



Town of Barnstable

Design & Installation Standards

for

Building Sewer Connections

Winter , 2011

**Town of Barnstable
Department of Public Works
Sewer and Trench Permit**

_____ **Permit Number**

Connection : _____ Disconnect : _____ Mod or Repair : _____

Map & Parcel # : _____ Street : _____ Village : _____ Septic Abandonment Permit # : _____	Water Supplier : _____ Sewer Account # : _____ Permit Fee & Check # : _____ 1. Residential Bldg Fee - \$420.00 ; Commercial Bldg Fee - \$875.00 2. Surcharge for Each Additional Bldg on Same Service - \$200.00 3. Surcharge for Pump Station - \$300.00 4. Minor Repair or Disconnect of Existing Service - \$50.00
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Project Contact Information	
Owner Name : _____	Contractor Name : _____
Mailing Address : _____ _____	Contact Name : _____ Business Address : _____ _____
Telephone : _____	Contact Phone : _____ Contact Fax : _____

Property Use Information	
Residential : <input type="checkbox"/>	Commercial : <input type="checkbox"/> Commercial Use : _____
Industrial : <input type="checkbox"/>	Standard Industrial Code : _____
Number of Bldgs : _____	Size of Parcel (acres) : _____
Pipe Dia & Material : _____	Pipe Length : _____

Before excavating in a Town Way or on Town owned property, the sewer installer must obtain a Road Opening/Trench Permit and comply with the Construction Standards & Specifications outlined therein. Applicant must notify DPW 48 hours prior to installation. Failure to comply with the regulations shall be grounds to revoke this permit. The Sewer & Trench Permit is valid for 180 calendar days from DPW approval and the installation must be completed within that time period. Engineered drawings must be submitted, with this application form, to the DPW for all commercial or industrial installations. The drawings must be approved before a permit will be issued.

Contractor Signature & Date : _____

DPW Approval Signature & Date : _____

Sewer Permit Expires : _____

**Town of Barnstable
Department of Public Works
Sewer and Trench Permit**

Permit Number

Trench / Excavation Information

Name Excavator Operator : _____ MA Hoisting Lic # : _____
License Grade & Exp Date : _____ Dig Safe # : _____
Name of Competent Person : _____ Current Ins Cert # : _____
Insurers Name & Contact : _____

By signing this form, the applicant, owner, and excavator all acknowledge and certify that that they are familiar with, or before commencement of work, will become familiar with all laws and regulations applicable with the proposed work, including OSHA regulations; G.L.C. 82A, 520 CMR 7.00 et.seq., and any applicable Town of Barnstable ordinances, by-laws and regulations and they covenant and agree that all work done under the permit issued for such work will comply therewith in all respects and with the conditions set forth below.

The undersigned owner authorizes the applicant to apply for the permit and the excavator to undertake such work on the property of the owner, and also, for the duration of construction, authorizes persons duly appointed by the Town of Barnstable to enter upon the property to monitor and inspect the work for conformity with the conditions attached hereto and the laws and regulations governing such work.

The undersigned applicant, owner, and excavator agree jointly and severally to reimburse the Town of Barnstable for any and all costs and expenses incurred by the Town of Barnstable in connection with this permit and the work conducted thereunder, including but not limited to, enforcing the requirements of state law and conditions of this permit, inspections made to assure compliance therewith, and measures taken by the Town of Barnstable to protect the public where applicant, owner, or excavator has failed to comply therewith including police details and other remedial measures deemed necessary by the Town of Barnstable.

The undersigned applicant, owner, and excavator agree jointly and severally to defend, indemnify, and hold harmless the Town of Barnstable and all of its agents and employees from any and all liability, causes or action, costs, and expenses resulting from or arising out of any injury, death, loss, or damage to any person or property during the work conducted under this permit.

**THIS PERMIT MUST BE COMPLETED PRIOR TO CONSIDERATION
THIS PERMIT EXPIRES 180 DAYS FROM DATE OF ISSUE**

Applicant Signature

Date

Excavator Signature (if different)

Date

CONDITIONS AND REQUIREMENTS PURSUANT TO G.L.C.82A AND 520 CMR 7.00 et seq. (as amended)

By signing the application, the applicant understands and agrees to comply with the following:

- i. No trench may be excavated unless the requirements of sections 40 through 40D of chapter 82, and any accompanying regulations, have been met and this permit is invalid unless and until said requirements have been complied with by the excavator applying for the permit including, but not limited to, the establishment of a valid excavation number with the underground plant damage prevention system as said system is defined in section 76D of chapter 164 (DIG SAFE);
- ii. Trenches may pose a significant health and safety hazard. Pursuant to Section 1 of Chapter 82 of the General Laws, an excavator shall not leave any open trench unattended without first making every reasonable effort to eliminate any recognized safety hazard that may exist as a result of leaving said open trench unattended. Excavators should consult regulations promulgated by the Department of Public Safety in order to familiarize themselves with the recognized safety hazards associated with excavations and open trenches and the procedures required or recommended by said department in order to make every reasonable effort to eliminate said safety hazards which may include covering, barricading or otherwise protecting open trenches from accidental entry.
- iii. Persons engaging in any in any trenching operation shall familiarize themselves with the federal safety standards promulgated by the Occupational Safety and Health Administration on excavations: 29 CFR 1926.650 et.seq., entitled Subpart P "Excavations".
- iv. Excavators engaging in any trenching operation who utilize hoisting or other mechanical equipment subject to chapter 146 shall only employ individuals licensed to operate said equipment by the Department of Public Safety pursuant to said chapter and this permit must be presented to said licensed operator before any excavation is commenced;
- v. By applying for, accepting and signing this permit, the applicant hereby attests to the following: (1) that they have read and understand the regulations promulgated by the Department of Public Safety with regard to construction related excavations and trench safety; (2) that he has read and understands the federal safety standards promulgated by the Occupational Safety and Health Administration on excavations: 29 CFR 1926.650 et.seq., entitled Subpart P "Excavations" as well as any other excavation requirements established by this municipality; and (3) that he is aware of and has, with regard to the proposed trench excavation on private property or proposed excavation of a city or town public way that forms the basis of the permit application, complied with the requirements of sections 40-40D of chapter 82A.
- vi. This permit shall be posted in plain view on the site of the trench.

For additional information please visit the Department of Public Safety's website at www.mass.gov/dps

Summary of Excavation and Trench Safety Regulation (520 CMR 14.00 et seq.)

This summary was prepared by the Massachusetts Department of Public Safety pursuant to G.L.c.82A and does not include all requirements of the 520 CMR 14.00. To view the full regulation and G.L.c.82A, go to www.mass.gov/dps Pursuant to M.G.L. c. 82, § 1, the Department of Public Safety, jointly with the Division of Occupational Safety, drafted regulations relative to trench safety. The regulation is codified in section 14.00 of title 520 of the Code of Massachusetts Regulations. The regulation requires all excavators to obtain a permit prior to the excavation of a trench made for a construction-related purpose on public or private land or rights-of-way. All municipalities must establish a local permitting authority for the purpose of issuing permits for trenches within their municipality. Trenches on land owned or controlled by a public (state) agency requires a permit to be issued by that public agency unless otherwise designated.

In addition to the permitting requirements mandated by statute, the trench safety regulations require that all excavators, whether public or private, take specific precautions to protect the general public and prevent unauthorized access to unattended trenches. Accordingly, unattended trenches must be covered, barricaded or backfilled. Covers must be road plates at least ¾" thick or equivalent; barricades must be fences at least 6' high with no openings greater than 4" between vertical supports; backfilling must be sufficient to eliminate the trench. Alternatively, excavators may choose to attend trenches at all times, for instance by hiring a police detail, security guard or other attendant who will be present during times when the trench will be unattended by the excavator.

The regulations further provide that local permitting authorities, the Department of Public Safety, or the Division of Occupational Safety may order an immediate shutdown of a trench in the event of a death or serious injury; the failure to obtain a permit; or the failure to implement or effectively use adequate protections for the general public. The trench shall remain shutdown until re-inspected and authorized to re-open provided, however, that excavators shall have the right to appeal an immediate shutdown. Permitting authorities are further authorized to suspend or revoke a permit following a hearing. Excavators may also be subject to administrative fines issued by the Department of Public Safety for identified violations.

Summary of 1926 CFR Subpart P -OSHA Excavation Standard

This is a worker protection standard, and is designed to protect employees who are working inside a trench. This summary was prepared by the Massachusetts Division of Occupational Safety and not OSHA for informational purposes only and does not constitute an official interpretation by OSHA of their regulations, and may not include all aspects of the standard. For further information or a full copy of the standard go to www.osha.gov.

- **Trench Definition per the OSHA standard:**
 - An excavation made below the surface of the ground, narrow in relation to its length.
 - In general, the depth is greater than the width, but the width of the trench is not greater than fifteen feet.
- **Protective Systems** to prevent soil wall collapse are always required in trenches deeper than 5', and are also required in trenches less than 5' deep when the competent person determines that a hazard exists. Protection options include:
 - Shoring. Shoring must be used in accordance with the OSHA Excavation standard appendices, the equipment manufacturer's tabulated data, or designed by a registered professional engineer.
 - Shielding (Trench Boxes). Trench boxes must be used in accordance with the equipment manufacturer's tabulated data, or a registered professional engineer.
 - Sloping or Benching. In Type C soils (what is most typically encountered) the excavation must extend horizontally 1 ½ feet for every foot of trench depth on both sides, 1 foot for Type B soils, and ¾ foot for Type A soils.
 - A registered professional engineer must design protective systems for all excavations greater than 20' in depth.
- **Ladders** must be used in trenches deeper than 4'.
 - Ladders must be inside the trench with workers at all times, and located within 25' of unobstructed lateral travel for every worker in the trench.
 - Ladders must extend 3' above the top of the trench so workers can safely get onto and off of the ladder.
- **Inspections** of every trench worksite are required:
 - Prior to the start of each shift, and again when there is a change in conditions such as a rainstorm.
 - Inspections must be conducted by the competent person (see below).
- **Competent Person(s) is:**
 - Capable (i.e., trained and knowledgeable) in identifying existing and predictable hazards in the trench, and other working conditions which may pose a hazard to workers, and
 - Authorized by management to take necessary corrective action to eliminate the hazards. Employees must be removed from hazardous areas until the hazard has been corrected.
- **Underground Utilities** must be:
 - Identified prior to opening the excavation (e.g., contact Digsafe).
 - Located by safe and acceptable means while excavating.
 - Protected, supported, or removed once exposed.
- **Spoils** must be kept back a minimum of 2' from the edge of the trench.
- **Surface Encumbrances** creating a hazard must be removed or supported to safeguard employees. Keep heavy equipment and heavy material as far back from the edge of the trench as possible.
- **Stability of Adjacent Structures:**
 - Where the stability of adjacent structures is endangered by creation of the trench, they must be underpinned, braced, or otherwise supported.
 - Sidewalks, pavements, etc. shall not be undermined unless a support system or other method of protection is provided.
- **Protection from water accumulation hazards:**
 - It is not allowable for employees to work in trenches with accumulated water. If water control such as pumping is used to prevent water accumulation, this must be monitored by the competent person.
 - If the trench interrupts natural drainage of surface water, ditches, dikes or other means must be used to prevent this water from entering the excavation.
- **Additional Requirements:**
 - For mobile equipment operated near the edge of the trench, a warning system such as barricades or stop logs must be used.
 - Employees are not permitted to work underneath loads. Operators may not remain in vehicles being loaded unless vehicles are equipped with adequate protection as per 1926.601(b)(6).
 - Employees must wear high-visibility clothing in traffic work zones.
 - Air monitoring must be conducted in trenches deeper than 4' if the potential for a hazardous atmosphere exists. If a hazardous atmosphere is found to exist (e.g., O₂ <19.5% or >23.5%, 20% LEL, specific chemical hazard), adequate protections shall be taken such as ventilation of the space.
 - Walkways are required where employees must cross over the trench. Walkways with guardrails must be provided for crossing over trenches > 6' deep.
 - Employees must be protected from loose rock or soil through protections such as scaling or protective barricades.

Contents

Town Sewer Connection Permit.....	1
Contractor Approval to Connect Building Sewer	2
State Sewer Connection Permit	3
Other Permits and Forms.....	3
Design Submittal & Record Drawings	4
Pipe Material	5
Pipe Joints	5
Pipe Bedding & Cover.....	5
Slope & Grade	6
Clean-outs.....	7
Sampling Manhole / Sampling Station	7
Manholes	7
Manhole Frames & Covers	8
Grease Traps.....	8
Building Floor Drains & Oil/Water Separators	9
Force Mains and Low Pressure Sewers	10
Vacuum Valve Pit & Buffer Tanks	10
Vacuum Sewer Vent Pipe	10

Pressure Sewer Connection to Valve Pits & Buffer Tanks.....	11
Pumping Stations Connecting to Gravity Mains.....	12
Saddling of Existing Pipelines.....	12
Vehicular Traffic.....	13
Erosion Control.....	14
Gravity Sewer Limitations.....	14

Definitions

ANSI - American National Standards Institute

ASTM - American Society for Testing and Materials

Building Floor Drains - that part of the lowest horizontal piping of a drainage system which receives the discharge from soil, waste and other drainage pipes inside the walls of a building and conveys the discharge to the building sewer, beginning five (5) feet outside the inner face of the building wall.

Building Sewer - the sewer extension from the building drain to the public sewer, or other place of wastewater disposal.

Industrial - any property on which an activity is carried which falls into any of the Standard Industrial Classification codes listed in Comm of Mass 3.14 CMR 7.17 (2)(c). The following is a partial list.

SIC Code(s)	Industry Category
7532 - 7549.....	Automotive Repair and Services
7231, 7241.....	Beauty Shops, Barber Shops
7211 - 7219.....	Laundry Cleaning and Garment Services
4911, 4925, 4931, 4939.....	Electric, Gas Services (Power Generation Gas Production Only)
4011 - 4581.....	Transportation (Maintenance Only)
8062 - 8069.....	Hospitals
2000 - 3999.....	Manufacturing
2000 - 2099.....	Food Products
2100 - 2199.....	Tobacco Products
2200 - 2299.....	Textile Mill Products
2300 - 2399.....	Apparel and Other Finished Products Made from Fabrics and Similar Materials
2400 - 2499.....	Lumber and Wood Products, except Furniture
2500 - 2599.....	Furniture and Fixtures
2600 - 2699.....	Paper and Allied Products

2700 - 2799.....	Printing, Publishing and Allied Industries
2800 - 2899.....	Chemicals and Allied Products
2900 - 2999.....	Petroleum Refining and related Industries
3000 - 3099.....	Rubber and Miscellaneous Plastics
3100 - 3199.....	Leather Tanning and Finishing
3200 - 3299.....	Stone, Clay, Glass and Concrete Products
3300 - 3399.....	Primary Metals Industries
3400 - 3499.....	Fabricated Metal Products (except Machinery and Transportation Equipment)
3500 - 3599.....	Industrial and Commercial Machinery and Computer Equipment
3600 - 3699.....	Electronics and Other Electrical Equipment and Components, except Computer Equipment
3700 - 3799.....	Transportation Equipment
3800 - 3899.....	Measuring, Analyzing and Controlling Instruments; Photographic, Medical and Optical Goods; Watches and Clocks
3900 - 3999.....	Miscellaneous Manufacturing Industries

Public Sewer - a sewer owned or controlled by the Town in which owners of abutting properties are allowed to connect.

Residential - any property which is used exclusively for residential use and where the waste being generated contains sanitary sewage with no waste from any process or industrial trade or business activity.

Sanitary Sewer - a sewer which carries sewage and to which storm waters, surface waters and ground waters are not intentionally admitted.

Sewage - a combination of the water carried wastes from residences, business buildings, commercial or industrial establishments and other facilities of public or private institutions, together with such ground waters, surface waters and storm waters as may be present.

Sewer - a pipe or conduit for carrying sewage.

Sewer System - the combination of building sewers, associated collection and storage containers, valve pits, buffer tanks and pumping stations, and public sewers through

and by means of which wastewater flows and is transported to the wastewater treatment plant.

Town - the Town of Barnstable

Wastewater - a combination of liquid and water carried wastes, whether treated or untreated, from residences, business buildings, industrial and manufacturing facilities, and facilities of private and public institutions, together with such ground waters, surface waters and storm waters as may be present, which is contributed into or permitted to enter the sewer system.

Town Sewer Connection & Trench Opening Permit

No connection to, disconnection from or alteration of a sewer connection to a municipal sewer shall be constructed without first obtaining the appropriate Sewer Connection & Trench Permit, and payment of the appropriate permit fee to the Town of Barnstable Department of Public Works. A new Permit, and full connection fee, is required when a building sewer is extended to service a building, or section of building, not previously serviced or previously connected to an existing sewer connection. All building sewer connection permit applications must include correct Map & Parcel identification, and correct address; property owner contact information, including mailing address and phone number. All building sewer connection permit applications must include contact information concerning the licensed installer, including mailing address, phone number and fax number; and a description of the property to be tied-in. All permit applications must include equipment operator name, state license number, insurance identification and be signed & dated.

The building sewer connection, modification or disconnection, must be completed by a contractor who is licensed as a Disposal Works Installer by the Town of Barnstable Board of Health or by a contractor who has been approved to make building sewer connections by the Town of Barnstable Department of Public Works. Excavation equipment operators must be familiar with, and understand, the regulations issued by the Mass Dept of Public Safety, with regard to construction related excavations and trench safety (GL c 82A and 520 CMR 7.00 et seq and 520 CMR 14.00 et seq).

A Sewer Connection & Trench Permit is issued to a specified contractor for a specified property. Sewer Connection & Trench Permits are not transferable to another contractor or property. If a sewer connection is not completed by the specified contractor or within the specified time frame, a new permit must be obtained, by the new contractor performing the work, and a new fee will be assessed by the Department of Public Works.

All sewer connections associated with the demolition of existing buildings on a property must be disconnected from the municipal sewer. The disconnection shall be performed at the property line and the disconnected sewer line shall be capped and encased in concrete.

Failure of an approved installer to secure a permit prior to beginning work on a connection, disconnection or alteration shall result in a 90 day license suspension for the first offense, a one year suspension for the second offense and license revocation for the third offense. Any work on a municipal sewer connection by anyone not licensed by the Department of Public Works shall be subject to a fine not to exceed \$500.00.

All building sewer connections for industrial / commercial discharges shall submit a copy of their State sewer connection permit to the Town of Barnstable Department of Public Works for review, as part of the application to connect to the Town sewer.

All industrial / commercial building sewer connections shall have installed any pretreatment equipment and meet all pretreatment discharge requirements, as determined to be necessary by the Town of Barnstable Department of Public Works - Water Pollution Control Division.

All sewer connection & trench permits are valid for a period of 180 calendar days from the date of issue. All work must be completed within 180 days of permit issuance. If the sewer tie-in is not completed within 180 days, a new permit must be obtained, by the contractor performing the work, and a new fee will be assessed by the Department of Public Works. Notice of at least 48 hours must be given to the DPW - Admin & Tech Support before beginning work on a sewer connection. No work shall be backfilled until approval for backfilling is given by Engineering Division personnel. Any work that has been backfilled without that approval shall be uncovered at the request of Engineering Division personnel.

Contractor Approval to Connect Building Sewer

Other contractors (plumbers, general contractors, excavation contractors, etc.) who wish to install or alter building sewer connections in the Town of Barnstable must submit to the Department of Public Works a company history; certificate(s) of insurance(s) and/or bond(s); a list of references and any other information which the contractor believes may be pertinent. The information will be reviewed by the Town Engineer and a determination will be made regarding the request to do sewer work.

Insurance(s) and bond(s) must include the following:

Workmen's Compensation - minimum limit of employer's liability of \$ 1,000,000.

Commercial General Liability Insurance - covering the Premises, Operations, Completed Operations, Contractual and Protective Hazards that may be presented by the work to be done, in an amount \$ 1,000,000 Each Occurrence Limit; a \$ 2,000,000 Products-Completed Operations Aggregate Limit and a General Aggregate Limit of \$ 2,000,000.

Owned and Non-Owned Automobile Liability Insurance - Combined Single Limit in an amount of not less than \$ 1,000,000.

State Sewer Connection Permit

The appropriate Sewer Connection / Extension Permit, when applicable, must be obtained from the Massachusetts Department of Environmental Protection, prior to applying for a Sewer Connection & Trench Permit from the Town of Barnstable Department of Public Works. A copy of the approved State Permit must accompany the application to connect to Town sewer.

Other Permits and Forms

The property owner is responsible for obtaining all permits or license(s) from the Town of Barnstable Building Services Division; The Town of Barnstable Conservation Commission; Town of Barnstable Water Pollution Control Division; municipal fire districts and water departments; Mass Dept of Transportation; Mass Dept of Environmental Protection; and all other federal, state or municipal regulatory agencies, as may be appropriate.

A permit to abandon the existing septic system must be obtained from the Town of Barnstable Department of Public Health and submitted with the Sewer Connection application.

A Road Opening / Trench Permit must be obtained, from the Town of Barnstable Department of Public Works – Admin & Tech Support, prior to any work being performed within the designated layout of a town road, sidewalk or Town owned property. All road opening work must be performed by a contractor licensed to perform Road Opening work by the Town of Barnstable Department of Public Works.

All industrial or commercial properties and any residential property whose flow is expected to exceed 2,000 gallons per day, connecting to the municipal sewer must obtain and file a pretreatment survey with the Town of Barnstable Water Pollution Control Facility. All industrial building sewer connections shall install any pretreatment equipment and meet all pretreatment discharge requirements, as determined to be necessary by the Town of Barnstable Department of Public Works. Flow estimates should be based on existing water use records or should be estimated using one of the following - Comm of Mass 3.10 CMR 15.203, Title 5 ; Comm of Mass 3.14 CMR 7.15, Sewer System Permits or TR-16, Guide for the Design of Wastewater Treatment Works.

Design Submittal & Record Drawings

A detailed design must be submitted, to the Town of Barnstable DPW for review and approval, for residential flows expected to exceed 2,000 gallons per day, and for all commercial or industrial flows. The design should include flow data and calculations for existing water use, or should be estimated using one of the following - Comm of Mass 3.10 CMR 15.203, Title 5 ; Comm of Mass 3.14 CMR 7.15, Sewer System Permits or TR-16, Guide for the Design of Wastewater Treatment Works. The detailed design shall include information showing the lot and buildings to be served and the layout, locations and depths, or elevations, of existing piping and underground structures. The design drawing should be a 22" x 34" drawing centered on a standard 24" x 36" sheet. The detailed design should include a plan view and a profile view of the proposed sewer piping and other appurtenant structures (manholes; valve pits; buffer tanks; grease traps; clean-outs; etc.). The drawing shall carry the original stamp of a Massachusetts licensed engineer. Where groundwater may be encountered, a dewatering plan must accompany the applications.

The plan for a disconnection of residential or commercial/industrial properties shall include a sketch of the lot and buildings located on the property, locations of existing sewer pipe and appurtenances. The disconnection shall be performed at the property line and the disconnected sewer line shall be capped and encased in concrete.

Consultants and contractors installing sewer connections and mains for commercial or industrial properties and for residential flows greater than 2,000 gallons per day, may be required to submit a 'Record Drawing' of the completed sewer connection, as actually constructed. Consultants and contractors will be notified, of the need for a 'Record Drawing', as part of the design review and approval. The 'Record Drawing' should include a plan view and a profile view of the sewer installation. The drawing(s) should be at a scale of 1" = 40 ft horizontal and 1" = 4 ft vertical. The 'Record Drawing' should be a 22" x 34" drawing centered on a standard 24" x 36" sheet.

The 'Record Drawing' should include information concerning the location of all above-ground buildings, and the locations and elevations of all underground utilities and structures. Sewer information should include pipe material, pipe size, slope, manhole rim elevations and manhole outlet elevations. The profile view should include stationing along the pipeline, stationing for each wye and each manhole. The profile view should identify and locate the horizontal & vertical information for all underground utilities that cross the finished sewer line. The plan view should include depth, or elevation, of sewer stubs, and swing ties to end of each sewer stub. Measurements and surveys should be taken during the construction project to verify locations and elevations.

Pipe Material

The building sewer shall be constructed of PVC SDR 35 pipe, or Schedule 40 PVC or better, as acceptable to the Department of Public Works. The minimum size of the building sewer shall be 4 inch diameter for residential connections and 6 inch diameter for commercial or industrial connections. Upon approval from the Department of Public Works, larger diameter pipe may be installed. Pipe and fittings shall be uniform and homogeneous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. Pipe, fittings and other materials shall be examined prior to installation for any defects. Fittings which utilize a worm-drive type hose clamp will not be allowed as part of the sewer service connection, without prior approval of the Department of Public Works.

Pipe Joints

All pipe joints of the building sewer shall be made watertight and protected against damage from roots, stones or other objects. Each length of pipe shall be laid to form a tight joint and to bring the inverts into a continuous line. All pipes shall be clean and free of dirt before laying and open ends shall be kept covered and free of dirt during construction. Any water shall be pumped from the trench while the pipes are laid and the joints made tight. Where new pipes are to join existing piping, structures or appurtenances, extreme care shall be taken in cutting into the existing material and watertight connections shall be made. Where new piping and construction is to join existing structures and appurtenances, care shall be taken so as to not interrupt existing service.

Pipe Bedding & Cover

The building sewer shall be laid on a firm base. The sub base shall be compacted prior to placing the pipe bedding material. Material used for bedding and cover shall be free of large stones, frozen clumps of earth, masonry, stumps or any other deleterious materials. In order to minimize settlement or other movement of the piping and any appurtenant structures, the bedding material shall be placed and compacted by manual or mechanical means to suit the material, and acceptable to the Department of Public Works. Commercial or industrial connections and appurtenant structures shall be laid on a 6" layer of ¾" Crushed Stone conforming to the following gradation -

<u>Sieve Size</u>	<u>% Passing</u>
1 inch	100
¾ inch	90 - 100
½ inch	10 - 50
3/8 inch	0 - 20
#4	0 - 5

Burial depth for building sewer connections shall be a minimum of 3 feet at the shallowest point of the pipe run. A drop clean-out, or a series of 45 degree bends with a short pipe length between each bend, shall be installed, when necessary, to gain appropriate cover or slope.

For residential connections, suitable excavated material may be used as backfill for pipe bedding and cover. All backfill must be properly compacted. Backfill should be placed in six inch lifts, and fully compacted, before additional material is added to the excavation. If the trench is over-excavated, the void must be backfilled and compacted before placing and installing the pipe. Appropriate amounts of ¾" stone may be used in place of natural backfill.

Each pipe shall be held firmly in position by carefully and thoroughly tamping backfill material around the barrel of the pipe. Tamping irons shall be used.

The building sewer must be designed and constructed so as to pass below water pipes and all other utilities. Sewer connections shall be installed with a minimum vertical separation of 18 inches below and a minimum horizontal separation of 36 inches from a water line or other utilities. If it is necessary to cross above a water pipe or other utilities, either the utility or the sewer shall be encased in concrete or placed in a large diameter watertight sleeve for a distance of 10 feet on both sides of the crossing.

Slope & Grade

The building sewer shall be designed so that the flow velocity is not less than 2 feet per second for the expected flow conditions. The flow conditions should be based on available water use data or estimated using one of the following - Comm of Mass 3.10 CMR 15.203, Title 5 ; Comm of Mass 3.14 CMR 7.15, Sewer System Permits or TR-16, Guide for the Design of Wastewater Treatment Works. Burial depth for building sewer connections shall be a minimum of 3 feet at the shallowest point of the pipe run. The building sewer shall be laid on a continuous grade and in a straight line. If the building sewer is expected to flow at less than half-full under average flow conditions, the pipe

shall be installed at a minimum slope of 0.021 for a 4" dia pipe; 0.012 for a 6" dia pipe, or at a slope of 0.008 for an 8" dia pipe.

Clean-outs

A drop clean-out tee or wye shall be provided at the exterior wall of the building for all building sewer connections. Residential sewer connections shall include a clean-out upstream of all major bends. Where right angle bends cannot be avoided, a drop clean-out, shall be installed, or they shall be a series of 45 degree bends with a short pipe length between each bend. Clean-outs shall be sealed with a removable, reusable threaded screw-on cap. Clean-outs, or riser connections, shall be installed at or just below grade, for reasonable access and use. All clean-outs installed in areas subject to vehicular traffic must include a clean-out cover which can withstand H-20 wheel loads. The clean-out cover must be installed according to manufacturers' recommendations.

Sampling Manhole / Sampling Station

Commercial or industrial sewer connections shall include a sampling station, to be used for discharge sampling, located in the road layout at the property line. The sampling station shall consist of a precast manhole with an approved frame & cover.

Manholes

For commercial or industrial sewer connections manholes shall be used at all locations where pipe size, slope or direction changes. Distance between manholes shall not exceed 300 feet. With prior approval from the Town of Barnstable Department of Public Works, minor direction changes may consist of a drop clean-out or a series of bends, none exceeding 45 degrees, with a short pipe length between each bend. Manholes shall be constructed of pre-cast reinforced concrete. Precast reinforced concrete manholes shall be commercially manufactured units of 3,000 psi minimum, air entrained concrete conforming to ASTM Standard C478. All joints between precast sections shall be sealed with bitumastic sealant or other method acceptable to the Department of Public Works. Steps in precast concrete manholes shall be aluminum or polypropylene. Polypropylene steps shall be steel reinforced and shall be embedded a minimum of 3 inches into the concrete. Joints between the manhole and pipes shall consist of cast-in-place flexible rubber sleeves with stainless steel clamps. Manholes shall be laid on a layer of ¾" Crushed Stone - Type A meeting the gradation requirements listed above. The layer of bedding material for the manhole base shall be not less than 6" thick. Inverts may be cast of cement concrete, or brick and mortar, and must be surfaced with

cement or clay brick. Brick shall be laid in Portland cement mortar composed of 1 part Portland cement and 2 parts sand, measured by volume, to which not more than 10 pounds of lime shall be added for each bag of cement. Portland cement shall conform to ASTM Standard C150, Type II. Sand for the mortar shall be clean and sharp and contain no grains that will be retained on a 1/8 inch mesh screen. Backfill material shall consist of clean soil material and be free of large stones, frozen clumps of earth, masonry, stumps or any other deleterious materials. Backfill shall be uniformly placed, in six inch layers around the structure and thoroughly compacted with hand tampers or mechanical equipment.

Manhole Frames & Covers

Manholes shall be topped with a cast iron frame & cover. Manhole frames & covers shall be marked 'SEWER'. Frames & covers shall be of tough, gray cast iron conforming to ASTM Standard A48, Class 30. Cast iron frames & covers shall be set in full mortar beds true to line and set to grade. Cement concrete collars shall be placed around the castings after the final setting. Final setting shall not be accomplished with more than two coarse of brick with mortar.

Each casting shall bear an identifying mark of the manufacturer and a part number or pattern number traceable to the manufacturer. All frames & covers installed in areas subject to vehicular traffic must withstand H-20 wheel loads.

Grease Interceptor Tanks

Grease traps or waste interceptors must be installed at restaurants, nursing homes, schools, hospitals, bakeries, or similar establishments, as determined by the municipal Board of Health. The grease trap or waste interceptor shall be installed on a separate discharge line serving that part of the plumbing system into which the grease or waste will be discharged before flowing to the building sewer. The waste interceptor / grease trap shall have sufficient capacity to provide at least a 24-hour detention period. Flow shall be calculated by the kitchen flow rate of 15 gallons per chair or per seat. Grease traps / waste interceptors shall have a minimum depth of four feet and a minimum capacity of 1,000 gallons.

Grease trap / waste interceptors shall be commercially manufactured units of 4,000 psi minimum, air entrained concrete. Concrete structure and piping shall be laid on a 6" layer of ¾" Crushed Stone. Access covers shall be installed over the inlet and the outlet tee and shall be a minimum diameter of 20 inches. Access covers shall be set in full mortar beds true to line and set to grade. Cement concrete collars shall be placed

around the castings after the final setting. Final setting shall not be accomplished with more than two coarse of brick with mortar. If area is subject to vehicular traffic, the concrete structure and access covers shall be rated for H-20 loads.

Inlet piping for waste interceptors / grease traps shall consist of 4" diameter Cast Iron, direction changes may consist of a series of bends, none exceeding 45 degrees. All outlet piping shall be installed with a minimum slope of 0.021. The invert elevation of the inlet pipe shall be at least 2 inches above the invert elevation of the outlet pipe. The outlet tee shall extend to within 12 inches of the bottom of the tank. Tees shall be 4" Cast Iron or Sch40 PVC and must be properly supported by hangers, straps or other acceptable method. Burial depth for outlet discharge pipe shall be a minimum of 3 feet at the shallowest point of the pipe run. The inlet tee shall extend to the mid-depth of the tank.

Grease traps / waste interceptors shall be inspected monthly and shall be cleaned when the level of grease is 25% of the effective depth of the trap, or at least every three months, whichever is sooner. A copy of the inspection & cleaning shall be submitted to the Barnstable Department of Public Works Water Pollution Control Facility.

Building Floor Drains and Oil/Water Separators

Building floor drains may be connected to the town sewer system provided that an appropriately designed and constructed oil/water separator is installed between the floor drain(s) and the sewer connection. The amount of oil in the discharge effluent from the oil/water separator shall not exceed ten parts per million (10 ppm). The oil/water separator should be of double-walled unit and of sufficient capacity to allow a minimum retention time of 10 minutes, for the expected flow conditions. The separator should be a multiple chamber design consisting of a sand & grit removal area, baffles to control flow velocity, and a coalescing filter to separate and remove the oil. The oil/water separator should have sufficient access manways to perform appropriate inspection and maintenance operations. The separator shall be equipped with audible and visual alarms for oil levels, hydrocarbon build-up and for leak detection. A description of the proposed oil/water separator must be submitted to the Department of Public Works with the sewer connection application. The submittal shall include a list of materials that will be stored or utilized in or adjacent to the area of the floor drain(s). Additional treatment requirements, protection or surety may be required by the Town, after review of the sewer connection application, on a case by case basis. The oil/water separator shall be inspected monthly and cleaned in accordance with the manufacturer's recommendations or when the level of waste oil is 25% of the effective depth or at least every 3 months, whichever comes first. A copy of the inspection & cleaning shall be

submitted to the Barnstable Department of Public Works Water Pollution Control Facility.

Force Mains and Low Pressure Sewers

PVC pipe for force mains or low-pressure sewers shall be Schedule 40 or SDR 21. Ductile iron pipe shall conform to ANSI Standards A21.50 and A21.51, Thickness Class 52 and shall have either mechanical joint or a type of joint which employs a single, elongated, grooved rubber gasket. Rubber gaskets shall be oil-resistant, conforming to ANSI Standard A21.11. Inline flushing connections shall be installed at the terminus of pressure lines. Distance between cleanout / flushing connections shall not exceed 600 feet. Air release valves shall be installed at each high point on a force or pressure sewer and shall be placed in a precast manhole for ease of maintenance.

Vacuum Valve Pit and Buffer Tank Connections

The building sewer connecting to a vacuum valve pit shall be constructed of Schedule 40 or SDR-21 PVC pipe. The pipe shall be connected to existing pipe stubs from the valve pit or buffer tank. The contractor shall field verify the invert elevation at each buffer tank or valve pit to be connected. Valve pits are provided with 4-inch stubs and will require the use of 4-inch x 6-inch eccentric reducers for commercial connections. Reducers shall be located within 2 feet of the valve pit for proper connection. Gravity piping to the valve pit or buffer tank shall be installed with proper slope and bedding as specified in this document. Pipe joints shall be as specified under the "Pipe Joints" section.

The Department of Public Works shall be notified a minimum of 48 hours prior to making the final connection to any valve pit or buffer tank. Connections shall be scheduled with the Department of Public Works to allow for the installation of the vacuum valves within the valve pit. Vacuum valves shall only be installed following the installation of the vent pipe but prior to final connection to the building. Valve installation shall be performed by the Town during the hours of 8:00 am to 1:00 pm, Monday through Thursday excluding all Holidays.

Vacuum Sewer Vent Piping

A minimum 4-inch diameter vent pipe shall be provided at the exterior wall of the building for all sewer connections to valve pits or buffer tanks connected to the vacuum

sewer system. All above ground vent piping shall be schedule 80 PVC and shall have a stainless steel bird screen. Vent piping shall be located at least 20 linear feet away, but not more than 75 linear feet, from the valve pit or buffer tank. Bollards or similar Department of Public Works approved protective devices shall be installed to protect above-grade piping at all commercial and/or industrial sites. Protective devices for residential installations shall be required as determined by Department of Public Works sewer inspector.

Connection of Pressure Sewers to Vacuum Valve Pits or Buffer Tanks

Force main piping shall be as specified under the “Force Main and Low Pressure Sewers” section and gravity piping shall be constructed of SDR-21 PVC pipe. A minimum of 20 feet of gravity piping shall be provided at proper slope prior to entering the valve pit or buffer tank. Force main and low-pressure sewer systems may only connect to a vacuum sewer system after approval from the Department of Public Works. Any force main and low pressure sewer system allowed to connect to a vacuum sewer system shall not pump to a rate greater than that listed on the following table.

Vacuum Sewer Connection Via:	Maximum Allowable Pumping Flow Rate ⁽¹⁾
Valve Pit (1 valve)	15 gpm (maximum 50 gallon pumping volume per cycle)
Single Valve Buffer Tank (1 valve)	15 gpm commercial; 30 gpm residential
Dual Valve Buffer Tank (2 valves)	30 gpm commercial; 60 gpm residential
Dual Buffer Tank with Splitter MH (4 valves)	60 gpm commercial; 120 gpm residential

Note:

1. Maximum allowable pumping flow rate for buffer tanks is the total of all connections to the buffer tank(s).

With prior approval from the Department of Public Works, wastewater may be pumped up to a properly designed and constructed distribution box or sampling manhole upstream of the valve pit or buffer tank and then connected to the valve pit or buffer tank by gravity as describe above. Flows shall not exceed those as shown on the table above. Distribution boxes and manholes shall be constructed of pre-cast reinforced concrete or other prefabricated materials acceptable to the Department of Public Works. A description of the proposed distribution box connection must be submitted to the Department of Public works with the sewer connection application.

Pumping Stations Connecting to Gravity Mains

Pumps shall be either factory pre-assembled grinder pump(s) or non-clog centrifugal pump(s) capable of passing 4" solids, appropriately sized for required capacity at the system design head. The pre-engineered pump station shall consist of either submersible pump(s) within a wet well or dry pit pump(s) housed separately from the wet well. Either shall have appropriate level controls within the wet well. A separate electrical control panel, with warning alarms connected from the wet well level controls shall be contained within a watertight exterior enclosure or be located within a building. A red flashing alarm light shall be located on the exterior of the building at a location visible from the street. The alarm system shall be equipped with an audible alarm with override. The pre-engineered pump station shall have a check valve and a gate valve in the discharge line of each pipe, located outside the wet well and contained within a pre-cast pit for accessibility and servicing. Single-family residential sewer connections may be served by a simplex pump installation, all commercial or industrial sewer connections and multiple residential sewer connections shall install a duplex pump system.

The pressurized discharge line must be installed for the shortest distance feasible, at which point the force main must be connected to a gravity line. The gravity line connection may consist of a precast concrete manhole.

Saddling of Existing Pipelines

No direct sewer connections or repairs shall be made to a vacuum sewer, except by written permission of the Department of Public Works. All proposed connections to a vacuum sewer shall be accompanied by a written request from the owner, and/or contractor, clearly identifying the proposed flow to be connected, to allow the Town to determine the impact on system capacity and allow for proper sizing of required valve pit or buffer tank. Only following verification of sufficient available capacity of the vacuum system shall the DPW issue approvals for connection.

When a gravity sewer connection must be made into an existing sewer main, where a service connection is not available, the sewer connection shall be tied-in using an appropriate tapping saddle or PVC wye. The tapping saddle shall be made of stainless steel or other material acceptable to the Department of Public Works. The saddle shall be a wrap-around type with full-length internal gasket and multiple stainless steel nut and bolt clamps. The sewer main shall be cleaned of all dirt and foreign matter and inspected for any scores, dents, pin-holes, small surface cracks or other injurious

defects which may interfere with the proper installation or operation of the saddle. The saddle and tapping shall be installed according to the manufacturer's recommendations and in such a manner so as not allow any exfiltration of wastewater from the sewer main or infiltration of groundwater into the sewer main. The sewer main and service pipe shall be encased in concrete for a distance of twelve inches beyond the tapping saddle.

For installation of a PVC wye tie-in, a suitable length of sewer main shall be cut out using a saw with a high speed rotating cutting blade. The sewer main pipe ends shall be wiped clean with a clean cloth. All rough edges and burrs shall be removed or smoothed. Any foreign material shall be removed from the sewer main prior to installation of the tie-in wye assembly.

The sewer main tie-in assembly shall consist of an appropriately sized PVC wye, two short lengths of PVC transition pipe with spigot ends, and two PVC repair slip couplings (for PVC sewer main tie-ins) or two flexible couplings (for tie-ins to vitrified clay, AC transite, steel or other types of sewer main pipe).

All couplings, pipe, wyes and other materials shall be examined, prior to installation, and shall be clean and free of any injurious defects. The PVC wye and repair coupling gaskets shall be free of any cuts, slices, abrasions or other defects which could interfere with a proper fit of all pieces. The flexible coupling gaskets shall be free of any cuts, slices, abrasions or other defects. The flexible coupling body shall be free of any cracks, inclusions, dents or other defects. The threads on the flexible coupling bolts and collar shall be free of cracks, burrs, rust or other defects which could interfere with the proper fit and function of the coupling and tie-in assembly.

The tie-in assembly shall be installed and shall not allow any exfiltration of wastewater from the sewer main or infiltration of groundwater into the sewer main.

Vehicular Traffic

When a building sewer connection or other appurtenant structures may be subject to vehicular traffic, the system should be designed and constructed to withstand H-20 wheel loads.

Erosion Control

During the construction project, soil erosion can be a major contributing factor to environmental pollution. In order to minimize the effect of sedimentation, washouts, etc., during construction activity, erosion control devices shall be installed for the duration of the construction.

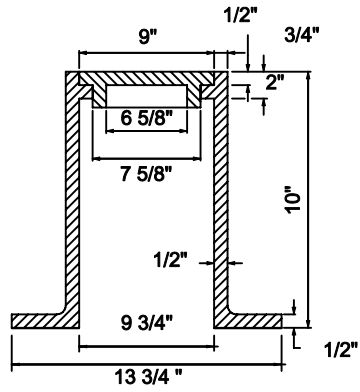
The form and design of the controls will vary with the area that is to be protected and the anticipated cause of the environmental degradation. In most situations the type and location of controls can be determined during the design phase, however, field conditions may require a reevaluation of the controls needed during construction.

Erosion control methods must be submitted to the Department of Public Works for review and approval.

Gravity Sewer Limitations

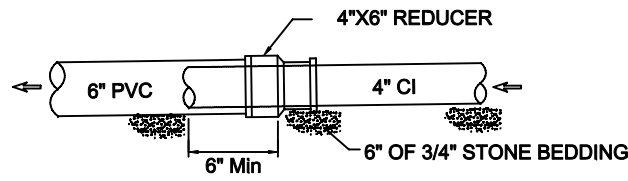
Gravity sewers may not be available to service a basement or other below ground area. In such situations the sanitary sewage shall be lifted, by a pumping system or other approved means, and discharged to the building sewer. The pressurized discharge line must be installed for the shortest distance feasible, at which point the force main must be connected to a gravity line. The gravity line connection may consist of a precast concrete manhole. Before design is begun the Department of Public Works should be contacted to determine the availability of service for below grade connections.

The Town attempts to maintain records concerning the location of available sewer stubs and existing sewer connections, but does not guarantee the accuracy of these records. If the Towns' records are discovered to be incomplete or inaccurate, the contractor and property owner may be required to submit a revised application design for the sewer tie-in.



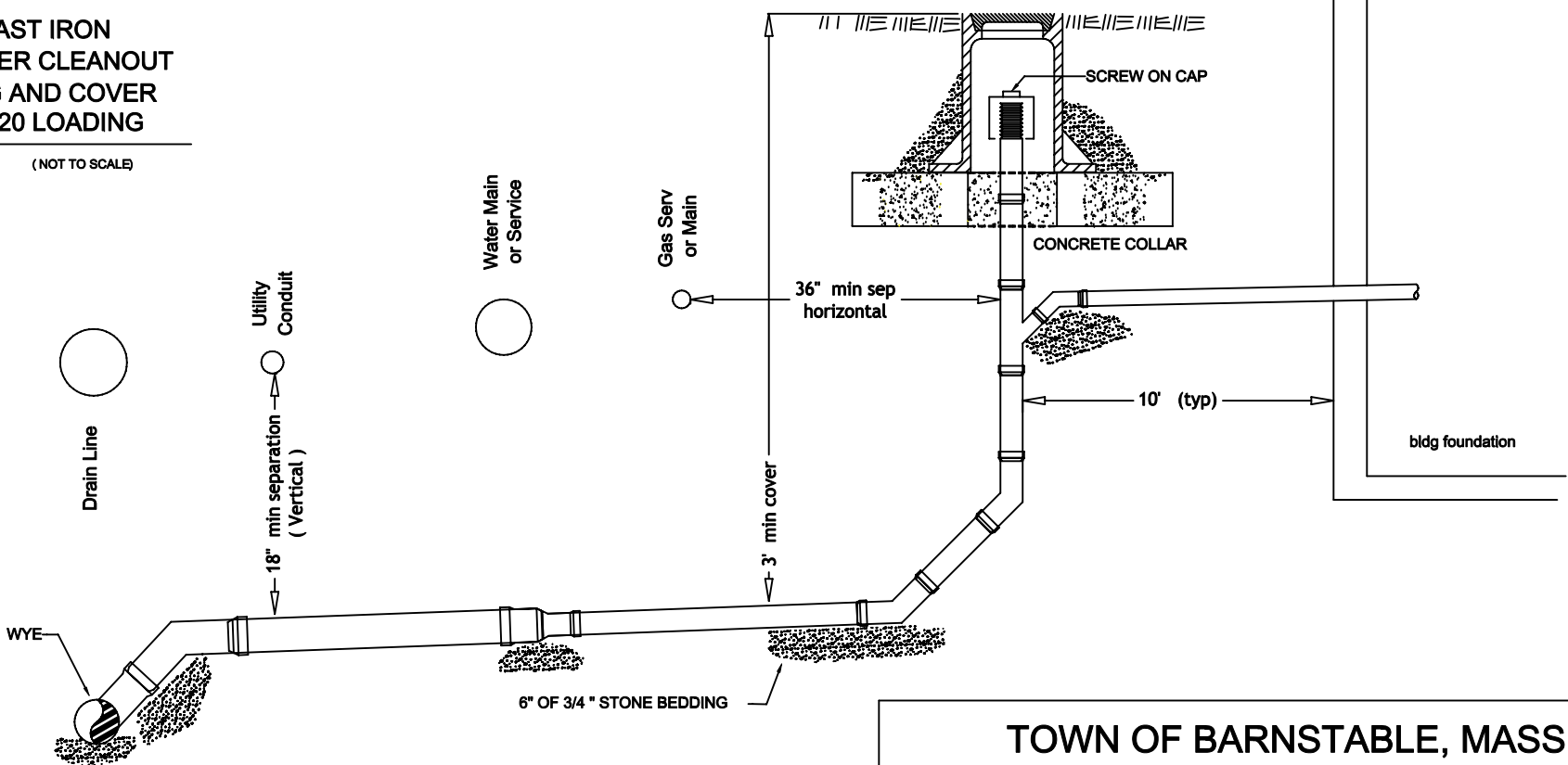
**CAST IRON
SEWER CLEANOUT
RING AND COVER
H-20 LOADING**

(NOT TO SCALE)



4"X6" PVC REDUCER

(NOT TO SCALE)

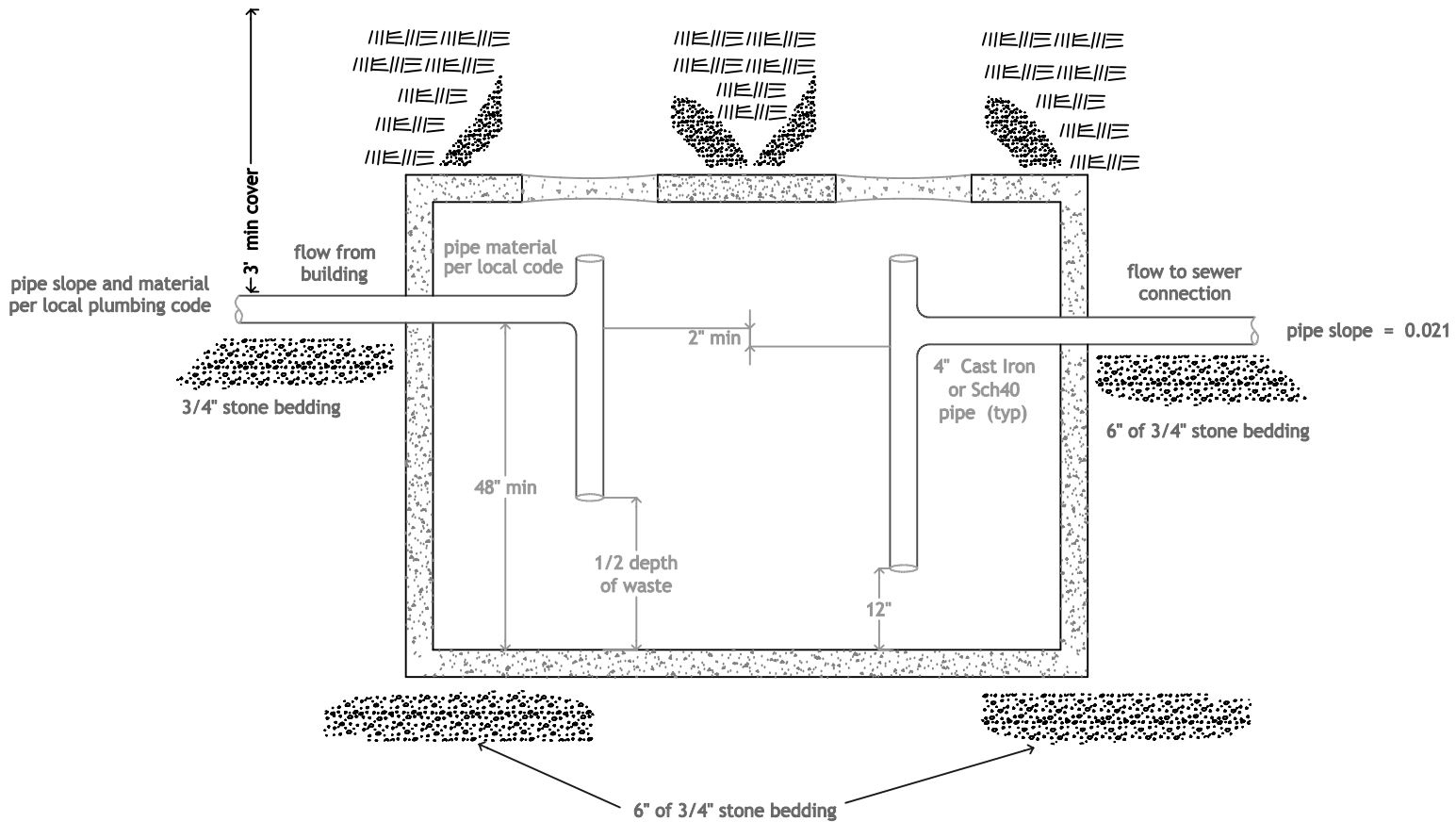


DROP CLEAN OUT
NOT TO SCALE

**TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS**

**Building Sewer Connections
Details for Drop Clean-outs**

Scale : As Noted	Drawn By : JHC & DJA
Date : Jan , 2007	Designed By : DJA



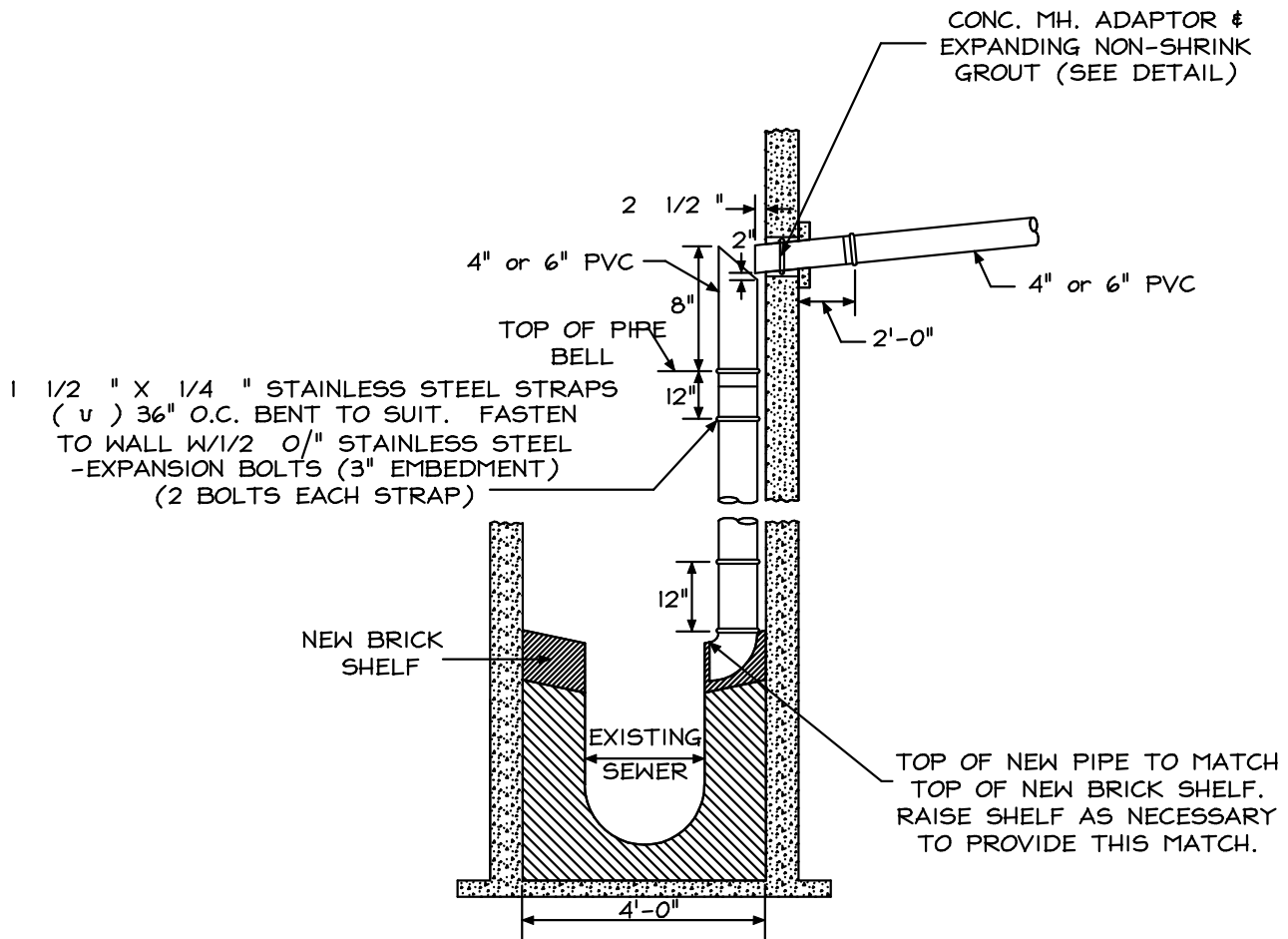
Grease Trap / Waste Interceptor
NOT TO SCALE

TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS

Building Sewer Connections
Details for Typical Grease Trap

Scale : As Noted
Date : July , 2010

Drawn By :
Designed By : DJA



1 1/2 " X 1/4 " STAINLESS STEEL STRAPS
(v) 36" O.C. BENT TO SUIT. FASTEN
TO WALL W/1/2 0/" STAINLESS STEEL
-EXPANSION BOLTS (3" EMBEDMENT)
(2 BOLTS EACH STRAP)

CONC. MH. ADAPTOR &
EXPANDING NON-SHRINK
GROUT (SEE DETAIL)

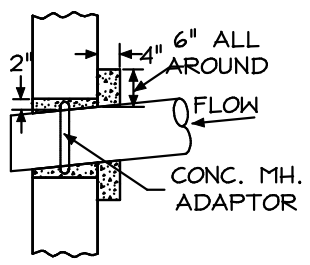
NEW BRICK
SHELF

EXISTING
SEWER

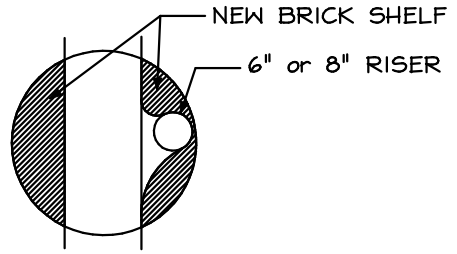
TOP OF NEW PIPE TO MATCH
TOP OF NEW BRICK SHELF.
RAISE SHELF AS NECESSARY
TO PROVIDE THIS MATCH.

ELEVATION

(NOT TO SCALE)



CONCRETE MH. ADAPTOR
(NOT TO SCALE)



PLAN
(NOT TO SCALE)

NOTE: FIELD CHECK HEIGHT OF EXIST.
BRICK SHELF BEFORE INSTALLING NEW
PIPE AND LOCATION OF EXIST. RUNGS.
INSTALLATION OF DROP PIPE NOT TO
INTERFERE WITH EXIST. RUNGS OR
ACCESS THERE ON.

TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS

Building Sewer Connections
Inside Manhole Drop

Scale : None	Drawn By :
Date : Feb , 2003	Edited By : DJA

FINISHED GRADE (PAVED AREA)
PER ROAD OPENING REQ
FINISH GRADE (UNPAVED AREAS)
AS APPROVED BY ENGINEER

ADJUST TO GRADE WITH
2 BRICK COURSE MAX &
WITH 3/8 " MORTAR JOINTS
OR WITH FRAME RISER RING.
BED FRAME IN FULL 3/8 " MIN.
MORTAR BED.

MANHOLE JOINT SHALL
BE SEALED WITH
BITUMASTIC SEALANT

COMPLETELY FILL ANNULAR
SURFACE WITH NON SHRINK
GROUT ON INSIDE OF MANHOLE

PIPE TO MANHOLE JOINT
TO BE FLEXIBLE SLEEVE
AND STAINLESS STEEL
STRAP OR APPROVED EQUAL

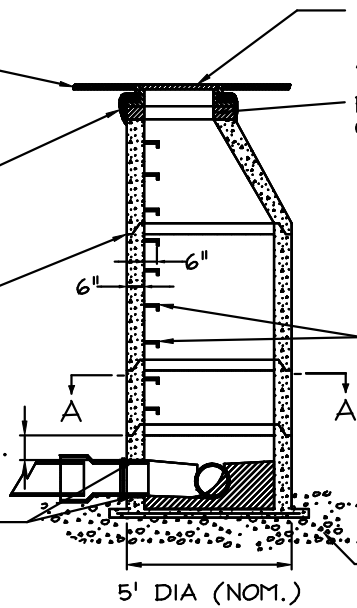
HEAVY WEIGHT, H-20 LOADING
FRAME AND COVER, REFER
TO SEWER SPECS FOR
ADDITIONAL COMMENTS

POINT UP BRICKWORK
ON THE INSIDE

4' DIA (NOM) PRECAST
REINFORCED CONCRETE MANHOLE
BASE, RISER(S) & ECCENTRIC CONE
2', 3', OR 4' HT. (TYP.)

STEEL REINFORCED POLYPROPYLENE
STEP, 12" O.C. (TYP)

1' 0" MIN.

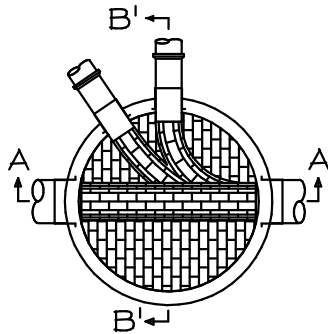


ELEVATION VIEW

SEWER MANHOLE (TYP)

(NOT TO SCALE)

6" HOUSE SERVICE OR
MAIN LINE SEWER LOCATION
TO BE DETERMINED IN FIELD



SECTION VIEW A - A

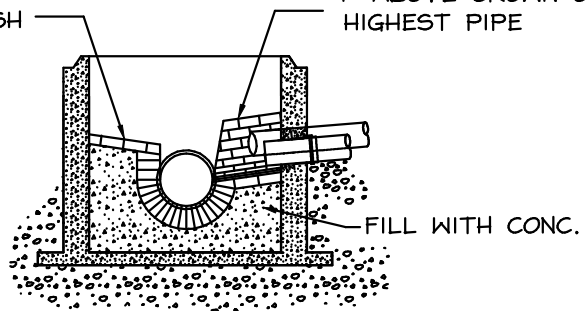
(NOT TO SCALE)

USE 4'-0" LENGTHS
AT MANHOLES MAX.
(TYP.)

NOTE: CARE SHALL BE TAKEN
TO INSURE THAT THE
BRICK INVERT IS A
SMOOTH CONTINUATION
OF THE SEWER INVERT.
INVERT TO BE INVERTED
ARCH WITH BRICKS LAID
AS STRETCHERS AND
ON EDGE.

1" WASH

TOP OF SHELF SHALL BE
1" ABOVE CROWN OF
HIGHEST PIPE



SECTION VIEW B' - B'

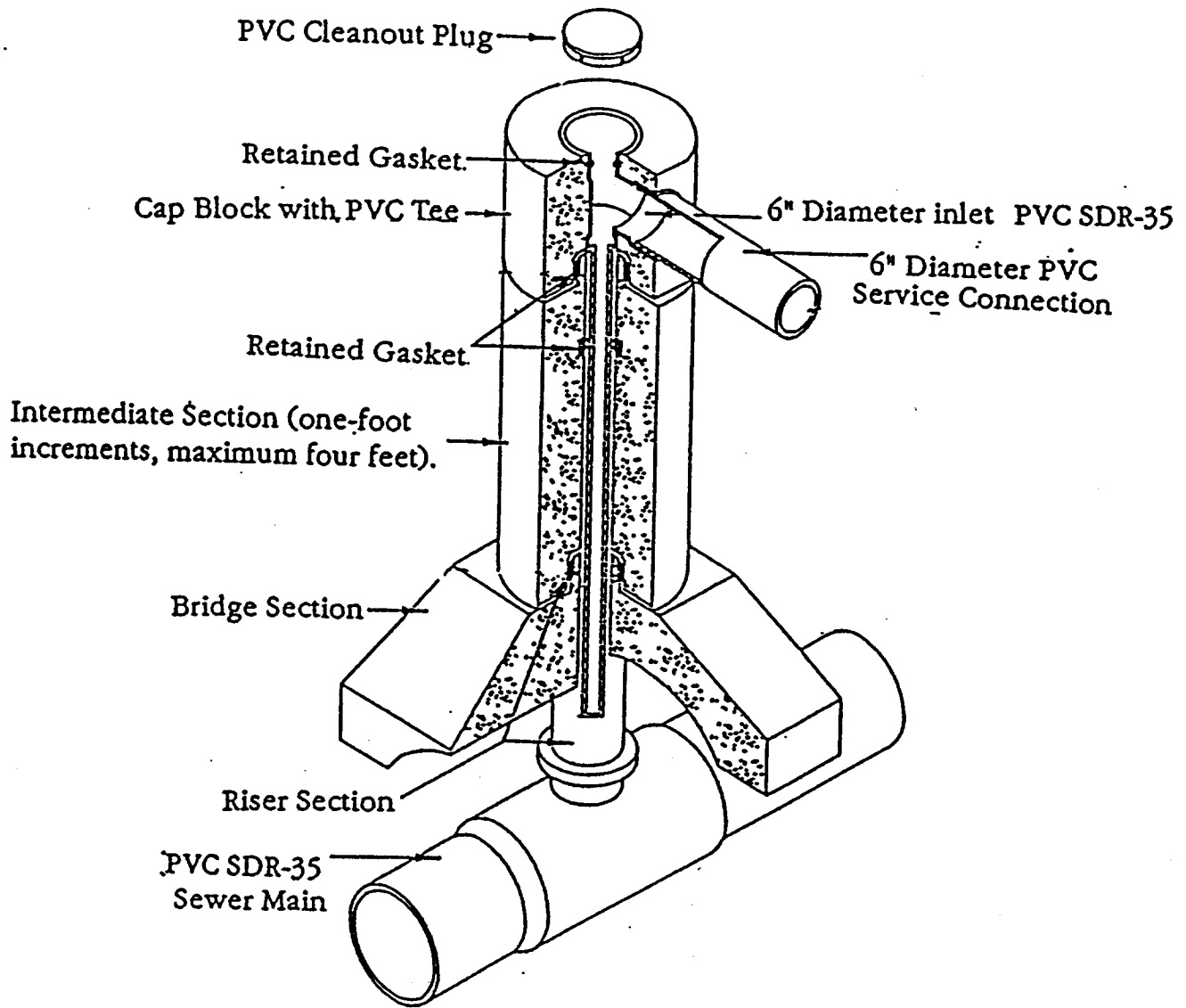
TYPICAL DETAIL OF BRICK INVERT

(NOT TO SCALE)

TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS

Building Sewer Connections
Standard Details for Manholes

Scale : As Noted	Drawn By : JHC
Date : Feb , 2001	Designed By : DJA



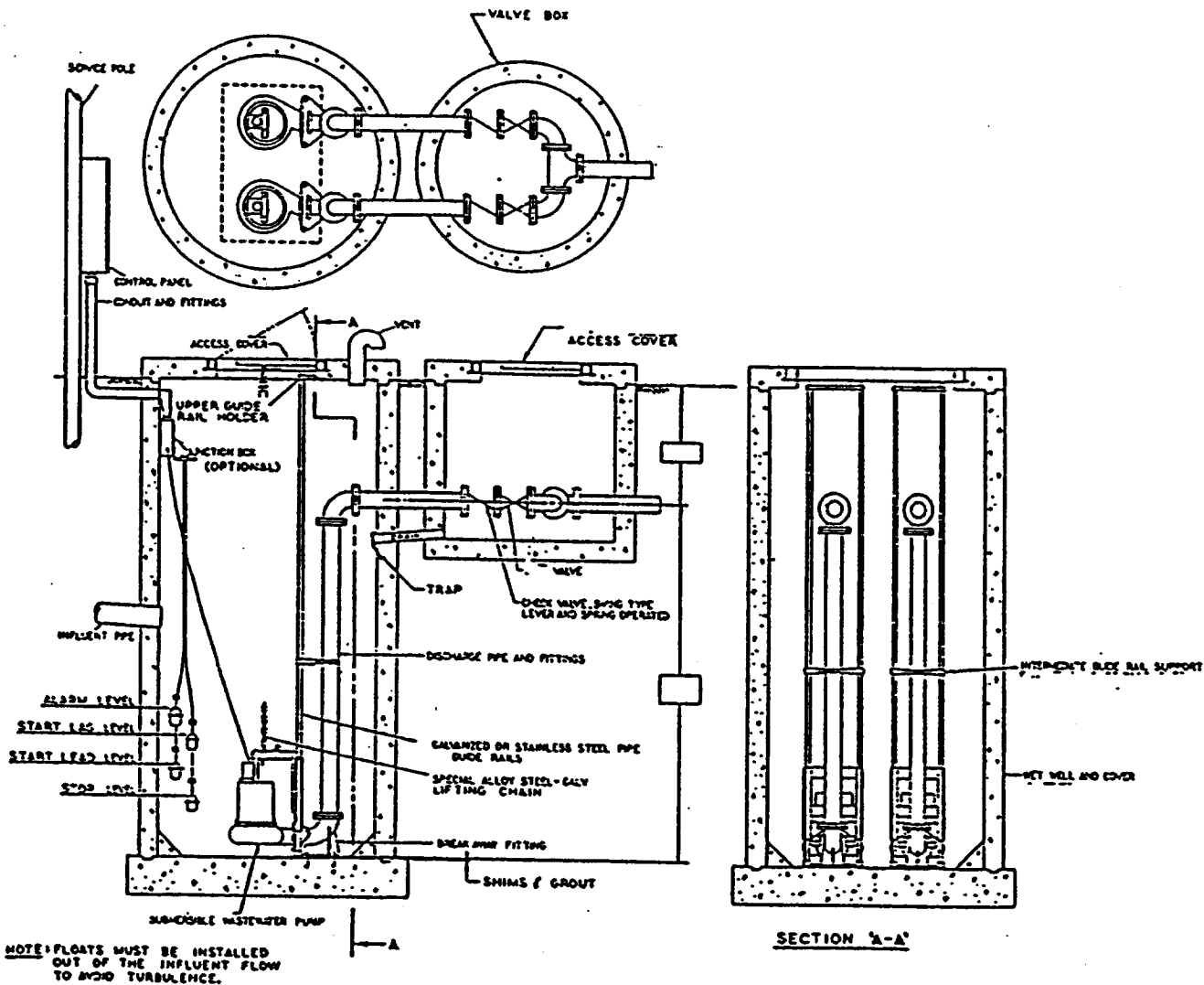
Town of Barnstable

Standard Detail of:

Precast Concrete Chimney
pre-cdn-chim

Department of Public Works

Scale: None



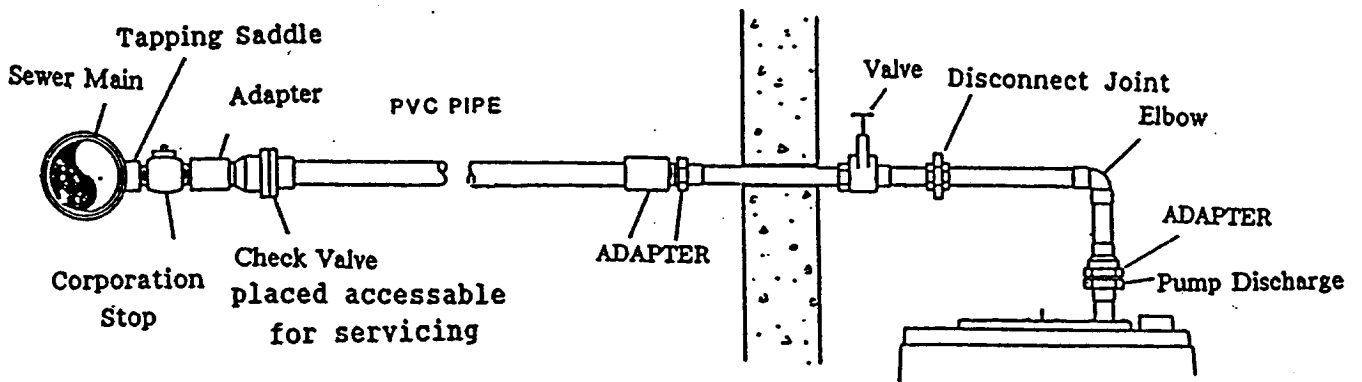
Town of Barnstable

Standard Detail of:
 Duplex Submersible
 Pump Station

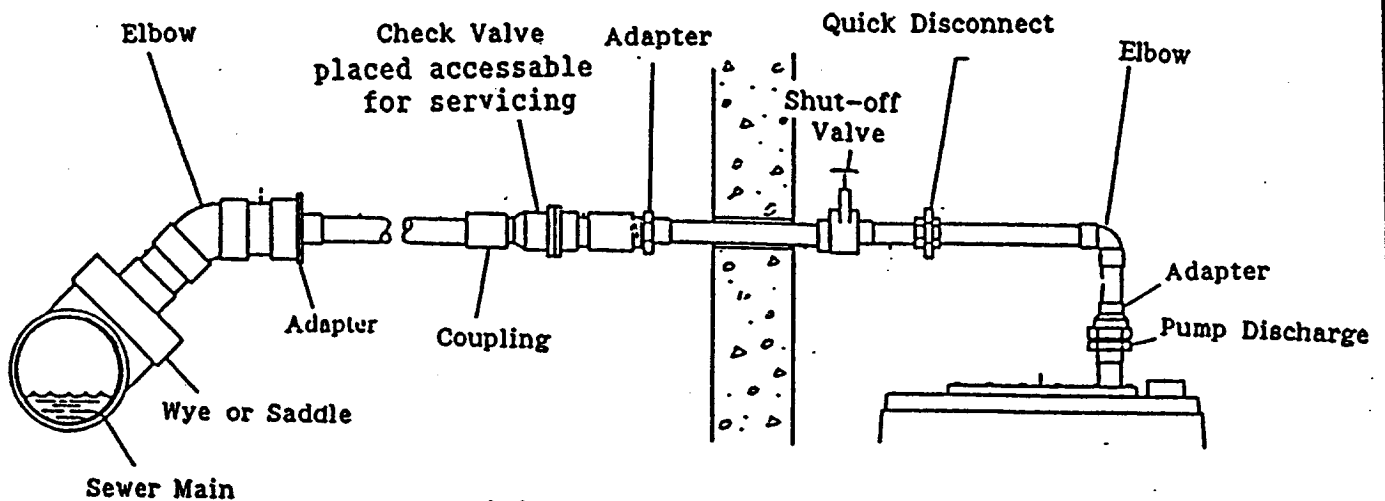
Department of Public Works

DUP-SUB

Scale: None



Piping to Low Pressure Sewer Main



Piping to Gravity Sewer Main

Town of Barnstable

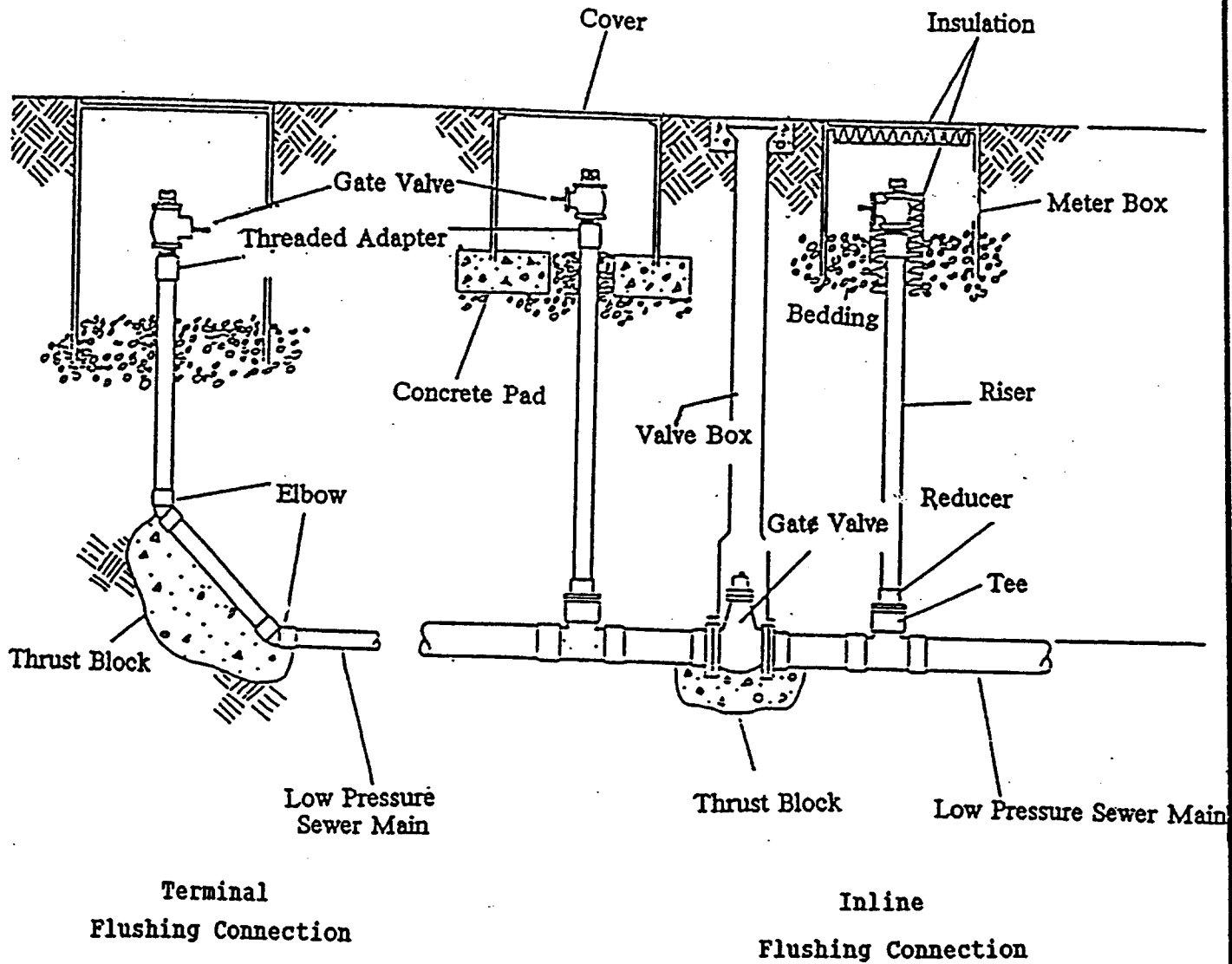
Standard Detail of:

LOW PRESSURE SEWER

DISCHARGE PIPING

Department of Public Works

DIS. pipe Scale: None



Town of Barnstable

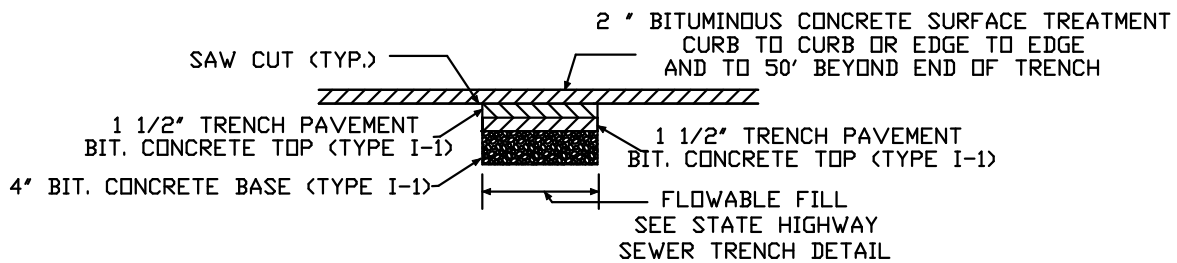
Standard Detail of :

Flushing Connection
FLUSH-CAN

Department of Public Works

Scale : None

REMOVE & EXCAVATE TRENCH
TO A DEPTH OF 7"



STATE ROADS - OVERLAY & TRENCH PAVEMENT
With CONTROLLED DENSITY FILL

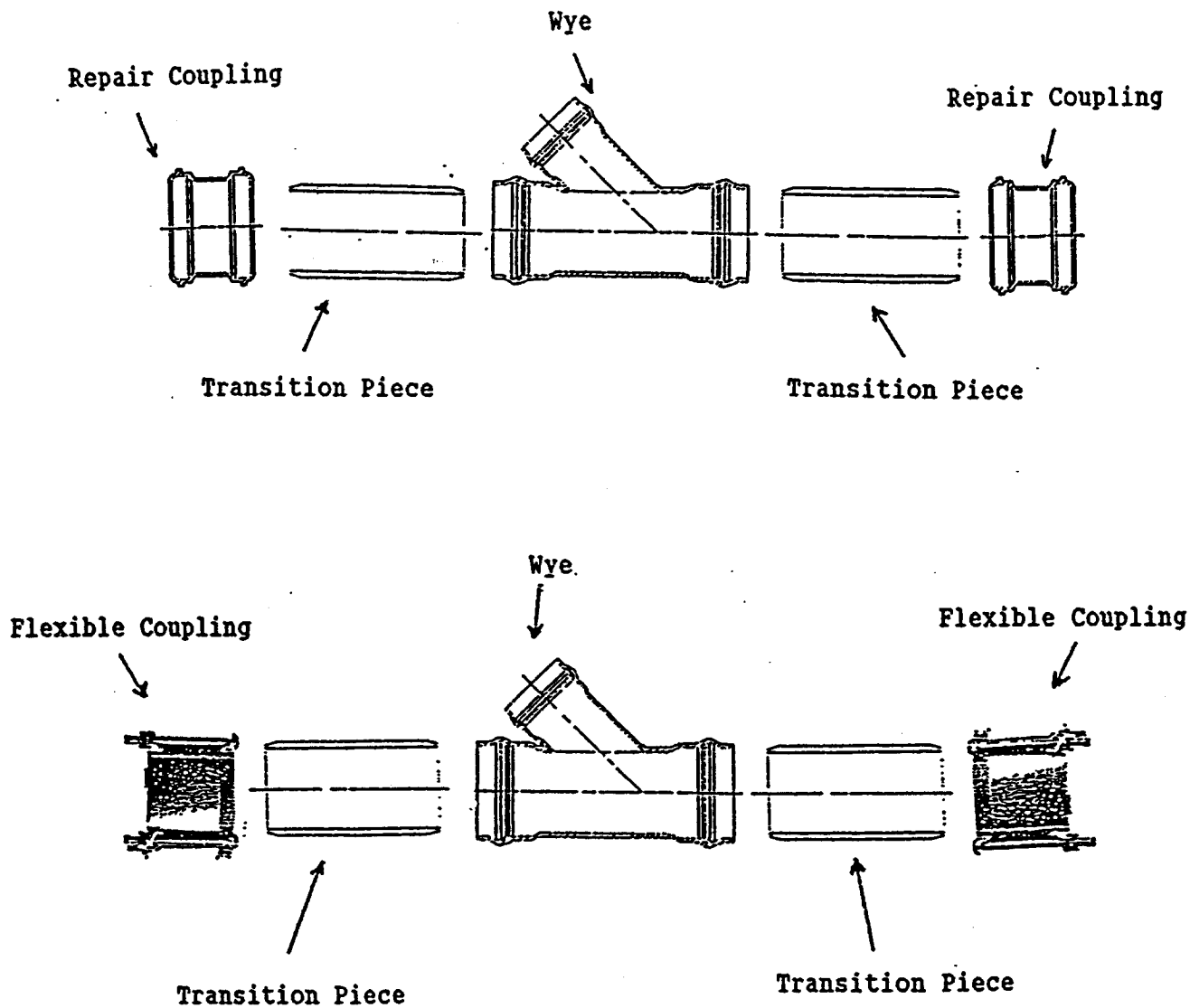
(NOT TO SCALE)

PAVEMENT REPLACEMENT

TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS

DETAIL FOR STATE HIGHWAY
PAVEMENT REPLACEMENT

Scale : None	Drawn By :
Date : Feb , 2003	Edited By : DJA

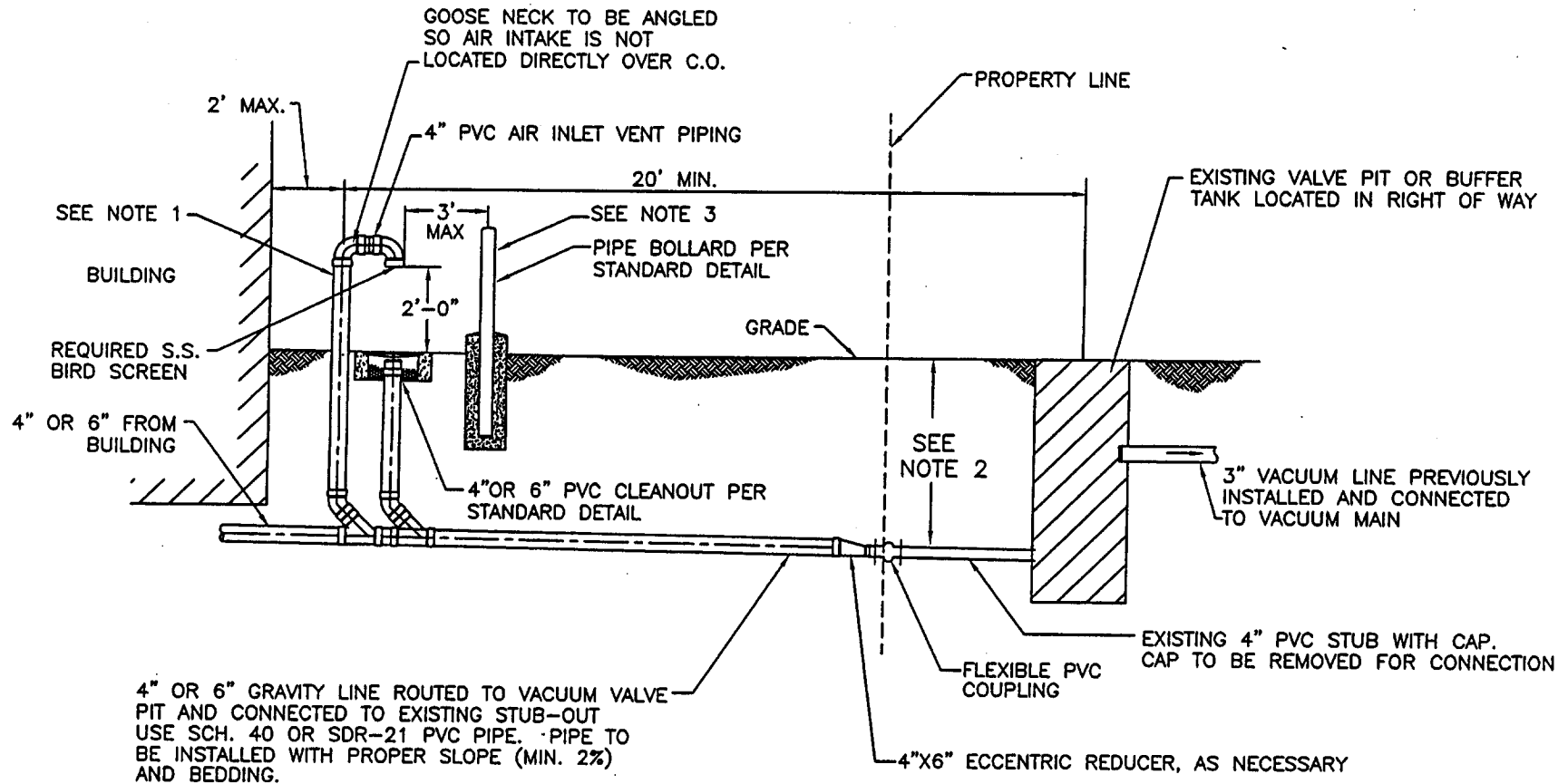


Town of Barnstable

Department of Public Works

Standard Detail of:
 Sewer Main
 Tie - in
 Scale: None

Tie-in



**TYPICAL BUILDING CONNECTION TO VACUUM
SEWER VALVE PIT/BUFFER TANK**

NOT TO SCALE

NOTE:

1. VENT PIPING LOCATED ABOVE GRADE SHALL SCH 80 PVC.
2. APPROX. DEPTH OF STUB TO VALVE PITS IS 4'-6" TO 6'-6". DEPTHS FOR BUFFER TANKS - CONTRACTOR TO REFER TO ASBUILTS AS PROVIDED BY TOWN.
3. BOLLARD NOT TO BE LOCATED DIRECTLY OVER SEWER PIPE.
4. PROVIDE BOLLARD(S) AS REQUIRED TO PROTECT VENT PIPING.

**TOWN OF BARNSTABLE, MASS
DEPARTMENT OF PUBLIC WORKS**

Standard Detail Of: Building Sewer
Connections To Valve Pit Or Buffer Tank

Scale: As Noted	Drawn By: JJO
Date: Jan, 2003	Designed By: JJC

BLD-50W