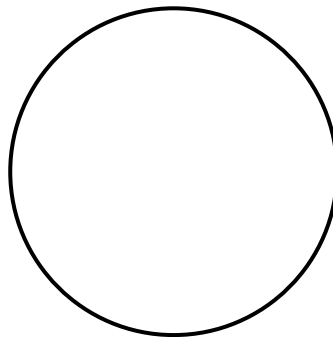




TOWN OF HILLSBOROUGH TECHNICAL SPECIFICATIONS AND DESIGN STANDARDS FOR WATER AND SANITARY SEWER SYSTEMS

Last Revision Date: March ~~13~~27, 2023



This main document is incorporated into Town Code Chapter 14, Appendix F through adoption by the Board of Commissioners and subject to enforcement through such adoption. The appendices to this document may be modified outside of Board of Commissioners adoption, as necessary.

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TABLE OF CONTENTS

1. Introduction	2
2. Definitions.....	3
3. Utilities Department Review Process	4
4. GENERAL	5
A. <i>Design Guidelines</i>	<i>5</i>
B. <i>Construction and Inspections</i>	<i>7</i>
C. <i>Use of Town Water</i>	<i>8</i>
D. <i>Blasting Operations.....</i>	<i>8</i>
E. <i>Utility Easements</i>	<i>8</i>
F. <i>Utility Separations</i>	<i>9</i>
G. <i>Boring and Jacking</i>	<i>10</i>
H. <i>Directional Drilling</i>	<i>10</i>
I. <i>Utility Abandonment</i>	<i>11</i>
J. <i>Renewal or Relocation of Services for Redevelopment or Subdivision.....</i>	<i>12</i>
K. <i>Standard Details and Approved Materials List</i>	<i>12</i>
5. WATER	13
A. <i>Piping, Hydrants, Valves and Other Appurtenances.....</i>	<i>13</i>
B. <i>Backflow and Cross Connection Control</i>	<i>15</i>
C. <i>Meters, Vaults, and Services</i>	<i>16</i>
D. <i>Fire Protection Systems.....</i>	<i>18</i>
6. SEWER	18
A. <i>Piping, Manholes, Valves and Other Appurtenances</i>	<i>18</i>
B. <i>Sewer Services (Taps or Laterals).....</i>	<i>20</i>
7. SEWAGE PUMPING STATIONS	21
8. Collection and Distribution Acceptance Testing Requirements.....	24
A. <i>Water Distribution Flushing and Testing.....</i>	<i>24</i>
B. <i>Collection System Testing</i>	<i>26</i>
C. <i>Pumping Station Start Up Testing.....</i>	<i>26</i>
D. <i>System Final Approval and Acceptance</i>	<i>27</i>

Appendices

1. Introduction

These specifications shall apply to any projects that do not have construction drawings approved by the Town Utilities Department on or prior to the adoption date of the specifications into Town Code, or if a prior ~~design was approved~~ design plan was granted more than one year prior with no construction activity as of the adoption date, or when a previously approved utilities design plan is significantly modified. Approvals are required in writing and prior to implementation where “as approved by the Utilities Director or designee” or “as approved by Utilities Inspector” is indicated unless otherwise specified. Utilities Department approvals may be granted separately from the Town’s planning review process depending on the situation.

Purpose of specifications:

- Convey the Town’s requirements related to design and construction of water and sewer system extensions and modifications proposed for dedication to the Town for operation and maintenance or connecting to the Town’s water and sewer system.
- Provide additional guidance to requirements established in the Town ordinances.

These specifications are complemented by other Utilities Department documents like Standard Details, As-Built Digital Submittal Requirements, ancillary specifications, Developer’s Checklist, and approved product lists. These specifications do not cover stormwater conveyance systems or management facilities or roadways to the extent new roads are being developed.

These specifications are not intended to supersede any federal or state regulations or design criteria or required permitting or regulatory approvals. These are not inclusive of all standard specifications required for construction, such as typical Division 1 Specifications for trenching, shoring, backfill, excavation, etc. Where conflict may occur, the more stringent specification shall apply. Ordinances take precedent if there is a significant difference in established requirements. This document takes precedence over any discrepancies in the Standard Details. Generally, wherever the provisions of this document conflict with the provisions of any other law, ordinance, or regulation, the standards of the more restrictive law, ordinance, or regulations shall govern. This document does supersede any previous versions of the Town’s technical specifications at such time it is adopted into code.

It is highly recommended to discuss capacity and utilities layout with Town Utilities staff prior to initiating land purchases, rezoning, master planning, special use permits or significant engineering design. Approval of drawings and specifications does not constitute a reservation of water and sewer capacity for a proposed project. Water and sewer capacity shall be reserved when the Town approves a building permit, in the case of single connections, signs off on state water and sewer permit applications and the terms of the executed Water and Sewer Extension Contract where extensions are involved.

The Town has several areas within its distribution system that do not support necessary fire flow. The Town will conduct fire flow testing upon request at test and flow hydrants selected by the applicant. The report will be provided upon payment by the applicant of the fee as outlined in the current fee schedule. The report provided by the Town is for informational purposes only and is not a guarantee of fire flow availability or a commitment to provide a defined level of fire protection.

2. Definitions

As-Built Digital Submittal Requirements – Document containing the Town's requirements for providing as-built record drawings and digital data for incorporation into Town mapping and work order systems.

ASTM – American Society for Testing and Materials

AWWA – American Water Works Association

Capacity - Capacity is defined as that available in the Town's treatment facilities and conveyance systems that would provide for the project. It also includes capacity and storage to provide available fire flow to a project in accordance with plumbing or fire code, as applicable

County – Orange County, North Carolina

Designee – Designee named by the Utilities Director who is authorized to comment upon, reject or approve project submittals and allow deviations from Town standards

Developer's Checklist – A checklist of items developers can utilize through the development process which is tied to the Town's requirements for design, construction and acceptance of water and sewer infrastructure

DIP – Ductile iron pipe

HDPE – High density polyethylene pipe

NCDEQ – North Carolina Department of Environmental Quality

NCDOT – North Carolina Department of Transportation

NCRR – North Carolina Railroad

PE – Polyethylene pipe

PVC – Polyvinyl chloride pipe

ROW – Right of Way

Standard Details – Standard detail drawings for common water and sewer appurtenances and construction

Town – Town of Hillsborough, North Carolina

Town Code – The Code of Ordinances of the Town of Hillsborough, North Carolina, in particular, Chapter 14 and any related chapters regarding utilities

Utilities Director – The Director of the Town's Utilities Department

WEF – Water Environment Federation

WSEC – Water and Sewer Extension Contract

3. Utilities Department Review Process

The Town contracts with Orange County for building permit issuance within the Town's water and sewer service area, including where connections or extensions will occur to Town infrastructure located outside Town limits and within its primary service boundary. As such, the process through the County that requires utilities review and sign off on permits and certificates of completeness (occupancy) will take longer for approval. The Utilities Department has five days to act on building permit approvals and sign offs. Please plan accordingly when scheduling anticipated work, occupancy, and new home closings. The Department will do its best to accommodate schedules but should not be pressured to act before fully satisfying utilities requirements. In the case of new single building projects, delays can be avoided by contacting the utilities department prior to submitting for a building permit as fees are due and a connection request form must be completed.

For larger projects, the Utilities Department participates in the Technical Review Committee (TRC) process initiated by the Planning Department. The Utilities Department will provide general comments on site plan submissions and more detailed comments on construction drawings. The Utilities Department will still require an issued for construction plan and specification set, including any required calculations, for separate approval because oftentimes construction drawings are modified between planning department approval and construction due to state permit comments or site changes. Any extensions of the Town's water and sewer system will require an extension agreement. Such agreement provides for the capacity reservation, project description, pre-construction, construction, post-construction conditions, fees, and any special stipulations. The Development Checklist found on the Town utilities webpage has common items the department confirms for any water or sewer extensions. Building permits will not be approved before fees are paid, state permits and encroachments are obtained, and a utilities pre-construction meeting has occurred. Certificates of Completeness will not be released until engineering certifications, and as-built digital submittal requirements are met.

Approval by the Utilities Department on utilities plans does not negate or incorporate the requirements for other federal, state, county or Town approvals which may include those from Town planning, floodplain, county building permits or erosion control, stormwater, encroachments, street utility cuts, septic tank abandonment, etc. Nor does approval of plans by other state, Town or county departments constitute approval by the Utilities Department.

New developments and redevelopments are subject to fees as established in the approved Town fee schedule. Fees shall be paid before any building permits are approved and before any construction begins in the case of projects involving extensions, amongst other stipulations in an extension contract.

The Utilities Department shall review in advance all projects that may impact the Town's utility system even if the work is not extending or connecting to system (i.e., telecommunications, street widening, landscaping in ROW).

4. GENERAL

A. Design Guidelines

All sewer projects shall be designed and constructed in accordance with the State's Minimum Design Criteria for the Permitting of Gravity Sewers and the Minimum Design Criteria for the Permitting of Pump Stations and Force Mains and 2T regulations. All water projects shall meet the requirements of the Public Water Supply Section 15A NCAC Chapter 18 regulations and its Engineering, Planning and Development Guidance Document. Any deficiencies or variances to these require supplemental review and permitting approval by the State and may not be accepted by the Town of Hillsborough. The Town may implement additional requirements to these Minimum Design Criteria either in these Specifications, Town Code or through subsequent reviews as necessary.

When designing new water and sewer extensions, care shall be taken to satisfy Town Code, Section 1-4, state design criteria, and Standard Details with respect to separation from other utilities. Designs shall avoid placing meter boxes, valves and manholes in wheel paths, driveways, and sidewalks. Water lines shall generally be installed on the north or west sides of road right of ways, and sewer on the south or east sides of road right of ways where practical. Water and sewer lines should be installed outside of paved areas where practical. Plan profiles should always have north facing up and be 1:30 or 1:40 scale.

The presence of a Standard Detail does not mean it is necessarily approved for a utility installation scenario. The Town will require review and approval of external specifications and complete construction drawings prior to implementation and approval of projects. It is expected that any connections to the Town system, whether public or private, service tapping or extensions, be constructed to state and Town standards, industry standards as referenced, or plumbing code, current versions, as applicable. Where industry specifications are stated (i.e., AWWA or ASTM), the latest version of the specification at the time of construction shall be used unless special provisions on the construction plans state otherwise. NCDOT specifications do not take precedence over this document unless approved.

Where prior approval for a deviation, substitution or variance from Town specifications is required by the Utilities Director or designee, that approval must be granted *in writing prior to the subject improvement being implemented* unless otherwise indicated. Water and sewer infrastructure installed out of compliance with this document, Town Code, referenced AWWA/ANSI/WEF standards, or state regulations may be rejected by the Town for ownership and operation, or additional stipulations may be required for acceptance such as additional warranty, extra testing, or correction. These instances shall be an exception and not the norm.

Proposed multi-family residential and multi-building commercial, institutional, or industrial developments under single ownership on one parcel shall be master metered with appropriate backflow device per Chapter 14 of Town Code unless otherwise approved by the Utilities Director or designee. Sewer only connections are prohibited. Water only connections may be allowable if septic is approved by the Orange County Health Department, Environmental Health Division. Town Code governs the availability of water and sewer connections.

The Town will develop its water and sewer systems in an orderly and proper fashion and in compatibility with overarching development planning documents such as land use, connectivity, and sustainability as well as available capacity and the will of the Town Board of Commissioners. The Town may prohibit connections to undersized water and sewer mains (physical, pressure, fire flow, volume concerns), mains without recorded easement, mains in poor condition or of substandard material, or where crossing of other property with services is required or areas where no water or sewer front the property without necessary improvements by the developer to the system to eliminate these scenarios.

The Town of Hillsborough's water distribution system is not sized to meet ISO, Appendix B, or ISO fire suppression requirements in all portions of the service area. Construction drawings must show offsite improvements needed to meet a fire suppression standard adopted by the Fire Marshall or the project must document acceptance by the Fire Marshal of inclusion in a Tanker Task Force dispatch list.

As per Town Code, extensions shall be designed across the entire property frontage. The Town may require looping of water mains, oversized mains, pumping station improvements, or other improvements for Town and systemwide needs. Town Code governs any cost share scenarios.

Private wWater and sewer services shall not cross other property lines to reach the public system unless otherwise approved by the Utilities Director or designee. The Utilities Department will not support subdivision requests that isolate a parcel. Parcels that have no water or sewer frontage shall require a mainline extension at the owner/developer's cost or utilization of well and septic as permitted by the Orange County Environmental Health Division--

Projects involving uses requiring backflow prevention or that generate fats, oils and grease will be required to provide information regarding type and sizing of such protective devices as part of the review process. Projects that are considered significant industrial uses or will discharge chemicals of concern to the sewer system shall discuss the project with the Utilities Department in advance. The Town does not have an active pretreatment program but is concerned over "forever chemicals" like PFAS, PFOA, 1,4-dioxane and other chemicals that can harm the collection and treatment system and may require significant improvements to wastewater treatment due to regulatory requirements.

B. Construction and Inspections

48-hours' notice shall be required for utilities construction and inspections, including notice on all construction activity that might impact existing utilities. Construction activity requiring notice includes but is not limited to water or sewer installation or relocation, connection to existing utilities, adjustments or relocations of existing fire hydrants, pavement milling and/or resurfacing, dry utility installation in any ROW where utilities are present, acceptance testing, etc. Utilities construction activities shall normally be limited to between 7 a.m. and 4 p.m. Monday through Friday, excluding Town observed holidays, unless otherwise approved.

Construction shall not commence until all requirements of the Utilities Department are satisfied in accordance with Town Code, policy and any WSEC. This will include payment of necessary fees, approval of construction drawings, receipt of all required permits and encroachments, establishment of easements and participation in a pre-construction meeting with the Utilities Department, which may differ from other Town or county pre-construction meetings. The Town does not make water and sewer taps. A licensed utility contractor is required to perform any construction of main lines and tapping and only after a connection request has been made to the Utilities Department and fees paid.

Inspections shall be requested at least 48 hours in advance through inspections@hillsboroughnc.gov. Inspections are subject to fees as outlined in the Town's approved fee schedule. All fees shall be paid prior to approval of certificates of completeness or acceptance or warranty release of water or sewer extensions.

The Utilities Inspector's duties are to periodically observe the work. When a WSEC is executed, the developer shall utilize qualified 3rd party observation services for all meaningful water and sewer work. The 3rd party observer is responsible for preparing daily reports of the work with photographic documentation and documenting all acceptance testing activities. Failure to document key construction and testing may require exposure of the work or retesting. As the observation intent is to ensure quality construction in accordance with approved plans and best practices, the Town may hire a 3rd party observer, the cost of which services shall be reimbursed by the owner/developer for such services. The arrangement will be documented in the WSEC.

Construction practices shall comply with all applicable codes and industry standards, regardless of ultimate ownership. All hardware shall be 316L stainless steel. Changes to approved plans during construction regarding project use, demands, materials, alignment or appurtenance location or configuration shall be approved by the Utilities Department prior to the change being implemented. Changes made without approval as well as deficient workmanship or improper material use may be rejected by the Town and required to be redone in accordance with the approved plans. The nature of any changes may necessitate other approvals outside the Utilities Department.

Construction of assets to be dedicated to the Town will require a warranty period on installation and workmanship of two years after acceptance of the assets or as stipulated in the WSEC and be secured by a Letter of Credit or Maintenance Bond for 125% of the value of the water and sewer construction. The security shall require approval by the Town to cancel or to not renew. The security will not be released until the owner/developer requests the end of warranty walk-through and all punch list items are corrected to the Town's satisfaction, even if beyond the warranty period. It is the owner/developer responsibility to request acceptance of projects and for end of warranty review. Until such time as requests are made, a project will remain private and under warranty. The Town will not perform utility locates on private systems, respond to complaints or be responsible for reporting sanitary sewer overflows.

Restoration of Town or NCDOT roads or stormwater systems from water and sewer construction activities shall be in accordance with those departmental guidelines or Town Code relating to such. For Town funded projects, restoration of grassed areas shall be by hydroseeding only.

C. Use of Town Water

Rental of a hydrant meter through the Town's Financial Services Department or purchase of bulk water from the Town's Water Treatment Plant at 711 Dimmock's Mill Road are the only approved methods of obtaining water through the Town's water system. Utilizing a water hydrant, bypassing or jumping a water meter, or connecting to a hydrant using a meter not provided by the Town, or other connection to the Town's system is considered tampering and theft and will be subject to fees and penalties in accordance with Town Code.

D. Blasting Operations

Prior to any blasting operations for installation of new utilities or for general construction that may impact existing utilities, the contractor shall notify the Utilities Director and the Hillsborough Fire Marshal to obtain blasting permits as required. The contractor shall furnish proof (certification) of insurance specifically covering all obligations assumed pursuant to the use of explosives. Pre and post blasting video of the potential impacted area shall be provided, including televising of existing sanitary sewers in accordance with Town specifications.

E. Utility Easements

Utility easements shall be a minimum of 20 feet wide for a single utility pipeline, and a minimum of 30 feet wide for pipes deeper than 16 feet. For multiple pipes, easement shall provide a minimum of 10 feet clearance on either side of each pipe. Easement plats shall be recorded in the Orange County Registry as Town of Hillsborough Utility Easement. All easements shall be cleared of all trees and debris and graded to be "driveable" by Town staff in heavy equipment such as dump trucks, backhoes, jet vac truck, etc. Longitudinal slopes steeper than 7:1 and cross-slopes steeper than 5:1 will not be permitted

in Town easements. The following features shall not be permitted in Town of Hillsborough utility easements:

- Structures, buildings, foundations, footers, caissons, hardscapes, pools, ponds, lighting, etc.
- Trees, bushes, and other perennial large plantings.
- Retaining walls and retaining wall support systems such as geogrids, soil anchors, etc., unless specifically approved by the Town.
- Stormwater control systems and best management practices such as wet ponds, stormwater impoundments, dams, berms, sand filters, catch basins, or similar. Discharge of level spreaders or other diffuse flow devices into Town sewer easements shall not be permitted.
- Overhangs or vertical structural elements such as second floor decks, gazebos, or bridges that span the easement, etc.
- Fences, longitudinally or perpendicular unless an encroachment agreement is executed with the Town which requires certain clearances and access terms.
- Well or septic system piping, gutter outlets or yard drain piping, etc.
- Private water or sewer system components.
- Material storage areas.

Where easements are proposed “cross country”, the Town may require installation of access barriers like gates to prohibit unauthorized access of pedestrians, all-terrain vehicles, etc. as part of the project. Easements shall not split property lines. Easements shall be recorded with the county register of deeds and must contain an exhibit or plat and language related to it. If infrastructure is not centered along an established easement, the easement will need to be adjusted before acceptance.

For other public utilities crossing water or sewer easement areas, an encroachment agreement shall be executed by the Town for such crossing with stipulations to include but not be limited to necessary casing or conduit piping, submission of as-built records and disclaimers for any damage caused.

F. Utility Separations

All utilities (electric, phone, gas, cable TV, etc.) shall be installed a minimum of three feet horizontally from all Town waterlines (existing and proposed). Where other utilities are installed closer to or cross any water or sewer main, they shall be installed in rigid conduit. Electrical transformers, and cable TV & telephone distribution boxes shall not be located within 5’ of existing or proposed water meters and/or sewer services. Water lines shall have a minimum of 3’ of cover. When crossing water bodies, water mains shall maintain a minimum of five feet cover unless otherwise approved by the Utilities Director or designee. In some situations, a NCDEQ 401/404 authorization may be required. Sewers should be designed for at least 5’ of cover and below water lines. Minimum separations between sanitary sewers

and water lines and sanitary sewers and storm sewers shall be as specified by the NCDEQ, Rule .0906, and Recommended Standards for Waterworks, the most stringent. Minimum separations and allowable alternatives are noted in the Town of Hillsborough Standard Details.

Town water and sewer lines shall be located within Town or NCDOT ROW per Section 14-63 of the Town Code. Sewers be not allowed in dedicated easements except as determined necessary by the Utilities Department. All building footings, foundations or subgrade support structures must be located outside a 1:1 failure plane extending from the bottom of the existing or proposed sewer or water line to the ground surface. The Town is not interested in projects that require sewage pumping stations.

G. Boring and Jacking

When installed within a casing pipe, the carrier piping shall refer to ductile iron pipe standards, AWWA C600 and AWWA M41. Joints installed on ductile iron carrier pipes inside an encasement pipe shall use rigid restrained joints. Carrier pipes inside the casing shall be supported using approved pipe supports, three stainless steel (316 SS) supports (spiders) shall be used for each pipe segment. The end of each encasement shall be bricked closed to ensure adjacent soils do not encroach. Bore and jacks under NCDOT roads shall meet NCDOT requirements. The annular space under NCDOT roads may not be filled with concrete or grout. Bore and jacks under railroads shall meet the requirements of that agency.

Steel casing pipes and joints shall be constructed to prevent leakage of any substance from the casing throughout its length with a minimum thickness of 0.625 inches or as required by site-specific regulatory agencies, such as NCDOT or NCRR. Steel pipes are to be designed for the external and internal loads to which they will be subjected.

Grout between casing and adjacent soils shall consist of one part Portland cement, three parts sand and the minimum amount of water necessary to obtain the desired consistency; and all grout mixtures shall contain 2% of bentonite by weight of the cement. 2-inch diameter grout connections shall be provided and regularly spaced at 5' on center alternating at 30 degrees from plumb each side of the vertical centerline.

A boring and jacking specification and detail is required with the project submittal documents.

H. Directional Drilling

Directional drilling shall be performed for trenchless crossings of streams, rivers, or other water bodies, but shall not be permitted under roads. Directional drilling of gravity sewer systems shall not be permitted. Directional drilling shall be performed using HDPE pipe.

HDPE pipe shall be installed by horizontal directional drilling using a surface mounted rig, first to drill a guided hole along a bore path consisting of a shall arc and then to pull a string of pipe into the hole. Pull back is facilitated by a back-reamer, which enlarges the hole to approximately one and a half times the pipe diameter. Drilling fluids are injected into the bore hole to stabilize the hole and lubricate the pipe and drilling string. Tracking equipment is used to guide and direct the drilling.

When polyethylene pipe (PE) is pressurized, it expands slightly and shortens slightly. Shortening may be enough to disjoin unrestrained mechanical joints that are in line with PE pipe. Disjoining can be prevented by installing external joint restraints at mechanical connections, by installing line anchors, or by a combination of both. Contractor shall install mechanical connections with joint restraint at connection to mechanical joint pipe.

Note: Poisson Effect pipe shortening must be considered whenever the pipe is pressurized, both during the pressure testing, and when it is placed in service. Because pressures are usually higher during pressure testing (up to 150% of the system pressure rating), pipe expansion and Poisson Effect pipe shortening may be slightly greater during pressure testing. Before pressure testing, all mechanical joint restraints must be completely installed and secured per manufacturer's instructions. Concrete in-line anchors and thrust blocking (if used) must be fully cured (minimum of 21 days for 3,000 psi or 7 days for 4,500 psi concrete) and properly backfilled before testing. Restraint is not required at PE-to-PE butt fusion joints. Restraint is not required at bolted flanged joints. Mechanical coupling: Stainless steel internal stiffeners shall be used on all couplings to increase the seal. All couplings shall have restraint devices per the manufacturer's recommendation and installed per the Manufacturer's direction.

In some situations, a NCDEQ 401/404 authorization may be required.

I. Utility Abandonment

All inactive water and sewer services encountered, or made inactive by the scope of work, shall be fully abandoned. Abandonment of water services shall include removal of corporation and installation of a full seal clamp over the corporation's location. Abandonment of sewer services shall include removal of the saddle tap, wye, or other connection to existing sewer main with no gaps present that would allow inflow and infiltration. All inactive water and sewer mains encountered by or made inactive by the scope of the proposed work shall be removed as much as possible. Sewer mains shall be flushed of debris (recognizing the requirements of Section 4.C.) Mains not able to have complete removal shall be filled with flowable fill once water and sewer service abandonment is complete.

All sanitary sewer pumping stations made obsolete by gravity sewer systems shall be abandoned. The Town shall retain ownership of all equipment at pumping stations to be abandoned. The party abandoning the pumping station shall remove all equipment requested to be retained by Town staff and deliver said equipment to a location specified by the Town (within the Town's current service area). All equipment not delivered to the Town shall be removed and lawfully disposed of by the abandoning

party. Once all equipment is removed, the pumping station wet well shall be filled with diggable, flowable fill to within 3' of grade. The final 3' of grade shall be compacted soil and seeded.

All above-ground racks, poles, fencing and appurtenances shall be removed by party abandoning the lift station. All gravel or other parking surfaces shall be removed, and grass shall be restored with approved seeding mix. The force main from the abandoned pumping station shall be flushed of debris (recognizing the requirements of Section 4.C.) and removed as much as possible and the remaining filled with grout.

Once all utilities are abandoned, quitclaim deeds for any water and sewer easements no longer required shall be submitted to the Town for approval prior to legal recordation.

J. Renewal or Relocation of Services for Redevelopment or Subdivision

Redevelopment of parcels containing existing water or sewer services shall require renewal of such services to the main unless in the opinion of the Utilities Director or designee after submittal of conditional evidence by the owner/builder that such services are properly sized, are not of substandard materials, are not leaking, crushed, cracked, corroded, or have other evidence of inadequacy that is harmful to the utility system. Furthermore, any meters or clean outs not at the right of way or edge of easement, or located on other parcels, shall be relocated to a location legally accessible to Town meter reading staff as a condition of building permit approval. Any subdivision of property that results in existing services remaining on other parcels shall be relocated to the parcel being served.

K. Standard Details and Approved Materials List

The Town of Hillsborough has developed Standard Details for many of the specifications presented herein. The details shall be reviewed for additional specifications not stated in this document. Details shall be incorporated into the design plans as applicable. A list of the standard details available is presented below. The Town may request project-specific details be developed for projects where a standard Town detail does not exist or is not appropriate for the situation.

Materials and products shall be from the Town's Approved Materials List. Substitutions of equal products will be considered on a case-by-case basis and only approved by the Utility Director or designee, in writing. Where the Town's specifications and details conflict, the specifications shall govern. Where the Town's pre-approved products list and details conflict, the pre-approved products list shall govern. The Standard Details and Approved Material Lists may be modified from time to time without Board of Commissioners adoption.

Standard Details List

General		Water		Sewer	
G-01	Utility Separation	W-01	Hydrants	S-01	Air/Vacuum Release Valve for Sewer Force Main
WS-01	Valve Box Assembly and Gate Valve	W-02	Flushing Device for New Water Main Extensions	S-02	Cored Connections for Sewer Wetwell or Manhole
WS-02	Thrust Blocking	W-03	Reduced Pressure Backflow Preventer (RP)	S-03	Sewer Service and Cleanout with Collar
WS-03	Trench Details	W-04	Double Check Valve Assembly (DCVA)	S-04	Odor Control for Sewer Pumping Station
		W-05	Water Main Taps	S-05	Electrical Panel Riser Diagram (Typical)
		W-06	Residential Water Meter and Box	S-06	Pumping Station Valve Vault
		W-07	Commercial Water Meter and Vault	S-07	Pumping Station Yard Hydrant and Meter
		W-08	Backflow for Fire Line	S-08	Precast Concrete Manhole
		W-09	Water Meter Location	S-09	Frames and Cover
		W-10	Air Release Valve – Water	S-10	Outside Drop Manhole
		W-11	Blow-Off Detail	S-11	Doghouse Manhole
		W-12	Temporary Faucet	S-12	Aerial Crossing

5. WATER

A. *Piping, Hydrants, Valves and Other Appurtenances*

Piping for public water extensions shall be Ductile Iron Pipe (DIP) Pressure Class 350 cement mortar lined interior/asphaltic coated exterior. Bedding shall be installed as Type 2, 3, 4 or 5 as described in ANSI/AWWA C150/A21.5 and ANSI/AWWA C151/A21.51. Pipe shall have a burial depth of 3' minimum. When crossing water bodies, water mains shall maintain a minimum of 5' of cover unless otherwise approved by the Utilities Director or designee.

A professional engineer shall supply restrained joint pipe calculations with construction drawings. The restrained joint calculations shall be performed using the Ductile Iron Pipe Research Associated (DIPRA) Thrust Restraint Design for Ductile Iron pipe methodology or approved equal. PVC pipe shall not be accepted where restraint is required.

All new water mains proposed for acceptance by the Town shall be DIP and 6" minimum diameter. Existing 2" waterlines that would serve the parcel to be developed shall be replaced with 6" waterlines as needed to ensure new 6" waterlines are not fed exclusively by 2" waterlines and that adequate fire protection is provided. Proposed water mains shall extend across the entire length of the parcel to be served. Materials shall be from the Approved Materials List. Blue marking warning tape shall be placed

2' above installed water lines. The tape shall read "CAUTION – BURIED WATER LINE". In certain situations, the Town may require pipe markers.

DIP water main shall be installed in accordance with AWWA C600 and AWWA M41 guidance, latest version as of the time of construction.

Polyethylene encasement shall be provided for ductile iron pipe and fittings, unless exempted by the Town, to prevent contact between pipe and surrounding materials and utilities to protect from corrosive soils and stray currents from other utilities. Polyethylene encasement shall be in accordance with ANSI/AWWA C105 and from the approved materials list.

For water crossings greater than 15' in width, pipes shall be constructed with flexible, restrained watertight joints. Aerial water mains shall be prohibited unless authorized by the Utilities Director or designee, and Public Works Director or NCDOT, in writing prior to implementation. Piers for aerial crossings of water or sewer shall be designed and sealed by a structural engineer and included in the project submittal package. Water mains crossing roads may require encasement piping. If the Standard Detail of the Town is not appropriate for the application, the engineer shall provide a specific detail. Town water mains shall be extended in NCDOT ROW or Town ROW across the frontage of any parcel where a new connection is proposed. Dead-end water mains shall not be permitted if the waterline extension can be extended 300' or less to connect to an existing Town waterline and eliminate the dead-end waterline. Otherwise, a blow-off or flushing device will be required at the end of dead-end mains.

Two discrete connections to the Town's water distribution system shall be provided for all developments to be ultimately designed for 100 units or greater, or equivalent flow, whether phased or not, or as required to meet other Town-wide or system-wide needs per Town Code. An inline valve must be existing or proposed between the two connection points, and water must be available to the entire development through one of the two connection points under any main break scenario on the Town's existing system.

Hydrants shall be 5 ¼", dry-barrel, AWWA C502, as manufactured by Clow (Medallion), or Mueller. Alternate manufacturers and models are not acceptable without pre-approval by the Utilities Director or designee. Hydrant flanges shall be installed between 2" and 6" above surrounding final grade (after landscaping), and hydrants shall be installed with a minimum 12" clearance between the edge of the hydrant and the sidewalk. Hydrants shall not be installed in existing or proposed roadside ditches, sidewalks, stormwater control measures, or driveways. Bollards shall be provided at hydrants where required by Utilities Director or designee. A 350 ductile iron Gradelok hydrant leg, conforming to AWWA C153/C104, may be used for grade adjustment.

Hydrants shall be located a minimum of 6' behind the edge of the curb, 10' from the edge of pavement in locations without a drainage ditch, or behind the ditch. Spacing shall be 500 feet between hydrants. Resilient wedge gate valves shall be required on the main line and hydrant leg at all hydrants. Hydrant legs shall be restrained joint and rodded from the main through the valve and to the hydrant. Fire Department Connection (FDC) shall be mounted between 24" and 36" above surrounding grade. Public hydrants shall be factory-painted in Safety Red. Private hydrants shall be factory-painted Safety Yellow and shall have an RP-Detector backflow preventer installed on the customer's side of the property line near the service connection.

Clow or Mueller resilient wedge gate valves (AWWA C509) shall be used on water lines in buried service. Three valves shall be installed at all tees, and four valves at all crosses. Mainline valves shall be installed every 1000' on water. Additional valves shall be furnished on existing mains to meet these requirements.

All castings shall be made-in-USA conforming to ASTM A48, Class 35B, gray cast iron. In unusual circumstances where vaults, valve or meter boxes are approved in pedestrian traffic areas such as sidewalks or trails, materials shall be traffic rated. All other vehicular traffic areas shall match the same for traffic loading.

A #9800 Eclipse Automatic flushing device (manufactured by The Kupferle Foundry Company) shall be installed for every 2,500 feet of water line installed with no planned connections for all new water line extension projects. Location and need of automatic flushers to be determined by the Utilities Director or designee. Blow off or flushing device must also be installed at the end of all dead-end lines if such lines are approved. A 2" Neptune T-10 water meter (with Auto-Detect ARB and R-900 MIU (radio read) shall be installed for each installed flushing device and purchased from the Town. All water main taps 6" and greater require a cut-in tee and inline valve. Mains 2" and smaller require saddle taps. Galvanized mains shall be replaced in place in lieu of tapping without Town participation in the cost. The galvanized main shall be replaced across the project's frontage or to nearest stable waterline material, whichever is farther. Mains greater than 2" may not connect to 2" mains unless the main is the second connection on a looped system.

Air release valves are to be used to bleed air during filling of a water line and to automatically vent air that collects in the water lines. Pressure air release valves shall be located at high points on proposed waterlines that are at least 8" in diameter. Air release valves shall be 2" connections, Vent-Tech Model WTR Series C or equal as approved in writing by the Utilities Director. The valve shall be housed in a precast concrete eccentric manhole. All pipe and fittings are to be brass including the plumbing gate valve.

B. Backflow and Cross Connection Control

A Reduced Pressure (RP) backflow prevention assembly (AWWA C511) is required as outlined in Section 14 of the Town Code immediately after the meter in an above-ground ASSE 1060 compliant enclosure

(Class I or II) for all commercial, industrial, institutional, or irrigation services where a severe hazard exists (as defined in NCAC 15A-18C Appendix B). A double check valve assembly (DCVA) (AWWA C510) shall be installed immediately after the meter in an above-ground ASSE 1060 compliant enclosure (Class I or II) for all commercial/industrial/institutional/irrigation services not requiring an RP (unless requirement is waived on a case-by-case basis). A Detector assembly shall be provided for all fire services (RP-D or DCDA depending on hazard level). An RP-D is required if a Fire Department Connection is installed on the fire service. Fire service strainers shall be installed on fire services prior to the backflow preventer.

The location of backflow preventers within the Historic District shall be determined on a case-by-case basis, in compliance with Historic District Design Guidelines. A dual check valve shall be installed on residential services at the meter yoke. RP and DCVA assemblies shall be approved by USC-FCCCHR and ASSE, shall be tested by a certified tester after installation, and test results shall be provided to the Town. Dual check valves shall be ASSE approved. RP assemblies shall have a minimum of 12" clearance on all sides. DCVA shall have adequate clearance for testing. RP and DCVA assemblies shall be installed over a concrete pad base, and all exposed (non-buried) piping through vaults shall be flanged ductile iron or copper (compression joints/fittings). Copper piping passing through concrete shall include a collar/sleeve at the concrete interface. All fire service installations shall fully comply with NFPA requirements.

Backflow prevention is required on homes that also utilize a non-potable well or will have a swimming pool per Town Code.

C. Meters, Vaults, and Services

Meters shall be Schlumberger Neptune brand. Models shall be T-10 (<2"), Tru/Flo Compound or Mach10 Ultrasonic (2" – 6") or HP Turbine or Mach10 Ultrasonic (8" – 10") with Auto-Detect ARB and R-900 MIU (radio read). All meters and strainers, where needed, shall be purchased directly from the Town. Flanged bronze strainers by Neptune shall be installed immediately before all 2" and larger compound meters with appropriately sized spacer installed between the strainer and meter to avoid meter inaccuracies. The proposed meter size shall be reviewed and approved by the Town prior to implementation and shall be at least 5/8". Meters shall be sized used AWWA's M6 meter sizing methodology.

Homes with residential sprinkler systems shall require a minimum of ¾" meters. If proposed services are excessively long or have steep topography at the discretion of the Utilities Director or designee and where volume or pressure is of concern, a larger meter and service line size may be required as a condition of service, or service may be denied. In these cases, a plumber or engineer shall provide calculations demonstrating the meter and service line is sufficient.

All residential size meter box lids shall be cast iron with pre-drilled 2" hole for Pro-Read disk installation. Hatches for large meter boxes shall be hinged aluminum and be drilled with a 2" hole adjacent to hinge area. Residential size meter boxes (5/8", 3/4" and 1") shall be standard rectangular black plastic boxes, 12" deep, with flared bottom. Boxes for 1" meters shall be a minimum of 22" x 35" at the base. Large (>1") meter boxes/vaults shall be pre-cast concrete, with drainpipe at the bottom of the vault to daylight (and shown on the plans), unless approved otherwise.

Irrigation lines must have separate meter, be tapped separately, and have an RPZ backflow preventor. Separate irrigation services are considered subject to water connection fees.

All piping (>1") through vaults shall be flanged ductile iron or copper (compression joints/fittings) with Linkseal, or equal, provided at penetrations. Meter vaults shall be no deeper than stated on the applicable Standard Detail (from ground surface to vault bottom) with adequate personnel entry points for service. Water taps shall be a minimum of 1' from the main to the meter box.

All water meter locations shall be coordinated with the Utilities Department and shown specifically on the plans. Meters shall be grouped in pairs at adjoining property lines, unless approved otherwise. All water meters shall be located at the property line adjoining the public road right-of-way (unless approved otherwise) and shall be no deeper than 12" below grade for residential size meters. The domestic service may be tapped off the fire service only when the fire service is 6" or larger (NFPA 24).

Services shall not be permitted to cross private property lines except with the Utility Director's prior approval. Meter boxes, curb stops, and bedding shall be installed per Town details. Meter boxes shall not be stacked to meet grade. The meter box surroundings shall be graded to make water drain away from such. Care shall be taken to ensure the valves are facing the proper direction and the box cleared of debris or the meter cannot be set, and a return trip fee will be incurred. Any locations approved in trafficked areas (vehicular or pedestrian) will be required to be traffic rated.

Water services shall be minimum 1" Type K copper, or Class 350 DIP. PEX crosslinked polyethylene (2" or smaller) that meets the requirements of AWWA C904-2016 Crosslinked Polyethylene (PEX) Pressure Tubing may be used on a case-by-case basis as approved by the Utilities Director, or designee, primarily due to the type of soils present. Non-metallic services shall have tracing wire placed from the main to the meter and continuity of such verified.

Taps on existing or proposed distribution mains shall be Ford double band brass saddle per the Approved Material List. All taps on existing copper or distribution mains must be discussed directly with Town staff prior to implementation. All service connections shall be backfilled properly under the corporation stop to prevent undue stress on the connection. Residential water meter boxes shall have orange temporary safety fencing (or other Town-approved barrier) installed around the meter area to protect the installation during home construction activities. Services shall be made perpendicular to the main and within the parcel boundaries it will serve.

Buried couplings between existing services and new services must be rated for use underground, “shark bites” or similar transition couplings will not be allowed. Pressure reducing valves on all new services are required.

Temporary faucets installed for construction shall be a minimum of 10’ from the meter box. Temporary faucets shall be removed before occupation of the structure. Refer to the TOH Temporary Faucet Standard Detail for additional requirements. Temporary faucets are subject to all Town water and sewer charges.

D. Fire Protection Systems

The Town of Hillsborough and Orange County have adopted Appendix B and C to the North Carolina State Building Code Fire Code Requirements. Residential fire sprinkler systems shall be designed to NFPA 13D requirements (multipurpose systems). Fire flow required by a proposed project shall be calculated in accordance with these requirements. Where fire flows are required, they shall be identified on the construction drawings.

Sprinklers shall share the home plumbing system and be looped to minimize dead ends. No additional backflow prevention device/assembly shall be required. Calculations and layout of the residential sprinkler system shall be provided as a condition of connection to the Town system.

6. SEWER

A. Piping, Manholes, Valves and Other Appurtenances

Gravity sewer piping shall be Ductile Iron Pipe (DIP) Pressure Class 350 epoxy lined interior/ asphaltic coated exterior (Conforming to AWWA C150 and AWWA C151 and with rubber jointed gaskets conforming to AWWA C111), or SDR 35 PVC (pipe and fittings meeting ASTM 3034; gaskets conforming to ASTM F477).

Gravity sewer mains requiring a collection system extension permit (public or private) shall be a minimum of 8” diameter. A collection system is a pipe that serves more than one building on separate parcels. Eight-inch gravity sewers shall be designed with a minimum slope of 0.5%. Other sized sewer slopes shall be in accordance with NC DEQ Minimum Design Criteria for Gravity Sewers. Acceptance of smaller mains shall be an exception and not without permit variance approval from the state and only after Town approval of the concept. Gravity sewer systems shall be sized to serve the entire buildout sewer flow of the basin upstream of the proposed system. Gravity sewer mains shall extend across the entire parcel.

Gravity sewer mains shall be installed within public ROW where possible, and in alignment where manholes are kept out of the wheel path of vehicles in paved surfaces. When topography and hydraulic

conditions preclude gravity sewer alignments in ROW, gravity sewer shall be installed in public utility easements. Easements shall be located along property edges to minimize impacts to current and future owners. Gravity sewer lines installed along property lines where easements encumber two parcels shall be prohibited unless approved in writing by the Utilities Director or designee. See earlier specification sections regarding easements and separation distances. Aerial sewer mains shall be prohibited unless approved by the Utilities Director or designee in writing. Piers for aerial sewer mains shall be designed and sealed by a structural engineer and meet all state and local criteria for placement. Calculations shall be submitted with the drawings and specifications for the project.

Piping deeper than 16' shall be DIP for the entire length between manholes, with 5' diameter manholes required. Manholes 20' deep or deeper shall be 6' diameter and are approved on a case-by-case basis. Manholes of significant depth may require intermittent landings or fall protection apparatus. Pipe bedding shall be as recommended by the manufacturer, with crushed stone bedding required for PVC pipe. Non-erosive warning tape shall be placed 2' above the sewer mains. Tape shall be green and indicate, "CAUTION – BURIED SEWER MAIN." In certain situations, the Town may require marker posts.

Manholes shall be pre-cast concrete with cast-in-place or pre-cast inverts. All castings shall be made-in-USA conforming to ASTM A48, Class 35B, gray cast iron. Castings shall be per Standard Detail. Manhole tops shall be a minimum of 18" above grade in unpaved areas not adjacent to public roads (grade rings not allowed in unpaved areas). No more than 12" of grade rings (or a maximum of two grade rings, whichever is less) will be allowed from the top of the cone to the bottom of the manhole ring (including 2' diameter sections cast into the manhole sections above the cone). Grade rings can be of concrete or composite materials and be installed underneath the ring and cover, steel rings inserted into the manhole rim (or other, similar technology mounted in the rim) are prohibited.

When manholes are situated in floodplains, manhole covers shall be watertight and vented above the 100-year floodplain every 1000 feet. Conseal CS-212 Polyolefin backed exterior joint wrap or approved equal shall be used on all manhole and pump station joints, including grade rings. Cored holes with rubber boots shall be required for manholes and pump stations where pipes are inserted. Rubber boots shall be manufactured by A-Lok, NPC, or Press-seal Corporation. Elevated manholes outside of the ROW shall be hinged frames and covers.

Core drilling existing brick or block manholes is prohibited, replacement of the brick or block manhole with a pre-cast manhole is required prior to connection.

Doghouse manholes should be avoided by specifying full replacement of the manhole and a stub of at least five feet of sewer with a connector piece and a cap to the existing sewers. Should the Utilities Director or designee approve doghouse manholes, refer to the relevant Standard Detail. Repair bands are prohibited unless authorized in writing by the Utilities Director or designee. Repair bands must be per the approved materials list.

B. Sewer Services (Taps or Laterals)

An individual sewer service shall be provided for each property from the property line to the sewer main. Sewer services for new construction shall be installed perpendicular to the main with an in-line wye fitting. Service connections to existing manholes shall not be permitted unless approved in writing by the Utilities Director or designee. Saddles or band fittings are not acceptable for new construction. New services cannot be connected to the following:

- existing sewers that are less than 8" in diameter unless approved by the Utilities Director or designee
- sewers in deteriorated condition or of substandard material
- services serving other buildings unless on the same parcel and properly sized
- force mains
- areas without established easement without rectification

See earlier section regarding renewal of existing services for redeveloped or subdivided lots. Services to be tapped into existing iron or PVC sewer mains shall be per the Approved Materials List or pre-approved equal and shall have precision-cut entries into the sewer main that match the saddle used (no sharp or protruding edges). Coordination with the Utilities Department prior to tapping existing mains shall occur and special circumstances and materials shall be provided for tapping atypical existing materials such as truss, Orangeburg, reinforced concrete, galvanized, pipe that has been lined, etc. Connections to existing mains may not be hammered, chiseled, or impacted for access, but must be saw cut.

Services shall be a minimum of 4" in diameter and constructed with Schedule 40 PVC. Services shall have cleanouts installed at all changes in direction and at the right of way. Cleanout caps shall be brass screw type and inverted when in pedestrian areas. Connections to new mains shall be made with in-line wye connections, connections to existing mains shall be made a sewer saddle on the approved material list or approved equal. All taps must be made at the 10 o'clock or 2 o'clock position. Taps at any other location are prohibited. Upon proper installation and acceptance, the Town will assume ownership and maintenance from the sewer main wye connection to the clean out at the right of way. Tracer wire shall be provided on all plastic sewer services per NC One Call requirements and continuity confirmed.

A pre-cast concrete ring shall be installed around cleanouts in non-paved areas. A 2' x 2' cast in place concrete pad shall be installed around all cleanouts in paved areas. A traffic rated "mini manhole" per Standard Detail is also allowable if cleanouts are approved within a paved area.

Private grinder pumps to connect to gravity sewers where single buildings are lower than the sewer are allowable. These are considered private to the owner and the Town will not own or operate such

systems. Their installation shall be to applicable plumbing code except that ejector stations are not allowable. The pump must be either semi-positive displacement or centrifugal grinder pump in a simplex or duplex package configuration depending on application. Residential packages may be simplex. The grinder pumping station discharge must not cross property lines or travel down a road right of way, unless approved by the Utilities Department and Public Works Department, as applicable.

Concrete shall be level with finished grade, and top of cleanout 2" above the concrete.

7. SEWAGE PUMPING STATIONS

Municipal style pumping stations are not permitted on new projects unless the applicant can demonstrate it is hydraulically not feasible to serve the proposed development with a gravity sewer system. Distance to the existing sewer system or potential costs of a gravity sewer system extension are not sufficient reason for a proposed pumping station. The Board of Commissioners may decline requests to serve projects where municipal pumping stations are required and all pumping stations must be approved by the Board of Commissioners.

A Preliminary Engineering Report (PER) reviewed and approved by the Town is required for all pumping stations prior to review and approval of any construction drawings that rely on the pumping station for service. The PER must demonstrate the pumping station can meet the standards established in NC DEQ's Minimum Design Criteria for the Permitting of Pump Stations and Force Mains. The PER must include the following:

- An analysis of potential discharge locations, including an analysis of the capacity of the downstream sewer to receive the proposed discharge through other downstream pumping stations and the wastewater plant
- Pump, wet well and line sizing calculations
- Velocity calculations for the entire length of the force main, including discharge headers, for both startup and buildout conditions
- Total Dynamic Head (TDH) consistent with the state's Minimum Design Criteria for the Permitting of Pump Stations and Force Mains
- Surge analysis of the pumping station and force main, including an analysis of a sudden power loss scenario
- Cycle times and runtimes of the proposed pumps
- Generator sizing calculations. On-site generators are required for all lift stations
- Analysis of discharge head conditions and an analysis of Variable Frequency Drive or soft start applicability.
- Anti-floatation calculations for the valve vault and wet well

If approved, sewage pumping stations shall be duplex submersible unless approved otherwise by the Utilities Director or designee. Motors shall be minimum of 5 hp, and must be 3 phase, 480V, 60 Hz, 1800 rpm maximum. Force mains shall be a minimum of 4" and designed to meet state design criteria for velocity and passing solids. Pumps shall be non-clog centrifugal pumps, Flygt N-Series, or equal, unless approved otherwise by the Utilities Director.

Grinder pumps shall only be approved when conditions preclude other selections. Identical pumps shall be provided on duplex or greater pumping stations. Pumps shall be as stated in the Approved Materials List. One spare pump and motor shall be provided that is identical to the pumps installed in the station. One spare set of floats shall be provided to the Town. Alternate level sensing equipment such as bubbler or pressure sensing and alarm notifications shall be approved by the Town during review.

Manifolded force mains are prohibited. Diesel pumping stations are prohibited. All pump stations must be locally controlled. SCADA integrated controls for load management are not permitted.

Pumping station wet wells shall be round pre-cast concrete, 6' inside diameter minimum with a stainless-steel vent and bug screen. Top shall be pre-cast concrete, with cast-in aluminum double-leaf hatch. The hatch shall be at least 48" by 36" and align with the slide guides for the submersible pumps to allow pump removal.

A 1,000-gallon odor control chemical tank and chemical feed metering pump (adjustable and sized for manufacturer's recommended application rate), piped to a point just below the wet well hatch, shall also be provided, and shall be filled with calcium nitrate tetrahydrate, or chemical specified by the Utilities Director or designee, prior to operation. Refer to the odor control Standard Detail.

Sewer force main piping shall be green PVC SDR 21 or C900/905 AWWA C150 and AWWA C151, with combination air & vacuum valves at all high points (see standard detail and approved material list for valve information). Combination valves shall also be provided every 1000', on both sides of stream crossings, on both sides of collector streets and controlled access NCDOT roads, and at both ends of all encasements or directional drill installations. Force mains shall be installed in steel casing pipe where installed under roads or railroads in accordance with NCDOT and NCRR specifications, as applicable.

Trace wire shall be installed over sewer force main piping, and shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness colored green. Direct bury wire connectors shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner to prevent any uninsulated wire exposure. Non-locking friction fit, twist on, or taped connectors are prohibited. All termination points shall utilize an approved trace wire access box, specifically manufactured for this purpose, and shall include a manually interruptible

conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection. Tracer wire must be properly grounded at all dead ends/stubs with a drive-in magnesium grounding anode rod with a minimum of 20 feet of #14 red HDPE insulated copper clad steel wire connected to the anode (minimum 0.5 lb.) specifically manufactured for this purpose and buried at the same elevation as the utility. The connectivity of the tracer wire shall be demonstrated after installation and prior to acceptance. Non-erosive warning tape shall be placed 2' above the force main. Tape shall be green and indicate, "CAUTION – BURIED SEWAGE FORCE MAIN."

Prescreening of raw wastewater may be required, the Utilities Director or designee may require prescreening if discharge to a receiving pumping station without pretreatment is proposed.

Gravity sewer manholes receiving force mains, either existing manholes or proposed manholes, must be lined with epoxy liner. A submittal of the proposed product shall be provided for approval by the Utilities Director or designee. If the receiving manhole is brick or block or in poor condition, its replacement shall be specified and completed (with acceptance testing) before a force main connection is allowed.

Pumping station electrical panels shall be NEMA 4X, UL listed, with alarm horn/light with silence switch, pump alternator & switch, pump run-time hour meters, contacts for RTU/SCADA, heater/thermostat, phase monitor, and run lights. Control panel lights shall be LED and of color and materials on the approved materials list. If a traditional float system is not provided, an MJK 704 Level/Pump Controller/Transmitter/Flowmeter/Datalogger with Model 2100 Pressure Transmitter & mounting bracket shall be installed to control the pump operation. Two level control floats shall be provided for low level alarm and high-level alarm as backup units tied-into the power control panel (separate from the pump controller). A discharge flow meter with a 4-20mA signal shall be required and integrated to any PLC and SCADA systems.

All electrical panels shall be mounted to an aluminum or 0.4 pressure treated lumber (PTL) backboard with 4" diameter aluminum or 6"x6" 0.4 PTL posts, with aluminum rain cover (or other pre-approved material) extending 36" from backboard over panels. A 4' LED light with switch shall be mounted under rain cover. A 110V GFCI power outlet shall be installed in the electrical panel. See Standard Detail for layout and additional requirements along with the Approved Materials List. A laminated single line diagram of all onsite wiring shall be provided to the Town at pumping station startup. All electrical services to pumping stations shall be three-phase "wye" services unless approved by the Utilities Director or designee.

Resilient wedge gate valves shall be installed on the influent piping and force main piping. Force main gate and check valves shall be in a separate vault next to the wet well. Gate valves shall be installed on each pump line and on the force main and check valves on each pump line. A tee (with the leg facing up), plug valve, and quick-connect fitting shall be installed on the discharge side of one check valve as a "pump-around" connection inside the valve vault. The pump around connection shall be configured to

allow the station to be run with an above-ground temporary bypass pump during an emergency. An equal size blind flange shall also be provided for maintenance purposes. Access hatches shall be placed above steps into the vault and in proximity to a light switch. Vaults shall be drained to the wet well with small diameter (2") plastic or steel piping. Wall penetrations shall be sealed with Linkseal, or equal. The vault floor shall be sloped to allow for positive drainage. The wet well piping shall have a duckbill type outlet on the drain line. Valve vaults shall have an LED weatherproof light and switch.

All guide rails, fasteners, hardware, and miscellaneous metals inside the wet well shall be 316L stainless steel. Access ladders shall be aluminum, composite, or stainless steel. Piping inside the wet well shall be flanged ductile iron or stainless steel. Wet well vent shall be 316L stainless steel gooseneck with a screened outside end. A yard hydrant with water meter and backflow device connected to potable water per the Standard Detail shall be installed at the pumping station site, unless approved otherwise.

Access hatches shall be hinged and lockable, with stainless steel or aluminum frame, and ¼" thick aluminum diamond plate door(s). All hardware and hinges shall be 316L stainless steel.

All new pumping stations shall have permanent on-site standby power with auto transfer switch and highest-level sound-attenuating enclosure, and Mission Communications telemetry equipment as specified by the Town with wet well module installed with the first year of service pre-paid. Generators shall be as manufactured by Generac, Kohler, Caterpillar/Olympian, or pre-approved equal. Generator shall operate on natural gas (or diesel fuel only if natural gas is unavailable to the site). Generator shall be sized to operate all pumps simultaneously and start the lag pump while the lead is operating. If diesel fuel is required, a double-walled tank with 48-hours of storage shall be provided.

Pumping station sites shall be sited on at least 0.25 square acres, have 6" depth (minimum) of ABC stone covering entire site underlain with geotextile fabric (to prevent weed growth), and include perimeter black plastic-coated chain link fencing (6 feet high, provided with black plastic privacy slates, topped with 3 strands of barbed wire, and 16 foot wide double leaf lockable gate), and dusk-to-dawn LED area light with independent circuit breaker (or switch) in main electrical panel. Alternate fencing materials may be required based on individual site conditions. Padlocks shall be provided for the gate, electrical panels, and access hatch(es) and shall be keyed to the Town's system. The Town prefers sites be acquired in fee simple and dedicated to the Town. Easement access is at last resort. Access to the site shall be established with a 12' wide paved or stone drive with turnaround area for large equipment. Developer shall provide a \$50 allowance for purchase of identification signage for the station.

8. Collection and Distribution Acceptance Testing Requirements

A. *Water Distribution Flushing and Testing*

All flushing and other use of water from the Town system shall be coordinated with the Utility Director or designee and always measured. Contractor shall pay for all water used unless Town capital funds

are used on the project. Options for water include renting a hydrant meter or obtaining bulk water from the Town's water plant or outside of Town. Note that tampering fees and penalties will be assessed for using a hydrant or tapping a water main without prior authorization from the Town.

All water piping shall be pressure tested in accordance with AWWA C600 to 200 psi for a 2-hour period. Pressure testing shall be performed with hydrants and services installed. Allowable leakage from the main is determined by the following formula:

$$L=(S*D*P^{1/2})/148000$$

L=Allowable leakage (gallons per hour), S=Length of pipe tested (feet) D=Nominal diameter of pipe (inches), P=Average test pressure (psig).

After successful pressure testing, all water piping shall be sterilized by chlorination in accordance with NCDENR and AWWA C651 (Section 4.4.3 – Continuous Feed Method) requirements. A chlorination and dechlorination plan is required for all water mains prior to implementation. The plan shall include proposed isolation valves, dechlorination methodology, disinfection chemical and duration. The Town shall review and approve the proposed chlorination plan prior to implementation.

The requirements of NCAC Title 15A, Subchapter 18C, section .1003 are to be followed (50 ppm chlorine, hold for 24 hours with a minimum of 10 ppm during that period). The line shall produce two consecutive negative bacteria samples drawn at least 24 hours after flushing of super-chlorinated water, and at least 24 hours apart, and tested by a State-approved laboratory. A list of approved laboratories is located on the NCDEQ / DWR Public Water Supply Section website at: <http://deq.nc.gov/about/divisions/water-resources/drinking-water/drinking-water-laboratories>. If any samples fail, the sterilization procedure shall be repeated until satisfactory results are obtained. Copies of all testing results and water usage data shall be submitted to the Utilities Director or Utilities Inspector when received. Test results are required for Town acceptance and must be received and approved prior to connecting new or existing customers. The Utilities Inspector may implement chain of custody requirements for all samples. Sample results shall clearly state the name of the project and location of the sample.

Mains that have not passed bacteriological testing may not be connected directly to the Town's water system and must be filled and tested through an approved backflow prevention system. Town hydrant meters meet this requirement. Sampling and fill lines and connections must be provided to allow filling and flushing through backflow prevention systems as well as to collect samples. Samples will not be collected from existing or proposed hydrants. Taps made to allow filling and draining the new line must be removed prior to Town operation.

Chlorinated water shall be properly disposed of in accordance with NCDEQ requirements. Chlorinated water shall not be discharged to storm sewers, ditches or overland. Super-chlorinated water shall be de-chlorinated with a neutralizing chemical upon discharge from water lines and metered.

B. Collection System Testing

All PVC gravity sewer mains shall be air tested in accordance with ASTM F 1417 – “Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air”. For ductile iron pipelines, test in accordance with the applicable requirements of ASTM C924.

Tests shall be performed after services are installed. Plugs shall be secured to prevent blowouts and all pressure released before removal of plugs. Plug installation and removal shall be documented to ensure all plugs are removed when sewers are placed into service. A mandrel (95% of base inside diameter) shall be pulled through all PVC gravity mains to test for unacceptable deflection per ASTM D3034 and F679. Deflection-tested 30 days after backfilling, shall not exceed 5%. An alternative to waiting 30 days is to submit a certification from a soil sampling firm indicating that backfill was compacted to 95% maximum soil density.

All gravity sewer mains and services (to the customer cleanout) shall be cleaned, smoke-tested and televised in the presence of Town personnel, unless waived, after all other utilities have been installed, prior to acceptance, and at the end of the warranty period. See Appendix A for the cleaning and televising specifications, including deliverables.

Force mains shall be hydrostatically pressure tested in accordance with the NCDEQ Minimum Design Criteria for the Permitting of Pump Station and Force Mains. Allowable leakage shall be as determined by the formula provided by this standard.

All new manholes shall be vacuum tested before and after backfilling according to ASTM C1244. Manholes that fail the test according to ASTM C1244 shall be brought to a passing condition.

All deficiencies shall be corrected prior to acceptance and operation. Copies of all testing results shall be submitted to the Utilities Director as a condition of acceptance.

C. Pumping Station Start Up Testing

Pumping station start up shall be performed in accordance with the pumping station startup checklist provided by the Town at the pre-construction meeting. The following must be confirmed as operational at start up prior to Town acceptance for operation and maintenance:

- Pumps – Pumps must exceed the build out design point at startup during a drawdown test
- Generator – Generator must be delivered full of fuel and automatically start when the main power

to the site is disconnected. The generator must be able to start a second pump with one pump in service without main power

- PLC – PLC must receive signals from wet well level indicators and transmit signal appropriately to the Town's SCADA system
- Level Control – Level controllers must function and engage appropriate pumps
- SCADA – Lead pump, lag pump, low and high alarms must report accurately to Town SCADA systems.
- Site – Site must be fully graded, clear of trash and debris, and fenced per the approved drawings.

D. System Final Approval and Acceptance

Acceptance of water or sewer extensions for public ownership shall be per the WSEC. This includes submitting the CAD and PDF record drawings and information as presented in the Town's As-Built Digital Submittal Requirements in Appendix B. Note that individual building permits or sign offs for subdivision homes may NOT be approved until terms of the WSEC are satisfied. Builders are advised not to schedule closings before discussion with the Town on acceptance status. It is also advised to not submit bulk approvals where Town staff can become overburdened and unable to respond in a timely manner. Communication with the Town on construction status is preferable as while the Town will strive to accommodate construction schedules for approvals, a lack of communication or short notice will not constitute an emergency requiring a diversion of other important duties to accommodate. Not being prepared if the Utilities Inspector is called for observations will result in return trip charges in accordance with the Town's fee schedule.

Acceptance of individual water and sewer services not constituting an extension shall be upon Utilities Inspector review, [receipt of as-built connection information](#), and approval for Certificate of Completeness sign off after any inspection fees are paid. In the case of buildings requiring backflow devices, which may also include residential buildings having irrigation, non-potable wells, or swimming pools, a passing backflow test shall be uploaded to BSI Online and received by the Town prior to approval. Buildings requiring fats, oils and grease control shall also be inspected and approved prior to sign off.

APPENDIX A

CLEANING AND CLOSED-CIRCUIT TELEVISED VIDEO (CCTV) INSPECTION SPECIFICATIONS for SEWERS, MANHOLES, AND SEWER LATERALS

Incorporated by reference.

This appendix will be modified as necessary without
requiring Board of Commissioners adoption

PART 1 GENERAL

1.1 DESCRIPTION

- A. Scope: Provide all labor, materials, tools, equipment, and incidentals as shown, specified, and required to perform video inspection of sewer piping, manholes and laterals from mainline (to cleanout, or edge of right of way or easement), including all requirements to clean pipe, mains and/or lateral connections.
- B. This specification assumes traditional CCTV methods. However, the Town may accept alternative methods such as sonar investigation with submittal and approval of equipment, specifications and proposed deliverables that produce the same desired information.

1.2 REFERENCES

- A. NASSCO's Assessment and Certification Program for pipelines, manholes and lateral (PACP/MACP/LACP), latest version, for standard TV inspection form and condition codes.

1.3 QUALITY ASSURANCE

- A. Videographer shall be certified through NASSCO's PACP/MACP/LACP program and have 2-years of experience.
- B. Video inspection firm shall have a minimum of 5 years of experience in buried piping video inspection.
- C. Videographer shall conform to coding and reporting guidelines specified in PACP, MACP and LACP, including report annotations, pipe conditions, pipe defects, and severity ratings for all inspection types, regardless of the type of camera utilized.
- D. Contractor shall maintain a master copy of all reports and recordings for two years after Final Completion.
- E. Quality of inspection recording shall be acceptable to TOWN when viewed on a standard computer monitor.

1.4 SUBMITTALS

- A. Digital Video Disc (DVD) or USB Drive labeled with the following information:
 - 1. Contractor's name.
 - 2. Project or Contract number.
 - 3. Location and date of Inspection.
 - 4. Inspection type: pre, post, warranty, repair, etc.
- B. Printed inspection reports:
 - 1. Inspection reports shall include the following information:
 - a. CONTRACTOR's name.
 - b. Location of inspection (road name, etc.).
 - c. Project name and phase, as applicable.
 - d. Inspection Type: Pre, post, warranty, repair, etc.
 - e. Upstream and downstream invert measurements.
 - f. Manhole depths.
 - g. Upstream and downstream manhole identification.
 - h. Pipe diameter.
 - i. Pipe material(s).
 - j. Length between manholes.
 - k. Lateral locations and associated address or lot number.
 - l. Lateral depth at mainline and first cleanout, or edge of easement or right of way.
 - m. Date televised.
 - n. Video file name associated with the report.
 - o. Inclinator reports if part of scope.
 - 2. Provide printed location records to clearly identify the location of each defect, or lateral connection, in relation to adjacent manholes, using a standard stationing system zeroed on the upstream manhole. Record all information requested using proper NASSCO PACP/MACP/LACP defect codes. Color still shot images of all major defects encountered shall be included with each pipe segment.
 - 3. Provide a map of inspection locations.

4. Provide one inspection report per segment. If the conditions do not permit inspection of the entire segment from one direction, provide an additional inspection report from the opposite end to the point the initial inspection was abandoned.
- C. Inspection Video and Audio Recordings:
1. Provide digital inspection recordings for all recordings.
 2. Once the survey of the pipeline is under way, the following data shall be displayed. The size and position of the data display shall not to interfere with the main subject of the picture yet shall be easily readable when the recording is replayed.
 - a. Camera's position, in feet, in the line segment from adjusted zero.
 - b. Pipe dimensions and type (8" VCP, etc.).
 - c. Upstream manhole and downstream manhole reference numbers per the construction drawings.
 - d. Direction of inspection (upstream or downstream).
 - e. Starting date and time of the inspection.
 - f. The produced video shall also have an inclinometer that displays the slope of the sewer main being televised.
 3. Recording shall be of a quality sufficient for TOWN to evaluate the condition of the pipe, locate service connections, and verify cleaning.
 4. Video Inspection recordings shall not be edited.
 5. If TOWN determines that the quality is not sufficient, re-televiser the pipe segment and provide a new recording and report at no additional compensation.
 - a. Camera distortions, inadequate lighting, dirty lens, speed, or steamy/blurred/hazy picture will be cause for rejection.
 - b. Pipe stationing or headers not shown on the video or in a font style or color that is unreadable will be cause for rejection.
 - c. Evidence of improper footage, footage resetting or not counting, will be cause for rejection.
 - d. Erroneous labeling of manholes and pipe will be cause for rejection.
 6. Provide one electronic video file of each inspection.
- D. Provide submittals according to this article for all post-construction and repair inspections performed.

- E. Submittals for video inspection will require a minimum of 48 hours for review by the TOWN.

1.5 REGULATORY REQUIREMENTS

- A. OSHA confined space requirements and other applicable health and safety requirements.

PART 2 PRODUCTS

2.1 TELEVISION EQUIPMENT

A. TV Inspection System:

1. Audio visual digital encoding equipment and software with color pan-and-tilt, waterproof camera specifically designed and constructed for pipeline inspection and recording.
2. Footage counter: Automatic, accurate, updatable metering device accurate to two tenths of a foot and which displays on the TV monitor the exact distance of the camera from the starting point of the TV inspection recording.
3. Lighting system: Fixed intensity with an even distribution of the light around the pipe perimeter without the loss of color or contrast, flare out of picture, or shadowing. Sufficiently powered so that all features and condition of the pipe can be clearly seen extending at least 10 feet in front, including for darker materials.
4. Camera features:
 - a. Vertical resolution: Minimum 470-line colored image quality and definition; to the satisfaction of the TOWN.
 - b. Focus adjustment: Minimum focal range of 3 inches in front of the camera's lens.
 - c. Radial viewing with ± 275 degrees pan and 360 degree rotation.
 - d. Camera height: Adjustable so camera lens is always centered at one-half the inside diameter of pipe or higher.
 - e. Provide a reflector in front of the camera, if necessary, to provide acceptable video image quality in large diameter pipes.
5. Operating conditions: 100 percent humidity.
6. Inspection length: Minimum 1,500 feet of pipe.
 - a. Service connections: 90 feet into connection

7. Self-propelled and capable of traversing minor off-set joints or pulled through with a tag line in more difficult circumstances.
8. Able to inspect laterals as small as 3 inches.
9. Self-leveling lateral launch camera.
10. Camera equipped with 512 Hz sonde for depth and location of mainline and laterals.
11. The transporter and camera assembly shall be equipped with a slope measuring device (inclinometer) capable of detecting pipe grade variations ± 5 degrees from true horizontal ($\pm 8.7\%$ grade) with a maximum error of ± 0.1 degree with readings taken at minimum intervals of two (≤ 2) feet. Inclinometer data shall be capable of being displayed in both numerical and graphical formats that can be printed or exported to an external database. The inclinometer data submitted shall allow easy identification of any high and/or low sections, correlated with the proper footage.

B. TV Studio:

1. Contained in an enclosed truck, trailer or van and insulated against noise and extremes in temperature with air conditioning and heating.
2. Provided with means of controlling external and internal light sources to ensure monitor screen display is in accordance with the requirements of these Specifications.

C. Digital Recordings:

1. Image Capture: Images shall be stored and be exportable as JPEG formats.
2. Video Capture:
 - a. Capture full time live video and audio files for each pipe segment and service connections inspected.
 - b. File storage:
 - 1) Use industry standard Windows Media or MPEG-4 format.
 - 2) Viewable on a personal computer.
 - 3) Ensure compatibility of recordings and software with ENGINEER or provide compatible software for viewing.
 - c. Resolution: Minimum 640 pixels (x) by 480 pixels (y) with an encoded frame rate of
29.97 frames per second.
 - d. Software should be able to record a minimum of 120 minutes of recording on

each file.

- e. Clear and stable image free of electrical interference.
 - f. Clear and discernable audio recording free of background and electrical noise.
 - g. Cross-reference the digital recording and inspection data to allow instant access to any point of interest within the digital recording.
3. Electronic recording file must allow snap scrolling to allow easy and quick access of the entire recording.

PART 3 EXECUTION

3.1 CLEANING

- A. Prior to TV inspection, clean pipe and manholes. Re-clean any segment or manhole found to be insufficiently cleaned during the TV inspection process.
- B. Clean pipelines to remove foreign materials, such as, rocks, grease, roots, gravel, settled sludge, or other materials that may prevent proper video inspection. Routine cleaning shall consist of up to three passes.
- C. Cleaning equipment may consist of hydraulically propelled, high-velocity jet, mechanically powered, or manual hand removal and should be provided, operated, and maintained by the CONTRACTOR. Other types of cleaning equipment may also be utilized for special applications with the TOWN's approval. Selection of the equipment used shall be based on the conditions of lines at the time the work commences. The equipment and methods selected shall be satisfactory to the TOWN.
- D. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists, and the cleaning effort shall be abandoned.
- E. Damage to the sewer lines caused by the CONTRACTOR's operations shall be repaired prior to final payment.
- F. Damage due to flooding of any public or private property being served by any line section which is over-filled by CONTRACTOR's cleaning operations shall also be repaired or otherwise paid for by the CONTRACTOR.
- G. All sludge, dirt, sand, grease, roots, and other solid or semi-solid material resulting from the cleaning operation shall be removed from the Site and disposed of at a location permitted and approved by the TOWN. All materials and debris will be removed from the Site no less than the end of every workday. Passing material from manhole section

to manhole section, which could cause line stoppages, accumulations of debris, or damage downstream, shall not be permitted. Under no circumstances shall this debris be dumped or spilled into the streets, ditches, storm drains, streams, or other sewer mains.

- H. The TOWN does not have a septage receiving station at its wastewater plant. Emptying the vacuum truck will need to be done at a nearby facility with the ability to accept the waste. Debris shall be disposed of at a landfill.
- I. Under no circumstances shall cleaning and CCTV inspection be performed simultaneously.
- J. Sewer reaches that require debris removal of depths up to 25 percent of the pipe height shall be categorized as "heavy cleaning". Video proof of heavy cleaning shall be obtained by acquiring a "before" video of all accessible portions of the obstructed reach and submitting that to Owner along with the completed inspection. A submerged camera does not justify a need for heavy cleaning. Proof that the submergence was due to a blockage and/or heavy debris and not a sag in the line will be required. Heavy cleaning will be paid for cleaning in addition to regular cleaning (3 passes) paid at the cost per linear foot. No payment will be made until disposal tickets for debris removed and disposed of are submitted.
 - 1. Costs related to the cleaning of such sewers shall include post cleaning CCTV and all contingent items. Compensation for heavy cleaning will only be paid if the heavy cleaning was authorized by the Owner prior to Contractor performance of the Work. Heavy cleaning shall be measured as the horizontal distance from the center of the entry manhole to the furthestmost extent of the heavy cleaning performed. Measurements shall be made to the nearest foot.

3.2 TELEVISION INSPECTION

- A. Provide inspection of both the upstream and downstream manholes beginning at the top of each manhole and panning down to inspect the manhole's interior walls. Center camera in manhole invert to the extent allowed by the invert geometry. Pan and record the entire circumference of the pipe penetration/manhole wall.
- B. Inspect pipelines with pan and tilt conventional television imagery to record the condition, relevant features, and defects of the pipeline under inspection. Notify the TOWN 48 hours in advance of any TV inspection so that the TOWN may observe inspection operations, if desired.
 - 1. With camera rolling, perform the distance counter preset. If a preset point on the CCTV cable is used to set the counter, CONTRACTOR shall back up the camera after setting the preset and record the entry to the pipe.

2. Use manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the pipe conditions to move the camera through the segment.
3. Pipeline inspection shall be from center of the starting manhole to the center of the ending manhole. Measure distances along the pipe from the inside of manhole wall of the starting manhole to inside of manhole wall of the downstream manhole.
4. Position the camera head to reduce the risk of picture distortion. In circular pipes, the camera lens shall be positioned centrally, in prime position, within the pipe. Direct camera lens along the longitudinal axis of the pipe when in prime position.
5. Inspect pipes during low flow conditions.
6. Move the camera smoothly through the pipeline (in the downstream direction whenever possible) at a uniform rate not to exceed 30 feet per minute. Stop at every joint. When infiltration or other defects are evident, use pan and tilt when camera is not moving to document pipe condition. Stop elsewhere when necessary to ensure proper documentation of the pipe's condition and to record lateral locations.
7. If, and only if, during a normal flow CCTV survey the televising camera cannot pass through the entire pipe section due to a defect, anomaly, or obstruction in the pipe, the contractor shall attempt a reverse setup so that the inspection can be performed from the opposite manhole, wet well, or access point.
8. When a reverse or second inspection is required to complete the inspection of a sewer, the PACP database field "Reverse_Setup" shall be populated with corresponding inspection number. The "Reverse_Setup" field shall be null for all inspections that are not reverse or follow-up inspections.
9. Prior to recording the location of defects, construction features and service connections, remove slack in the cable of the television inspection camera to ensure metering device is designating proper footage. Check accuracy of the measurement meters daily by use of a walking meter, roll-a-tape, or other suitable device.
10. Capture color still shots of video recordings for all major defects encountered.
11. If relevant, stop at every lateral connection. Center the camera on the lateral so that the lighting and the pan and tilt view can be used to inspect as far into the lateral connection as possible. Pan the circumference of the tap, recording all defects found in the lateral service connection. Where lateral flow is observed, observe flows from service connections for approximately two minutes to ascertain if the flow is sanitary or extraneous flow. The video recording may be paused during lateral observation. Record results of the flow observed on video recording and

inspection logs.

12. TV inspection recordings shall be continuous for each pipe segment. If during TV inspection of a pipe segment the camera is unable to pass an obstruction even though flow is unobstructed, televise the pipe segment from the opposite direction to obtain a complete recording of the line. Measure the distance between the manholes (centerline to centerline) with a tape or wheel to accurately determine the total length of the manhole segment.
13. Adjust light levels, clean fouled or fogged lens, and allow vapor to dissipate from camera lights to produce acceptable recordings.
14. TV inspection recordings that do not meet the specified requirements shall be re-televised. Examples of inadequate recordings include: too much shaking, too fast to clearly observe pipe, lacking or incorrect screen information, water/fog/debris on lens, problems with meter counter during video, technical glitches resulting in loss of screen view or unable to view video, not capturing all items as required, not coding apparent defects, or anything preventing the TOWN from fully examining and understanding the infrastructure for which it is to assume full responsibility.
15. If the camera lens becomes covered with sewage, grease, deposits etc. resulting in poor picture quality then the inspection shall be suspended, and the camera shall be removed and cleaned. The inspection can then be resumed at the last clear camera location.
16. Televise each lateral up to the cleanout at the right-of-way or easement. Record the material, depth, and length of each lateral and the lot or address(es) for which it is associated. Identify any defects or deficiencies. Begin the length at the wye connection or entry into the smaller diameter lateral pipe.

3.3 FLOW CONTROL

- A. Maximum depth of flow for CCTV inspections shall be 25 percent of the pipe diameter. If the depth of flow is greater, then the CCTV inspection shall be performed during the low flow periods between the hours of 10:00 p.m. to 6:00 a.m. or when wet weather conditions subside.
- B. Provide flow control in the pipe segment as needed to ensure a clear and adequate video inspection. TOWN may reject video inspection if flow affects the quality of the video.
- C. Whenever flows in a pipeline are blocked, plugged, pumped, or bypassed, take sufficient precautions to protect the pipelines from damage that might be inflicted by excess pipe surcharging. Further, take precautions to ensure that pipe flow control operations do not cause flooding or damage to public or private property being served by the pipes

involved. No overflows are permitted. The DEVELOPER/CONTRACTOR is responsible for all damages.

- D. CONTRACTOR is responsible for all damages to CONTRACTOR owned and operated equipment, TOWN facilities, and privately-owned facilities caused by malfunction of plugs, pumps, or other CONTRACTOR equipment. In the event of a failure or malfunction of CONTRACTOR equipment, CONTRACTOR is responsible for all work necessary to restore facilities including, but not limited to, excavation and restoration of pipelines and roadways required to retrieve malfunctioning or stuck cameras, plugs and hoses.
- E. For portions of the pipe that are bowed or bellied, camera may submerge. Wherever the camera encounters a submerged condition, or where the flow depth negatively impacts the video quality, reduce the flow depth to an acceptable level by performing the video inspection during minimum flow hours, or by pulling a camera with swab, high-velocity jet nozzle or other acceptable dewatering device. Recordings made while floating the camera are not acceptable unless pre-approved by TOWN.
- F. Contractor shall include the original inspection in the final submittal even with high flow conditions.

3.4 FIELD QUALITY CONTROL

- A. The CONTRACTOR shall operate a quality control system, to be approved by the TOWN, which will effectively gauge the accuracy of all inspection reports produced by the operator.
- B. The TOWN shall be entitled to audit the control system and be present when assessments are being computed. Should any report or assessment be deemed unsatisfactory by the TOWN, the CONTRACTOR, shall re-record, re-code and re-submit any video, data, or reports that the TOWN deems necessary to assess condition.

3.5 CLEANING DOCUMENTATION

- A. The CONTRACTOR shall keep records (in a log-type form) of the Work accomplished in the cleaning of the sewer lines. Copies of the log shall be furnished to the TOWN documenting Work completed. The following information shall be required as a minimum:
 - 1. Location (manhole no. to manhole no.) and type of surface cover.
 - 2. Date and time.
 - 3. Length of sewer.

4. Condition and depth of manholes.
5. Size and type of pipe.
6. Type and condition of manholes.
7. Type of cleaning performed, and various types of equipment used.
8. Meter readings (fire hydrant use).
9. Remarks as to type of materials removed, amount of materials removed, and number of hours spent to clean each pipe section.

APPENDIX B

AS-BUILT DIGITAL SUBMITTAL REQUIREMENTS

Incorporated by reference and published on Town utilities department web page.

This appendix will be modified as necessary without
requiring Board of Commissioners adoption.

Town of Hillsborough As-Built Digital Submittal Requirements

Submit electronic drawings and data files as described further on CD or DVD computer media, subject to the following requirements:

1. Summary information file.
2. CAD file(s) that include all as-built structures within the project.
3. PDF files of each as-built drawing submitted for review.
4. Data files for water, sanitary sewer, and stormwater infrastructure.

The CD (or DVD) shall have a permanent typewritten label (hand written labels will not be accepted due to the issues regarding legibility) that contains the project name, name of the firm that prepared the data, and date when the CD (or DVD) was prepared.

A. Summary Information File

The summary information file is to be an ASCII file that contains the following items:

1. Project name.
2. Name of the firm that prepared the data.
3. Date the CD (or DVD) was prepared.
4. Specification of two or more survey control monuments established and/or used for the project.

The preferred horizontal coordinate system for the digitally submitted data as described below shall be North Carolina State Plane (NAD83), U.S. Survey Feet. The preferred vertical coordinate system for the digitally submitted data as described below shall be North American Vertical Datum, 1988 (NAVD 1988), U.S. Survey Feet. This specification should include the following information for each survey control point:

- a. Easting – East coordinate value (+/- 0.01').
- b. Northing – North coordinate value (+/- 0.01').
- c. Elevation – Elevation (+/- 0.01').
- d. Description – A brief description of the control monument (including what type of monument it is, such as USGS, NCGS, LEC, WKD, or monument located for the project).
- e. A statement that indicates the horizontal and vertical datum of the control monuments.

B. CAD File(s)

Submit one or more AutoCad/MicroStation (DGN, DWG, or DXF format) drawing files that contain the entire utility infrastructure (water, sewer, and stormwater) that was constructed during the project, as well as all other pertinent reference lines, project information, and survey control data. The infrastructure shall be drawn in the file at the **as-built locations** as surveyed and certified by the Professional Land Surveyor (except for buried features like bends, tees, crosses, and reducers whose locations can be derived from CAD data). The AutoCAD or MicroStation file(s) shall be placed into a folder named "CAD" on the submitted media. **Please note: the delivered CAD files should not be of the Plan/Profile sheets, but should be the overall working drawing in "model space" that is registered to North Carolina State Plane, NAD 1983.**

C. PDF Files of each As-built Drawing Submitted

Submit one PDF file for each hard copy as-built drawing submitted according to the town's specifications. The PDF file(s) shall be placed into a folder named "PDF" on the submitted media. The PDF must include the signature and seal of the engineer.

D. Data files for Water, Sanitary Sewer, and Stormwater Infrastructure

Submit as-built data for direct import into the Town's Geographic Information System (GIS). This data shall consist of files in an ASCII Comma Separated Value (CSV or TXT) file format. The preferred horizontal coordinate system for the digitally submitted data as described below shall be North Carolina State Plane (NAD83), U.S. Survey Feet. The preferred vertical coordinate system for the digitally submitted data as described below shall be North American Vertical Datum, 1988 (NAVD 1988), U.S. Survey Feet. All of these file(s) shall be placed into a folder named "DATA" on the submitted media.

Several of the data files require the recording of materials for various pipes and structures. Please use the following standard codes where required:

Table 1.1: Material Codes

Code	Description
ACP	Asbestos Coated
Block	Concrete Block
Brick	Brick
CA	Corrugated Aluminum
CI	Cast Iron
CM	Corrugated Metal
CONC	Concrete
CU	Copper
DI	Ductile Iron
Earth	Earth
Foam core	Foam core
GALV	Galvanized
GRAVEL	GRAVEL
HDPE	High Density Polyethylene
PAVEMENT	PAVEMENT
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete
STONE	Stone
VC	Vitrified Clay

Water Features— The file shall be named "WaterFeatures" and contains various elements that connect and control the distribution of water within and among various water lines. These features include both buried fittings (bends, crosses, end caps, reducers, and tees) and features that are accessible and/or visible at the surface (meters, valves, and hydrants). The Easting, Northing (X, Y) data for buried features are to be derived from the as-built CAD file(s).

Each line of the file shall contain the following information:

1. **ID, Type, Easting, Northing, Elevation, Description** (all on first line of the file).
2. Where:

- a. **ID** - A unique ID number assigned to each feature noted on the as-built plan and profile sheets (e.g. GV-1, HYD-1, etc.).
- b. **Type** - The type of feature. Provide the following codes as indicated in the table below:

Table 1.2: Water Features Descriptions

Feature Description	Type
Air Release Valve	ARV
Backflow Preventer	BFP, RPZ, RPA, etc
Bend	BEND
Blow Off	BLOWOFF
Cross	CROSS
End Cap	CAP
Fire Department Connection	FDC
Fire Hydrant	HYDRANT
Pressure Reducing Valve	PRV
Reducer/Increaser	REDUCER
Tee/Tapping Sleeve	TEE
Water Valve	VALVE
Water Line	WATERLINE
Water Meter	METER

- c. **Easting** – East coordinate value (from CAD if buried, +/- 0.1' otherwise).
- d. **Northing** – North coordinate value (from CAD if buried, +/- 0.1' otherwise).
- e. **Elevation** – Elevation : N/A if buried, +/- 0.1' otherwise), collected as follows:

Table 1.3: Water Feature Elevation Locations

Feature Type	Elevation Location
HYDRANT	Top of the fire hydrant.
METER/VALVE/BLOWOFF	Center of the access structure.

- f. **Description** - The description of the item for the feature; encoded as follows:

Table 1.4: Water Feature Descriptions

Feature Type	Description
BLOWOFF	Size (in inches) of the blow off.
HYDRANT	Manufacturer and year of manufacture. This information will be on the hydrant (e.g. "CLOW-2004").
METER	The size (in inches).
VALVE	The size (in inches) and type of the valve (e.g. 6 GV, 12 BFV)
WATERLINE	No description required.

Water Lines – The file shall be named "WaterLines" and shall contain the following data. There is one line of data for each water line that connects two water features.

1. **ID, Material, Size, FeatureID1, FeatureID2** (all on first line of the file).
2. Where:
 - a. **ID** – A unique number assigned to each section of water line noted on the as-built plan and profile sheets (e.g. “WL-1”).
 - b. **Material** – Water line material (see Table 1.1: Material Codes above).
 - c. **Size** – The size (in inches) of the water line.
 - d. **FeatureID1** - The ID of the feature on the near end of the water line as shown on the as-built plans (e.g. “GV-1”).
 - e. **FeatureID2** - The ID of the feature on the far end of the water line as shown on the as-built plans (e.g. “HYD-1”).

Example data files:**Water Features.txt**

ID, Type, Easting, Northing, Elevation, Description
 EXFH-1, HYDRANT, 2021678.31, 774030.93, 287.00, unknown make-model-year
 HYD-1, HYDRANT, 2021596.64, 774389.70, 284.55, AMERICAN DARLING-2013
 HYD-2, HYDRANT, 2021623.72, 774906.27, 274.37, AMERICAN DARLING-2013
 WV-1, VALVE, 2021673.39, 774026.22, 277.36, 6
 WV-2, VALVE, 2021671.72, 774005.17, 276.05, 6
 WV-3, VALVE, 2021613.65, 774389.86, 278.19, 6
 WV-4, VALVE, 2021640.29, 774604.05, 276.20, 8
 WV-5, VALVE, 2021635.25, 774610.46, 276.21, 8
 WV-6, VALVE, 2021640.09, 774615.21, 276.13, 8
 WV-7, VALVE, 2021643.96, 774903.70, 268.46, 6
 WV-8, VALVE, 2021672.35, 774959.34, 267.91, 8
 BO-1, BLOWOFF, 2021484.45, 774625.62, 289.45, 2
 WM-1, METER, 2021600.15, 774760.41, 280.08, 0.625
 WM-2, METER, 2021599.45, 774741.80, 279.78, 0.625
 WM-3, METER, 2021596.38, 774674.04, 278.79, 0.625
 WM-4, METER, 2021596.51, 774518.27, 278.96, 0.625
 WM-5, METER, 2021595.61, 774500.97, 279.59, 0.625
 WM-6, METER, 2021593.95, 774439.67, 281.98, 0.625
 WM-7, METER, 2021593.29, 774376.83, 283.53, 0.625
 WM-8, METER, 2021591.61, 774314.25, 284.33, 0.625
 WM-9, METER, 2021590.86, 774248.34, 285.25, 0.625
 WM-10, METER, 2021589.35, 774190.29, 285.80, 0.625
 WM-11, METER, 2021588.90, 774129.95, 288.31, 0.625
 WM-12, METER, 2021588.08, 774068.75, 288.87, 0.625
 WM-13, METER, 2021605.17, 774013.81, 286.71, 0.625
 WM-14, METER, 2021620.90, 774001.24, 285.49, 0.625
 WM-15, METER, 2021668.34, 774140.25, 284.37, 0.625

WaterLines.txt

ID, Material, Size, WaterFeatureID1, WaterFeatureID2
 WL-1, DI, 6, WV-1, EXFH-1
 WL-2, DI, 8, WV-2, WV-1
 WL-3, DI, 8, BEND-1, TEE-2
 WL-4, DI, 6, TEE-2, HYD-1
 WL-5, DI, 8, TEE-2, TEE-1
 WL-6, DI, 8, TEE-1, CAP-1
 WL-7, DI, 8, TEE-1, TEE-4
 WL-8, DI, 6, TEE-4, HYD-2
 WL-9, DI, 8, TEE-4, BEND-2
 WL-9, DI, 8, BEND-2, WV-8
 WL10, DI, 8, TEE-3, BEND-3
 WL11, DI, 8, WV-8, BEND-0

Sewer Features – The file shall be named “SewerFeatures” and shall contain information about manholes, cleanouts, and other features listed in the table below. There is one line of data for each sewer feature. The Easting, Northing (X, Y) data for buried features can be derived from the as-built CAD file(s).

1. **ID, Type, Easting, Northing, Elevation, Invert, Size, Material** (all on first line of file)
2. Where:
 - a. **ID** – If the feature is a manhole then the number as shown on the as-built drawings (e.g. “MH-1”). If feature is a clean out then a lot number or street address (e.g. “LOT10” or “123 Street Name”).
 - b. **Type** – The feature type, coded according to the following table:

Table 1.5: Sanitary Sewer Features Descriptions

Feature Description	Type
Clean Out	CLEANOUT
Drain	DRAIN
Force Main Valve	FMVALVE
Force Main Tee	FMTEE
Force Main Bend	FMBEND
Force Main	FORCEMAIN
Grease Trap	GREASETRAP
Manhole	MANHOLE
Oil-Water Separator	OWS

- c. **Easting** – East coordinate value (+/- 0.1’).
- d. **Northing** – North coordinate value (+/- 0.1’).
- e. **Elevation** – Elevation (+/- 0.1’), collected as follows:

Table 1.6: Sanitary Sewer Features Elevation Locations

Feature Type	Elevation Location
CLEANOUT	Surface adjacent to the cleanout.
DRAIN	Center of the drain grate.
FMVALVE	Center of the access structure.
GREASETRAP/OWS	Center of the structure
MANHOLE	Rim of the manhole.

- f. **Invert** – Invert elevation (+/- 0.1’, required only for manholes).
- g. **Size** – diameter of manhole or cleanout (inches)
- h. **Material** – Construction material (see Table 1.1: Material Codes above).

Sewer Pipes - The file shall be named "SewerPipes" and shall contain the following data. There is one line of data for each sewer pipe.

If the pipe is a force main, values for **Size**, **Material**, **USId**, and **DSId** only need to be provided.

1. **ID, Size, Material, USId, DSId, USInv, DSInv, Slope, Length** (all on first line of the file).
2. Where:
 - a. **ID** – A sequential pipe number as noted on the as-built drawings (e.g. "SSP-1").
 - b. **Size** – Inside pipe diameter (inches).
 - c. **Material** – Pipe material (see Table 1.1: Material Codes above).
 - d. **USId** – Upstream manhole number as shown on the as-built drawings (e.g. "MH-1").
 - e. **DSId** - Downstream manhole number as shown on the as-built drawings (e.g. "MH-2").
 - f. **USInv** – Invert elevation at the upstream end.
 - g. **DSInv** – Invert elevation at the downstream end. If downstream end is a drop connection provide both elevations separated by a slash (e.g. 344.10/340.03).
 - h. **Slope** – The as-built grade of the pipe, expressed as a percentage and carried out to two decimal places.
 - i. **Length** – The length (in linear feet) of the pipe as indicated on the as-builts carried out two decimal places.

Example data files:**SewerFeatures.txt**

ID, Type, Easting, Northing, Elevation, Invert, Size, Material
SSMH-1, MANHOLE, 2021869.21, 774515.01, 255.71, 248.71, 48, CONC
SSMH-2, MANHOLE, 2021627.29, 774521.95, 277.32, 265.07, 48, CONC
SSMH-3, MANHOLE, 2021624.41, 774323.15, 281.81, 276.46, 48, CONC
SSMH-4, MANHOLE, 2021619.92, 774064.44, 284.86, 279.51, 48, CONC
SSMH-5, MANHOLE, 2021635.93, 774816.73, 276.17, 268.45, 48, CONC
SSMH-6, MANHOLE, 2021628.27, 774583.69, 276.42, 265.67, 48, CONC
SSMH-7, MANHOLE, 2021482.89, 774586.83, 289.21, 279.86, 48, CONC
CO-1, CLEANOUT, 2021602.12, 774757.09, 279.64, 0.00, 4, PVC
CO-2, CLEANOUT, 2021601.25, 774738.38, 279.59, 0.00, 4, PVC
CO-3, CLEANOUT, 2021598.65, 774677.44, 278.36, 0.00, 4, PVC
CO-4, CLEANOUT, 2021597.22, 774514.96, 278.91, 0.00, 4, PVC
CO-5, CLEANOUT, 2021596.64, 774497.90, 279.53, 0.00, 4, PVC
CO-6, CLEANOUT, 2021595.35, 774436.82, 281.93, 0.00, 4, PVC
CO-7, CLEANOUT, 2021594.58, 774374.24, 283.20, 0.00, 4, PVC
CO-8, CLEANOUT, 2021592.77, 774311.81, 284.25, 0.00, 4, PVC
CO-9, CLEANOUT, 2021592.37, 774246.19, 285.13, 0.00, 4, PVC
CO-10, CLEANOUT, 2021590.28, 774187.48, 286.03, 0.00, 4, PVC
CO-11, CLEANOUT, 2021589.75, 774126.40, 288.49, 0.00, 4, PVC
CO-12, CLEANOUT, 2021588.82, 774065.51, 288.80, 0.00, 4, PVC
CO-13, CLEANOUT, 2021611.72, 774007.75, 286.25, 0.00, 4, PVC
CO-14, CLEANOUT, 2021627.22, 773999.07, 285.47, 0.00, 4, PVC
CO-15, CLEANOUT, 2021667.72, 774143.70, 284.12, 0.00, 4, PVC
CO-16, CLEANOUT, 2021669.03, 774205.83, 283.26, 0.00, 4, PVC
CO-17, CLEANOUT, 2021670.19, 774267.36, 281.68, 0.00, 4, PVC
CO-18, CLEANOUT, 2021671.77, 774327.39, 281.45, 0.00, 4, PVC
CO-19, CLEANOUT, 2021672.69, 774390.72, 281.43, 0.00, 4, PVC
CO-20, CLEANOUT, 2021673.02, 774453.41, 279.19, 0.00, 4, PVC
CO-21, CLEANOUT, 2021673.72, 774540.74, 277.24, 0.00, 4, PVC

SewerPipes.txt

ID, Size, Material, USId, DSId, USInv, DSInv, Slope, Length
SSP-1, 8.00, PVC, SSMH-1, SSMH-2, 251.25, 249.81, 0.68, 212.02
SSP-2, 8.00, DI, SSMH-2, SSMH-3, 261.39, 254.80, 3.33, 198.18
SSP-3, 8.00, PVC, SSMH-3, SSMH-4, 264.69, 261.64, 3.47, 88.01
SSP-4, 8.00, PVC, SSMH-4, SSMH-5, 268.44, 264.89, 3.76, 94.36
SSP-5, 8.00, PVC, SSMH-5, SSMH-6, 266.74, 265.95, 0.57, 137.43
SSP-6, 8.00, PVC, SS-6, SSMH-7, 268.01, 266.79, 0.83, 147.21
SSP-7, 8.00, PVC, SSMH-7, SSMH-1, 268.19, 266.84, 0.74, 183.48

Stormwater Features – The file shall be named “StormwaterFeatures.” A storm water feature is either a grated drop inlet, hooded catch basin, curb inlet, drop/yard/grate inlet (cast iron grate cover with slotted openings), flared end section outlet, flared end section inlet, headwall inlet, headwall outlet, junction box, manhole, riser pipe, open throat catch basin (solid concrete cover, supported on the corners with side flow entry) or weir box. There is one line of data for each storm water structure.

1. **ID, Type, Easting, Northing, Elevation, Invert, Material** (all on first line of the file).
2. Where:
 - a. **ID** – Structure number as shown on the as-built drawings (e.g. “SWMH-1”, “CB-2”, “YI-4”, “DI-3”).
 - b. **Type** – Type of storm water feature, to be encoded according to the following table:

Table 4.7: Stormwater Features Description

Feature Description	Type
Grated drop inlet	GDI
Hooded Catch Basin	HCB
Curb Inlet (frame, no grate)	CI
Drop/Grate/Yard Inlet (grate flush with ground)	DI
Flared End Section Inlet/Outlet	FESI, FESO
Headwall Inlet/Outlet	HWI, HWO
Junction Box	JBOX
Manhole	SWMH
Pond Outlet Riser	RISER PIPE
Slab Inlet/Open Throat Catch Basin	OTCB
Weir Box	WEIR BOX

- c. **Easting** – East coordinate value (+/- 0.1’).
- d. **Northing** – North coordinate value (+/- 0.1’).
- e. **Elevation** – Elevation (+/- 0.1’), collected as follows:

Table 4.8: Stormwater Features Elevation Locations

Feature Type	Elevation Location
GRATED DROP INLET	Back of curb, center of box
HOODED CATCH BASIN	Back of curb, center of box
CURB INLET	Back of curb, center of box
DROP INLET	Center of grate
FLARED END SECTION	Top of end section
HEADWALL	Center of the headwall
JUNCTION BOX	Center of cover
MANHOLE	Center of cover
RISER PIPE	Top of the riser
SLAB INLET	Top of slab, center of box
WEIR BOX	Top center of box

- f. **Invert** – The invert elevation.
- g. **Material** – Construction material (see Table 1.1: Material Codes above).

Stormwater Pipes – The file shall be named “StormwaterPipes” and shall contain the following data. There is one line of data for each stormwater pipe. .

1. **ID, Size, Material, USId, DSId, USInv, DSInv, Slope, Length** (all on first line of the file).
2. Where:
 - a. **ID** – A sequential pipe number as noted on the as-built drawings (e.g. “SWP-1”).
 - b. **Size** – Pipe diameter (inches). Non-circular pipe sizes can be indicated with two dimension values separated by an “X” (e.g. “4x6”).
 - c. **Material** – Pipe material (see Table 1.1: Material Codes above).
 - d. **USId** – Upstream feature ID number as shown on the as-built drawings (e.g. “SWMH-1”).
 - e. **DSId** – Downstream feature ID number as shown on the as-built drawings (e.g. “CB-2”).
 - f. **USInv** – Invert elevation at the upstream end.
 - g. **DSInv** – Invert elevation at the downstream end.
 - h. **Slope** – The as-built grade of the pipe, expressed as a percentage carried out to two decimal places.
 - i. **Length** – The length (in linear feet) of the pipe as indicated on the as-builts and carried out to two decimal places.

Stormwater Channels (constructed channels) – The file shall be named “StormwaterChannels” and shall contain the following data. Each line of the file shall correspond to a location collected at 25 foot stations along the centerline of the open channel. Each line of the file shall contain the following information:

1. **ID, Easting, Northing, Elevation** (all on first line of the file)
2. Where:
 - a. **ID** – is a unique number assigned to each section of open channel. The ID for an open channel changes at any intersection with another open channel and/or stormwater structure.
 - b. **Easting** – East coordinate value (+/- 0.1').
 - c. **Northing** – North coordinate value (+/- 0.1').
 - d. **Elevation** – Elevation at the bottom of the channel (+/- 0.1').
 - e. **Material** – see table 1.1

StormwaterFeatures.txt**ID, Type, Easting, Northing, Elevation, Invert, Material**

YI2B-588,DI,2063280.79,794463.69,419.54,416.95,HDPE
 CB2B-40,CI,2063259.89,794278.14,417.6,404.19,CONC
 CB2B-734,CI,2063250.51,794307.18,417.52,411.07,CONC
 CB2B-589E,CI,2063211.2,794324.37,417.47,414.19,CONC
 CB2B-588,CI,2063310.79,794384.15,417.42,413.28,CONC
 CB2B-589,CI,2063183.17,794312.32,417.4,414.7,CONC
 JB2B-589W,CI,2063077.31,794216.91,415.53,404.88,CONC
 CB2B-41,CI,2063099.31,794184.38,415.08,402.29,CONC
 CB2B-39,CI,2063358.56,794299.49,414.84,406.52,CONC
 CB3146,CI,2063536.22,794359.21,413.95,408.41,CONC
 CB2B-42,CI,2063020.9,794130.48,412.69,400.31,CONC
 CB2B-612S,CI,2063002.78,794154.94,412.69,402.13,CONC
 CB3044,CI,2063499.39,794298.24,412.44,408.03,CONC
 YI2B-610,DI,2062984.32,794349.5,412.42,410.15,HDPE
 CB3043,GDI,2063501.68,794328.1,412.09,409.05,CONC
 CB2B-623W,GDI,2062444.61,794474.19,411.21,404.46,CONC
 CB2B-612,GDI,2062958.96,794163.73,410.88,407.56,CONC
 CB2B-613,GDI,2062933.99,794146.18,410.82,407.9,CONC
 CB2B-624N,GDI,2062385.87,794402.84,410.26,403.04,CONC
 YI2B-612,DI,2063070.33,794225.16,409.86,405.23,HDPE
 YI2B-621,GDI,2062556.4,794381.02,409.63,407.52,CONC
 CB2B-638,GDI,2062369,794334.88,409.22,402.17,CONC
 CB2B-624,GDI,2062387.8,794359.01,409.17,402.44,CONC
 CB2B-43,GDI,2062888.68,794039.35,408.67,398.76,CONC
 CB2B-685,GDI,2062307.85,794356.56,408.41,402.1,CONC
 CB2B - 638N,GDI,2062324.38,794328.66,408.18,400.87,CONC
 YI2B-622,DI,2062504.45,794424.29,407.88,405.53,HDPE
 YI2B-631,GDI,2062775.97,794109.33,402.72,400.6,CONC
 CB2B-45,GDI,2062687.47,793911.45,402.62,392.63,CONC
 YI2B-637,DI,2062310.25,794188.07,395.79,393.04,HDPE
 CB2B-632S,GDI,2062549.89,793887.09,395.62,389.47,CONC
 CB2B-656,GDI,2062391.44,793853.12,393.52,391.46,CONC
 YI2B-643,GDI,2062498.28,793971.61,393.42,391.22,CONC
 CB2B-644,GDI,2062421.01,793863.49,393.21,389.82,CONC
 CB2B-693,CI,2062472.43,793822.27,391.82,386.38,CONC
 CB2B-644S,CI,2062459.83,793849.96,391.71,388.19,CONC
 CB2B-645,CI,2062453.48,793784.31,391.54,385.53,CONC
 CB2B-675,CI,2061985.47,793965.29,389.59,383.52,CONC
 CB2B-651,CI,2062013.96,793952.42,387.06,382.45,CONC
 JB2B-665,JBOX,2062453.26,793436.94,380.94,364.54,CONC
 YI2B-662,DI,2062064.69,793664.47,376.52,373.65,HDPE
 JB12,CI,2062645.51,793473.09,376.15,371.29,CONC
 JB13,CI,2062544.24,793458.62,374.41,370.03,CONC
 HW2B-664,HWO,2062326.4,793410.36,368.9,368.9,CONC
 YI2B-572,DI,2063098.6,794716.98,415.58,413.47,HDPE
 YI3143,DI,2063323.74,794938.28,415.02,411.81,HDPE
 YI3142,DI,2063286,794982.46,412.85,409.63,HDPE
 YI3141,DI,2063173.93,795094.46,409.3,406.22,HDPE
 YI2B-576,DI,2062950.47,794865.47,405.95,402.69,HDPE
 CB2B-600,CI,2062801.93,794791.3,405.71,400.1,CONC
 CB2B-578,CI,2062831.38,794805.33,405.47,400.39,CONC
 YI2B-600,DI,2062734.63,794679.41,404.91,401.96,HDPE
 YI2B-694,DI,2062524.66,794801.16,402.17,395.32,HDPE
 HW2B-34,HWO,2062472.16,794838.63,396.51,396.51,CONC

StormwaterPipes.txt**ID,Size,Material,USId,DSId,USInv,DSInv,Slope,Length**

SDP2-103,15,CONC,CB3146,CB3043,410.41,409.05,2.93,46.49
 SDP2-102,15,CONC,CB3043,CB3044,409.05,408.03,3.41,29.94
 SDP2-104,18,CONC,CB3044,CB2B-39,408.03,406.62,1,140.84
 SDP2B-688,18,CONC,CB2B-39,CB2B-40,406.52,404.69,1.81,100.95
 SDP2B-689,24,CONC,CB2B-40,CB2B-41,404.19,402.5,0.91,185.95
 SDP2B-690,24,CONC,CB2B-41,CB2B-42,402.29,400.81,1.56,95.15
 SDP2B-691,30,CONC,CB2B-42,CB2B-43,400.31,399.16,0.72,160.58
 SDP2B-692,30,CONC,CB2B-43,CB2B-44,398.76,395.99,1.8,153.61
 SDP2B-693,30,CONC,CB2B-44,CB2B-45,395.84,392.82,3.55,85.08
 SDP2B-694,30,CONC,CB2B-45,CB2B-693,392.63,386.48,2.64,232.8
 SDP2B-695,36,CONC,CB2B-693,CB2B-645,386.38,385.63,1.77,42.43
 SDP2B-696,36,CONC,CB2B-645,CB2B-647,385.53,378.38,4.92,145.3
 SDP2B-697,36,CONC,CB2B-647,CB2B-658E,378.28,377.94,1.13,30.14
 SDP2B-698,36,CONC,CB2B-658E,CB2B-658,377.84,377.6,0.49,49.07
 SDP2B-699,36,CONC,CB2B-658,CB2B-663,376.7,376.24,1.56,29.57
 SDP2B-700,42,CONC,CB2B-666,CB2B-663,368.63,366.56,0.74,278.89
 SDP2B-701,48,CONC,CB2B-663,CB2B-663E,366.18,365.79,0.8,48.89
 SDP2B-702,48,CONC,CB2B-663E,CB2B-665,365.59,364.7,0.81,109.31
 SDP2B-706,15,CONC,CB2B-671,CB2B-650S,376.65,375.64,3.28,30.76
 SDP2B-707,24,CONC,CB2B-650,CB2B-650S,377.04,373.83,3.13,102.65
 SDP2B-708,30,CONC,CB2B-650S,CB2B-662,373.11,371.81,1.06,122.39
 SDP2B-709,24,CONC,CB2B-668,CB2B-662,371.77,369.76,6.72,29.9
 SDP2B-222,42,CONC,CB2B-662,CB2B-666,369.56,368.75,0.76,106.54
 SDP2B-223,15,CONC,CB2B-589,CB2B-589E,414.7,414.24,1.51,30.51
 SDP2B-224,15,CONC,CB2B-589E,CB2B-734,414.19,413.77,0.98,42.9
 SDP2B-731,15,CONC,CB2B-734,CB2B-40,411.07,410.84,0.75,30.52
 SDP2B-730,15,CONC,CB2B-588,CB2B-734,413.28,412.5,0.8,97.76
 SDP2B-723,15,CONC,CB2B-613,CB2B-612,407.9,407.61,0.95,30.52
 SDP2B-724,15,CONC,CB2B-612,CB2B-612S,407.56,407.13,0.96,44.69
 SDP2B-725,18,CONC,CB2B-612S,CB2B-42,402.13,401.21,3.02,30.45
 SDP2B-716,18,CONC,CB2B-631,CB2B-632,398.42,398.25,0.56,30.33
 SDP2B-717,18,CONC,CB2B-631S,CB2B-631,398.87,398.68,0.38,50.3
 SDP2B-718,24,CONC,CB2B-632,CB2B-45,397.91,394.92,4.34,68.84
 SDP2B-710,15,CONC,CB2B-656,CB2B-644,391.46,389.92,4.91,31.34
 SDP2B-711,15,CONC,CB2B-644,CB2B-644S,389.82,388.59,2.99,41.11
 SDP2B-236,24,CONC,CB2B-644S,CB2B-693,388.19,387.48,2.33,30.41
 SDP2B-728,15,HDPE,YI2B-610,YI2B-612,410.15,405.43,3.12,151.18
 SDP2B-729,18,CONC,YI2B-612,CB2B-589W,405.23,404.93,2.78,10.81
 SDP2B-721,15,CONC,YI2B-631,CB2B-613S,400.6,399.69,1,91.31
 SDP2B-722,18,CONC,CB2B-613S,CB2B-631S,399.57,399.14,0.47,92.32
 SDP2B-713,15,HDPE,YI2B-643,YI2B-644,391.22,390.29,1.27,72.94
 SDP2B-714,15,CONC,YI2B-644,CB2B-632S,390.14,389.52,2.33,26.55
 SDP2B-715,18,CONC,CB2B-632S,CB2B-644S,389.47,388.39,1.11,97.41
 SDP2B-687,24,CONC,YI2B-662,CB2B-662,373.65,369.96,12.74,28.97
 SDP2B-2,15,CONC,YI2B-588,CB2B-588,416.95,414.28,3.14,85.02
 SDP2B-4,48,CONC,CB2B-665,CB2B-664,364.54,363.98,0.43,129.62
 SDP2B-23,24,CONC,CB2B-639N,CB2B-639,390.18,389.15,1.88,54.7
 SDP2B-24,24,CONC,CB2B-639,CB2B-653E,389.1,388.93,0.56,30.5
 SDP2B-25,24,CONC,CB2B-653E,CB2B-653,388.88,388.49,0.69,56.9
 SDP2B-5,24,CONC,CB2B-653,CB2B-651,388.17,383.29,2.7,180.89
 SDP2B-6,24,CONC,CB2B-651,CB2B-650,382.45,376.74,5.15,110.93
 SDP - 7,24,CONC,CB2B-638W,CB2B-639N,390.75,390.28,0.51,92.38
 SDP2B-47,18,CONC,CB2B-624,CB2B-638,402.44,402.27,0.5,30.59
 SDP2B-19,18,CONC,CB2B-624N,CB2B-624,403.04,402.62,0.96,43.87
 SDP2B-18,15,CONC,CB2B-685,CB2B - 638N,402.1,401.75,1.08,32.43
 SDP2B-20,24,CONC,CB2B - 638N,CB2B-638W,400.87,396.9,3.37,117.96
 SDP2B-28,15,CONC,CB2B-681,CB2B-639N,391.98,391.48,1.45,34.58
 SDP2B-41,15,CONC,YI2B-637,CB2B-639,393.04,392.11,1.32,70.31
 SDP2B-40,15,HDPE,YI2B-636,YI2B-637,393.81,393.09,1.06,67.74

APPENDIX C

APPROVED MATERIALS LIST

Incorporated by reference and published on Town utilities department web page.

This appendix will be modified as necessary without
requiring Board of Commissioners adoption.

[under development – see body of specifications for current material preferences]

APPENDIX D

STANDARD DETAILS

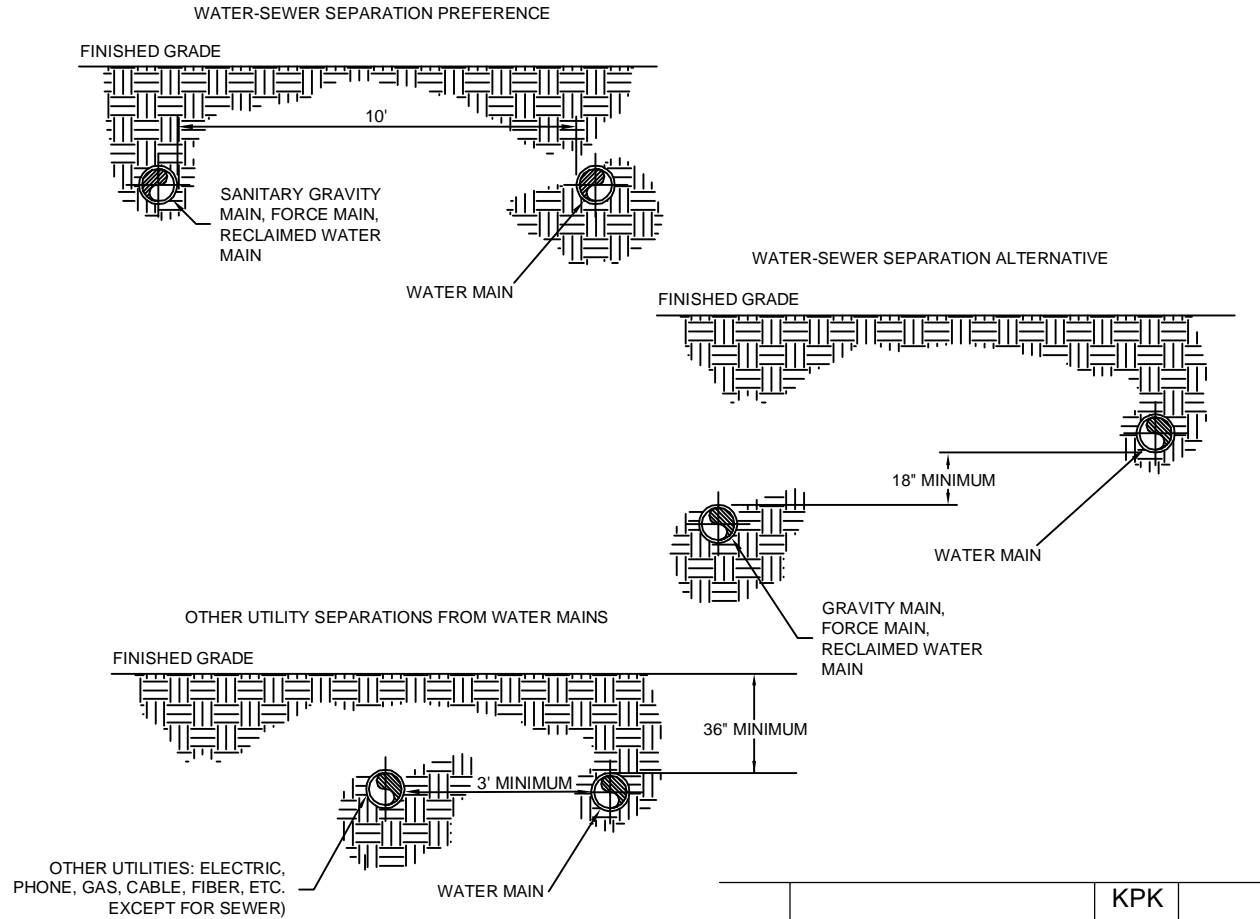
Incorporated by reference and published on Town utilities department web page.

This appendix will be modified as necessary without
requiring Board of Commissioners adoption.

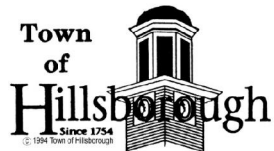
NOTES:

THE FOLLOWING MINIMUM SEPARATIONS SHALL BE PROVIDED FOR UTILITIES:

1. STORM SEWERS AND OTHER UTILITIES SHALL HAVE A MINIMUM VERTICAL SEPARATION OF 24 INCHES. IN THE EVENT THIS MINIMUM SEPARATION CANNOT BE MET, STRUCTURAL BRIDGING OR DUCTILE IRON PIPE SHALL BE USED TO PREVENT CRUSHING OF THE UNDERLYING PIPE
2. WATER MAINS (WATER OVER SEWER INCLUDING IN BENCHED TRENCHES) SHALL HAVE A MINIMUM VERTICAL SEPARATION OF 18 INCHES OR A MINIMUM HORIZONTAL SEPARATION OF 10 FEET. IN THE EVENT THIS MINIMUM SEPARATION CANNOT BE MET, FOLLOW THE ALTERNATIVES LISTED IN 15A NCAC 18C.0906 (b) AND (c)
3. FINAL GRADE SHALL PROVIDE 36 INCHES OF COVER OVER TOP OF SEWERS AND WATER MAINS. FOR LESS THAN 36-INCHES COVER FROM FINAL GRADE FOR SEWER, DUCTILE IRON PIPE SHALL BE SPECIFIED. DUCTILE IRON PIPE BEDDING TO DEVELOP DESIGN SUPPORTING STRENGTH SHALL BE PROVIDED WHERE SEWERS ARE SUBJECT TO TRAFFIC BEARING LOADS
4. ALL OTHER UTILITIES (ELECTRIC, GAS, COMMUNICATIONS, ETC.) SHALL BE A MINIMUM OF 3 FEET HORIZONTALLY FROM ALL WATER MAINS
5. THESE SEPARATIONS MIRROR STATE AND TOWN REQUIREMENTS AT THE DATE DEVELOPED. IF AT ANY TIME STATE OR TOWN REQUIREMENTS ARE REVISED TO BE MORE STRINGENT, THEY WILL TAKE PRECEDENCE OVER THIS DETAIL




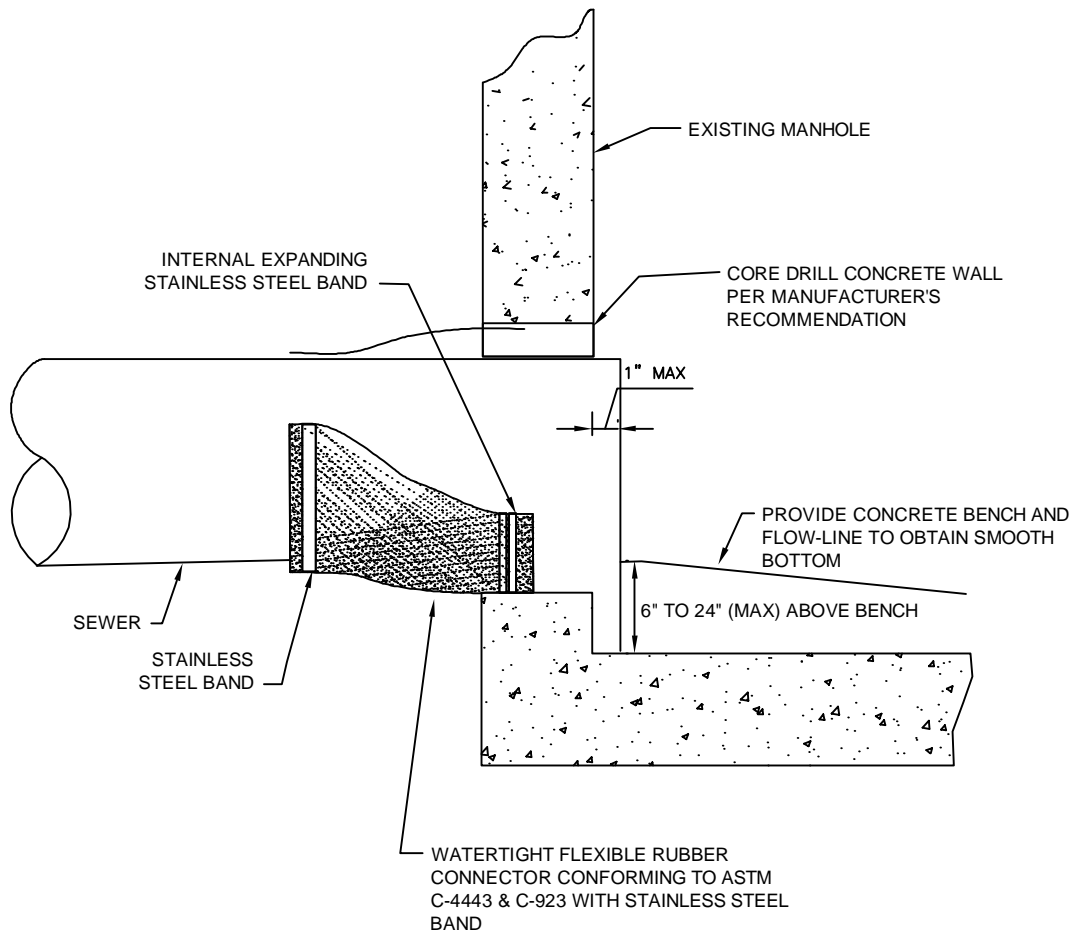
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UTILITY SEPARATION

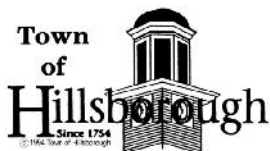
scale | NTS drawing no. | **G-01**
date | JUNE 2012
approved |  Kenneth P. Keel, P.E., Town Engineer



NOTES:

1. ALL CONNECTIONS TO EXISTING MANHOLES OR WETWELLS SHALL UTILIZE A CORING METHOD AND IN-FIELD INSTALLATION OF A RUBBER BOOT CONNECTION

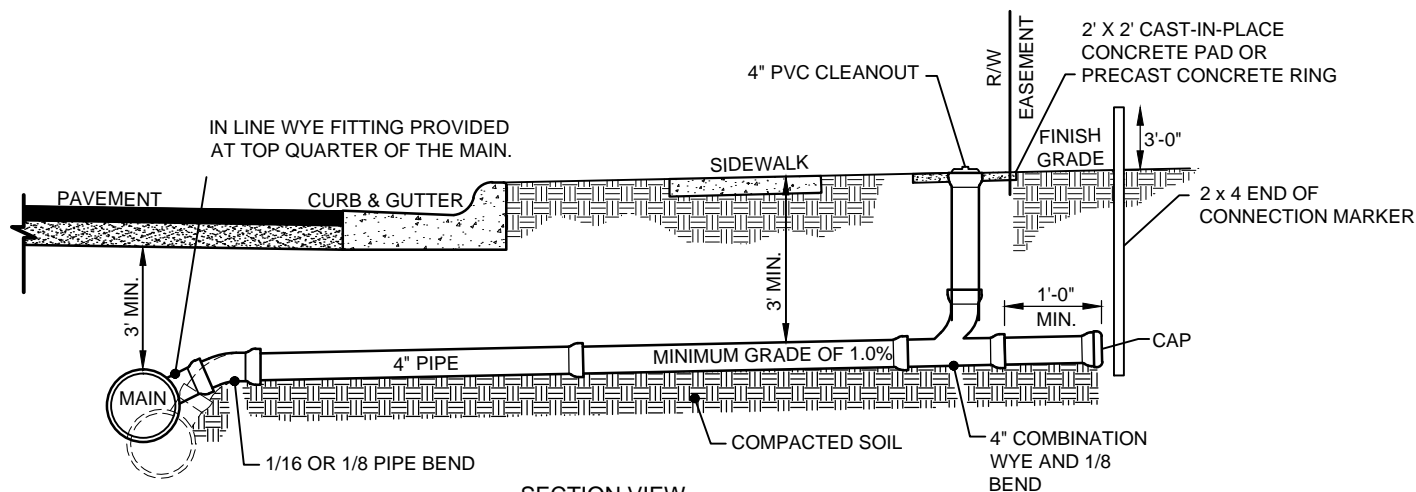
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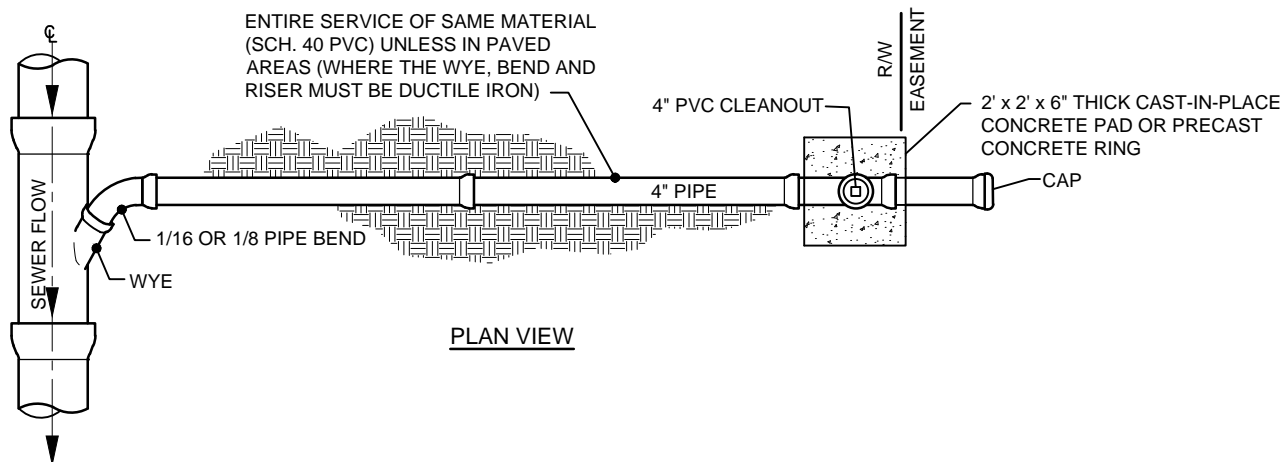
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CORED CONNECTIONS SEWER WETWELL OR MANHOLE

scale | NTS drawing no. | **S-02**
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



SECTION VIEW

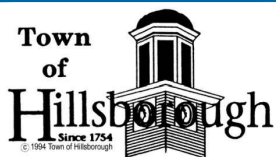


PLAN VIEW

NOTES:

1. CLEANOUT SHALL BE PLACED AT RIGHT-OF-WAY OR EDGE OF EASEMENT
2. DO NOT INSTALL CLEANOUT INSIDE A FENCE
3. CONNECTIONS TO 15" OUTFALLS AND GREATER MUST BE MADE INTO MANHOLE

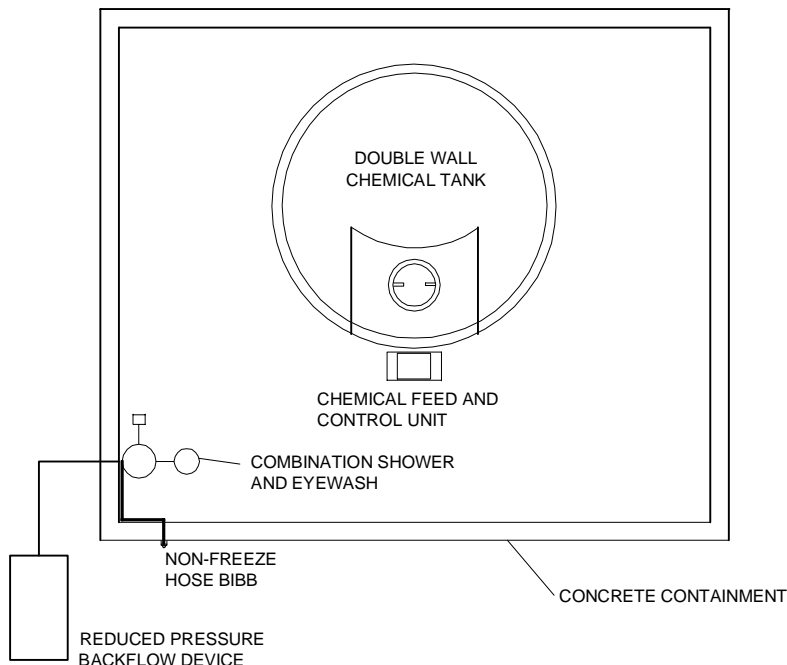
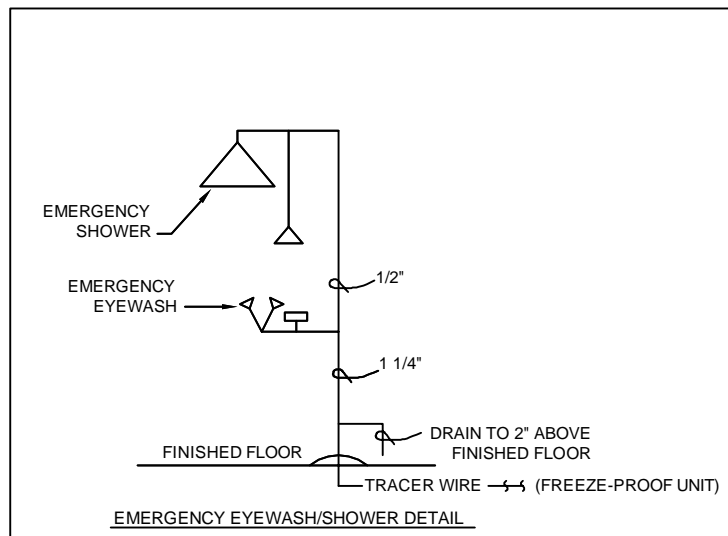
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rev	description	app'd	date



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SEWER SERVICE AND CLEANOUT WITH COLLAR

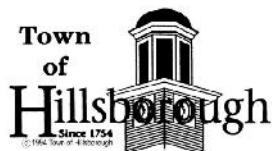
scale | NTS drawing no. | **S-03**
date | JANUARY 2017
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



NOTES:

1. THE ODOR CONTROL SYSTEM SHALL INCLUDE A 1,000 GALLON CHEMICAL TANK AND A CHEMICAL FEED METERING PUMP (LMI)
2. THE CHEMICAL TANK SHALL BE FILLED WITH CALCIUM NITRATE TETRAHYDRATE OR CHEMICAL SPECIFIED BY THE TOWN ENGINEER PRIOR TO OPERATION
3. ODOR CONTROL SYSTEM SHALL BE PIPED TO JUST BELOW THE WET WELL HATCH
4. TIMER IS OPTIONAL
5. TANK AND SLAB SHALL BE DESIGNED IN ACCORDANCE WITH APPLICABLE FEDERAL OR STATE SECONDARY CONTAINMENT STANDARDS
6. SLAB SHALL BE DESIGNED FOR THE PROPOSED TANK DIMENSIONS AND WEIGHT AND FOR THE SITE SPECIFIC SOIL CONDITIONS

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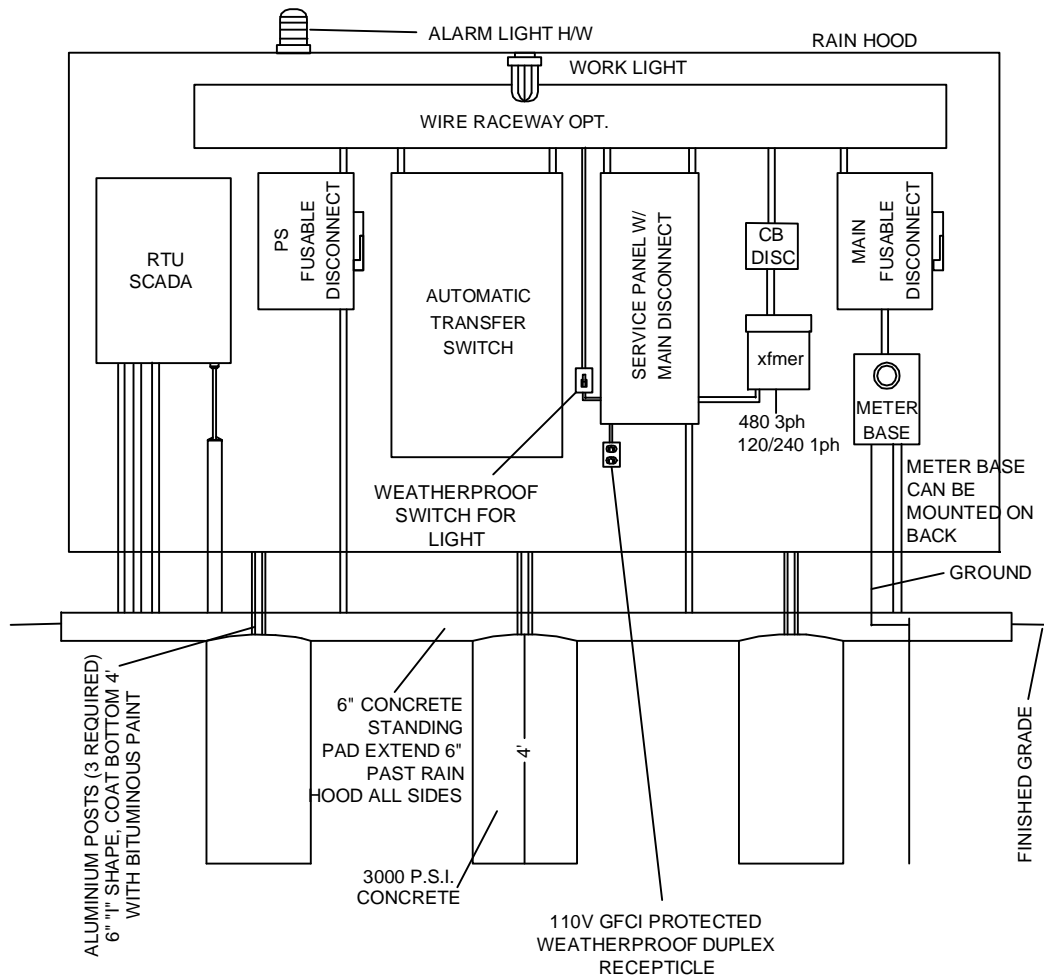
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ODOR CONTROL FOR SEWER PUMPING STATION

scale | NTS
date | JUNE 2012
approved | *Kenneth P. Keel*

drawing no. **S-04**

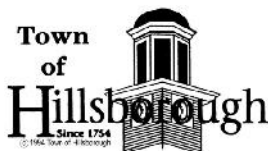
Kenneth P. Keel, P.E., Town Engineer



NOTES

1. BACKING PLATE TO BE 1/4" ALUMINUM. MOUNT TO "I" BEAM POSTS WITH STAINLESS STEEL NUT, BOLTS, AND WASHERS
2. ALL ELECTRICAL WORK SHALL CONFORM TO LATEST NATIONAL, STATE AND LOCAL CODES AND REQUIREMENTS
3. PANEL LAYOUT IS SCHEMATIC ONLY. ADJUST AS NEEDED TO ACCOMMODATE EQUIPMENT AND TOH SPECIFICATIONS. MAINTAIN 4" MIN. CLEARANCE BETWEEN PANELS AND SIDE SHIELDS
4. ALL ENCLOSURES SHALL BE NEMA 4X RATED AND LOCKABLE
5. ENCLOSURES SHALL BE MOUNTED TO ALUMINUM BACKING PLATE WITH NYLON SPACERS & STAINLESS STEEL NUTS, BOLTS & WASHERS
6. CONDUIT SHALL BE RIGID ALUMINUM OR GALVANIZED. MEYERS HUBS SHALL BE USED AT ALL PANEL CONNECTIONS
7. NO EQUIPMENT SHALL BE MOUNTED LESS THAN 36" ABOVE FINISHED GRADE AND AT LEAST TWO FEET ABOVE THE 100 YEAR FLOOD ELEVATION
8. MIN. CLEARANCE FROM WORK LIGHT TO STANDING PAD SHALL BE 6'-6"
9. PROVIDE WEATHER HOOD OF 12 GA. MILL FINISH ALUMINUM STITCH WELDED TO BACKING PLATE. HOOD TO BE SAME WIDTH AS BACKING BOARD
10. ALARM LIGHT SHALL BE RED STROBE. HORN SHALL BE A MIN OF 90DB

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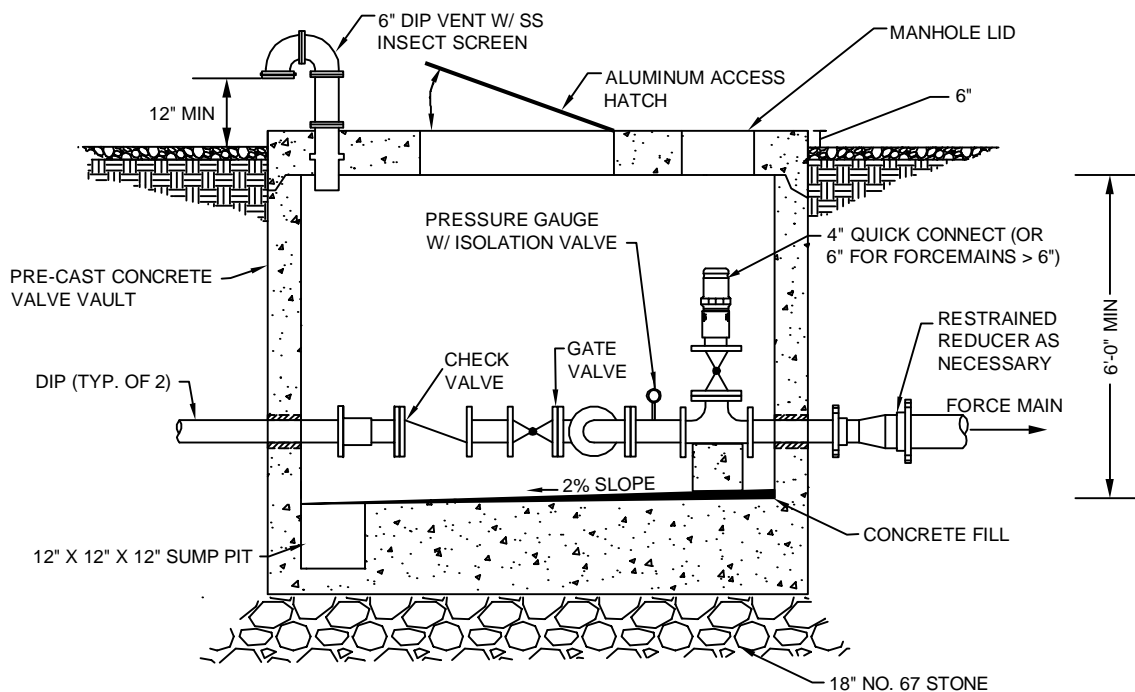
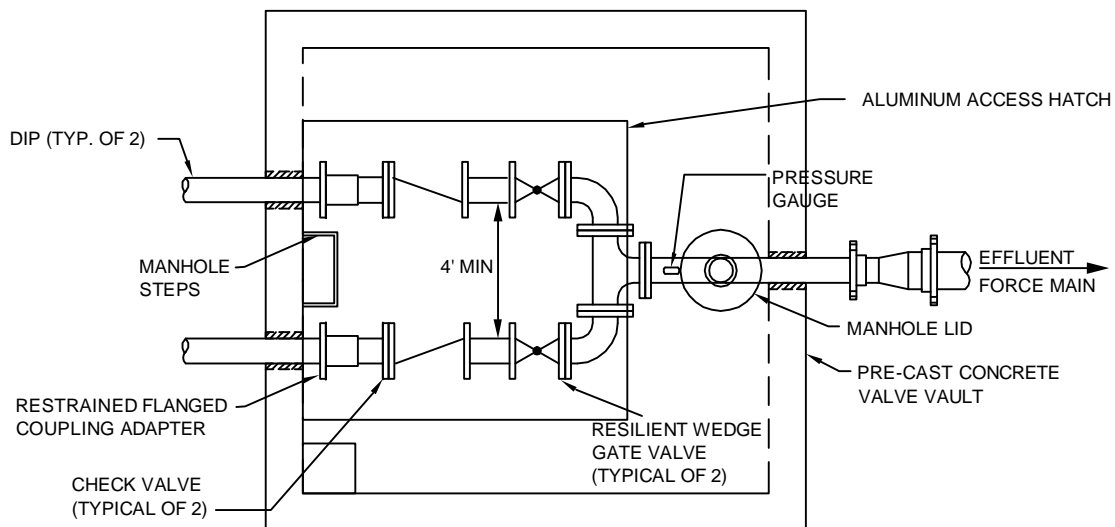


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ELECTRICAL PANEL RISER DIAGRAM (TYP)

scale | NTS
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer

drawing no. | **S-05**

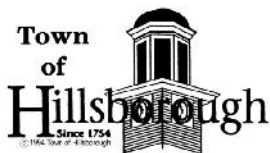


NOTES:

1. ALL PIPE AND VALVE SIZES SHALL BE 4" DIAMETER OR GREATER AS DETERMINED BY THE DESIGN ENGINEER
2. VALVE VAULT BUOYANCY SHALL BE CALCULATED BY THE DESIGN ENGINEER. APPROPRIATE ANTI-FLOTATION MEASURE SHALL BE PROVIDED
3. ACCESS HATCH: HINGES AND OTHER HARDWARE SHALL BE STAINLESS STEEL WITH TAMPER PROOF FASTENERS. ALUMINUM SURFACES IN CONTACT WITH CONCRETE OR GROUT SHALL BE COATED WITH BITUMINOUS MATERIAL FOR PROTECTION. HATCHES SHALL BE SINGLE OR DOUBLE LEAF DEPENDING ON OPENING AND MANUFACTURER'S RECOMMENDATIONS.
4. DOORS SHALL BE RATED FOR 300 PSF LIVE LOADINGS OR H-20 TRAFFIC RATED

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PUMPING STATION VALVE VAULT

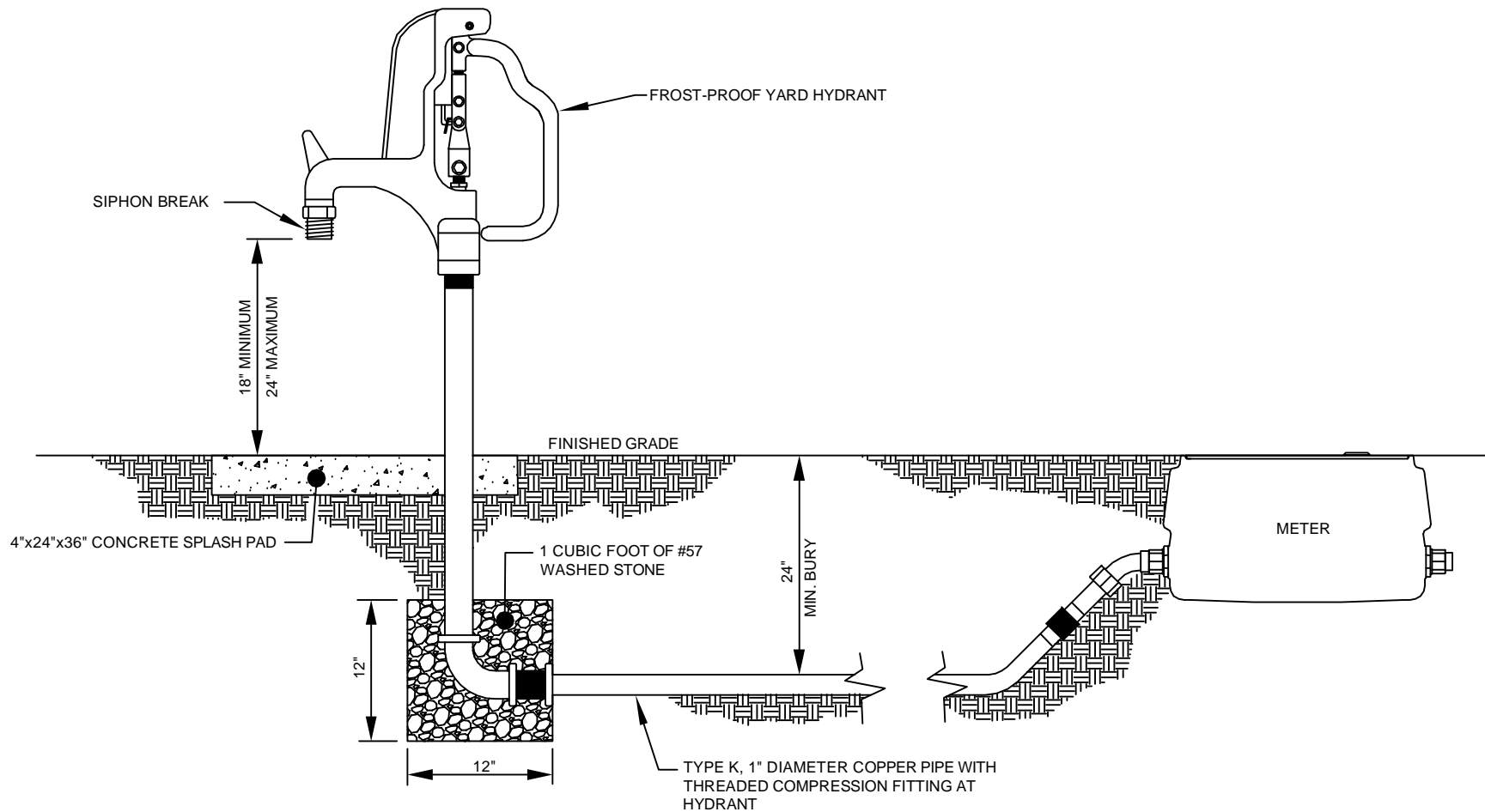


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scale NTS
date JUNE 2012
approved *Kenneth P. Keel*

drawing no. **S-06**

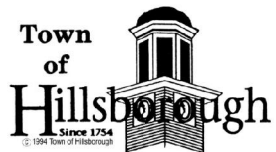
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NOTES:

- HOSE BIB SHALL ACCOMMODATE STANDARD 3/4" GARDEN HOSE

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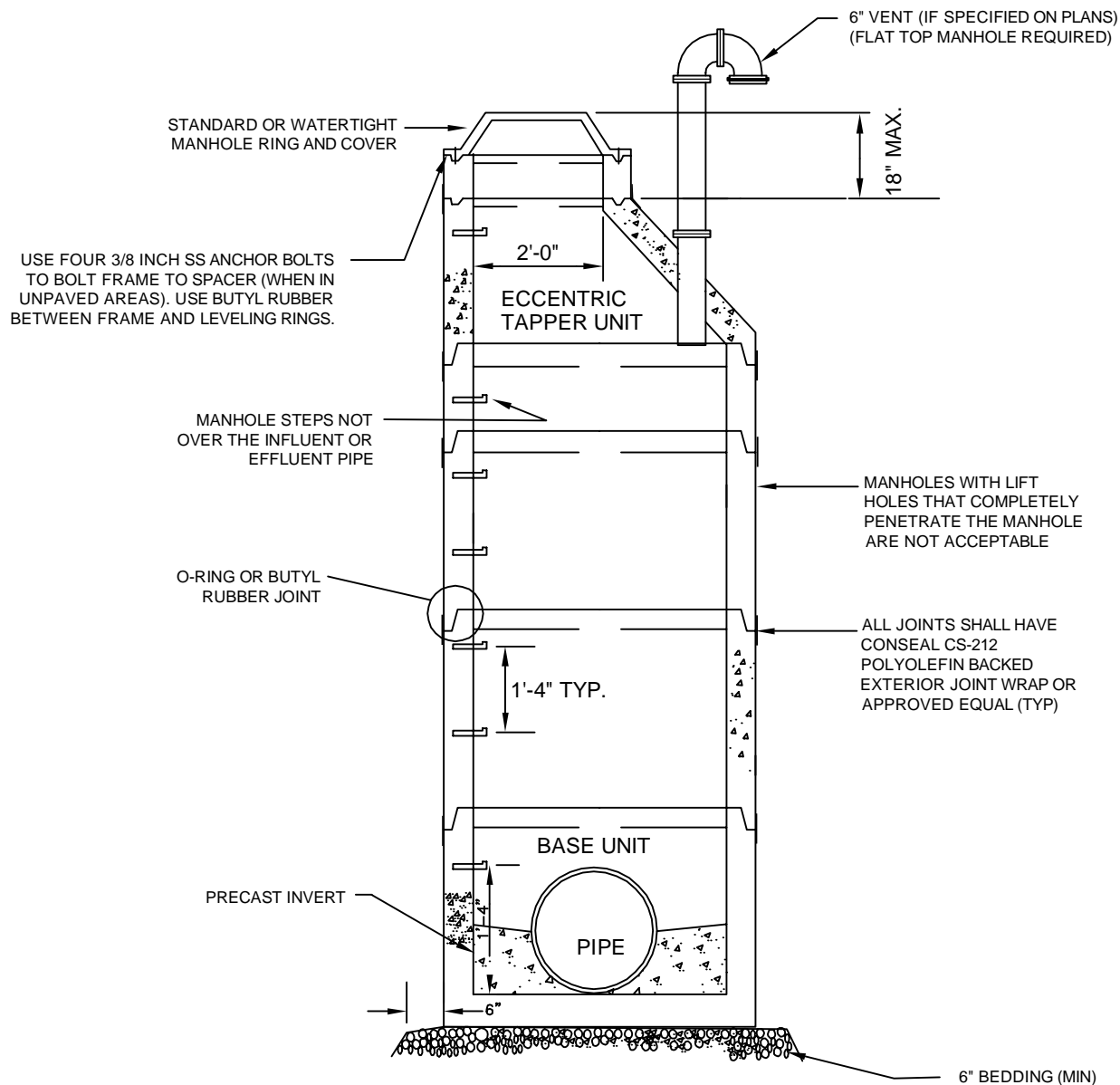
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PUMPING STATION YARD HYDRANT AND METER

scale | NTS | drawing no. | **S-07**

date | JUNE 2012

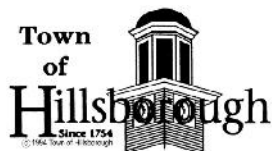
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



NOTES:

1. ALL VENT OPENINGS SHALL BE TWO FEET ABOVE HUNDRED YEAR FLOOD ELEVATION
2. VENT SHALL BE DIP WITH SS INSECT SCREEN
3. VENT SHALL BE ANGLED OR GOOSE-NECKED.
4. PIPING DEEPER THAN 16 FT SHALL REQUIRE A 5 FOOT DIAMETER MANHOLE WHILE MANHOLES 20 FOOT OR DEEPER SHALL BE 6 FOOT IN DIAMETER

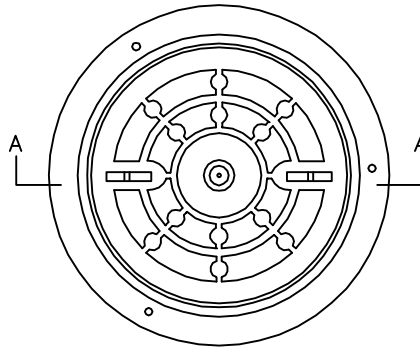
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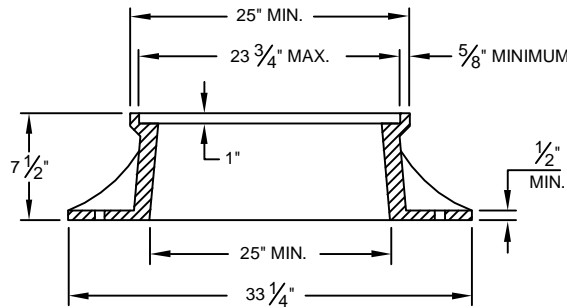
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PRECAST CONCRETE MANHOLE

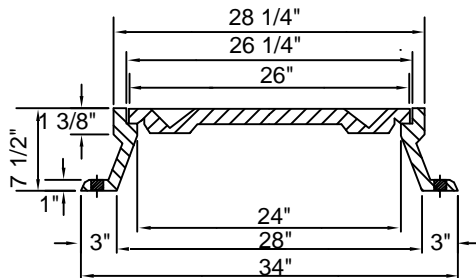
scale | NTS drawing no. | **S-08**
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



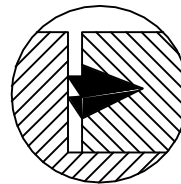
PLAN



SECTION A-A
STANDARD MANHOLE COVER & FRAME



SECTION A-A
WATERTIGHT MANHOLE COVER & FRAME

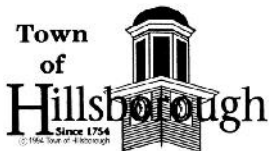


GASKET IN VERTICAL
FACE OF COVER

NOTES:


1. CASTINGS SHALL BE MADE-IN-USA CONFORMING TO ASTM A48, CLASS 35B GRAY CAST IRON
2. MANHOLE FRAME & COVER TO BE H-20 LOAD RATED IN PAVED AREAS

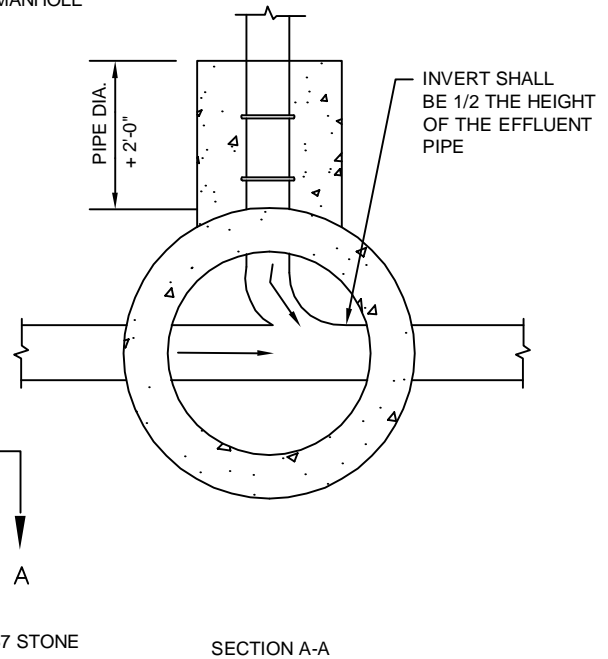
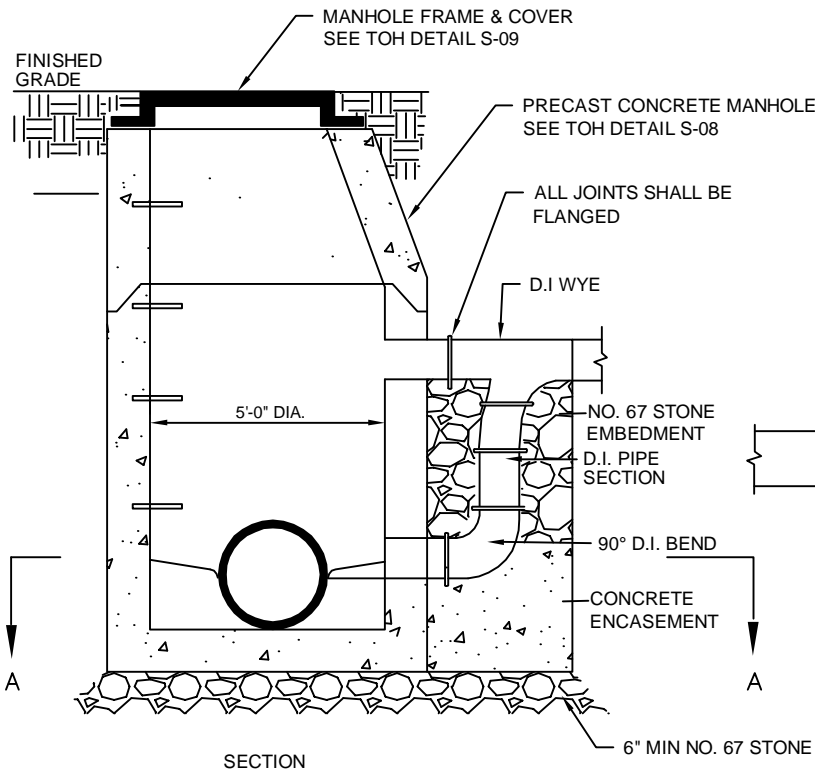
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FRAMES AND COVER

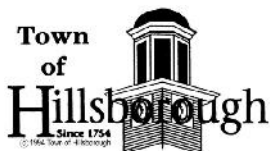
scale | NTS drawing no. | **S-09**
date | JUNE 2012
approved | 
Kenneth P. Keel, P.E., Town Engineer



NOTES:

1. DROP CONNECTIONS SHALL BE REQUIRED WHENEVER AN INFLUENT SEWER IS LOCATED TWO (2) FEET OR MORE ABOVE THE MAIN INVERT CHANNEL
2. A FLOW CHANNEL SHALL BE CONSTRUCTED INSIDE THE MANHOLE TO DIRECT THE INFLUENT INTO FLOW STREAM

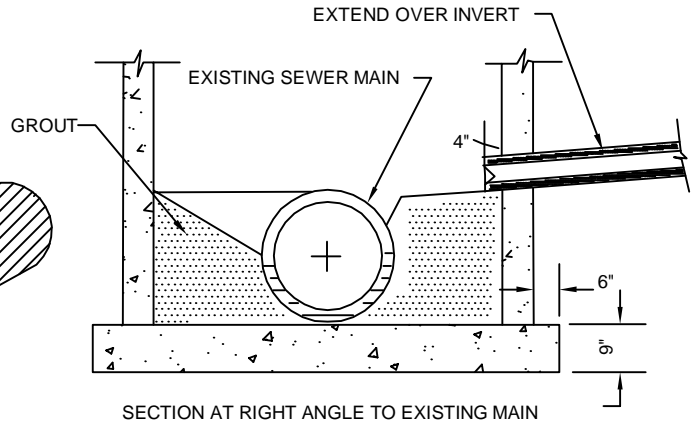
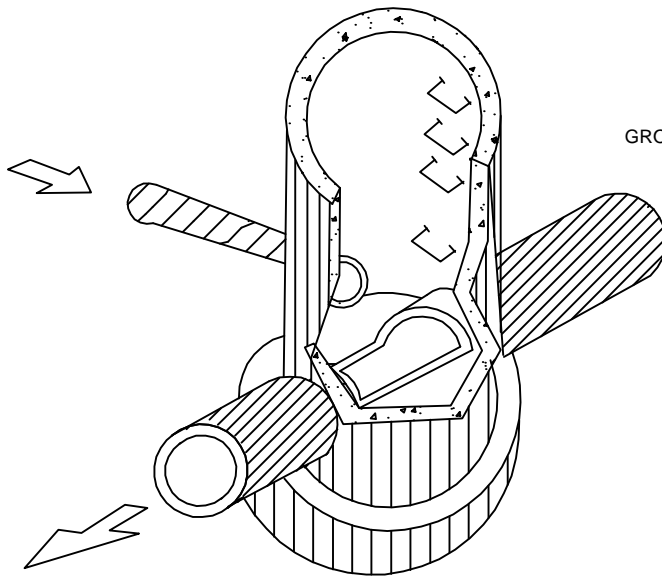
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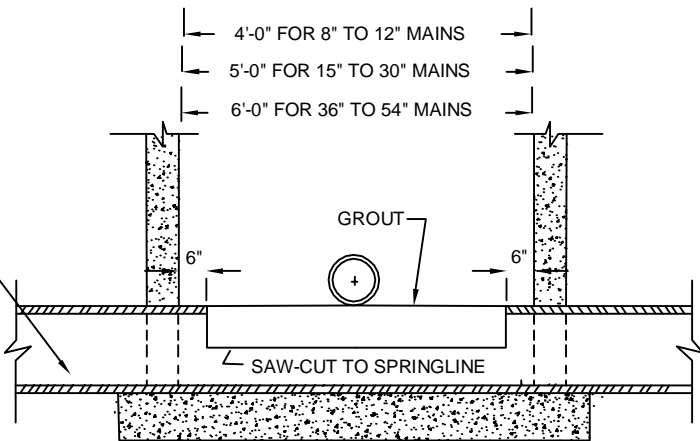
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OUTSIDE DROP MANHOLE

scale | NTS drawing no. | **S-10**
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



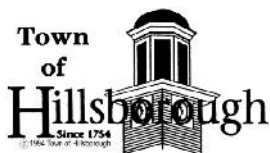
EXISTING SEWER MAIN



NOTES:

1. FLOW SHALL BE MAINTAINED DURING CONSTRUCTION
2. THIS DETAIL TO BE USED WHEN A 6" OR LARGER SEWER NECESSITATES CONSTRUCTION OF A NEW MANHOLE
3. SEE STANDARD DETAIL S-08 FOR PRECAST CONCRETE MANHOLE AND S-09 FOR FRAMES AND COVERS
4. THE CONTRACTOR SHALL PROVIDE A MINIMUM 6" COMPACTED #67 STONE BASE
5. NEW PIPE SHALL HAVE INVERT SHAPED INTO THE EXISTING SEWER MAIN, OR PIPE TO BE EXTENDED AND TOP SECTION CUT OUT AND GROUTED AROUND TO FORM NEW INVERT INTO EXISTING SEWER MAIN

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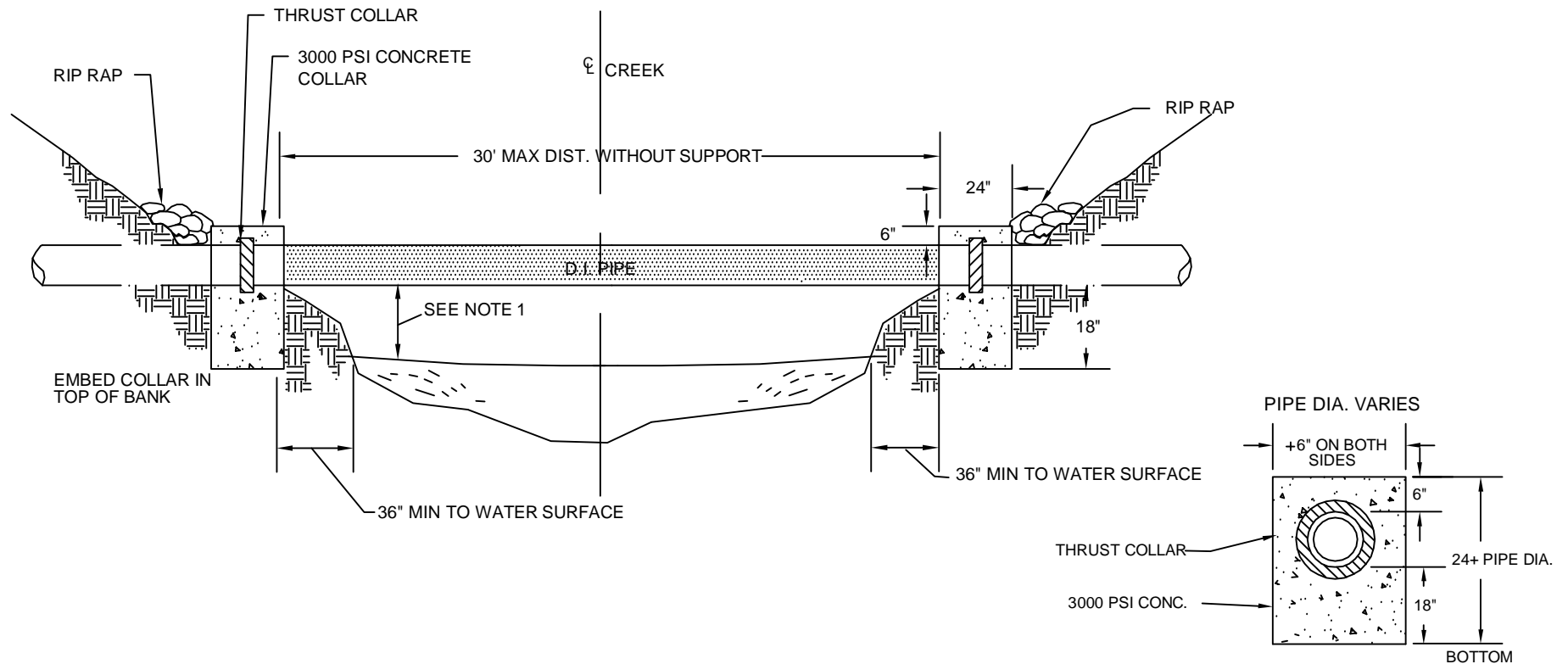
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DOGHOUSE MANHOLE

scale | NTS drawing no. | **S-11**

date | JUNE 2012

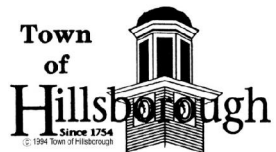
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



NOTES:

1. THE BOTTOM OF THE PIPE SHALL BE PLACED NO LOWER THAN THE 25 YEAR FLOOD ELEVATION OF THE CREEK
2. PIPE SHALL BE "MECH-LOCK" 401 PROTECTO
3. PLACE COLLARS ON FIRM UN-DISTURBED EARTH
4. IF CROSSING DISTANCE IS GREATER THAN 30' PIERS SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER
5. ADDITIONAL RIP RAP ON BANKS FOR STABILIZATION TO BE IDENTIFIED ON DESIGN PLANS IF NECESSARY

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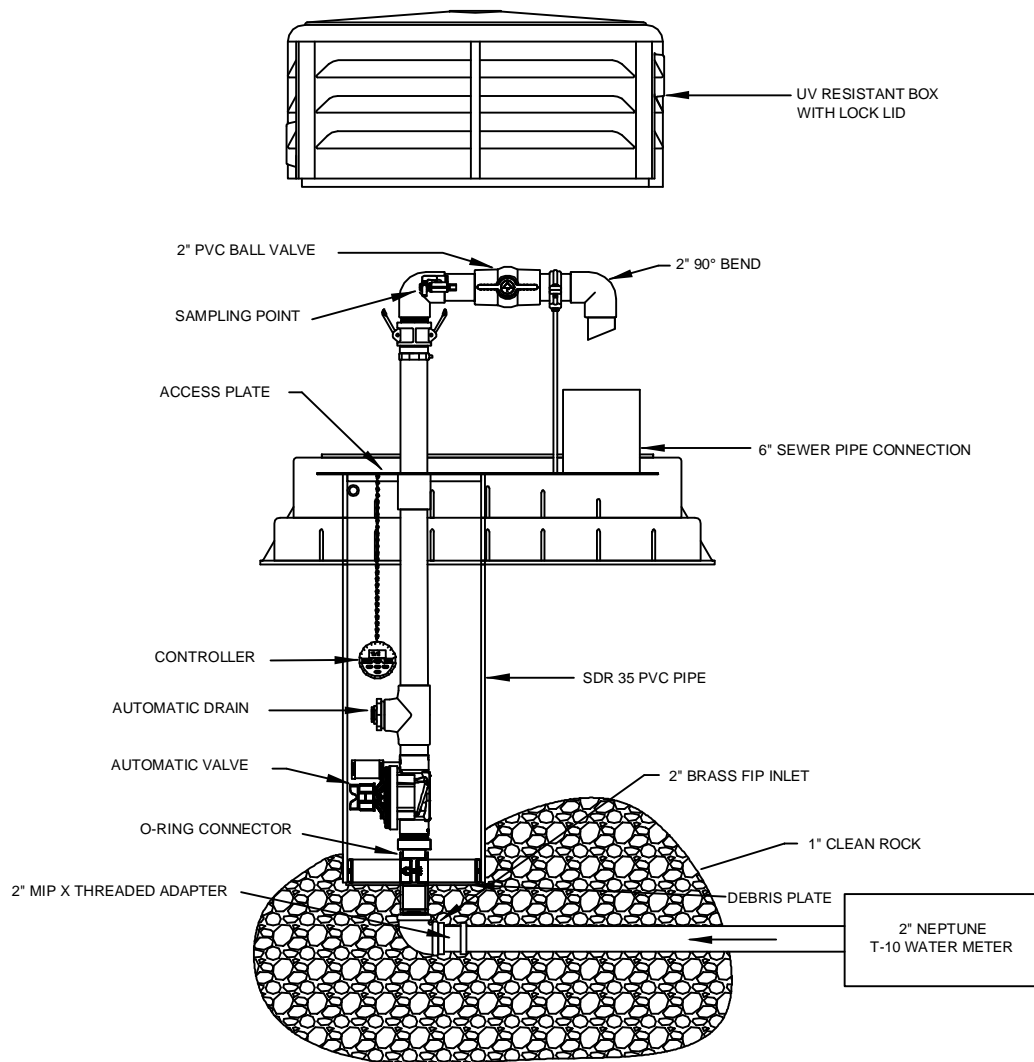


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AERIAL CROSSING

scale | NTS
date | JUNE 2012
approved | *Kenneth P. Keel*
drawing no. | **S-12**
Kenneth P. Keel, P.E., Town Engineer

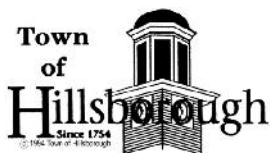
scale | NTS drawing no. | **W-01**
date | JANUARY 2017
approved | 
Kenneth P. Keel, P.E., Town Engineer



NOTES:

1. AUTOMATIC FLUSHING DEVICE TO BE #9800 ECLIPSE BY KUPFERLE FOUNDRY COMPANY
2. PIPING SHALL BE INSTALLED UP TO 2" CURB STOP WITH VALVE BOX AND COVER AT TIME OF MAIN INSTALLATION
3. AUTOMATIC FLUSHING DEVICE SHALL BE SHUT OFF UNTIL MAIN LINE HAS BEEN BACTERIOLOGICALLY TESTED
4. ALL THREAD HARD PIPING SHALL BE STAINLESS STEEL
5. SEE TOH DETAIL WS-01 FOR GATE VALVE AND VALVE BOX REQUIREMENTS
6. A NEPTUNE 2" T-10 WATER METER SHALL BE INSTALLED FOR EACH INSTALLED FLUSHING DEVICE
7. ALL COMPONENTS THAT COME INTO CONTACT WITH DRINKING WATER SHALL CONFORM TO NSF STANDARD 61
8. SPACE 2,500 FEET APART

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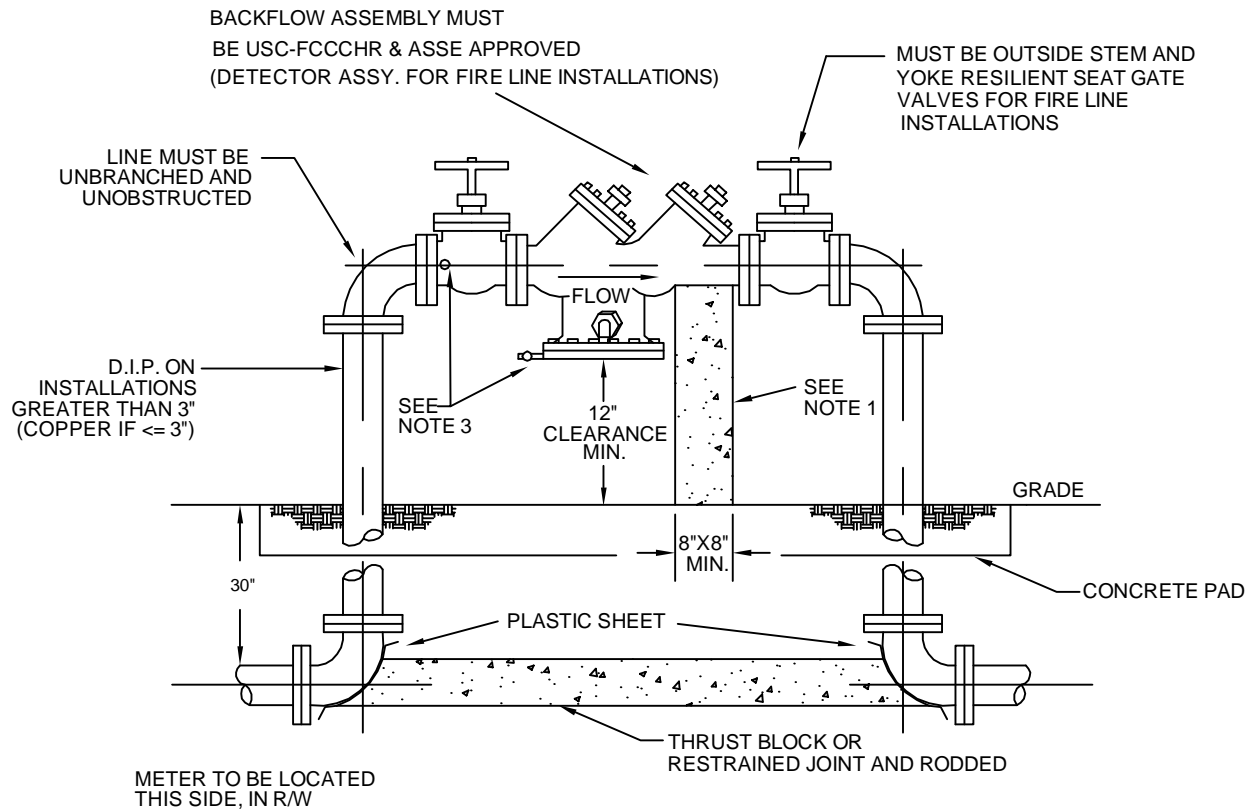


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FLUSHING DEVICE FOR NEW WATER MAIN EXTENSIONS

scale | NTS
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer

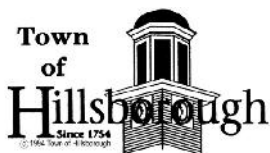
drawing no. | **W-02**



NOTES:

1. CONCRETE SUPPORT BLOCK REQUIRED ON 2 1/2" & LARGER BACKFLOW PREVENTERS
2. THE DEVICE MUST BE INSTALLED WITH MINIMUM HORIZONTAL CLEARANCES OF 30" FOR SIDE WITH TEST COCKS AND 8" FOR BACK SIDE (N/A WITH REMOVABLE BOX OR PANELS)
3. ASSEMBLY IS NOT COMPLETE UNLESS ALL TEST COCKS ARE INSTALLED PER MANUFACTURERS SPECIFICATIONS
4. ASSE 1060 ENCLOSURE REQUIRED FOR ALL BACKFLOW ASSEMBLIES

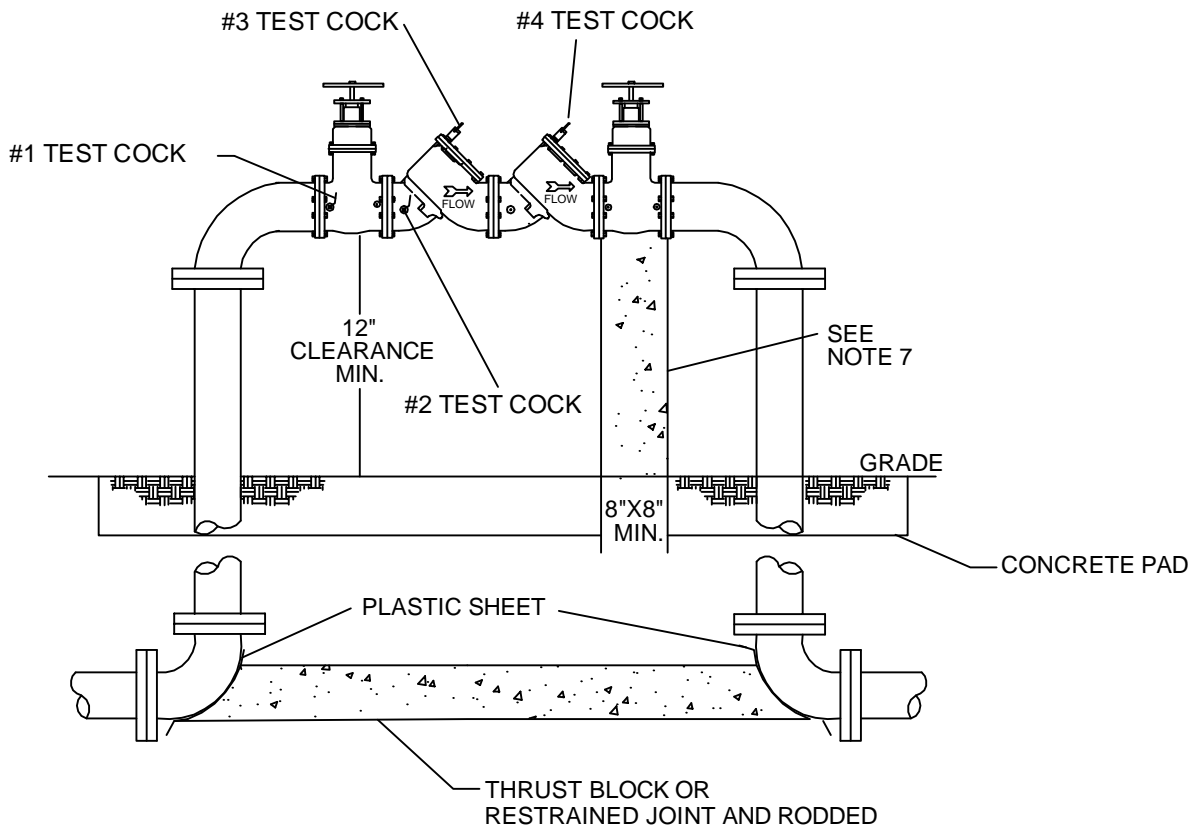
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rev	description	app'd	date



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REDUCED PRESSURE BACKFLOW PREVENTER (RP)

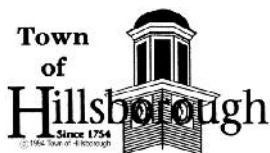
scale | NTS drawing no. | **W-03**
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



NOTES:

1. SHUT OFF VALVES, CHECK VALVES, AND TEST COCKS SHALL BE STANDARD TO THE APPROVED BACKFLOW ASSEMBLY
2. ALL LARGE (2-1/2" - 10") ASSEMBLIES TO BE SUPPORTED BY A CRADLE
3. ENCLOSURE FOUNDATIONS SHALL BE CONSTRUCTED OF 4" OF CONCRETE
4. 2-1/2" AND LARGER ASSEMBLIES SHALL BE FUSION BONDED EPOXY COATED INCLUDING SHUTOFF VALVES
5. ASSEMBLY SHALL BE APPROVED BY USC-FCCCHR AND ASSE. A CERTIFIED TESTER SHALL PRESENT TEST RESULTS TO TOH
6. ASSE 1060 ENCLOSURE REQUIRED FOR ALL BACKFLOW ASSEMBLIES
7. CONCRETE SUPPORT BLOCK REQUIRED ON 2 1/2" & LARGER BACKFLOW PREVENTERS

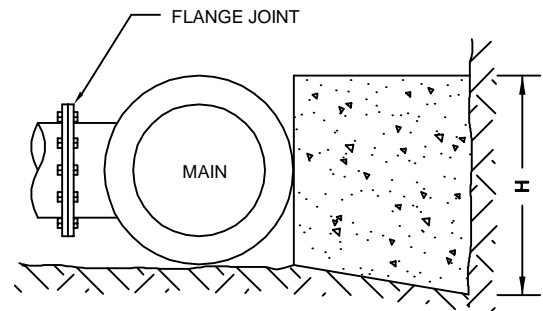
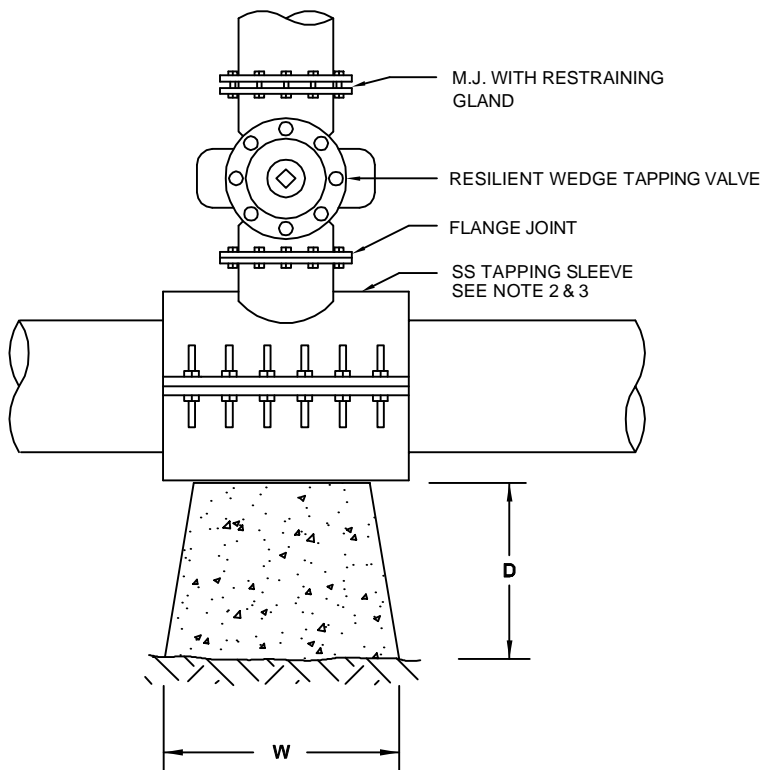
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DOUBLE CHECK VALVE ASSEMBLY (DCVA)

scale | NTS drawing no. | **W-04**
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



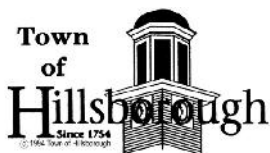
MINIMUM CONCRETE STRENGTH = 3000 PSI.

TAP SIZE	DIMENSIONS IN FEET		
	W	H	D
4" & 6"	2.0	1.4	1.0
8"	3.5	2.0	1.4
10"	4.0	2.5	1.8
12"	5.0	3.0	2.5

NOTES:

1. TAPS ONTO EQUAL SIZED MAINS MUST BE CUT AND SLEEVED WITH A TEE AND MAIN LINE VALVE INSTALLED
2. BOLTS AND NUTS FOR TAPPING SLEEVE SHALL BE STAINLESS STEEL
3. ALL TAPS 4" AND GREATER REQUIRE A STAINLESS STEEL TAPPING SLEEVE WITH FULL CIRCUMFERENTIAL SEAL, MECHANICAL JOINT OUTLET AND STAINLESS STEEL BOLTS
4. USE THRUST BLOCKING FOR ALL TAPS
5. DEPTH FROM GROUND SURFACE TO TOP OF BLOCKING SHALL BE GREATER THAN HEIGHT OF BLOCKING
6. THE END OF THE TAPPING SLEEVE SHALL BE NO CLOSER THAN 4 FEET TO A JOINT
7. TAPS ONTO ASBESTOS-CEMENT (AC) OR PVC MAINS REQUIRE AN EXTENDED LENGTH SLEEVE ON THE MAIN BEING TAPPED
8. A 3/4" TEST PLUG OR SLEEVE SHALL BE INSTALLED

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		KPK	
rev	description	app'd	date

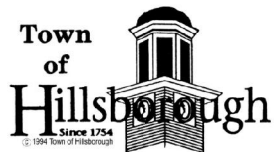
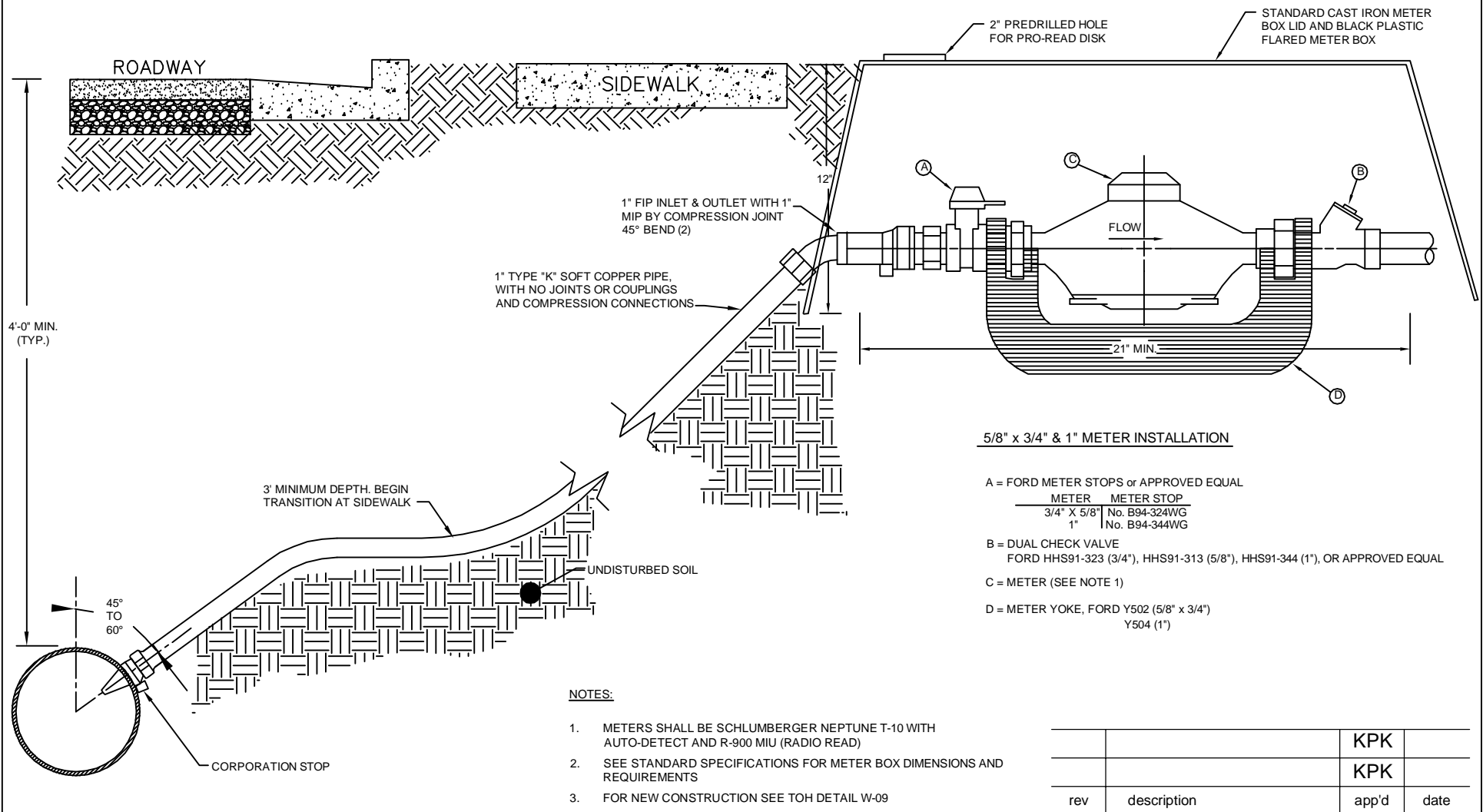


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WATER MAIN TAPS


scale | NTS
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer

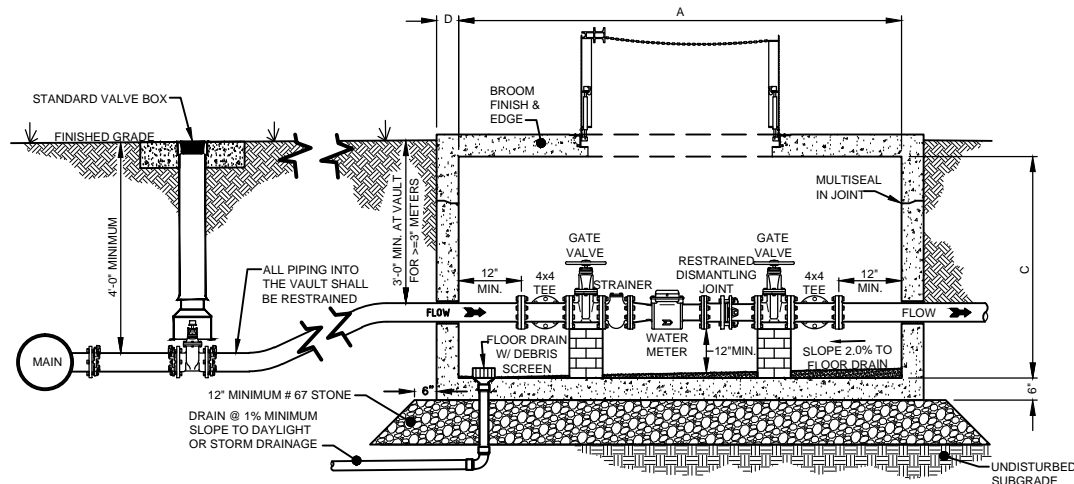
drawing no. | **W-05**



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RESIDENTIAL WATER METER AND BOX

scale NTS drawing no. **W-06**
 date JUNE 2012
 approved 
 Kenneth P. Keel, P.E., Town Engineer



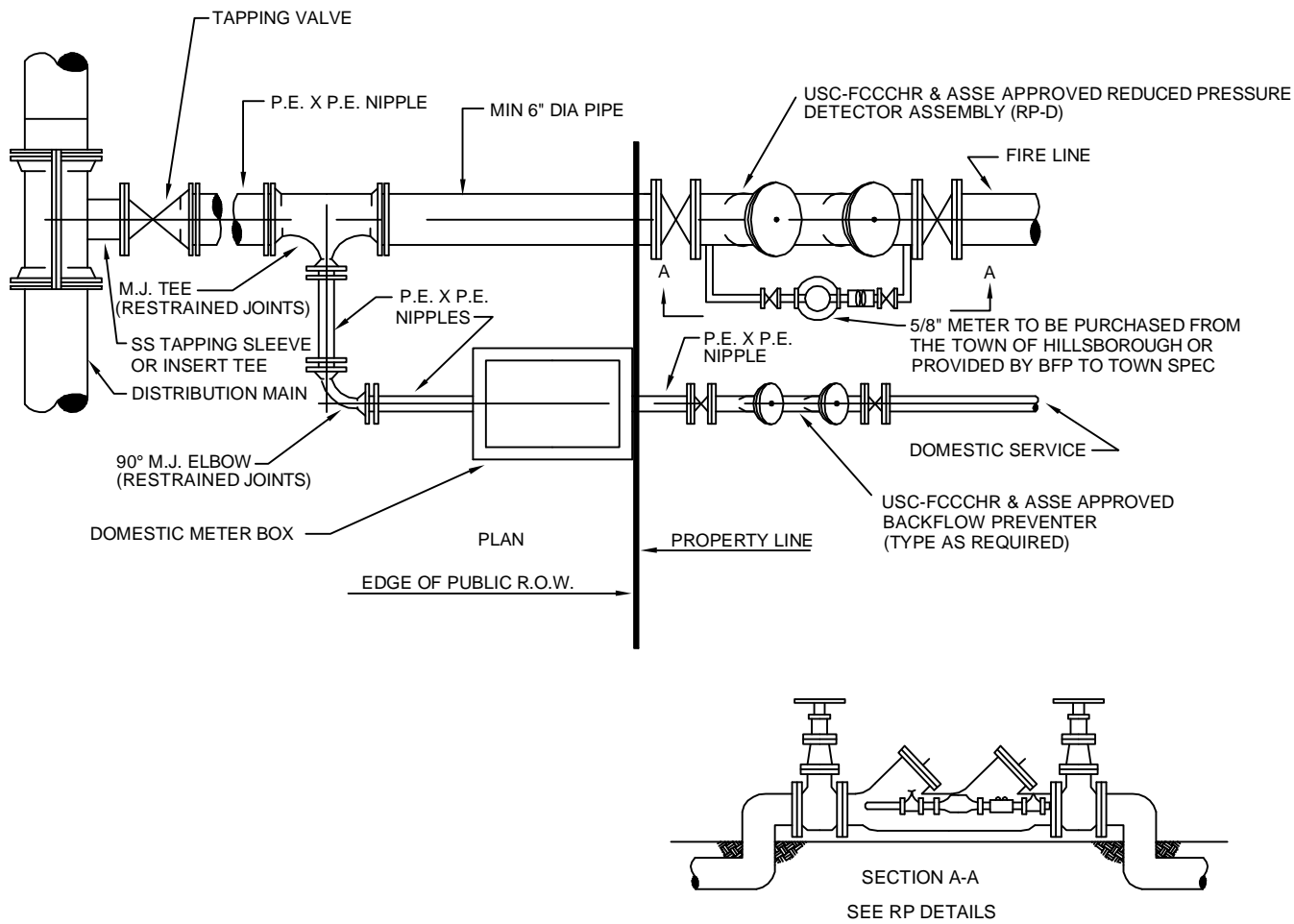
*MAXIMUM DEPTH IS 60"; MIN. WALL THICKNESS 6" IN H-20 AREAS.

1. FLANGED BRONZE STRAINERS BY NEPTUNE SHALL BE INSTALLED IMMEDIATELY BEFORE ALL 2" AND LARGER METERS WITH APPROPRIATELY SIZED SPACER BETWEEN THE STRAINER AND METER
2. A SEPARATE ABOVE GROUND BACKFLOW PREVENTION DEVICE IS REQUIRED PER TOH SPECIFICATIONS
3. PIPING > 1" THROUGH VAULTS SHALL BE FLANGED OR RESTRAINED DUCTILE IRON OR COPPER (COMPRESSION JOINTS/FITTINGS)
4. METERS SHALL BE PURCHASED THROUGH THE TOH
5. 1-1/2" - 2" METER INSTALLATIONS SHALL USE A FORD 70 SERIES COPPERSETTER WITH BALL VALVE INLET AND OUTLET (OR EQUAL)
6. HATCHES SHALL BE DOUBLE LEAF ALUMINUM DIAMOND PLATE H-20 RATED IN TRAFFIC AREAS (300 PSF NON-TRAFFIC AREAS) DESIGN WITH HINGED LOCKING SPRING LOADED DOORS WITH OPEN POSITION LOCK. HARDWARE TO BE STAINLESS STEEL. HATCH SIZES (TO BE CENTERED OVER METER) ARE AS FOLLOWS:
 - 6.1. 1.5" METERS: 36" X 48"
 - 6.2. 2" METERS: 42" x 54"
 - 6.3. 3" AND 4" METERS: 60" X 60"
 - 6.4. 6", 8" AND 10" METERS: 48" X 72" UNLESS CUSTOM SIZE MANDATED BY TOH
7. TWO (2) 2" HOLES SHALL BE CUT NEAR HINGE AREA FOR RADIO READ DEVICES
8. VAULTS SHOULD BE PROVIDED WITH STEPS OR A LADDER ACCESSIBLE FROM THE HATCH WITH THE HATCH PLACEMENT ALLOWING VIEWING AND REMOVAL OF THE METER..

1	2" hatch size & misc. dimensioning	KPK	1/10/17
		KPK	
rev	description	app'd	date



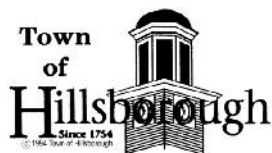
scale | NTS drawing no. | **W-07**
date | JANUARY 2017
proved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



NOTES:

1. 12" CLEARANCE REQUIRED UNDER BFP ASSEMBLIES
2. ASSE 1060 ENCLOSURE REQUIRED FOR BFP ASSEMBLIES
3. ONLY APPLICABLE TO MAINS > 6 INCHES

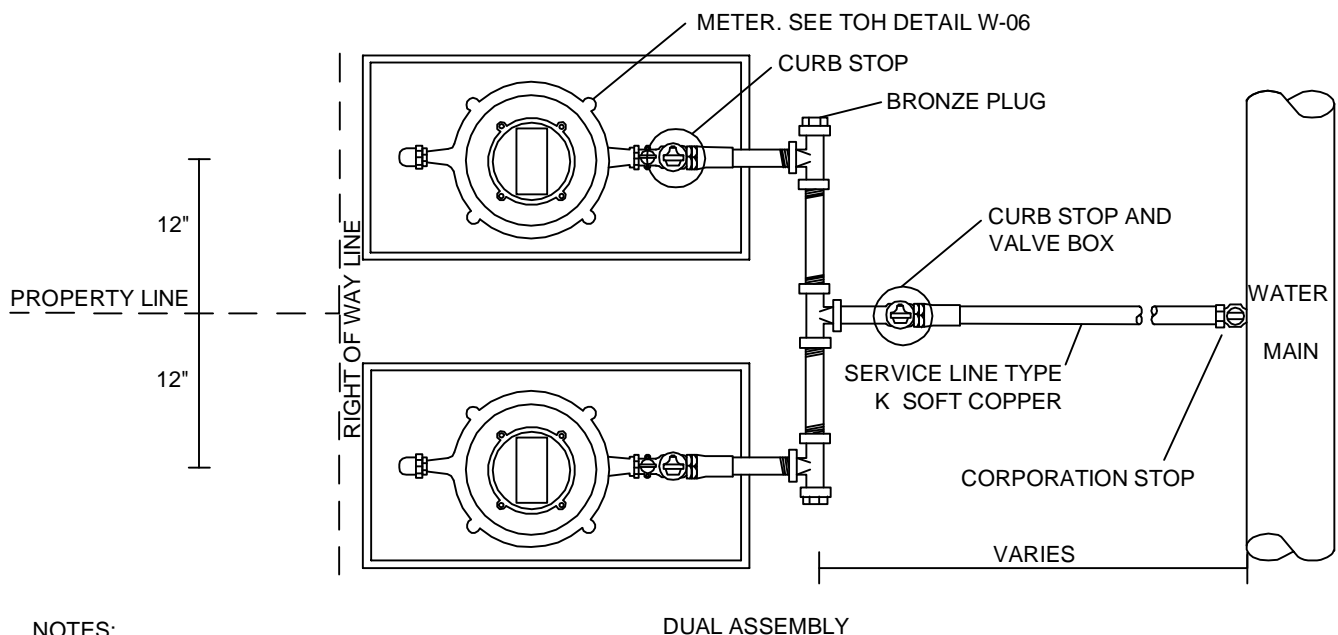
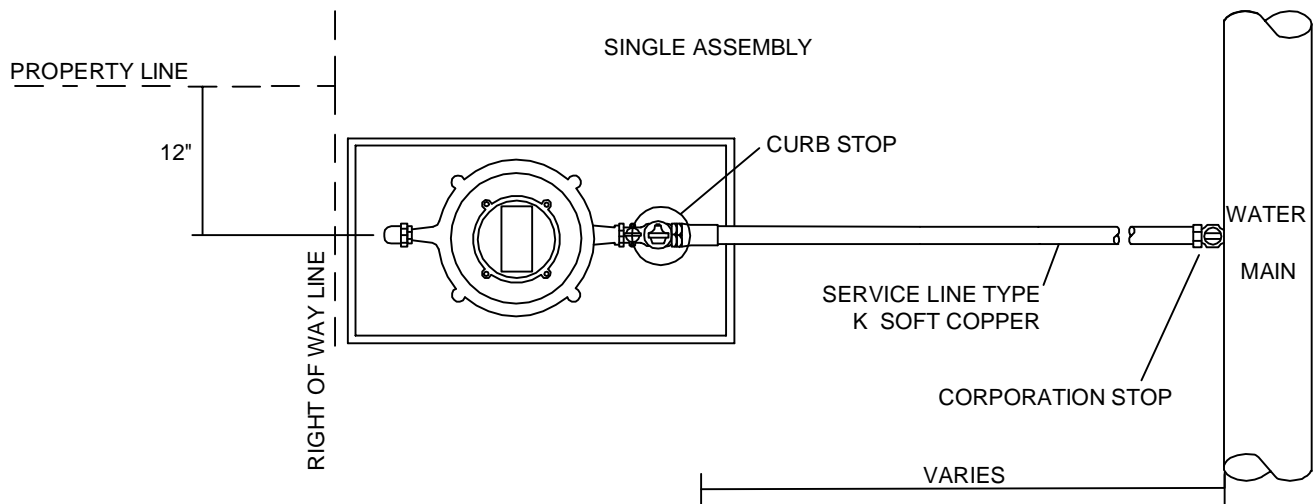
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		KPK	
rev	description	app'd	date



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BACKFLOW FOR FIRE LINE

scale | NTS drawing no. | **W-08**
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer

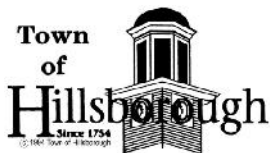


NOTES:

1. ALL WATER METER LOCATIONS SHALL BE COORDINATED WITH THE METER READER SUPERVISOR
2. METERS WILL BE GROUPED IN PAIRS AT ADJOINING PROPERTY LINES
3. EACH SERVICE SHALL HAVE ITS OWN CURBSTOP/BALLSTOP IN ITS OWN METER BOX
4. MINIMUM SERVICE LINE IS 1"
5. FOR DUAL ASSEMBLY INSTALLATION, USE FORD BALL VALVE CURB STOP (B44-444-G) ON SERVICE PRIOR TO TEE AND STANDARD VALVE BOX

SIZE (I.D.) (SERVICE TAP SIZE FROM MAIN)	NUMBER OF METERED SERVICES ALLOWED	
	3/4"	1"
2"	9-16	5-8
1 1/2"	5-8	4
1"	4	2

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		KPK	
rev	description	app'd	date

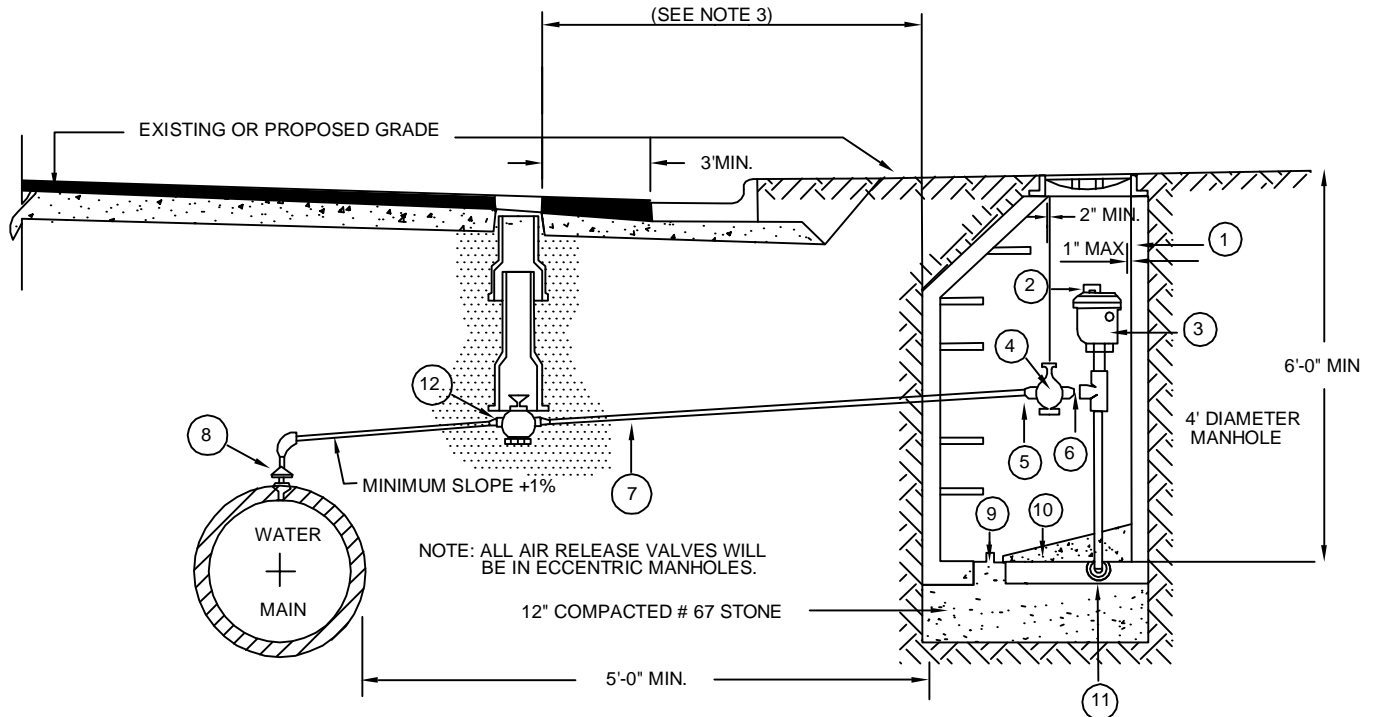


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WATER METER LOCATION

scale | NTS
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer

drawing no. | **W-09**



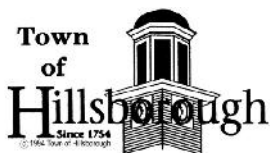
BILL OF MATERIALS

1	PRECAST MANHOLE
2	TRASH HOOD
3	2" AIR RELEASE VALVE
4	2"-INCH GATE VALVE
5	ADAPTER
6	2" MECHANICAL JOINT BRASS PIPE AND FITTINGS.
7	2" TYPE "K", SOFT COPPER WITH FLARED ELBOW.
8	CORPORATION STOP
9	6" DIAMETER DRAIN TO STONE BASE
10	GROUT, 1/8" TO 1'-0" MIN. SLOPE TO DRAIN
11	PIPE CAP
12	2"-INCH GATE VALVE

NOTES:

- AIR VALVE TO BE A.R.I D-020 VENT-O-MAT SERIES RBX OR EQUAL
- THE AIR RELEASE MANHOLE SHALL BE INSTALLED IN THE SHOULDER OR AS DIRECTED BY THE ENGINEER
- FOR MAINS LOCATED OUTSIDE OF STREET RIGHT-OF-WAYS THE MAXIMUM DISTANCE BETWEEN THE MANHOLE AND THE VALVE BOX SHOULD BE THREE (3) FEET

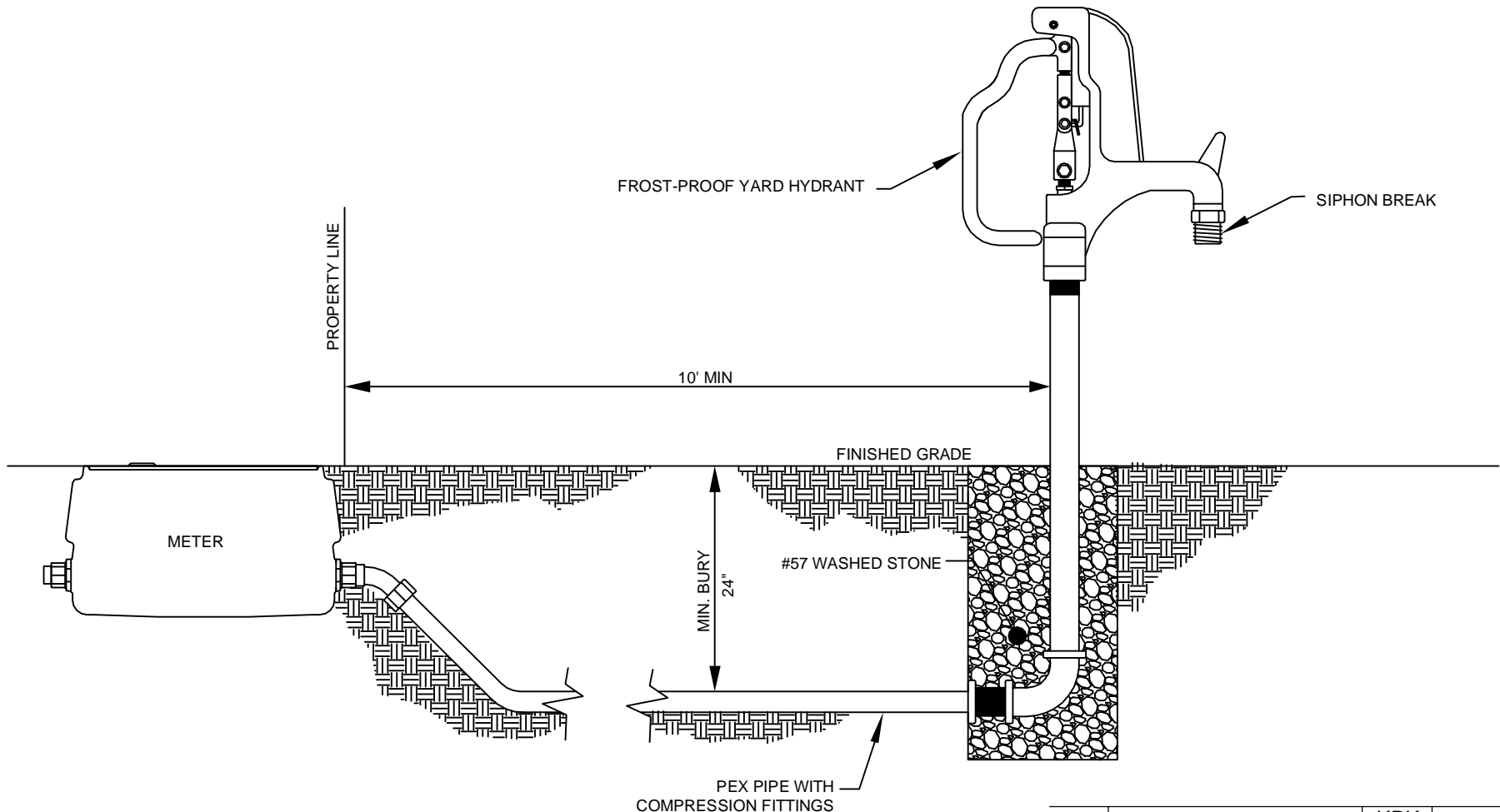
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AIR RELEASE VALVE-WATER

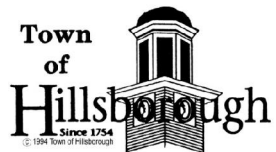
scale | NTS drawing no. | **W-10**
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



NOTES:


1. HOSE BIB SHALL ACCOMMODATE STANDARD 3/4" GARDEN HOSE
2. A BACKFLOW PREVENTER WITH ENCLOSURE SHALL BE INCLUDED ON ALL TEMPORARY FAUCETS

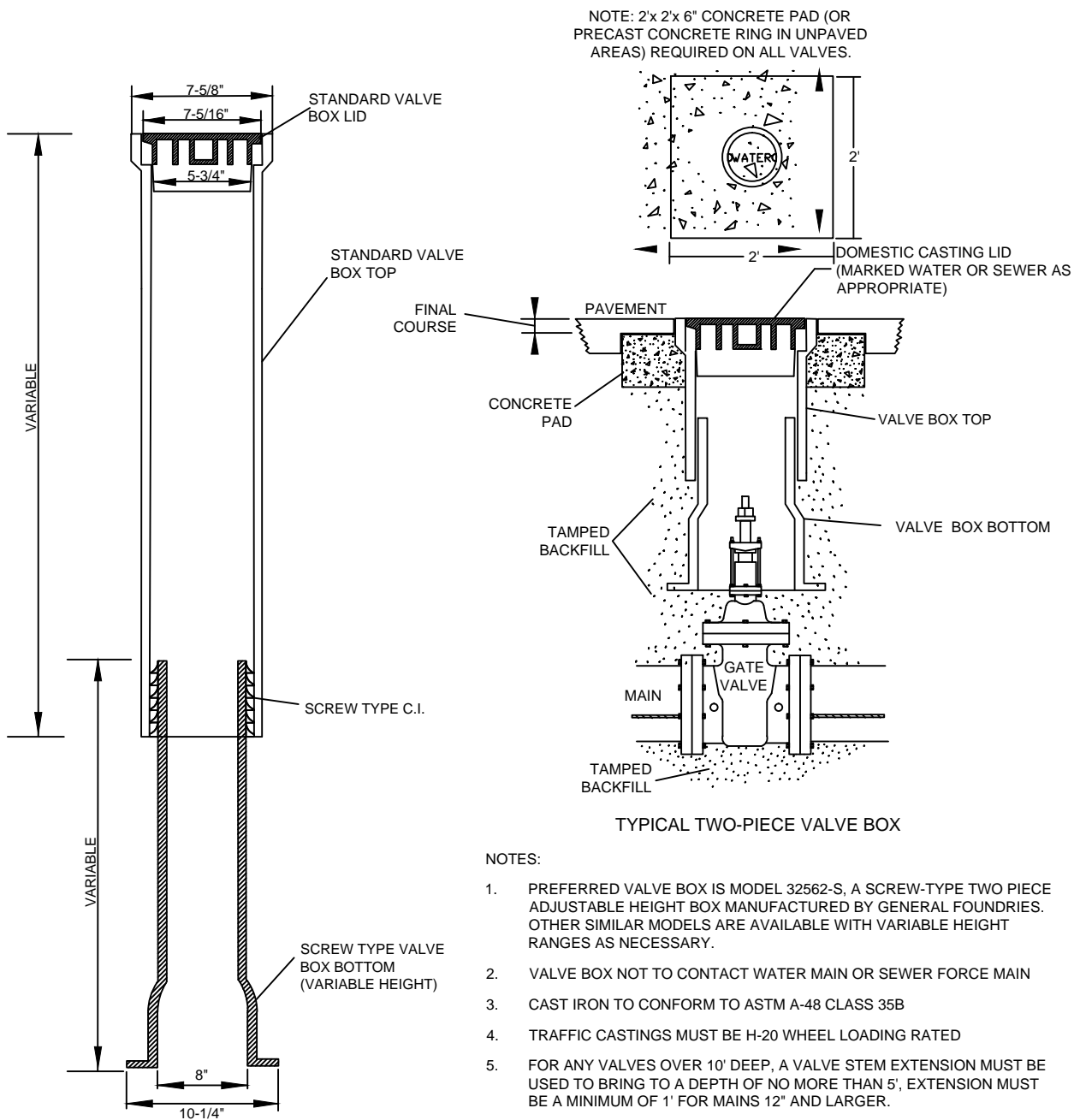
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rev	description	app'd	date



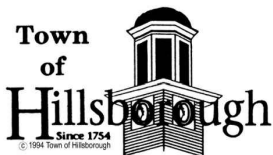
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TEMPORARY FAUCET

scale | NTS | drawing no. | **W-12**
date | JUNE 2012
approved |  |
Kenneth P. Keel, P.E., Town Engineer



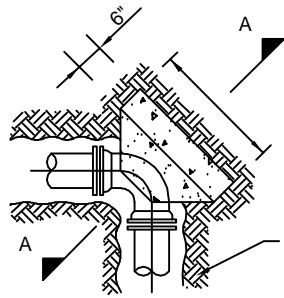
1	Added ref. to sewer applications	KPK	1/10/17
		KPK	
rev	description	app'd	date



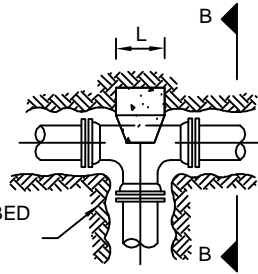
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VALVE BOX ASSEMBLY AND GATE VALVE

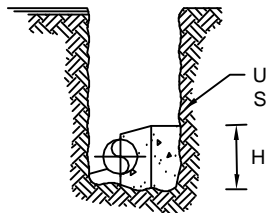
scale NTS drawing no. **WS-01**
date JANUARY 2017
approved *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



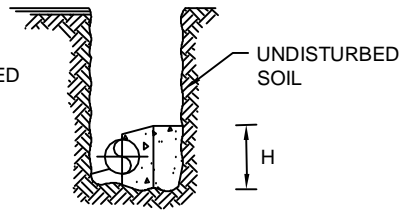
HORIZONTAL BEND PLAN



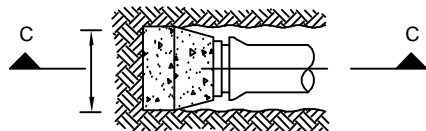
TEE/TAPPING PLAN



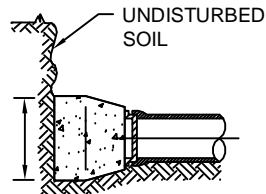
SECTION A-A



SECTION B-B



PLUG/CAP PLAN



SECTION C-C

NOTES:

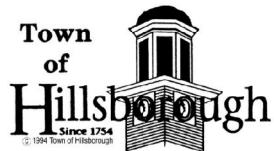
1. SEE CHART "HORIZONTAL ANCHOR DIMENSIONS". USE WITH CHART UP TO 150 PSI WORKING PRESSURE.

HORIZONTAL ANCHOR DIMENSIONS FOR AVERAGE SOIL CONDITIONS

UP TO 150 P.S.I. WORKING PRESSURE

PIPE SIZE	PLUG, CAP, TEE OR TAP SLEEVE		90° BEND		45° BEND		22 1/2° BEND		11 1/4° BEND	
	H	L	H	L	H	L	H	L	H	L
4"	1'-0"	2'-0"	1'-0"	2'-0"	1'-0"	1'-4"	0'-9"	1'-0"	0'-6"	1'-0"
6"	1'-0"	2'-0"	1'-0"	2'-0"	1'-0"	1'-4"	0'-9"	1'-0"	0'-6"	1'-0"
8"	1'-4"	2'-8"	1'-4"	2'-8"	1'-4"	1'-6"	1'-0"	1'-0"	0'-9"	1'-0"
10"	1'-8"	3'-4"	1'-8"	3'-4"	1'-8"	2'-0"	1'-3"	1'-3"	1'-0"	1'-0"
12"	2'-0"	4'-0"	2'-0"	4'-0"	2'-0"	2'-2"	1'-6"	1'-6"	1'-3"	1'-3"
14"	2'-4"	4'-8"	2'-4"	4'-8"	2'-4"	2'-6"	1'-9"	1'-9"	1'-4"	1'-4"
16"	2'-8"	5'-4"	2'-8"	5'-4"	2'-8"	3'-0"	2'-0"	2'-0"	1'-6"	1'-6"
18"	3'-0"	6'-0"	3'-0"	6'-0"	3'-0"	3'-4"	2'-3"	2'-3"	1'-8"	1'-8"
20"	3'-4"	6'-8"	3'-4"	6'-8"	3'-4"	3'-8"	2'-6"	2'-6"	2'-0"	2'-0"
24"	4'-0"	8'-0"	4'-0"	8'-0"	4'-0"	4'-4"	3'-0"	3'-0"	2'-3"	2'-3"
30"	5'-0"	10'-0"	5'-0"	10'-0"	5'-0"	5'-6"	3'-9"	3'-9"	2'-9"	2'-9"
36"	6'-0"	12'-0"	6'-0"	12'-0"	6'-0"	6'-6"	4'-6"	4'-6"	-	-
42"	7'-0"	14'-0"	7'-0"	14'-0"	7'-0"	7'-9"	5'-0"	5'-3"	-	-
48"	8'-0"	16'-0"	8'-0"	16'-0"	8'-0"	8'-9"	6'-0"	6'-0"	-	-

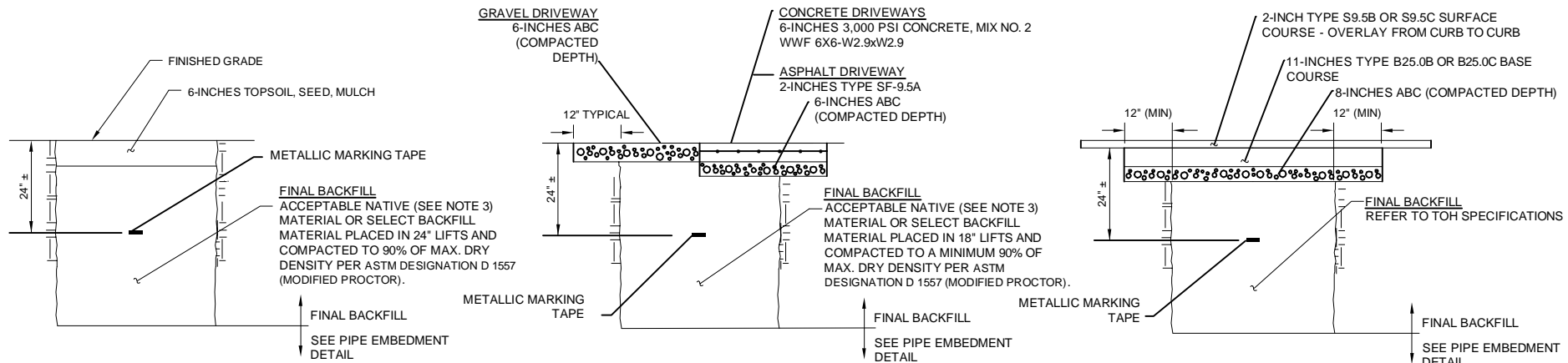
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		KPK	
rev	description	app'd	date



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THRUST BLOCKING

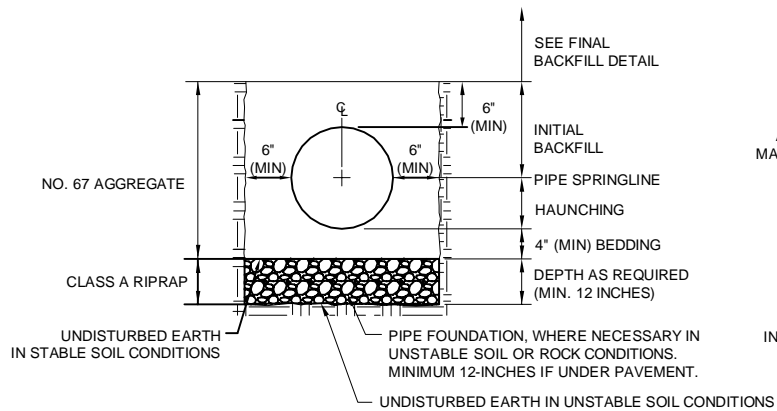
scale | NTS | drawing no. | **WS-02**
date | JUNE 2012
approved | *Kenneth P. Keel*
Kenneth P. Keel, P.E., Town Engineer



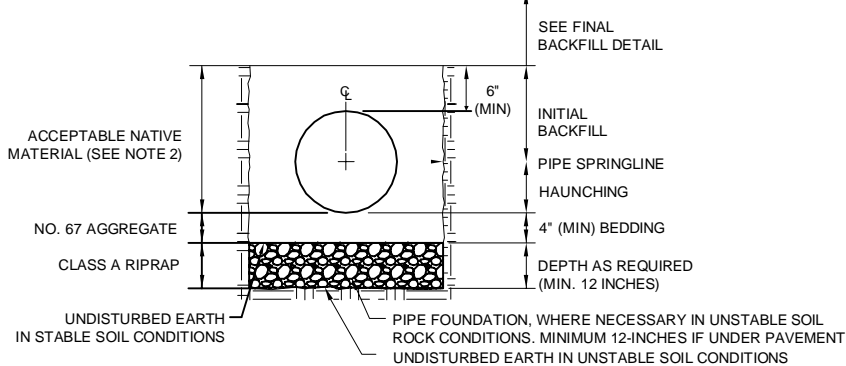
FINAL BACKFILL AND RESTORATION
IN UNPAVED AREAS

FINAL BACKFILL AND RESTORATION
IN DRIVEWAYS

FINAL BACKFILL AND RESTORATION
IN CITY STREETS



PVC PIPE EMBEDMENT

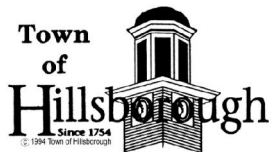


DUCTILE IRON PIPE EMBEDMENT

NOTES:


1. REFERENCE TOH CODE SECTION 7-01-6 FOR STREET BASE & PAVEMENTS, MATERIALS AND TESTING STANDARDS (REFERENCES NCDOT STANDARDS)
2. NATIVE MATERIAL SHALL NOT CONTAIN ANY ROCKS GREATER THAN 2 INCHES AND FREE OF VEGETATION AND DEBRIS
3. NATIVE MATERIAL SHALL NOT CONTAIN ANY ROCKS GREATER THAN 6 INCHES AND FREE OF VEGETATION AND DEBRIS

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TRENCH DETAILS

scale NTS drawing no. **WS-03**
date JUNE 2012
approved 
Kenneth P. Keel, P.E., Town Engineer