and be tapered to ensure a secure bond. Steps shall start a foot above the shelf of the manhole floor and continued twelve inches on center spacing up through the completed height of the unit. The steps shall finish no lower than twenty-four (24)-inches below the rim elevation. Placement into precast walls shall be by a method recommended by the supplier of the precast manhole sections. Steps shall be installed per the manufacturer's specifications.
- I. Pipe Connections: Drainage structures shall have plain beveled openings to accept the type of pipe specified. Pipe openings shall be minimum size required to receive the pipe and shall be accurately set to conform to the required line and grade. Drain pipe shall be joined to the wall of the concrete manhole or catch basin with non-shrink grout or flexible manhole sleeve as indicated on the drawings. Grout mixture shall follow instructions provided by manufacturer. Flexible manhole sleeves shall be cast in the walls of the manholes during the manufacturing process. Flexible manhole sleeves shall be NPC Kor-N-Seal Pipe-to-Manhole Connector as manufactured by Trelleborg Pipe Seals Milford, Inc., Milford, NH; Z-Lok as manufactured by A-Lok Products, Inc., Tullytown, PA; Tylox CIB Series Cast-In Boot Connector as manufactured by Hamilton Kent, Winchester, TN; or approved equal.
- J. Storm Drainage Brick Masonry: Bricks shall be sound, hard, uniformly burned, regular, and uniform in shape and size. Underburned or salmon brick shall not be acceptable. Only whole brick shall be used.
  - 1. Bricks for raising manhole and catch basin frames to finished grade shall conform to ASTM C32, Grade MS.
  - 2. Mortar shall be in conformance with ASTM C270, Type M. The mortar shall be composed of one-part Portland cement, 3-1/2 parts sand, and ¼ parts hydrated lime, by volume. Portland cement shall be ASTM C150, Type II; hydrated lime shall be Type S conforming to ASTM D207.
  - 3. Sand shall be washed, cleaned, screened, well-graded with all particles passing a No. 4 sieve, and conform to ASTM C33.
- K. Inverts in drain manholes shall be constructed of cement concrete shaped to conform accurately to size of the adjoining pipe. Side inverts and main inverts where the direction changes shall be laid out in smooth curves of the longest possible radius which is tangent, within the manhole, to the centerline of the adjoining pipe lines.
- L. For all manhole depths greater than 10 feet, the inside diameter of the manholes shall be at least 5'-0".
- M. Safety landings will be installed inside manholes greater than 16-feet in depth.
- N. When installing manholes on existing lines and when flows cannot be diverted, drop-over manholes shall be used. Drop-over manholes shall be precast with opening cast in the sidewalls of sufficient size to fit over the existing line(s) to remain in service. Drop-over manholes shall be set on a precast or cast-in-place concrete base slab. Drop-over manholes shall be manufactured to the same requirements and dimensions as standard manholes.

#### 2.2 MANHOLE FRAMES AND COVERS

A. Frames and covers shall be of cast iron conforming to the requirements of ASTM A48, Class No. 30 and shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Manhole covers shall be machined to fit securely and evenly on the frame. Frames and covers shall be designed to accept H20 loads, have a diamond surface finish, and frame height of 6 to 9-inches. Covers shall be equal to Item Numbers 12665 and 12685 (6" and 8-1/8" frame heights, respectively) as manufactured by General Foundries Inc. Catalog numbers are provided to establish a standard of quality and configuration of castings. Covers shall bear the word "DRAIN" in 3-inch-high letters.

#### 2.3 CATCH BASIN FRAMES AND GRATES

- A. Catch basin grates located at low points shall consist of a 24-inch square grate with a minimum frame height of 8 inches unless otherwise noted on the drawings. Frames and grates shall be of cast iron and designed to accept H20 loads. Catch Basin Frames and Grates shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Single frames and grates shall be equal to Item Numbers 22444-SQH, 22464-SQH, and 22484-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. ADA Compliant frames and grates shall be equal to Item Numbers 22444-ADA, 22464-ADA, and 22484-ADA (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Double frames and grates shall be equal to Item Numbers 24844-SQH, 24864-SQH, 24864-SQH, and 24884-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Double frames and grates shall be equal to Item Numbers 24844-SQH, 24864-SQH, and 24884-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Double frames and grates shall be equal to Item Numbers 24844-SQH, 24864-SQH, and 24884-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Double frames and grates shall be equal to Item Numbers 24844-SQH, 24864-SQH, and 24884-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Touble frames and grates shall be equal to Item Numbers 24844-SQH, 24864-SQH, and 24884-SQH (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Four and three-flange frames shall be provided as required. Catalog numbers are provided to establish a standard of quality and configuration of castings.
- B. Catch basin cascade frames and grates shall consist of a 24-inch square grate with a minimum frame height of 8 inches unless otherwise noted on the drawings. Frames and grates shall be of cast iron and designed to accept H20 loads. Cascade frames and grates shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Cascade frames and grates shall be equal to Item Numbers 22444-CAS, 22464-CAS, and 22484-CAS (4", 6", and 8" frame heights, respectively) as manufactured by General Foundries Inc. Four and three-flange frames shall be provided as required. Catalog numbers are provided to establish a standard of quality and configuration of castings.

#### 2.4 CATCH BASIN HOODS

A. All catch basins shall have hoods installed over the outlet pipe. Hoods shall be cast iron removable or hinged traps that fit over the catch basin outlet pipe. Traps shall be approximately 19-inches wide by 18-inches high and extend 11-inches from the wall of the structure. Catch Basin Hoods shall be manufactured by General Foundries Inc., North Brunswick, New Jersey; East Jordan Iron Works (formerly LeBaron Foundry, Inc.), East Jordan, Michigan; Neenah Foundry Company, Neenah, Wisconsin; or approved equal. Hoods shall be equal to Item Number MATRP as manufactured by General Foundries Inc. Catalog numbers are provided to establish a standard of quality and configuration of castings.

#### 2.5 AREA DRAIN

A. Area drains required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a

watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals conforming to ASTM F477. The pipe bell spigot shall be joined to the main body of the area drain. A PVC cap shall be installed at the bottom of the area drain sump. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454. Area drains shall be manufactured by Nyloplast or approved equal.

B. Grates and frames furnished for all area drainage shall be ductile iron for sizes 8", 10", 12", 15", 18" and 24" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for area drains shall be capable of supporting H-20-wheel loading for vehicular traffic areas or H-10 loading for pedestrian traffic areas unless otherwise noted. 12" and 15" square grates shall be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black. Grates in walkways shall meet ADA requirements. Grates in planting beds shall be domed grates. The grates furnished for area drains bioretention areas shall be 24" in diameter. All area drain grates should include a locking device. Area drain grates shall be manufactured by Nyloplast or approved equal.

#### 2.6 INLINE DRAINS

- A. The inline drain required for this contract shall be manufactured from PVC pipe stock, utilizing a thermos-molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the inline drain body by use of a swage mechanical joint. The ram material used to manufacture the pipe stock that is used to manufacture the inline drain body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.
- B. The grates furnished for all surface drainage inlets shall be ductile iron grates for sizes 8", 10", 12", 15", 18", and 30" shall be made specifically for each fitting so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for inline drains shall be capable of supporting H-20-wheel loading for traffic areas or H-10 loading for pedestrian areas. 12" and 15" square grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron. Grates shall be provided painted black.

#### 2.7 MANUFACTURED TRENCH DRAINS

- A. Trench drains shall be a pre-engineered, manufactured system that conforms to the design loading requirements of AASHTO H-20 and HS-20 (minimum) with the following minimum requirements:
  - 1. Channels shall be manufactured from polyester resin polymer concrete with an integrally cast-in ductile iron edge rail. Each edge rail shall be at least ¼" thick.
  - 2. The polymer concrete shall be frost proof, dilute acid and alkali resistant, and salt proof (B117 Salt Spray Test Compliant) with the minimum properties as follows:
    - a. Compressive Strength: 14,000 psi
    - b. Flexural Strength: 4,000 psi
    - c. Tensile Strength: 1,500 psi
    - d. Water Absorption: 0.07%

- 3. The system shall be 12" nominal internal width with a 14.2" overall width and a built-in slope of 0.5%. Channel invert shall have a partial radius in the trench bottom. All channels shall be interlocking with a male/female joint.
- 4. Trench drain grates shall be slotted ductile iron conforming to ASTM 536-84, Grade 65-45-12. After removal of grates, there shall be uninterrupted access to the trench to aid maintenance.
- 5. Units shall have horizontal cast in anchoring keys on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and pavement surface.
- 6. The trench drain shall have a locking device that directly connects the grate to the frame.
- 7. Channel shall be designed to withstand loading to Load Class F as outlined by EN 1433. Grate type shall be appropriate to meet the system load class specified.
- 8. Trench drain system shall be installed in strict accordance with manufacturer's installation instructions, recommendations, and shop drawings.

#### 2.8 WATER QUALITY STRUCTURE

- A. The water quality drainage structure models indicated on the Contract Drawings are Stormceptor® as manufactured by the Stormceptor Corporation, Rockville, MD. Equivalent structures include Vortechs as manufactured by Vortechnics, Inc. of Portland, ME, and Downstream Defender as manufactured by Hydro International of Portland, ME. Other acceptable equivalent manufactured devices may be used if following requirements are met. Prior to acceptance, the contractor shall receive written approval for use of said substitution from the Town of Belmont and/or their authorized representatives.
- B. The water quality structure shall have a proven laboratory test record of having the capability to remove a minimum of 80% of the sediment load from the low-flow storm conditions from the total catchment area of the drainage system. Laboratory testing methods shall conform to the "Technology Acceptance Reciprocity Partnership" (TARP) Tier II protocol or other acceptable equivalent method and shall have the capability of removing clay and silt size particles.
- C. The available water quality structure laboratory performance documentation shall achieve a grade of "2" or better as rated through the "Massachusetts Stormwater Evaluation Project" (MAStep).
- D. The water quality structure shall be installed underground as part of the stormwater system.
- E. The structure shall be constructed of precast concrete components.
- F. Precast Concrete Sections: All precast concrete components shall be designed and manufactured to a minimum live load of AASHTO HS-20 truck loading.
- G. Joints: The concrete joints shall be watertight and meet the design criteria according to ASTM C443.
- H. Frame and Cover: The frame and cover shall clearly indicate with lettering the unit's name cast into the cover to allow for easy identification in the field.
- I. Concrete: Precast concrete components shall meet the requirements of ASTM C478.
- J. Fiberglass: The fiberglass portion of the water treatment structure shall be constructed in accordance with ASTM D409, Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks. The internal fiberglass insert shall be bolted and sealed watertight inside the reinforced concrete component.

- K. The water quality structure shall be vertically oriented with easy access to facilitate maintenance.
- L. The first 16 inches of oil storage should be lined with fiberglass or other coating acceptable to the Engineer to provide double-wall containment of any hydrocarbon-based material.
- M. Water quality structure shall be equipped with high flow bypass that shall be physically separated from the separation area to prevent mixing.
- N. The structure shall be maintainable from the surface via access points without requiring entry into the structure.
- O. The structure shall be designed to prevent the formation of secondary eddy currents or scour conditions.
- P. The structure shall be able to be installed to the invert elevations of the drainage system as detailed on the Contract Drawings.
- Q. The water quality structure shall be capable of containing floatable substances such as oil and gasoline within the structure during normal operation as well as periods of service and repair. Floatables containment shall be achieved without the use of floatable additives.
- R. The water quality structure shall not be compromised by backwater conditions i.e., trapped pollutants should not be resuspended and scoured from the interceptor during backwater conditions.
- S. Calculations stamped by a Professional Engineer shall be supplied to demonstrate that the water quality structures will accept the design flow rates without causing a backwater condition.
- T. Inspection: All precast concrete sections shall be inspected to ensure that dimensions, appearance, and quality of the product meet the requirements of ASTM C478.

#### 2.9 DUCTILE IRON PIPE AND FITTINGS

- A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
  - 1. Ductile iron pipe shall be that of a manufacturer who can demonstrate at least five years of successful experience in manufacturing ductile iron pipe. The pipe shall be equipped with push on type, restrained joint, or mechanical joints, as required.
  - 2. All ductile iron drain pipe shall conform to American Water Works Association (AWWA) C150 and AWWA C151.
  - 3. The ductile iron pipe shall be Class 52 and furnished in minimum nominal 18-foot lengths, with Push-on as manufactured by U.S. Pipe and Foundry Company, Atlantic States Cast Iron Pipe Co., Clow Corporation, or approved equal with gaskets conforming to AWWA C111 "Rubber Gasket Joints".
  - 4. Ductile iron drain pipe shall be cement-mortar lined and the pipe exterior asphalt seal coated in accordance with AWWA C104.
  - 5. The pipe shall be furnished along with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.
  - 6. Fittings shall be ASTM A-536 ductile iron with mechanical joint fittings. All fittings 3 inch through 48 inches in diameter shall meet or exceed the requirements of AWWA C110. Compact fittings shall be ductile iron meeting or exceeding the requirements of AWWA

C153. Fittings shall have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. All fittings 4 through 24 inches shall be Class 350. All fittings greater than 24 inches shall be as specified above except they shall be Class 250. Compact fittings shall only be used in sizes 4 through 24 inches. Fittings shall conform to the weights, excluding accessories, and dimension shown in the latest edition of the Handbook of Ductile Iron Pipe and come complete with all joint accessories as required. All accessories (gland gaskets, T-bolts, and nuts) shall be in accordance with AWWA C111. All mechanical joint bolts (T-bolts) shall be Cor-Ten or equal.

- 7. Contractor shall provide all adapters and fittings such as transition couplings, as determined in the field, necessary to complete all cross connections, whether or not specifically stated in the Contract Drawings and Specifications.
- 8. All pipes shall be marked with the class, thickness designation, and initials of the manufacturer.
- 9. If required the manufacturer shall supply the Engineer with certificates of compliance with these Specifications and certification that each piece of ductile iron pipe has been tested at the foundry with the Ball Impression Test, Ring Bending, or equal.
- 10. Pipe for use with sleeve-type couplings shall be as specified except that the ends shall be plain (without bells or beads). The ends shall be cast or machined at right angles to the axis.

#### B. INSPECTION, TESTS, AND ACCEPTANCE FOR DUCTILE IRON PIPE

- 1. All pipe delivered to the job site shall be accompanied by test reports certifying that the pipe and fittings conform to "AWWA Standard for Ductile Iron Pipe, for Water and Other Liquids" (AWWA H3) and (AWWA C151).
- 2. All tests shall be made in accordance with the methods prescribed by the above mentioned AWWA Standards, and the acceptance or rejection shall be based on the test results.
- 3. Pipe which does not conform to the requirements of this contract shall be immediately removed and replaced by the Contractor.
- 4. All ductile iron pipe to be installed under this Contract may be inspected at the foundry for compliance with these Specifications by an independent testing laboratory selected by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of foundry inspection of all pipe approved for this Contract, plus the cost of the inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.

#### C. SLEEVE COUPLINGS FOR DUCTILE IRON PIPE

- 1. Sleeve couplings and accessories shall be pressure rated at least equal to that of the pipe. Couplings shall be cast iron and shall be Dresser Style 53 or 153, Rockwell Style 441, Baker Series 4245 or acceptable equivalent product. The couplings shall be provided with Cor-Ten bolts and nuts or approved equal.
- 2. After assembly, all exterior surfaces including the bolts and nuts shall be thoroughly coated with two coats of heavy-duty protective coating. The interior of the coupling shall be epoxy coated. Coating shall be a minimum of 10 mils. and a maximum of 20 mils. dry film thickness thermosetting epoxy.

#### 2.10 HUB AND SPIGOT CAST IRON SOIL PIPE AND FITTINGS

A. Hub and Spigot Cast Iron pipe and fittings shall be manufactured from gray cast iron and shall conform to ASTM A74. Joints shall be made using a compression gasket manufactured

from an elastomer meeting the requirements of ASTM C564. Installation shall comply with manufacturer's recommendations and applicable code requirements.

#### 2.11 PVC DRAINAGE PIPE

- A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
- PVC (Polyvinyl Chloride) Gravity Sewer Pipe and Fittings: ASTM D3034, SDR 35, for elastomeric gasket joints. Pipe 18 to 36 inches in diameter shall conform to ASTM F679, T-1 heavy wall. The pipe shall have a Standard Dimension Ratio (SDR) of 35 and a pipe stiffness of 46 psi.
- C. Joints: PVC pipe shall have an integral wall bell and spigot push-on joint with elastomeric gaskets secured in place in the bell of the pipe. The bell shall consist of an integral wall section with solid cross section elastomeric gasket, factory assembled, securely locked in place to prevent displacement during assembly. Pipe joints shall conform to ASTM D3212 and elastomeric gaskets shall conform to ASTM F477.
- D. Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an "assembly stripe" imprinted thereon to which the bell end of the mated pipe will extend upon proper joining of the two pipes.
- E. PVC gravity sewer fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and spigot configurations compatible with that of the pipe.

#### 2.12 CORRUGATED POLYETHYLENE PIPE

- A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
  - 1. Corrugated polyethylene pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind.
    - a. Pipe shall conform to AASHTO M252, Type S for 4- through 10-inch diameter pipes.
    - b. Pipe shall conform to AASHTO M294, Type S or ASTM F2306 for 12- through 60inch diameter pipes.
    - c. Fittings shall conform to AASHTO M252, AASHTO M294 or ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of AASHTO M252, AASHTO M294 or ASTM F2306.
  - 2. Pipe and fittings shall be high-density polyethylene meeting the requirements of ASTM D3350.
  - 3. Pipe units shall have a minimum laying length of 20-feet except as otherwise indicated or allowed by the Engineer.
  - 4. Pipe shall be installed with a minimum 12-inch cover for AASHTO H-20 loading.
- B. CORRUGATED POLYETHYLENE FLARED END SECTION
  - 1. The pipe shall have an interior surface that is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Flared end section shall

be high-density polyethylene meeting ASTM D3350 minimum cell classification 213320C. Metal threaded fastening rods shall be stainless steel.

- C. JOINTS ON CORRUGATED POLYETHYLENE PIPE
  - 1. The pipe and fitting joints shall be bell-and spigot with watertight gaskets in accordance with the requirements of ASTM D3212.
  - 2. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
  - 3. Pipe entrances at catch basins shall be made with a mortar made with Type II cement. Mortar mixture shall follow instructions provided by cement manufacturer. Pipe connections at drain manholes and water quality structures shall be made with integral flexible rubber sleeves and Corrugated Pipe Adapters designed for use with the pipe and sleeves.
- 2.13 REINFORCED CONCRETE PIPE (CLASS IV; 12 THROUGH 48 INCHES)
  - A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.
    - The pipe shall have an interior surface, which is smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. Pipe shall conform to ASTM "Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe," Designation: C76 and shall be Wall B for the Class IV and V, as noted on the drawings, and with additions and exceptions as follows:
    - 2. Type II cement shall be used unless otherwise approved by the Engineer. Admixtures shall not be used except with prior approval of the Engineer.
    - 3. Elliptical reinforcement will not be permitted. Longitudinal reinforcement shall be continuous. Reinforcement shall have a minimum cover of <sup>3</sup>/<sub>4</sub> inch. Pipe shall have no lifting holes.
    - 4. Absorption shall be as specified under "Tests of Materials and Pipe Units."
    - 5. Pipes manufactured by the centrifugal process or in vertical forms shall be cast of wet mix concrete. Concrete cast in vertical forms shall be consolidated by internal or external mechanical vibration or both. The vibrating equipment shall be operated at high speed (more than 5,000 rpm) and have a low amplitude. Pipes manufactured by the modified packer process shall have a supplementary concrete densification operation that shall assure the attainment of full bond between reinforcement and concrete and also eliminate any displacement of the reinforcement. Additional passes with the revolving packerhead or the use of additional vibrators attached to the platform or exterior forms will not be acceptable.
    - 6. Pipe units shall have a minimum laying length of 8-feet except as otherwise indicated or allowed by the Engineer.
    - 7. Pipe may be rejected for any of the following reasons:
      - a. Exposure of any wires, positioning spacers or chairs used to hold the reinforcement cage in position, or steel reinforcement in any surface of the pipe, except as permitted by Section 8.2 of ASTM C76.
      - b. Transverse reinforcing steel found to be in excess of 1/4-inch out of specified position after the pipe is molded.
      - c. Any shattering or flaking of concrete as a crack.

- d. Voids, with the exception of a few minor bugholes, on the interior and exterior surfaces of the pipe exceeding 1/4-inch in depth, unless properly and soundly pointed with mortar or other approved material.
- e. A hollow spot (identified by tapping the internal surface of the pipe) which is greater than 30-inches in length or wider than 3 times the specified wall thickness.
- f. Defects that indicate imperfect molding of concrete; or any surface defect indicating honeycomb or open texture (rock pockets) greater in size than area equal to a square with a side dimension of 2½ times the wall thickness or deeper than two times the maximum graded aggregate size; or local deficiency of cement resulting in loosely bonded concrete.
- g. Any of the following:
  - 1) A crack having a width of 0.005 to 0.01-inches throughout a continuous length of 36-inches or more.
  - 2) A crack having a width of 0.0 to 0.03-inches or more throughout a continuous length of 1-foot or more.
  - 3) Any crack greater than 0.005-inches extending through the wall of the pipe and having a length in excess of the wall thickness.
  - 4) Any crack showing two visible lines of separation for a continuous length 2feet or more, or an interrupted length of 3-feet or more anywhere in evidence, both inside and outside.
  - 5) Cracks anywhere greater than 0.03-inches in width.
- h. Application of any wash coat of cement or grout to the pipe will not be permitted without approval of the Engineer. Any pipe dressing procedures shall be subject to the approval of the Engineer.
- B. Joints on Reinforced Concrete Pipe:
  - 1. Pipe joints for all reinforced concrete pipe shall be of the rubber gasket type in which the gaskets are in compression and which will permit both longitudinal and angular movement. Each unit of pipe shall be provided with proper ends made of concrete formed true to size and formed on machined rings to ensure accurate joint surfaces.
  - 2. Joints and gaskets for pipe shall be the O-ring gasket type and shall conform to the requirements of ASTM C443 and the additional requirements specified.
  - 3. Joints shall be of such design that when tested under an average internal hydrostatic pressure of 13 pounds per square inch for a period of 10 minutes, no visible leakage will result. The diameters of the joint surfaces which compress the gasket shall not vary from the true diameters by more than 1/16-in or the amount permitted by the appropriate above-mentioned ASTM Standard Specifications, whichever is less.
  - 4. Gaskets shall be of a composition and texture which is resistant to common ingredients of sewage, industrial wastes, and groundwater, and which will endure permanently under the conditions likely to be imposed by this service. Gaskets shall be the product of a manufacturer regularly engaged in the manufacture of rubber gaskets for pipe joints.
- C. Flared End Sections: Reinforced Concrete Pipe flared end sections shall conform to requirements of AASHTO M170, minimum Class IV.

#### 2.14 SUBSURFACE INFILTRATION CHAMBERS

A. Subsurface detention chambers shall be HDPE chamber system as manufactured by StormTech, Cultec, or similar. The chambers will be handled, stored, and installed according to manufacturer's specifications and details. The chambers will be placed on a drainage course bed with a minimum of depth of six inches. The chambers shall not be placed with backfill depths greater than 96" to surface as per manufacturer's details.

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- B. The nominal storage volume of stormwater chambers shall be 74.9 cubic feet per chamber, including the volume of drainage course bedding.
- C. The galley shall have both of its ends open to allow for unimpeded hydraulic flows and for visual inspection and maintenance of the row's entire length. The galley shall have a circular, indented, flat surface on the top for an inspection port or clean-out.
- D. The galley shall be analyzed and designed using AASHTO methods for thermoplastic culverts contained in the LRFD Bridge Design Specifications, 2nd Edition, including Interim Specifications through 2001. Design live load shall be the AASHTO HS20 vehicle. Design shall consider earth and live loads as appropriate for the specified depth of fill.
- E. The end cap shall be designed to fit into any corrugation of a galley, which allows capping a galley that has its length trimmed and segmenting rows into storage basins of various lengths.
- F. The end cap shall have saw guides to allow easy cutting for various diameters of pipe that may be used to inlet the system. The end cap shall have excess structural adequacies to allow cutting an orifice of the required size at any invert elevation.
- G. The primary face of an end cap shall be curved outward to resist horizontal loads generated near the edges of beds.

#### 2.15 WATER STORAGE TANKS FOR NONPOTABLE WATER REUSE

- A. All storage tanks shall be furnished and installed as single wall fiberglass reinforced plastic UL. Sizes and fittings shall be as shown on the contract drawings. Tank manufacturer shall be in the business of manufacturing tanks to Underwriter Laboratories (UL) Standard 1316. The tank must be manufactured to meet or exceed the requirements of ANSI/AWWA-D120 (Thermosetting Fiberglass Reinforced Plastic Tanks).
- B. The tank shall be manufactured with 100% resin and glass-fiber reinforcement with no sand fillers, and shall be compatible with non-potable water products.
- C. Tanks must be vented. Tanks are designed for operation at atmospheric pressure only.
- D. Tanks shall be capable of storing non-potable water not to exceed 150 degrees Fahrenheit at the tank interior surface.
- E. Loading Conditions Tanks shall meet the following design criteria:
  - 1. Internal Load Tank shall withstand a 5-psig air-pressure test with 5:1 safety factor. When tank is designed for on-site testing, contractor shall individually test tank for leakage prior to installation. Maximum test pressure is 5 psig.
  - 2. Vacuum Test To verify structural integrity, every 10-ft diameter tank and smaller shall be designed to withstand a vacuum test to 11.5 inches of mercury.
  - 3. Surface Loads Tank shall withstand surface H-20 axle loads when properly installed according to tank manufacturer's current Installation Manual and Operating Guidelines.
  - 4. External Hydrostatic Pressure Tank shall be capable of being buried in ground with 7 feet of overburden over the top of the tank, the hole fully flooded and a safely factor of 5:1 against general buckling.
  - 5. Tank shall support accessory equipment such as drop/fill tubes when installed according to tank manufacturer's current Installation Manual and Operating Guidelines.
- F. Flanged Manways:
  - 1. The standard manway is 24-inch, nominal internal diameter, which is supplied by the manufacturer (30-inch and 36-inch manways are optional).

- 2. All manways will be furnished complete with gasket, bolting hardware, and cover.
- 3. Location(s) shall be indicated on tank drawings.
- 4. Manway extensions shall be Fiberglass Reinforced Plastic (FRP).
- G. Tank Bottom Deflector Plates: These plates shall be installed under each service fitting and manway opening.
- H. Ladders: Ladders shall be the standard ladder as supplied by the tank manufacturer (fiberglass, stainless steel, or aluminum).
- I. Fittings:
  - 1. All inlet/outlet stub outs shall be FRP, and shall be flat-faced, flanged and conform to ANSI B16.5 150# bolting patterns.
  - 2. Flexible connectors must be used on all piping connections. Piping must be free to move independent of the tank.
  - 3. All metal fittings and other metal components must be coated to protect against corrosion.

#### 2.16 FILTER FABRIC

A. Filter Fabric used, as a drainage medium shall consist of a non-woven fabric made from polypropylene or polyethylene filaments or yarns. The fabric shall be inert to organic chemicals commonly encountered in the soil. Edges of filter fabric shall overlap a minimum of one foot. The fabric shall conform to the following recommended property tests:

Property	Unit	Test Method	Minimum Value
Weight	oz/sy	ASTM D-5261-92	4.8
Grab Strength	lbs	ASTM D-4632-91	120
Grab Elongation	percent	ASTM D-4632-91	50
Trapezoid Tear Strength	lbs	ASTM D-4533-91	50
Mullen Burst Strength	psi	ASTM D-3786-87	225
Puncture Strength	lbs	ASTM D-4833-00	65
Apparent Opening Size (AOS)	U.S. std. Size Sieve	ASTM D-4751-99A	70

#### 2.17 CRUSHED STONE

A. Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

Percent Passing by Weight				
Sieve Size	3/4-inch Stone	1/2-inch Stone		
1-inch	100			
3/4-inch	90-100			
5/8-inch		100		
1/2-inch	10-50	85-100		
3/8-inch	0-20	15-45		
No. 4	0-5	0-15		
No. 8		0-5		

#### 2.18 DRAIN COUPLINGS

A. Drain Couplings shall be pressure rated at least equal to that of the pipe. The coupling sleeve, shall be 1/4-inch minimum thickness elastomeric polyvinylchloride with a minimum tensile strength of 1500 psi. The sleeve shall fit snugly onto the pipe to be joined and be resistant to common chemicals present in storm water. Adjustable pipe clamps shall consist of a slotted band that mate with the worm gear screw and a screw housing all manufactured of stainless steel, and suitable for underground service.

#### 2.19 CLEANOUTS

- A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.
- B. The drain cleanouts shall be minimum 6-inch diameter or sized to match the service pipe, whichever is greater. The cleanout shall be complete with a flush mount over. The cleanout cover shall be clearly marked "DRAIN" and shall be minimum eight inches in diameter or two inches greater than the cleanout size, whichever is greater. Cleanouts shall include a watertight cap.

#### 2.20 IDENTIFICATION

A. Detectable Underground Warning Tapes: Acid and alkali-resistant polyethylene plastic film warning tape, 6-inches wide by 4-mils. minimum thickness, with continuously printed caption in black letters "CAUTION - xxxxx LINE BURIED BELOW." The text and color of the tape shall be as shown in the table below. The tape shall have a metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when the tape is buried up to 2.5-feet deep.

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam
Safety Alert Orange	Telephone, Communications, Cable
	Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer

#### PART 3 – EXECUTION

#### 3.1 GENERAL INSTALLATION

- A. General: General Locations and Arrangements: Contract Drawings indicate the general location and arrangement of the underground storm drainage system piping. Location and arrangement of piping layout take into account many design considerations. Install the piping as indicated, to the extent practical. Any modifications to the layout of the storm drainage system shall be submitted to the Engineer for review and approval at least five days prior to the start of the affected work.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations, accepted practices, and utility owner's requirements. Maintain swab or drag in line and pull past each joint as it is completed.

- C. All pipe shall be laid in the dry. Adequate measures shall be taken to prevent floatation of pipe in the trench.
- D. Whenever encountered within the trench, existing abandoned water, sewer, and/or drain lines shall be removed within the trench limits, unless otherwise noted. The remaining portion of the abandoned lines shall be plugged at all open ends.
- E. When bell and spigot pipes are used, bell holes shall be dug in the bedding to accommodate the bells. They shall be deep enough to ensure that the bell does not bear on the bottom of the hole but shall be excessively wide in the longitudinal direction of the installation.
- F. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into an existing storm drain is indicated.
- G. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited without the written approval of the Engineer.
- H. Install piping pitched down in direction of flow as indicated on the Contract Drawings.
- I. Extend storm drainage system piping to connect to building drain services, of sizes and in locations indicated on the Contract Drawings.
- J. Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
- K. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.
- L. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- M. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.
- N. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.
- O. Jointing Pipe: After the pipe are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
- P. Alignment and Placement: All pipe shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

- 1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
- 2. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
- Q. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing drainage system.
  - 1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.
  - 2. Flush lines between manholes to remove collected debris.
- R. Review of Completed Storm Drain System: The completed drain system shall be visually inspected by the Owner's Representative. If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material, the defect shall be replaced or repaired as directed by the Engineer or the Owner's Representative. The Contractor shall coordinate and provide site access for inspection.

#### 3.2 PLACEMENT OF DUCTILE IRON PIPE AND FITTINGS

- A. Care shall be taken in loading, transportation, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before placement, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer.
- B. If any defective pipe is discovered after it has been placed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense. All pipe and fittings shall be kept clean until they are used in the work, be thoroughly cleaned before placement, and when placed, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. A firm even bearing throughout the length of the pipe shall be constructed by compacting gravel borrow around the pipe and up to the springline.
  - 1. Blocking will not be permitted.
- C. All pipes shall be sound and clean before placement. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be temporarily closed by watertight plug or other acceptable means. Alignment shall be maintained during placement. The deflection at joints shall not exceed sixty percent of that recommended by the manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities, which may be encountered upon opening the trench. Solid sleeves shall be used only where allowed by the Engineer.
- D. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on type bell shall be beveled to conform to the manufactured spigot end.
- E. The Contractor shall take care not to damage pipe by impact, bending, compression, or abrasion during handling, and installation. Joint ends of pipe especially shall be kept clean.
- F. Pipe shall be stored above ground at a height no greater than 5 feet and with even support for the pipe barrel.
- G. Only nylon protected slings shall be used for handling the pipe. No hooks, chains or bare cables will be permitted.

- H. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.
- I. Jointing of ductile iron push on pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The last 8 inches of the outside of the spigot end of pipe and the inside of the bell end of pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be painted with a lubricant just prior to making up the joint. The spigot end shall then be gently pushed home into the bell. The position of the gasket shall be checked to ensure that the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
  - 1. Jointing Ductile Iron Pipe (Push-On Type): Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.
  - 2. Jointing Mechanical Joint Fittings: Mechanical joints at fittings and where designated shall be installed in accordance with the "Notes on Method of Installation" under ANSI Specification A 21.11 and the instructions of the manufacturer. To assemble the joints in the field, the Contractor shall thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torque. Under no condition shall extension wrenches or pipes over handles or ordinary ratchet wrenches be used to secure greater leverage.
- J. Installation and jointing of ductile iron pipe shall be in accordance with AWWA C600, Sections 9b and 9c, latest revision, as applicable.
- K. Ductile iron pipe installed within 5-feet of gas lines shall be fully encased with polyethylene material. Polyethylene shall be 8 millimeters thick and comply with AWWA C 105.

#### 3.3 PVC PIPE

- A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
- B. PIPE HANDLING
  - 1. All pipe and fittings shall be carefully handled from the truck onto the ground and into the trench or excavation so as to prevent damage to the pipe. Pipes shall be kept free of dirt and foreign material, especially on the inside. Joint ends of pipe shall especially be kept clean.
  - 2. Pipe stored on site shall be protected from heat and direct sun light and shall be suitably ventilated.
  - 3. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

#### C. ALIGNMENT AND PLACEMENT OF PVC PIPE

- 1. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade.
- 2. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.

- 3. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.
- 4. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.
- 5. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
- 6. Full lengths of pipe shall be used in the installation except that partial lengths may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
- 7. Pipe entrances to structures shall be cut flush with the inside face of the structure, and cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the sewage flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
- 8. The Contractor shall protect the installation at all times during construction. The movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's own risk.
- 9. Drain pipes shall be laid to the required grades by use of a laser and target system, unless otherwise specifically approved by the Engineer.
- 10. Jointing of PVC drain pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to ensure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
- 11. PVC pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, is not acceptable.
- 12. Field-cut pipe ends shall be cut square and the pipe surface beveled to the size and shape of a factory-finished beveled end. All sharp edges shall be rounded off.

#### 3.4 INSTALLATION OF REINFORCED CONCRETE PIPE AND PIPE FITTINGS

- A. General: Install piping in accordance with ASTM D2321, the governing authorities having jurisdiction of the utility, and the manufacturer's instructions, except where more stringent requirements are required by the Contract Documents.
- B. Acceptance of Pipe: Acceptance will be on the basis of tests specified hereinbefore. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor at no cost to the Owner.
- C. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- D. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will

be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.

- E. Jointing Pipe: After the pipes are aligned in the trench and are ready to be jointed, all joint surfaces shall be cleaned.
- F. Alignment and Placement: All pipes shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
  - 1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
  - 2. The Contractor shall establish centerline and offset stakes at each manhole, plus intermediate centerline and offset stakes as needed to ensure proper alignment and grade. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
- G. Cleaning: Care shall be taken to prevent earth, water, and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water, and debris from entering any existing Drain.
  - 1. Place plugs in end of uncompleted conduit at end of day, or whenever work stops.
  - 2. Flush lines between manholes to remove collected debris.
- H. Review of Completed Reinforced Concrete Pipe System: If the visual observation of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material the defect shall be replaced or repaired as directed at no cost to the Owner. The visual observation shall be conducted by the Engineer and any defects shall be as identified by such. The Contractor shall coordinate and provide site access for the Owner.

#### 3.5 INSTALLATION OF CORRUGATED POLYETHYLENE PIPE AND PIPE FITTINGS

- A. General: Install Corrugated Polyethylene Pipe in accordance with ASTM D2321 and governing authorities having jurisdiction, except where more stringent requirements are indicated.
- B. Acceptance of Pipe: Acceptance will be on the basis of tests specified herein before. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to review by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. All pipe which is rejected shall be immediately removed from the project site by the Contractor.
- C. Pipe Storage: Pipe sections shall not be stored on areas over the newly placed pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.
- D. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.

- E. Alignment and Placement: All pipe shall be placed with extreme care as to grade and alignment. Each pipe shall be so placed as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.
  - 1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.
  - 2. The Contractor shall establish centerline and offset stakes at each manhole, plus intermediate centerline and offset stake as needed to ensure proper alignment and grade between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400-feet.
  - 3. Bedding material for the pipe must be installed with care in the area around the pipe. Bedding material must be placed to provide uniform and adequate support under pipe. Do not use blocking to bring pipe up to grade. Bedding shall be crushed stone.
  - 4. Provide bell holes at each joint to permit joint to be assembled properly while maintaining uniform pipe support.
  - 5. Place and consolidate the bedding material under the pipe haunch to provide adequate side support while avoiding both vertical and lateral displacement of pipe.
  - 6. Initial backfill must be completed to a point at least 12-inches over the top of the pipe and be hand placed. Use little or no tamping of initial backfill directly over the top of pipe. Compaction methods may be utilized during final backfilling.
  - 7. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.
  - 8. Full lengths of pipe shall be used in the installation except that partial lengths may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.
  - 9. Pipe entrances to structures shall be cut flush with the inside face of the structure, and cut ends of the pipe surface within the structure shall be properly finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the stormwater flow. The method of cutting and finishing shall be subject to the approval of the Engineer.
  - 10. The Contractor shall protect the installation at all times during construction. The movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's own risk.
  - 11. Jointing of pipe and fittings shall be done in accordance with the printed recommendations of the manufacturer and as specified. The bell end of the pipe shall be thoroughly cleaned. The joint surfaces and the gasket shall be lubricated prior to making up the joint. The position of the gasket shall be checked to ensure the joint has been properly made and is watertight. Care shall be taken not to exceed the manufacturer's recommended maximum deflection allowed for each joint.
  - 12. Each length of pipe shall be pushed home by hand or with the use of bar and block. The use of power equipment, such as a backhoe bucket, is not acceptable.
  - 13. Field-cut pipe ends shall be cut square.

#### 3.6 INSTALLATION OF DRAIN MANHOLES AND CATCH BASINS

- A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.
  - 1. The Contractor shall install the manholes and catch basins as soon as the pipe laying reaches the location of the structures.
  - 2. The Contractor shall accurately locate each manhole and catch basin and set accurate templates to conform to the required line and grade. Any manhole or catch basin which

is not installed in the correct location or oriented improperly shall be removed and rebuilt in its proper location, alignment, and orientation at no additional cost to the Owner.

- 3. Manhole risers and tops shall be installed using approved butyl rubber sealant or rubber gasket for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints.
- 4. Openings shall be provided in the precast concrete manhole sections to receive entering pipes and these openings shall be made at the place of manufacture. Pipe entrances at catch basins shall have plain beveled openings to accept the type of pipe specified and to be sealed with non-shrink grout. Grout mixture shall follow instructions provided by manufacturer. Pipe connections at drain manholes shall be made as indicated on the Drawings with either non-shrink grout or integral flexible rubber sleeves and Corrugated Pipe Adapters designed for use with the pipe and sleeves. For grouted joints, surface between pipe and wall shall be completely filled with non-shrink grout and troweled to provide a smooth surface conforming to both the outside and inside structure wall.
- 5. Care shall be taken to ensure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so that the manhole steps shall be in alignment.
- 6. All holes used for handling shall be thoroughly plugged with non-shrink grout.
- 7. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted except at the discretion of the Engineer or if necessary concrete block manhole(s) shall be used.
- 8. All interior manhole joints where the sealing material is not flush with the inside wall shall be grouted with non-shrink mortar and finished by hand/wet-brush.
- 9. A cast-in-place concrete invert shelf and channel shall be poured and shaped to the lower half of the pipes
- 10. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

#### 3.7 SETTING MANHOLE FRAMES AND COVERS AND CATCH BASIN FRAMES AND GRATES

- A. Manhole and catch basin frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Contract Drawings or as directed.
- B. Brick shall be used to bring the frames to the required elevation.
  - 1. Frames shall be set centered with the opening in the top of the precast structure on two to four courses of brick in a full bed of mortar. A thick ring of mortar extending to the outer edge of brick or concrete shall be placed all around the bottom flange of the cast iron frame. The mortar shall be smoothly finished to a height of 5 inches above the flange for 8-inch frames and sloped to shed water away from the frame.
  - 2. Completed brick installation shall be coated with mortar at least a <sup>3</sup>/<sub>4</sub> inch thick on the outside to provide a fully sealed and watertight collar between the top manhole section and the cover frame.
  - 3. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.
- C. Manhole covers shall be left in place in the frame until completion of other work at the manholes.

D. Where directed, the castings shall be temporarily set at such grades as to provide drainage during construction. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all other casting shall be performed at the proper stage of construction.

#### 3.8 CHANGE IN TYPE

- A. When an existing catch basin is to be converted to a manhole, the frame and grate shall be carefully removed and a new frame and cover installed to finish grade. If in the opinion of the Engineer the existing casting is reusable, it may be reused in the work, otherwise, it shall be disposed of off-site.
  - 1. The sump of the catch basin shall be thoroughly cleaned of debris and silt and the interior surfaces brushed to remove contaminants.
  - 2. The sump shall be thoroughly filled with compacted gravel to a level no greater than 6 inches below the pipe invert. A cast-in-place concrete invert shelf and channel shall be poured and shaped to the lower half of the pipes.
  - 3. New openings in existing structures shall be carefully cut with power saws of the proper size and elevation to accept the new connection. Damage to the structure caused by the Contractor's construction methods shall be repaired at no additional cost.

#### 3.9 STRUCTURE REBUILT

- A. When in the opinion of the Engineer existing masonry structure walls show deterioration, the structure shall be rebuilt. The casting and deteriorated masonry shall be removed in a careful and neat manner until only a sound condition remains. Concrete blocks shall be used to rebuild the structure. The new masonry construction, replacing of the casting, and other incidental work shall be performed as specified above.
  - 1. The Contractor's base bid shall include rebuilding [ ] vertical linear feet of existing manhole or catch basin structures.

#### 3.10 INSTALLATION OF WATER QUALITY STRUCTURES

- A. Contractor shall take appropriate action to protect all structure components throughout the installation and construction process. Care shall be taken in loading, transporting, and unloading to prevent damage to materials during storage and handling.
- B. Install water quality structures per manufacturer's specifications.
- C. The installation of a precast concrete structure should conform to ASTM C 891 for the construction of manholes.
- D. The precast concrete structure shall be installed in sections in the following sequence:
  - 1. Aggregate Base: Structure shall be supported on a compacted level foundation of gravel borrow or crushed stone a minimum of 12 inches thick.
  - 2. Base Slab
  - 3. Treatment chamber section(s)
  - 4. Transition slab (if required)
  - 5. Bypass Section
  - 6. Connect inlet and outlet pipes
  - 7. Riser section and/or transition slab (if required)
  - 8. Maintenance rider section(s) (if required)
  - 9. Frame and access cover

- E. The precast base shall be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, shall be installed in accordance with the precast concrete manufacturer's installation requirements.
- F. Adjustment of the stormwater quality treatment structure can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the stormwater quality treatment structure has been constructed, any lift holes shall be plugged watertight with mortar or non-shrink grout.
- G. Internal components requiring field installation shall be installed by the Contractor in accordance with the manufacturer's specifications and installation requirements.
- H. Inlet and outlet pipes should be securely set into the structure using approved pipe seals (flexible boot connections) so that the structure is watertight.
- I. Grade rings shall be installed to set the frame and cover at the required elevation. The grade rings shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover shall be set in a full bed of mortar at the elevation specified.
- J. If precast tank sections are to be field assembled, adequate waterproofing shall be used at the joint to resist the waterhead at that joint.

#### 3.11 INSTALLATION OF STORMWATER QUALITY FILTER TREATMENT STRUCTURE

- A. Contractor shall take appropriate action to protect all of the structures' internal components throughout the installation and construction process. No lifting shall be conducted or lifting mechanisms shall be connected to or come into contact with the stormwater quality treatment structures' deck or cartridge receptacles.
- B. Install stormwater quality filter treatment structure per manufacturer's specifications.
- C. PRECAST STRUCTURE CONSTRUCTION SEQUENCE
  - 1. The installation of a precast concrete structure should conform to ASTM C 891 for the construction of manholes.
  - 2. The precast concrete structure shall be installed in sections in the following sequence:
    - a. Aggregate Base: Structure shall be supported on a compacted level foundation of gravel borrow or crushed stone a minimum of 12 inches thick.
    - b. Base Slab
    - c. Treatment chamber and cartridge deck riser section(s)
    - d. Bypass Section
    - e. Connect inlet and outlet pipes
    - f. Riser section and/or transition slab (if required)
    - g. Maintenance rider section(s) (if required)
    - h. Frame and access cover
  - 3. The precast base shall be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations.
  - 4. Adjustment of the stormwater quality treatment structure can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the

sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the stormwater quality treatment structure has been constructed, any lift holes shall be plugged watertight with mortar or non-shrink grout.

- 5. Inlet and outlet pipes should be securely set into the structure using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight.
- 6. Grade rings shall be installed to set the frame and cover at the required elevation. The grade rings shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover shall be set in a full bed of mortar at the elevation specified.
- D. MAINTENANCE ACCESS WALL: In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation, attachment, and sealing of these components shall be performed according to instructions provided by the manufacturer.
- E. STRUCTURE PROTECTION PRIOR TO FILTER CARTRIDGE INSTALLATION
  - 1. Filter cartridges shall not be installed until the project site is clean and free of debris, by the contractor. The project site includes any surface that contributes storm drainage to the treatment structure. All impermeable surfaces shall be clean and free of dirt and debris. All catch basins, manholes and pipes shall be free of debris, dirt, and sediments.
  - 2. It is the contractor's full responsibility to properly protect the treatment structure, and keep the structure offline during construction.
- F. FILTER CARTRIDGE INSTALLATION
  - 1. The Contractor shall confirm the project site and stormwater quality filter treatment structure is clean and free of debris prior to pursuing cartridge installation. Filter cartridges and lids shall be installed in the cartridge deck only after the construction site is fully stabilized and the unit clean and free of debris by the contractor.
  - 2. Contractor shall notify and coordinate with the manufacturer three weeks prior to requiring filter cartridges installed on-site. Filter cartridges and lids shall be delivered and installed to commission the stormwater quality filter treatment structure.

#### 3.12 INSTALLATION OF PRECAST CONCRETE TANKS AND VAULTS

- A. The bases shall be supported on a compacted level foundation of gravel borrow a minimum of 12 inches thick. Crushed stone may be substituted for gravel borrow if field conditions at the bottom of the excavation are wet.
- B. The precast base shall be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations. Structure sections shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to ensure watertight joints.
- C. Adjustment of the structure can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets shall be repaired or replaced as necessary. Once the structure has been constructed, any lift holes shall be plugged watertight with mortar or non-shrink grout. Any precast structure which is not installed in the correct location or oriented improperly shall be removed and rebuilt in its proper location, alignment, and orientation at no additional cost to the Owner.

- D. Inlet and outlet pipes should be securely set into the structure using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Care shall be taken to ensure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Cutting or tampering in the field, for purpose of creating new sidewall openings or altering existing openings, will not be permitted.
- E. Grade rings shall be installed to set the frame and cover at the required elevation. The grade rings shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover shall be set in a full bed of mortar at the elevation specified.
- F. Clean all debris, mortar, and soil from the bottom of all structures prior to final acceptance of the project.

#### 3.13 AREA DRAINS

- A. Install area drains per manufacturer specifications.
- B. The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height.
- C. For H-20 load rated installations, a concrete ring shall be poured under and around the grate and frame as indicated on the Drawings.

#### 3.14 INLINE DRAINS

A. The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 1 or class 2 material as defined in ASTM D2321. Bedding and backfill for surface drainage inlets shall be well placed and compacted uniformly in accordance with ASTM D2321. The drain basin body will be cut at the time of the final grade. No brick stone or concrete block will be required to set the grate to the final grade height. For H-20 load rated installations, a concrete ring will be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors. For other installation considerations such as migration of fines, ground water, and soft foundations refer to ASTM D2321 guidelines.

#### 3.15 TRENCH DRAINS

A. Install trench drain structures per manufacturer specifications.

#### 3.16 DRAIN COUPLINGS

- A. Couplings which are factory manufactured shall be installed at all connections from existing pipe to proposed pipe unless the existing pipe is the same material as the proposed pipe and the bell and spigot end of the pipes to be connected are compatible and free from defects. All drain couplings shall be installed in accordance with the manufacturer's recommendations for the types of pipe to be connected.
- 3.17 SUBSURFACE INFILTRATION CHAMBERS
  - A. Install chambers, bedding, and inspection ports per manufacturer specifications.

#### 3.18 CLEANOUTS

A. Install cleanouts and extensions from drain pipe to cleanout at grade as indicated on the Contract Drawings. Set cleanout frame and cover in concrete 18 by 18 by 6-inches deep, except where location is in bituminous or concrete paving. Set top of cleanout 1-inch above surrounding earth grade or flush with grade when installed in paving.

#### 3.19 INSTALLATION OF WATER STORAGE TANK FOR NONPOTABLE WATER REUSE

- A. Testing: Tank shall be tested and installed according to the manufacturer's installation instructions in effect at time of installation.
- B. Installation: Tank shall be installed according to the manufacturer's installation instructions in effect at time of installation. Contractor shall be trained by the tank manufacturer to install the tank.
- C. Hydrostatic Testing: Tank shall be hydrostatically tested after backfilling is completed to the top of the tank according to the manufacturer's instructions. All inlet and outlet piping shall be sealed with watertight caps or plugs. Tank shall be filled with water to a level that is 3 inches into the manway extension and left to stand for a minimum of 72 hours to allow for expansion and for air voids to dissipate. Water level shall be checked and additional water shall be added to fill the tank back to the standard testing level (a level that is 3 inches into the manway extension). The tank shall be left to stand for a minimum of 72 hours and the water level shall be checked. If the water level drops more than 1/2-inch in the manway extension, the caps and plugs sealing the inlet and outlet piping shall be checked and the test shall be repeated. If the water level does not stabilize, there may be a leak in the system and the tank manufacturer shall be contacted. Observations shall be recorded and provided to the Engineer prior to acceptance of the system.

#### 3.20 TAP CONNECTIONS

- A. Make connections to existing underground drainage structures, so that finished work will conform as nearly as practicable to requirements specified for new work. The contractor shall verify the location, size, invert, and type of existing pipes at all points of connection prior to make the connections.
- B. Make branch connections from side into existing piping by installing a wye or T-wyes, and couplings manufactured for use with the same type of pipe as indicated on the Contract Drawings. The Contractor shall install a 45-degree wye branch or 90-degree tee fittings in the drain pipe at all locations where storm service pipe connections are shown on the Drawings. Connections of the storm service pipes shall be made into the wye branches or tees by means of 45-degree bends. The connections shall be made thoroughly watertight and concrete shall be placed under each connection to bear on undisturbed earth and firmly support the connection.
- C. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris, concrete, or other extraneous material that may accumulate.
- D. Connections into existing drainage facilities shall be performed in accordance with the requirements of the Town of Belmont. The Contractor shall comply with all such requirements, including securing of all required permits and paying the costs thereof.

#### 3.21 BACKFILLING

- A. General: Conduct excavation and backfill operations for structure and pipe installations in accordance with Section 312000 EARTH MOVING, local requirements, and the contract documents.
- B. Initial backfill shall be placed evenly on both sides of the pipe to distribute the load and not to cause movement or deflection of the pipe.

#### 3.22 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground storm drainage system piping. Locate tape two-feet below finished grade, directly over piping.

#### 3.23 FIELD TESTING OF CORRUGATED POLYETHYLENE PIPING

- A. The pipe shall be cleaned and visually inspected for offsets and obstructions prior to testing.
- B. The total length of each pipe installed on the project shall be tested or inspected for deflection. Conveyance pipes connecting at both ends to concrete drainage structures (catch basins, manholes, outlet control structures, water quality structures, etc.) shall be mandrel tested. Deflection of pipes used for stormwater detention/retention/infiltration systems, and pipes connecting to wye connections, building connections, trench drains, and other connections that do not allow mandrel testing shall be verified by visual inspection by the Owner's Representative during installation.
- C. Mandrel tests shall be performed by the Contractor and observed by the Owner's Representative not sooner than 20 days after completion of installation and compaction of backfill. Testing for pipes greater than 24-inch in diameter shall be tested prior to the installation of drainage structure cone and frame.
- D. Installed pipe shall be tested to ensure that the maximum deflection of the pipe does not exceed 7.5 percent of its base inside diameter. The base inside diameter is defined as the specified nominal diameter minus the allowable inside diameter tolerance of 1.5% but not more than 1/2 inch.
- E. A mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel diameter shall be verified and approved by the Owner's Representative prior to use. Use of an unapproved mandrel will invalidate the test. If the mandrel fails to pass through the pipe, the pipe will be deemed to be over-deflected.
- F. The mandrel shall be a rigid device, with an odd number of legs (9 legs minimum) having an effective length not less than its nominal diameter. The mandrel shall be fabricated of steel with pulling rings at each end.
- G. The minimum diameters at any point along the full length are as follows:

Nominal Size	Minimum Mandrel Diameter
6"	5.3"
8"	7.0"
10"	8.8"
12"	10.6"
15"	13.2"
18"	15.8"

24"	21.1"
30"	26.4"
36"	31.7"
42"	37.0"
48"	42.2"
54"	47.5"
60"	52.8"

#### 3.24 FIELD QUALITY CONTROL

- A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.
- B. Video Inspections: Seven days after the completion of the backfilling of each section of new pipe, as defined as a length of pipe between two manholes, the Contractor will provide a televised inspection of the pipe to be submitted to the Designer. The Owner's Representative shall be present during the recording. The recording shall be in DVD color format with audio and will show a clear picture of the inside of the new pipe. If the Designer determines that the DVD is unacceptable for review the contractor shall re-televise the line until an acceptable DVD has been submitted. In the event that the pipe is not acceptable for any reason relating to the proper construction of the pipe according to these specifications, the Contractor will be responsible to re-excavate and repair the defects to the satisfaction of the Designer at no additional cost.
- C. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
  - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
  - 2. Place watertight plugs in ends of uncompleted pipe at end of day or whenever work stops. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.
  - 3. Flush piping between manholes to remove collected debris.
- D. Interior Inspection: If deemed necessary by the Owner's Representative, inspect piping to determine whether line displacement or other damage has occurred.
  - 1. Make inspections after pipe between manholes has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
  - 2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, the Contractor shall correct such defects and reinspect.
- E. Prior to acceptance of the storm drainage system, the Contractor shall submit the following to the Architect and to the local authority:
  - 1. System As-Built Plan stamped by a Professional Land Surveyor or Engineer Registered in the Commonwealth of Massachusetts.
  - 2. Video inspection DVDs and report: The report shall document the observations of the video inspections.
  - 3. Deflection test report: The report shall fully describe the test procedures and list the test results. The report shall be signed by the Contractor's superintendent.

#### 3.25 FINAL INSPECTION

A. Final inspection and acceptance of the storm drainage system shall be made by the Owner's Representative and the utility owner having jurisdiction of the particular system.

- B. Prior to placing the systems in service, all components shall be inspected, with the Owner's Representative present, to ensure that no debris or other contaminants are present. If necessary, the Contractor shall clean the structures and flush piping.
- C. The Contractor is responsible for coordinating and scheduling the inspection of the work by local jurisdictional authorities. No additional payment will be made for inspections and permits required in the performance of the work.

#### END OF SECTION

#### SITE OUTLINE SPECIFICATIONS

#### **DIVISION 04 – MASONRY**

#### Section 044302 Granite

Granite post: 6"x6"x 7'-6" TYP worn granite post set to frost depth in dense graded crushed stone base. Chelmsford Granite or approved equal.

Stepped granite blocks: rustic monolithic granite blocks, 2' height and 6' length, typ. Width varies 2'-3'. Chelmsford Granite or approved equal.

#### DIVISION 05 – METALS

#### Section 055500 Metal Fabrications

Curb inlet: welded stainless steel with blackened stainless steel, cold rolled, free of mill scales, to have eased edge.

Steel splash box: welded blackened stainless steel set on cast in place concrete pad.

#### Section 055213 Pipe and Tube Railings

Guardrail at wood deck: stainless-steel barstock posts with braided horizontal stainless-steel cable and stainless-steel tube pipe toprail.

Toe Rails: galvanized steel pipe rail as toe rail.

#### DIVISION 06 - WOOD AND PLASTICS

Section 061500 Wood Decking (Railings and/or Seating)

Wood decking: ipe deck boards on pressure-treated beams and joists.

#### **DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

#### Section 079200 Joint Sealants

Caulk and seal all joints. Sealing of joints in exterior concrete, masonry, and steel construction.

#### DIVISIONS 11 – EQUIPMENT

Section 116816 Play Structures

Natural wood climbing structure "Log Stack": reclaimed logs with steel reinforcement bars Climbing boulders: locally sourced stones

#### **DIVISION 12 - FURNISHINGS**

#### Section 129300 Site Furnishings

Wood bench: Landscape Forms 'Palisade' 8' long, backless, jarrah wood

#### DIVISION 31 – EARTHWORK

#### Section 312000 Earth Moving

Site Excavating, Backfilling, and Compacting will be coordinated with the civil engineer. Provide all equipment and materials necessary to complete the work as indicated on the drawings.

#### DIVISION 32 – EXTERIOR IMPROVEMENTS

#### Section 321216 Bituminous Concrete Pavement

Bituminous Concrete Pavement: bituminous concrete top course on bituminous concrete base course over dense graded crushed stone base with non-woven geotextile filter fabric per drawings.

Porous Bituminous Concrete: Porous bituminous concrete surface set on choke course, filter course, pea stone gravel filter, and reservoir course per drawings.

#### Section 321313 Portland Cement Concrete Pavement

Concrete pavement, vehicular: reinforced concrete pavement with expansion joints and sawn control joints, on a dense graded construction base per drawings.

Concrete pavement, pedestrian: reinforced concrete pavement with expansion joints and sawn control joints, on a dense graded construction base per drawings.

#### Section 321413 Concrete Unit Paving

Permeable concrete unit pavers: Hanover permeable pavers, 4.5"x9", custom color on opengraded stone per drawings.

Permeable concrete unit pavers on structural soil: Hanover permeable pavers, 4.5"x9", custom color on open-graded stone on sand-based structural soil per drawings.

Edge restraint for concrete unit pavers: 3/16" extruded aluminum Structure Edge by Permaloc Corporation, Holland MI 49424.

#### Section 321544 Aggregate Paving

Stabilized aggregate: crushed "beige" granite with Stabilizer Solutions stabilizer set on a 12" dense graded crushed stone base over displacement foam. Stabilizer Solutions (www.stabilizersolutions.com)

Section 321640 Granite Curb

Granite Curb: 6"x18"x60" reclaimed 2<sup>nd</sup> generation MDOT granite curb with concrete haunch at joints set on 6" dense graded stone base

#### Section 323225 Stone Walls

Stacked stone wall: stacked stone wall set on dense graded crushed stone base, rusticated finish. Chelmsford granite or approved equal. Cap stone of stone wall to be sawn and flame-topped surface for seating.

Granite block wall: rustic monolithic granite blocks, 2' height and 6' length, typ. Width varies 2'-3'. Chelmsford Granite or approved equal. Granite walls at lawn amphitheater and at community terrace to have sawn and flamed top surface.

#### Section 328000 Irrigation System

Irrigation system for all lawn planting areas, and courtyard plantings. Irrigation system to include control boxes, electrical system, backflow prevention, potable and non-potable source connection, filters, rain sensors, valves, heads, pipes and fittings. Temporary watering system for all meadow and planting areas.

#### Section 329115 Planting Soil

Planting Soils will be engineered soils with base components of naturally occurring loam(L), coarse sand(S) and well-aged leaf compost(C). Soils will require testing and approval of base components prior to mixing and testing of engineered soil blends.

Trees in pavement will have a Sand Based Structural Soil (6 parts Sand: 1 part Loam: 1 part Compost) profile 3 feet deep by 20 feet square per tree. Trees in lawn or planting will have an additional 18" of horticultural subsoil below the planting soil depth.

Lawn areas will have a 12" minimum soil (1 part L: 2 part S: 1 part Compost). Planting areas will have 18" minimum soil (1 part L: 1 part S: 1 part Compost) with 12" of horticultural subsoil below.

#### Section 329119 Landscape Grading

Provide all equipment and materials necessary to complete the site grading as indicated on the drawings and as specified. Biodegradable erosion control fabric is required for all slopes greater than 3:1.

Section 329200 Lawns and Grasses Lawns will be sodded with sand grown Fescue blend from Tuckahoe Sod Farm in New Jersey.

Section 329300 Trees, Plants, and Ground Covers Native plants and groundcovers, sourced as locally as possible Trees: native, locally sourced as possible

Note: All plant material to be guaranteed for two years after acceptance by Owner.

END OF DOCUMENT



# vsp

## **BELMONT PUBLIC LIBRARY**

### Schematic Design Narrative

Project Number: B1912268.000

August 09, 2019

Prepared For: Oudens Ello Architecture


### **BELMONT PUBLIC LIBRARY**

### Schematic Design Narrative

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### I. PROJECT DESCRIPTION

- A. The project consists of a new two story library located in the Town of Belmont, MA.
- B. The proposed new library will be considered a low-rise building, with a building footprint of 21,392 SF and total building square footage of 41,969 SF. The new building will include book stacks, study rooms, meeting rooms and an archive space.
- C. The design will be based on achieving USGB LEED Certification and Net Zero ready.
- D. The new building will be built in the same location as the existing public library. Many of the services to the existing will be utilized for the new library.
- E. The purpose of this narrative in conjunction with the MEP Space Allocation Memo is to provide sufficient information for preliminary pricing to be obtained and to identify the MEP/FP systems design proposed for the new building.

### II. HVAC

### Section 1 - Design Criteria

- A. Applicable Codes, Guidelines and Standards
  - 1. Design will conform to the following codes, standards and guidelines. Where differences arise between any of them, codes shall prevail. In all cases, where an edition number is not indicated, the current accepted edition will be used.
    - a. 2015 International Building Code (IBC) with MA amendments (780 CMR, 9<sup>th</sup> Edition).
    - b. 2015 International Mechanical Code (IMC) with local amendments.
    - c. 2015 International Energy Conservation Code (IECC) with local amendments (ASHRAE 90.1-2010 shall govern where more restrictive for compliance with LEED certification requirements).
    - d. 2015 International Fuel Gas Code (IFG) with local amendments.
    - e. National Fire Protection Agency (NFPA)
    - f. ASHRAE Standard 15 Refrigerant Safety Code
    - g. 2004 Controls and Safety Devices for Automatically Fire Boilers CSD-1
    - h. 2004 Boiler and Combustion System Hazards Code, NFPA 85
    - i. ANSI/ASME B31.1 Code for Pressure Piping, Boiler and Pressure Vessel
    - j. ASHRAE 55-2010 Thermal Environmental Conditions for Human Occupancy
    - k. ASHRAE 61.2-2010 Ventilation for Acceptable Indoor Air Quality
- B. Load Calculation Criteria
  - 1. Outdoor Design Conditions.
    - a. The proposed building is located in Belmont, MA and falls into climate zone 5A.
      - (1) Summer: (per ASHRAE Fundamentals 2017 1.0% DB/MCWB; Boston Logan INTL, MA)

(a)	Dry Bulb	=	87.6°F
(b)	Wet Bulb	=	71.6°F



- (2) Winter: (Per ASHRAE Fundamentals 2017 99.6% DB: Boston Logan INTL, MA)
  - (a) Dry Bulb =  $8.5^{\circ}F$
- 2. Indoor Design Conditions:
  - a. Internal: The cooling loads for the mechanical system will be based on the following combined electrical and equipment loading and indoor design criteria for the various spaces, as shown in Table 1 below:

Table 1: Indoor Design Conditions												
	Summer			Winter								
		Maximum				Minimum		Temperature			Occup	pant
	Temp	Relative	Temp			Relative	Specific	Control	Lighting	Equpment	Heat C	Gain
	DB	Humidity	DB	Enthalpy	Temp	Humidity	Humidity	Range	Heat Gain	Heat Gain	(BTUH/pe	erson)
Room Type	(°F)	(%)	(°F)	(Btuh/ lb)	(°F)	(%)	(gr/lb)	(°F)	(watts/sf)	(watts/sf)	Sensible	Latent
Media Center	75	55	64	29.31	70	-	-	2	0.9	5.0	250	200
Conference rooms	75	55	64	29.31	70	-	-	2	2.0	2.0	245	155
Office spaces	75	55	64	29.31	70	-	-	2	2.0	2.2	245	155
Main entry lobbies	75	55	64	29.31	70	-	-	2	2.0	0.5	250	250
Corridors	75	55	64	29.31	70	-	-	2	0.8	-	-	-
Libraries	75	55	64	29.31	70	-	-	2	1.2	2.0	245	155
Storage rooms	75	55	64	29.31	70	-	-	2	0.8	-	-	-
Archive storage room	75	50	63	28.30	70	35	38	2	0.8	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

3. Building Outdoor Air Ventilation Rates:

a. Outside air quantities will be designed per the 2015 IMC, Chapter 4. The maximum outdoor ventilation air for each space is indicated below in Table 2.

Table 2: Required Outdoor Ventilation Air					
	SF per				
Room Type	Person	CFM person	CFM/ SF		
Media Center	40	10	0.12		
Conference rooms	20	5	0.06		
Office spaces	200	5	0.06		
Main entry lobbies	100	5	0.06		
Corridors	-	-	0.40		
Libraries	100	5	0.12		
Storage rooms	-	-	0.12		
Archive storage room	-	-	0.06		
-	-	-	-		



- 4. Mechanical Exhaust Ventilation:
  - a. Exhaust shall be provided by exhaust fans discharging to atmosphere for the following areas:
    - (1) Toilet rooms
    - (2) Mechanical equipment rooms
    - (3) Storage areas
    - (4) Electric rooms
    - (5) Trash room
- 5. Noise Control
  - a. The following Occupancy Dependent Room Criteria with Neutral Sounding Spectrum [RC(N)] based on Chapter 48 of the 2015 ASHRAE Applications Handbook will be utilized for the design unless criteria is provided by a Sound Consultant:

NC-40

- (1) Administrative Offices: NC-40
- (2) BOH Spaces:
- (3) Housekeeping: NC-40
- (4) Library Spaces: NC-30(5) Conference Rooms: NC-30
- (5) Conference Rooms: NC-30(6) Meeting Rooms: NC-30
- (6) Meeting Rooms:(7) Storage Rooms:
- (7) Storage Rooms: NC-40(8) Mech/Elec/Utility: NC-50
- b. Sound attenuators, acoustic duct lining or duct lagging with drywall will be specified as required to achieve the above noise levels within the retail and guestroom spaces.
- c. The rooftop equipment will be provided with integral sound attenuation as required to achieve any sound level constraints.
- d. Additional sound and vibration from mechanical equipment will be mitigated using flexible connections to all vibrating equipment, spring inertia bases (pumps), double wall casings with internal isolation (AHUs), as well as neoprene pads below vibrating equipment.

### Section 2 - System Description

- A. Variable Refrigerant System
  - 1. Multiple air cooled condenser systems consisting of one (1) two (2) or three (3) modules will be provided. Each module requires its own power connection. The modules will be provided with 12-18 inch snow stands with an open base, snow hood and hail guards, basepan heaters and low ambient kits for zones requiring year round cooling.
  - 2. Each air cooled condenser system will utilize two-pipe refrigerant piping mains that branch to the heat recovery branch circuit controllers. The branch circuit controller allows simultaneous cooling and heating of the indoor evaporator systems by connecting several indoor units to one outdoor unit. Each branch circuit controller requires dedicated power connection, means for condensate removal and full port ball valves.



- 3. Each indoor evaporator unit will have dedicated refrigerant piping from the branch circuit controller. The spaces will utilize ceiling concealed ducted fan coil units, low pressure supply and return ductwork to supply diffusers and return grilles. All indoor units will be provided with integral condensate pumps.
- 4. Careful design consideration of the refrigerant piping system must be adhered to for compliance with ASHRAE.
- 5. Each space will be heated and cooled with ceiling-mounted, horizontal VRF fan coil unit (VAC). Each VAC will be equipped with an R410a coil, a fan with an electronically commutated motor (ECM), condensate drain pan with secondary connection, and filter. Refrigerant piping will be distributed horizontally from the associated zone branch control circuit.



Figure 1 – Branch Circuit Controller



Figure 2 – Outdoor VRF Condensing Unit

- B. Rooftop Energy Recovery Unit Ventilation System
  - 1. Ventilation and toilet exhaust for the building will be provided by Energy Recovery Unit (ERU) located on the roof. The ERU will include, but not be limited to, the following sections: outside air intake section, 30 percent and 85 percent filters, DX cooling coil, energy recovery wheel, electric heating coil (modulating), supply air fan, and exhaust fan. The ERU will be a variable volume unit and will be provided with VFDs on the enthalpy wheel and the fans for modulation.
  - 2. VAV boxes will be provided to regulate the amount of ventilation air to each space based on an occupied/unoccupied schedule and CO2 sensors. The ventilation system will be designed to create a positive pressure in the building to offset infiltration.
  - 3. Packaged rooftop unit will be provided with integral controls and with local DDC panels for monitoring and start/stop functions.

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Figure 3 – Packaged Energy Recovery Rooftop Unit



Figure 4 – Variable Volume Terminal Unit

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Table 3: HVAC Major Equipment List							
Unit Number	Unit Location	Area Served	Characteristics	Emergency Power			
			16 ton air cooled condenser system				
VACC-01	Roof	VRF System 1	w ith tw o (2) modules;	No			
			208/3/60; 57/57 MOCP				
			22 ton air cooled condenser system				
VACC-02	Roof	VRF System 2	with two (2) modules;	No			
			208/3/60; 87/74 MOCP				
			16 ton air cooled condenser system				
VACC-03	Roof	VRF System 3	with two (2) modules;	No			
	'	<u> </u>	208/3/60; 57/57 MOCP				
i I		1	16 ton air cooled condenser system				
VACC-04	Roof	VRF System 4	with two (2) modules;	No			
!	'		208/3/60; 57/57 MOCP				
i I		1	16 ton air cooled condenser system				
VACC-05	Roof	VRF System 5	with two (2) modules;	No			
!			208/3/60; 57/57 MOCP				
			22 ton air cooled condenser system				
VACC-06	Roof	VRF System 6	with two (2) modules;	No			
			208/3/60; 87/74 MOCP				
[			16 port heat recovery branch circuit				
BCC-01	Plenum	VRF System 1	controller;	No			
	l		208/1/60; 1.65 MCA				
[			16 port heat recovery branch circuit				
BCC-02	Plenum	VRF System 2	controller;	No			
			208/1/60; 1.65 MCA				
[ /			16 port heat recovery branch circuit				
BCC-03	Plenum	VRF System 3	controller;	No			
			208/1/60; 1.65 MCA				
[			16 port heat recovery branch circuit				
BCC-04	Plenum	VRF System 4	controller;	No			
Ĺ'			208/1/60; 1.65 MCA				
í ľ			16 port heat recovery branch circuit				
BCC-05	Plenum	VRF System 5	controller;	No			
!			208/1/60; 1.65 MCA				
(			16 port heat recovery branch circuit				
BCC-06	Plenum	VRF System 6	controller;	No			
Ĺ!			208/1/60; 1.65 MCA				
í I		Indoor Spaces	Ceiling concealed fan coil with ECM				
VAC	Plenum	(Fetimate Quantity of 24)	motor;	No			
!			208/1/60; 15 MFS				
í ľ		1	2,500 CFM energy recovery unit;				
ERU-01	Roof	Public spaces ventilation	208/3/60; 80 MOP	No			
<u> </u>							
í I		1	2,500 CFM energy recovery unit;				
ERU-02	Roof	Public spaces ventilation	208/3/60; 80 MOP	No			
1 1	1						



### III. FIRE PROTECTION

#### Section 1 - Design Criteria

- A. General
  - 1. The automatic sprinkler system within the building will conform to the following codes and standards:
    - a. 2015 International Building Code with Massachusetts State Building Code 9th Edition amendments.
    - b. National Fire Protection Association Standards:
      - (1) NFPA 13 Installation of Sprinkler Systems (2013)
      - (2) NFPA 25 Water Based Fire Protection Systems (2017)
    - c. Local Codes and Ordinances.
    - d. Belmont Fire Department.
    - e. Insurance Underwriter.
  - 2. Light Hazard Occupancy spaces will conform to the densities and design areas as required by NFPA 13 or the Owner's Insurance Underwriter.
  - 3. Ordinary Hazard Occupancy spaces will conform to the densities and design areas as required by NFPA 13 or the Owner's Insurance Underwriter.
  - 4. A 10 psi water pressure cushion will be added to hydraulic calculations for water pressure fluctuations and pipe deterioration.
  - 5. The building will be fully sprinklered in accordance with NFPA 13.
  - 6. The system shall be based on the sprinkler design densities and areas listed in the schedule below:

Area	Density GPM/FT <sup>2</sup>	Area of Operation	Hose Allowance	Hazard Classification	Standard
Library and Study Areas	0.10	1,500	100	Light	NFPA 13
Offices and Meeting Rooms	0.10	1,500	100	Light	NFPA 13
Toilet and Break Rooms	0.10	1,500	100	Light	NFPA 13
Mechanical and Storage Rooms	0.15	1,500	250	Ord. I	NFPA 13
Electrical Rooms	0.15	1,500	250	Ord. I	NFPA 13
Maker Space	0.20	1,500	250	Ord. II	NFPA 13



### Section 2 - Systems Description

- A. Fire Protection Water Service
  - 1. A new 6-inch fire service will be extended from the municipal main from Concord Avenue into the building.
  - 2. The fire service will enter under the building and come up into a room within 18 inches of the foundation.
  - 3. A double check valve assembly and a riser check valve will be provided at the incoming fire service inside the building. Location to be determined in DD Drawings.
  - 4. A hydrant flow test has been performed on July 18, 2019 at 10am to determine the adequacy of the municipal water supply. The water pressure is very good and no fire pump is anticipated.



- B. Sprinkler System
  - 1. Automatic sprinklers will be provided in accordance with the Massachusetts State Building Code and NFPA 13. The building will be equipped with an automatic wet sprinkler system.
  - 2. Library, office, meeting rooms will be protected as Light Hazard. Mechanical rooms, electrical rooms, and storage rooms will be protected as Ordinary Hazard Group 1.
  - 3. All Light and Ordinary Hazard areas, will be equipped with quick response automatic sprinklers.
  - 4. Combustible concealed spaces will be protected throughout with special application concealed space sprinklers.
  - 5. Combustible covered walkways will be protected with dry sidewall sprinklers connected to the buildings wet sprinkler system.

#### Section 3 - Outline Specification

- A. Acceptable Products
  - 1. Materials and equipment provided under this Section shall be in conformance with the referenced NFPA Standards and be listed by Underwriters-Laboratories, Inc. or be approved by Factory Mutual Research Corporation.



- 2. Acceptable Manufacturers: The following manufacturers are acceptable. Manufacturers not listed below shall be submitted for review and approval as specified for substitutions.
  - a. Grooved fittings and couplings: Anvil, Tyco, Central, Grinnell, or Victaulic.
  - b. Sprinklers: Viking, Reliable, or Tyco.
  - c. Pipe hangers and supports: B-Line, Grinnell, or PHD.
  - d. Expansion shields: Anchoring Systems, Grinnell, Hiliti Inc., or Mag.
  - e. Inserts: B-Line, Empire, Globe, Grinnell, Michigan, or Unistrut.
- 3. Buried Fire Service Piping
  - a. Ductile iron, Class 56, cement-lined with mechanical joints. Provide restrained mechanical joints at changes of direction.
- 4. Wet System Sprinkler Piping:
  - a. Black Steel:
    - (1) 2 inches and smaller: ASTM 135 Schedule 40 with threaded joints
    - (2) 2 1/2 inches and larger: ASTM 135 Schedule 10 light wall with roll-grooved joints.
  - b. Galvanized Schedule 40 Steel:
    - (1) Application: Parking garage sprinkler system.
    - (2) Schedule 40 threaded joints.
- 5. Inspectors Test / Drain Piping:
  - a. Black Steel
    - (1) Inches and smaller: ASTM 135 Schedule 40 black steel with threaded joints.
    - (2) Exposed to Exterior: ASTM A795 Schedule 40 galvanized steel pipe with galvanized steel or galvanized malleable iron screwed fittings.
- 6. Fittings:
  - a. Ductile Iron: ASTM A-536.
  - b. Malleable Iron: ANSI B16.3.
  - c. Steel: ANSI B16.11.
  - d. Cast Iron: ANSI B16.4.
- 7. Grooved Fittings and Couplings:
  - a. For system pressures up to 350 psi:
  - b. Provide rigid or flexible couplings where required by NFPA Standards 13 and 14 with pipe and groove types as required by the product listing for the appropriate pressure application.

- c. Products shall be per the acceptable manufacturers listed in this section for grooved fittings and couplings.
- d. Products shall be equal to the following model numbers.
  - (1) Rigid Couplings : Victualic Style 07
  - (2) Flexible Couplings : Victualic Style 75
- 8. Sprinklers
  - a. Provide sprinklers with orifice size, temperature, RTI rating, and protective finishes to suit occupancy and hazard types in compliance with the referenced NFPA Standards, and sprinkler listing and approvals.
  - b. Finishes: Provide brass sprinklers in unfinished areas without ceilings, and recessed pendent sprinklers in finish ceilings.
  - c. Quick Response Sprinklers:
    - (1) Pendent: Reliable F1FR
    - (2) Upright: Reliable F1FR
    - (3) Concealed Pendent: Reliable Model G5-56
    - (4) Dry sidewall: Reliable F3QR56



- d. Concealed Space Sprinklers:
  - (1) Tyco CC2.
  - (2) Victualic V2602.
- e. Spare Sprinklers: Provide Globe or Croker Fig No. 8055 20-gauge steel sprinkler cabinets with red enamel finish. Furnish the quantities of spare sprinklers for each type sprinklers installed as required by NFPA Standard 13. Furnish sprinkler wrench for each type sprinkler installed.
- 9. Pipe Hangers and Supports
  - a. Acceptable products: Hanger materials shall match piping material as required for dielectric isolation.
  - b. Piping 4 inches and larger: Grinnell Fig. 260 adjustable Clevis, carbon steel.

- c. Piping 3 inches and smaller: Grinnell Fig. 260 Clevis or Grinnell Fig. 69 adjustable swivel ring.
- d. Hanger Attachments:
  - (1) Beam Clamps: Grinnell Fig. 61.
  - (2) Expansion Shields: Grinnell Fig. 117, American Anchor Corporation W3800.
  - (3) C Clamps: Grinnell Fig. 86.
  - (4) Inserts: Grinnell Fig. 282 malleable iron body and nut.
- e. Hanger Rods: Provide hanger rods sized according to the following schedule:

Pipe Size:	Minimum Rod Diameter:
4 inches and smaller	3/8-inch
6 inches and 8 inches	1/2-inch

f. Seismic Restraints: Provide seismic restraints in compliance with NFPA 13.



### IV. PLUMBING

### Section 1 - Design Criteria

- A. General
  - 1. The plumbing systems within the buildings will conform to the following codes and standards:
    - a. 2015 International Building Code with Massachusetts State Building Code 9th Edition amendments.
    - b. Massachusetts State Plumbing Code
    - c. Local Codes and Ordinances.
  - 2. State Plumbing Code Requirements:
    - a. The maximum water pressure shall be limited to 80 psi at any fixture per 248 CMR 10.14, (4) (g).
    - b. The domestic cold water system will be sized for a maximum water velocity of 8 feet per second.
    - c. The domestic hot water system will be sized for a maximum water velocity of 6 feet per second.
    - d. The domestic hot water system will be designed for a maximum delivery temperature of 120 degrees F.
    - e. The maximum temperature at public lavatory faucets will be limited to 110 degrees F, per 248 CMR 10.14, (3) (a).
    - f. The maximum temperature at public showers will be limited to 112 degrees F, per 248 CMR 10.10, (7) (e).
    - g. The fuel gas system will be designed for a maximum delivery pressure of 1/2-psi or 14 inches w.c. The maximum pressure drop in the system will be 0.5 inches w.c.
    - h. The sanitary system will be designed with piping pitched at 1/4 inch per foot for sizes 3-inch and smaller, and 1/8 inch per foot for sizes 4-inch and larger. Pipe sizes will be based on criteria as per 248 CMR 10.15.
    - i. The storm system will be designed with piping pitched at 1/4 inch per foot for sizes 3-inch and smaller, and 1/8 inch per foot for sizes 4-inch and larger. Pipe sizes will be based on criteria as per 248 CMR 10.17.

#### Section 2 - Systems Description

- A. Domestic Water Service
  - 1. A new 2-inch domestic water service will be extended from the main in Concord Avenue into the proposed building.



- 2. The Town of Belmont compliant water meter assembly will be provided at the incoming service inside the building. A cross connection device (backflow preventer) will be provided if required by the Belmont Water Department. Location to be determined in DD Drawings.
- B. Domestic Cold Water
  - 1. Domestic cold water will be distributed to plumbing fixtures, the water heater, hose bibbs, and make up water for the heating system.
  - 2. Hose bibs will be provided in toilet rooms, mechanical or utility rooms, and green roofs.
  - 3. Trap primers will be provided on floor drains.
  - 4. A reduced pressure backflow preventer will be provided at each the make up water for the heating system and the irrigation system. A water sub-meter will be provided for the irrigation system.
- C. Domestic Hot Water Heaters:
  - 1. There will be one (1) central gas fired condensing style water heaters. The water heater will be equal to A.O. Smith BTX-80, 50 gallons, 76,000 BTU input. The domestic hot water supply and return system to the library will be distributed in the ceiling.
  - 2. The hot water will be stored at 140° F in the heater, and delivered to building at 120° F. The hot water will be blended with an ASSE 1017 compliant thermostatic mixing valve.
  - 3. The hot water system will have a return piping loop with circulator pump that will maintain the temperature in the piping system.





- D. Sanitary Drainage
  - 1. A 6-inch sanitary service will be provided. The service will tie into the municipal server in Concord Avenue.
  - 2. The building piping will be pitched to be capable of flowing by gravity to the exterior of the building.



- 3. Floor drains will be provided in the mechanical room, located generally throughout the space, and at specific locations where water is likely to occur, such as near boilers, water heaters, pumps, backflow preventers, and any equipment that will require a drain down. Floor drains will have trap primer connections to maintain the trap seal.
- 4. Floor drains will be provided in single stall and multi-stall toilet rooms.
- 5. Floor drains will be provided in custodian closets.
- E. Storm Drainage System
  - 1. The storm drainage system will consist of roof drains located on all flat roof sections that do not otherwise do not have another means of diverting rain water off the building. The roof drains will collect together with a series of pitched piping and stacks that run down through the interior of the building.
  - 2. The roof drains will be located as per the roof insulation layout plans, and will be spaced at approximately 2,000 sq. ft. per drain.
  - 3. The storm piping will combine under the floor slab and connect to the stormwater management structures, as designed by the civil engineer.
  - 4. If the roofs do not have a means of relieving (scuppers) ponded water should the primary roof drains get clogged, an emergency/overflow roof drain system will be provided. Emergency roof drains will be located near the primary roof drains. These roof drains will collect together with a series of pitched piping and stacks that run down through the interior of the building. The piping will be completely independent of the primary storm piping system. The piping will discharge onto grade through the exterior wall at visibly observable locations.
  - 5. Underslab (sub-surface) drainage, if required, will be designed and laid out by the geotechnical engineer, and installed under Division 22. The system will include perforated piping, cleanouts and fittings installed within a stone gravel layer under the floor slab. The underslab drainage system will connect to the building's storm drainage system at the foundation wall where the storm drain exits the building.
- F. Plumbing Fixtures

Fixture Type	Baseline Water Use	Proposed Water Use
Waterclosets	1.6 gpf	1.28 gpf
Urinals	1.0 gpf	0.125 gpf
Lavatories	0.25 gpc	0.10 gpc
Sinks	2.5 gpm	1.5 gpm

1. The proposed water saving plumbing fixtures will be used for the building:

- 2. Waterclosets and urinals will be vitreous china, wall hung with manual or sensor operated flush valves.
- 3. Lavatories and sinks will be vitreous china or stainless steel with manual or automatic faucets.



- 4. Mop sinks will be floor mounted terrazzo bases with a wall hung faucet.
- 5. Drinking fountains with bottle fillers will be dual level, wall hung with integral chillers.



### Section 3 - Outline Specification

- A. Plumbing Products and Equipment
  - 1. Acceptable Manufacturers: The following manufacturers are acceptable to define standards of quality.
    - a. China Fixtures: Kohler, Toto or American Standard.
    - b. Stainless Steel Fixtures: Elkay or Just.
    - c. Faucets and Trim: Kohler. Symmons or Chicago Faucets.
    - d. Drains and Carriers: Josam, J.R. Smith, Wade, or Zurn.
    - e. Shower Valves: Kohler, or Symmons.
    - f. Ball Valves: Apollo, Watts, or Nibco.
    - g. Water Heaters: Vaughn, Navien or HTP.
- B. Piping, Fittings, and Joints
  - 1. Soil, Waste and Vent Systems:
    - a. Above-ground piping:
      - (1) 4-inch and larger: Hub-less cast-iron pipe and fittings heavy-duty stainless steel no-hub couplings:
      - (2) Waste and vent piping 3 inches and smaller: Hub-less cast-iron pipe and fittings or Type "L" copper with cast brass drainage fittings and solder joints.
    - b. Buried piping:
      - (1) Asphaltum-coated, ASTM A74 service-weight, cast iron pipe and fittings with lead and oakum calk or ASTM C564 resilient neoprene gasket joints.
  - 2. Water System:
    - a. Above ground piping, 2 inches and smaller:
      - (1) Hard drawn Type L copper with wrought copper or cast brass fittings with 95-5 lead-free solder joints.

- b. Above ground piping, 2 <sup>1</sup>/<sub>2</sub> inches and larger:
  - (1) Hard drawn Type L copper pipe with wrought copper or cast bronze fittings with roll grooved mechanical couplings.
- 3. Hubless Piping Couplings:
  - a. Heavy-Duty Couplings: Provide heavy-duty stainless steel hubless piping couplings equal to Anaco Husky Series 4000, Tyler Wide-Body, or Clamp-All.
    - (1)  $1-\frac{1}{2}$  inches to 4 inches in size: 4 bands.
    - (2) 5 inches and larger in size: 6 bands.
  - b. Regular-Duty Couplings: May be used on vent piping and 3-inch and smaller waste branches.
- 4. Indirect Waste Piping:
  - a. Type "L" copper with sweated connections.
  - b. Exposed 1<sup>1</sup>/<sub>2</sub> inches and smaller: chrome plated brass, threaded connections and fittings.
- 5. Piping Materials
  - a. Cast-Iron Soil Pipe and Fittings:
    - (1) Service Weight Cast Iron: ASTM A72.
    - (2) Hubless Cast Iron: CISPI 301-75.
  - b. Type "L" Copper Tubings
    - (1) Pipe: ASTM B88, hard temper.
    - (2) Fittings: Wrought copper
  - c. Ductile Iron Piping:
    - (1) Pipe: ANSI / AWWA C151-A21.10
    - (2) Fittings: ANSI / AWWA C110-A21.10
    - (3) Cement Lining: ANSI / AWWA C104-A21.4
    - (4) Gasket: ANSI / AWWA C111-A21.11
  - d. Resilient Gaskets:
    - (1) Rubber: ASTM C564-70.
  - e. Galvanized or Black Steel Pipe:
    - (1) Pipe: Schedule 40, ASTM A12.
    - (2) Fittings: Service weight cast iron
  - f. Unions:
    - (1) For copper lines, provide brass-threaded unions.

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- (2) For connections in iron pipe lines 2-1/2 inches and smaller, provide ground joint brass-to-iron unions.
- g. Solder:
  - (1) Domestic water, 95-5 lead-free. ASTM B32.
  - (2) Waste and vent, 50-50. ASTM B32.
- 6. Valves
  - a. Ball Valves: Acceptable manufacturer's: Watts, Apollo or Nibco.
    - (1) Provide: two-piece bronze body, full-port TFE seats with solid brass chrome-plated ball and stem extension.
    - (2)  $2-\frac{1}{2}$  inches and smaller: Apollo 77-200 or Watts B-6080.
    - (3) Drain Valves: Watts B-6000CC, Apollo 78-203 <sup>3</sup>/<sub>4</sub>-inch hose connection with Watts 8A vacuum breaker, and cap and chain
  - b. Check Valves:
    - (1) 3 inches and smaller: Provide Crane No. 37, bronze, screwed, Y-pattern, 200# WOG.
    - (2) 4 inches and larger: Provide Watts 411, Crane No. 373, IBBM, flanged 200 lbs. WOG.
- 7. Plumbing Specialties
  - a. Vacuum Relief Valves: Watts 36A, bronze body, silicon, disc, 200 PSI working pressure, and 250 degrees F temperature rating. ANSI Z21.22, A.G.A. Certified.
  - b. Pressure and Temperature Relief Valves: Watts or approved equal in compliance with ANSI Z21.22, A.G.A. Certified.
  - c. Trap Primers, (TP):
    - (1) TP-1 for use on ½-inch supply lines: Watts A200S, J.R. Smith Fig. 2699-1 cast bronze body with 1/2-inch sweat connections.
  - d. Dielectric Fittings:
    - (1) Unions: Watts 3000 Series.
    - (2) Flanges: Watts 3100 Series.
    - (3) Nipples: Clearflow 19000 Series.
  - e. Vent terminal Caps: Wade W-3680-TV.
    - (1) Air Relief Valves: APCO No. 61.



- 8. Pipe Hangers, Supports and Attachments
  - a. Provide hangers, rods, and attachments to support the Work of this Section from the building structure with UL-listed or FM-approved attachments. Provide oversized hangers on insulated piping.
  - b. Water Piping:
    - (1) 3 inches and smaller: Provide B-Line Systems Inc. Fig. B3104 light duty clevis hangers or Fig. B3174C and B3174CT band hangers.
    - (2) 4 inches and larger: Provide B-Line Systems Inc. Fig. B3100 clevis hangers over insulation with 12-inch long galvanized insulation shields with supporting rods.
    - (3) Riser clamps: B- Line Systems Inc. Fig. B3373CT copper-plated steel.
    - (4) 2 inches and smaller within toilet chase: Carpenter & Patterson Fig. 81 CT copper- plated malleable iron with Fig. 94CT copper-plated steel rod.
    - (5) Gang Hangers: Carpenter & Patterson Fig. 342 adjustable gang hanger with clips.
    - (6) Insulation Shields: Provide 12 inch long insulation shields on piping  $1\frac{1}{2}$  inches and larger.
  - c. Drainage Piping:
    - (1) Horizontal Supports: Provide B-Line Systems Inc. Fig. B3100 clevis hangers with supporting rods and adjustable turnbuckles.
    - (2) Riser Clamps: Provide B-Line Systems Inc. Fig. B3373 riser clamps at each floor and as required.
    - (3) Insulation Shields: Provide oversized hangers with 12-inch long galvanized insulation shields on rainwater piping.
  - d. Structure Attachments:
    - (1) Clamps: B-Line Systems, Globe, Grinnell, and Michigan.
    - (2) Ceiling Bolts: For installation in metal decks, Carpenter & Patterson Fig. 143.
    - (3) Inserts: Empire, Grinnell, Michigan and Unistrut. Fig. or Carpenter & Patterson 650 UL-listed.
    - (4) Expansion Shields: Carpenter & Patterson, Grinnell, Hilti, or Ramset.
    - (5) Provide hanger rods for horizontal piping sized according to the following schedule:

Pipe Size:	Rod Size:
2 inches and smaller	3/8-inch
2 <sup>1</sup> / <sub>2</sub> inches and 3 inches	1/2-inch



5/8-inch

- e. Insulation shields: Carpenter & Patterson Fig. 265P.
  - (1) Provide insulation shields on insulated piping.

Pipe Size:	Gauge:
6 inches and smaller	18
8 inches and larger	16

- f. Trapeze Hangers: Provide metal strut trapeze hangers by B-Line, Unistrut, or Grinnell with Clip-It nylon, B-Line Systems Inc. BVT series, or Grinnell PS-1400 insulated pipe clamps attached to the strut.
- g. Insulating Clamps: Provide IPS Corp. Strap-Tite insulating clamps on uninsulated copper piping installed through metal stud partitions.

#### 9. Cleanouts

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- a. Finished Walls and Ceilings:
  - (1) Furnish access panels as specified in Sections 08311 and 15050 for installation under other sections.
  - (2) Provide cleanout plugs of extra-heavy bronze.
- 10. Hose Bibbs
  - a. Hose Bibb HB-1: Chicago Faucet No. 952; Hose Bibb shall be <sup>3</sup>/<sub>4</sub>-inch with vacuum breaker and removable tee handle.
- 11. Drains
  - a. Manufacturers:
    - Products equal to the specified Zurn number by Watts, Josam, Wade, or J.
      R. Smith may be submitted for approval.
- 12. Traps
  - a. Traps:
    - (1) Provide separate traps with integral cleanouts on fixtures and equipment that require connections to sanitary system, except on fixtures with integral traps.
    - (2) Traps exposed to view, including connecting drain lines, shall be chromeplated. Traps shall be of sizes shown on Drawings but shall not be less than 1 ½ inch.

#### 13. Insulation

a. Adhesives and Insulation Materials: ASTM E-84 composite fire and smoke hazard rating maximum 25 for Flame Spread and 50 for Smoke Developed. Adhesives shall be waterproof.

- b. Acceptable Manufacturer's: Provide heavy density fiberglass insulation by Owens-Corning, Certain-Teed, Knauf, or Schuller.
- c. Fire Rated Penetrations: Provide minimum density 3.5 pcf fiberglass insulation through fire rated partitions or heavier as required by the UL through penetration system number.
- d. Hot water and recirculation piping: 1-inch minimum thickness with all service jacket (ASJ) and self-sealing lap (SSL).
- e. Fittings and Valves: Minimum of two layers of pre-cut fiberglass blanket insulation with PVC covers.
- f. Cold water and rainwater piping: ½-inch minimum thickness with all service jacket (ASJ), self-sealing lap (SSL), with tape and continuous vapor seal. Do not use staples.
- g. Fittings and Valves: Single layer of pre-cut fiberglass blanket insulation with PVC covers.
- h. Indirect waste piping: Armaflex 2000 25/50 rated elastomeric expanded closed-cell insulation. Color: white.
- i. Minimum Insulation Thicknesses:
  - (1) Cold water, rainwater, and indirect waste piping: <sup>1</sup>/<sub>2</sub>-inch.
  - (2) Hot water run out within pipe chase or drop to fixture:  $\frac{1}{2}$ -inch.
  - (3) Hot water distribution and return piping: 2-inch.
- j. Piping Guards: Provide Handi Lav-Guard insulation by Truebro on water supplies and waste piping below Handicapped Use Lavatories.
- 14. Pressure Gauges
  - a. Pressure gauges shall have brass movement, aluminum case, double strength clear glass window with black embossed figures and graduations on a white dial face, with 1% accuracy of scale range. Gauges shall be manufactured by Therice Co., Taylor Instrument, or Marshalltown Mfg. Gauges shall be furnished with snubbers and needle valve shutoff valves.
  - b. Gauges shall be 4½-inch diameter furnished with ranges that will locate the intended pressure at the point of application approximately midpoint on the range scale. Gauges for natural gas, vacuum and similar low pressure systems shall be gauges specifically designed for low pressure applications.
  - c. Pressure gauges shall be furnished with pressure ranges of 0 to 200 psi. Equal to Dwyer or Therice.



### V. ELECTRICAL

### Section 1 - Design Criteria

- A. The electrical systems will comply with the applicable codes and standards established for the project.
  - 1. The electrical system will be designed in accordance with the following local and national codes and standards as well as local authority requirements.
    - a. American National Standard Institute (ANSI)
    - b. American with Disabilities Act (ADA)
    - c. National Electric Code (NEC)
    - d. National Electric Safety Code (NESC)
    - e. National Fire Protection Association (NFPA)
    - f. National Electrical Manufacturers Association (NEMA)
    - g. Massachusetts State Building Code 9<sup>TH</sup> Edition (MSBC)
    - h. Massachusetts Fire Prevention Regulations (MFPR)
    - i. Massachusetts Electrical Code (MEC)
- B. Illumination levels and fixture selection will be designed by Architect and lighting designer to provide lighting levels as recommended by IES.
- C. Emergency lighting shall be provided via integral battery drivers for public spaces and wall mounted battery units for back of house space.

#### Section 2 - Systems Description

- A. Main Electrical Normal Power Service
  - 1. The proposed electrical service to the new building shall be provided by Belmont Light. Coordination with the utility company has not been accomplished at this time. It is assumed the building will be fed from pad mounted transformer. For the purpose of this report it is assumed a 208/120 volt, 3 phase, 4 wire, 1000 amp service will be provided.
- B. Building Electrical Distribution System
  - 1. The electrical distribution system shall consist of a 1000 amp distribution panel (DP), and sub panels will feed receptacle, lighting and small HVAC loads and will be placed strategically throughout the facility. A total of 3 sub-panels per level for a total of six (6) sized for 150 amps each. Larger HVAC equipment will be fed from the main distribution panelboard. A 400 amp panel will be located on the top level to feed HVAC and elevator loads. One breaker within the DP will be capable of back feeding for a PV system. In recent analysis, panels have been install in 7,400 sqft of roof space that will provide for 72 kW. Depending on shading of the area around the PV array, Belmont could get up to 17 W / sqft.
  - 2. It has been determined that the roof plan will be the space for mechanical equipment. Space will have to be allocated on the land surrounding the site and will determine the maximum amount of power generated from the panels.
- C. Standard Generator
  - 1. An 100 kW/120 kVA, 208/120V, 3 phase, 4 wire generator shall be provided to provide backup power to one wing of the building.



- 2. The main distribution panel will feed an 600 amp automatic transfer switch (ATS) on the normal side. The load side of the ATS will feed a 500 amp panel.
- 3. Generator shall be located at grade and meet the Town of Belmont noise requirements of 65 dBA at the property line. If consideration is being made to house the generator on the roof in an enclosure, a fuel tank will need to be located on the first-floor ground level, with a fuel pump.
- D. Lighting
  - 1. All lighting throughout the facility will be LED.
  - 2. A central dimming system will be provided for the public spaces. This system will allow for reduction of energy use via occupancy sensors and photocells.
  - 3. Back of house spaces will be provided with line voltage or occupancy sensors to control the spaces.
- E. Fire Alarm
  - 1. A new fully addressable fire alarm system consisting of a fire alarm control panel, batteries, and remote LCD annunciator will be provided.
  - 2. The main control panel will be in the mechanical room.
  - 3. A remote annunciator will be in the main building lobby.
  - 4. An exterior beacon shall be provided, and exact location to be confirmed with Belmont Fire Department.
  - 5. Fire alarm devices such as speaker/strobes, smoke detectors, and pull stations will be provided as required throughout the facility.
  - 6. The building will be provided with a bi-directional antenna system, "BDA".
- F. Emergency Power.
  - 1. Emergency lighting in all public spaces will be by driver battery units.
  - 2. Emergency lighting in all back of house spaces will be by wall mounted battery units.
  - 3. Exit signs will be battery backup and be placed throughout the building.
- G. Telecom/Security/AV Raceways
  - 1. Provide all back boxes and conduit as required for the telecommunications, security and AV documents.
  - 2. Provide 120-volt power and receptacles at all headend equipment.
  - 3. Provide power for all AV equipment such as projectors, projector screens and televisions.



### Section 3 - Outline Specifications

- A. Perform work and provide materials as indicated on the drawings for complete and fully operational electrical and low voltage systems for the area of renovation.
- B. Obtain and pay for all permits required for electrical and fire alarm work. This includes all municipal permits.
- C. All equipment and materials shall be tested, approved and listed by Underwriters Laboratories (UL). Where equipment and/or material is not UL listed, listing by a nationally recognized testing laboratory (NRTL) will be acceptable where approved by all Authorities Having Jurisdiction (AHJ). For all equipment that needs on site test and approval by UL, associated costs shall be included in this contract.
- D. In addition to manufacturer's warranties, all equipment shall include complete materials and labor warranties from the installer for 1 year from the date of substantial completion, unless warranties of greater duration are specified.
- E. In general the work of this section shall include, but not be limited to:
  - 1. Grounding systems.
  - 2. Distribution panelboard with utility C/T metering.
  - 3. Panelboards branch circuit.
  - 4. Wireways.
  - 5. Outlets and pull boxes.
  - 6. Wires and cables.
  - 7. Disconnect switches.
  - 8. Enclosed circuit breakers.
  - 9. Power and alarm wiring including connections for heating, ventilating, and air conditioning system motors and equipment. All starters and line voltage thermostats will be furnished for installation (wiring, connecting, and mounting) under this section.
  - 10. Power, control, and alarm wiring, including connections for the plumbing and fire protection systems equipment, shall be provided under this section.
  - 11. Electrical wiring and connections for owner furnished equipment.
  - 12. Devices and device plates.
  - 13. Lighting fixtures and lamps.
  - 14. Relays.
  - 15. Fire alarm system.
  - 16. Protection of new work.
  - 17. Record drawings and documentation.
  - 18. Seismic supports, supplementary steel and channels.
  - 19. Operation and maintenance instructions and manuals for this section's work.
  - 20. Nameplates, labels, and tags.
  - 21. Testing and certifications.
  - 22. Fireproofing of penetrations and openings.
  - 23. Access panels and doors.
  - 24. Coordination with manufacturers, other trades, general contractor, and owner. Include costs associated with adjustments and changes resulting from coordination.
  - 25. MDO plywood backboards for telecommunications systems, starters, equipment, etc.
  - 26. Temporary power and lighting and fire alarm for complete project requirements as per, MEC, NFPA 72 and OSHA requirements.
  - 27. Seals.



### F. Products

- 1. Raceways and Fittings
  - a. Conduits shall be rigid galvanized steel (RGS), or electrical metallic tubing (EMT). Conduits shall be as manufactured by Allied, Wheatland Tube Company, or approved equal.
  - b. Fittings for RGS shall be threaded malleable iron. Hubs shall be self-insulated and shall be self-locking weatherproof type.
  - c. Fittings for EMT shall be galvanized steel compression type or galvanized steel set screw type. Die-cast is not allowed. Setscrew fittings for EMT of trade size greater than 2 inches shall include minimum of (4) set screws for couplings and minimum of (2) setscrews for connectors.
  - d. Raceways for connections to motors and other equipment subject to vibration shall be galvanized spiral wrapped flexible metallic conduit utilizing fittings for flexible metallic conduits. Flexible conduits shall not exceed 36 inches in length. Provide liquid-tight type at damp and wet locations.
  - e. Conduit expansion fittings shall be threaded, hot-dipped galvanized malleable iron with internal bonding assembly by OZ Gedney or approved equal.
  - f. Provide water-tight gland sealing assemblies with pressure bushing for penetrations to the exterior.
  - g. Wireways shall be galvanized sheet steel with hinged and screw covers. Interiors shall be smooth and free of sharp edges and burrs. Wireways shall be sized for conductors to be installed within and the bend radii of those conductors. Wireways for fire alarm shall be provided without factory knockout locations. Wireways shall be manufactured by square d or approved equal.
  - h. All fire alarm fittings and box covers shall be painted red.
  - i. Minimum raceway (RGS, EMT, etc.) trade size is <sup>3</sup>/<sub>4</sub> inches.
  - j. Minimum raceway size for fire alarm as follows:
    - (1) 1 inch horizontal circuit installations.
    - (2)  $\frac{3}{4}$  inch final installation from box above to end-use device.
- 2. 600 Volt Insulation Wire and Cable
  - a. Provide annealed copper wire and cable with insulation rated for 600V and 90°C of sizes specified and as manufactured by Essex, Southwire, or approved equal.
  - b. Wire and cable shall have copper conductors. All conductors shall be stranded, soft drawn, annealed with 98% conductivity and insulated for 600 volts. Conductors shall be color coded as specified.

- c. Fire-protective signaling wiring shall be in accordance with the electrical code, (Article 760), fire prevention systems for building fire alarm systems, and as indicated. All wires for the local fire alarm system shall be color-coded and the size and type as required by the NEC.
- d. Metal clad (MC) cable shall be a multi-conductor assembly with insulated copper conductors and galvanized steel armor. Minimum conductor size is #12 AWG and equipment grounding conductor shall be full size and insulated (green). Conductors for MC cables that are #12 AWG or #10 AWG may be either stranded or solid. MC cables shall be manufactured by AFC.
- 3. Outlet, Pull and Junction Boxes
  - a. Boxes, and fittings for general use, flush mounted in concrete work and walls in normally dry locations, shall be manufactured by Steel City, Appleton, Raco, or approved equal. Boxes and fittings for normally wet locations, or surface or pendant mounted in all locations, shall be of the proper cast metal type and shall be manufactured by Crouse-Hinds, Appleton, Red Dot, Russell and Stoll, or approved equal.
  - b. Outlet boxes shall, in general, be as follows:
    - (1) Shall be 4" square minimum with plaster ring extension sized for devices specified.
    - (2) Exposed, surface, and pendant mounted outlet boxes, or outlet boxes installed in normally wet locations, shall be of the cast metal type with threaded hubs.
    - (3) Recessed outlet boxes for dry locations shall be of the pressed sheet steel, zinc coated type.
    - (4) Ceiling and bracket outlet boxes shall not be less than 4". Flush or recessed fixtures shall be provided with separate outlet boxes where required by the fixture terminal temperature requirements.
  - c. Pull and junction boxes shall be as follows:
    - (1) Pull and junction boxes less than 6" x 6" shall be as specified for outlet boxes.
    - (2) Pull and junction boxes shall be constructed of code gauge galvanized sheet metal and not less than the minimum size required by the electrical code and other applicable specification "standards" and shall be furnished with screw fastened covers. Boxes exceeding 48" in any direction shall be properly reinforced
    - (3) Pull and junction boxes to be installed in normally wet location areas shall be of the cast type with threaded hub and gasketed cover plate.
- 4. Distribution Panelboards
  - a. Distribution panelboards shall be Square D, I-Line or Eaton-Cutler Hammer type PRL5P Series.

- b. Distribution panelboard shall be rated for service entrance.
- c. Panelboards shall be of the dead-front type suitable for 120/208V, three phase, fourwire operation and shall have a short circuit current rating of 65 KAIC.
- d. Panelboard cabinets shall be fabricated from code gauge galvanized sheet steel and furnished with either flush or surface trim. Trims shall be fitted with hinged doors having combination lock and latch, with all locks keyed alike and heavy duty, continuous, section vertical hinging to box section for access to wiring gutters in addition to trim door.
- e. Where indicated, distribution panelboard shall include a main circuit breaker. Main circuit breaker the main circuit breaker shall be a 100 percent rated device.
- f. Interiors shall have copper bus bars with mains arranged for a grounded solidneutral system with lugs only in the mains or main breakers as indicated. Panelboard shall be suitable for use with 75°C conductor ampacities.
- g. Neutral bus shall be insulated from the panel enclosure, except provide bonded neutral only for service entrance equipment. Panelboards shall have a separate equipment ground bus and terminal strip.
- h. Circuit breakers shall be molded case, thermal magnetic type and shall be single, double, and three-pole circuit breakers with interrupting ratings indicated on the drawings. The design of the structure shall be such that the units may be removed without disturbing adjacent sections, bus structure, or insulation. Circuit breakers shall be labeled for use with 75°C conductor ampacities. Circuit breakers used for switching shall be type "SWD". Circuit breakers for HVAC equipment and any other equipment with multiple motors shall be type "HACR".
- i. Two and three-pole breakers shall be common trip type so that an overload on one pole will trip all poles simultaneously. No handle bar ties will be allowed on multipole circuit breakers to accomplish either manual or automatic tripping. All circuit breakers with trip sizes larger than 100 ampere rating shall have interchangeable trips.
- j. All circuit breakers rated 125 ampere to 600 ampere feeding motors shall have adjustable magnetic trip units with a range 500% to 1000% (10 percent tolerance) of trip unit rating.
- k. All circuit breakers shall be fully rated for the AIC rating as indicated or higher rating. Series rated circuit breakers are not allowed.
- 5. Branch Circuit Panelboards
  - a. Branch circuit panelboards shall be as manufactured by Square D, Eaton Cutler-Hammer, Siemens or GE.
  - b. Panelboards shall be of the dead-front type suitable for 120/208V, three phase, fourwire operation and shall have a short circuit current rating of 65 KAIC.
  - c. Panelboard cabinets shall be fabricated from code gauge galvanized sheet steel and furnished with either flush or surface trim as indicated on drawings. Trims shall be fitted with hinged doors having combination lock and latch, with all locks keyed alike and heavy duty, continuous, vertical section hinging to box section for access



to wiring gutters in addition to trim door. A directory holder with a clear plastic or glass plate and metal frame shall be mounted on the inside of each door. A neatly typed directory properly identifying each circuit shall be provided in the holder.

- d. Interiors shall have copper bus bars with mains arranged for a grounded solidneutral system with lugs only in the mains or main breakers as indicated. Panelboard shall be suitable for use with 75°C conductor ampacities. All bus bars (phases, neutral, and equipment grounding) shall be of copper.
- e. Neutral bus shall be insulated from the panel enclosure, except provide bonded neutral only for service entrance equipment. Panelboards shall have a separate equipment ground bus and terminal strip.
- f. Circuit breakers shall be molded case, thermal magnetic type with bolted connections to the bus and shall be single, double, and three-pole circuit breakers with interrupting ratings indicated on the drawings. Circuit breakers shall be labeled for use with 75°C conductor ampacities. Circuit breakers used for switching shall be type "SWD". Circuit breakers for HVAC equipment and any other equipment with multiple motors shall be type "HACR".
- g. Two and three-pole breakers shall be common trip type so that an overload on one pole will trip all poles simultaneously. No handle bar ties will be allowed on multipole circuit breakers to accomplish either manual or automatic tripping. All circuit breakers with trip sizes larger than 100 ampere rating shall have interchangeable trips.
- h. All circuit breakers rated 125 ampere to 600 ampere feeding motors shall have adjustable magnetic trip units with a range 500% to 1000% (10 percent tolerance) of trip unit rating.
- I. All circuit breakers shall be fully rated for AIC indicated or higher rating. Series rated circuit breakers are not allowed.
- i. Quantity of total poles scheduled shall not include main circuit breaker (MCB). MCB shall not be installed in branch circuit breaker locations in the panelboards.
- 6. Disconnect Switches
  - a. Disconnect switches shall be manufactured by Square D, Eaton-Cutler Hammer or GE.
  - b. Disconnect switches shall be horsepower rated, heavy duty of the fusible or non-fusible type as indicated and equipped with an external lever or handle for manual operation. Each unit shall be enclosed in a code-gauge, sheet steel cabinet with hinged door and catches and suitable for surface mounting as indicated on the drawings. Provide NEMA 1 enclosures for indoor use and NEMA 4X for outdoor applications and all other wet areas. Disconnect switches shall include arc containing shields.
- 7. Wiring Devices
  - a. Wiring devices shall be made by single manufacturer; Hubbell, Cooper, Leviton, or Pass and Seymour. Catalog numbers indicated shall be those of Hubbell.

- b. Bodies shall be of thermoplastic compound, with faces of nylon supported by mounting yoke having plaster ears and shall be NEMA WD-1 heavy duty "commercial specification grade. All devices shall be the grounding type and shall be connected to metal mounting yoke. A terminal shall be provided for the ground wire on all devices.
- c. Wiring devices color shall be of color as selected by Architect.
- d. All receptacles unless specifically indicated otherwise shall be as follows:
  - (1) Receptacles shall be side wired with two screws per terminal. Provide receptacles tested to UL 498, NEMA WD-1 heavy duty, federal spec WC596 and 2008 compliant "tamper resistant and weather resistant" where applicable. Receptacles on individual branch circuits shall match the ampacities of the circuit.
  - (2) Convenience receptacles duplex 20 ampere, 125 volts, 1 phase, 3 wire, u-slot grounded type BR20 series or approved equal.
  - (3) Weatherproof ground fault interrupter type 'GFCI", duplex 20 ampere, 125 volts, 1 phase, 3 wire U-slot grounded type. Ground fault test function shall sense a ground fault and activate the LED in a ground fault condition. Red LED "flashing" indicates device has lost capability to provide ground fault protection. No power to face of receptacle where reverse wired. Receptacles shall be GFTR20 series or approved equal.
  - (4) USB Charging Receptacles
    - (a) USB charging convenience receptacles, 125V, 15A and 20A comply with NEMA WD1, NEMA WD 6, UL 498, UL 1310, and FS W-C-596. Compatible with USB 1.1/2.0/3/0 devices including Apple products. Hubbell USB15X2X 15A, or USB20X2X 20A duplex receptacle with 2 USB charging ports and 3.8 amps of charging capacity or equal.
- 8. Toggle Switches:
  - a. Toggle switches shall be of the totally enclosed, flush tumbler type of suitable capacity for the intended load and shall be "specification grade". Provide listed switches tested to UL 20, and federal spec WS896E where applicable.
  - b. Toggle switch bodies shall be NEMA WD-1 heavy-duty thermoplastic compound, quiet indicating type with screw type terminals. Provide grounding terminal.
  - c. General lighting switches shall be 20 ampere, 120/277 volts AC, #1221 series, or approved equal.
- 9. Device Plates
  - a. Wiring device plates shall be of the same manufacturer as the wiring devices for the project. Device plates color shall be selected by the architect.
  - b. Outdoor devices shall have wet location listing for "in-use" weatherproof covers as manufactured by Hubbell Inc., TayMac, or approved equal.



- 10. Lighting
  - a. Power Supply Unit (Drivers)
    - (1) Luminaires shall be equipped with an L.E.D. driver(s) that accepts the voltage as indicated on the Light Fixture Schedule. Individual driver(s) shall be replaceable.
    - (2) Driver(s) shall be UL8750 class 2 compliant for their intended purpose.
    - (3) Total harmonic distortion (THD) for current:  $\leq 20\%$ .
    - (4) Driver(s) shall be rated to operate between -30°C to 50°C minimum.
    - (5) Individual driver(s) shall be equipped with surge protection (6 kV minimum) in accordance with IEEE/ANSI C62.4.1. Driver shall be protected against damage due to either an open circuit or short circuit fault condition on the driver output.
    - (6) Driver(s) shall have a minimum efficiency of 85%.
    - (7) Drivers shall deliver full-range dimming from 0-10V control signal.
  - b. L.E.D. Light Source (Light Engine)
    - (1) Individual light engine(s) shall be replaceable.
    - (2) L.E.D. light engine(s) shall have a minimum lifetime of 50,000+ hours at 40°C and shall have a minimum efficiency of 80 lumens per watt.
    - (3) L.E.D. dies shall be tested in accordance with I.E.S.N.A. LM-80-08 standards.
    - (4) Thermal management shall be passive by design and shall consist of heat sinks with no fans, pumps or liquids.
    - (5) All L.E.D. lamps shall be binned to ensure uniformity on lamp color and light output.
- 11. Fire Alarm System
  - a. All signaling devices shall be synchronized.
  - b. Audible signaling shall be evacuation by speakers.
  - c. Visible signaling shall be ADA compliant strobes.
- 12. Seals
  - a. Water seals shall be OZ Gednay or approved equal.
  - b. Fire seals shall be 3M or approved equal.

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c. Provide environmental seals where raceways are installed through areas of widely different temperatures.



### VI. Energy Modeling Narrative

The purpose of this narrative is to show the current progress of the energy model for the Belmont Public Library and the modeling process. WSP is utilizing eQUEST v3.65 as the energy modeling software. The program uses the local weather file and information of the HVAC, electrical, plumbing, and building envelope systems to simulate an 8,760 hour model to determine projected energy usage. As the project is seeking LEED v4 certification, two models will eventually be created. One model will have the inputs based on the design documents, this will be the "proposed" model. The second will be the "baseline" model, which will be created using ASHRAE 90.1-2010 Appendix G, as required by the USGBC. The projected energy cost of the two models will be compared to show compliance with the LEED v4 requirements, and determine the number of points that can be achieved for the Energy & Atmosphere Credit – Optimize Energy Performance.



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**APPENDIX - VRF Zoning Plan** 

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88 Black Falcon Avenue, Suite 210 Boston, MA 02210

+1-617-210-1600



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