



To: Ridgway Town Council and the General Public
From: Joanne Fagan, Town Engineer; Chase Jones, Public Works Administrator
Date: June 25, 2020
RE: Standards and Specs Comments

BACKGROUND:

During the June 10th, 2020 Town Council meeting, staff presented updated Standards and Specifications to be adopted by the Council. A comprehensible redline of changes was not available at that time due to the magnitude of grammatical, formatting and reorganization changes. Various community members requested adoption to be postponed until the next regularly scheduled Town Council meeting to provide more time to review. Council postponed adoption and requested staff to create a version of the documents highlighting substantial changes.

DISCUSSION:

At Council's request staff reviewed the proposed Standards and Specifications documents and highlighted perceived major changes. Many items also have brief description as to why the change was made. Staff believes they adequately captured changes from the original 1990's document, the 2001 update and the addenda issued since, however, it is recommended that any interested party review the material in its entirety. The commented version of the Standards and Specifications is attached to this memo.

In addition to commenting on the proposed document, a summary of changes staff noticed that may have financial implications to a developer are summarized below. This summary is not expected to be all inclusive due to construction variability, design variability, and generally unknown future circumstances but should serve as good basis for understanding proposed changes.

Requirement to Extend and Upsize facilities for future extensions

In the General Requirements (Section 9.11) the following is proposed:

“Where it is determined that utility lines are necessary to serve property beyond the subdivision or development in question, the Developer will be required to design, properly size, and construct the system to permit future extensions to be made at the limits of the subdivision or development in question. Public utility systems must be designed and constructed along roads and/or through the development to facilitate future extensions.”

The Water Minimum Standards previously required:



“If the Town anticipates future expansion and or extension from the area being developed by the Responsible Party the Town will work with the applicant in determining an equitable breakdown for the additional cost in most cases only the price difference for the increase in materials costs.”

We are proposing the Water Minimum Standards be updated to read (section 3.02):

“If the Town anticipates future expansion and or extension from the area being developed by the Responsible Party, the Developer will be required to design, properly size, and construct the system to permit future extensions to be made at the limits of the subdivision or development in question.”

The cost to upsize pipes is typically \$1-2 per foot whereas the cost to install the pipe is in the \$50 range. The developer is tying on to pipes someone else installed and is getting that benefit from work someone else did. Most subdivisions end up with water lines sized to ensure fire protection and do not need to upsize for development beyond their development. Most sewer lines are the minimum size of 8” and also do not need upsized to accommodate future development. Extending lines through the development typically requires extending water and sewer the length of the width of the last lot. This makes it so the next development can start their work at the beginning of their parcel without disturbing the infrastructure in the prior development, including paved streets.

Water Minimums – Commercial Fire Flow

The Town has been requiring commercial fire flows to be 1500 gpm for a long time. This section has and continues to reference ISO recommendations which at the last update, commercial buildings were required to have 1500 gpm unless a sprinkler system was present. It was surprising to see the commercial minimums listed it as 1000 gpm. The current draft lists the commercial minimum as 1500 gpm. There has not been issues with meeting the 1500 gpm in commercial areas as far as staff knows.

Water Minimums – Water Line Looping.

The only change in this section is to update the dollar amount to reference the current tap fee. Otherwise it read the same which is as follows:

“Water mains shall be designed through a subdivision and other type multi-unit development so that a continuous loop is provided for an alternate route of water, better circulation, and more even pressure. A variance of the looping requirement will be considered when the amount of pipe required to complete the loop will exceed 70% of the line required to serve the subdivision in accordance with Town specifications and the total



cost of the water system extension will exceed \$6,000 per tap plus inflation (based on Ordinance 4-2016).”

Water Minimums – Valve spacing

The standards have required that valves be spaced so that one can isolate a single block at a time. Changes in this section would require a valve every 400 ft if the layout of the development is not designed in standard blocks and to have valves on each side of a hydrant tee. The former is because most new development is not in lots and blocks and the latter is facilitate flushing, something that became more important as CDPHE has added more distribution system water quality requirements. Both of these have been required in previous developments.

Water Minimums – Hydrants

The standards have required hydrants at no more than 500 ft intervals going back to 1992. The intent was that no structure would be more than 300 ft or so from a hydrant. With non-grid lot layouts, we have had some development that resulted in structures being farther from a hydrant. The updated draft includes the following to address that after the 500 spacing:

“such that hydrants are within 250 ft of property lot lines and habitable structures are entirely within 300 ft of hydrant.”

Water Minimums – Cross Connection Control

This is updated based on CDPHE regulations and revisions to RMC 9-1.

Water Minimums – Removal of Abandoned Infrastructure

Leaving abandoned utilities in the ROW causes confusion and clutters the space. Typically, removal of lines has been required in the last decade. There have been issues where the abandoned utility lines were not removed. The requirement to remove abandoned infrastructure is listed in multiple sections.

Water Standards – Meter Can

The insulated meter can that the Town used in the past has been discontinued. The new meter can is no longer insulated but is a little larger diameter to facilitate access to the meter can.

Sewer Minimums - Sewer Slopes



All lines are now required to have a slope of at least 0.5%. The previous version allowed flatter slopes for larger pipes following CDPHE minimums. However, in Ridgway there is often not enough flow to fill the larger pipe about half full and the velocity in the pipe is too slow to be self-cleaning at the previously allowed minimum slopes. In addition, in looking at videos of the sewer lines, multiple sags have been noted in the flatter pipes. The 0.5% minimum slope allows for some minimal deviations without getting flat spots.

Sewer Minimums – Terminal Manhole

There were previously a few rare circumstances where there could be a service connection beyond the last manhole. It's much harder for the Town to clean a line without a terminal manhole and when there is an issue with performance of the line it is very difficult to determine if it's the Town's main or the private service.

Sewer Minimums - Sewer Inspections

All new sewer lines are required to be video inspected. The previous standard said the Town could require this. As video services have become more common, the requirement to video inspect the new lines has become a common requirement. It allows the Town to make sure the pipe is on a steady slope, flows within tolerances, and ensure any taps are properly installed. Infiltration and exfiltration testing requirements were deleted.

Sewer Standards

A requirement was added for manholes to have an integral base. That does not typically cost more (sometimes less) and is typically needed to meet the testing requirements for manholes.

In the layout out the project, a requirement was added to have benchmarks for the sewer every 150 ft. The contractor should be doing this routinely, but if there is an error in grade, it's better to find it before one has gone too far. It's difficult and potentially more dangerous to re-dig a line than it is install it the first time.

Added a requirement to remove abandoned lines for the same reasons as for water. This is more important for sewer because if the wrong line is tapped it is less obvious than with water and a bigger problem environmentally.

There are a few other new items in the sewer minimums and sewer standards which were added mostly to cover topics not previously covered that aren't seen as being expensive/controversial. Examples include; adding specs for seep and drain pipes, specs for geotextiles, standards for crossing existing lines, connecting new lines to existing manholes, and updated concrete design



mixtures. The requirement for infiltration and exfiltration testing was deleted, as video inspection and air testing make up for those tests.

ATTACHMENTS:

Standards and Specifications with Staff Comments.



TOWN OF RIDGWAY

STANDARD SPECIFICATION AND TYPICAL DRAWINGS FOR INFRASTRUCTURE CONSTRUCTION

JUNE 2020

These standards, drawings, and supporting reports, plans, files, field data, notes, and other documents and instruments prepared by Consolidated Consulting Services (CCS) as instruments of service shall remain the property of CCS and the Town of Ridgway. The Town and CCS shall retain all common law, statutory, and other reserved rights, including the copyright thereto. These documents may not be used by others or duplicated for any other purpose.

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DIVISION 1 – GENERAL REQUIREMENTS

1. GENERAL PROVISIONS

The provisions stipulated in this section are general in nature and shall be considered as applicable to all parts of these Standards, including any supplements and revisions as allowed by Town ordinances and regulations.

2. PURPOSE

The purpose of these Standards is to provide minimum standards to safeguard life, health, property, and public welfare by regulating and controlling the design, construction, quality of materials, use, location, and maintenance of all Public Improvements and private improvements of common ownership including, but not limited to, sanitary sewer systems, water supply systems, storm drainage systems, wire utilities, streets, pedestrian facilities, open space, parking lots, and appurtenances thereto.

The purpose of these Standards is also to ensure that the Town receives public facilities which are constructed with the care and materials such that the facility meets or exceeds the normal service life requirements for similar installations. Also, to ensure that when said facilities are transferred to the Town's ownership that they will be free from all defects and in suitable working order to provide the service capabilities anticipated with such a facility while protecting public and private interests.

3. APPLICABILITY

Any reference to Town Standards, construction regulations, or the like in any Town ordinance, contract, policy, permit, license or regulations shall be deemed to mean these Standards. These Standards shall apply to construction, enlargement, alteration, moving, removal, conversion, demolition, repair, and excavation of any Public Improvements or private improvements of common ownership specifically regulated herein. The provision of these Standards applies to Town contracts, utility extension agreements, and contracts made for the development of property in the Town. In the case of Town capital improvement contracts, the project specifications may supersede or modify these Standards. Alterations, additions or repairs to existing improvements shall comply with all requirements of these Standards unless specifically exempted, in writing, by the Town. The Town retains the right to require additional information, criteria, or requirements as conditions may warrant. In instances where provisions of Town ordinances are inconsistent with these Standards, the stricter regulation shall prevail.

Wherever the words "these specifications", "Standards and Specifications", "Standards" or words of similar connotation are used, it shall be understood that reference is made to the Town of Ridgway, Standard Specifications and Typical Drawings for Infrastructure Design and Construction, including all parts, supplements and revisions pertaining thereto.

Whenever references are made to standard specification, methods of testing materials, codes, practices and requirements, it shall be understood that the latest revision of said references shall govern unless a specific revision is stated.

Commented [c1]: Any references to "No Changes", "In Original", etc. are in regard to requirements in the standards. Formatting or grammatical edits are not highlighted.

4. INTERPRETATION

In the interpretation of the provisions of these Standards the following shall govern:

4.01. In its interpretation, the provisions of these Standards shall be regarded as the minimum requirements for the protection of the public health, safety, comfort, convenience, prosperity, and welfare of the residents of the Town and the general public.

4.02. Whenever a provision of these Standards or any provision in any law, ordinance, resolution, rule or regulation of any kind, contain any restrictions covering any of the same subject matter, whichever standards produce higher quality shall govern.

4.03. These Standards shall not abrogate or annul any permits or approved drainage reports and construction plans issued or any easement or covenant granted before the effective date of these Standards. However, if the review and approval of construction plans, specifications, and associated engineering reports by the Town has occurred more than twelve (12) months prior to execution of the Encroachment and Excavation Permit or commencement of construction activities, or the improvements are not substantially complete, the Town shall have the right to require another review process for the plans, specifications, and reports to ensure compliance with these Standards.

4.04. The Town shall not act arbitrarily and shall take care to fairly interpret and enforce the requirements in these Standards and in the Town code and regulations. In addition, the Town shall not take actions beyond what is required in these Standards, the Town Code and regulations unless it is to protect the health, safety, and welfare of the public.

4.05. Where there is a conflict between these General Requirements, Technical Specifications, and Typical Drawings, the conflict should be promptly called to the attention of the Town and the Town will determine the resolution. In general, the more stringent standard shall apply. Where there are conflicts between the technical specifications and the typical drawings, the typical drawings will generally be the governing requirement

5. AMENDMENTS AND REVISIONS

These Standards may be amended from time to time in accordance with the Town Charter. It is the responsibility of the Responsible Party to obtain all revisions to these Standards.

6. DEFINITIONS AND ABBREVIATIONS

6.01. Definitions: Wherever the following words, phrases or abbreviations appear in the specifications, they shall have the following meanings:

AIR GAP shall mean the unobstructed vertical distance through the free atmosphere between the lowest opening of the potable water system feeding into a vessel and the flood level of the vessel.

BACKFLOW shall mean the undesirable reversal of the direction of flow in the potable water supply.

Commented [c2]: All sections above are per the original.

Commented [c3]: Added definitions and moved definitions from other sections into this section.

DIVISION 1

GENERAL REQUIREMENTS

BACKFLOW PREVENTION DEVICE shall mean a device or means designed to prevent backflow or backsiphonage.

BACKPRESSURE shall mean a condition that results when the downstream pressure in a system connected to the potable water supply exceeds the upstream pressure of the potable water supply.

BACKSIPHONAGE shall mean a type of backflow created by negative pressure or sub-atmospheric pressure in the potable water supply.

CONTRACTOR shall mean a person, partnership, or corporation responsible to construct improvements (facilities, infrastructure, etc.) to be dedicated to the Town for ownership or maintenance or to be constructed in a Town right of way or easement.

CROSS-CONNECTION shall mean a link, connection, or channel between a source of a non-potable substance and a potable water supply.

DESIGNATED PRIVATE CONSTRUCTION WORK includes: private sewer systems, water and sewer service lines to buildings, grading, drainage structures, retaining walls, parking lots, private streets and walks, fire lanes, driveways, and associated construction.

DEVELOPER shall mean the person, partnership, or corporation responsible for financial obligations to provide improvements for the Town's continued ownership and maintenance or to be constructed in a Town right of way or easement.

DEVELOPER'S ENGINEER shall mean a duly registered professional engineer in the State of Colorado employed by the Developer to prepare the required engineered drawings and documents for the construction of improvements for the Town's continued ownership and maintenance or to be constructed in a Town right of way or easement.

DEVELOPER'S REPRESENTATIVE shall mean any person or persons authorized by the Developer to act on behalf of the Developer.

DOUBLE CHECK VALVE ASSEMBLY shall mean an assembly of two independently operating check valves between two tightly closing shut-off valves with four properly located test cocks for the testing of each check valve.

ENGINEER shall mean a duly registered professional engineer in the State of Colorado.

EXPRESSIONS: Wherever the words "as directed", "as required", "as permitted", or words of like meaning are used, it shall be understood that the direction, requirements, or permission of the Town Representative is intended. Similarly, the words "approved", "acceptable", "satisfactory" shall refer to approval by the Town Representative.

GRAVITY GREASE INTERCEPTOR (GGI) shall mean a plumbing appurtenance or appliance that is installed in a wastewater drainage system to separate non-petroleum fats, oils, and greases (FOG's) and solid food particles from wastewater and is identified by outdoor (usually below grade) installation, 300-gallon minimum volume, 30-minute minimum retention time, baffles, a minimum of two compartments, and gravity separation.

DIVISION 1

GENERAL REQUIREMENTS

GREASE TRAP shall mean a generic term used to refer to all forms of grease separation and retention, no longer officially used in codes and standards.

HYDROMECHANICAL GREASE INTERCEPTOR (HGI) shall mean a plumbing appurtenance or appliance that is installed in a wastewater drainage system to separate non-petroleum fats, oils, and greases (FOG's) from wastewater and is identified by indoor installation, separation and retention efficiency, and flow rate. The design incorporates air entrapment, hydromechanical separation, internal baffling and/or barriers in combination or separately, and one of the following:

1. External flow control with air intake, directly connected
2. External flow control without air intake (vent), directly connected
3. Without external flow control, directly connected
4. Without external flow control, indirectly connected.
5. Certified under PDI G-101 and ASME A112.14.3

INSPECTOR shall mean an authorized representative of the Town and/or Town's Engineer working on behalf of the Town.

OWNER shall mean a person, company, firm, or corporation holding title to land that is being developed or modified within the Town.

OWNER'S REPRESENTATIVE (OR) shall mean any person or persons (including Engineer) authorized by the Owner acting on behalf of the Owner.

PUBLIC IMPROVEMENTS include: all work in the public right-of-way, Town property, easements dedicated to the Town, private property that will become Town property or an easement to the Town in the future, and projects or utilities that will become the Town's responsibility to maintain.

RECORD DRAWINGS shall mean a set of drawings prepared by a registered Professional Engineer in the State of Colorado which reflect the information of record for construction of any public improvements. Commonly referred to as "As-Builts".

REDUCED PRESSURE ZONE ASSEMBLY shall mean an assembly of two independently operating check valves with a hydraulic automatic operating differential relief valve between the two check valves and located between two tightly closing shut-off valves with four properly located test cocks.

RESPONSIBLE PARTY: These Standards are for the Design and Construction of Public Improvements and improvements in public rights of way, Town property and easements, and private property of common ownership. Therefore, the Responsible Party shall be anyone liable for the design and/or construction of public improvements projects related to these Standards and Specifications and may include but not be limited to the Contractor, Developer, permittee, builder, Engineer, consultant, and Owner.

SUBCONTRACTOR shall mean any person, company, firm, or corporation performing work within the Town limits which has a direct or indirect contract with the Responsible Party or other subcontractors and furnishes and/or performs on-site labor, and/or furnishes materials in connection with the performance of the Work.

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SURETY shall mean the entity that is bound with and for the Responsible Party for the performance of the Work as described in these specifications. (Bonded)

TESTING AGENCY shall mean any individual, partnership, or corporation which is qualified and licensed to perform the required sampling, analysis, testing, and professional recommendation service.

TOWN shall mean Town of Ridgway, Colorado. When referencing an individual, the Town shall mean a designee of the Town Council.

TOWN CODE shall mean the official adopted Town of Ridgway Municipal Code of Ridgway, Colorado.

TOWN ENGINEER shall mean the Town Engineer, Town of Ridgway, Colorado, or his authorized representatives acting on behalf of the Town.

TOWN REPRESENTATIVE shall mean the Town Manager or his/her authorized representative acting on behalf of the Town.

TOWN STANDARDS shall mean Town of Ridgway's Standard Specifications and Typical Drawings for Infrastructure.

UTILITY shall include the water and sewer utilities of the Town of Ridgway and all other utilities (e.g. power, telephone, fiber, cable, gas, etc.) provided by other entities.

VACUUM BREAKER shall mean a device designed to prevent backsiphonage.

WORK shall mean furnishing all labor, materials, equipment, support services and incidentals to successfully complete all design and construction needed for the project consistent with the Town Standards and approved project plans and including all associated items such as but not limited to notifications, submittals, testing, safety precautions, and record drawings.

6.02. Abbreviations: Wherever any of the following abbreviations appear, they shall have the following meaning:

AASHTO	American Association of State Highway and Transportation Official
ACI	American Concrete Institute
ADA	American Disabilities Act
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APWA	American Public Works Association
ASA	American Standards Association
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWWA	American Water Works Association
C.	Centigrade
CDPHE	Colorado Department of Public Health and Environment
CDOT	Colorado Department of Transportation
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch

Commented [c4]: Added more abbreviations

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CUHP	Colorado Urban Hydrograph Procedure
CWCB	Colorado Water Conservation Board
DIP	Ductile Iron Pipe
EPA	US Environmental Protection Agency
F.	Fahrenheit
Fc	Footcandles
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
"Green Book"	AASHTO's "A Policy on Geometric Design of Highways and Streets"
HERCP	Horizontal Elliptical Reinforced Concrete Pipe
HDPE	High Density Poly-Ethylene
HPPS	Handbook for Public Playground Safety
IAAF	International Amateur Athletic Federation
IMSA	International Municipal Signal Association
ISO	Insurance Service Office
ITE	Institute of Transportation Engineers
MUTCD	Manual on Uniform Traffic Control Devices
NFIP	National Flood Insurance Program
NPDES	National Pollution Discharge Elimination System
OR	Owner's (Town's) Representative O&M Operation and Maintenance
OSHA	Occupational Safety and Health Association
PUD	Planned Unit Development
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
ROW	Rights-of-Way
SCS	Soil Conservation Service
UNCC	Utility Notification Center of Colorado
USDCM	Urban Storm Drainage Criteria Manual (MANUAL)
USC FCCCHR	University of Southern California Foundation for Cross-Connection Control and Hydraulic Research
USGS	United States Geological Survey

7. ENFORCEMENT

7.01. Authority of the Town

- A. The Town Engineer or Town's Representative designated by the Council shall have the authority on behalf of the Town to ascertain that all design and construction of infrastructure, surface improvements, and facilities are at least equal to the minimum requirements set forth in the Town Standards and in other known applicable State and Federal requirements.
- B. The Town will resolve all questions that arise as to the quality and acceptability of designs proposed, materials furnished, work performed, interpretation of the plans and specifications, and acceptable fulfillment of the requirements of the Town standards.
- C. The Town reserves the right to provide full-time or part time construction inspection (Town representative) of all infrastructure and improvements which the Town will ultimately own and/or

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Commented [c6]: In original

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maintain or which is located in Town easements or rights of way. The cost of such inspection will be charged to the Responsible Party at a predetermined hourly rate. Any concerns from the Responsible Party will be reviewed promptly by the Town.

Commented [c7]: No changes

- D. The Town's representative, if provided, is there to ensure that the work complies with these Standards and the approved project plans. The Town's representative has the authority to reject defective material, defective workmanship, and to suspend work until such time as the Responsible Party shall correct the situation in question, subject to final decision by the Town.
- E. The Town's representative is authorized to inspect all work and all material furnished. Inspections may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The Town's representative is not authorized to revoke, alter, or waive any requirements of these Standards. They are authorized to call the attention of the Responsible Party to any failure of the work or materials to conform to these Standards. The Town's representative will have the authority to reject materials until the Town resolves any and all questions at issue.
- F. The Town and its representative will, at all times, have reasonable and safe access to the work whenever it is in preparation or progress and the Responsible Party will provide proper facilities for such access and inspection.
- G. The Town will have the authority to stop work whenever such stoppage may be deemed necessary.
- H. The Town's representative will, in no case, act as foreman or perform other duties for the Responsible Party nor interfere with the management of the Work performed by the Responsible Party. Any "advice" or "opinion" which the Inspector may give the Responsible Party will not be construed as binding upon the Town Representative or the Town in any way or release the Responsible Party from fulfilling all of the terms of these Standards and the approved plans. The presence or absence of the Town's representative will not relieve, in any degree, the responsibility or the obligation of the Responsible Party.
- I. The Developer and/or the Developer's Engineer may assign an inspector to check any and all Work, including materials to be incorporated in the Work, and all construction methods and practice at his or the Developer's expense. The Developer's inspector will not reduce or eliminate the Town's ability to inspect the Work or enforce compliance with the approved construction documents and the Town's Standards and to assess the charges for such inspection and enforcement to the Developer or Responsible Party.

Commented [c8]: Reworded and clarified.

Commented [c9]: Added clarification

7.02. Violations: No person, firm, or corporation shall construct, enlarge, alter, repair, move, improve, remove, excavate, convert, or demolish any Public Improvements or private improvements in common ownership or permit the same to be done in violation of these Standards. Whenever any work is being done contrary to the provisions of these Standards, the Town's representative may order the Work stopped by a written notice in accordance with Section 16 of these Standards.

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7.03. Deviations

- A. The provisions of these Standards are not intended to prevent the use of any material or method of construction not specifically prescribed by these standards, provided any alternate has been previously approved and its use authorized in writing by the Town.

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B. Whenever there are practical difficulties involved in carrying out the provisions of these procedures not created by the Responsible Party, the Town may grant a deviation for individual cases, provided that the Town shall first find that a unique reason makes these standards impractical and that the modification is in conformity with the intent and purpose of these standards, and providing that such deviation does not lessen any design requirements or any degree of structural or operational integrity. The Responsible Party shall provide the Town with sufficient specifications, evidence, justification, calculations, and/or proof to substantiate any claims that may be made regarding the hardship and alternate material, detail, or technique. The Town, in its sole discretion, will decide upon the acceptability of any proposed deviation.

8. RESPONSIBLE PARTY RESPONSIBILITIES

8.01. It shall be the responsibility of the Responsible Party and his representatives to read and fully comply with all the provisions of the Standards and all laws and regulations that apply to local and state agencies. The Responsible Party is responsible for ensuring that all construction and construction activities and materials are in compliance with these Standards.

8.02. The Responsible Party shall take such precautions as may be necessary to provide a safe work environment, prevent damage to the project and other properties, provide for public safety, normal drainage, and erect any necessary barricades, signs, or other facilities at his expense as required by these Standards and good construction practice.

8.03. The Responsible Party shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and shall be responsible for the acts and omissions of his employees, Subcontractors, and their agents and employees.

8.04. The Responsible Party shall be solely responsible for locating all existing underground installations, including service connections, in advance of excavating. Town maps and databases are intended to be used for general information only, and the location of any utilities or property lines as found on the maps or databases shall be verified in the field prior to proceeding with design where interferences may occur or with work in the area as applicable.

8.05. The Responsible Party shall conduct all his activities in a manner that protects all existing infrastructure and improvements.

8.06. The Responsible Party agrees to indemnify and hold harmless the Town, its officers, employees, consultants, insurers, and self-insurance pool, from and against all liability, claims, actions, and demands, on account of injury, loss, or damage, including without limitation claims arising from bodily injury, personal injury, sickness, disease, death, property loss or damage, violation of statute, ordinance, or regulation or any other loss of any kind whatsoever, which arise out of or are in any manner connected with this contract, if such injury, loss, or damage is caused in whole or in part by, or is claimed to be caused in whole or in part by, the act, omission, error, Contractor error, mistake, negligence, or other fault of ++the Responsible Party, any Subcontractor of the Responsible Party, or any officer, employee, representative, or agent of the Responsible Party or of any Subcontractor of the Responsible Party, or which arise out of any workmen's compensation claim of any employee of the Responsible Party or of any employee of any Subcontractor of the Responsible Party. The Responsible Party agrees to investigate, handle, respond to, and to provide defense for and defend against, any such liability, claims or demands at the sole expense of the Responsible Party. The Responsible Party also agrees to bear all other costs and expenses related thereto, including court costs and attorney fees,

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whether or not any such liability, claims, or demands alleged are groundless, false, or fraudulent. Responsible Party shall procure and maintain, and shall cause any Subcontractor of the Responsible Party to procure and maintain, the minimum insurance coverages listed below. The Responsible Party shall not allow any Subcontractor to commence Work on this project until all similar insurance required of the Subcontractor has been obtained and approved. For the duration of his Work, the Responsible Party must maintain the insurance coverage required in this section. Such coverages shall be procured and maintained with forms and insurers acceptable to Town. All coverages shall be continuously maintained from the date of commencement of Work to cover all liability, claims, demands, and other obligations assumed by the Responsible Party Responsible Party. The Responsible Party shall provide a Certificate of Insurance with the Town, its officers, employees, consultants, insurers, and self-insurance pool as additional insured. Limits of insurance shall be consistent with those required for an Encroachment Permit.

8.07. The Responsible Party shall provide proper and safe conditions for inspection of the Work.

8.08. The Responsible Party shall arrange and pay for all testing required to demonstrate Work and materials conform with the Town Standards.

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8.09. The Responsible Party shall not cover or enclose work until inspected and tested in the presence of the Town's representative. When tests and inspections are complete, they shall be checked and approved by the Town. Should any work be enclosed or covered up before such inspection, testing and approval, if requested by Town, the Responsible Party shall at his expense uncover work unless the Responsible Party has given the Town timely notice of Responsible Party's intention to cover the same and the Town has not acted with reasonable promptness in response to such notice. If any Work is covered contrary to the Town's request, the Work must be uncovered by the Responsible Party for Town's observation and replaced at Responsible Party's expense. After inspection testing, and approval, Responsible Party shall make all repairs as necessary to restore all work disturbed by him to its original condition.

Commented [c14]: Paragraphs 8.10-8.14 were elsewhere and moved to this section. All have been required.

8.10. If Work is performed during non-regular hours as defined in Paragraph 13.01 without authorization of Town and Work is covered during that period, Work must, if requested by the Town, be uncovered for Town's observation and replaced at Responsible Party's expense in accordance with paragraph 7.09.

8.11. The Responsible Party shall provide and maintain adequate water service for drinking and sanitation purposes, as well as for construction purposes at the job site throughout the duration of construction. He/she shall also provide proper sanitary facilities, as and where needed, for the duration of the construction.

8.12. The Responsible Party shall be required to provide adequate construction signing, flagmen, barricades, etc. to warn vehicular and pedestrian traffic of work in progress, obstacles, etc., and divert traffic as may be required in the course of construction. All signing and traffic control shall be subject to approval of the Town Marshall and generally in accordance with the Manual of Uniform Traffic Control. When specifically authorized by the Town Marshall, portions of a street may be allowed to be partially closed to traffic for construction, though typically not more than one half the street at the time. Responsible Party shall make every attempt to minimize time of such closures. In addition to the requirements listed below under "Disruption of Service", Section 14.02 it shall be the responsibility of the Responsible Party to notify the Marshall, Sheriff, Fire, Ambulance, and other applicable emergency services at least 24 hours prior to such closures.

8.13. The Responsible Party shall provide submittal information including samples, drawings, reports, field notes, cutsheets, certifications, and data as appropriate on all specific materials to be supplied for review and approval by the Town for conformance with Town Specifications. Samples shall be collected, stored and

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tested in accordance with methods in these Standards, or if not addressed in these Standards, as specified by the Town. Tests of materials shall be by an entity acceptable to the Town. Materials for construction shall not be purchased prior to such approval. Shop drawings shall be provided for major mechanical installations such as lift stations, pressure reducing stations, etc. Shop drawings shall be of a scale sufficiently large to show all pertinent features of the item and its layout, setting, method of connection, etc. to the Work.

8.14. Responsible Party agrees to properly maintain his Work and shall be responsible to repair any damages to Town or private property, street surfaces or improvements which impacted or are caused in any manner by the Responsible Party's Work including off site impacts.

9. PLANS FOR REVIEW

9.01. The Developer or other Responsible Party shall submit to the Town for review and approval completed plans and specifications for any proposed improvements including water, sanitary and storm sewer, streets, walks, parks, wire utilities, etc. that will become the ongoing ownership and/or maintenance of the Town or be constructed on Town property or in a Town right of way or easement. The Responsible Party will be provided with written comments and questions which result from the Town's review. Unless the requirement is waived by the Town, plans and specifications shall be prepared and stamped by an Engineer.

9.02. Plans shall include an overall plan which shows lots and blocks to be served and the locations of all utilities to be constructed. Reference to the sheet which contains the detail for the area shall also be shown.

9.03. Detail plans for all infrastructure and surface improvements shall have a minimum scale of 1 inch equals 50 feet unless the minimum lot size is larger than 3.0 acres in which case the minimum scale shall be 1 inch equals 100 feet. The scale in all cases should be sufficient to clearly illustrate the Work. Utilities should be color coded on the plans per the colors required by UNCC with lot lines and building footprint in faded background line types on utility plans. Plan view drawings shall include at least 2 foot contours to show overall topography of the lots to be served and the existing and proposed topography of the streets and drainage. Water plans shall show the location, dimension, and grades of the existing and proposed water mains, valves, fittings, hydrants, and other appurtenances, and all service lines with reference to property lines and stationing. Profiles shall be required, unless waived by the Town on an individual project basis for very short extensions. Roads and sewer lines shall have the same minimum scale and shall include both plan and profile on the same page and at related scales. Profile drawings should show all taps and crossings (including all utility mains and service lines, culverts, storm sewers etc.). Sewer plans shall show location, dimensions, stationing, and grades of mains, manholes, taps, and appurtenances. Street plans shall include locations, stationing, dimensions, and grades for centerline and gutter or drainage. Monumentation of new streets shall include permanent centerline monuments which shall be shown on the plans. All other proposed improvements shall be shown on the plans as should all existing infrastructure and improvements.

9.04. Unless otherwise approved by the Town, utility lines and pipes shall be perpendicular or parallel to rights of way lines.

9.05. Detail drawings shall be of a scale sufficient to clearly describe the particular item. The type, size, approximate location and number of all known underground utilities shall be shown on all drawings.

9.06. Where materials to be furnished are other than those commonly used by the Town, the plan submittal should include specifications and support information for those materials so that the Town can

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determine that the materials meet the intent of these Standards. The Responsible Party should be aware of and comply with the Operation and Maintenance submission requirements in Section 18.

9.07. The cost of development review and enforcement including but not limited to design review, legal review, and inspection of these Standards and related Town ordinances and regulations will be based on the Town Code as amended from time to time. Refer to the Ridgway Municipal Code for fees and out-of pocket costs the Town incurs including but not limited to for Engineers, technical review, attorney's fees and/or other reasonable expenses.

9.08. The Town shall review and return one copy of said plans (assuming more than one copy was submitted) with either a stamp of approval or a letter designating necessary revisions required to receive approval. Upon presentation of the plans revised as per this letter, the Town will approve the plans without undue delay unless there are other changes to the plans which create problems or the revisions are not re-submitted within 60 days in which case they will be re-checked as outlined in the next paragraph.

9.09. If resubmittal of plans is required, the resubmitted plans shall indicate all revisions (including those not requested by the Town) from the previous submittal. If the Town supplied written comments the Responsible party shall provide a letter explain how each question was addressed. It is suggested that the Responsible Party also provide a letter responding to each of the Town's verbal comments as well.

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9.10. Construction plans approved by the Town shall be effective for a period of 12 months from the date of approval unless otherwise approved in writing by the Town. After 12 months, the documents for Work not yet constructed shall be subject to re-review by the Town to bring those portions of the documents into compliance with then current Town Standards and Drawings.

9.11. Where it is determined that utility lines are necessary to serve property beyond the subdivision or development in question, the Developer will be required to design, properly size, and construct the system to permit future extensions to be made at the limits of the subdivision or development in question. Public utility systems must be designed and constructed along roads and/or through the development to facilitate future extensions.

Commented [c19]: Existing requirement

~~9.12. The Town reserves the right to reject any materials or equipment which does not fully comply with the Town's Standards.~~

10. RESPONSIBILITY FOR DESIGN AND CONSTRUCTION

The Town shall have full authority to review and approve all submittals and construction for compliance with Town Standards. An approval or acceptance by the Town does not relieve the Responsible Party from responsibility for ensuring that the calculations, plans, specifications, construction, and Record Drawings are in compliance with these Standards. Any approval or acceptance by the Town shall not result in any liability to the Town or its employees and consultants for any claim, suit, loss, damage, or injury resulting from the use or implementation of the approved document.

11. EASEMENT REQUIREMENTS

11.01. The following are the minimum utility easement requirements adjoining a right of way:

Front	10'
Rear with alley	5'

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11.02. Side and rear lot easements are required when there is a specific need.

Commented [c20]: No changes

11.03. For all other easements not adjoining a right of way, the following minimums are required:

Minimum	20'
For single subsurface utility	3 * invert depth
For ditches and drainages	12' + top bank width
For multiple sub-surface utilities	3' * the invert depth of deepest utility + 5' between each utility + meet requirements below for the distance to the edge of the easement.

Commented [c21]: Matches town code

Commented [c22]: Was 5' + 3 times the invert depth

Commented [c23]: No changes

11.04. Buried utilities shall be no closer than 1' horizontal from the edge of the utility easement for each foot of depth and no utility, ditch or drainage structure should be within 3' of the edge of an easement.

Commented [c24]: Was 15' + 5' between utilities & 3' between utility & easement

11.05. Minimum separation between water and non-potable lines shall be 10' consistent with the sanitary protection requirements in the Minimum Water (Chapter 2, Section 02712) and Minimum Sewer (Chapter 2 Section 02721, 02722) Standards.

11.06. Street right of way widths shall take into account the need for future, currently unanticipated, utilities.

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12. PRE-CONSTRUCTION MEETINGS

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12.01. Pre-Bid Meeting: On projects where the Responsible Party will be receiving bids, the Responsible Party is encouraged to have a meeting for interested bidders prior to receiving bids. The Responsible Party should invite all bidders and all utilities which are involved in the project to attend the meeting. One purpose of the meeting should include to make bidders aware of: the scope of the project, the site conditions, and Town requirements.

12.02. Pre-Construction Meeting: Unless the requirement is waived by the Town, a pre-construction meeting shall be held prior to commencing construction. In attendance shall be the Responsible Party, his Contractor including the on-site project superintendent and representatives of the Town as designated by the Town. Representatives of other utilities which will be impacted by the project shall be given notice of the meeting sufficiently in advance by the Responsible Party or his representative to reasonably allow their attending. The purpose of the meeting will be to review and coordinate construction schedules, review Town requirements during construction, address any questions, discuss anticipated problems, establish ground rules for working together, and develop an inspection schedule.

13. NOTIFICATIONS BY RESPONSIBLE PARTY

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13.01. Notification prior to Work: The Responsible Party shall notify the Town at least three (3) working days before beginning any Work. If, for any reason, the Responsible Party should halt Work on a project during any stage of construction for more than one working day, it shall be the responsibility of the Responsible Party to notify the Town or its designated representative a day (orally or in writing) in advance of resuming construction.

13.02. Non-Regular Work Hours: If the Responsible Party intends to work non-regular work hours, Responsible Party shall notify the Town in writing and receive written approval at least 24 hours prior to such

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work, except in the event of an emergency. Failure to provide such notifications may provide sufficient cause for the suspension of the Project in accordance with Sections 13 and 16 below.

13.03. Emergency Notice: In the case of an emergency situation, the Responsible Party shall notify of the Town by contacting the on-call Town Representative, and then proceed to safely address the emergency situation(s). Once the emergency is safely addressed, work shall cease until proper notice can be given. The non-emergency Work will then proceed in accordance with a normal work schedule. If any Work is completed and covered without oversight by the Town, that Work shall, at the Town's request, be uncovered, at no expense to the Town, so that the Town can confirm the work was completed in accordance with the approved plans and these Standards.

13.04. Testing: The Responsible Party or his representative shall be responsible for providing notice to the Town at least 24 hours in advance of any testing which will be to demonstrate compliance with the plans and Town standards. A representative of the Town shall be present at all tests for conformance with the plans and specifications and Town Standards and where applicable shall determine where and how the tests are performed. Should the Responsible Party fail to provide such notification and a representative of the Town not be present during any testing, the tests shall be deemed to have been at the convenience of the Responsible Party rather than for acceptance by the Town. The Town shall have the right to require retesting including re-exposing the work should that be necessary to demonstrate conformance with approved plans and specifications and Town requirements.

14. CONTROL OF WORK AND MATERIALS

14.01. Work Hours: Except in an emergency, the Responsible Party shall not permit work to proceed in non-regular Town work hours or overtime work without Town's written consent given in accordance with Section ~~12.02~~13.02 regarding notification of Non-Regular Work Hours above. The Responsible Party shall reimburse Town for all expenses of Town including construction observation and testing, incurred as a result of working during non-regular hours. Regular hours shall not exceed 8 hours in a 24-hour period (and shall typically conform to the Town's normal work hours) nor 40 hours in a ~~seven-day~~seven-day period, nor include Saturdays, Sundays, or legal holidays. All other work hours shall be considered "non-regular".

14.02. Delivery and Storage of Materials: The Responsible Party shall arrange for delivery of materials, products and equipment to the project site in undamaged condition in manufacturer's original, unopened containers or packaging, with identifying labels intact and legible. The Responsible Party shall store and handle products in accordance with manufacturer recommendations, referenced standards, and as specified in the specifications in a manner to protect from damage by moisture, weather, abuse, construction operations, etc. Materials shall be stored so as to ensure the preservation of their quality and suitability for the Work. Stored materials, even though approved prior to storage, will be subject to inspection prior to their use in the Work and must at that time meet all requirements of these Standards at the time they are used. Stored materials shall be located so as to facilitate inspection. The Responsible Party shall be responsible for providing adequate storage and protecting stored materials at his expense. All Federal, State, and Local requirements pertaining to storage and handling of materials must be followed.

14.03. Work Conditions

A. Protect Public Safety: The Responsible Party shall maintain the condition of the Work site such that public safety and welfare are protected.

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- B. Workmanship: Workmanship shall be the very best. Lack of quality in workmanship shall be considered sufficient reason for rejection in part or in whole.
- C. Site Maintenance and Cleaning: Throughout the construction period, the Responsible Party shall:
- i. Provide all required personnel, equipment, and materials needed to maintain the site in a reasonable standard of cleanliness and in accordance with this sub-section.
 - ii. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 - iii. Not burn or bury rubbish and waste materials on project site.
 - iv. Not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains or in a manner which might cause ignition.
 - v. Not dispose of wastes into streams or waterways.
 - vi. Make provision to prevent "tracking" debris onto any public street and will be responsible for the promptly cleaning of any debris which is tracked and remedying any damage to Town infrastructure. In most cases a track pad of sufficient size to prevent tracking will be required.
 - vii. Maintain rights of way and surrounding properties free from accumulations of waste, rubble, debris, and rubbish caused by construction operations.
 - viii. Wet down dry materials and rubbish to lay dust and prevent blowing dust as frequently as necessary.
 - ix. At reasonable intervals during progress of Work, clean site and public properties, and dispose of waste materials, debris and rubbish in a legally allowable manner.
 - x. Provide on-site trash receptacles for collection and storage of waste materials in an orderly manner which will not impede normal or emergency access or people and equipment, nor obstruct drainage.
 - xi. Remove waste materials, debris and rubbish from the site and legally dispose of them at public or private dumping areas off Owner's property.
- D. Final Cleaning: At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed and visible surfaces. Correct any settlement and dress on areas impacted. Leave project clean and ready for intended use. Restore all disturbed surfaces to original condition. Maintain clean work site until project, or portion thereof, is accepted by the Town. Schedule final cleaning so Town can accept a completely clean project.

14.04. Defective Materials: All materials installed must conform with these Standards and shall be free of defects of manufacture or damage. Materials not meeting the requirements of these Standards will be considered defective and rejected. Any defective or damaged materials found in the construction or on the construction site shall be marked and removed from the site. In the event the Responsible Party fails to remove rejected materials from the construction site within a reasonable length of time, the Town may arrange for such removal at the expense of the Responsible Party.

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14.05. Unacceptable or Unauthorized Work

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- A. Work which does not conform to the Town Standards and/or which results in an inferior or unsatisfactory product will be considered unacceptable Work. Unacceptable Work, whether the result of poor workmanship, poor design, use of defective materials, damage through carelessness, or any other cause which is found to exist prior to the final acceptance of the Work will be immediately removed and acceptably replaced or otherwise satisfactorily corrected by and at the expense of the Responsible Party. This expense includes total and complete restoration of any disturbed land or surface to original or better than the original condition that existed before the repairs or replacement.
- B. Unauthorized Work includes Work which is conducted without Town approval of the plans or Work which is completed without giving required notice to the Town. The Town may reject the Work and require its removal or take other actions the Town feels are appropriate. Those actions may include issuing a Stop Work Order (see Section 16) and/or requiring the Responsible Party, at no expense to the Town, to expose the Work and allow the Town observe the materials and installation.

15. PROTECTION OF FACILITIES, PROPERTY AND IMPROVEMENTS

15.01. Protection of Existing Facilities and Improvements

Commented [c32]: reorganized, amplified and clarified but content similar to past version

- A. The Responsible Party shall contact the Utility Notification Service of Colorado at 1 (800) 922-1987 or by dialing 811 in adequate advance of Work and shall notify all utility companies and interested parties 3 business days prior to commencement of Work in order to ensure that there will not be interruptions of services during construction. The Contractor shall be liable for all damages to existing structures, public or private, and he/she shall hold the Town harmless from any liability or expense for injuries, damages or repairs to such facilities.
- B. The Responsible Party at all times shall take proper precautions for the protection of and prevent damage to public and private property including but not limited to utility lines, manholes, valve boxes, survey monuments, fences, driveways, culverts, storm drains, ditches, pans, mailboxes, plantings, and other structures and improvements that maybe encountered during construction. Hand excavation and support of existing lines shall be used where necessary.
- C. In the event that during construction it is determined that any underground utility conduit, including sewers, water mains, gas mains and drainage structures and any above ground utility facilities are required to be relocated, the Responsible Party shall notify the utility owner well in advance of his approach to such utility so that arrangements with the Town and/or owners of the affected utility can be completed without delay of the Work. Prior to constructing over another utility, notify the utility and resolve any conflicts.
- D. Responsibility for Repair
 - i. The Responsible Party shall be liable for all damages to existing structures and improvements, public or private caused by his activities or inactivities, and he/she shall save the Town harmless from any liability or expense for injuries, damages, or repairs to such facilities.

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- ii. Should any utility be damaged in the construction operations, the Responsible Party shall immediately notify the owner of such utility, and unless authorized by the owner of the utility, the Responsible Party shall not attempt to make repairs. The Responsible Party will be responsible for the cost of repair of underground pipes, wires or conduits damaged by them or their Subcontractors completed to the satisfaction of the owner.
 - iii. The Responsible Party will be responsible for the repair of any damage or destruction of property resulting from neglect, misconduct, or omission in his manner or method of execution or non-execution of the Work or caused by defective Work or the use of unsatisfactory materials. The Responsible Party will restore such property to a condition equal to or better than that existing before such damage or injury was done by repairing, rebuilding, or replacing it as may be directed by the Town, or they will otherwise make good such damage or destruction in a manner acceptable to the Town and the property owner.
- E. The Responsible Party is required to provide each property with access to and from the property during the time of construction. Existing driveways shall be cut, filled, and graded as required to meet new construction. Existing driveways shall be resurfaced with the presently existing type of surfacing whenever existing surface is destroyed.
- F. The Responsible Party will protect and carefully preserve all land boundary, topographic, and Town survey control monuments unless otherwise arranged in writing with the Town. All monuments disturbed or removed by the Responsible Party through negligence or carelessness on his part or on the part of his employees or Subcontractors will be replaced by a land surveyor registered in the State of Colorado, at the Responsible Party's expense.
- G. Where compaction activities could potentially impact existing improvements, the Responsible Party shall coordinate with the owner of the existing improvements to ensure protection of those improvement.

15.02. Public Safety and Convenience

- A. Disruption in Service: Should it be necessary for any utility service to existing consumers to be disrupted for any reason, the Responsible Party shall provide as much notice as possible to those whose service will be disrupted coordinating such activity with the Town to minimize impact on consumers and assist the Town in providing inspection. Responsible party shall schedule Work in a manner which will minimize disruption and inconvenience to others. At a minimum, the Responsible Party shall provide written notice to each effected consumer at least 48 hours in advance with the time, date, and estimated length of the disruption. Notice shall be by personal contact and written notice to each structure. When service to commercial customers will be disrupted, the Responsible Party and the Town shall meet with each business at least three days in advance and determine when it would be least inconvenient to have service disrupted. If at all possible, the service interruption shall be at time which will have the least impact on all the consumers effected. Should construction necessitate street or road closures, advanced notice in local newspaper will also be required. When the Work involves excavation adjacent to any building or wall along the Work, the Responsible Party will give property owners due and sufficient notice thereof, in writing with a copy to the Town. When possible, any construction operations which will result in disruption of services to residential consumers, shall be done between the hours of 10 a.m. and 4 p.m. or 11 p.m. to 4 a.m.

Commented [c33]: added

Commented [c34]: added what is highlighted, rest of the 15.02 is in previous versions except as noted

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- i. **Emergency Disruption:** When service is unexpectedly disrupted, the Responsible Party shall notify each effected consumer as expeditiously as possible and notify when service will be restored and shall use all means at his disposal to minimize the length of disruption.
 - ii. **Minimizing Disruptions:** The length of disruption in service shall be kept to an absolute minimum. All Work which can be done in advance shall be done and inspected and found acceptable by the Town and other appropriate entities before the service interruption begins. All personnel, materials, and tools shall be on site and ready prior to disrupting service. Responsible Party shall make use of personnel, materials, and equipment which will reduce the length of service disruption. For example, megalugs and temporary restraints shall be provided in addition to required thrust blocks so water lines can be repressurized as soon as initial backfill is compacted.
 - iii. **Phasing Disruptions:** When the Work which will cause the disruption can be phased, the Developer in coordination with the Town shall work with the effected customers to determine whether one long or multiple shorter disruptions are preferable.
- B. **Use of Explosives:** The use of explosives must be approved in writing by the Town and will only be allowed when no less dangerous method is practical. If approved, the Responsible Party will use the utmost care to protect life and property and shall be liable for any damages which result. Signals warning persons of danger will be given before any blast. Excessive blasting or overshooting will not be permitted. The Town will have authority to order any method of blasting discontinued that leads to overshooting, is dangerous to the public, or destructive to property, environment or natural features.

Before any blasting is to be performed by the Responsible Party, a certificate of insurance indicating special blasting coverage in the following minimum amounts will be filed with the Town:

Property damage, each accident	\$2,000,000
Public liability, bodily injury single limit or equivalent, each accident	\$2,000,000

The Town reserves the right to require additional insurance coverage if the circumstances warrant.

The Town has the right to require detailed inspections by an independent consultant or by Town Inspectors on any structures or properties located in the vicinity of the blasting, both before and after the blasting activity. The cost for such inspections shall be the responsibility of the Responsible Party.

- C. **Protection of Potable Water Supply, Streams, Lakes, and Reservoirs**
- i. The Responsible Party shall conserve water and shall not waste or let streams flow unused and shall be sure that waters used for cleaning and flushing are disposed of in a manner which will not create a health, safety, or nuisance problem. The Responsible Party shall furnish all needed Backflow devices to ensure sanitary protection of the Town's water supply. The Owner reserves the right to curtail the Responsible Party's use of water during periods of shortage in its transmission and distribution system.
 - ii. The Responsible Party will take all necessary precautions to prevent pollution of streams, lakes, and reservoirs by sediment, fuels, oils, bitumens, calcium chloride, fertilizers, insecticides, or other harmful materials. They will conduct and schedule their operations to avoid or minimize runoff, pollution, and/or siltation of streams, lakes, and reservoirs. A plan for erosion protection and drainage control shall be submitted to the Town, and all required

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drainage and erosion control measures shall be in place before starting Work. All Work must conform to all applicable local, state, and federal regulations.

- iii. Responsible party shall avoid interrupting the flow in any streams, drainages, flumes, canals, or similar facilities.

Commented [c35]: Added, its required by state regs too.

16. CONSTRUCTION SAFETY REQUIREMENTS

16.01. All installations shall be made in a safe manner which complies with current OSHA and other applicable local, state, and federal requirements. The Responsible Party shall be solely responsible for providing adequate safety on the project.

16.02. Although not obligated to do so, if the Town observes any unsafe work condition at any time, they may issue a stop work order until the unsafe condition is properly remedied.

16.03. When, in the opinion of the Town, the Responsible Party has not taken sufficient precautions for the safety of the public or the protection of the Work to be constructed, or if adjacent structures or property which may be damaged by processes of construction on account of such neglect, and an emergency arises and immediate action is considered necessary in order to protect private or public interests, the Town, WITH OR WITHOUT NOTICE to the Responsible Party, may provide suitable protection by causing such Work to be done and material to be furnished and placed as the Town may consider necessary and adequate. The cost and expense of such Work and material so furnished will be borne by the Responsible Party and will be paid within 30 days of presentation of the bills. The Town may also draw from the Responsible Party's Surety to cover any non-payment, including accrued interest and applicable overhead costs. The performance or non-performance of such emergency Work under the direction of the Town will in no way relieve the Responsible Party of responsibility for damages which may occur during or after such precaution has been taken.

17. STOP WORK ORDER

Commented [c36]: No changes

17.01. Any Town approval may be revoked or suspended by the Town and a Stop Work Order may be issued after adequate notice to the Responsible Party if the Responsible Party fails to adequately address the notice in a timely manner given the situation (taking into consideration health, safety and welfare), for:

- A. Violations of any condition of the Encroachment and Excavation Permit or of the approved construction drawings or specifications; or
- B. Violation of any provision of these Standards; or
- C. Existence of any condition or the occurrence of any act which may constitute or cause a condition endangering health, life, or safety, or serious damage to property.

17.02. A suspension or revocation by the Town and stop work orders shall take effect immediately upon notice to the person performing the Work in the field or if no one is on site to receive notice, to the project lead or a representative of the Responsible Party and shall remain in effect until such time as the Town cancels the Order in writing. A failure to abide by the terms of the suspension or revocation will be considered a violation of Town ordinance.

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17.03. Upon receipt of a Stop Work Order, the Responsible Party shall be responsible for taking such precautions as may be necessary to prevent damage to the project, prevent inconvenience or hazardous conditions for the general public, provide for normal drainage, and to erect any necessary barricades, signs, or other facilities which may be necessary or directed by the Town.

18. CHANGES TO APPROVED PLANS

Commented [c37]: No changes

18.01. All proposed changes, except minor field changes, to the approved plans shall be submitted to the Town for review and written approval obtained prior to commencing construction. Such changes shall be submitted as soon as they are contemplated to allow as much review time as is possible and to adjust any other facilities which may be impacted by the change. "Changes" include additions and deletions as well as changes to all utilities and improvements located in public rights of way, on Town property, or in utility or other Town easements.

18.02. The Responsible Party shall distribute copies of approved changes to the Town, Utility Owner, Responsible Party sub-contractors, Developer and the Developer's Engineer and other parties with an interest or impact. No Work shall proceed on that portion of the project being revised until said revisions are submitted, approved by Town and Utility Owner and Developer and distributed.

18.03. Field changes shall be discussed with the Town and shall receive a verbal approval before being implemented. Field changes shall be defined as minor deviations in the Work which do not result in significant changes in location or function or minimum standard of the item being altered, nor a change in contract price.

19. RECORD (AS-BUILT) DRAWINGS AND OPERATION AND MAINTENANCE DATA

19.01. Unless otherwise agreed in writing, during construction the Responsible Party shall keep a log of the construction progress and the field location of the new facilities. All buried facilities and lines shall be tied to permanent surface monuments, using centerline monuments when available, at 200 foot intervals or less. Valves, fittings, appurtenances, vaults, cleanouts, and manholes shall be tied to a minimum of three permanent surface monuments. Water service connections shall also include distance from the closest valve to valve box and for sewer services the distance from the manhole and the depth from the sidewalk to the invert of the dead end stub. Depths and elevations shall be recorded at each station as well. Record Drawings shall be 24" x 36" lettered drawings, at a scale at least as large as required in Section 8, shall be prepared noting the final sizes, locations, and ties at all of the required locations. These drawings shall also note the brand names, model numbers, and sizes of all manufactured equipment installed as part of the project. Approved Record Drawings shall be a requirement for release of security and/or final completion unless the deadline is specifically extended by the Town. Once the Record Drawings have been approved by the Town, the Responsible Party shall promptly submit a mylar copy of the approved drawings, a digital copy in an AutoCAD 2020 readable and edit-able format and a shape file the Town can insert in to their GIS system per the following:

- A. **DIGITAL MAP FILE SUBMITALS:** Submittals require all map related data to be submitted in digital map files in either CAD (DWG), GIS (shapefile or geodatabase), or both CAD and GIS formats.
- B. **ASSOCIATED TABULAR INFORMATION:** Pertinent tabular information associated with the map data being submitted is required to be included within the CAD or GIS files. For example, all feature types need to be defined and easily distinguishable from one. In addition, each feature all pertinent

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information associated to the individual features needs to be included with that feature inside the CAD or GIS file.

- C. COORDINATE SYSTEM: It is required that all digital map data submittals have a known coordinate system assigned to them. That coordinate system needs to be either the Ouray Local Coordinate System or NAD 1983 State Plane Colorado South FIPS 0503 US Feet. The vertical datum is required to be defined as NAVD88.

Commented [c38]: Updated to reflect new technology.

19.02. Where equipment is installed which is not the same as equipment already in use in the Town system, the Responsible Party shall submit manufacturer's operation and maintenance literature on the equipment or device. If necessary, Responsible Party shall provide supplemental O & M data on materials if there is not sufficient detail in the manufacturer's literature to operate and maintain the equipment and for complete repair of all repairable parts. Such information shall be submitted and approved by the Town prior to the Town accepting the project as Substantially Complete. Any specialized tools required to perform such O & M shall be provided to the Town at no expense to the Town. Unless the Town already has an inventory of spare parts for the particular equipment, a complete set of spare parts to overhaul the equipment shall be provided by the Responsible Party (or Developer) to the Town prior to final acceptance.

Commented [c39]: Included in previous version

20. ACCEPTANCE, OPERATION AND MAINTENANCE

20.01. The requirements in this section are in addition to the requirements in the Encroachment and Excavation Permit for the Work.

20.02. Following the Town determining the construction has been satisfactorily completed, all required satisfactory testing as defined in applicable minimum and standard specifications being completed and submitted, and delivery of all required equipment and materials and necessary documents (including Record Drawings and any required O&M data) to convey the system and appurtenant easements to the Town, the Town will give preliminary acceptance to the project. At this time the facilities may be tied into the Town system and service provided. For the first twelve months thereafter, longer if agreed to by Town and the Responsible Party, referred to as the Correction Period, the Responsible Party will be responsible for all operation, maintenance, and repair costs including but not be limited to, the cleaning of streets, patching of potholes, and maintenance and repair of water, storm and sanitary sewer facilities. The cost of any routine maintenance not performed by the Responsible Party that must be performed by the Town will be billed to the Responsible Party at cost plus twenty five percent (25%). During that period, the Town shall be notified when O & M and/or repairs will be performed on the facilities, and at the Town's option it may elect to have an Inspector present during such operations.

Commented [c40]: added

20.03. In the event of a water main break, sanitary sewer main blockage, street or bridge failure, or other emergency that may occur during the correction period, it may become necessary for the Town to undertake immediate repairs to the facilities and/or make the area safe to residents, pedestrians, or motorists. The Town will attempt to contact the Responsible Party in the event of such emergency. However, if the Responsible Party or his representative cannot be contacted quickly or if the Responsible Party is unable to take immediate action to relieve the urgent situation, the Town may proceed with such action as deemed necessary by the Town Representative, and the Responsible Party will be billed for all costs of these actions at cost plus twenty five percent (25%).

Commented [c41]: added. This has been the practice but it was not spelled out so clearly.

20.04. Before the end of the correction period there shall be an inspection of the system which will include a physical, and possibly video, inspection of the construction and a review of the O & M records. The

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Responsible Party shall notify Town of when facilities are ready and schedule the inspection. Failure to notify the Town will be reason to extend the inspection period. If, in the opinion of the Town, the system is performing satisfactorily, the Town will accept the facilities following proper assignment of all Responsible Party and vendor warranties on the Project, and assume maintenance of it. The Town may elect to extend the period of Developer's maintenance beyond twelve months until any on-going problems are corrected. If the Developer fails to correct any problems within one month of notification, the Town may correct the problems and collect the costs it incurs from the Developer at cost plus 25%. Such costs, if not promptly paid shall be a delinquent charge which may be assessed against the property being developed, in addition to any other rights and remedies the Town may have. If significant deficiencies are identified in any of the Work, the Town at its discretion may extend the correction period for up to 12 months from when the Town finds the deficiencies are remedied.

Commented [c42]: added

Commented [c43]: In the past the Town took the position that the correction period reset in these circumstances, but it was not spelled out.

21. SERVICE RATES

21.01. The Town reserves the right to set rates for supplying services to a Development which are commensurate with the costs associated with providing the services. This means that in some instances it may be necessary to place a surcharge or to charge a higher rate to provide services to certain areas. The foregoing provisions may be modified by appropriate utility extension agreements.

21.02. During the correction period when the Town is providing services, but before the ~~one-year~~one-year inspection, the Town will charge users for the services and control all taps as provided in Town Ordinances and Regulations.

DIVISION 2 – SITE WORK**SECTION 02200 – EXCAVATION, BACKFILL, AND COMPACTION****1. GENERAL**

These specifications are general in nature and are designed to cover excavation and backfill for embankments, roadways, pipe lines and their appurtenances, and structures. In cases where a provision is applicable to a particular type of construction or use, it is covered in the specification for the specific application e.g. Standard Specifications for Sewer System. Where there is a more stringent requirement in such a specification, compliance shall be with the specific specification which is directly applicable to the situation.

A Contractor shall comply with all applicable laws and regulations including "Rules and Regulations Governing Excavation Work" of the State of Colorado and receive an Encroachment and Excavation permit from the Town when working on Town right of way.

1.01. Description

Work under this section includes clearing and grubbing, excavation, controlling surface flow, seep, and groundwater, dewatering and stabilization, bedding and backfilling, with moisture control, and grading, and compaction to specified density and elevations needed for construction as well as complete site restoration. Also included are stockpiling excavated material to be used as fill and removal of unsuitable and excess soils from site and furnishing and installing flowable fill.

1.02. Related Work Specified Elsewhere

Section 02508 - Asphalt Paving and Patching
 Section 02712 - Water System - Minimum Design Standards
 Section 02713 – Water System Construction
 Section 02722 - Sewer System - Minimum Design Standards
 Section 02723 – Sewer System Construction
 Section 03000 - Concrete

1.03. Measurements and Levels

Contractor shall verify all drawing measurements and levels in relation to existing elevations, grades, and adjacent structures, and determine conditions and requirements for excavations, fill, backfill, and all sheeting, shoring, bracing, and protection of the premises and buildings. Contractor shall carefully and accurately lay out all lines and levels of the new construction before proceeding with any Work.

1.04. Conformance Testing

All testing shall be performed and arranged and paid for by the Contractor. OR will determine location and frequency of such tests to ensure that minimum requirements specified below are met at all locations. At Owner's discretion, Owner may arrange for or perform additional such tests. Each lift shall be tested for compaction and moisture content at two OR designated locations per 150 lf of trench and 2 tests per 600 sf of surface area and results shall be approved by the OR. If tests fail to meet the specified density or moisture content, or to pass proof rolling tests, additional tests will be required in the vicinity of the failed test to determine the extent of the inadequate compaction, then corrective actions shall be taken by the Contractor. After the deficiencies have been corrected, additional tests will be taken in approximately the

Commented [c1]: Reformatted and reorganized, but content has been present in past editions.

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same location and number as was used to determine the extent of the failed area to demonstrate conformance with the specifications. The cost of all testing required due to failed tests and as needed to determine adequacy of compaction methods shall also be paid by the Contractor. In addition, Town reserves the right to contract directly for testing. The Contractor will be responsible to reimburse the Town for any Town contracted tests that fail to meet the contract requirements.

Contractor shall arrange and pay for tests for determination of maximum density and optimum moisture in accordance with the requirements of ASTM 698 - Moisture density relations of soils using a 5.5 lb. hammer and 12-inch drop for native materials and ASTM 1557 Modified Proctor for structural and road base materials. With ASTM 698 use method A, B, C, or D as appropriate, based on soil condition and judgment of the qualified party conducting tests. When appropriate, determine the correct rock correction. Samples tested shall be representative of materials to be placed.

Contractor shall arrange and pay for tests to determine optimum moisture density curve and Atterburg limits for each type of material or combination of materials encountered or utilized.

Tests for density control to verify the compaction of the materials in any area of backfill will be in accordance with the requirements of ASTM D 2922 - Density of Soil and Soil Aggregate In-Place by Nuclear Methods, or ASTM D 1556 - Density of Soil In-Place by the Sand-Cone Method. Use test results as basis for density control of compaction operations. The Town will also use visual observations of deflection (proof-rolling) to determine the adequacy of moisture control and compaction.

Organic content test results shall represent organics by percent of volume and by weight.

1.05. Existing Conditions

Protect from damage or restore to original condition all surface and sub-surface improvements existing prior to commencement of construction.

Prior to commencing construction the Contractor shall be responsible for documenting the existing condition of the construction site and surrounding areas. Photographs and written descriptions of all substandard pre-existing conditions are recommended. Width of gravel and/or pavement, depth of such, and existence of drainage should be noted for roadways, as should broken fences and other landscape and structures which are in need of repair. Unless sub-standard conditions are adequately documented prior to commencing construction, the Contractor will be held responsible for restoring the site to conditions which the Town consider to be those which are standard and/or were pre-existing. Since construction equipment tends to be destructive of gravel and asphalt roads, particular attention should also be paid to recording conditions of roads which will be traversed by construction equipment even if there will not be any construction along the specific roadway.

1.06. Protection of Existing Utilities

The Town will assist the Contractor in locating existing utilities of which it has knowledge. Contractor shall be responsible for scheduling with the Town sufficiently in advance for the Town to have someone available to provide such assistance. It will be the Contractor's responsibility to contact all other utilities to get assistance in locating their lines and buried structures. The Contractor will be responsible for verifying the locations of all utilities and for repairing any damage caused by his Work. The Contractor must file notice of intent to excavate with each of these entities at least 48 hours prior to commencing work. All utility lines, including cables and pipelines, in the vicinity of the work shall be exposed by the Contractor

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before work is started. If, after exposure, a conflict is discovered, Contractor shall propose a remedy which shall be subject to approval of the Town and all other effected parties.

Commented [c2]: Moved section to document existing conditions to genl reqts

2. PRODUCTS

2.01. Submittals

Commented [c3]: New section to define what needs to be furnished.

Contractor shall furnish preliminary representative test samples of native and base materials to an approved independent testing laboratory and shall pay for testing to determine that the materials conform with the Contract Documents and to determine proctor and optimum moisture values for each earthen and base material proposed for use on the project. Appropriately labeled samples of each material tested shall be kept on site in a one gallon zip lock bag for comparison with materials being placed. All fill and backfill material must be tested and proctor curves, and other required lab test results shall be available on site and approved by the Engineer before fill and backfill is started.

Submittal information for materials specified by CDOT tables or maximum gradation requirements will require sieve analysis and other test results to demonstrate conformance with CDOT table data and notes. Submittal shall include optimum moisture density curve for each type of material or combination of materials encountered or utilized and Atterberg limits for each clayey material.

Materials for foundation(s) shall meet the requirements in the approved foundation submittal.

2.02. General Use Materials

General use materials are intended to be used in trenches above the pipe zone, and for embankment fill to sub-grade elevations.

On-site materials obtained from excavation, free of any unsuitable materials (see below), shall be deemed acceptable for general use. On-site materials encountered during excavations which are appropriate for specific uses shall be separated and stockpiled for their later intended use (i.e. topsoil, fine bedding, etc.).

Imported and on-site material for general use shall be non-expansive soil, pit run, or bank run sands and gravels with 4" maximum rock size, adequate binders, capable of being compacted and tested as specified herein unless other material is specified for the particular structure or work.

Imported materials for general use shall be taken from borrow areas acceptable to the Engineer. All borrow materials shall meet the same quality criteria as is required herein for on site materials to be used as fill.

Town Engineer reserves right to reject any material he/she finds to be unacceptable.

2.03. Bedding and Pipe Zone Materials Classification

Commented [c4]: Changed materials classification system to match water and sewer stds.

Pipe zone area is defined as the backfill placed within twelve (12) inches of the pipes fittings and appurtenances. All pipe zone materials must be free of sharp edges and other matter which could damage the pipe.

Class A Flowable fill shall have one half sack of cement per cubic yard of concrete. Aggregates and sands for flowable fill shall meet the requirements for concrete in CDOT Section 703.

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- Class B Well graded crushed stone or crushed gravel meeting the requirements of Class 6 specified below for "Road Construction Materials."
- Class C Selected soil of low permeability free from clods and stones greater than 3/4 inch in maximum dimension and free of all unsuitable materials as defined below.
- Class D Screened or Washed Rock, of single grade 1-1/2" or less, free of clay and fine particles (for gravity sewer lines use only).
- Class E Bedding sand passing #4 screen or less (for pressurized water lines only).

2.04. Road Construction Materials

Road construction materials are those used for road sub-base, base and finished road surfaces. CDOT Class 2 materials shall be well graded natural or crushed aggregate with sufficient filler or binding materials which when placed and compacted result in a firm, dense, unyielding foundation. CDOT Class 6 materials shall consist of crushed gravel or crushed stone base course material of hard, durable particles or fragments of stone or gravel crushed to required size and a filler of sand or other finely divided mineral matter. Not less than 60% by weight of the aggregate particles shall be particles having at least one fractured face. The composite base course material shall be free from vegetable matter, expansive materials, and lumps or balls of clay. The class 2 and 6 materials shall meet the following requirements:

<u>Gradation (% Passing)</u>	<u>Class 2</u>	<u>Class 6</u>
4"	100%	-----
3"	95-100%	-----
2"	-----	-----
1"	-----	-----
3/4"	-----	100%
No. 4	-----	30-65%
No. 8	-----	25-55%
No. 200	3-15%	3-12%
Liquid Limit	35 Max.	30 Max. (nonplastic)
Plasticity Index	6 Max.	6 Max.
Resistance Value	75 Min.	78 Min.

Inclusion of fractured concrete and/or recycled asphalt pavement is prohibited.

Structural subgrade and backfill materials are defined as those materials used to prepare for structural construction.

- Class 6 Meeting the requirements of Class 6 specified above for "Road Construction Materials."
- Class D Washed Rock, of single grade 1-1/2" or less, free of clay and fine particles. (not for use around pressured pipe lines)

On site and borrow area sand and gravels if available may be used for structural backfill material except where special foundation material is otherwise specified.

2.05. Unsuitable Materials

Expansive materials and material that contain debris, roots, organics, or frozen materials, stone or concrete having a maximum dimension larger than 4 inches or materials that are unsuitable for providing

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stable slopes, fill, backfill, foundation or subgrade material for structures or surfaces shall be classified as unsuitable. Otherwise suitable material which is unsuitable due to excess moisture content will not be classified as unsuitable unless it cannot be dried by manipulation, aeration, or blending with other materials satisfactorily to meet moisture limits for proper compaction.

2.06. Topsoil

Topsoil shall consist of loose friable loam with minimum 15% organic matter, reasonably free of admixtures of subsoil, refuse, stumps, roots, rocks, brush, weeds and weed seed, heavy clay, hard clods, toxic substances or other material which would be detrimental to the proper development of vegetative growth, including construction debris.

Commented [c5]: Added stds for topsoil. Note that topsoil and the other materials thru 2.11 have been part of construction in the past, we just did not have product stds.

2.07. Riprap

Material for riprap shall come from rock stockpiled while excavating or imported. Material used for riprap shall be dense, sound rock fragments which are resistant to abrasion and shall be free from cracks, seams, and other defects that would decrease its durability and to resist destruction by water and/or frost action. Unless otherwise called for on the plans riprap shall have a D-50 of 12”.

2.08. Spot Subgrade Reinforcement and Sub-Grade Stabilization

Material includes sound, tough, durable crushed stone, or gravel, consisting of angular pieces varying from 1 inch to 4 inches in maximum diameter or other Engineer approved material, with necessary filler in dry conditions, and when a geotextile is used. In wet conditions, and without geotextile, rock shall be without fines. When a smaller material is necessary for filler, screened gravel, or sand may be used to completely fill all voids.

2.09. Geotextiles

Geotextiles and geogrids used for stabilization shall be designed specifically for stabilization and/or soil reinforcement and of a type recommended by the manufacturer for the application. Geotextiles for stabilization shall be a woven material Mirafi RS380i, or approved equal. Geogrids shall be at least equal to Miragrid or Tensar SS with a tensile strength of 200 x 134 psi. The grid shall have sufficiently large openings which are capable of interlocking with the on-site soils. Geotextile used to separate rock and gravel from native materials and for drains shall be non-woven 12 oz/sy filter fabric, Mirafi 1120N or approved equal.

Commented [c6]: Upgraded to a road fabric.

Commented [c7]: Matched the specific material to match the strength requirement.

2.10. Capillary Water Barrier Material (CWB)

Clean, crushed stone, crushed or uncrushed gravel composed of hard, durable particles, uniformly graded with 1-1/2 inch maximum particle size and not more than three percent (3%) of minimum particle size passing a No. 4 sieve.

2.11. Seed, Mulch, and Tackifier

All seed shall be furnished in sealed bags or containers showing the name and address of the supplier, the seed name or mix, the lot number, net weight, % of weed seed content, and the guaranteed percentage of purity and germination. All seed furnished must be certified as free from noxious weeds as defined by local, state, BLM and USFS. Seed shall be harvested from a location of not more than 200 mile radius of the site. Seed which has become wet, moldy, old, or otherwise damaged or not labeled will be rejected. The Contractor shall furnish a signed statement certifying that the seed furnished is from a lot that has

DIVISION 2

SITE WORK

been tested by a recognized laboratory for seed testing within six months prior to the date of delivery and shall be certified weed free. Seed mix shall be a mix approved by BLM or CSU for the micro-climate where the seed is being placed. Grass areas on private property have are disturbed shall be replaced with sod of a mix similar to the surrounding area to the satisfaction of the owner.

Materials for straw mulching shall consist of straw from native grasses and shall be certified weed free in accordance with State and Federal requirements for weed free straw. Straw in such an advanced stage of decomposition as to smother or retard the normal growth of grass will not be accepted. Old, dry straw, which breaks instead of bending will not be accepted. Mulch tackifier shall be consistent with CDOT section 213.

3. EXECUTION

3.01. Clearing and Grubbing

The area to be occupied by permanent construction shall be cleared and grubbed of trees, stumps, roots, brush, rubbish, and other objectionable matter to the extent necessary for orderly performance of the work and to a depth sufficient to remove organics and other materials unsuitable for the intended purpose. Unstable saturated materials shall be removed or stabilized. All clearing limits shall be staked by the Contractor and approved by the Town prior to any construction. The Contractor is responsible for and shall exercise care in his work area. If there is disturbance to improvements or vegetation outside the clearing limits, the Contractor shall take remedial action at his own expense. No trees shall be removed or injured outside the area to be occupied by the work without the prior approval of the property owner and/or the Town. The Town will mark trees within the clearing limits to be removed.

Commented [c8]: Modified wording in this section

Where applicable, strip existing topsoil prior to trenching operations. Depth of stripping shall be determined in the field by the Town based on depth of the topsoil and roots. Stockpile topsoil material for replacement after all backfilling and compacting operations are completed.

The Contractor shall be responsible for the protection of all surface improvements, structures, buried utilities, and plantings that have not been designated for removal or modification as part of this project. The Contractor shall exercise care in his work to ensure that no damage will occur to lawns, shrubs, hedges, trees, and other plantings adjacent to the right of way or in areas of access to the work. If there is disturbance to structures or plantings, the Contractor shall take remedial action at his own expense. No act, representation, or instruction of the Town shall in any way relieve the Contractor from liability for damages or costs that result from activities of the Contractor. The Contractor may with permission of the property owner, remove fences and other property to expedite trenching operations. These shall be repaired to the satisfaction of the property owner as soon as backfilling operations are completed.

3.02. Removal of Cleared and Unsuitable Materials

Materials from the clearing operations shall be the responsibility of the Contractor and shall be removed from the site of the work and disposed of in a manner satisfactory to the Owner and Town, and in accordance with state and local regulations at the expense of the Contractor. The Contractor shall make an effort to channel materials of value from the clearing and grubbing to beneficial use.

During the process of clearing or excavation, saturated soils, soils such as peat, soft clay, quicksand, cobble, large rock or other materials which are unsuitable for bedding may be encountered. Unless there is a use for these materials elsewhere on the project, these materials shall be removed from the site and disposed of by the Contractor. If removal of unsuitable materials results in excavation below the grade required for

bedding, the area shall be backfilled to grade with suitable bedding materials complying with the provisions of applicable specifications for the work being constructed.

3.03. Access Roads and Bypasses

The Contractor shall be responsible for providing all access roads required to get materials and equipment to the work areas. When required, the Contractor shall construct and maintain detours or bypasses around portions of the work that conflict with traffic. All barricades and safety devices required to protect persons from injury and to avoid property damage shall be determined and furnished by the Contractor. When necessary, the Contractor shall provide suitable bridges at crossings where traffic must cross open trenches. Construction of access ways on private or government property must have written approval of the property owner prior to commencing construction.

No road will be completely closed unless expressly approved by the Town in writing where there is minimal traffic impact. If a detour around the construction is not feasible, then the installation across the road will be made one-half at a time to allow through traffic around the construction. Adequate traffic control and signage must be provided by the Contractor and is subject to approval of the Town Marshall.

3.04. Pavement Cutting

Where trench excavation requires the removal of asphaltic and/or concrete pavement, the pavement shall be cut in a straight line parallel or perpendicular to the direction of trench excavation as applicable. The cut shall be made with a spadebit air hammer, by sawing, or with similar approved equipment to obtain a straight, square, and clean break. Ripping the asphalt/concrete will not be allowed. The pavement cuts shall be at least one foot wider in each direction than the anticipated limits of the open trench. No excavation in paved areas will be started until after the pavement has been cut. The paving material obtained from excavations in paved areas shall be disposed of by the Contractor. All areas where pavement is removed shall be restored as specified herein and shown on the typical drawings. Temporary surfaces shall be placed until the permanent repair can be made.

All surface improvements consisting of, but not limited to, pavements, gutters, driveways, curbs, and sidewalks damaged by the Contractor during the progress of work shall be replaced at Contractor expense. The construction of the repairs shall result in work equal to or better than that which existed before the damage was done.

3.05. Dust Control

The Contractor will be required to furnish and apply an environmentally acceptable dust palliative to control dust on the project site and along haul routes. Dust control may consist of water or other substances found not to be detrimental to the Work or the surroundings as approved in writing by the Town. Spreading of water or water mixture shall be done with acceptable sprinkling equipment. Such equipment shall be a type which ensures uniform and controlled distribution of the palliative without ponding, washing, or adverse impacts to the public, private property, or the environment.

3.06. Drainage

The Contractor shall maintain the excavations, borrow areas, and site free from water throughout the work and shall shape excavations and surrounding areas to minimize the entrance of water. Drain surface water or seepage by gravity or temporary pumps or other approved means. Discharge such waters in a manner which conforms with all federal, state, and local requirements. Use drainage methods which will prevent softening or undercutting of foundation bottoms or trenches or other conditions detrimental to

Commented [c9]: Added. Been required in the encroachment permit

proper construction procedures. Accomplish the foregoing by the use of sumps and gravel blankets, well points, drain lines, or other means approved by the Town. Remove any water encountered to the extent necessary to provide firm subgrade. If the trench or foundation bottom or other excavation becomes unstable due to the entrance of water into the open excavation, the saturated soil shall be removed and suitable backfill placed and compacted to grade at Contractor's expense. Handling of drainage, live flow, seepage, groundwater, runoff, discharges, and other water shall be included in the scope of Contractor's unit costs for the work to which it is associated.

3.07. Excavation

Commented [c10]: Reorganized

Excavation for pipe shall be by open trenches unless otherwise specified or shown on the approved plans. The trench shall be excavated using conventional methods. Any method which is not in accordance with normally accepted practice must receive prior approval of the Town. Excavation shall be made to line and grade shown on the approved plans. The banks of the trench shall be kept as nearly vertical as soil conditions will permit, but shall not exceed the angle of repose of the soil. Vertical trench walls shall be used in the pipe zone wherever possible.

A. Grade Stakes

Commented [c11]: Combines requirements from other pipe specs.

The Developer's engineer shall provide grade stakes for all pipeline excavation. These stakes shall locate the pipelines both horizontally and vertically for sewer and at least horizontally for water. Where finished grade of the ground will differ significantly from existing grade, vertical control shall be provided for water and other utilities. Maximum distance between grade stakes shall be 50 feet unless otherwise approved by the Town. All appurtenances and structures shall be staked for location and elevation. Grade stakes shall also be provided for structures and fill.

B. Tolerances

Commented [c12]: Added to define the expectations

Complete excavations and fills with suitable equipment to line and grades as shown on the plans within a horizontal tolerance of ±0.20 ft and a vertical tolerance of ± 0.1 ft unless otherwise noted on the plans or specified for a specific location or application.

Subgrade excavations for structures shall be within a horizontal tolerance of ±0.10 ft and a vertical tolerance of ± 0.05 ft unless otherwise noted on the plans or in an approved submittal.

Pipelines shall be installed to within a horizontal tolerance of ± 0.20 ft and a vertical tolerance of ± 0.01 ~~ft and~~ ft for gravity utility lines, structures and fills shall be installed to within a horizontal tolerance of ± 0.10 ft and a vertical tolerance of ± 0.01 ft unless otherwise noted on the plans or required by an approved foundation and/or structures submittal.

C. Stockpiling Material

Where material is excavated from the trenches and piled adjacent thereto, it shall be piled sufficiently away from the edge of the trench to prevent caving of the trench wall and to permit safe access along the trench. In unsupported trenches the minimum distance from the edge of the trench to the toe of the spoil bank should not be less than one half the total depth of the excavation, nor less than three feet or farther as soil conditions dictate. With sheeted trenches, the toe of the spoil bank should be at least three feet from the edge of the trench.

D. Sheeting Bracing and Shoring

Where necessary or called for on the excavation stabilization plan, or needed to control the width of the excavation, excavation shall be braced and sheeted to provide complete safety to persons working in or around the trenches and minimize the width of the trenches and shall comply with applicable federal (OSHA), state, and local laws, regulations, and ordinances. The Contractor shall be fully responsible for sufficiency and adequacy of bracing excavations with respect to work under construction and to adjacent utility lines and public and private property. Remove sheeting and shoring as excavations are backfilled in a manner to protect the material, construction, and compaction and/or other structures, utilities or property. No such sheeting will be permitted to remain in the trench or excavation except when, in the opinion of the Contractor, field conditions or the type of sheeting or methods of construction used by the Contractor are such as to make the removal of sheeting unsafe. In such cases, with Town approval, portions of the sheeting to be cut off to such depth as he/she may approve and permit lower portions thereof to remain in the trench.

E. Drainage and Groundwater Control

Maintain the excavations and site free from water throughout the work. Remove any water encountered in the trench to the extent necessary to provide firm subgrade, to keep water level below final pipe grade and to prevent entrance of water into the pipeline. Contractor shall furnish and operate adequate pumping equipment to keep the water level below the grade of construction. Water shall not be permitted to run through lengths of pipe already laid without written approval of the Town. Ends of all pipes shall be capped or plugged to ensure that water, dirt, etc., does not enter the pipe. Should any dirt, mud, etc., enter the pipe during installation, the Contractor shall flush the pipe thoroughly in the presence of the Town's representative to ensure complete removal of all foreign objects prior to connection to the existing system.

Use drainage methods which will prevent softening of foundation bottoms, undercutting of footings, or other conditions detrimental to proper construction procedures. Accomplish the foregoing by the use of sumps and gravel blankets, well points, drain lines, or other means approved by the Town. Grade as necessary to prevent surface water from flowing into trenches or other excavations. Remove any surface or ground water accumulated in the excavation by the use of well points, pumps or other approved methods. If the trench bottom becomes unstable due to the entrance of surface water into the open excavation, the saturated soil shall be removed and suitable backfill placed and compacted to pipe grade.

F. Use of Explosives

No blasting will be permitted without written consent of the Town. Should the use of explosives be required, and their use approved by the Town, exercise all possible precautions in the use, storage, or transport of same. Employ only competent, experienced personnel. Comply with all local and state requirements. Contractor assumes full responsibility and liability for all damage which may be caused by his use of explosives.

G. Sequencing

The Contractor shall excavate in advance of pipe laying only a sufficient length to assure steady progress in the installation of pipe. The length of open trench shall be limited where necessary to accommodate traffic, public safety, or as required by the Town and/or other entities with authority, in vicinity of the work being performed.

Pipeline installation shall follow trench excavation within 100 lineal feet. Trench backfill shall follow pipe installation within 50 lineal feet. Approved cleanup shall follow trench excavation within 300 lineal feet. Open trench length shall be kept to a minimum and not exceed the length that can be installed and backfilled in a work day. Particular care shall be taken to provide minimum interference with mail delivery and school bus operation. If the work will require a road to be closed, the Contractor shall notify the proper agencies, in writing with a copy of the notice to the Town. In State and County road rights of way, the amount of open trench permitted shall be in accordance with the requirements of the respective agencies.

H. Excavation to Grade

All installation of utilities and structures shall be to the grade designated on the approved plans and in conformance with Town specifications and standards. Excavation for water lines shall be to a depth sufficient to provide a minimum cover below finished grade of the depth listed in the Water Specification or shown on the approved Drawings. Specific authorization may be given by the Town to reduce the minimum cover by up to 6" along short sections to eliminate or minimize conflict with other utilities or to facilitate connections if O & M problems are not likely to result from such a change. Additional trench depth shall be provided where street and roadway grades will probably be lowered under future construction and where necessary to provide clearance between ditches, culverts, and other structures. The Town shall determine in the field the additional trench depth required in locations where possible future lowering of street grades or other future construction makes greater depth desirable.

Sewer line excavation shall be to the depth necessary to provide the grade and bury depth shown on the approved plans. When tying into an existing line, the Contractor shall excavate at the manhole or approved tie in and shall begin laying pipe from the existing facility unless otherwise authorized by the Town. More detailed specifications are discussed in other sections of this standards.

Where utilities are to be installed in fill, construct fill a ~~minimum~~ minimum of 2' above top of pipe prior to excavation for utility installation.

I. Trench Width

Alignment of trenches shall be carefully controlled so that uniform distances are maintained from property lines and so that the pipe will be laid with adequate space for compaction of backfill between the pipe and trench walls. All excavation shall be of sufficient width to provide ample room for proper joining of pipe and fittings. Minimum trench width shall be twelve (12) inches plus pipe OD. Maximum trench width will be restricted to pipe diameter plus two feet unless otherwise approved by the Town. If the maximum trench width is exceeded, provide special bedding, encasement, or higher strength pipe as approved by the Town.

3.08. Bedding, Backfill, and Compaction of Embankment, Pipe Lines, and Structures**A. Pipe Bedding****i. Bedding Preparation**

The bottom of the trenches shall be accurately graded to provide uniform bearing and support throughout the pipe length. Excess loading of the bell will not be permitted under any circumstances. Dig bell holes and depressions for joints after trench bottom has been graded. Bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joint. The use of earth mounds for bedding the pipe will not be permitted.

All sharp stones, trash, and other materials which may damage the pipe or interfere with the proper bedding of the pipe and the placement and compaction of the backfill shall be removed from the trench. The soil in the bottom of the trench shall be loose, and at the optimum moisture, so that uniform bedding and compaction around the pipe is easily obtainable. Should any material be encountered which would prevent the obtaining of suitable bedding, e.g. wet, unstable, etc., the trench shall be over-excavated to a depth of 6 inches minimum below the outside bottom of the conduit, except at points of rock and earth transitions, at which point the rock shall be excavated to a minimum of 12 inches below the outside bottom of the flexible conduit as shown on the typical drawing for pipe bedding. Backfill any over-excavation, required or inadvertent, with materials equivalent to, and compacted as specified for haunching materials according to these specifications.

If the trench bottom becomes unstable due to the entrance of water into the excavation, the saturated soil shall be removed and suitable bedding placed and compacted to pipe grade.

ii. Placing Bedding Material

The bottom of the trench must be dry or well-drained before bedding and backfilling is started. Place material below and around the pipe by hand to prevent damage or displacement of the pipe. Place in lifts not to exceed 3" in compacted thickness in the pipe zone.

Whenever flexible pipe is used, special care shall be employed in the pipe bedding. Flexible pipes include PVC sewer and water pipe, fiberglass pipe, lightweight steel pipe, polyethylene pipe, and other similar pipes. Conform to recommendations of (1) AWWA C 900 Appendix A Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch Through 12 inch for Water, (2) Uni-Bell PVC Handbook and relevant Unibell recommended practice manuals, and (3) ASTM Designation D 2321 Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

B. Backfill and Compaction

The Contractor shall proceed with backfilling as soon as practicable, but not until Work is inspected by Town and Engineer and all tests satisfactorily completed. Compaction or consolidation shall follow as soon after the placing as is practical.

Backfill material shall consist of material which after placement and compaction will result in a stabilized soil condition capable of supporting the normal traffic and use loads that may be encountered. Normally the backfill material above the pipe zone will be obtained from the soil banks accumulated from the trench excavation. The backfill materials shall be free of vegetation,

lumps, trash, lumber, and other unsuitable or objectionable materials. The backfill placed within twelve (12) inches of the pipe (the pipe zone), shall be a Class B, C, or D material, depending on the application and site conditions, and shall not contain any sharp rocks, stones larger than 3/4" in diameter or other objects that might damage the pipe. Outside the pipe zone, backfill shall not contain rocks or other objects whose largest dimension exceeds four (4) inches. All such material shall be removed from the work area and disposed of in a manner acceptable to the Town. Moisture control of fill will be required to facilitate achieving acceptable soil densities. Unless otherwise specified for a specific application, moisture content shall be +/- 2% of optimum.

Construct fills and embankments to the lines and grades indicated on the drawings. Immediately prior to placing fill or base material, scarify the entire area upon which fill is to be placed to a depth of 12 inches. The foundation for earthen fill shall also be prepared by disking or scarifying parallel to the axis of the fill, and compacted such that the surface materials of the foundation will bond well with the first layer of fill as is specified for the subsequent layers of earthen materials.

Compact existing subgrade surfaces if densities are not equal to that required for backfill materials. Plow, step, or bench sloped surfaces steeper than 4 to 1 on which backfill is to be placed in such a manner that fill material will adequately bond with existing surfaces. Scarify where necessary to ensure uniform compaction and good bonding between lifts.

Backfill areas to grades, contours, levels, and elevations required. Place approved excavated or imported material in successive horizontal layers of 8 inches or less loose depth for full width of cross section, bring to optimum moisture content for compaction, and compact each layer to the required density with equipment designed for compaction purposes for the type of material. Backfill systematically in continuous level layers for the full width of the cross section. Uniformly place each layer to the specified maximum lift (or less) and thoroughly blade mix or otherwise blend during the spreading to ensure uniformity of material in each layer. The distribution and gradation of the materials throughout the earthen fill shall be such that the fills will be free from lenses, pockets, streaks, or layers of material differing substantially in texture, gradation, or moisture from the surrounding materials. The materials, when compacted in the earthen fill, shall be blended sufficiently to secure the best practicable degree of compaction and stability. If there is a varying degree of permeability in material for embankments, the most impervious materials shall be placed in the central portion of the earthen fill and the more pervious materials shall be placed so that the permeability of the fill will be gradually increased toward the upstream and downstream slopes of the earthen fill. Testing of each lift shall be performed prior to placing the next lift in accordance with the specified testing requirements.

i. Structure and Appurtenance Backfill and Compaction

Backfill around structures and appurtenances such as vaults, manholes, foundations, buildings, valves, valve boxes, cleanouts, miscellaneous structures with care to prevent damage to the work. Materials shall be compacted to 95% standard proctor for native materials and 95% modified proctor for processed materials both at +/-2% optimum, unless otherwise noted on the plans for a particular use, using equipment which will not damage the structures, appurtenances or surrounding construction.

Compact each layer continuously over its entire area and make sufficient trips with the compaction equipment to ensure that the required density has been obtained uniformly. Backfill simultaneously on each side of foundation walls and other structures to equalize soil pressures. Do not backfill against or operate heavy equipment adjacent to walls until all structural elements

are constructed, cured, properly braced, and approved by the Engineer. Do not operate heavy equipment closer to foundations than a horizontal distance equal to height of backfill above bottom of foundation. Compact remaining area with hand tampers suitable for material being compacted. Where needed, the hand work (e.g. compaction with a whacker) for a lift should be done in advance of and blended into the work of the larger equipment.

Perform all compaction with approved equipment well suited to location, structure, and materials being compacted. Do not begin compaction until structures are properly secured and have adequate strength. Perform compaction while the material is at the specified moisture content. Maintain optimum moisture content during final rolling and until compacted material is covered by subsequent construction. Remove loose material and protect material until covered.

ii. Pipe Zone Compaction

After the pipeline has been installed, suitable backfill material shall be hand placed in up to 3" lifts to the pipe centerline (springline) and hand tamped with appropriate tamping equipment and compacted to provide firm uniform support for the pipe. Take care to ensure that sufficient material has been worked under the haunch of the pipe to provide adequate side support. With rigid pipe, if care has been taken to shape the bedding material to the curvature of the pipe, only one stage of placement will be required to bring the haunching material to the spring line. Compact haunching material to a minimum of 95% Standard Proctor Density. Additional backfill shall then be hand placed and hand compacted in 3" lifts to provide at least six inches of suitable cover over the top of the pipe before any material is placed with machinery. Take care to avoid contact between the pipe and compaction equipment to avoid damage or displacement. Where specified or called for on the plans, pipe zone shall be backfilled with flowable fill.

Compaction of backfill materials shall be done in such a way the sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe or its installation yet ensure proper compaction through the depth of the trench and around the pipe. Any damage resulting from the backfilling or compaction of the backfill shall be repaired by the Contractor in a timely manner. At all times precautions should be taken to prevent flotation of the pipeline due to entry of water into the trench and ensure proper compaction through the depth of the trench and around the pipe.

iii. Upper Trench Compaction

Within the public right of way and in Town easements, minimum compaction through the entire depth shall be 95% of maximum dry density as measured by Standard Proctor tests for native materials. Structural materials such as road base shall be compacted to 95% of maximum dry modified Proctor. Moisture control at +/- 2% of optimum of all fill will be required to facilitate achieving acceptable densities. On private property, density shall be at least 90% or original soil density whichever is greater. Top soil need not be compacted.

In general, backfill shall be mechanically compacted by means of tamping rollers, sheep foot rollers, pneumatic tire rollers, vibrating roller or other mechanical tampers which are appropriate for the material being compacted. Compaction by jetting or flooding shall not be permitted. The trench shall be filled to provide a minimum of 3 feet of cover over the pipe before rolling equipment is used and 50 inches before utilizing a hydrohammer during compaction.

C. Surface Restoration

On completion of backfill operations and other work, the entire site shall be cleared of all debris, and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workman-like appearance. The final grade in unpaved streets and other areas will be graded to match existing grades without producing drainage problems. Areas which are to receive pavements, surfacing, topsoil, or landscaping shall be graded as required to allow installation of the specific surface treatment. Depths of road base shall be per typical trench detail drawing. Restoration of grass, shrubs, and other plants shall be done to the extent required to restore the damaged areas to a condition as close as practical to that which existed prior to construction. Replace topsoil without compacting, to depth which was stripped in landscaped areas. Tree damage shall be repaired in accordance with good horticultural practice.

No permanent pavement shall be restored until the backfill is determined to be adequate and able to properly support the pavement. All paved areas shall be replaced with suitable pavement.

The finished surface of roads impacted directly or indirectly by the project will be restored to their original or better condition as determined by the owner(s) involved. Asphalt damage shall be repaired with hot mix asphalt (4" minimum depth, and not less than the thickness of asphalt removed), and damaged concrete, repaired with concrete by cutting and replacing to the closest control joints. The Town, County, or State Road Department as applicable, shall be notified two working days prior to repair so that inspection can be provided.

Commented [c13]: added

The respective property owner shall be the final judge of the acceptance of restoration work. In cases where sub-standard conditions existed prior to beginning construction, it shall be the Contractor's responsibility to have documented such conditions or to restore the site to standard conditions acceptable to the Engineer, respective property owner and Town. Pavement repair shall be guaranteed for a period of one year.

Commented [c14]: added to address requirements when more than just the town is impacted by construction.

The Town shall be the final judge of the acceptance of restoration work. The Contractor shall be responsible for returning all roadways traversed with his equipment to conditions at least as good as existed prior to commencing construction. Again, in cases where sub-standard conditions existed prior to beginning construction, it shall be the Contractor's responsibility to have documented such conditions or to restore the site to standard conditions acceptable to the Town.

D. Patching

Prior to replacing asphalt on properly compacted backfill, square up any ragged edges of adjoining pavement. Such cutting shall be done in accordance with "Pavement Cutting" paragraph above. Apply approved prime coat to Class 6 roadbase and tack coat against sides where pavement is to be placed, in accordance with manufacturer's recommendations. Lay two 2" mats of hot bituminous asphalt to area and compact to 92-96% of Rice Density. Place patching material around the edges and work inward. Unless otherwise specified herein, materials and construction methods shall comply with the Colorado Departments of Transportation (CDOT) Specifications, Section 401 - Hot Mix Pavements.

Commented [c15]: Added to address how to patch

Concrete work shall be removed and replaced to the nearest joint on each side of the trench. (See Town standard drawing for concrete replacement.) Replace at least 6" past the trench width in

each direction. Concrete shall be a 3/4" CDOT Class B meeting the requirements of Section 601 with no more than 20% flyash. Thickness of the concrete mat shall equal the thickness of the surrounding concrete but not less than 4" thick. Immediately prior to placing concrete, foundation shall be thoroughly moistened. After placing, the surface shall be shaped to match surrounding surface, floated with a wooden or magnesium float, and given a broom finish. All outside edges of slab and all joints shall be edged with a 1/4" radius edging tool. Expansion joints shall be placed to match surrounding concrete. Use tool joints, saw cut or zip strips as needed to match existing concrete. Joints shall be ¼ depth of the concrete. Place construction joints around all appurtenances. Premolded expansion joint filler or thicker shall be installed in the joints for the full depth. Use of the water to finish concrete is prohibited. Concrete shall be protected from freezing for a minimum of 3 days. The concrete shall be kept continuous moisture for a minimum of 7 days by the use of a Town approved membrane applied in accordance with manufacturer's recommendation or other Town approved technique. . During curing all traffic both pedestrian and traffic shall be excluded.

E. **Topsoiling**

i. Conservation

When excavating, stockpile on site topsoil for future placement. Topsoil material is subject to approval. Conserve, or import if necessary, sufficient topsoil to cover a depth of 6" all disturbed areas which are not covered by riprap, road base, hard surface, or a structure.

ii. Clearing

Prior to placing topsoil remove vegetation and clear ground surface of all other materials that would hinder proper grading, tillage or subsequent maintenance operations.

iii. Placing Topsoil

Place topsoil on all disturbed areas which are not access or road ways, or designated to be covered by other materials. Prior to placing topsoil, prepare previously constructed grades as required such that when topsoiling is completed the proper grade will be achieved. After grading, scarify areas to be topsoiled to a depth of at least six inches. Perform work only during periods when beneficial results are likely to be obtained.

Perform spreading so that planting can proceed with little additional soil preparation or tillage.

Do not place topsoil when subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or proposed planting.

F. Revegetation

Prior to commencing construction, it will be necessary to determine the amount and type of vegetation which naturally occurred on the areas to be disturbed. This will be done by counting the quantity of each type of vegetation in randomly selected representative quadrants of the site to be disturbed. Quadrants shall be either a square foot or a square yard depending on the density of the vegetation. Assessment shall be completed in accordance with the Contractor's Storm Water Management Plan.

Disturbed areas that are to be revegetated shall be left in a roughened condition. Roughen vertical depth shall be approximately 3". Roughening shall be completed with undulations running

Commented [c16]: New section to address restoration of areas that don't get pavement or gravel.

parallel to contouring. Use erosion control logs, silt berms, silt fence, or other suitable means to limit erosion prior to revegetation.

Preparatory to seeding, the top 4" of the topsoil shall be tilled into an even and loose seed bed 4" deep, free of clods, in excess of 2" diameter and brought to desired line and grade. Reseeding shall be done in accordance with specifications, requirements of the landowner, the recommendations from CSU Extension, BLM, and good horticultural practice for the areas being revegetated. Seed mix on private property shall be selected by the land owner. Where lawn and in other grassy areas are disturbed, sod shall be provided for restoration. Furnish and install sod in accordance with CDOT standard 212.05. Contractor shall make arrangements to keep it moist until it is established.

Seed shall not be placed in windy weather or when the ground is frozen or likely to freeze in the next 48 hours. Seeding shall only take place in the fall or early spring. Hand broadcasting of seed will only be permitted for small areas which not accessible to machine methods. In places where the seed is not drilled, the application rate of the seed shall be doubled.

In all areas where the slope is 3:1 or flatter, seeding will be accomplished in general conformance with CDOT Section 213. In larger areas, use an approved mechanical power drawn drill followed by packer wheels or drag chains. The drill shall be operated in a direction generally perpendicular to the direction of the slope. Drill seed 1/2" deep with rows spaced no more than 4" apart. Seed that is extremely small shall be sowed from a separate hopper adjusted to the proper rate of application. Hydromulching will be allowed only if adequate water will be applied to the seed to keep the mulch continuously moist until the seedlings are established.

On all slopes steeper than 3:1, and smaller areas seed shall be applied by means of a mechanical broadcaster at double the rate required for drill seeding. The surface shall be cat tracked up and down the side slope prior to, or just after, seeding to create depressions to help hold seed and moisture. All seed sown by mechanical broadcasters shall be raked into the soil to a depth of 1/2" prior to cat tracking.

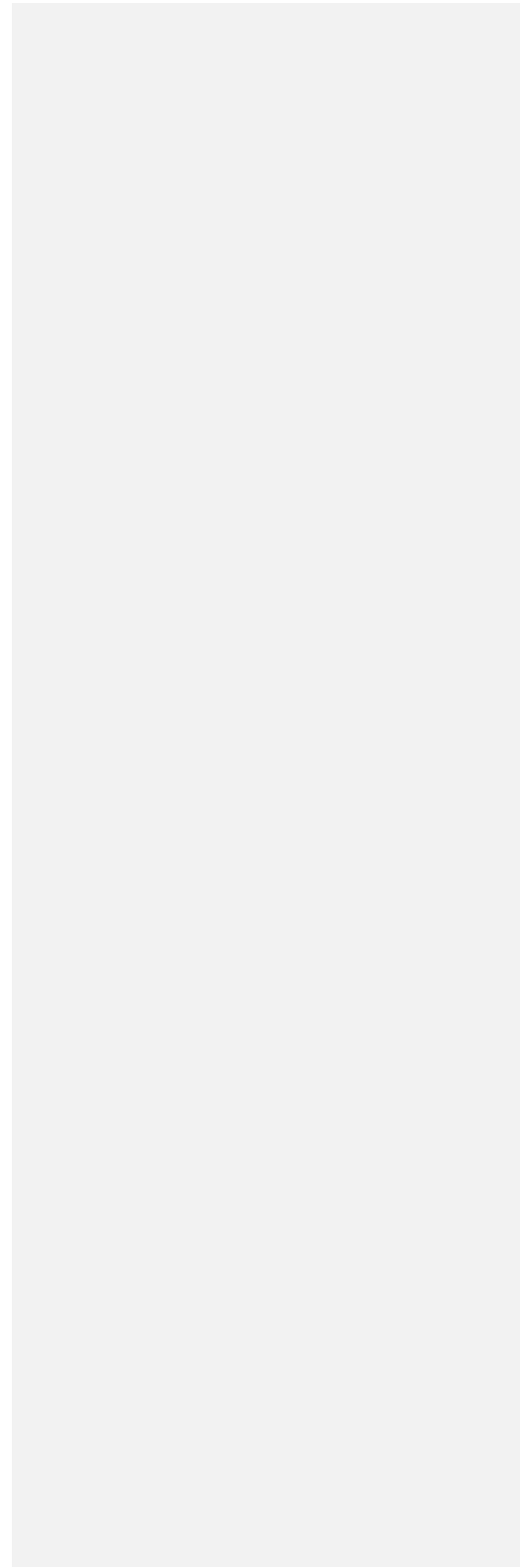
Unless more stringent requirements are specified in the storm water management plan, weed free native grass straw shall be applied at the rate of two tons per acre in areas that have native vegetation. It shall be uniformly crimped in with a crimper or other approved method to a minimum depth of 3". The seeded areas shall be mulched and crimped within 24 hours after seeding. Alternately a mulch with tackifier (200#/Ac) may be used. Jute, soils blanket, or other suitable covering shall be secured to all slopes steeper than 3:1 as soon after mulching as practical. The material shall be applied smoothly but loosely on the soil surface without stretching. Workers shall minimize the amount of walking of the seedbed even after the jute is applied. The upslope end of each piece of jute mesh shall be buried in a narrow trench about 6" deep. The jute shall be secured in the trench with compacted dirt fill. Where one roll of jute ends and a second begins, the upslope piece should be brought over the buried end of the second roll with a 12" overlap to form a junction slot. Where two or more widths are side by side the overlap shall be at least 6".

Seeded areas that have been disturbed prior to or during mulching operations shall be reseeded. Areas not properly mulched or that are damaged shall be repaired or remulched as needed to meet the standards specified herein. Mulching activities shall not occur during windy weather.

DIVISION 2

SITE WORK

Where shrubs or trees were present prior to the disturbance, it is recommended that the same type shrubs and trees be re-planted at approximately the same density as originally present, unless the slope prohibits such plantings. Where trees in excess of 3" caliber are damaged or removed during project, replace trees with trees of similar species at twice the density. Protect such plantings from wildlife damage.



DIVISION 2 – SITE WORK

SECTION 02712 - WATER SYSTEM - MINIMUM DESIGN STANDARDS

1. MATERIALS

Pipe, fittings, valves and fire hydrants shall conform to the latest standards issued by the AWWA, Colorado Department of Public Health and Environment (CDPHE), and shall comply with Town's detailed standard specifications. In the absence of such standards, materials meeting applicable Product Standards may be submitted to the Town for review and possible approval. Jointing material used in joining pipe shall meet pipe manufacturer's specifications and AWWA Standards, Ridgway Municipal Code (RMC) 9.1.,as well as these Town's standards. All materials that could come in contact with potable water must meet NSF 61 and be so marked. Specific details for water materials are included in the Products section of the Water Distribution Standards.

Commented [c1]: Moved the materials specs to the water construction stds.

Commented [c2]: Added

2. MINIMUM FLOW

2.01. Design shall be based on an average peak flow of 4 gallons per minute (gpm) per tap and 8 gpm per dead end for lines servicing 5 or more taps. Instantaneous residential flow shall be assumed to be 15 gpm. Fire flow in residential areas shall be at least 1000 gpm unless structures are more than 20 feet apart in which case required flows can be reduced to 750 gpm. The required flow may be from more than one hydrant, provided the additional hydrants are accessible (within 300 ft) to all possible fire locations.

2.02. Commercial and industrial flows shall be designed based on the nature of the business using such references as CDPHE and Insurance Services Office (ISO) guidelines for sizing lines. The Town will have final review authority on all such lines. Fire flow in commercial and industrial areas shall be at least 1500 gpm and if the business has an above average hazard, the fire flow will be determined by the Town with assistance from the State Fire Marshall's office to insure no detrimental impact on the fire rating of the Town.

Commented [c3]: added

Commented [c4]: Been requiring 1500 in commercial since at least Riverpark but the standard had not been updated to match.

2.03. All areas shall be designed to have a maximum static head of 231 feet (100 psi) with Town mains designed to have 90 psi or less except for short distances. A minimum static head of 103 feet (45 psi). Distribution systems shall be designed to maintain a 35 psi residual pressure during required fire flow and peak residential flows. Pressure zones shall conform to existing Town zones as approved by the Town.

3. LINE SIZE

3.01. Size and location of all water lines shall be designed by a competent, licensed engineer and must be approved by the Town. The Town may at its option waive the requirement for an engineered design when the line is less than 100 feet and will serve 3 or less residential taps. The minimum line size shall be 6 inches except that four inch mains may be installed on permanent deadends (see looping requirements below) less than 150 feet long which serve three or less houses and when a permanent flushing hydrant is provided. Any lines that temporarily deadend and that will be tapped for service before being extended shall be provided with a temporary flushing hydrant.

3.02. If the Town anticipates future expansion and or extension from the area being developed by the Responsible Party, ~~the lines shall be design~~ the Developer will be required to design, properly size, and

construct the system to permit future extensions to be made at the limits of the subdivision or development in question.

Commented [c5]: wording revised. Previous version said "the Town will work with the applicant in determining an equitable breakdown for the additional cost in most cases only the price difference for the increase in materials costs."

4. WATER LINE DEPTHS

In most cases water lines and services should be designed with 5’ of cover. Depths of cover of more than 6’ should be avoided. If there is a conflict at the 5’ depth, the water line can be gradually reduced to 4 foot of cover with extruded polystyrene structural insulation rated at 400 pounds and an R value of 13 or more installed from where the depth reduces to where it returns to 5 ft of cover. If the conflict cannot be addressed by reducing the depth to 4’, the depth shall be increased but only the minimum needed to make the crossing.

Commented [c6]: New section.

5. WATER LINE LOOPING

Water mains shall be designed through a subdivision and other type multi-unit development so that a continuous loop is provided for an alternate route of water, better circulation, and more even pressure. A variance of the looping requirement will be considered when the amount of pipe required to complete the loop will exceed 70% of the line required to serve the subdivision in accordance with Town specifications and the total cost of the water system extension will exceed \$6,000 per tap plus inflation (based on Ordinance 4-2016)

Commented [c7]: This section unchanged except for updating to the current tap fee and year

6. VALVE SPACING

6.01. A sufficient number of valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. The water system for residential areas shall be designed so that only one block need be closed off in the event of a water line break. When development has a geometry other than lot and block, valves shall be placed at intervals less than 400 ft. Gate valves shall be placed at all pipe line intersections so that each segment of line can be isolated while minimizing the number of customers out of water. Where the line runs as a single segment for long distances (over 750 feet), valves should be placed at least at 800 foot intervals when taps are more than 150 feet apart with more frequent intervals being required on larger lines and in densely populated areas.

Commented [c8]: Added due to most new development is not in a lot and block format

6.02. Valves shall be placed on each leg of the tee for a fire hydrant and on each branch of a tee or cross and at a minimum on the branch of a tee for permanent flush hydrants. Air vacuum valves shall be installed at high points on primary feeders and where venting high points through a fire hydrant is not feasible on other mains.

Commented [c9]: Reworded. It did not clearly state that a valve was required on each leg, but that has been required for years.

7. HYDRANTS

7.01. Fire hydrants shall be placed at the intervals recommended by the State Insurance Services Office, generally, at 500 foot intervals and such that hydrants are within 250 ft of property lot lines and habitable structures are entirely within 300 ft of hydrant. Hydrants shall also be located to facilitate flushing and draining even if that necessitates reducing the spacing. Hydrant leads shall be a minimum of six inches in diameter. Auxiliary valves shall be installed on all hydrant leads in conformance with typical drawings. Fire hydrant bottom valve size shall be at least five inches. Nozzle size and threads shall be confirmed with the requirements of the Ridgway Fire District.

Commented [c10]: The intent of the 500 ft spacing was to put habitable structures within 300 ft of a hydrant. This just clarifies that.

7.02. Hydrant weep hole and leach area shall not be connected to or located within 10 feet of sanitary sewers or storm drains. In cases where an existing sewer conflicts with a proposed hydrant leach area, the

Town may allow encasement of the sewer, flowable fill encasing the sewer, or other solution on a case by case basis.

7.03. Use of antifreeze and hydrants that need antifreeze are prohibited.

8. SERVICE CONNECTIONS

8.01. The installation of service lines and taps will be performed by the Town public works staff, or with Town approval, under Town supervision. Residential lots shall be served by a 3/4" ID tap. No direct taps will be allowed under any circumstances. Double strap stainless steel tapping saddles of non-rigid construction shall be used on PVC pipe. Materials and construction shall conform with the materials specified in the Water Line Construction Standard Specifications (Section 02713) and in accordance with relevant typical drawings.

Commented [c11]: Added because HDPE pipe has a thicker wall and thus less internal diameter

Commented [c12]: Added the location reference

8.02. Service lines shall be installed perpendicular to the main and shall typically be located 10 feet inside the uphill property line. Any variance of this layout will require justification and approval of the Town. Meter cans shall be set in the public right of way at property line, or if the sidewalk is at property line either just inside the front utility easements, or just to the street side of the sidewalk. Service lines shall be stubbed across the property line through the width of the utility easement with the end sealed with a watertight seal and marked full depth with a 2 x 4 painted blue and brought to grade and marked with the depth to the service line. Place a steel T post behind the 2 x 4 post to protect it.

Commented [c13]: Added because there have been issues with finding the ends of the service stubs.

9. PROXIMITY STATEMENT

Commented [c14]: Section moved from water construction standards and modified slightly to meet CDPHE requirements.

9.01. There shall be no physical connection between a public or private potable water supply system and a sewer, other non-potable line or appurtenance thereto which would permit the passage of any sewage, non-potable, or polluted water into the potable supply directly or through contamination of the surrounding soils.

9.02. Buried potable water lines shall not be laid closer horizontally than 10 feet outside edge to outside edge from non-potable lines and the water lines shall typically be at a higher elevation than the non-potable. If this is not possible, separate trenches will be required and the water line shall be at least 18" above the non-potable and a pipe with a water tight welded joint such as HDPE shall be used. When water and non-potable lines cross each other, the water line shall be at least 18" above the non-potable. If this condition is not met, then where practical, the non-potable line shall be encased with a 20' PVC casing pipe centered on the water line crossing. If is not practical to case the non-potable line, the potable line shall be so cased. Should the non-potable line be above the water line, no matter what vertical separation the casing pipe shall be sealed to the carrier pipe with no-hub reducing couplings, Link-Seal or other approved method to provide a water tight seal.

9.03. Force main sewers require a separation from the water main of at least 10 feet measured horizontally unless both pipes are encased in and properly supported with pipe joints as far apart as possible with sealed end encasements. There shall be a 2' vertical separation at crossings or a watertight casing shall be provided around the force main.

9.04. There shall be a minimum clear distance vertically of 8" between the uppermost part of the lower utility and the lowermost part of the upper utility including casings to allow for proper bedding. In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of any of the pipes.

Commented [c15]: Added to protect the pipes. It has been common practice.

9.05. No water pipe shall pass through or come within ten feet of a sewer manhole unless absolutely unavoidable, in which case adequate protection as determined by the Town Engineer must be provided.

Water lines shall have at least 5 foot horizontal separation from wire utilities. The Town shall have final review authority of all proposed designs which do not provide adequate separation. These requirements for protection of the water system against contamination from non-potable water conveyances shall apply equally to water mains and service connections.

10. CROSS CONNECTIONS AND BACKFLOW PREVENTION

There shall be no connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water or other contaminated materials may be discharged or drawn into the Town potable water system. Any interconnections between potable water supplies shall have prior written approval of the Town. All water mains, service lines and connections and appurtenance shall be installed consistent with RMC 9-1-27 Cross Connection and Backflow Prevention and meet the requirements in the Water Distribution Section of these Standards.

11. REMOVAL OF ABANDONED INFRASTRUCTURE

Where new construction will replace existing infrastructure, unless otherwise approved by the Town the abandoned infrastructure shall be removed.

12. DISINFECTION AND FLUSHING

Refer to Standard Specifications – Water Line Construction for disinfection and flushing requirements.

13. TESTING

Testing of water lines, services, and appurtenances, shall conform with the requirements of AWWA and the applicable Town Code and Standard Specifications of the Town.

Commented [c16]: Moved from water stds. This is consistent with easement requirement easement requirements in the general requirements.

Commented [c17]: Added due to new CDPHE regs and good practice

Commented [c18]: Added. Leaving abandoned utilities in the ROW causes confusion and clutters the space. We typically have required this in the last decade and we have had issues where the abandoned utility was not removed.

DIVISION 2 – SITE WORK**SECTION 02713 – WATER SYSTEM CONSTRUCTION****1. GENERAL**

The water lines and appurtenances shall be constructed according to standard accepted practices and as specified herein. Reference to standard specifications e.g. AWWA, ASTM, etc. made a portion of these specifications by reference shall be the latest edition and revision thereof. All water line improvements and additions must also comply with the Minimum Standards portion of the Town Standards, Section 9.1 of the Ridgway Municipal Code, and all applicable Colorado Department of Public Health and Environment (CDPHE) and EPA regulations.

Commented [c1]: Added reference to RMC

1.01. Description

- A. This section covers the furnishing, installation and testing of water distribution lines and appurtenances. Contractor shall furnish all equipment necessary for said work and testing.
- B. Contractor shall follow manufacturer's recommended procedures in all handling and installation operations. All water line improvement must also comply with the Town's Minimum Standards and all applicable codes, laws, and regulations.
- C. Contractor shall engage the services of a licensed surveyor to layout the locations and depths of the new water infrastructure in accordance with the Town approved plans. If not done during design and incorporated into the approved construction drawings, the Contractor shall make such excavations as are necessary to determine the exact location of existing utilities which affect new construction. Where practical, new lines shall be routed to facilitate installation, allow for future maintenance, minimize existing utility conflicts and to minimize construction problems.

1.02. Related Work Specified Elsewhere

Section 02200 – Excavation, Backfill, and Compaction Specifications
Section 02712 – Water System – Minimum Design Standards
Section 02723 – Sewer System Construction

- 1.03. Proximity Statement:** Refer to Section 02712 - Minimum Design Standards for Water Distribution System.

2. PRODUCTS

All materials shall be new, unused, and of the best standard quality available for the purpose intended. All materials in contact or potential contact with potable water shall be NSF 61 certified and meet all current EPA and CDPHE requirements including the lead-free requirements. All brass shall meet AWWA C-800. Where materials are specified by brand names, materials of equal quality may be substituted if the Contractor submits adequate technical and descriptive data and secures the approval of the Town unless the material is specifically noted to be the only material allowed. The Town or its designated representative shall be the sole judge of the suitability and acceptance of materials. The Town in some instances may insist on a particular brand or model (to match materials in use) to minimize the parts inventory and/or O and M requirements.

Commented [c2]: New state and fed requirements

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Certificate of Compliance shall be submitted to the Town stating all pipe and materials furnished under these specifications do in fact comply with all referenced specifications and meet the Safe Drinking Water Act, CDPHE, and NSF 61 requirements.

2.01. Ductile Iron Pipe

Conformance	AWWA C151
Thickness	Class 50
Pressure Rating	150 PSI
Joints	Neoprene Gasket AWWA C111/ with Conductivity Straps
Fittings	ANSI/AWWA C153 when available or C110
Corrosion Protection	Wrap pipe in polyethylene tubes and sealed

2.02. Plastic Pipe (PVC) - Water

Conformance	AWWA C900
Thickness	Class 150
Pressure Rating	DR-18 to line pressures of 100 psi and DR-15 when typical line pressures are expected to exceed 100 psi
Joints	Rubber Gasket, bell and spigot
Fittings	Ductile Iron AWWA C153 when available or C110
	Under 4", PVC with 200 PSI rating allowable
Marking	10 ga color coded tracer wire taped to pipe (blue for potable water and purple for non-potable. Metallic 6" wide color-coded color-coded marking tape, located 12" above water line

Commented [c3]: New rating system for C900

2.03. Copper Tubing

Conformance	ASTM B88, lead free
Thickness	0.65" for 3/4" and 1"
Service	Potable water service lines
Type	K soft copper

2.04. Water Service Materials

- A. Corporation Valve: Corp valves shall be A.Y. McDonald #5182 brass. Valves shall be AWWA C-800 and NSF 61 certified.
- B. Service Saddles: Service Saddles shall be Mueller BR2B bronze saddle with stainless steel straps and O-Ring sealed outlet, sized for the pipe to which it will be connected with the correct tap size and thread. Saddles shall be AWWA C-800 and be NSF 61 certified. **Only this model will be allowed.**
- C. Meter Setters:
Meter setters shall be A.Y. McDonald #5141-077 ONLY compression brass. With ball valve shutoff and dual check valve. Meter setters shall be AWWA C-800 and NSF 61 certified.
- D. Water Service Backflow Preventor
Mueller M-98 Angle Dual check valve or can be incorporated into meter setter.
- E. Meter Can: Meter cans shall be Bingham Taylor MMPE 24" diameter. **Only this model will be allowed.**

Commented [c4]: Materials updated to what the Town currently uses

Commented [c5]: New model, slightly larger diameter to facilitate work in the can.

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SITE WORK – WATER SYSTEM CONSTRUCTION

- F. Meter Can Lid: Castings – M 70 meter can cover with cast iron outer lid of sufficient diameter for the meter can with 2 in hole and M 70 aluminum inner frost lid. **Only this model will be allowed.**
- G. Water Service Pressure Regulator: Pressure regulators with strainers shall be installed on the mainline side of meters when the pressure through the meter will exceed 80 psi. Regulators will be diaphragm type, easily field adjustable for pressure, and shall be accessible for repair without removal from the pipe line. Unless otherwise approved regulators shall be pre-set at 50 psi. A "Y" type strainer with plug and screen removable without removing the strainer or regulator shall be installed at the inlet end of each regulator.
- H. Curb Stop and Box: Curb ball stops shall be McDonald brand brass with compression joints on both end and with cast brass pinned handle with box and cap lid.

2.05. Gate Valves

Conformance	AWWA C515
Material	Epoxy coated ductile
Body Type	Resilient seat, non-rising stem
Pressure Rating	150 PSI, minimum
Joints	Flange or Mechanical Joint end as required typically flanged to fitting, mechanical joint to pipe
Coating	Epoxy inside
Operating Nut	2" Square, open counterclockwise (buried) Handwheel (non-buried service)
Acceptable Models	Mueller, (Only these products will be accepted by Town)

Commented [c5]: Clarification

2.06. Valve Box

Location	All buried valves not in vaults
Type	Slip type, two or three piece 5 1/4" as req'd, traffic rated
Base	Suitable for valve size, depth, and operating mechanism
Material	Cast Iron, 1/4" minimum wall thickness
Coating	Bituminous varnish, plastic wrapped
Cover	Cast Iron, traffic type, marked "WATER"
Location	All buried gate valves
Operator Extension	1" minimum diameter cold rolled steel rod (where depth greater than 5 feet)

2.07. Butterfly 3-inch and Larger

Conformance	AWWA C504
Material	Iron Body, bronze mounted
Type	Resilient seat
Pressure Rating	150 PSI
Coating	Epoxy inside
Seat	Rubber
Joints	Flange
Operator	Electric Actuator (see below for details)
Operation	Open by turning counterclockwise
Acceptable Models	Bray, Mueller

2.08. Butterfly Valve Electric Actuator: Actuator shall be UL listed, designed to be located in a wet environment, NEMA 4 rated. It shall include adjustable speed control for both opening and closing speeds such that operating the valve will not create water hammer in the line. Wiring shall go to a terminal strip.

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Actuator shall include a simple manual override handwheel system. Actuator shall be designed to function with the butterfly valve furnished. Actuator shall be Bray Series 70 or approved equal.

2.09. Fire Hydrants

Conformance	AWWA C502
Material	Ductile iron body, fully bronze mounted
Pressure Rating	150 PSI, minimum
Type	Breakaway traffic w/easily replaced flange
Size	6" w/ 6" mechanical joint inlet, 5' minimum bury
Joints	Megalug, O.A.E. restraints on mechanical joints
Outlets	2 - 2 1/2" hose nozzles, 1 - 4 1/2" pumper nozzle all w/ National Standard Thread
Operating Nut	1 1/2" National Standard pentagon, open counter-clockwise
Main Shut off	Gate valve per spec. above
Acceptable Models	Mueller Modern Centurion (Only this model will be accepted by Town)

Commented [c6]: Changed from cast to ductile

2.10. Flushing Hydrants

Conformance	NSF/ANSI 372
Service	Potable water, frost free, self-draining, with vacuum breaker
Size	Inlet 2" or same as existing line, outlet 2-1/2" NST Bury match existing water line typically 5-6'
Type	Breakaway traffic w/easily replaced flange
Joints	Megalug 2000 series restraints on mechanical joints
Outlets	1 - 2 1/2" hose nozzle w/ National Standard Thread
Interior Operating Parts	Brass, bronze, and shall be removable for service and replacement without excavating the hydrant.
Exterior Casing	Ductile Iron
Operating Nut	1 1/2" National Standard pentagon, open counter-clockwise
Main Shut off	Gate valve per spec. above
Model	Mueller 2-1/8" Post type Hydrant with one 2-1/2" nozzle or approved equal.

Commented [c7]: Added this because we have had a couple of developments need a flush hydrant.

2.11. Yard Hydrants

Service	Potable water, frost free, with vacuum breaker
Size	3/4" NPT inlet, 3/4" hose bib lockable, 5' bury
Valve	Woodford Y34-4 or approved equal

2.12. Air Valves:

At high points in water mains where air can accumulate, provisions shall be made to remove air by means of air relief valves or other means approved by the Town. Air relief valves shall be placed in vaults which allow convenient service of the valve and provide for adequate drainage.

Material	Cast iron body, ASTM approved materials
Pressure Rating	150 PSI
Size	3/4" minimum, sized by air flow requirements
Connection	3/4" tapping saddle, tap at high point in line
Main Shut off	Corporation stop
Support	Support weight so not transferred to water line
Vent	12" above ground, pointed downward, covered with #24 mesh
Acceptable Models	APCO or Valmatic automatic valves or approved equal

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2.13. Cross Connection Control Valves: Where there is a potential of backflow, either backpressure or back siphonage, into the potable water supply, the service line shall be isolated from the potable supply by a backflow prevention device such as a double check valve, reduced pressure principal device (RP), pressure or atmospheric vacuum breaker depending on the location and nature of the hazard. The Town shall approve the type of device to be installed. All cross-connection control devices shall meet the standards of the Foundation for Cross Connection Control and Hydraulic Research (Foundation). The valves shall be used only as recommended by the Foundation and installation shall be in accordance with its recommendations. A list of currently approved devices and valves is available from the CDPHE. Valves shall be installed in vaults which allow for convenient testing and maintenance of the valves and they must be installed in a manner that allows for gravity drainage from the vault.

Commented [c8]: Added because if the vault does not drain the valve does not work.

2.14. Miscellaneous Valves: Plans for all large valves, control valves, pressure reducing valves, and other specialized valves shall be submitted to the Town for review and approval. In all cases such valves shall be installed in vaults or pits that are sufficiently large to accommodate all operation and maintenance required. Bypass lines are required.

2.15. Bolts and Hardware: All bolts, nuts, and small miscellaneous hardware shall be Cor-Blue, stainless steel, or other durable corrosion resistant material approved by the Town unless specifically noted.

2.16. Compression Couplings: Compression couplings 2" or smaller shall be Mueller.

2.17. Tracer Wire and Marking Tape

A. Tracer wire shall be 10 gauge with blue insulation.

B. Marking tape at least 6" wide labeled "water" shall be placed 12" above pipes of all materials.

2.18. Insulation: Trench insulation shall be high compressive strength extruded polystyrene ridge foam insulation designed for use in engineered applications for high load bearing uses. Materials shall be a closed cell structure and meet ASTM C578 type VII. Minimum compressive strength (ASTM D1621) shall be 60 psi with an R value (ASTM C518) of 5 per inch. Insulation shall be Foamular XPS or each. Thickness and width shall be in accordance with the table below:

Commented [c9]: New section because we are getting requests for deviations from standard burial depth.

<u>Depth of Cover</u>	<u>Insulation Width and Thickness</u>
4.5' – 5'	2" thick, 3.5' wide
4.0' – 4.5'	3" thick, 3.5' wide
3.0' – 4.0'	4" thick, 4' wide
Pipe crossing above water line	3" thick, 3' each side of crossing

2.19. Manholes: Manholes shall meet the requirements for manholes in the Sewer Standards (Section 02722).

3. EXECUTION

Commented [c10]: This section has been totally reorganized. Have only highlighted items that have not been common practice and required by the town for many years/decades.

3.01. Field Locations: The Contractor shall make such excavations as are necessary to determine the exact location of existing utilities which affect new construction. Where practical, new lines shall be routed to facilitate installation, allow for future maintenance, minimize existing utility conflicts and to minimize construction problems. Notify the Town if existing utilities present conflicts for the new infrastructure.

3.02. Service Disruption: Service disruption shall conform to the requirements in the General Requirements.

3.03. Receiving, Handling, and Storage

Upon receipt make overall inspection that pipe has been received in good condition. Pipe and appurtenances should be inspected for any damage or imperfections and problem materials should be so marked set aside until removed from the job site. Town reserves the right to inspect all materials received and reject any which does not meet the requirements of Town specifications and standards.

Pipe, valves, fitting, and other appurtenances should be unloaded, handled, and stored in accordance with manufacturer's recommendations. Pipe shall be handled during all phases of construction in a manner that will provide the maximum protection of the pipe and any coating or lining and will prevent the intrusion of dirt or other foreign materials into the pipe. All slings, hooks, and other lifting or handling equipment which comes in contact with pipe and appurtenances shall be padded. Dropping the pipe during unloading or placing in the trench is prohibited and will be cause for rejecting that material. Do not drag pipe spigot rings on the ground and do prevent damage to the ring from contact with abrasive or hard objects. Extreme care shall be used in the handling, storage, and installation of valves and other appurtenances to prevent damage or distortion to the equipment and to ensure proper performance and assure cleanliness. Valves shall not be lifted by operating stems. Dropping materials during unloading or placement in the trench is prohibited and will be cause for rejecting that material.

Only the amount of pipe and fittings necessary to ensure efficient installation progress shall be strung along the trenches. All other pipe and fittings shall be stored in the Contractor's yard. Piping strung or stored shall be protected at all times from damage by traffic, workmen, construction operations, and other hazards. PVC pipe stored for a prolonged period of time shall be protected from sunlight.

3.04. Alignment and Grade

Pipe shall be laid and maintained to the required line and/or grade shown on the approved plans with fittings, valves, and hydrants at the required locations with spigots centered in the bells. Pipes and appurtenances shall be installed within 0.5' horizontal and 0.1' vertical of design.

Changes in horizontal or vertical alignment of the pipe at a joint shall not exceed the manufacturer's recommended deflection for the type and size pipe being laid. When the change required is more than that recommended, a fitting or several short joints of pipe shall be used. All changes in direction in excess of eight (8) degrees or the maximum deflection recommended by the manufacturer, shall require a fitting unless otherwise approved by the Town.

When new pipe is to be connected to an existing pipe or when crossing existing pipe line, the Contractor shall excavate the existing lines well in advance of the laying of the new line to enable the Town's representative to verify their elevation and placement and to make any adjustments in grade and/or alignment of the new pipe line that may be required.

The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he/she shall be held responsible for the repair or replacement of such structures when broken or otherwise damaged. Temporary support, adequate protection, and maintenance of all underground and surface utility structures, drains, sewers, and other structures encountered in the progress of the Work shall be furnished by the Contractor at his expense.

Whenever obstructions are encountered during the progress of the Work and interfere to such an extent that an alteration in the approved plans is required, the Contractor shall notify the Town and the Town

DIVISION 2**SITE WORK – WATER SYSTEM CONSTRUCTION**

shall have the authority to change the plans and order a deviation from the line and/or grade or arrange with the owners of the structures for the removal, relocation, or reconstruction of the obstructions.

All pipe shall be laid to the depth shown on the approved plans or pipeline typical drawing. The depth of cover shall be measured from the top of the barrel of the pipe to the established finished grade of the street unless changes in street grade are proposed in which case the cover shall be measured to the proposed depth. Construction staking is required at minimum 150 ft intervals for line and grade control.

3.05. Excavation and Trench Preparation

Excavation shall be in accordance with Trench Excavation, Compaction, and Backfilling Standard Specifications except as more stringent requirements are outlined herein.

Bedding for water lines shall be in accordance with Section 02200 Excavation, Compaction, and Backfilling Standards and manufacturer's recommendations including that select bedding for water taps and service lines shall be a low permeability material.

3.06. Pipe Laying

- A. Lowering Pipe into Trench: Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient performance of the Work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench piece by piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. Dropped or dumped materials will be cause for rejection of same.
- B. Inspection Before Installation: The pipe and accessories shall be carefully inspected for cracks and other damage before installation in the final position. Defective or unsound material shall be set aside for inspection by the Town who will determine if the material shall be repaired or rejected. Rejected materials shall be removed by the Contractor from the job.
- C. Keeping Pipe Clean: Every effort shall be made to keep the interior of pipe and fittings clean during all phases of construction. This is especially important if the tablet method of disinfection is to be allowed. The interior of the pipe shall be thoroughly cleaned of foreign material before being lowered into the trench and shall be kept clean during operations by plugging or other approved means. Fittings shall be thoroughly cleaned, with a wire brush if necessary, taking care to not damage the internal coating. If the pipe laying crew cannot keep pipe clean while placing the pipe in the trench, Town may require that the ends of the pipe be covered before placing it in the trench and that the covers only be removed as the joints are assembled. If cleanliness is in question, the Town may require the line be swabbed and/or hydrojetted and video inspected at contractor's expense to confirm that it is clean. Providing access to all sections which are required to be videoed, then cleaning and reassembling pipe, shall be the responsibility of the Contractor.
- D. Laying of Pipe: The full length of each section of pipe shall rest solidly upon the bed, with recesses excavated to accommodate bells and joints. Pipe shall be laid with bell ends facing the direction of laying unless directed otherwise by the Town. Pipe laid on slopes 10% and steeper shall be laid from the bottom and proceed upward and have restraints approved by the Town. Pipe shall not be laid in water or when trench or weather conditions are unsuitable for the Work unless expressly permitted by the Town.

The subgrade upon which the pipe is placed shall consist of materials suitable for supporting the pipe without excessive settlement or stress development. Fine earthen materials shall be carefully placed and compacted around the pipe and up to a depth of six inches over the top of the pipe. Care shall be taken in backfilling to see that the pipe is not displaced, crushed, cracked, or otherwise injured. In the event that rock or excessively spongy materials are encountered, they shall be removed to a depth of not less than 6" below the bottom of the proposed lines and replaced with an approved material and mechanically compacted to grade. If no suitable subgrade material is available from the upper portion of the excavation, approved material shall be imported to the job site.

The sealing surface of the pipe, the bell to be joined, and the elastomeric gaskets shall be cleaned immediately before assembly. Assembly shall be made as recommended by the manufacturer. Unless otherwise directed, the gasket and the bell or the plain end of the pipe to be jointed shall both be lubricated with a suitable soft vegetable soap compound meeting NSF 61. The spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the spigot end is inserted to the full marked depth of the joint. Care shall be taken to ensure that no damage is done to the pipe, collar, gasket, or bell when the pipe is being homed. Use of excessive force will not be permitted. Any pipe that has had the grade or joint disturbed during or after laying shall be taken out and relayed.

Any section of pipe, fittings, valves, or hydrants already laid and found to be defective shall be taken out and replaced without additional expense to the Town.

HDPE pipe shall be installed in strict accordance with manufacturer's recommendation. All workers welding HDPE pipe must be trained and approved by the manufacturer for welding pipe of the size and DR being used on this project. At the beginning of welding each day, each worker who will be welding pipe shall demonstrate his qualifications by successfully completing a bend back test prior to welding any pipe for use on the project. All welds shall be full depth and shall have a uniform bead around the joint.

Flange and mechanical joints shall be made with properly sized machine bolts and nuts. All nuts and bolts utilized in underground connections shall be Cor-blue, stainless steel, coated high strength cast iron, or coated high strength wrought iron depending on soil conditions. All nuts and bolts shall be Cor-blue unless approved by the Town. All components of these types of joints shall be cleaned before jointing. Only one (1) gasket will be permitted in a flange joint. In a mechanical joint the plain end pipe shall be fully seated before the gland and gasket is slipped up to the bell; care shall be taken to locate the gasket evenly around the entire joint. All nuts on both types of joints shall be tightened by hand first then by alternating nuts 180 degrees apart to the manufacturer required torque. Deflection at a mechanical joint shall not exceed either the manufacturer's recommendation or Table 1 in AWWA C600. Buried bolts and nuts on mechanical and flanged joints shall be wrapped in a 10 mil plastic and taped closed.

When work is not in progress, open ends of pipe and fittings shall be securely closed by a watertight plug to prevent entry of foreign materials and/or water. If there is water in the trench, the seal shall remain in place until the trench is pumped completely dry. Whenever water is in the trench, enough backfill shall be placed on the pipe to prevent floating. Should any foreign material be allowed to enter the line or to remain in the line after installation, the Contractor shall remove such accumulation with a pipeline scraper or other approved means. Should the Contractor repeatedly fail to prevent dirt or other material from entering the line, he/she will be required to

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clean each section of pipe with a pipeline scraper or swab as it is installed. If pipeline cleanliness is in question the tablet method of disinfection will not be permitted.

Tracer wire shall be fastened to all pipes and shall be fastened to and be looped up to the surface at all valves, hydrant, and other metallic structures along the line. Tracer wire shall be 10 gauge. Marking tape at least 6" wide labeled "water" shall be placed 12" above pipes of all materials.

- E. Sequencing: Pipeline installation shall follow trench excavation within 100 lineal feet. Trench backfill shall follow pipe installation within 100 lineal feet. Approved cleanup shall follow trench excavation within 100 lineal feet. The Town may allow changes in these requirements if field conditions warrant.
- F. Cutting of Pipe: The pipe shall be cut in a neat and workmanlike manner in accordance with manufacturer recommendations. No damage shall be done to the pipe or any lining or coating and the cut shall leave a smooth end at right angles to the axis of the pipe. Flame cutting of iron pipe by means of an oxyacetylene torch shall not be allowed.
- G. Connection to and Crossing of Existing Lines: When new pipe is to be connected to or to cross an existing pipe, the Contractor shall excavate the existing lines well in advance of the laying of the new line to enable the Town's representative to verify elevation and placement and to make any changes in grade and/or alignment of the new pipe line that may be required. Connections to existing lines shall be made at the locations shown on the approved plans unless changes are approved by the Town. In most cases where there is significant elevation adjustment (more than 18"), the Contractor shall use 22.5 degree fittings to make the adjustment. For lesser changes a gradual adjustment of elevation should be made. Place insulation where cover is less than specified depths. Coordinate timing of the cut with Town, and provide required notice to affected customers. In cutting the existing pipe take great care to minimize contamination of existing line. Keep water level in the trench below the level of the pipes. Make connection using required fittings and restrain the joint. Disinfect the line as called for below for a repaired line. Cut off and seal abandoned section unless otherwise noted on the approved plans, remove abandoned sections of line.

3.07. Water Service Installation

- A. Service Line Installation and Responsibility: All water services shall be stubbed out to through the utility easement. Generally, meters shall be set at property line. When sidewalks are set close to property line, meters shall be set in the green belt near the sidewalk. In all cases owner responsibility for the service line shall begin at the meter. Installation of service lines shall be by open cut with bedding, backfill, and compaction in conformance with the specifications herein and Standard Specifications for Excavation, Backfill, and Compaction. Depth of bury shall be 5' unless otherwise indicated on the Town approved plans. Care shall be taken in laying the service line to prohibit kinks in the line. In placing backfill around pipe use only select materials which will bed and support the pipe and not cause injury to it.
- B. Meter Lid Elevation: The lid for the meter can boxes shall be flush to finished grade of the surrounding property and landscape. When a meter can must be set within a sidewalk the lid shall be set about 1/2" below grade to avoid catching on a plow.
- C. Curb Stop and Box: Install curb stop on service lines so that the box will be in the sidewalk or concrete. Boxes must be plumb and the box lid ¼" below the finished concrete.

Commented [c11]: Has been the practice in most cases. Leaving the old in place wastes space in the ROW, confuses excavators, can lead to conflicts and occasionally to someone using the wrong line.

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D. Fire Protection Service Line: Service lines for fire protection, unless smaller than 2", shall be made by installing a tee in the main with a gate valve flanged to the tee. All fire services shall be installed with a Town approved backflow prevention device. The property owner shall be responsible for maintenance of the fire service from the tee on the main to and through the property being served.

3.08. Crossings: Details for crossing roadways, canals, ditches, and arroyos (draws) are covered in a separate specification entitled "Crossings". All river crossings shall be submitted to the Town for specific review and approval.

3.09. Setting of Fittings, Valves, and Hydrants: All hydrants, valves, plugs, caps, and fittings shall be provided as shown on the approved plans and set and joined to the pipe in the manner specified herein for cleaning, laying, and joining pipe. Whenever practical, flanged fittings shall be used and gate valves bolted directly to crosses and tees as applicable. All valves, fittings, hydrants including the connections shall be wrapped in a 10 mil plastic and sealed.

A. Valves and Valve Boxes: Gate valves shall be installed as shown on the Town typical drawing and in accordance with the Minimum Standards adopted by the Town at the locations shown on the approved plans. In general, a valve shall be provided on each branch of a tee or cross. Care shall be taken to assure that the valve and box are plumb and that the valve box is properly supported on a concrete base, and adjusted for the correct finished grade. A box shall be provided for each buried valve and the box shall not transmit shock or stress to the valve and shall be centered over the valve nut. Each valve not in the roadway shall be marked with a steel T post. The top of the post shall have a 4 x4 minimum steel plate welded to the top. The plate shall be labeled with the valve ID.

Commented [c12]: Added so that we can find things that are buried and not in the typical location.

B. Hydrants: Hydrants shall be located as shown on the approved plans. Final location will be approved by the Town in the field and should provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians. Hydrants shall be accurately set to the proper bury lines so that bolts are accessible and shall be securely anchored when it is plumb. A gravel fill shall be placed around the hydrant barrel drain port as shown on the typical drawings. Each hydrant shall be connected to the main with a 6" minimum diameter branch controlled by an independent 6" gate valve, installed in accordance with the typical drawings for hydrant and gate valve installation adopted by the Town. The Contractor in the presence of the Town shall test each hydrant by operating it through several open and close cycles.

C. Dead Ends: All unconnected ends of pipe shall have a valve, and plug or cap installed on it with appropriate restraint. In general, plugs shall be inserted into the bells of all dead-end fittings. Spigot ends of accessories, fittings and plain ends of plastic pipe shall be capped. Blind flanges shall be used on flange fittings. A reaction or thrust block and mechanical restraint such as a megalug shall be provided at all dead-ends of pipe.

D. Thrust Blocks: A reaction or thrust block shall be provided at each bend, tee, valve, hydrant, plug, and at reducers or fittings where changes in pipe diameter or direction occur. The size and shape of the thrust blocking shall be as shown on the typical drawing. Concrete shall be a 6 sack, 4000 psi at 28 days mix approved by the Town. Maximum water cement ratio shall be 0.42. The concrete shall be placed between the poly wrapped pipe or appurtenance and the undisturbed wall of the trench. The concrete shall be placed in such a manner that no concrete is in contact with any bolts or nuts on the fitting etc. so that the pipe and fitting joints will be accessible for repair by poly wrapped the full joint and taping closed. In addition, a joint restraint system such as a megalug shall also be provided on all mechanical joints.

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- E. Air Valves: Air valves shall be installed in all locations where air is likely to accumulate in the water line, most often at high spots in the line. A tap shall be made in the top of the line and a corporation stop installed in the tap. The line shall then be connected to an air valve installed in a manhole or vault that meets the requirements of the material specifications above and shall be installed in accordance the standard drawing adopted by the Town. The valve shall be installed at 4 feet below finished grade. A frost-free lid shall be provided. Adequate insulation shall be installed around the valve to protect it from freezing.
- F. Cross Connection Control Valves: Cross connection control valves shall be installed in a manner which conforms with the recommendations of the Foundation for Cross Connection Control and Hydraulic Research and applicable CDPHE regulations and shall have sufficient space around and access to the valve to allow for proper testing.
- G. Vaults: Vaults where needed or required shall be of concrete with minimum wall thickness of 6 inches or the minimum required to properly encase the re-enforcing steel required by the structure. The vault shall be of such size as to allow easy operation and maintenance of the equipment contained therein with no less than 18" clear around the outside of the pipe. A 24" minimum access hatch shall be provided over the manway steps to allow access to the vault. Opening size and location shall allow for removal of any facilities that need to be maintained. Vaults shall include either a floor drain or sump depending on groundwater conditions.

3.10. Bedding and Compaction: Bedding, backfilling, and compaction shall be in accordance, with Excavation Backfill, and Compaction Standard Specifications of the Town and pipe manufacturer's specification. Special attention shall be given to placing and compacting select bedding material in the pipe zone. The haunching on PVC pipe shall be compacted to 95% Standard Proctor. Bedding and pipe zone backfill of water lines shall be fine grained and relatively impermeable rather than a graded material. Backfill shall not be wheel compacted until there is a minimum of 36" of compacted cover over the top of the pipe.

3.11. Hydrostatic Testing

The Contractor shall be required to perform hydrostatic tests on all water mains, laterals, dead ends, and service lines in accordance with AWWA specifications C600. Prior to making the test the Contractor shall advise the Town of the time and place of the test so that adequate inspection can be provided. Prior to performance of the test the pipeline shall be completely filled with water for a period of 24 hours.

The test shall be conducted in the presence of the Town or its authorized representative. The testing of the lines shall be done without being connected to existing lines unless approved by the Town. All necessary apparatus for pressure testing including the pump, pipe connection, gauges, and measuring devices shall be furnished by the Contractor at no cost to the Town. If connections to the existing lines are allowed by the Town, it is with the understanding that the Contractor assumes any and all responsibility in case of damage or failure of the existing system. Leakage through connections to the existing system, leaks in the existing lines, or leaking valves under the test pressure will invalidate the test and required the Contractor to find another means to test the line.

Prior to testing, all air shall be bled from the lines. If permanent air vents are not located at all high points, the Contractor shall install corporation stops at such high points so the air can be expelled as the line is filled then the corps closed. The lines shall be tested at 150 psi or 1.5 times the normal working pressure of the lines, whichever is greater, for not less than two (2) hours when performing the combined pressure and leakage test. Test pressure shall be measured at the high point in the line. All taps, gauges (3" face, 0-200 psi, at least 5 psi gradations), and necessary equipment shall be provided by the Contractor as

approved by the Town; however, the Town may utilize its own gauges if it so elects. Each section of the new line, between valves shall be tested to demonstrate that each valve will hold the test pressure. No pipe installed will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{N * D * \sqrt{P}}{7400}$$

Where:

- L** = Allowable leakage (gal/hr)
- N** = Number of joints in the line
- D** = Nominal Pipe Diameter (in)
- P** = Testing pressure (psig)

During the test, the test pressure shall not lose more than 5 psig without being pumped back up to the test pressure. The total gallons of water required to return the line to the test pressure at the end of the test period is the total leakage. If the total leakage is less than the allowable, the line can be given preliminary acceptance. All visible leaks will be repaired regardless of the amount of leakage. If leakage exceeds that allowed based on the above formula, Contractor shall identify problems, make repairs, and repeat the test until the leakage is less than or equal to the allowable leakage.

When separate pressure and leakage tests are to be performed, test procedures shall conform with the procedures detailed in AWWA C600. The duration of the pressure test shall be a minimum of one (1) hour and the duration of the leakage test shall be a minimum of four (4) hours.

Each gate valve shall be tested to ensure that it operates properly and provides watertight seal under 1 1/2 times operating pressure in the closed position.

3.12. Disinfection of Potable Waterlines

- A. General: Flushing and disinfection of potable waterlines shall be done in accordance with the procedure set forth in AWWA C651 Disinfecting Water Mains. All water lines and sections of water line which have been exposed including lines owned by other parties must be disinfected. The Contractor shall provide all temporary blowoffs, pumps, chlorination equipment, chlorine and all other necessary apparatus required. The placement of powder chlorine in each joint of pipe will not be allowed.
- B. Pipe Cleaning: If the pipe contains dirt or heavy encrusted matter that in the opinion of the Town Engineer will not be removed during the flushing operation, the Contractor shall clean and swab the interior of the pipe with a 5 percent chlorine solution.
- C. Preliminary Flushing: The pipeline shall be flushed prior to disinfection, except when the tablet method is used, to remove all remaining foreign material. The flushing operation shall develop a minimum velocity of 5 ft./sec. for 5 minutes minimum through the length of the pipe. If dirt cannot, in the opinion of the Town Engineer, be removed by flushing, the pipe shall be cleaned and swabbed with a 5% hypochlorite disinfecting solution. Preliminary flushing cannot be used with the Tablet Method. Use of tablet method for disinfection is only allowed if the pipe has been kept clean and dry duration installation. If the pipe has not been kept clean, the tablet method is not allowed and preliminary flushing is required.

Commented [c13]: This section and the CDPHE guidance have been updated to reflect current CDPHE requirements. Some chlorine concentrations are higher and some are lower.

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- D. Chlorine Application: In general, chlorine shall be applied using the continuous feed method. The tablet method may be used on short extensions (up to 2500 ft.) of small diameter mains (12-inch and smaller). Longer line segments require using the continuous feed method.
- E. Continuous Feed Method: Introduce water into the line at a constant rate while adding chlorine at a minimum concentration of 25 mg/l. Maintain the chlorinated water in the pipeline for a minimum of 24 hours after which period the treated water shall contain no less than 10 mg/l of chlorine throughout the entire length. Repeat the above procedure if the residual at the end of the 24 hours fails to meet the minimum concentration. Note that use of the slug method, requires 3 hours contact with not less than 100 mg/l solution and not less than 50 mg/l free Cl₂ at the end of the 3 hours.
- F. Tablet Method: This method shall not be used if trench water or foreign material has entered the line or if the water is below 5 degree C (41 degrees F). Because preliminary flushing cannot be used with this method, tablet method shall only be used when scrupulous cleanliness has been exercised. Place tablets in each section of pipe in sufficient number to produce a dose of 25 mg/l. Refer to Table 3 of AWWA C651 for the required minimum number of tablets (2 tablets for 6" and 3 for 8" pipe in 20' joints). All tablets within the main must be attached at the top of the pipe with an adhesive appropriate for potable water. Tablets shall also be placed on all hydrants. Introduce water into the pipeline at a rate no greater than 1 ft./sec. and retain the water in the pipeline for a period of 24 hours. The minimum residual shall be 5 mg/l throughout the line.
- G. Final Flushing: After the required retention period, flush all heavily chlorinated water from the main until the chlorine concentration is no higher than that prevailing in the system, or less than 1 mg/l. When the tablet method has been used, provide a flushing velocity equal to that of the preliminary flushing specified above.
- H. Disposal of Super Chlorinated Waters: All flushing of chlorinated water shall be completed in conformance with CDPHE guidance and in a manner that protects with environment and all property and improvements.
- I. Bacteriologic Tests: After completion of the final flushing and prior to placing the pipeline in service, collect samples from the end of the line and test for bacteriologic quality to show the absence of coliform organisms. The number and frequency of samples shall conform to the requirements of the public health authority having jurisdiction but in no case shall the number be less than one for chlorinated supplies and two collected 24 hours apart for unchlorinated supplies. Collect samples in sterile bottles from a standard corporation stop installed in the main. Do not collect samples using a hose or fire hydrant. Sterilize the corporation stop prior to sampling.
- J. Repetition of Procedure: If the original disinfection fails to produce satisfactory samples, repeat the disinfection procedure until satisfactory results are obtained.
- K. Disinfecting Existing Mains: The procedure outlined in this section apply primarily when existing mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and may not require disinfection as long as the repair parts and the pipe which will be covered are swabbed with chlorine immediately prior to connection.

When an old line is opened, either by accident or by design, the excavation is likely to be wet and could be contaminated. Liberal quantities of hypochlorite applied to open trench areas will lessen

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the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

The following procedure is considered as a minimum that may be used.

- i. Swabbing with Hypochlorite Solution - The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) and the open section of the existing line shall be swabbed with a 5% hypochlorite solution before they are installed.
- ii. Flushing - Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated and the water being discharged has a comparable chlorine residual to the water in the distribution system.

Where practicable, in addition to the above procedures a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described for new lines, except that the dose may be increased to as much as 500 mg/l, and the contact time reduced to as little as 1/2 hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated, and chlorine concentration is equal to that in the system.

Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures can be determined. If the direction of flow is unknown, samples shall be taken on each side of the main break.



Dedicated to protecting and improving the health and environment of the people of Colorado

Low Risk Discharge Guidance
Discharges of Potable Water
January 15, 2016

Scope and Purpose of Modification

This revised guidance document is effective January 15, 2016. In addition to editorial revisions, the following substantive modifications were made:

- Added definitions.
- Clarified the limitations on discharges for which this guidance is applicable, including what is included in a “potable water distribution system.”
- Clarified that certain discharges associated with “super-chlorinated” water may be allowed under this guidance when the criteria and conditions are met.
- Added conditions allowing for the use of chemical dechlorination.
- Clarified the requirements and practices for preventing erosion.
- Identified an allowable concentration for residual chlorine in discharges to classified surface waters, consistent with 5 CCR 1002-31, The Basic Standards and Methodologies for Surface Water.

Changes related to potable water distribution systems were made in response to comments received on the draft permit COG604000 General Permit for Discharges from Hydrostatic Testing of Pipelines, Tanks, and Similar Vessels. The final permit was issued on November 23, 2015 and is effective on April 1, 2016. Summaries of the comments and the division’s responses are included in the fact sheet for the final permit. In the final permit, the division excluded discharges of potable water from potable water distribution systems and reaffirmed that these discharges are more appropriately covered in accordance with WQP-27, Low Risk Discharges Policy, as an alternative to general permit coverage. The division determined that clarifications should be made to this guidance regarding the issues raised during the general permit renewal process and aligned the timeline of this update with the timeline for issuance of the final permit.

In regard to clarifications regarding what is included in a potable water distribution system, the division found that discharges associated with testing of new lines were consistent with scope of the guidance as long as the construction and installation methods did not render the water non-potable. Clarity was added to this guidance since construction contractors had previously applied and obtained authorization for the discharge of water, including potable water, associated with the installation and testing of new lines, under the COG604000 General Permit.

In regard to super-chlorinated water, the division determined that the super-chlorination of water in potable water distribution systems does not render the water non-potable, and that control measures for dechlorination of superchlorinated water are highly effective and widely available. Since comments on the COG604000 General Permit requested clarification regarding whether permit coverage under the general permit would be available for superchlorinated discharges, and since in response to other

comments the division excluded all discharges from potable water systems from the COG604000 General permit, the division is clarifying in this modification to the guidance document that certain discharges associated with super-chlorinated water may be allowed under this guidance.

Background and Discussion

This discharge policy guidance has been developed in accordance with WQP-27, Low Risk Discharges Policy. This guidance is only applicable to discharges meeting the low risk discharge criteria and conditions identified below. **Refer to the Alternative Disposal Options section at the end of this document for additional information for discharges that do not meet the criteria and conditions of this guidance.**

When the provisions of this guidance are met, the division will not actively pursue permitting or enforcement for the discharge of potable water, unless on a case-by-case basis the division finds that a discharge has resulted in an adverse impact to the quality of any state waters receiving the discharge.

Discharges of potable water are a type of industrial activity with short term, infrequent discharges that with proper management are not expected to contain pollutants in concentrations that are toxic or that would cause or contribute to a violation of a water quality standard. The typical pollutant of concern is total residual chlorine, however, depending on how the discharge occurs, total suspended solids and oil and grease may become pollutants of concern. These pollutants can be handled using dechlorination techniques, filters, oil booms, and other control measures.

There are a large number of discharges of potable water. For example, approximately 2,000 public water systems are subject to the Colorado Primary Drinking Water Regulations (5 CCR 1002-11). There are additional public and private systems that distribute water intended for human consumption which are not subject to 5 CCR 1002-11. These systems operate potable water distribution systems that generate the types of discharges covered by this guidance. From October 2001 through December 2008, the division had a general permit in place, the Treated Water Distribution Permit (COG380000), to authorize discharges from potable water distribution systems. During the seven years permit coverage was available, 35 systems applied for and obtained permit coverage, a small number relative to the number of systems expected to discharge. The division established the Low Risk Discharge Policy in June 2008 to provide an alternative to general permit coverage for low risk discharges. The division issued the first low risk discharge guidance for potable water discharges in January 2009, which aligned with the timeline for termination of the COG380000 general permit. The division finds that these types of discharges may occur at all times of the year, and require a resource intensive effort to permit, without resulting in a clear general benefit to environmental quality due to the low risk nature of the discharge.

The criteria provided in this guidance must be met, and all of these conditions must be followed, by anyone claiming to discharge under this low risk guidance.

The following are examples of common discharges that **do not meet** the criteria for discharging under this guidance. Discharges that do not meet the criteria for coverage under this guidance shall otherwise be disposed of properly, which may include sending to the sanitary sewer with permission of the local wastewater treatment facility or treating and discharging under a CDPS discharge permit (see the Alternative Disposal Options section at the end of this document).

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- Discharges associated with installing or repairing pipe, fittings, and appurtenances for distribution of potable water and for which the discharge water would not meet the definition of potable water are not covered by this guidance. For example, the following would not be covered under this guidance:

discharges from cleaning debris and foreign materials from new sections of pipe which have pollutant concentrations making the water unsuitable for human consumption in accordance with Colorado Primary Drinking Water Regulations (5 CCR 1002-11).

- Discharges from cleaning or maintaining components at a construction or utility yard are not covered by this guidance.
- Discharges from a distribution system, tank or storage facility that is used for conveyance or storage of materials other than potable water are not covered under this guidance.

Criteria, Conditions, and Control Measures

➤ Definitions

- ❖ **Backflow Prevention Assembly or Device:** means any mechanical assembly or device installed at a water service line or at a plumbing fixture to prevent a backflow contamination event, provided that the mechanical assembly is appropriate for the identified contaminant at the cross connection and is an in-line field-testable assembly.
- ❖ **Classified State Surface Water:** is a surface water with a classification in the Classification and Numeric Standards Regulation for each of the seven river basins in Colorado. Classifications for each segment within the river basin can be found in the numeric and standards table for each basin regulation.
- ❖ **Control measures:** are any best management practice or other method used to prevent or reduce the discharge of pollutants to waters of the state.
- ❖ **Potable Water:** means water suitable for human consumption in accordance with Colorado Primary Drinking Water Regulations (5 CCR 1002-11), or water intended for human consumption from a public or private supply system not subject to 5 CCR 1002-11.

➤ Low Risk Discharge Criteria

This guidance is applicable to point source discharges that meet the following criteria and that meet the conditions listed in the next section. See the Alternative Disposal Options section for guidance on addressing water not meeting these criteria.

- ❖ The discharge shall be of potable water from a potable water distribution system, including tanks and storage facilities that are part of that system. This includes lines supplying potable source water to other systems, not separated by a backflow preventer, where free mixing with the potable system occurs (e.g. fire suppression lines, irrigation lines, etc.). A system has been “maintained for potable water distribution use” when it will be or is currently delivering or storing potable water (i.e. existing systems).

➤ Conditions

The following conditions must be followed by anyone discharging potable water. See the Alternative Disposal Options section for guidance on addressing water not meeting these conditions.

- ❖ **Exclusion of Process Discharges:** With the exception of hydrostatic testing of potable water distribution systems, the potable water shall not be used in any additional processes. Processes include, but are not limited to, any type of washing, heat exchange, manufacturing, or hydrostatic testing of pipelines not associated with treated water distribution systems.

- ❖ **Requirement for Removal of Chlorine:** If the discharge is directly to a state surface water (any stream, creek, gully, whether dry or flowing), it must not contain any residual chlorine in excess of 0.011 mg/L. The operator is responsible for determining what is necessary for removing chlorine from the discharge. If the discharge is to a ditch, chlorine content may be limited by the owner of the ditch. However, if the ditch returns flow to classified state surface waters, it must not contain residual chlorine in excess of 0.011 mg/L at the point where it discharges to the classified state surface water. It is recommended that if an operator is unsure of the status of the receiving water for a discharge in accordance with this guidance, that they assume a receiving water is a classified state surface water and therefore subject to the 0.011 mg/L chlorine limitation.

- ❖ **Exclusion of Discharges with Cleaning Materials and Added Chemicals:** The addition of cleaning materials or chemicals to the potable water source water or discharge is not allowed under this guidance, except for additional chlorine and dechlorination chemicals meeting the conditions below.
 - Additional chlorine may be added to the potable water source for the purposes of maintaining the potable water distribution system, including the use of super-chlorinated water. Special attention should be paid to the selection and use of control measures implemented for dechlorinating superchlorinated waters.
 - Dechlorination chemicals may be added to the discharge for the purposes of removing residual chlorine and in accordance with the manufacturer's label.

- ❖ **Controlling Erosions:** The discharge shall not cause erosion of a land surface that could cause pollution of the receiving water. Signs of visible erosion that have the potential to cause pollution without downstream controls measures implemented include the formation of rills or gullies on the land surface. Energy dissipation devices designed to protect downstream areas from erosion by reducing velocity of flow (such as hose attachments and erosion controls), may be necessary to prevent erosion.

- ❖ **Limiting Solids in Discharge:** The discharge shall not contain solid materials in concentrations that can settle to form bottom deposits detrimental to the beneficial uses of the state waters or form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses.

- ❖ **Additional Requirements and Property Rights:**
 - All discharges must comply with the lawful requirements of federal agencies, municipalities, counties, drainage districts, ditch owners, and other local agencies regarding any discharges to storm drain systems, conveyances, ditches or other water courses under their jurisdiction.
 - The guidance included in this document in no way reduces the existing authority of the owner of a storm sewer, ditch owner, or other local agency, from prohibiting or placing additional conditions on the discharge.

➤ **Implementation of Control Measures**

Control measures should be implemented as necessary to meet the conditions above, by anyone discharging in accordance with this guidance. The following control measures have been developed by the division to help ensure that the discharge will not negatively affect water quality. When implementing control measures to meet the criteria and conditions of this guidance may not be practical, see the Alternative Disposal Options section for additional solutions.

- ❖ **Discharges to the Ground:** For discharge to the ground, the water should not cause any toxicity to vegetation. When discharging, allow the water to drain slowly so that it soaks into the ground as much as possible.

- ❖ **Chlorine:**
 - **Discharge to the Ground instead of Dechlorination:** The conditions for removing chlorine are not applicable when a discharge is to the ground and does not result in water reaching a state surface water. This option should be considered as an alternative to dechlorination.
 - **Dechlorination:** Potable water is expected to contain chlorine at concentrations greater than the 0.011 mg/L chlorine limitation, and therefore removal of residual chlorine must be done for any direct discharge to state surface waters, or for any discharge to a storm sewer or conveyance where the chlorine will not dissipate to below the 0.011 mg/L limitation prior to reaching a state surface water. Dechlorination, if necessary, may be achieved by allowing water to stand uncovered until no chlorine is detected; ensuring dechlorination occurs between the location it is released from the potable water system but prior to reaching the classified state surface water; or by using a portable dechlorinator.
 - **Additional Control Measures for Chemical Dechlorination:** Many portable dechlorinators rely on the addition of chemicals to remove chlorine from the discharge. All chemical additions must be in accordance with the manufacturer's specifications. When using chemicals in the dechlorination process, the operator must ensure the following: that proper quantities and rates are used, based on the concentration of chlorine; that adequate mixing occurs; and that enough time is allowed prior to flow reaching a surface water for the dechlorination chemicals to react with the chlorine in the water. In cases where the discharge of water that had been super-chlorinated will occur, operators should allow additional time for the chlorine to dissipate.
 - **Determining if Chlorine Concentration is below 0.011 mg/L:** It is the operators' responsibility to ensure that adequate processes are followed to meet the 0.011 mg/L chlorine limitation prior to discharge to a classified state surface water. It is not required that an EPA approved test method be used to make this determination.
 - **Discharge Testing:** There are a variety of methods to test for chlorine in the field, but the operator should ensure that the method selected is capable of detecting total residual chlorine down to the 0.011 mg/L limitation. For many methods, it will be necessary to have a test result indicating no (0 mg/L) residual chlorine to ensure that this limitation is met. A common and affordable test method is using a "color-wheel test kit" available from a variety of suppliers of chemical testing/analysis equipment. It is highly recommended that analysis occur for all superchlorinated discharges.
 - **Discharging without Testing:** In some cases, it may be possible for an operator to make a determination that the chlorine concentration in a discharge is below 0.011 mg/L without analysis. This may be based on a determination that the given hold time or travel time to a classified state water, based on other discharge-specific variables, will adequately reduce chlorine levels to result in the chlorine limitation

being met. It is the operator's responsibility to ensure they understand the variables associated with a specific discharge to ensure that the chlorine limitation has been met.

- ❖ **Pollutants Picked Up After Release:** The discharge should be conducted to minimize the potential to pick up additional pollutants following release from the potable water distribution systems and prior to discharge to a water of the state.
 - The discharge should be conducted to minimize the potential to pick up additional suspended solids and to control erosion. It is understood that minimal suspension of sediment is inherent to any water running across soils. However potential water quality impacts should be minimized through practices such as diffusing flows and avoiding flows across bare soils.
 - The discharge should be conducted to minimize the potential that it will contact petroleum products/waste, and avoid picking up any oil and grease. When possible, an absorbent oil pad, boom or similar device should be used to eliminate oil from the discharge. A visible sheen must not be evident in the discharge.

- ❖ **Preparing and Installing Components:** When installing new pipe, fittings and appurtenances into a potable water distribution system, the components should be prepared and maintained in a way to minimize the potential for contribution of pollutants to discharges covered under this guidance.
 - All pipe, fittings, and other appurtenances associated with the discharge should meet industry standards for cleanliness for a public water. Examples of standard operating procedures include, but are not limited to, those found in ANSI/AWWA Standard C600-10, (*Installation of Ductile-Iron Mains and Their Appurtenances*), or any other applicable standard operating procedures that reflect industry standards of cleanliness. When it is necessary to remove debris, foreign material or other gross contamination from components prior to installation, wastewater generated from such activities may not be covered under this guidance. Such activity should occur at a location that allows for generated wastewater to be sent to the sanitary sewer with permission of the local wastewater treatment facility. Such wastewater could also be otherwise collected and disposed of.
 - Practices should be implemented during transport, storage, installation, and maintenance to minimize introduction of contaminants to pipe, fittings, and other appurtenances that could contribute pollutants to discharges.

- ❖ **Removing Pollutants:** Control measures for filtering or settling suspended solids and other debris should be used to remove solids or other debris that have either been picked up after discharge or that originated from within the potable water system. Examples of suspended solid removal practices include but are not limited to, check dams and filter bags. As a final measure downstream from additional control measures, inlet protection can be used to provide some additional removal and to allow for redundancy. Pollutant removal control measures should be used and maintained in accordance with the manufacturers' specifications.

Alternative Disposal Options

Water that does not meet the criteria of this guidance or that cannot be discharged in a manner that meets the conditions of this guidance must be either authorized by a CDPS discharge permit issued by the division, or disposed of through an alternative means. Because the water sources addressed in this guidance are not covered by an existing general permit, it is expected that obtaining a CDPS permit will not be a practical solution for most discharges.

DIVISION 2

SITE WORK – WATER SYSTEM CONSTRUCTION

Water not meeting the criteria and conditions of this guidance may be sent to the sanitary sewer with permission of the local wastewater treatment facility or otherwise collected and disposed. If discharge is to the sanitary sewer, contact the local wastewater treatment facility prior to discharge. System owners may grant blanket authorization to discharge to their systems. This must be done to ensure that the facility is able to accept the discharge. Not all facilities are able to accept such discharges. Note that additional restrictions or local guidelines may apply.

If the waste is collected for disposal, it may be hauled off site for disposal at a facility that is authorized to discharge the water through an existing CDPS permit or in accordance with disposal requirements administered through the Colorado Hazardous Materials and Waste Management Division.

Alternatively the water may be land applied in a way that results in complete evapotranspiration. This will likely only be an option when the quantities of water are small.

DIVISION 2 – SITE WORK

SECTION 02722 – SEWER SYSTEM - MINIMUM DESIGN STANDARDS

1. PLAN APPROVAL

In addition to the requirements for plan approval in the General Requirements, the plans shall clearly show the lots and blocks to be served and the location of the sanitary sewer mains with reference to property lines. All service wyes shall be stationed for proper control and for future location. Profiles shall give dimensions, grade, rim elevations, and invert elevations into and out of the manholes of the sewer to be constructed. The plan view shall include topographic information with at least 2 foot contours for all lots in the service area.

2. DESIGN FLOW

2.01. The design shall include consideration for providing service to the entire area tributary to the outfall point. Estimates of residential sewage contribution shall be based on 100 gallons per capita per day with a peak hour factor of 3. Minimum residential population density shall be figured on a basis of 3.5 persons per house, structure density based on the zone, and 70 percent of total land area developed as residential unless otherwise zoned, subdivided, or restricted.

Commented [c1]: Added new criteria as an option

2.02. Institutional, commercial, and industrial sewage contribution estimates shall be based on the design criteria set by the Colorado Department of Public Health and Environment (CDPHE) with review by the Town. Allowance shall be made for infiltration flow of 50 gallons per day per inch diameter per mile of pipe. Design flow shall be the sum of the peak flow as computed above and the flow due to infiltration as determined above or by actual field experience if worse.

Commented [c2]: Reduced from 250 to 50 to reflect change from clay pipe to pvc

2.03. Sewers 15 inches in diameter and smaller shall carry the peak design flow at a maximum flow depth of half the pipe diameter. Sewers larger than 15" in diameter may be designed to flow up to three quarters full at peak design flow rate. The minimum velocity at the design flow rate shall be 2.0 feet per second (fps). Where actual flow will be much below normal for several years the minimum velocity shall be achieved by suitable grades at the partial design flow.

3. PIPING DETAILS

3.01. Materials: Piping materials shall meet the requirements specified in the Standard Specifications for Sewer Collection System Construction. In most cases pipe shall be SDR 35 PVC. Use of materials other than PVC pipe shall be permitted only with prior approval of the Town.

3.02. Size: Normally sanitary sewer mains shall be 8 inch diameter or larger to facilitate maintenance. Service connections shall be 4 inch diameter or larger. Six (6) inch sewer mains may be installed under special conditions where only 3 or fewer residential connections will be made to the line, and where approved by the Town. Smaller force mains may be used under certain conditions with approval of the Town.

Commented [c3]: Added for clarity

3.03. Grades: The following minimum grades shall apply unless hydraulic (flow) requirements above supersede the grade criteria:

DIVISION 2

SITE WORK – SEWER MINIMUM STANDARDS

<u>Sewer Diameter</u>	<u>Minimum Grade (percent)</u>
4 inch	2.0 or 1/2 inch per foot
6 inch	1.00
8 inch and larger	0.50

3.04. Minimum Velocity: Pipes must be designed to flow at a minimum of 2 fps at design flows unless the Town approves a deviation which will only be considered under extreme circumstances.

3.05. Maximum Slope: Sewer shall be designed with slopes of less than 10%. If the ground profile is steeper than that, control the slope of the sewer with the use of adequately spaced drop manholes. Where velocities greater than 5 feet per second are attained, special provisions shall be made to keep the liquids from separating from the solids and to protect against displacement by erosion and shock.

3.06. Manhole Spacing and Design: Manholes shall be provided at every change in direction or grade, or connection with other sewer main; maximum spacing shall be 400 feet for lines 15 inches or smaller, and 450 feet for lines larger than 15 inches. A minimum of 0.10' foot drop shall be provided in manholes with a maximum change in direction of 45 degrees and 0.20 feet for changes in direction greater than 45 degrees. Sewer lines shall be straight and not curved between manholes in both line and grade. Manholes shall be stubbed out with suitable size pipe wherever future extension of the sewer is anticipated.

3.07. Flexible Joints near Manhole: Provide a flexible joint in the pipe 12 to 18 inches from all manhole walls and other solid structures.

3.08. Terminal Manhole: There shall be a terminal manhole at the end of all sewer lines, past the last sewer service.

3.09. Underdrains: Where underdrains are to be constructed with the sewer mains (or other locations), cleanouts or manholes shall be provided for the underdrain at each manhole or at 400 foot maximum intervals for the underdrain. Typically underdrains installed with sewer mains shall be placed to the side and below the sewer main

3.10. Drop Manhole: Drop manholes should be provided when the change in elevation through the manhole is in excess of 24 inches. Designs that require drop manholes, require Town authorization.

3.11. Depth of Bury: Minimum cover on sewer mains shall normally be seven foot to ground surface. Bury of 7 to 9 feet is considered normal. Depths outside this range will require specific approval of the Town.

4. LIFT STATIONS

The need for pumping facilities and the design of these facilities shall be discussed with the Town prior to beginning design. The use of lift stations is discouraged unless truly necessary. The Town reserves the right to dictate the location and type of pumping facilities to be constructed and to require extra maintenance services from the developer and/or to impose additional charges to the users.

5. INVERTED SIPHONS

The use of inverted siphons is discouraged especially in low flow and intermittent flow situations. If the Town does approve the use of a siphon system, the system shall have not less than 2 barrels, with a minimum pipe size of 6 inches and shall be provided with necessary appurtenances for convenient flushing and maintenance. The manholes shall have adequate clearances for jetting. In general, sufficient head

Commented [c4]: Previous version followed 10 State and CDPHE standard. Town has been strongly recommending 0.5% for more than a decade. Our experience is that if the slope is less than 0.5% the installation results in sags in the pipe that allows solids to settle and creates maintenance issues.

Commented [c5]: Reduced from 20 to 10% max and max velocity from 15 ft per sec to 5 fps to keep the solids flowing with the liquid, reducing maintenance issues

Commented [c6]: Eliminated the option for a terminal cleanout if a very short segments with less than 3 taps. The town needs access to the sewer above the last tap to be able to properly maintain the line.

Commented [c7]: There were previously a few rare circumstances where there could be a tap beyond the last manhole. Its much harder for the town to clean the line without a terminal manhole and even harder when there is an issue to determine if it's the main or the service.

Commented [c8]: New provision.

Commented [c9]: Change from 14' as a max to encourage 7-9 but allow for other depths based on site specific situations. The Town does not have equipment for greater depths.

Commented [c10]: Moved from the construction stds as it's a design criteria

Commented [c11]: Moved from the construction stds as it's a design criteria

shall be provided with pipe sizes selected to secure velocities of at least 3.0 feet per second for average flows. The inlet and outlet details shall be arranged so that the normal flow is diverted to one barrel and so that either barrel may be out of service for cleaning.

6. SERVICE CONNECTIONS

6.01. Typically, the service line should not be any closer than five feet to the side property line, and no service line may be constructed through or in front of any adjoining property. Whenever possible, service lines shall be installed perpendicular to the main and shall be located 10 feet inside the downhill property line. Minimum fall on 6 inch sewer service lines shall be 1/8 inch (1%) per foot (2% preferred) and for 4 inch pipe 1/4 inch per foot (2%). Minimum cover of the sewer service shall be three (3) feet at the property line where there will be no basements.

6.02. Full body wyes shall be provided in the sewer main for service connections at each building site. Service lines shall be shown on the drawings in plan and profile. Tapping saddles will only be allowed with approval of the Town for circumstances which necessitate their use and not allowed for new construction. Fittings shall be angled upwards so that the upper invert of one-eighth bend connected to the fitting will have an elevation equal to or higher than the inside top of the sewer main. Service lines installed during main line construction shall extend through the front utility easement, have a cleanout out at the termination and be plugged with a water and air tight seal and marked with a 2 x 4 brought to grade and backed by a steel T post marked with the depth of the line. Riser connections shall be installed where the elevation of the top of the fitting is more than 12 feet below finished ground surface. See Standard Specifications and typical drawing for more detail on service stub-ins and connections.

6.03. Before a Contractor or property owner begins building a basement or any habitable structure below ground, the Owner or Contractor shall ensure that the level of the most adjacent sewer is 6 inches in elevation lower than the flood level of the lowest fixture or drain in said basement. This requirement will be waived if the Contractor or Owner installs a sewer lift station or an approved backflow prevention device.

6.04. Sewer mains shall be extended to a point at least 20 feet up from the lowest lot corner adjacent to the sewer main of the uppermost lot to be served and terminate in a manhole. Service connections will not be allowed to enter directly into a manholes except when the diameter of the service line is 50% or more of the main in which case a special manhole shall be added for that purpose. Only with the approval of the Town may service connections be allowed immediately above or below a manhole.

7. CONSTRUCTION

7.01. In general construction shall conform with the Standard Specifications for Sewer System Construction as well as with the Excavation, Backfill, and Compaction, Specifications (Section 02200). Select bedding shall extend from 6 inches below the pipe barrel to springline (half way up the pipe). Compaction in this region is critical to support the pipe and must be 95% Standard Proctor. The first one foot of backfill over the pipe shall be hand placed, hand compacted, select material as defined in the Excavation and Backfill Specifications. For gravity sewer line construction, a single size screen rock between ¾" and 1-1/2" shall be used as select bedding. Place a non-woven geotextile on top of the screened rock or wrap the entire pipe zone in a geotextile wrap.

7.02. In places where the sewer has less than four feet of cover, provisions shall be made to protect pipe from impact loading. If very shallow insulation may be required.

Commented [c12]: Moved from the construction stds as it's a design criteria.

- 7.03.** An approved cut-off wall shall be constructed on the lower side of crossings such as under open ditches, canals, or creeks, to prevent water from following the sewer trench.
- 7.04.** Where design velocities exceed 5 fps, special provisions shall be made to protect against pipe displacement by shock and/or erosion.
- 7.05.** Underdrains, where required, shall be formed by creating a non-woven geotextile wrap around screened bedding around the sewer pipe and underdrain. See Sewer / Seep trench typical drawing.

8. PROTECTION OF WATER SUPPLIES

- 8.01.** There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any sewage, non-potable, or polluted water into the potable supply directly or through contamination of the surrounding soils.
- 8.02.** Whenever possible, sewer mains and service lines should be laid at least 10 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a horizontal separation of 10 feet, a sewer may be laid closer than 10 feet to a water main if it is laid in a separate trench, or it is laid in the same trench with the water mains located at one side on a bench of undisturbed earth with at least five feet of horizontal separation.
- 8.03.** Unless there is at least 10 feet horizontal separation, the elevation of the crown of the sewer must be at least 18 inches below the invert of the water main or the sewer line encased.
- 8.04.** Whenever sewer must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of a sewer cannot be buried to meet the above requirement, the water main may be relocated to provide this separation or the sewer pipe shall be encased by either a single joint of PVC or HDPE pipe for a distance of 10 feet on each side of the water. When possible, one full length of water main shall be centered over the sewer so that both joints will be as far from the sewer as possible. When it is impractical to encase the sewer, the water line shall be encased with the same criteria above.
- 8.05.** When sewer lines or services cross above water mains or services, the water mains must be protected at a minimum by the criteria above. In such cases, there shall be no joints within ten feet on each side of the water line. In all cases where the sewer line is above the water, a casing shall be required and the ends of the casing shall be sealed in a watertight manner with a reducing no-hub gasket or other approved method. Both lines should be pressure tested to assure water tightness.
- 8.06.** There shall be a minimum clear distance vertically of 8" between the uppermost part of the lower utility and the lowermost part of the upper utility including casings to allow for proper bedding. In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of any of the pipes.
- 8.07.** The Town shall have final review authority of all proposed designs which do not provide adequate separation. These requirements for protection of the water system against contamination from non-potable water conveyances shall apply equally to water mains and service connections.

Commented [c13]: Moved from the construction stds as it's a design requirement

9. MISCELLANEOUS REQUIREMENTS

9.01. Rain water leaders, roof drains, surface drains, or ground water drains shall not be connected to the sanitary sewer. Each sanitary sewer service system shall be separate from the drainage system.

9.02. Grease and sand traps shall be installed where required by the provisions of the Ridgway Municipal Code and/or the International Plumbing Code.

10. TESTING

Testing of sewer lines and services, manholes and appurtenances shall conform with the requirements of the applicable portions of the Sewer System Construction (Section 02723) regarding lapping, vacuum, in- & exfiltration, and pressure testing.

DIVISION 2 – SITE WORK

SECTION 02733 - SEWER SYSTEM CONSTRUCTION

1. GENERAL

1.01. Related Work Specified Elsewhere

Section 02220 - Excavation, Backfill and Compaction
Section 02713 – Water System Construction
Section 02722- Minimum Design Standards – Sewer Collection System

1.02. Description

Work specified in this Section includes furnishing, installing, and testing of sewer mains, service lines, temporary services, drain and seep lines, manholes, valves, fittings, cleanouts, appurtenances, and manholes, and testing requirements for sewage and seep piping systems.

Sewers shall be constructed of such size and laid to such grades as approved by the Town. The Town must be notified in accordance with the General Requirements of when pipe will be laid. No pipe shall be laid or covered until it has been inspected by the Town.

Pressure sewer lines shall conform with applicable sections of these specifications and with the sections of Water Line Standard Specifications as they apply to installation and testing of piping lines under pressure.

1.03. Certificates of Compliance

Certificate of Compliance shall be submitted to the Town stating all pipe and materials furnished under these specifications do in fact comply with all referenced specifications.

1.04. Referenced Standards

- A. Uni-Bell PVC Pipe Association - Recommended Practice for the Installation of Polyvinyl Chloride Sewer Pipe (UNI-B-5) latest revision
- B. Uni-Bell PVC Pipe Association - Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe (UNI-B-6) latest revision
- C. C478 Standard Specifications for Precast Reinforced Concrete Manhole Sections

2. PRODUCTS

2.01. Pipe Materials

All materials shall be new, and of the best standard quality available for the purpose intended. Where materials are specified by brand names, materials of equal quality may be substituted if the Contractor submits adequate technical and descriptive data and secures the approval of the Town. The Town or its designated representative shall be the sole judge of the suitability and acceptance of materials. The Town in some instances may insist on a particular brand or model (to match materials in use) to minimize the parts inventory and/or O and M requirements.

Commented [c1]: Added drain and seep lines to what is covered by this standard

Commented [c2]: Consolidated notification requirements for all types of work in the General requirements.

Commented [c3]: Added generic description

DIVISION 2

SITE WORK – SEWER SYSTEM CONSTRUCTION

A. Polyvinyl Chloride (PVC) Pipe

Conformance	SDR 35, 3034 PVC sewer or heavier walled
Pressure Rating	Gravity, open channel flow
Joints **	Unibell bell and spigot, elastomeric gasket
Service	Gravity sewer lines, sewer service lines
Maximum Warp	1/32 inches per foot
Fittings	Schedule 40 or Schedule 80 PVC
Conformance	ASTM 1785 or AWWA C900
Pressure Rating	150 psi working pressure
Joints **	Unibell bell and spigot, elastomeric gasket
Fittings	AWWA C151/A21.51
Service	Pressure sewer lines
Conformance	Schedule 40 PVC
Pressure Rating	150 psi working pressure
Joints **	Solvent weld conforming to ASTM D-2564 & D-2855 (Specifications and Recommended practices for Solvent-Cemented Joints with PVC pipe)
Fittings	Schedule 40 - solvent cemented per ASTM D-2564
Service	Force mains less than 3" in diameter only

Commented [c4]: Added spec for fittings.

B. Ductile Iron Pipe and Fittings

Conformance	AWWA C151/A21.51
Class	Class 50
Lining	Cement Mortar, or epoxy
Coating	Polyethylene wrap tubes, tape seal ends
Pressure Rating	100 psi working pressure
Joints **	Push on, Super Bell-tite

** Joints shall be approved by the Town prior to purchasing the pipe and fittings.

C. High Density Polyethylene (HDPE) Pipe Perforated

Conformance	4-10" AASHTO M252, ASTM F2648; 12" - 60" AASHTO AASHTO M294, ASTM F2648 and F2306 Perforated
Joints	Bell and Spigot
Service	Seep line

Commented [c5]: Took out clay pipe and added HDPE

D. High Density Polyethylene (HDPE) Pipe

Conformance	AWWA C906, DI or IPS
Thickness	DR 11
Pressure Rating	200 PSI operating pressure
Joints	Butt fusion, Heat welded
Fittings	200 psi, HDPE butt fused, heat welded when available or Ductile Iron AWWA C153 or C110, 250 psi,
Restraints	Concrete & Megalug 2000 series or equal for DI MJ fittings
Service	Only where shown on the plans or specifically approved by the Town. If allowed, HDPE will need to meet same ID as the specified pipe
Service Connections	Electofusion tapping saddle or tee

DIVISION 2

SITE WORK – SEWER SYSTEM CONSTRUCTION

- E. Steel Casing Pipe
 - Service Buried Pipe Encasement
 - Conformance AWWA C200
 - Min. Yield Strength 35,000 psi
 - Pipe Wall Smooth inside, min wall thickness 3/8"
 - Exterior Coatings Cold tar epoxy coating (16 mil minimum) exterior,
 - Interior Coating Bituminous asphalt meeting ANSI-A21.4 or epoxy coating
 - Joints Welded, smooth interior
 - Carrier Pipe Support Redwood slats per typical drawing or ENGR approved casing spacers using twice the manufacturer recommended number of spacers

Commented [c6]: Added option of a steel pipe for casing.

- F. Cleanout: Materials for cleanouts shall conform to requirements listed on the typical drawing for gravity and pressure cleanouts

- G. Sewer Service Saddles: On new lines and in most cases on existing lines, full bodied PVC SDR 3034 wyes are required. Under unusual circumstances, where approved by the Town for use due to special conditions on existing lines such as having too much flow to be cut for installation of the full bodied wye, an elastomeric wye shaped saddle strapped to the main with an adjustable screw tightened stainless steel hose clamp that provides a water tight seal against the main may be authorized. Use of a saddle will be evaluated on a case by case basis by the Town.

Commented [c7]: Modified to match what has been required by the typical drawing.

Commented [c8]: Added provision for unusual circumstances

2.02. Manhole Materials

- A. Bases, Inverts, and Cones
 - Material Precast Concrete
 - Conformance ASTM C-478, 5" minimum wall thickness in State Highway Right of Way conform with State Specs
 - Cement Type I/II sulfate resistant
 - Concrete 4000 psi w/reinforcement per ASTM C-478
 - Joints Watertight flexible gasket

Manholes shall have integral base and barrel section with pipe openings equipped with boots installed into the manhole during fabrication. Unless otherwise specifically approved, precast bases will be required even on existing lines and even if that requires pumping around an existing section of main during construction. Manholes shall have precast invert and the opening shall flared at springline and that at the top of the pipe shall be at least 50% wider than the largest pipe diameter in the manhole. The bench outside the invert shall slope upward from the springline of the pipe to the wall of the manhole at not less than 1" per foot and no more than 2" per foot. All inverts must have a smooth invert, sufficiently smooth to not tear a thin latex glove run across the surface, or snag solids, and without any lip between the pipes and the concrete. Use of water as a finishing aid is prohibited. Changes in direction of flow through the manhole shall be made with a smooth curved channel having as large a radius as possible. The change in size of channels shall be made gradually and evenly and shall be formed directly in the concrete. Imperfections in the precast concrete manhole base or sections shall be reviewed by Town prior to repair. If the damage looks sufficient to compromise the structural integrity or other key performance criteria, the precast concrete may be rejected by the Town.

Commented [c9]: added requirement for integral base. That helps reduce infiltration and makes it easier to pass the vacuum test. In practice almost all manholes have had an integral base for decades.

- B. Markings: Manholes shall be clearly marked with the information specified for product marking in ASTM C478

C. Frame and Covers

Where approved by the Town, in non-traffic areas, the manhole frame and cover may be cast from an alloy of aluminum with physical properties exhibiting strength comparable to cast iron. The cover shall weigh about 60 pounds and the total assembly about 150 pounds. In traffic areas, except where noted on the plans, cast iron covers will be required. The assembly shall have a clear opening of 24 inches. For applications with pipes under pressure and where specified or shown on plans, frost free lids shall be furnished.

A good fit is required between the frame and cover to prevent rattling in traffic and leakage of dirt and water. To ensure good fit, the seat in the frame on which the cover rests and the matching face of the cover shall be machined. Provisions for opening the manhole shall consist of a pickhole or notch along the edge of the cover. Aluminum lids shall have a locking nut to secure them in place. Other means of opening the manhole shall be approved by the Town before the material is purchased.

D. Manhole Steps: Epoxy coated cast iron, plastic or other approved corrosion resistant steps shall be built into each manhole. The steps shall be at least 9 inches wide and shall protrude approximately 5 inches from the wall of the manhole, and shall be held in the wall by at least 4 inches of bar on each side. The steps shall be designed to provide an edge that will prevent the foot from slipping off the side of the step. Standard manufactured manhole steps shall be used. Reinforcing steel or other steel bars and material bent to form a step will not be permitted. Steps shall be spaced evenly at 12 inch intervals with each step being directly below the next. Spacing from the rim to the first step shall be as shown on the manhole typical drawing.

Commented [c10]: Deleted aluminum as an option. Have not seen those available in years.

E. Non-Shrink Grout: Commercial factory-mixed product made especially for intended use, including for a highly corrosive environment and providing a long-term watertight seal. Material shall be submitted for review and approval by the Town.

Commented [c11]: Added additional info about what is wanted.

F. Butyl Rubber Flexible Gasket Material

Type Preformed flexible rubber gasket
 Conformance Fed. Spec. SS-S210-A, Ram-Nek or approved equal.

Commented [c12]: Changed from plastic gasket which is for a joint and is not readily available.

G. Pipe Connections: Flexible pipe to manhole connectors complying with ASTM C923 shall be provided for all pipes that enter or exit the manhole to insure a water tight seal. Boot shall consist of EPDM and elastomers design to be resistant to ozone, weather elements, chemicals including acids, alkalis, and all fats. Hose clamps to fasten the boot must be at least 304 stainless steel.

H. Geotextile: Geotextile used for separation between graded rock and other backfill materials with any fines shall be a needle punched, non-woven 12 oz minimum such as Mirafi 1120 or approved equal.

2.03. Tracer Wire and Marking Tape

Tracer wire shall be insulated 10 gauge with green insulation for sewer lines. Tracer wire shall be fastened to all buried non-metallic pipes including service lines and shall be fastened to and looped to the surface on the outside of each manhole and cleanout, and cross through the grout of the frame and cover. Service line wire and any breaks in wire shall be connected by watertight connections.

Marking (warning) tape at least 6" wide labeled "sewer" shall be placed 12" above pipes of all materials.

Commented [c13]: Several of these have been on the typical drawings but have details added here.

3. EXECUTION

3.01. Handling and Storage

Exercise proper precautions in unloading, handling, stockpiling, and installation in order to prevent damage to materials and to insure delivery and installation in a sound and acceptable condition. Special care shall be taken to protect the plastic on the spigot ends from any contact with the earth.

Commented [c14]: This section has been reorganized to better follow the installation process.

Remove any broken or damaged materials from the construction site and do not use in any portion of the construction. Any damaged, broken, or otherwise defective materials which are included in the construction shall be removed and replaced by the Contractor at his expense. Handle pipe using wide slings; the use of hooks or other equipment which could damage pipe will not be permitted. During pipe handling, protect against impact shocks and fall.

3.02. Underground Obstructions

The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined. Hand excavation shall be used where necessary. If required, the Contractor will excavate and locate existing utilities ahead of trench excavation in order that necessary grade changes or utility adjustments may be known ahead of time. The Contractor will be responsible for notifying all appropriate utilities such as gas, electric, telephone, cable, etc. when working in areas where there may be such utilities.

The Contractor shall preserve intact any underground utilities encountered during construction unless they interfere with new pipe lines or structures being installed. When underground utilities will interfere with proposed construction, notify the utility and the Town. Contractor shall make suitable arrangements to adjust the proposed construction. In case any such utilities or other structures are accidentally broken, they shall be immediately replaced in a condition at least equal to that in which they were found, at the Contractor's expense.

3.03. Excavation

Excavation and preparation of the trench bottom shall be in accordance with Excavation, Backfill, and Compaction Standard Specifications (Section 02200) as should all backfill and compaction.

Excavation for pipe shall generally be by open trenches unless otherwise specified, required on the plans, or approved by the Town. The trench shall be excavated using conventional methods. Methods other than standard cut and cover must receive prior approval of the Town. The banks of the trench shall be kept as nearly vertical as soil conditions will permit, but shall not exceed the angle of repose of the soil. The Responsible Party shall assume shoring will be needed. Boring and pipe bursting methods where specified or authorized must be approved in advance by the Town.

Excavation for manholes and other accessories to have 16 inch minimum clearance on all sides.

Commented [c15]: Increased from 12", in practice the width is typically more than even the 16".

Excavation shall not be carried below the required level. Excess excavation below required level shall be backfilled with structural gravels, or concrete, as appropriate for proper backfill and use, and shall be thoroughly tamped to achieve the density required in the pipe zone or manhole foundation as appropriate.

3.04. Alignment and Grade

Basic surveying and control and stationing will be provided by land surveyors retained by the Developer. Basic control shall be set with stakes, spikes, shiners, or crosses set at the surface and on an offset from the sewer line. Benchmarks shall be provided within 150 feet of each manhole and for grade and offset stakes on the ground at 150 ft intervals which the Contractor shall use to confirm his elevation while installing the pipe. The Contractor shall transfer line and grade from these control points to the construction work in a manner approved by the Town, with spot checks by the Town's representative. The preservation of stakes and other line and grade references is the responsibility of the Contractor.

Commented [c16]: Added to make sure problems with grades are caught early

Sewer lines and manholes shall be laid to within 0.1 feet horizontal and 0.02 feet vertical of design alignment and grade. Where design sewer grades are greater than 1.0% vertical tolerance can be increased to 0.03 feet.

Alignment of trenches shall be carefully controlled so that the pipe will be laid with adequate space for compaction of backfill between the pipe and trench walls. All excavation shall be of sufficient width to provide ample room for proper joining and compaction of pipe and fittings, typically 16" plus pipe OD. Minimum trench width shall be twelve (12) inches plus pipe OD assuming proper compaction can be provided. Maximum trench width will be restricted to pipe diameter plus two feet unless otherwise approved by the Town. If the maximum trench width is exceeded, provide special bedding, encasement, or higher strength pipe as approved by the Town.

Contractor shall furnish and utilize an in-pipe laser to assist in controlling the grade. Calibration of the laser shall be checked at least weekly by checking it over a 500 ft range on the ground. Note that the accuracy of the pipe laser can be adversely impacted by a number of factors including heat, strobe lights, and water in the pipe.

The laser shall be located in the trench bottom, manhole invert, or in the pipe unless otherwise approved by the Town. When the laser equipment is placed in the trench, it shall be positioned in such a manner that the laser will describe the center of the conduit. As each pipe section is installed, a special target or template shall be placed in the pipe's end and the vertical and horizontal alignment checked. The beam projected through the previously placed conduit sections shall also be used to provide line and grade for trench excavation and placement of bedding materials. The light beam shall be periodically checked against surface control points to insure its correct vertical and horizontal alignment. Reasonable care must be taken to ensure that the conduit line is properly ventilated.

3.05. Laying Sewer Pipe

Commented [c17]: Reorganized. Added some details.

A. Inspection: The pipe and accessories shall be carefully and thoroughly inspected for cracks and other damage before installation in the final position. Defective or unsound material, pipes with bells that are not full and continuous, pipe that does not meet the deflection tolerances for gravity pipe, shall be rejected. Rejected materials shall be promptly marked and removed from the job by the Contractor.

B. Installation Instructions

All installation work shall conform with applicable portions pipe manufacturer's installation instructions and recommendations, and with these specifications and referenced sections of the Standards. If there are conflicts, the more stringent specification shall apply unless otherwise directed by the Town.

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Pipe shall be laid and maintained to the required line and/or grade shown on the plans at the required locations with spigots centered in the bells. When new pipe is to be connected to an existing pipe or when crossing an existing pipe line, the Contractor shall excavate the existing lines well in advance of the laying of the new line to enable the Contractor and OR (Owner's representative) to verify the elevation and placement and allow for adjustments in grade and/or alignment of the new pipe line that may be required.

- C. **Potential Conflicts:** The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground infrastructure, both known and unknown, may be determined, and he/she shall be held responsible for the repair or replacement of such improvements when broken or otherwise damaged. Temporary support, adequate protection, and maintenance of all underground and surface utility structures, drains, sewers, and other structures encountered in the progress of the Work shall be furnished by the Contractor at his expense.
- D. **Lowering Pipe into Trench:** Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and convenient performance of the Work. All pipe, fittings, manholes and appurtenances shall be carefully lowered into the trench piece by piece by means of straps, or other suitable tools or equipment, in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall the pipe or accessories be dropped or dumped into the trench. Dropped or dumped pipe will be rejected. All water must be kept out of the pipe and bell hole until the joint is completed and no water shall be allowed to rise in or about the pipe until the trench has been filled at least one foot above the pipe. No length of pipe shall be laid until the previous length has had sufficient backfilling placed around it to hold it securely in place and prevent floating.
- E. **Keeping Pipe Clean:** Every effort shall be made to keep the interior of pipe and fittings clean during all phases of construction. Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the Contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work. Keep water level below the pipe. Trench water shall not be allowed to flow through the pipe. The interior of the pipe shall be thoroughly cleaned of foreign material before being lowered into the trench and shall be kept clean during operations by plugging or other approved means. End of the pipe shall be kept sealed with a tight-fitting plug until joining with the next joint of pipe when there is water in the trench. Fittings shall be thoroughly cleaned, with a wire brush, if necessary. If the pipe laying crew cannot keep pipe clean while placing the pipe in the trench, Town may require that the ends of the pipe be covered before placing it in the trench and that the covers only be removed as the joints are assembled. If the cleanliness of the line is still in question, Town may require the line be hydrojetted or swabbing and video inspected at contractor's expense to confirm that it is clean. Providing access to all sections which are required to be videoed, then cleaning and reassembling pipe, shall be the responsibility of the Contractor.
- F. **Laying and Joining Pipe**

Begin pipe laying at the lowest point, unless otherwise directed by the Town, and install the pipe with the spigot ends pointing in the direction of flow. A firm bed must be prepared for each pipe to the required depth true to line and grade with uniform bearing for the pipe barrel and the material hollowed out underneath the bell so that the body of the pipe shall be supported for its entire length upon the bed so prepared. Adjustments to line and grade shall be made by scraping

away or adding properly compacted bedding materials under the pipe and not by using wedges and blocks or beating or jumping on the pipe.

Lay all sewer pipes straight between changes in alignment and at uniform grade between manholes, unless directed otherwise by the Town. All pipe shall be carefully centered and with a smooth invert at the joint. The joint shall be made in a workmanlike manner and shall be watertight. Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be centered in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home (to the depth mark) by hand with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full design depth of the joint. The pipe shall then be properly set and brought to correct line and grade. Care shall be taken to ensure that no damage is done to the pipe, collar, or bell when the pipe is being homed. Use of excessive force will not be permitted. Any pipe that has had the grade or joint disturbed during or after laying shall be taken out and re-laid.

Prior to making a solvent weld joint, all water shall be removed from the trench and the pipe shall be clean and dry. Trench and pipe shall remain dry until welded joint has had time to cure. The length of the cure time shall be as stated on the welding solvent container as corrected for the temperature. The minimum curing time shall be 2 hours for the rapid set solvent.

Pipe lines shall be checked by the Contractor to determine whether any displacement or other damage has occurred after the trench has been backfilled approximately two feet above the pipe. If this check shows that the pipeline to be out of alignment, broken, or otherwise damaged, the defects shall be corrected by the Contractor before proceeding with other pipe laying. The Town may require lamping or other testing at this stage of backfill or may decide to only test the completely backfilled lines. It shall be the responsibility of the Contractor to check his work as he/she proceeds.

The pipe shall then be secured in place by installation of bedding material and backfill, in accordance with the plans, Pipe Bedding section below, and Excavation Backfill and Compaction Specifications (Section 02200) using permeable materials for gravity sewer. Place and secure tracer wire on the pipe prior to bedding. Place warning tape at the top of the pipe zone (12" above the pipe).

Where HDPE pipe is approved for use, it shall be installed in strict accordance with manufacturer's recommendation. All workers welding HDPE pipe must be trained and approved by the manufacturer for welding pipe of the size and DR being used on this project. At the beginning of welding each day, each worker who will be welding pipe shall demonstrate his qualifications by successfully completing a bend back test prior to welding any pipe for use on the project. All welds shall be full depth and shall have a uniform bead around the joint with no bead on the inside of the pipe.

If, in making any joint, previous lengths of pipe are disturbed, such lengths must be uncovered and re-laid. Any section of pipe, fittings, valves, or appurtenances already laid and found to be defective shall be taken out and replaced without additional expense to the Owner.

G. Crossing Existing Lines

Expose existing line ahead of laying sewer pipe to allow adjustments in line and grade as needed anticipating that considerable adjustment may be needed. Where gradual grade adjust of existing line will allow for the crossing an existing pressure line, that is the preferred option. Where there is significant elevation adjustment, it will be accomplished with 22.5° fittings on the pressure line. Place insulation where cover on pressure line is less than specified cover depths. Coordinate timing of the cut of the existing line with pipeline Owner, and provide required notice to affected customers. In cutting the existing pipe, take great care to prevent contamination of existing line. Keep water level in the trench below the level of the pipes. Make connection using required fittings and restrain all joints. Disinfect the line as called for Water Line Construction Standards (Section 02713). Cut off and remove all abandoned sections.

Where water service lines need to be raised or lowered to allow sewer lines to remain on grade and there is not sufficient slack to allow for adjustment, expose at least 5' of the existing service, squarely cut the existing water service line and install new copper pipe to gradually adjust the grade of the water service line and reconnect both end of the existing water service with appropriate couplings for the existing material and the copper. If soil conditions are adverse the copper piping with Town approval the use of pure core HDPE of the same inside diameter as the existing service line may be used.

- H. Cutting of Pipe: The pipe shall be cut in a neat and workmanlike manner in accordance with manufacturer recommendations. No damage shall be done to the pipe or any lining or coating and the cut shall leave a smooth end at right angles to the axis of the pipe. Flame cutting of iron pipe by means of an oxyacetylene torch shall NOT be allowed.
- I. Sequencing: The Contractor shall excavate in advance of pipe laying only a sufficient length to assure steady progress in the installation of pipe. No more than 150' of trench shall be open at a time unless specifically authorized by the Town. The length of open trench shall be limited where necessary to accommodate traffic, public safety, minimize service disruptions or as required by the Town and/or other entities with authority, in vicinity of the work being performed. All open trenches shall be appropriately barricaded. No more than 20 feet of trench securely barricaded may be left open overnight. Where the work includes removing old pipe and replacing with new pipe in the same location, temporary connection between what has been replaced and the old must be made at the end of each day. In addition to requirements elsewhere related to disruption of service, all existing sewer services shall be functional at the end of construction each day.

3.06. Pipe Bedding

The bottom of the trenches shall be accurately graded to provide uniform bearing and support throughout the full pipe length without placing stress on the pipe or allowing voids under the pipe. Excess loading of the bell will not be permitted under any circumstances. Dig bell holes and depressions for joints after trench bottom has been graded. Bell holes and depressions shall be only of such length, depth, and width as required to properly make the particular type of joint. The use of earth mounds for bedding the pipe will not be permitted.

Where existing pipes are being removed and replaced with new, remove the old saturated materials and replace with new.

All sharp stones, trash, and other materials which may damage the pipe or interfere with the proper bedding of the pipe and the placement and compaction of the backfill shall be removed from the trench.

Commented [c18]: New section. Added as we are having more conflicts and want to have a general procedure for handling them.

Commented [c19]: Reorganized. Added some details.

The soil in the bottom of the trench shall be slightly loose, and at optimum moisture, so that uniform bedding and compaction around the pipe is easily obtainable. Should any material be encountered which would prevent the obtaining of suitable bedding, e.g. rock, wet, unstable material, etc., the trench shall be over-excavated as shown on the typical drawing for pipe bedding. Backfill any over-excavation, required or inadvertent, with materials equivalent to, and compacted as specified for haunching materials according to these specifications. Bedding and materials in the pipe zone, shall conform with materials specified in Section 02200, Excavation Backfill and Compaction for Class D bedding for gravity pipe lines and Class C for pressure pipes. At the top of the pipe zone, install non-woven geotextile on top of the Class D fill materials and place the warning tape on top of geotextile.

3.07. Backfill and Compaction: Backfill and compaction shall be in accordance with the applicable sections of the Excavation, Backfill, and Compaction Standard Specifications.

3.08. Manhole Construction and Installation

Precast manhole bases with integral bottom barrels are required. The ground surface below the precast concrete base shall be excavated a minimum of six inches below the elevation of the bottom of the base and backfilled with Mirafix RS 380i OAE geotextile on the bottom then on compacted ¾" or 1-1/2" screened gravel. The gravel shall be carefully leveled and smoothed to give uniform support to the precast base over its entire area. The precast base shall be set at the proper location to center the manhole over the sewer main.

Commented [c20]: Added fabric requirement to help stabilize below the manhole.

The base of the manhole shall have a minimum of five inches between the lowest invert of the manhole and the inside base to allow room for the construction of a channel or a precast channel may be utilized but must widen out at the midpoint (springline) on the pipe diameter.

Only when authorized by Town for a particular location and cause, may cast in place manhole base be constructed. When a cast in place base is authorized concrete mix shall be 6.5 sack, 0.4 water/cement ratio, 4500 psi concrete, placed on uniform compacted base and in conformance with the typical details on the plans. Bases shall extend at least eight (8) inches below the invert of the pipe and shall be benched starting at springline. Precast manhole barrel sections shall not be placed on the cast in place base until it has reached sufficient strength to provide support without damage. Cast in place bases will be held to the same leak and vacuum test requirements as precast manholes.

Commented [c21]: New terms for when a cast in place manhole is allowed.

Commented [c22]: Changed to help ensure the manhole will be watertight.

Set each manhole section in a band of 1" minimum thickness of RamNek OAE, to make a watertight joint. Set sections plumb and neatly point inside of joint with grout. Use sections of various heights to bring manhole ring and cover to specified elevation. Set frames and covers in a full bed of mortar or RamNek and accurately set to the grade indicated or as directed. Encase frames in cement mortar (not concrete) around entire perimeter, but not in excess of the perimeter. Install preformed flexible plastic gasket joints in accord with manufacturer's recommendations in a manner such that all surfaces are clean, dry, and warm.

All pipes shall be connected to precast manholes with a pipe boot. The opening in the manhole wall where a pipe enters or leaves shall be sealed and patched in a neat workmanlike manner, both inside and out with cement mortar. All lifting holes and other imperfections in the interior manhole wall shall be filled with cement mortar.

Provide a flexible joint in the pipe 12 to 24 inches outside from all manhole walls and other solid structures.

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Precast concrete adjustment rings shall be installed on top of the cone to support and adjust the manhole frame to the required final grade. The maximum depth of the adjustment rings shall be eight inches, and the maximum depth from top of cone to final grade shall be as shown on the manhole typical drawing. Use Ramnek or equal between each ring and between top ring and frame to provide secure, watertight seal.

The top elevation of the manhole shall be adjusted to match final street grade with the top of the lid being 1/4-1/2" below the finished pavement and sloped to match the slope of the pavement. If manholes are located in open fields, they shall be left at least 12 inches above grade and a locking ring and cover shall be installed. Where the road surface is gravel, the manhole shall be set 4-6" below finished gravel surface, sloped to match the surface.

3.09. Connections to Existing Manholes: Sewer pipe connections to existing manholes where there is no existing pipe stubbed out shall be made in such a manner that the finished work will conform as nearly as practicable to the requirements specified for new manhole construction. The Contractor shall carefully cut out as small an opening in the existing manhole as necessary to insert the new sewer pipe in a pipe boot using a saw which will cut a clean circular opening. The existing concrete foundation bench shall be cut with a hole saw similar to what is used to cut the manhole to the cross-section of the new pipe in order to form a smooth continuous invert similar to what would be formed in a new concrete base. Where practical, the upstream and downstream invert shall be plugged during construction to prevent flow and construction debris from entering the system. The Contractor shall pump out and clean the manhole before removing the plugs. A mortar that will securely bond to existing concrete shall be used to smoothly finish the new invert and to seal the new line, both inside and outside, so the junction is watertight and smooth.

Commented [c23]: Added because this situation has not been addressed by the specs

3.10. Connecting Existing Pipes to New Manholes: Where an existing manhole is to be replaced, Contractor shall excavate and remove and dispose of the existing manhole and replace the manhole with a precast base with pipe boots to accommodate each of the sewer lines which needs to be connected to the new manhole. No more than two couplings per manhole shall be used to reconnect all the pipes. Manhole base shall be bedded in flowable fill from the manhole to three feet past the coupling for the depth of the pipe zone.

Commented [c24]: Added because this situation has not been addressed by the specs

3.11. Wyes and Risers: The Contractor shall place wyes, stubs, and risers where required by the approved construction plans. Wyes shall be angled upwards so that the upper invert of a one-eighth band connected to the fitting will have an elevation equal to or higher than the inside crown of the sewer main. Riser connections shall be installed where the elevation of the top of the branch is more than 12 feet below finished ground. Riser connections shall ordinarily reach to a grade of 8 feet below finished ground surface. Temporary termini shall have water tight plugs in each branch pipe or stub. Wye and riser locations shall be marked with a fence post, tracer wire and be labeled with the depth. Details for service line connections and pipe laying are covered below and construction details are shown on typical drawings. As Built measurements shall be made by the Contractor to reference the wye or riser connection to the nearest manhole before backfilling.

3.12. Service Installations

Materials for service lines must meet the above specifications for each type of material. All installation work shall conform to applicable portions of the pipe manufacturer's installation instructions in addition to the requirements on the Town Typical Drawing for sewer service sewer installation requirements herein, and where applicable the International Plumbing Code.

Commented [c25]: Changed from UPC

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Unless otherwise approved by the Town based on native soils types, all service pipe shall be bedded on 6 inches of well graded screened rock or pea gravel conforming to select bedding material in the standard specifications for Excavation and Backfill.

Sanitary sewer service lines shall be installed perpendicular to the main on the shortest and straightest route possible. There shall be a cleanout placed at property line and at any changes in grade and/or direction.

When installing a new sewer main, service wyes shall be installed as pipe laying progresses. Where a connection is being installed in an existing main and full bodied service wyes have not been previously installed in the main sewer, the main shall be cut and a section of pipe installed with a full bodied wye and coupling or if allowed by the Town the service may be tapped by cutting a hole in it sized to fit the saddle for the service line such that the tap is smooth and watertight. The cutting method shall be approved by the Town.

Commented [c26]: Added

The Town's representative shall inspect the main and connection at every tap prior to backfilling. In the event the tap is covered before it is inspected, it shall be dug out by the Contractor, to allow visual inspection of the tap and the main by the Town. If the main sewer line is cracked or broken during the process of locating and/or tapping, it shall be repaired immediately, by replacing the broken section for at least 12" on each side of the damage. If the pipe needs to be cut, the tap shall be made with a full bodied wye.

Commented [c27]: Changed from saddle

A manhole shall be installed instead of a service wye when the size of the service line is more than 50% of the size of the main. Service taps to existing manholes shall be done in accordance with the Manhole section of these specifications and shall only be allowed when there are less than 3 inlet pipes and the service pipe will be at least 60 degrees in each direction from another inlet pipe.

Commented [c28]: Changed from tap to wye

Where a sewer service line will cross over a water main or service, a sealed end encasement shall be furnished around the sewer service at least 10' measured horizontally in each direction from the crossing. If the sewer service crosses under a water main or service with less than 18" of separation between the top of the sewer service and the bottom of the water, the sewer service shall be encased for at least 10' horizontal in each direction of the crossing.

Commented [c29]: Modified to match typical drawing and add details for the required separation.

In no instance shall a trench extend beneath an existing sidewalk or curb unless excavation conforms with the Town standards for concrete removal. The pipe shall typically be bored, jacked, or tunneled through the earth under the curb or sidewalk. If tunneled, backfill with flowable fill. Alternately, Contractor may remove the existing sidewalk back to joints on either side of the trench, backfill in accordance with the Standard Specifications for backfill and then replace the sidewalk.

Measurements shall be taken of the distances of the service wye from a manhole to the main, and the depth from back of the sidewalk or property line to invert at the main and at end of the service stub. In addition when a curb is present, the location shall be marked on the curb by a "SS" symbol. In all cases, the end of the service stub shall be marked with green painted 2 x 4 which marked at 1' increments starting at the top of the pipe brought to the surface and backed by a steel "T" fence post. Tracer wire shall be brought to grade and wrapped around the post. Where the sewer service is terminated on the lot side, install a glued-on cap.

Commented [c30]: Updated marking requirements to hopefully make it easier to find the stubs than it has been.

3.13. Underdrains: Where excessive groundwater is encountered, and in other areas where it is deemed advantageous or necessary, gravel or piped underdrains shall be installed. Underdrains shall daylight to the nearest suitable point as approved by the Town. The trench shall be excavated to the required depth

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and width, non-woven geotextile placed, the trench backfilled and compacted with screened bedding material and the geotextile wrapped over the top of the screened rock once the sewer and drain lines are installed. Where underdrain pipe is required, it shall be installed to a true line and grade and held in place with compacted single size screened bedding material. Additional underdrain bedding material shall then be placed to a level of at least 12" inches over the top of the underdrain pipe and the sewer pipe installed. The sewer shall be installed to one side of the underdrain and be offset at least one pipe diameter measured horizontally. The sewer pipe shall be bedded to springline and compacted and then covered with additional screened rock and compacted in lifts to 12" over the sewer pipe. Underdrain pipes shall be provided with cleanouts outside each sanitary manhole. Underdrain pipe shall be continued beside manholes by use of suitable bend and other fittings.

Commented [c31]: Added, it improves the performance of the drain.

3.14. Lift Stations and Force Mains: Where necessary and with approval of the Town, lift stations and force mains shall be constructed in accordance with Town approved plans. Force mains shall be installed from pumping facilities to tie into the gravity collection system. At design average flow, a cleansing velocity of at least two feet per second shall be maintained. When possible, force mains shall have a high point a short distance from the manhole and flow open channel into the next manhole. Where the force main enters the manhole above the invert, a fitting shall be installed to direct the flow from the entry point in the manhole to the flow channel. Automatic air relief valves shall be placed at high points in the force main to prevent air locking. Such valves shall be designed to handle sewage and be equipped with fittings to allow cleaning.

3.15. Field Quality Control (Testing)

Compaction Testing shall be consistent with the requirements in the Excavation, Backfill, and Compaction Standard Specifications (Section 02000).

- A. Infiltration Test: Any observed infiltration shall be corrected.
- B. Tests for Displacement of Sewers: Check sewer mains to determine whether any displacement of the pipe has occurred after the trench has been backfilled to two feet above the pipe and tamped as specified. Test as follows: Shine a light between manholes, boxes, and/or bends (if authorized by Town) by means of a flashlight or by reflecting sunlight with a mirror. If illuminated interior of pipeline shows poor alignment, displaced pipe, or any other defects, remedy defects until acceptable to the Town. Misalignment shall be less than 3% of pipe diameter.
- C. Ovalation of Flexible Conduits: All gravity lines constructed of flexible conduit shall be tested for ovalation. Such testing shall be performed by the Contractor using a mandrel, "Go - No Go" gauge, or by other instruments which will measure and record actual pipe deflection. Deflection shall not be measured less than 30 days after backfill is completed and shall not exceed 5% of the pipe diameter. Sections of pipe not meeting this specification shall be excavated, pipe bedding replaced, and trench again backfilled, compacted, and retested for all the tests of this sub-section. Should it still fail to meet these ovalation requirements or other required tests, the section of line shall be replaced. The Town may elect to perform this test again at any time during the one-year warranty. The Town will notify the Responsible Party in writing if problems are detected. The Responsible Party shall promptly make arrangements to correct the problem in accordance with the warranty provisions of this contract.
- D. Video Inspection of Line Interior: At the completion of segments of sewer (and storm) lines, the lines shall be jetted with water. After water ceases to flow, Contractor shall video each segment to demonstrate cleanliness, proper jointing, conformance to alignment and grade, and proper roundness. Video work shall be done in coordination with ovalation testing so the video records

Commented [c32]: Deleted the requirement to specifically do an infiltration test.

Commented [c33]: Has been required on past projects and when the lines aren't kept clean. Video inspection insures the pipe is on a smooth grade, the pipe is round, confirms the service connections are properly installed.

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the testing results of the "Go-No Go" gauge. No line shall be put into service prior to the Town accepting the results of the video and leakage tests. Where there are active services connected during the line installation, video testing will be used to determine leakage as well. On new lines and lines with no active services shall be capped and the service lines tested with the mains.

- E. Tests for Pressure Lines: Test sewer lines which will be subject to positive pressures in accordance with the testing the Town Standards for water line testing.

- F. Air Test - Gravity Flow Lines

Conduct an air test on all gravity lines including service lines in conformance with UniBell publication B-6-90 and ASTM F1417. Special attention shall be paid the safety admonishments provided in that publication.

Preparation for tests: Flush and clean the line prior to testing in order to wet the pipe surfaces and produce more consistent results. Plug and brace all openings in the line and the upper end of any connections. Check all pipe plugs with a soap solution to detect any air leakage. If leaks are found, release the air pressure, eliminate the leaks and start the test procedure over again.

Procedure of Test: Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average backpressure of any groundwater above the pipe, but not greater than 8.0 psig. Allow sufficient time for the air temperature to come to equilibrium with the temperature of the pipe and the pressure to stabilize. Refer to the UniBell publication for adjustments of required pressures due to groundwater.

After the temperature has stabilized, and the pressure is stabilized at 4.0 psig greater than the average groundwater back pressure, the air hose from the control panel to the air supply shall be shut off or disconnected. Continuously monitor the pressure gauge. Once the reading has stabilized, begin the test. The pressure reading shall be observed and the timing shall commence with a stop watch or other timing device that is at least 99.8% accurate.

If the time lapse (in seconds) for the allowable pressure drop exceeds that shown in at the end of this section, the pipe shall be presumed to be within the acceptable limits for leakage.

If the time lapse is less than that shown in the table, the Contractor shall make the necessary corrections to reduce the leakage to acceptable limits. All visible or audible leaks shall be fixed even if leakage is within acceptable limits.

Safety: The air test may be dangerous if proper precautions are not taken. All plugs must be sufficiently braced to prevent blowouts and the pipeline must be completely vented before attempting to remove the plugs.

As a safety precaution, pressurizing equipment shall be provided with a regulator set at 8 psi to avoid over-pressurizing and damaging an otherwise acceptable line.

- G. Manhole Tests

Vacuum Tests shall be performed in accordance with test methods in ASTM C 1244 following good safety practices. Do not pressurize manhole nor exceed the manufacturer's vacuum rating on vacuum disc or flat plate. Follow the manufacturer's instructions for the safe use of test plugs. Minimum test times shall conform Table 1 in ASTM C1244 which is partially quoted below:

DIVISION 2

SITE WORK – SEWER SYSTEM CONSTRUCTION

Depth	4' Dia	5' Dia	6' Dia
8'	20 sec	26 sec	33 sec
10'	25	33	41
12'	30	39	49
14'	35	48	57
16'	40	52	67

Test vacuum shall start at 10 in Hg and not drop to less than 9 in. Hg during the test period.

Smoothness of inverts shall be checked for roughness by rubbing a hand in a latex glove over the full surface of the invert. If the glove is torn or snags, the surface will need to be smoothed. In addition, if Owner's representative has concerns about solids in sewage becoming snagged on roughness in the flow line, suitable materials shall be mixed with water and observed flowing through the manhole. Manholes with rough inverts or inverts which do not encourage smooth flow through the manhole will not be accepted by the Town.

3.16. Inspection Cleaning and Lamping

Final acceptance of the sewer line shall be based on an inspection for compliance with all items in these specifications. No pipe spalls, rocks, dirt, joint compounds, cement mortar, and other trash and obstructions shall be left in a sewer pipeline of any size or type. If this debris is removed by flushing, the manhole outlet shall be bagged or plugged before construction so that this debris will not be carried into or contaminate the existing lines.

Flow of any kind into the existing sewer system shall not be allowed until the sewer has been satisfactorily completed and such a connection is approved by the Town.

3.17. Restoration and Cleanup

The Contractor shall restore or replace all removed or damaged roadbase, paving, curbing, walks, sod, shrubbery, fences, irrigation ditches, or other structures or surfaces to a condition at least equal to that before the work began and to the satisfaction of the Town. The construction site shall be left neat and orderly.

Surplus materials, tools, and temporary structures shall be removed by the Contractor. All dirt, rubbish, and excess earth from excavations shall be disposed of by the Contractor and the construction site shall be left clean and orderly.

The Contractor shall maintain the surface over the trenches in approved condition against any settlement or deterioration throughout the warranty period.

3.18. Abandonment

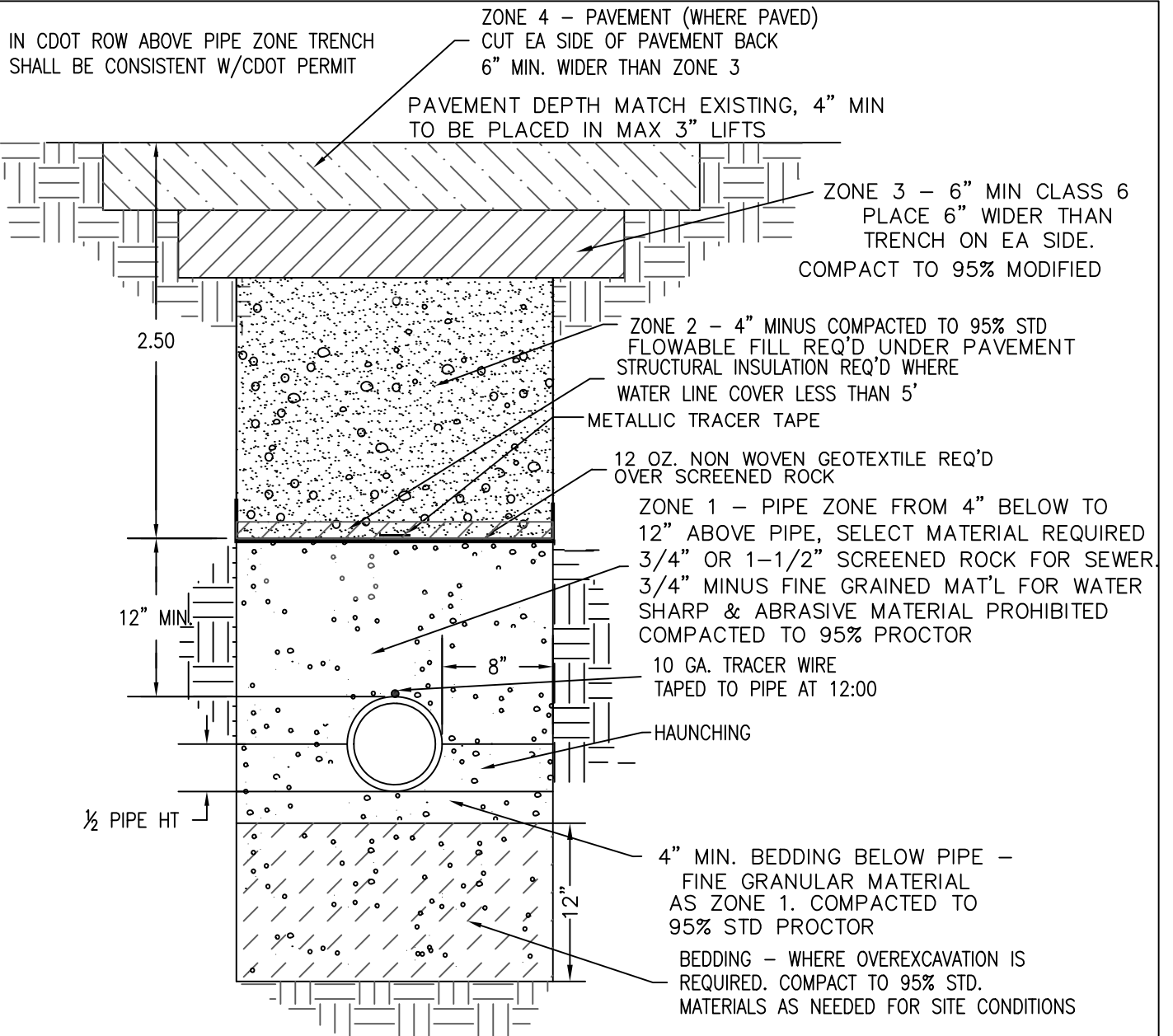
Sewer lines, services and/or manholes that are to be taken out of service will be completely removed and shall become the property of the Contractor. Abandonment in place will not be allowed. The location shall be backfilled in 8" lifts and compacted per Town Specifications.

Commented [c34]: Added to stds. Been required on a case by case basis in the past. Leaving abandoned lines in the ground takes up space in the right of way and can lead to someone connecting to the wrong line. Leaving abandoned taps in place leads to infiltration, roots, etc.

TABLE I
MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

1 Pipe Diameter (in.)	2 Minimum Time (min: sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L.) Shown (min:sec)									
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft		
4	3:46	597	380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24	
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	17:48	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	25:38	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	40:04	
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	57:41	
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	78:31	
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	102:33	
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	129:48	
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	160:15	
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	193:53	
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	230:46	

UNI-B-6-90



STANDARD TRENCH DETAIL

NOTE 1: IN COLD WEATHER PLACE ROAD BASE TO GRADE & REPLACE WITH HOT MIX WHEN WEATHER IS SUITABLE.

NOTE 2: HAUNCHING FOR WATER LINE SHALL BE 3/4" MINUS FINE, GRAINED LOW PERMEABILITY MATERIALS. SEWER BEDDING MAYBE SINGLE SIZE SCREENED ROCK UP TO 1.5". SHARP AND/OR ABRASIVE MATERIALS ARE PROHIBITED.

NOTE 3. DEPTH OF COVER OVER WATER LINES SHALL BE A MINIMUM 5' AND A MAXIMUM OF 6' UNLESS OTHERWISE INDICATED ON THE TOWN APPROVED PLANS IN THE TOWN APPROVED PLANS STRUCTURAL INSULATION (PER WATER STANDARDS) MAY BE REQUIRED FOR COVER OF LESS THAN 5'.



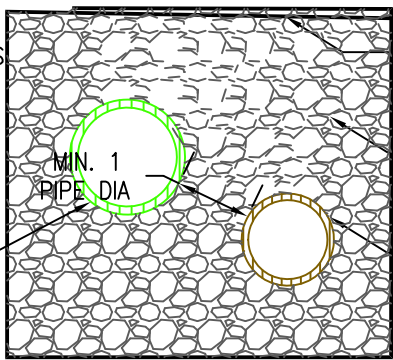
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**STANDARD TRENCH
DETAIL**

DATE: 6/10/20

SHEET:

HEIGHT OF WRAP ENOUGH TO ENCLOSE SEWER & SEEP LINES WITH 8" MIN ROCK BELOW AND 12" ABOVE PIPES



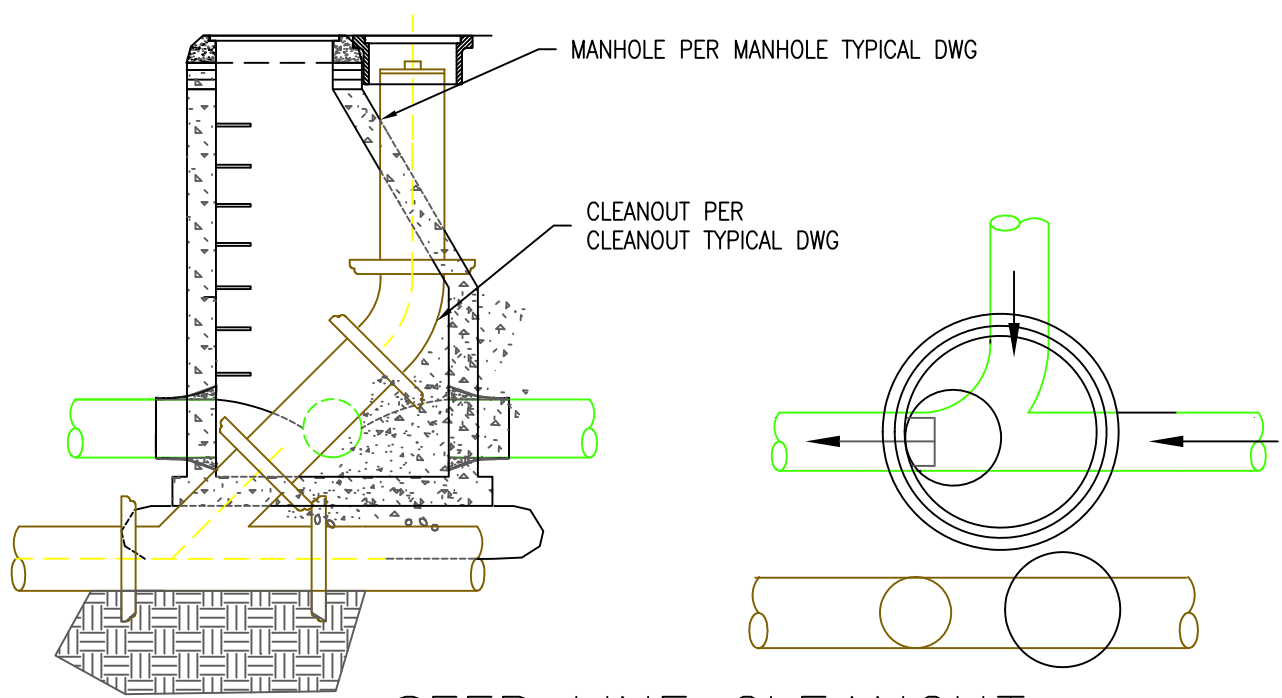
SEWER MAIN (SIZE & MATL PER APPD PLANS)

12 OZ MIN. NON WOVEN GEOTEXTILE SURROUNDING SCREENED ROCK PIPE BEDDING.

3/4" - 1-1/2" SCREENED ROCK 6" LIFTS COMPACTED TO 95% STD PROCTOR

PERFORATED HDPE (SEEP LINE.)

SEWER W/GEOTEXTILE BEDDING DETAIL



SEEP LINE CLEANOUT

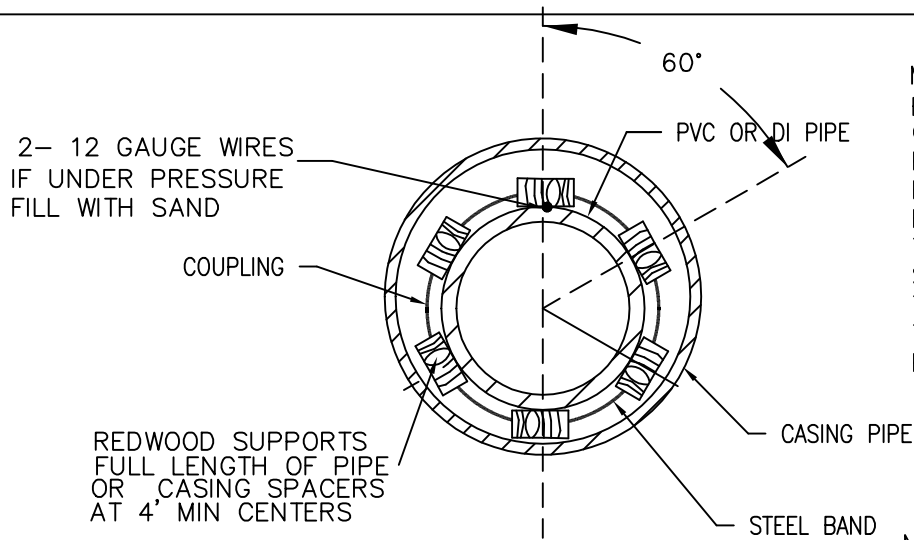
N.T.S.



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SEWER / SEEP TRENCH DETAIL

DATE: 6/10/20 SHEET:

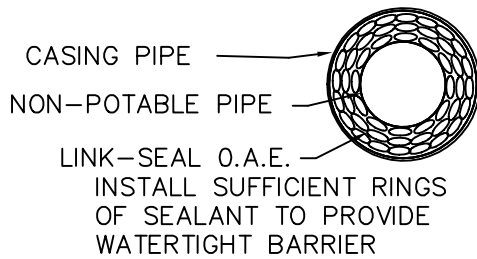


MANUFACTURED PIPE SUPPORTS OR REDWOOD STRIPS TO BE OF SUFFICIENT SIZE & SPACING TO PREVENT BELLS FROM RESTING ON ENCASING PIPE. WOODEN STRIPS TO EXTEND FULL LENGTH OF PIPE BETWEEN COUPLING. THREE STEEL BAND TIES TO BE USED TO CONNCT WOODEN SUPPORTS TO EACH JOINT OF PVC PIPE PLACED IN THE ENCASING PIPE.

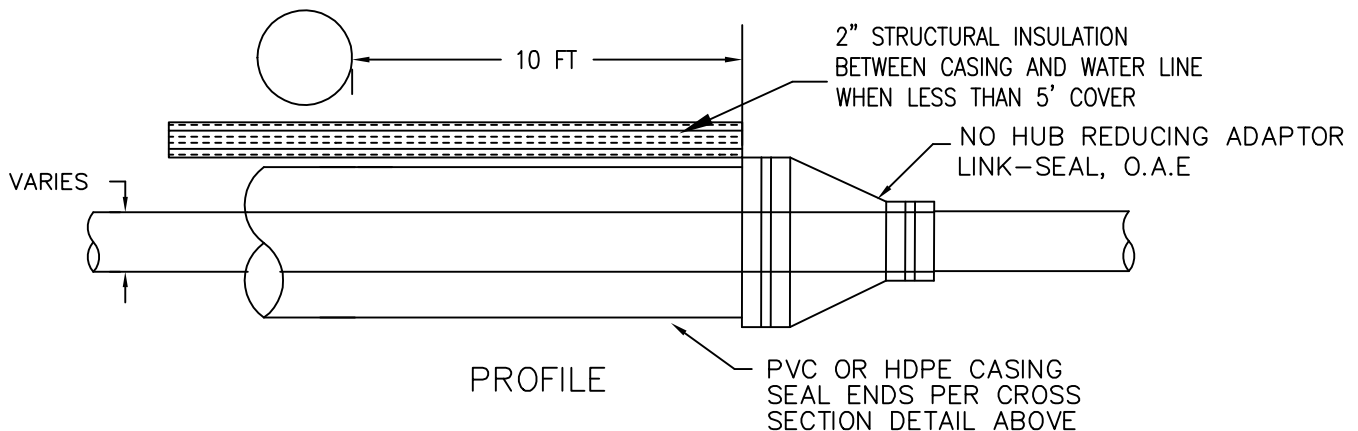
NOTES:

1. CENTER CASING OVER OR UNDER WATER LINE W/CARRIER PIPE JOINT CENTERED IN THE CASING.
2. PLACE 2" INSULATION BETWEEN CASING & WATER MAIN, 5' ON EACH SIDE OF WATER LINE.
3. WHEN POTABLE LINE IS BELOW THE SEWER LINE SEALED ENDS ARE REQUIRED ON THE CASING. SEAL MAY BE SOLID NO HUB REDUCING COUPLING OR LINK SEAL
4. CASING PIPE SHALL BE OF SUFFICIENT SIZE TO ALLOW FOR EASY INSTALLATION OF THE CARRIER PIPE INCLUDING THE BELL. CARRIER SHALL BE FULLY SUPPORTED

clarified sealed ends reqts in note and in graphics



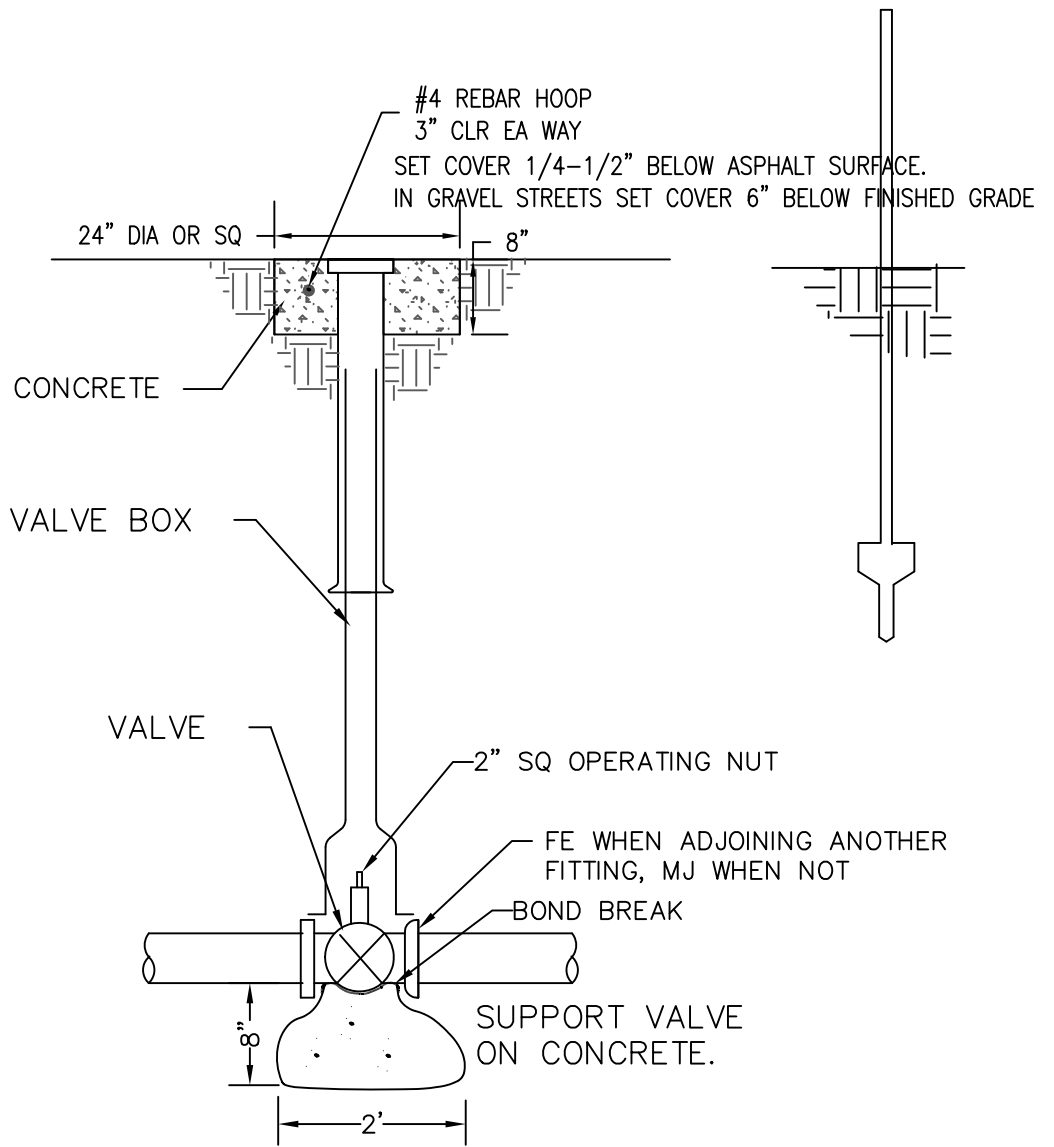
WATERTIGHT ENDS – CROSS SECTION



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**CASING PIPE
 DETAIL**

DATE: 6/20/20 SHEET:



GATE VALVE AND BOX

SECTION VIEW

VALVE BOXES TO BE BUFFALO TYPE
 TWO PIECE 5-1/4" SHAFT W/LID.
 EXTENSION PIECES SHALL BE USED
 AS REQ'D. PROVIDE EXTENSION
 SHAFT ON OPERATING NUT WHEN
 DEPTH GREATER THAN 6'.
 VALVE BOX SHALL BE SUPPORTED
 ON BODY OF VALVE

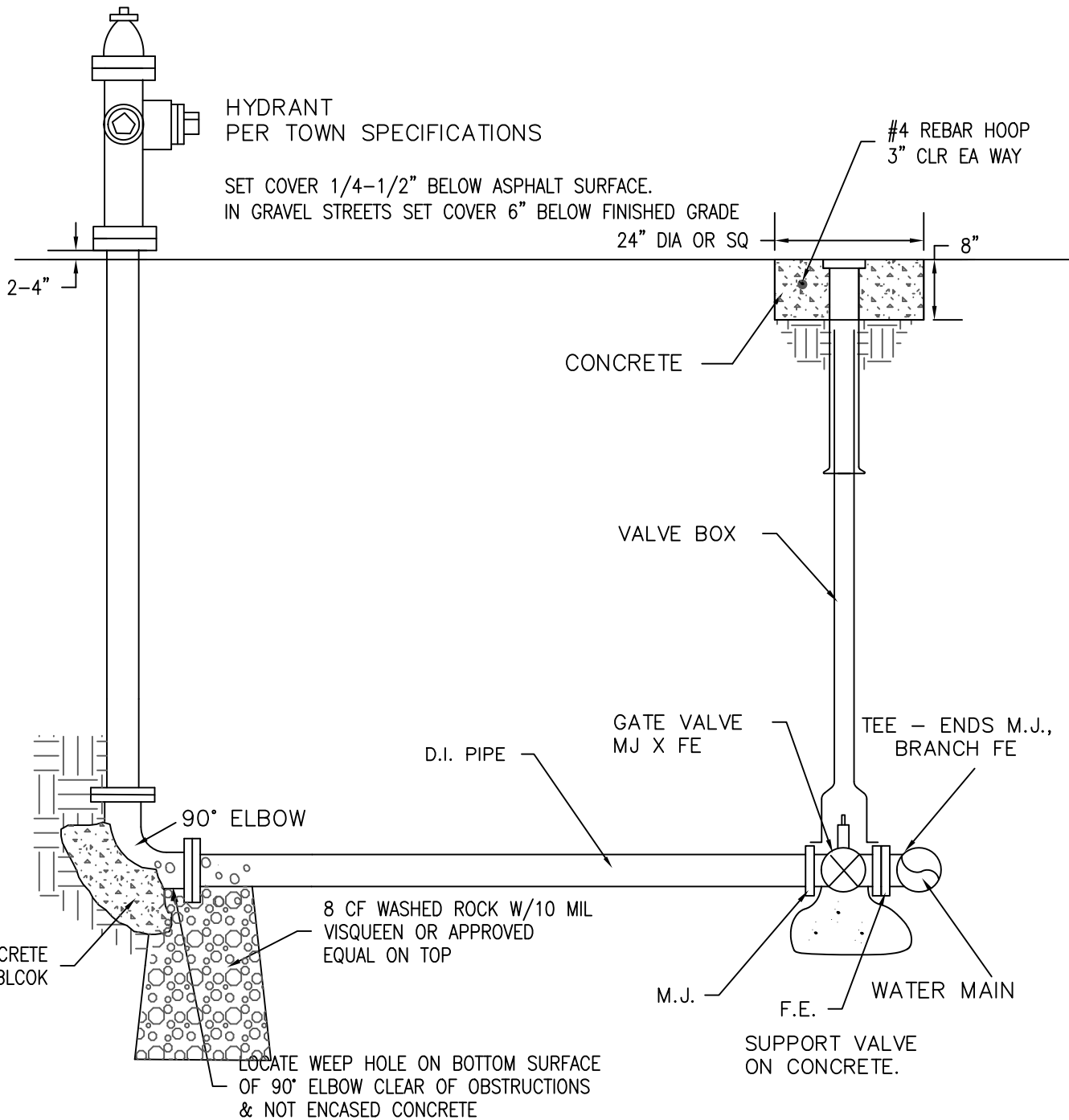


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**GATE VALVE
 DETAIL**

DATE: 6/10/20

SHEET:



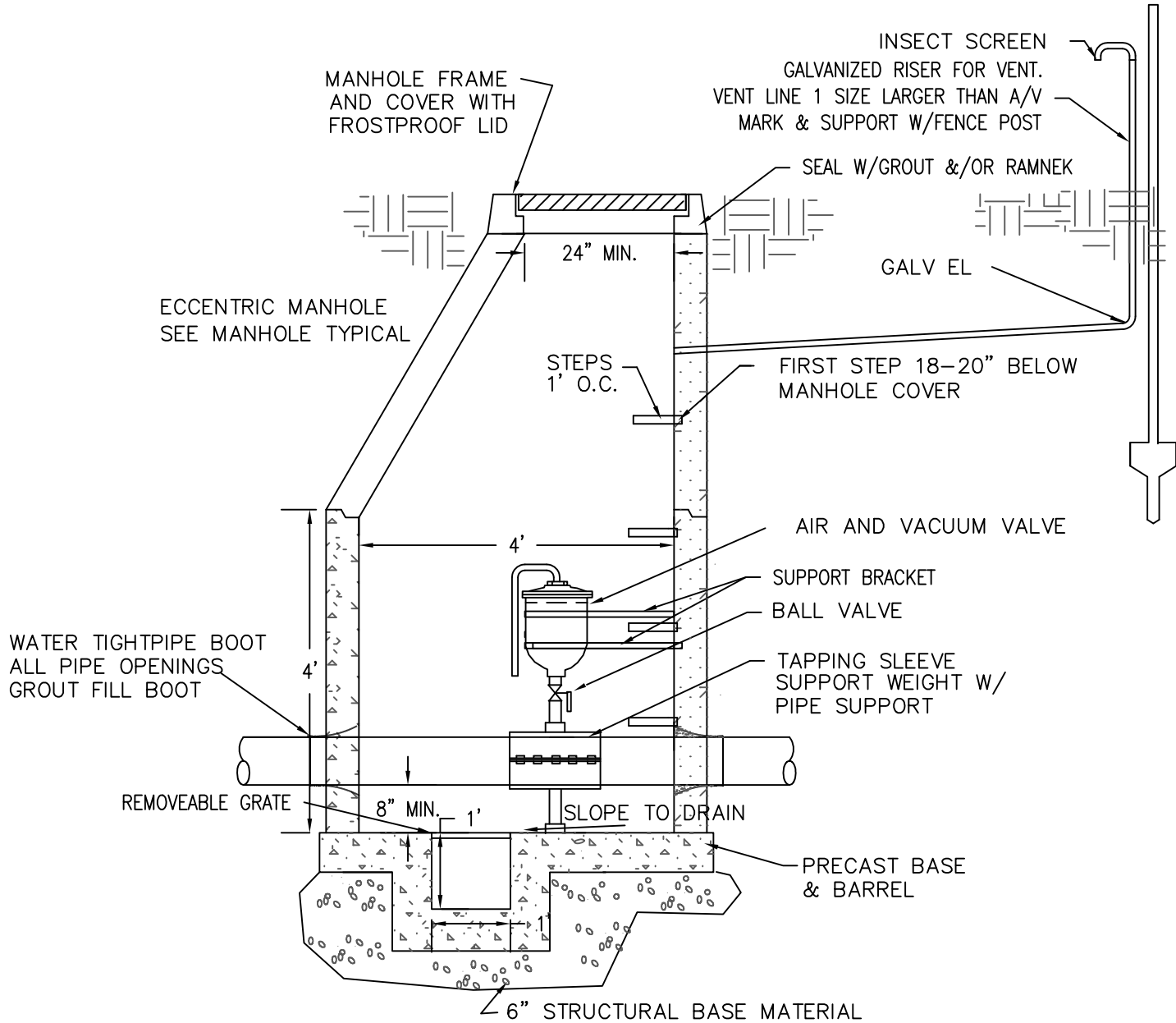
ALL MECHANICAL JOINTS SHALL
BE RESTRAINED BY MEGALUGS
(OAE) & CONCRETE THRUST
BLOCK



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**FIRE HYDRANT
 DETAIL**

DATE: 6/10/20 SHEET:



NOTES:

1. DETAIL APPLICABLE TO WATER & SEWER AIR VACUUM STATIONS
2. LOCATE VALVE DIRECTLY OVER PIPE
3. SIZE VALVE TO FLOW CONDITIONS
4. CONFIRM SIZE, MODEL, & BRAND W/ TOWN BEFORE PURCHASING
5. PLACE WATERPROOF INSULATION AROUND VALVE

6. FURNISH CLEANING APPARATUS FOR SEWER VALVES TO TOWN

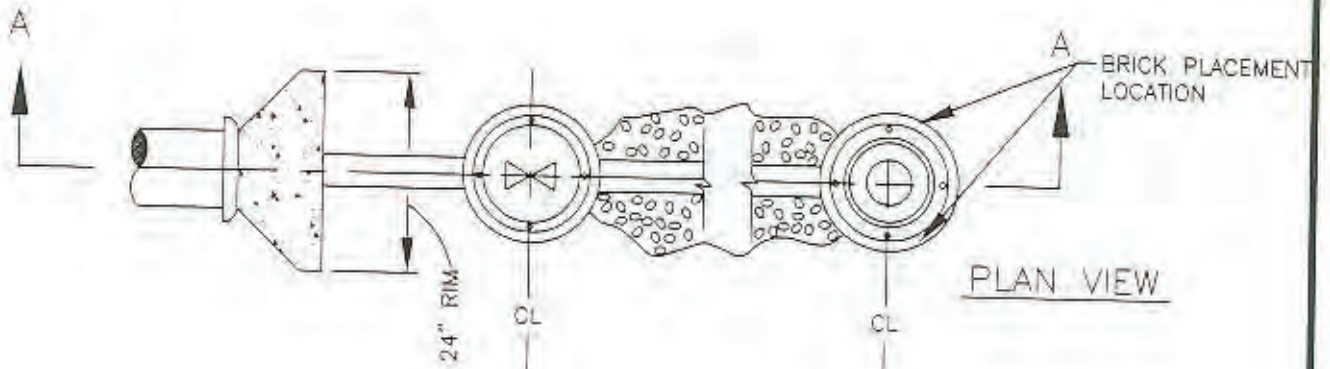
7. WHERE SEASONAL HIGH GROUNDWATER TABLE IS MORE THAN 3' BELOW THE BOTTOM OF THE MANHOLE, THE SUMP IN THE FLOOR CAN BE REPLACED WITH DRAIN IN FLOOR AND 1 CY MIN SCREENED ROCK BELOW THE MANHOLE PLACED ON NON WOVEN HIGH PERMEABILITY FABRIC



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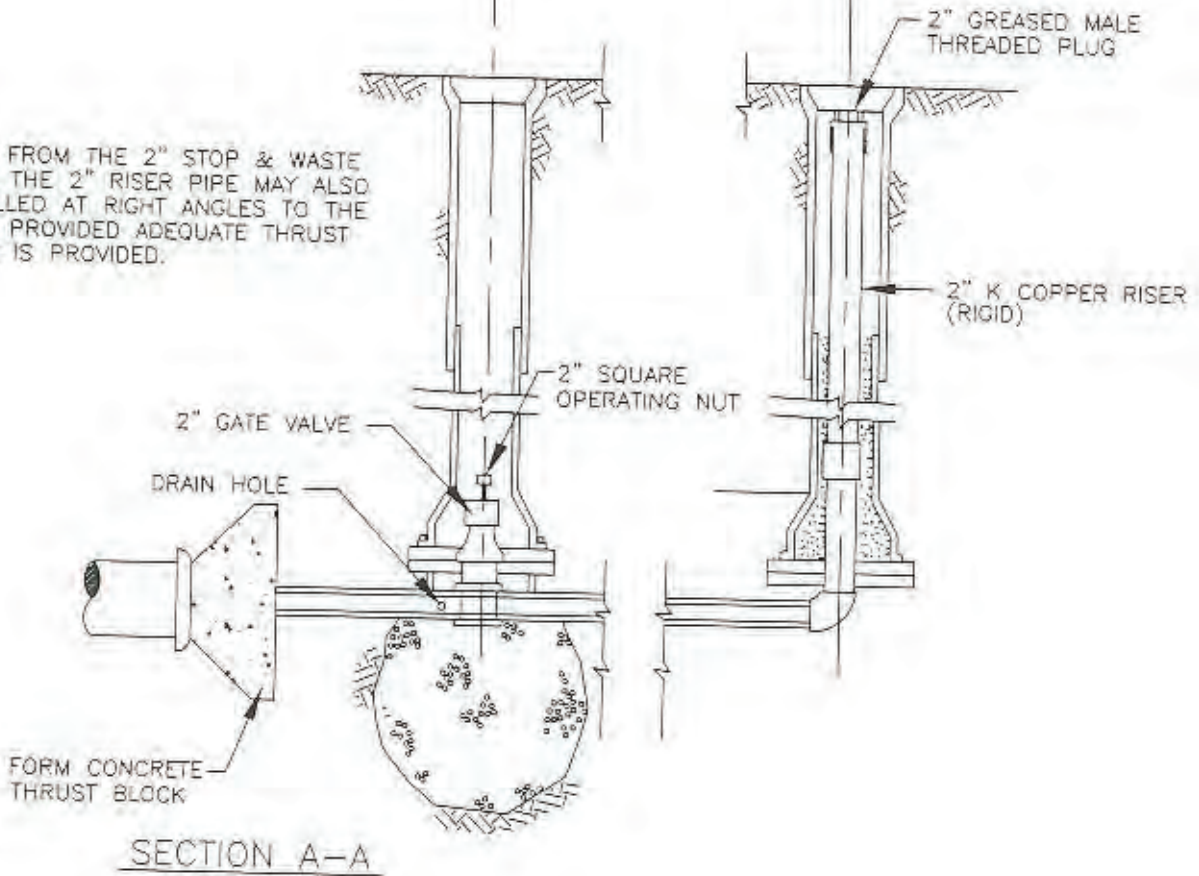
**AIR VACUUM
 STATION DETAIL**

DATE: 6/10/20 SHEET:



NOTE:

THE LINE FROM THE 2" STOP & WASTE VALVE TO THE 2" RISER PIPE MAY ALSO BE INSTALLED AT RIGHT ANGLES TO THE MAINLINE, PROVIDED ADEQUATE THRUST BLOCKING IS PROVIDED.



BLOWOFF INSTALLATION

CHK:	TOWN OF RIDGWAY
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES PO BOX 738, DELTA, CO 81416
DRN: R_TYP	BLOWOFF INSTALLATION

Bearing Area in Sq Ft

Pipe Size	Bends				Tees, Dead ends, Crosses & Dead end	
	90°	45°	22-1/2°	11-1/4°		
3	1.0	0.6	0.3	0.0		0.7
4	1.8	1.0	0.5	0.0		1.3
6	4.0	2.2	1.1	0.0		2.8
8	7.1	3.8	2.0	1.0		5.0
10	11.1	6.0	3.0	1.5		7.8
12	16.0	8.6	4.4	2.2		11.3
14	21.7	11.8	6.0	3.0		15.4
16	28.4	15.3	8.0	4.0		20.0
18	36.0	19.4	10.0	5.0		25.4
24	64.0	34.5	17.7	8.8		45.0

Areas given in the table are based on internal static pressure of 100 psi and soil bearing capacity of 1,000 pounds per square foot

Bearing areas for any pressure and soil bearing capacity may be obtained by multiplying tabulated values by the following correction factor (F)

$$F = \frac{\text{Actual specified test pressure in hundreds of pounds}}{\text{Actual soil bearing pressure in thousands of pounds}}$$

All water line plans shall contain the following table, with the values filled in by the Design Engineer:

Soil Bearing capacity	_____	Lbs/SF
Test Pressure	_____	psi
Bearing Area Multiplier (F)	_____	

GENERAL NOTES:

- THRUST BLOCKS AND MECHANICAL RESTRAINT SUCH AS MEGALUGS or single bolt REQUIRED ON ALL MECHANICAL JOINTS
- BEARING SURFACE AREAS SHOWN IN CHART ARE MINIMUMS
- ALL FITTING AND BOLTS SHALL BE WRAPPED & TAPED CLOSED WITH 10 MIL MINIMUM POLY WRAP

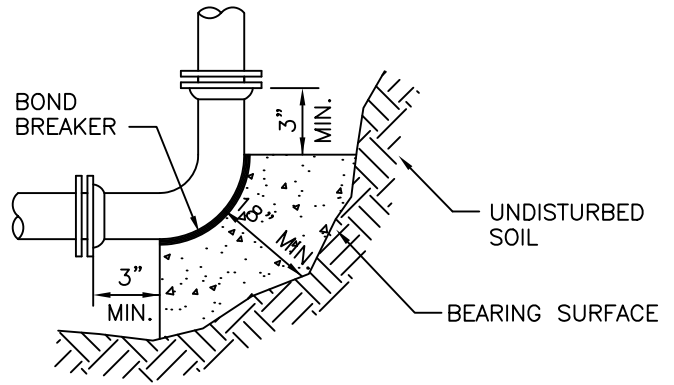
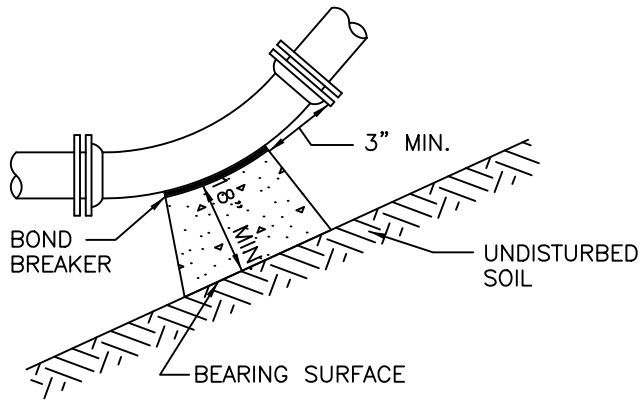


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THRUST BLOCK SIZING

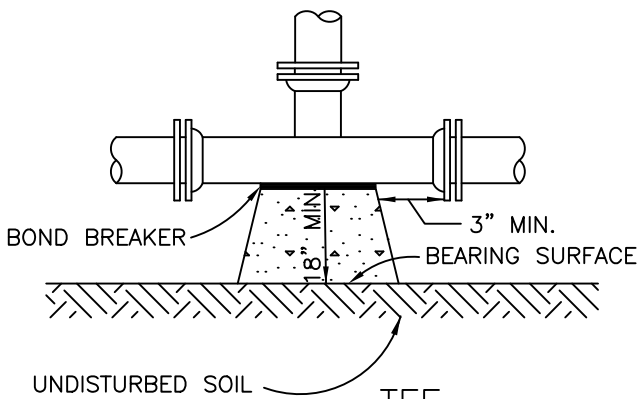
DATE: 6/10/20

SHEET:

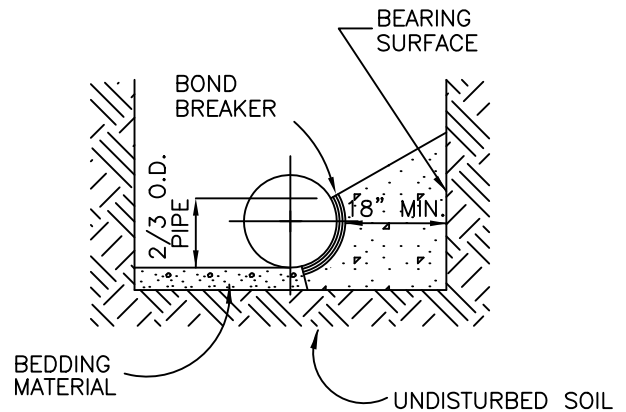


90° BEND

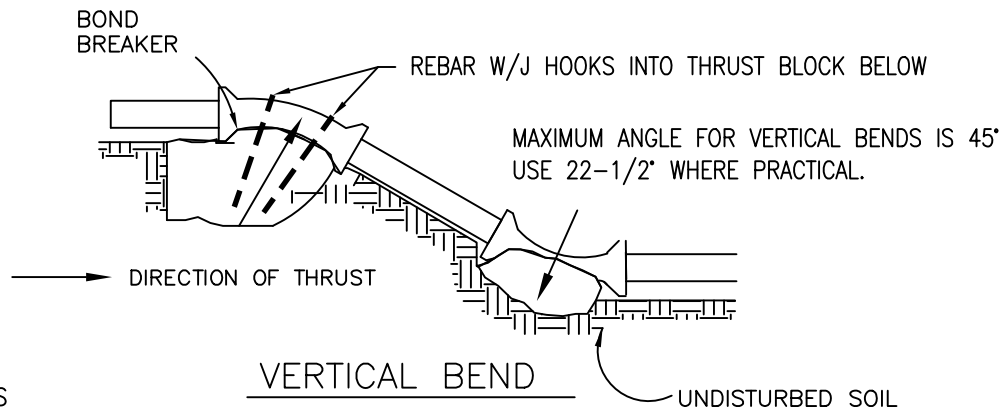
$\frac{11}{4} \frac{1}{4}$, $\frac{22}{2} \frac{1}{2}$ AND 45° BENDS



TEE



TYPICAL CROSS SECTION



VERTICAL BEND

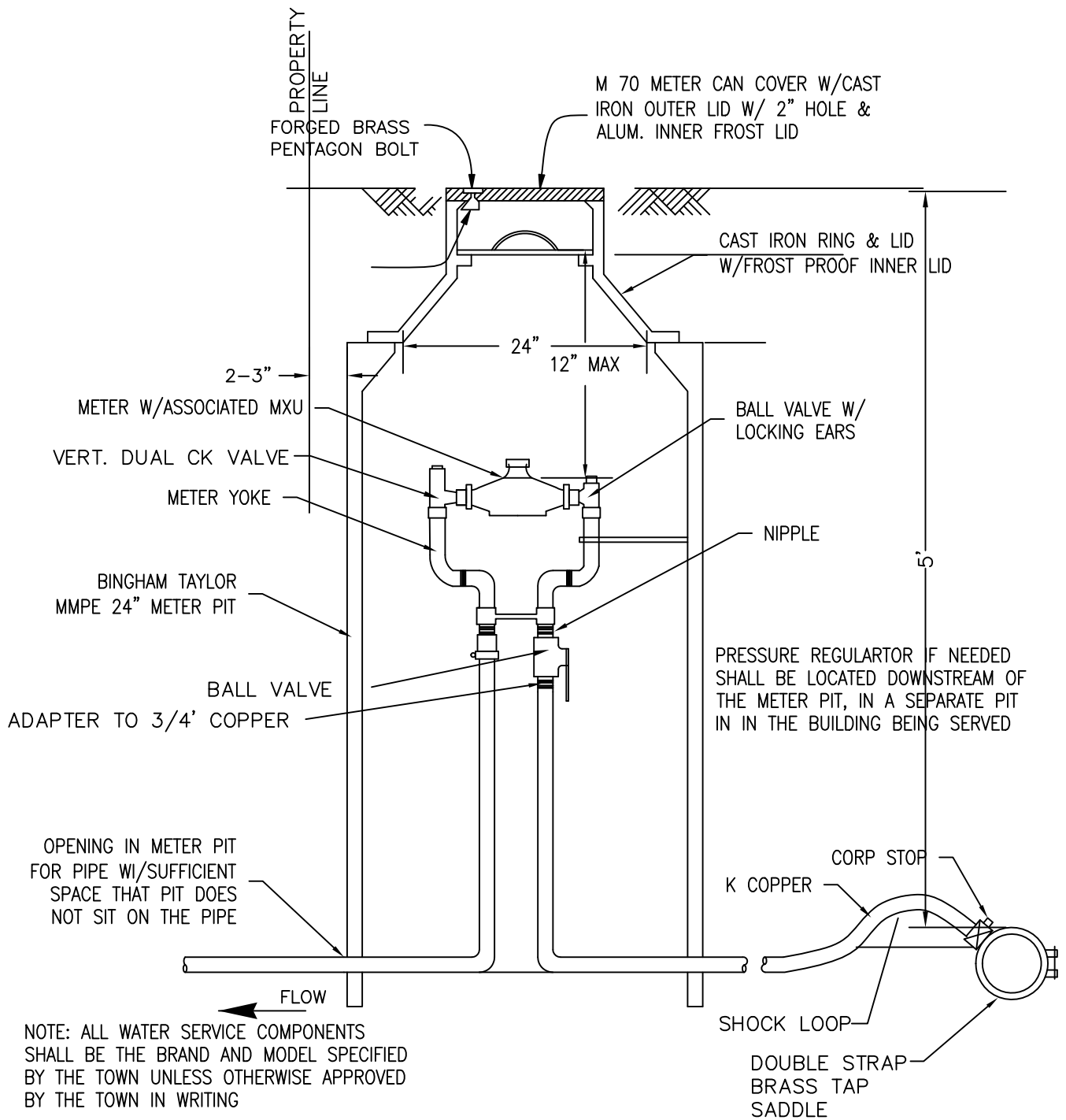
FOR THRUST SIZING AND NOTES
SEE THRUST BLOCK SIZING DETAIL



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**THRUST BLOCK
DETAIL**

DATE: 6/10/20 SHEET:



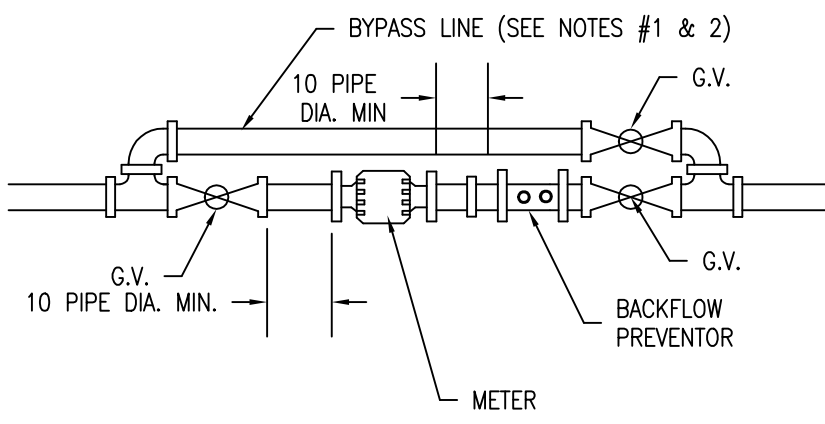
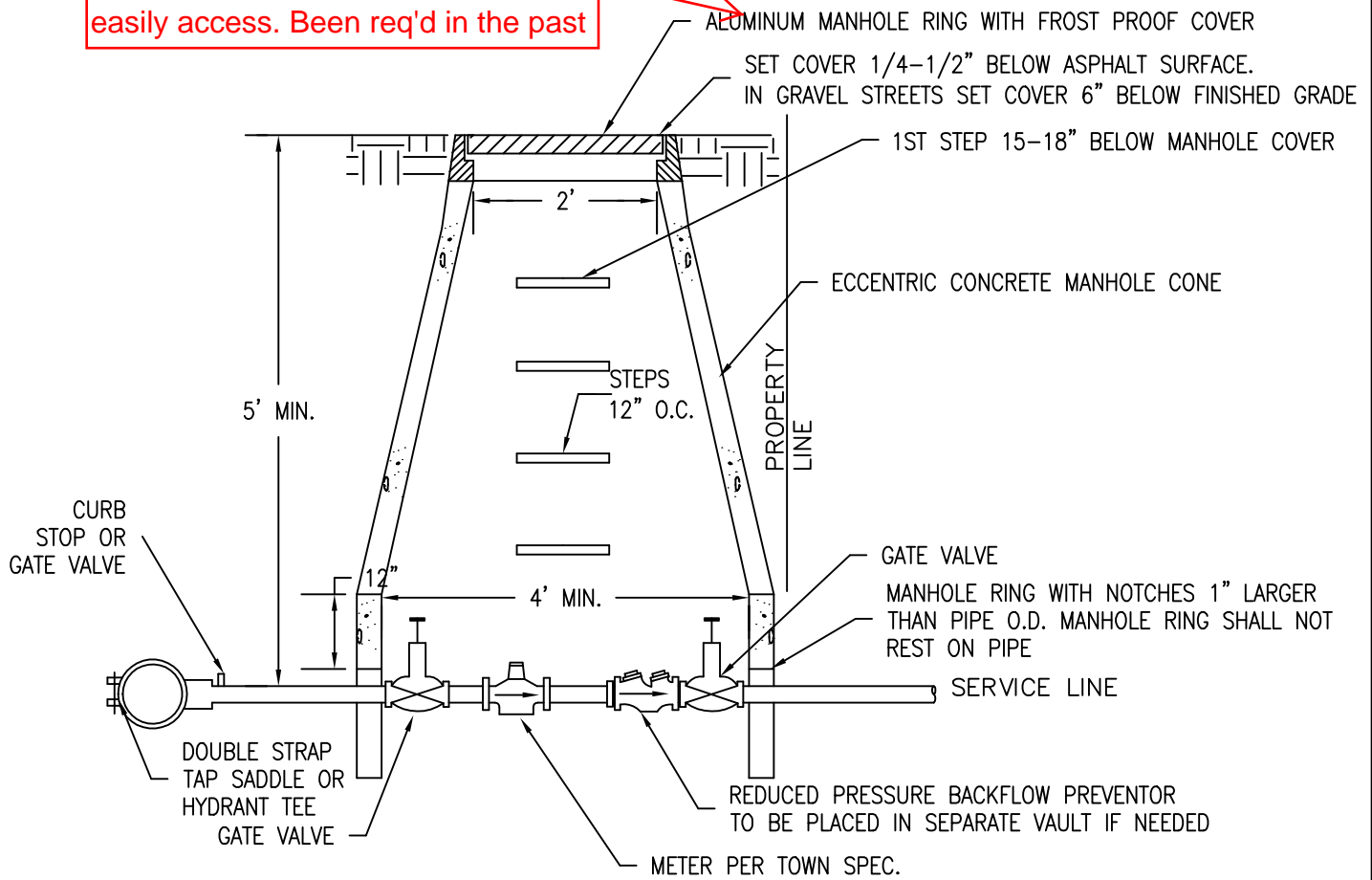
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**3/4" - 1" METER
 DETAIL**

DATE: 6/10/20

SHEET:

Added "aluminum" Most frost proof are alum. Want alum. so can more easily access. Been req'd in the past



NOTES:

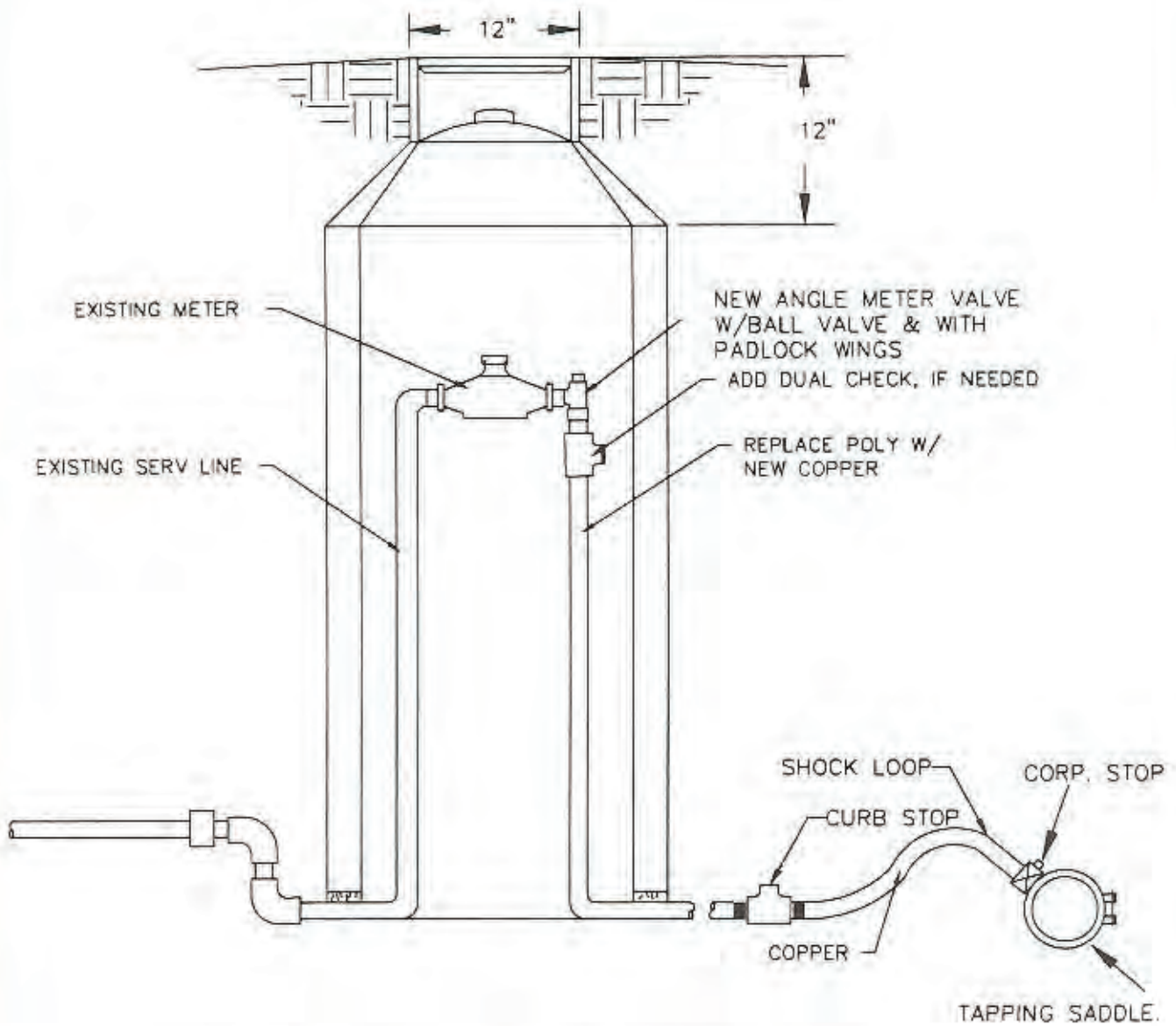
- 1) BYPASS LINE ONLY REQUIRED ON METERS 2" & GREATER
- 2) WHEN BYPASS IS REQUIRED, METER SHALL BE INSTALLED IN A VAULT SIZED TO ALLOW CONVENIENT IN PLACE MAINTENANCE OF METER VAVLES, AND APPURTENANCES
- 3) IF SERVICE LINE SIZE EXCEEDS 25% DIA. OF MAIN LINE SIZE, A HYDRANT TEE & FE X MJ GATE VALVE SHALL BE INSTALLED FOR THE SERVICE LINE CONNECTION
- 4) REQUESTS FOR SERVICE CONNECTIONS AND/OR METERS IN EXCESS OF 1" REQUIRES JUSTIFICATION AND TOWN APPROVAL
- 5) ALL MATERIALS SHALL CONFORM WITH TOWN STANDARDS



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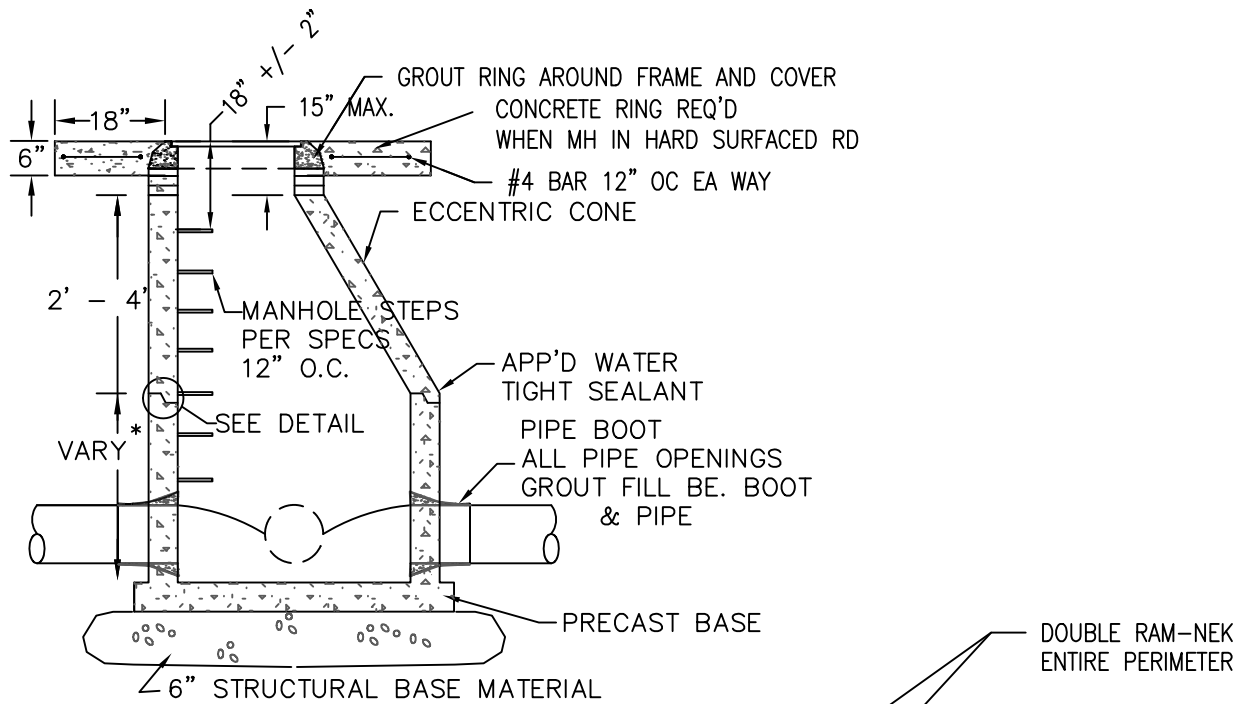
**1-1/2 - 2" METER
 DETAIL**

DATE: 6/20/20 SHEET:

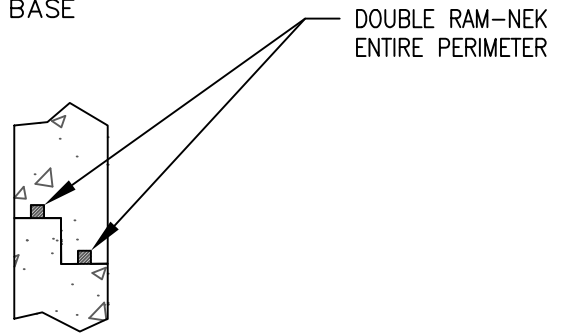


TYPICAL EXISTING SERVICE RECONNECTION

CHK:	TOWN OF RIDGWAY
DATE: 6/06	CONSOLIDATED CONSULTING SERVICES PO BOX 738, DELTA, CO 81416
DRN: R_TYP	RECONNECT SERVICE



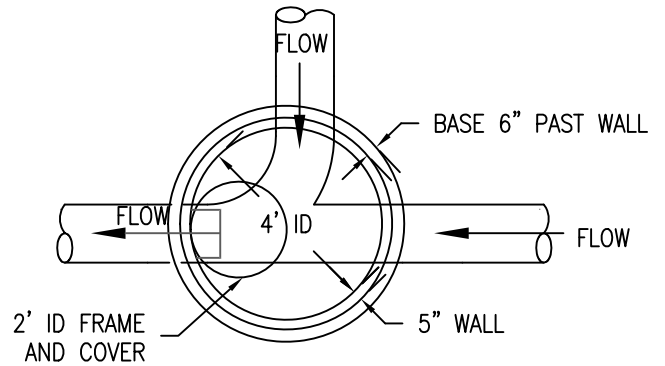
* BARREL SECTION HEIGHT
 MUST BE AT LEAST 48" OR
 VERTICAL WALLS ARE REQ'D



DETAIL
 N.T.S.

NOTES:

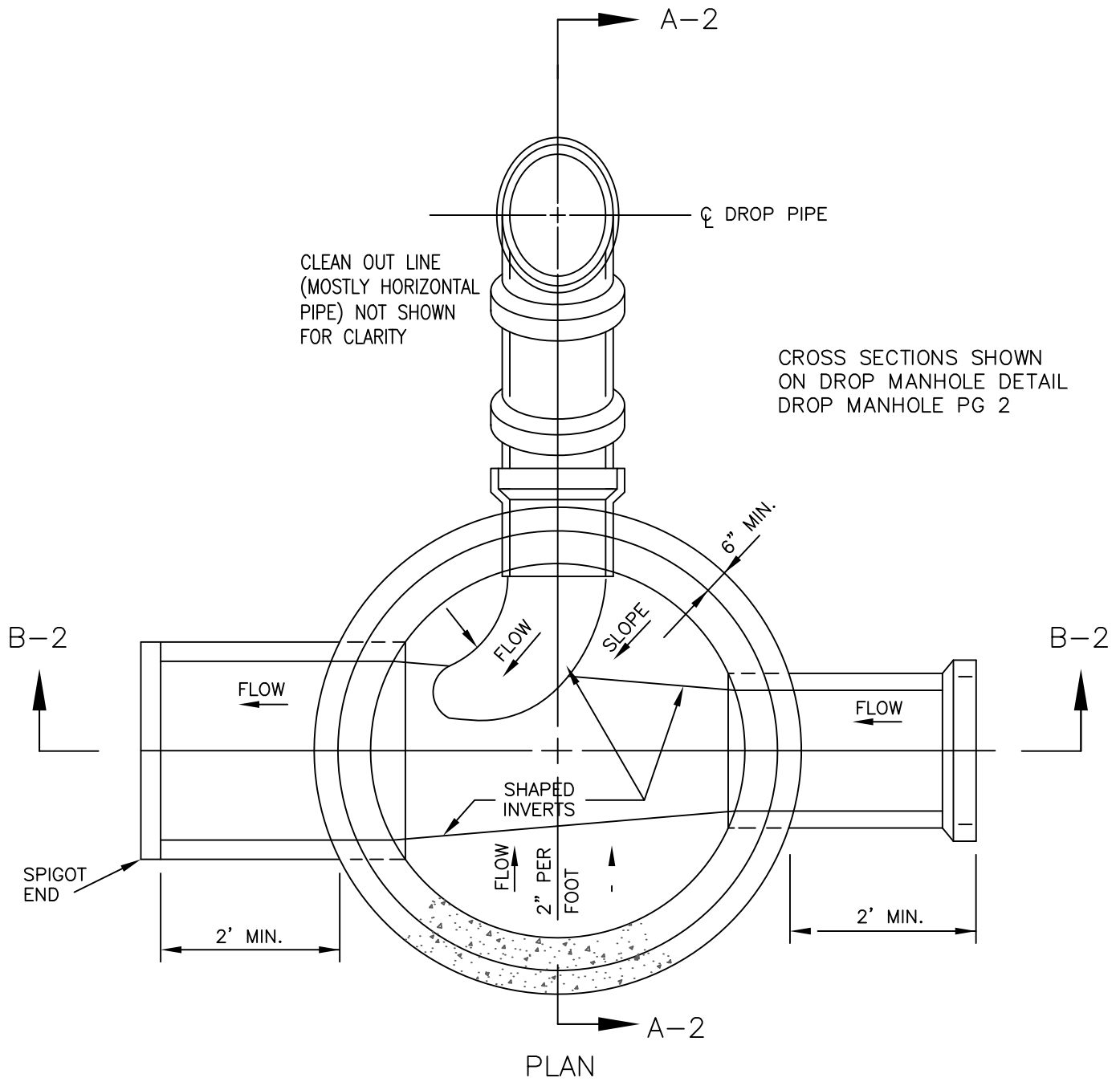
1. MIN. DROP THRU MANHOLE SHALL BE 0.1 FT FOR STRAIGHT RUNS & 0.2 FT FOR 90° BENDS
2. IF NEEDED TO PASS THE REQ'D VACUUM TEST, COAT EXTERIOR OF MANHOLE WITH COAL TAR EPOXY.
3. CONCRETE GROUT IS REQUIRED BETWEEN THE FRAME AND COVER ON ALL MANHOLES. THE LARGER CONCRETE RING SHOWN ABOVE IS ONLY REQUIRED WHEN THE COVER IS BROUGHT TO GRADE IN HARD SURFACED ROADWAYS



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**MANHOLE
 DETAIL**

DATE: 6/10/20 SHEET:



CLEAN OUT LINE
(MOSTLY HORIZONTAL
PIPE) NOT SHOWN
FOR CLARITY

CROSS SECTIONS SHOWN
ON DROP MANHOLE DETAIL
DROP MANHOLE PG 2

NOTES:

1. BASES SHALL BE REINFORCED WHEN THE DISTANCE FROM INVERT TO TOP OF COVER WILL EXCEED 15 FT AND IN ANY CASE WHEN THE INTERIOR DIA. OF MANHOLE IS 5' OR LARGER

DROP MANHOLE BASE
MONOLITHIC BASES FOR
DROP MANHOLE

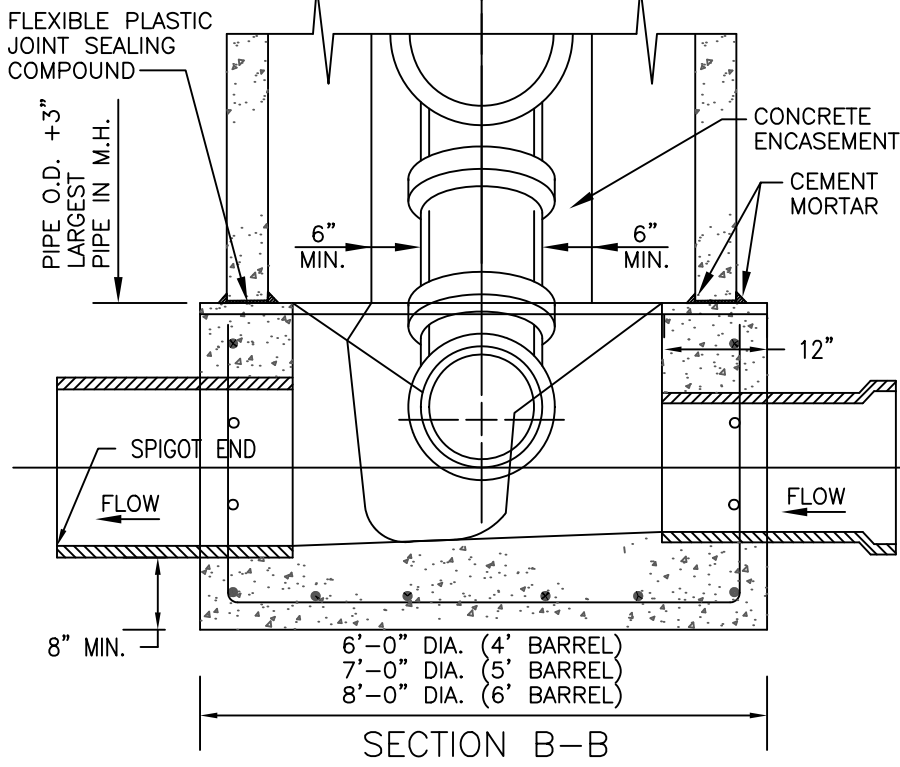
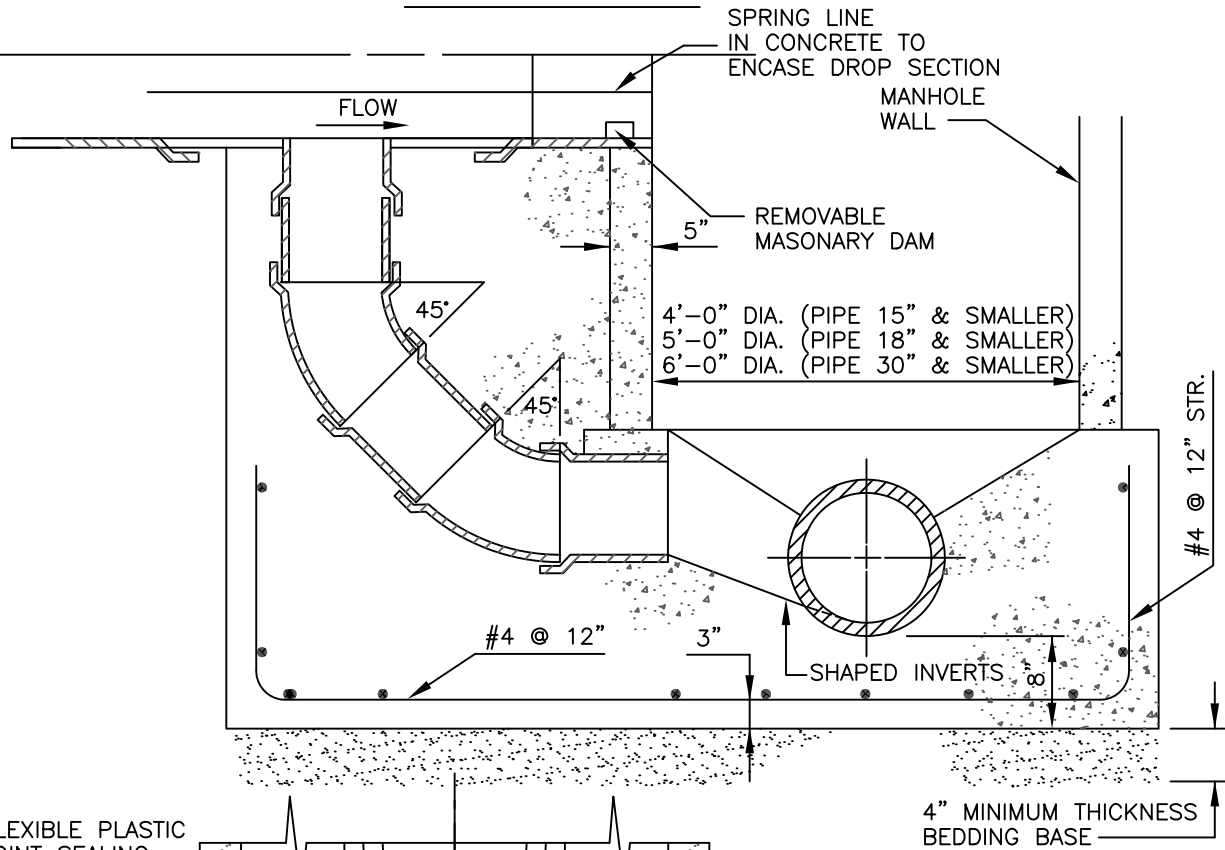


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**DROP MANHOLE
DETAIL**

DATE: 6/10/20 SHEET: 1 OF 2

SECTION A-A



NOTES:

1. THIS MANHOLE REQUIRED WHEN A SEWER LINE ENTERS THE MANHOLE AT AN INVERT ELEVATION OF 18" OR MORE ABOVE THE INVERT OF THE MANHOLE
2. PIPE BOOTS REQUIRED AT MANHOLE PENETRATIONS
3. VERTICAL ANGLE CHANGES SHALL BE SUPPORTED W/FLOWABLE FILL
4. PRECAST MANHOLE BASE REQUIRED

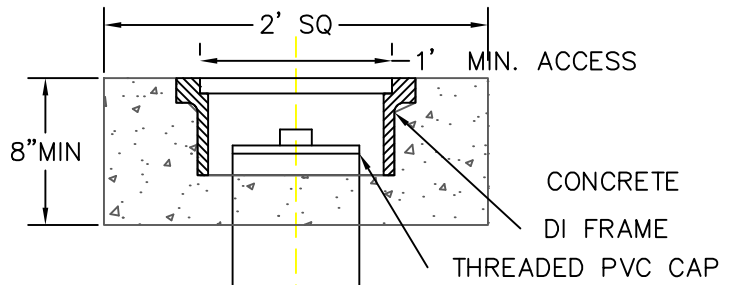


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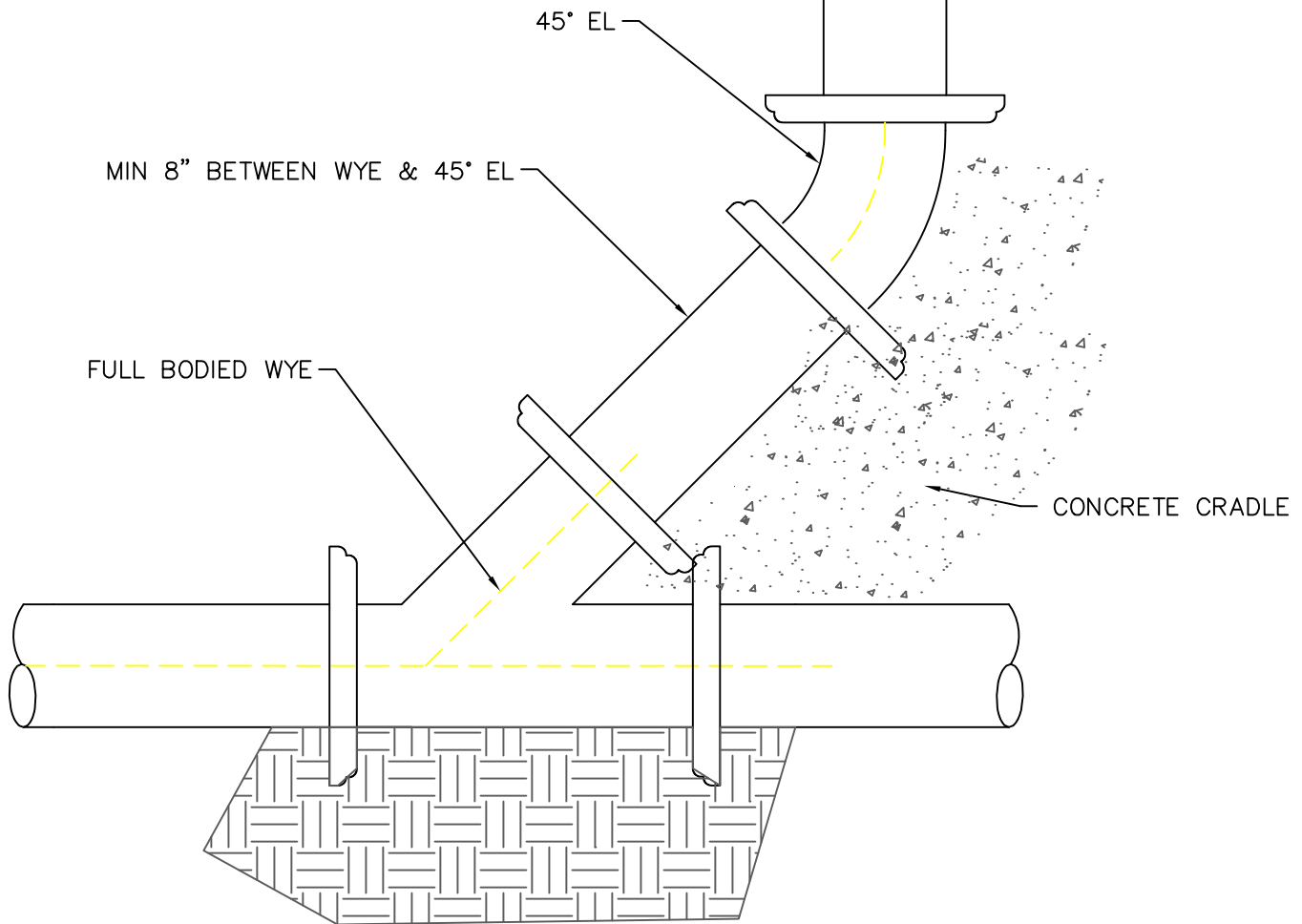
**DROP MANHOLE
 DETAILS**

DATE: 6/10/20 SHEET: 2 OF 2

FILL AROUND CONCRETE SHALL MATCH ROAD SECTION



SEE PLAN VIEW BELOW FOR LAYOUT IN POTENTIALLY PRESSURIZED LINES



TYPICAL CLEANOUT ELEVATION VIEW

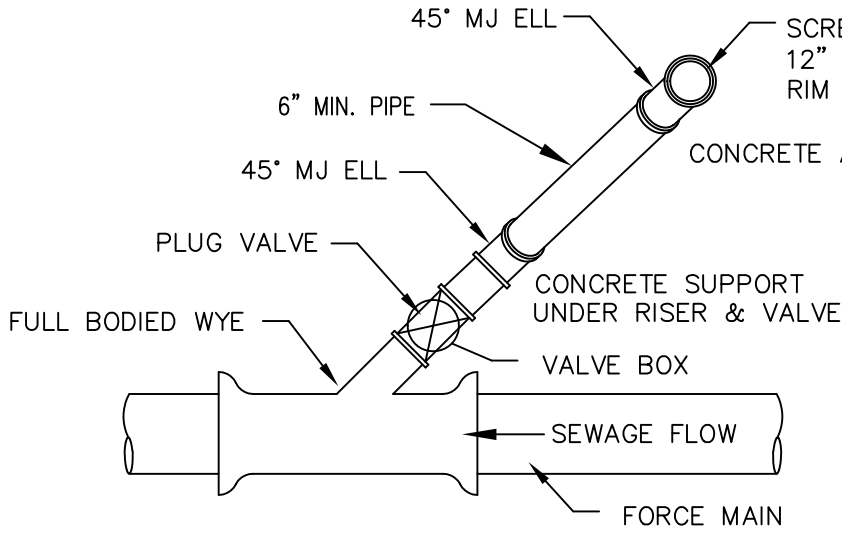


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970.626.5308
www.town.ridgway.co.us

GRAVITY CLEANOUT ELEVATION

DATE: 6/10/20

SHEET:



PRESSURE CLEANOUT
PLAN VIEW

ALL FITTINGS SHALL BE
DUCTILE IRON RESTRAINED
FOR PEAK ANTICIPATED
PRESSURES.

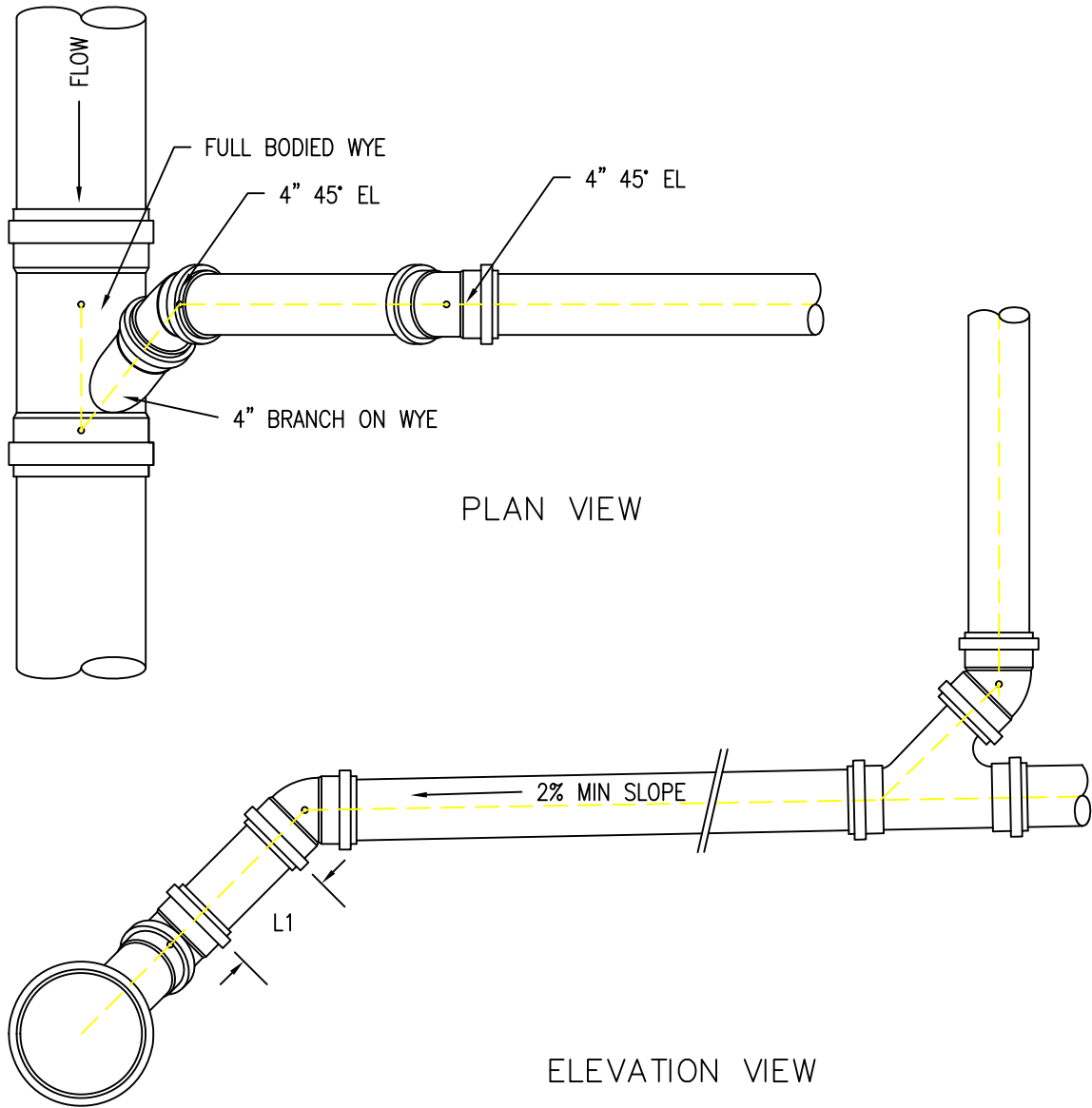
NOTE: FORCE MAIN MINIMUM SIZE
IS 4" WITH 4" VALVE & RISER



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**PRESSURE
CLEANOUT
PLAN VIEW**

DATE: 6/10/20 SHEET:



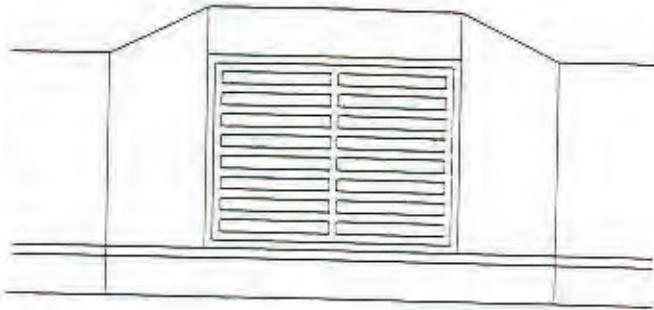
L1 = DISTANCE NEEDED TO ADJUST GRADE OF THE SERVICE TO DESIGN ELEVATION



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**4" SEWER
 SERVICE TAP**

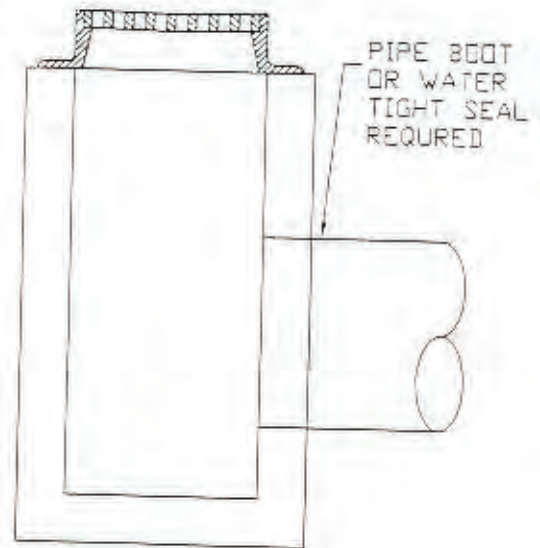
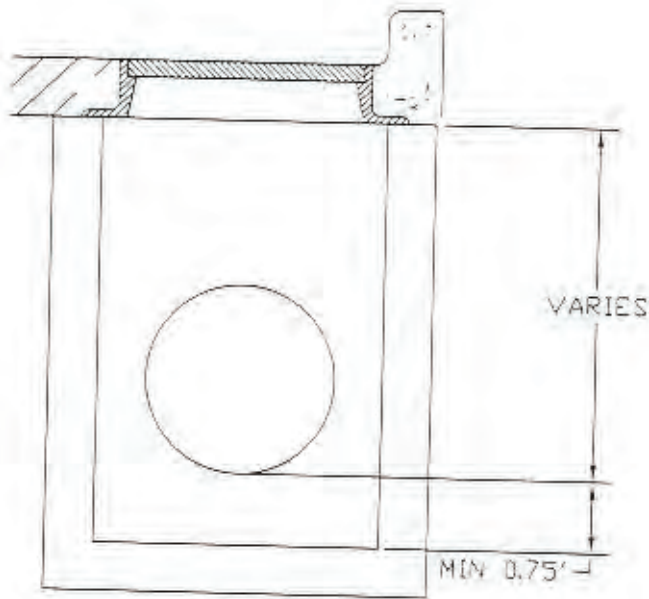
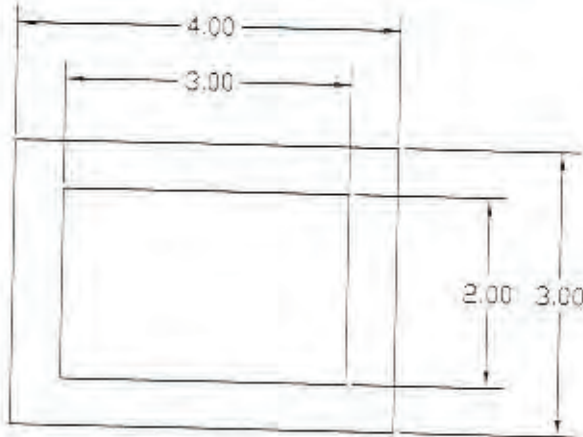
DATE: 6/10/20 SHEET:



STORM DRAIN CASTING

CONFORM TO ASTM A48-83 CLASS 35B FOR
GRAY IRON OR ASTM A536-80 GRADE
65-45-12 FOR DUCTILE IRON

GRATE TO COMPLY WITH BICYCLE SAFETY
STANDARDS



STORM DRAIN PIPE

ADS N-12 OR APPROVED EQUAL
24" DIAMETER MINIMUM

STORM DRAIN DESIGN LIMIT

STANDARD INLET FOR LESS THAN 2 CFS
LARGER FLOWS REQUIRE FLOW SPECIFIC DESIGN

STORM DRAIN MANHOLES TO CONFORM
TO SEWER MANHOLE TYP

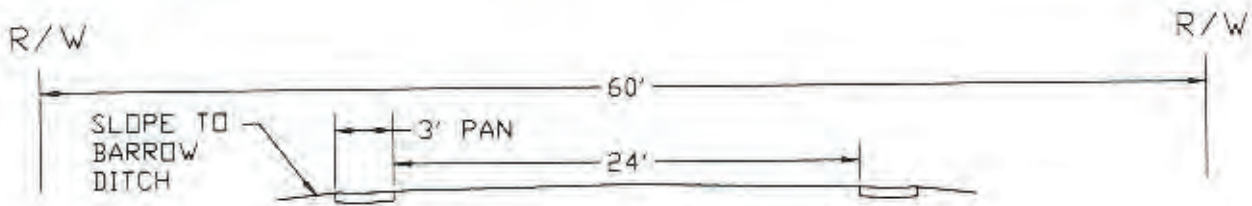
TOWN OF RIDGWAY

DATE:
2/01

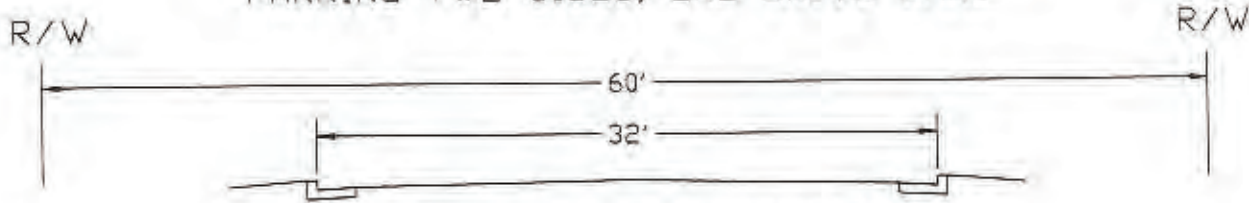
CONSOLIDATED
CONSULTING
SERVICES

DRN:

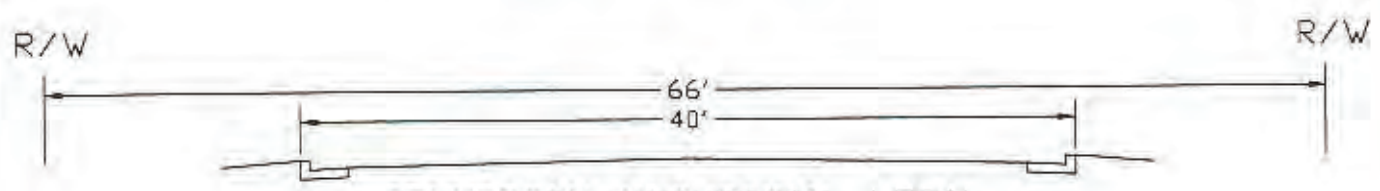
STORM DRAIN INLET



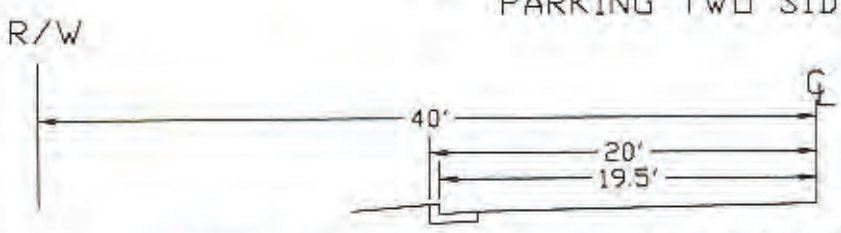
RESIDENTIAL LOCAL STREET
PARKING TWO SIDES, ONE DRIVE LANE



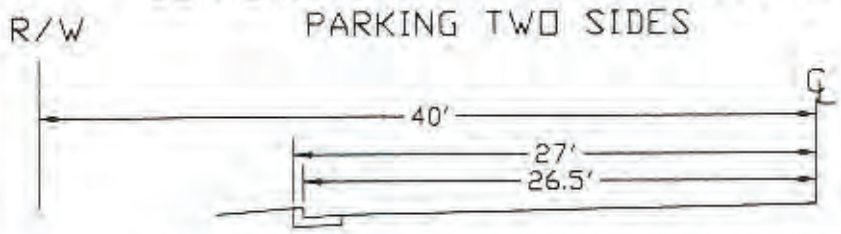
RESIDENTIAL COLLECTOR STREET
PARKING TWO SIDES



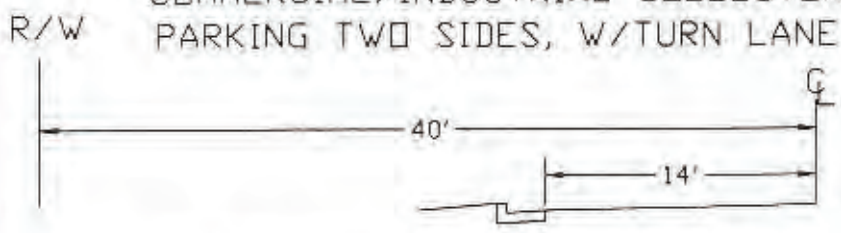
COMMERCIAL/INDUSTRIAL LOCAL
PARKING TWO SIDES



COMMERCIAL/INDUSTRIAL COLLECTOR
PARKING TWO SIDES



COMMERCIAL/INDUSTRIAL COLLECTOR
PARKING TWO SIDES, W/TURN LANE



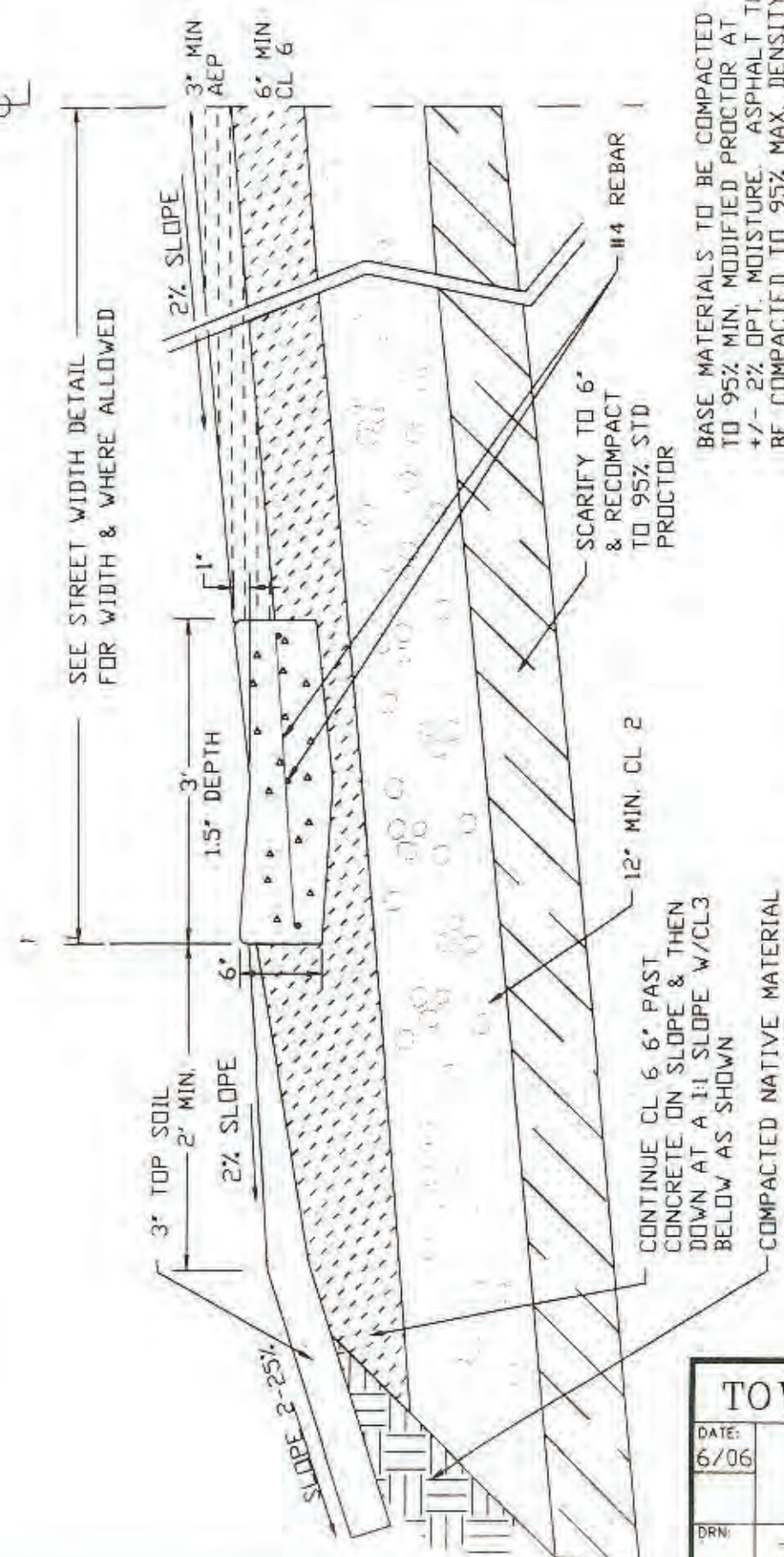
COMMERCIAL/INDUSTRIAL COLLECTOR
NO PARKING

NOTES:

1. SIDEWALK TO BE LOCATED AT LOCATION DESIGNATED BY TOWN BETWEEN BACK OF CURB & PROPERTY LINE. SIDEWALK WIDTH & STRUCTURE SPECIFIED IN TOWN STDS & SIDEWALK TYPICALS.
2. ROAD STRUCTURE REQ'TS ARE SPECIFIED IN TOWN STDS, AND ROAD SECTION TYPICALS.

TOWN OF RIDGWAY	
DATE: 6/06	CONSOLIDATED CONSULTING SERVICES
DRN:	

4



SEE STREET WIDTH DETAIL FOR WIDTH & WHERE ALLOWED

BASE MATERIALS TO BE COMPACTED TO 95% MIN. MODIFIED PROCTOR AT +/- 2% OPT. MOISTURE. ASPHALT TO BE COMPACTED TO 95% MAX. DENSITY

TYPICAL ROAD SECTION WITH PAN

STREETS WITH LOADS GREATER THAN A TYPICAL RESIDENTIAL STREET MAY REQUIRE ADD'L ROAD STRENGTH BASED ON ANTICIPATED TRAFFIC LOADS AS DESIGNED BY APP'D GEOTECHNICAL ENGINEER

TOPSOIL CAN BE NATIVE MATERIALS CAPABLE OF SUPPORTING VEGETATIVE GROWTH

TOWN OF RIDGWAY	
DATE: 6/06	CONSOLIDATED CONSULTING SERVICES
DRN:	TYP ROAD SECTION

SEE CURB, GUTTER & SIDEWALK
DETAIL FOR DIMENSIONS

SEE STREET WIDTH DETAIL

2% SLOPE

3" AEP MIN.
95% MAX DENSITY
6" MIN. CLASS 6

12" MIN. CLASS 2
OR ALT. APP'D DESIGN

SCARIFY TO 6" &
RECOMPACT TO
95% STD PROCTOR

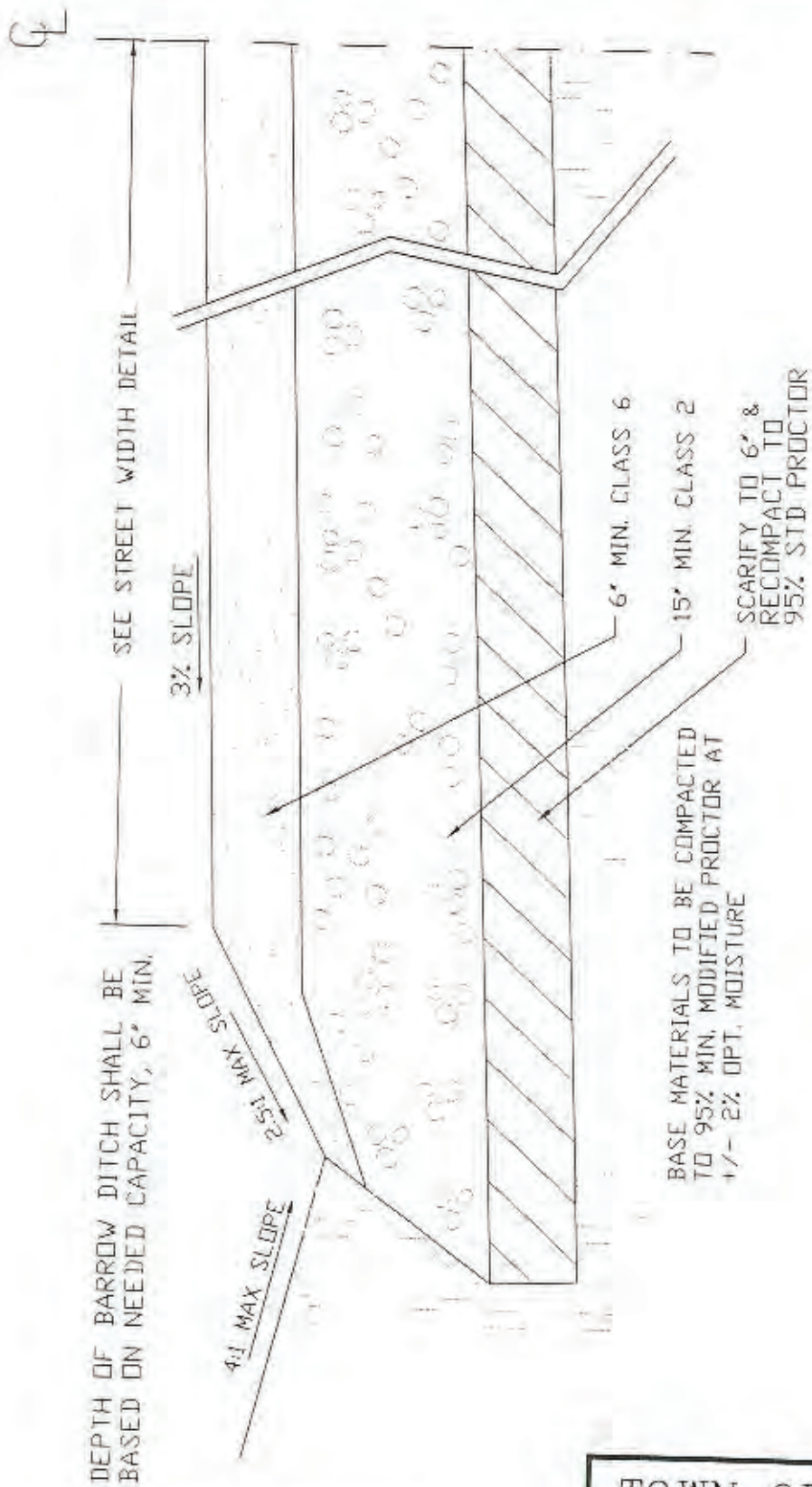
BASE MATERIALS TO BE COMPACTED
TO 95% MIN. MODIFIED PROCTOR AT
+/- 2% OPT. MOISTURE

2:1 MAX SLOPE

TYPICAL ROAD SECTION WITH VERTICAL CURB

STREETS WITH LOADS GREATER THAN
A TYPICAL LOCAL RESIDENTIAL STREET
MAY REQUIRE ADD'L ROAD STRENGTH
BASED ON ANTICIPATED TRAFFIC
LOADS AS DESIGNED BY APP'D
GEOTECHNICAL ENGINEER

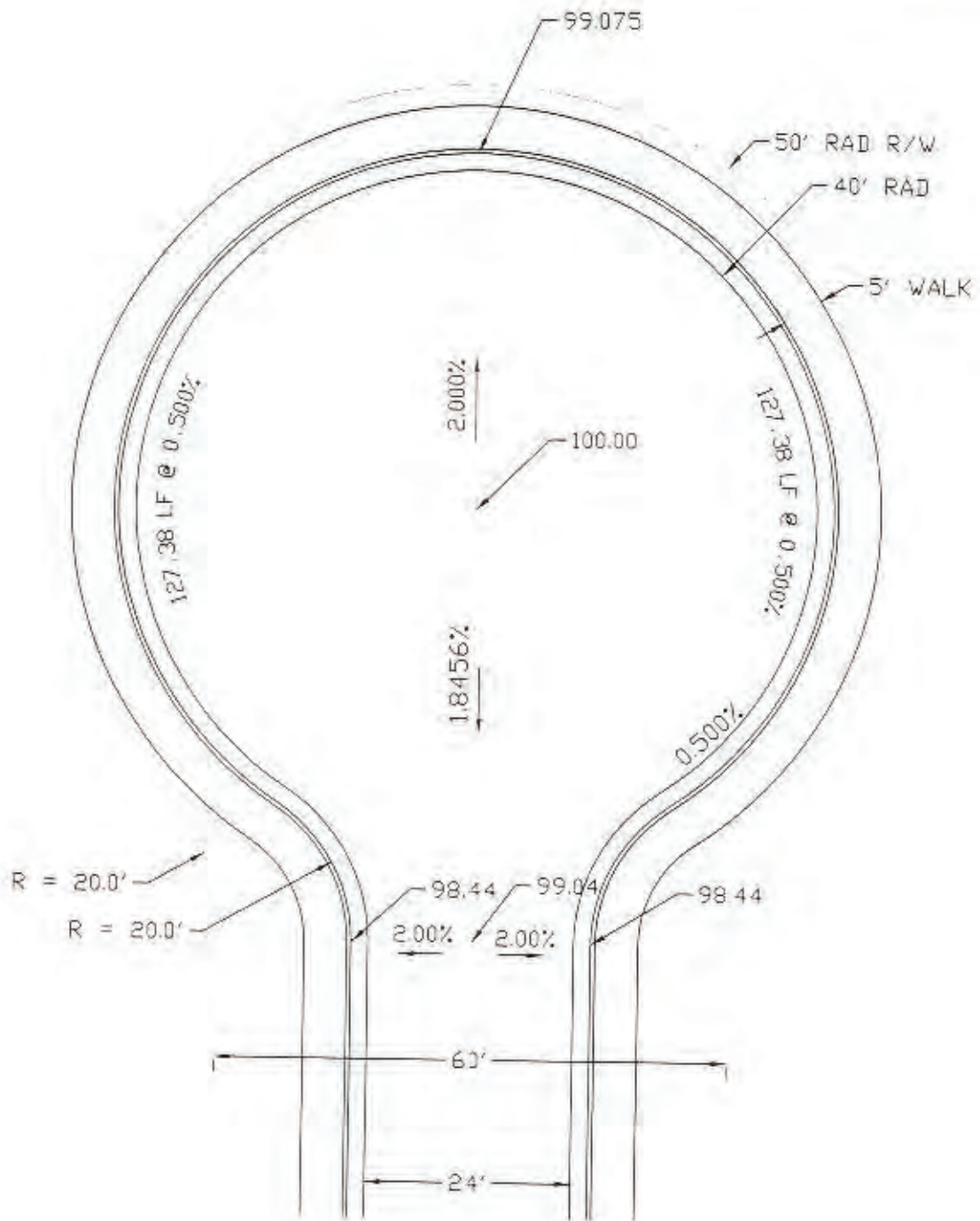
TOWN OF RIDGWAY	
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
DRN	TYP PAVED STREET



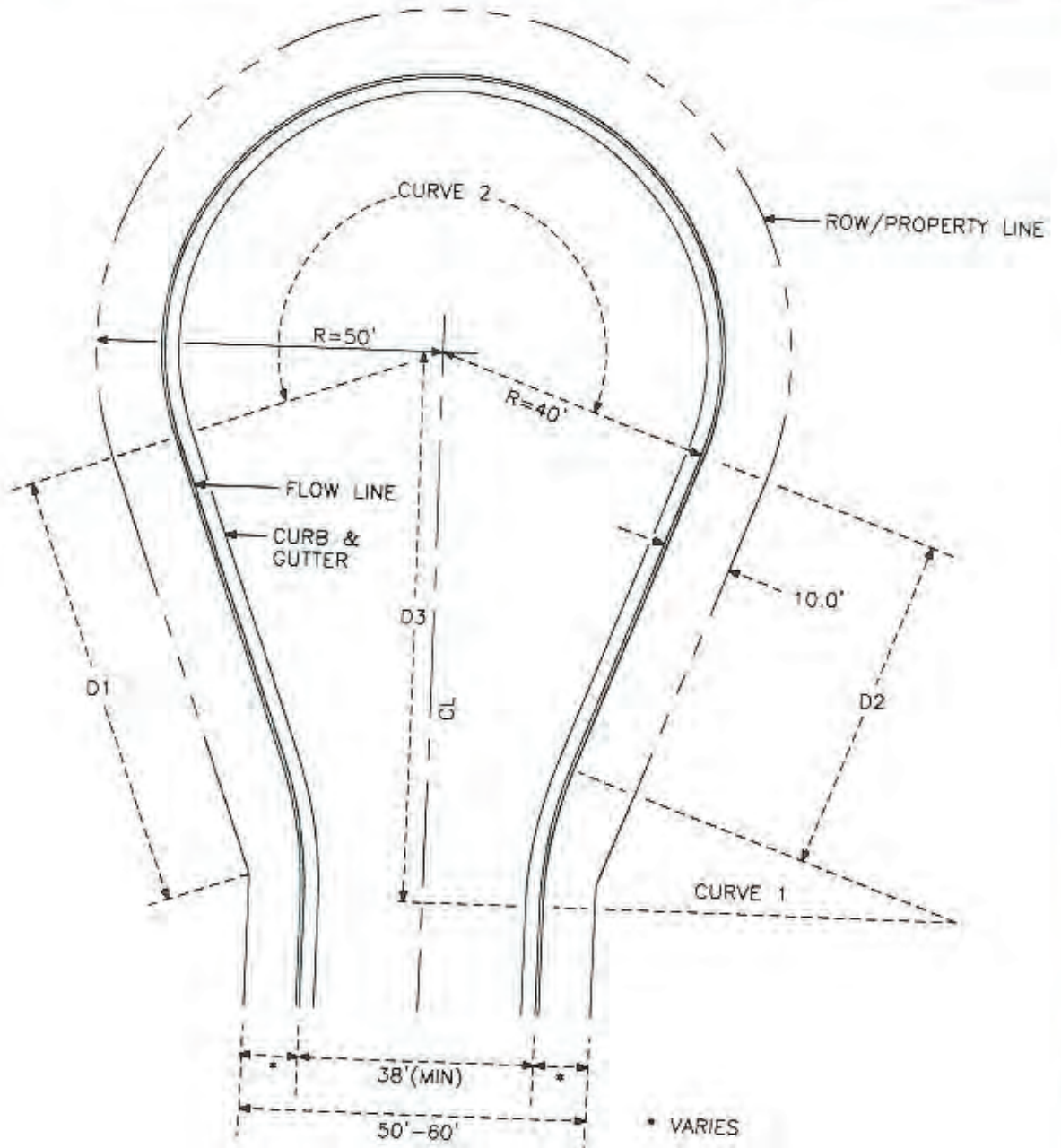
STREETS WITH LOADS GREATER THAN A TYPICAL RESIDENTIAL STREET MAY REQUIRE ADD'L ROAD STRENGTH BASED ON ANTICIPATED TRAFFIC LOADS AS DESIGNED BY APP'D GEOTECHNICAL ENGINEER

TYPICAL ROAD SECTION
GRAVEL STREET

TOWN OF RIDGWAY	
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
ORN:	TYP GRAVEL STREET



TOWN OF RIDGWAY	
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
DRN:	CUL DE SAC TYPICAL



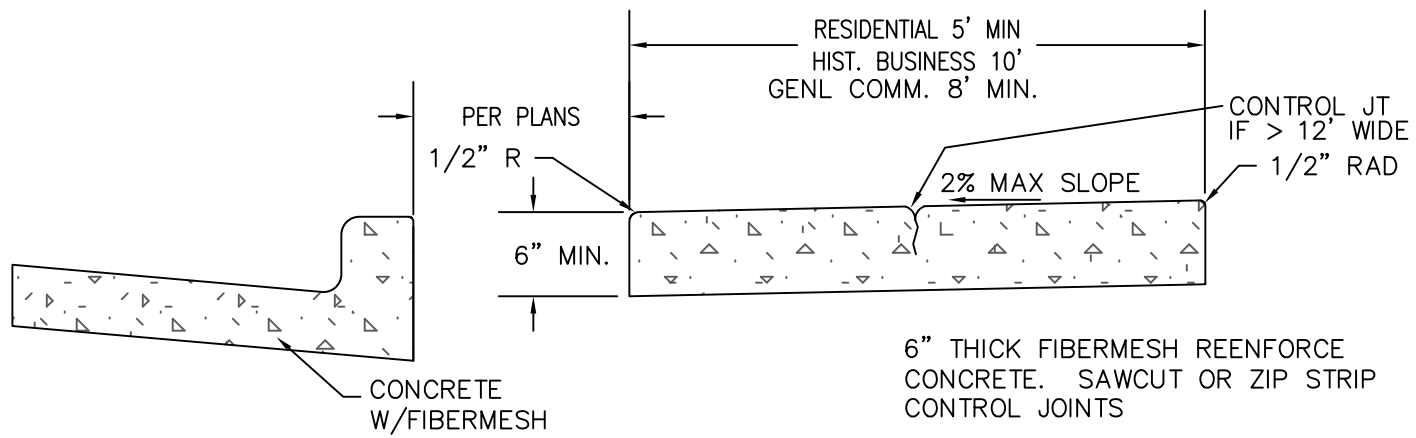
CURVE 1				CURVE 2				
△	CURB			△	CURB		PROP.	
	R	L	T		R	L	R	L
20°00'00"	60.0'	20.94'	10.58'	220°00'00"	40.0'	153.59'	50.0'	191.99'
STREET WIDTH		D1		D2		D3		
38'(MIN)		64.28'		49.61'		80.82'		

TOWN OF RIDGWAY

DATE: 6/06

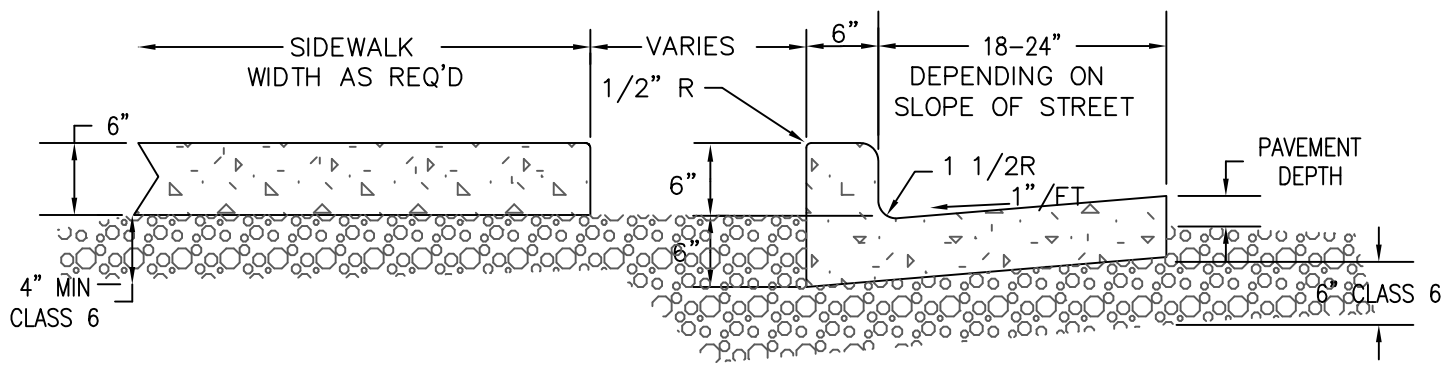
CONSOLIDATED
CONSULTING
SERVICES

DRN: CUL DE SAC (ALT)



SIDEWALK DETAIL

N.T.S.

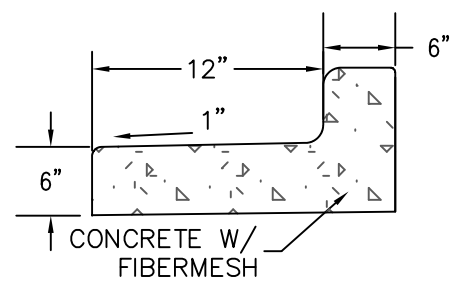


CURB AND GUTTER

N.T.S.

NOTES:

1. WHERE TOWN ALLOWS SIDEWALK TO BE PLACED ONLY ON ONE SIDE OF THE RIGHT OF WAY, THE STREET SHOULD BE OFFSET IN THE R/W & THE SIDEWALK WIDTH INCREASED TO 8' MIN.
2. SIDEWALK WIDTHS IN OTHER ZONES SHALL BE AT LEAST 8' UNLESS OTHERWISE ALLOWED BY THE TOWN.
3. CURB CUTTERS SHALL CONFORM WITH A.D.A. REQUIREMENTS



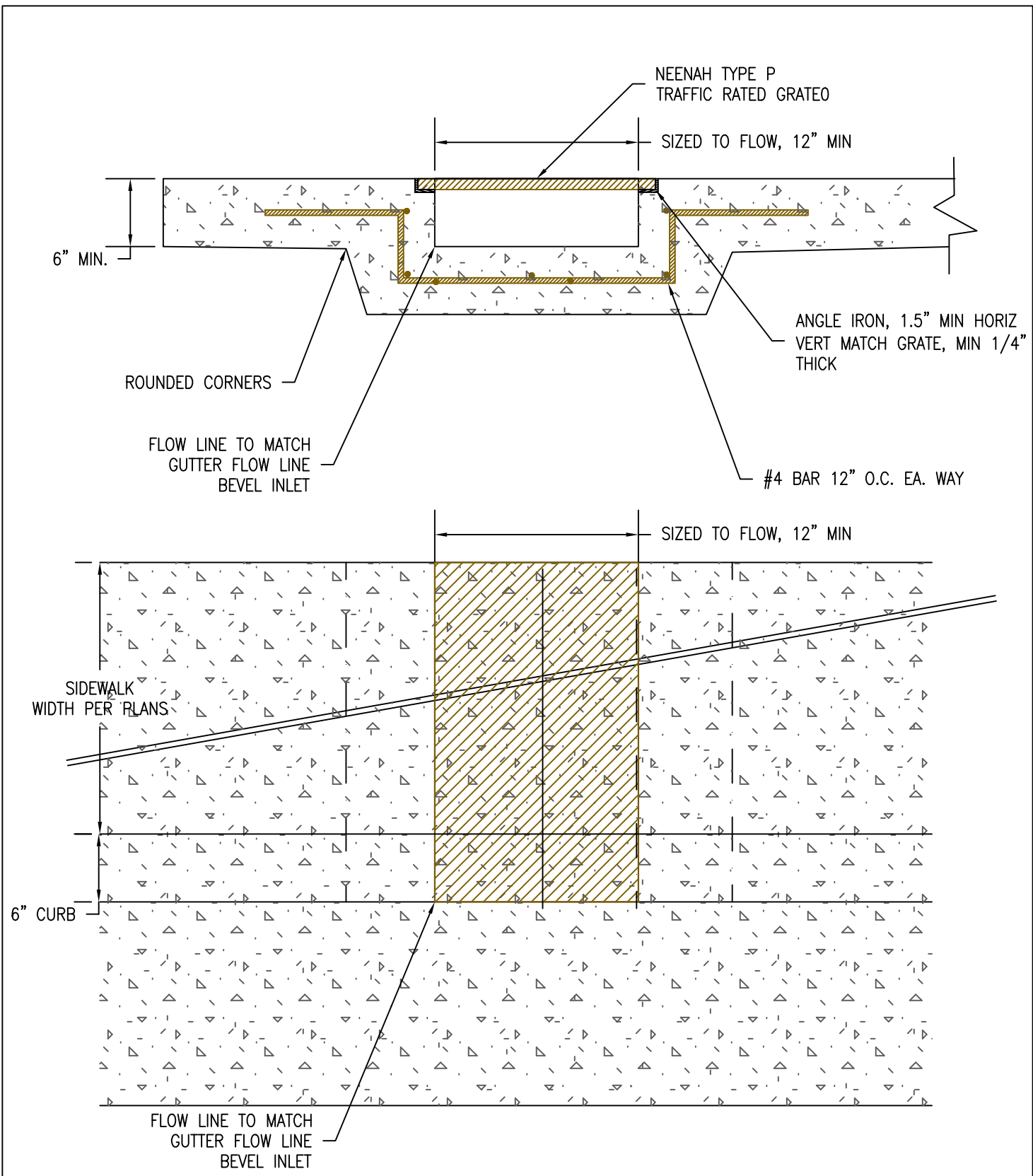
TIP OUT CURB & GUTTER



TOWN OF RIDGWAY
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**CURB, GUTTER,
SIDEWALK DETAIL**

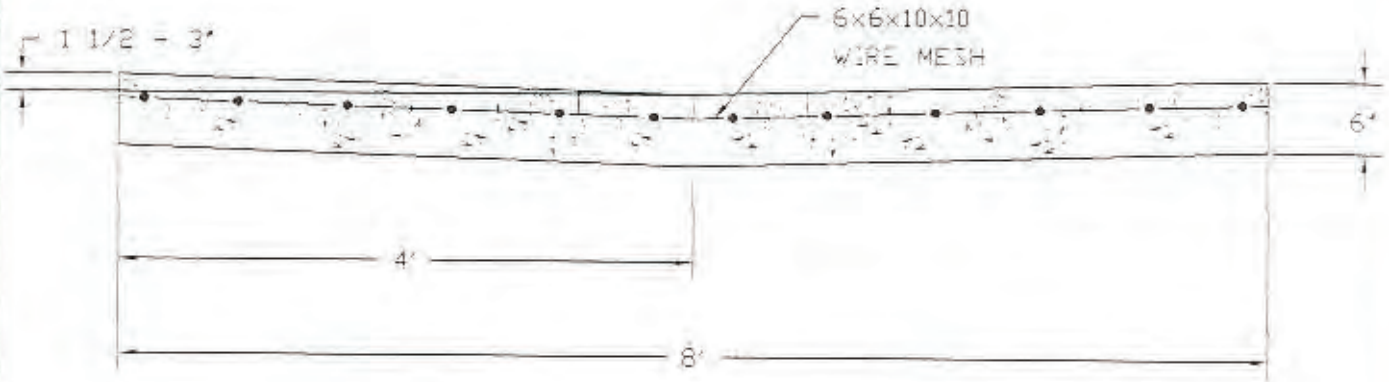
DATE: 6/10/20 SHEET:



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SIDEWALK DRAIN BOX

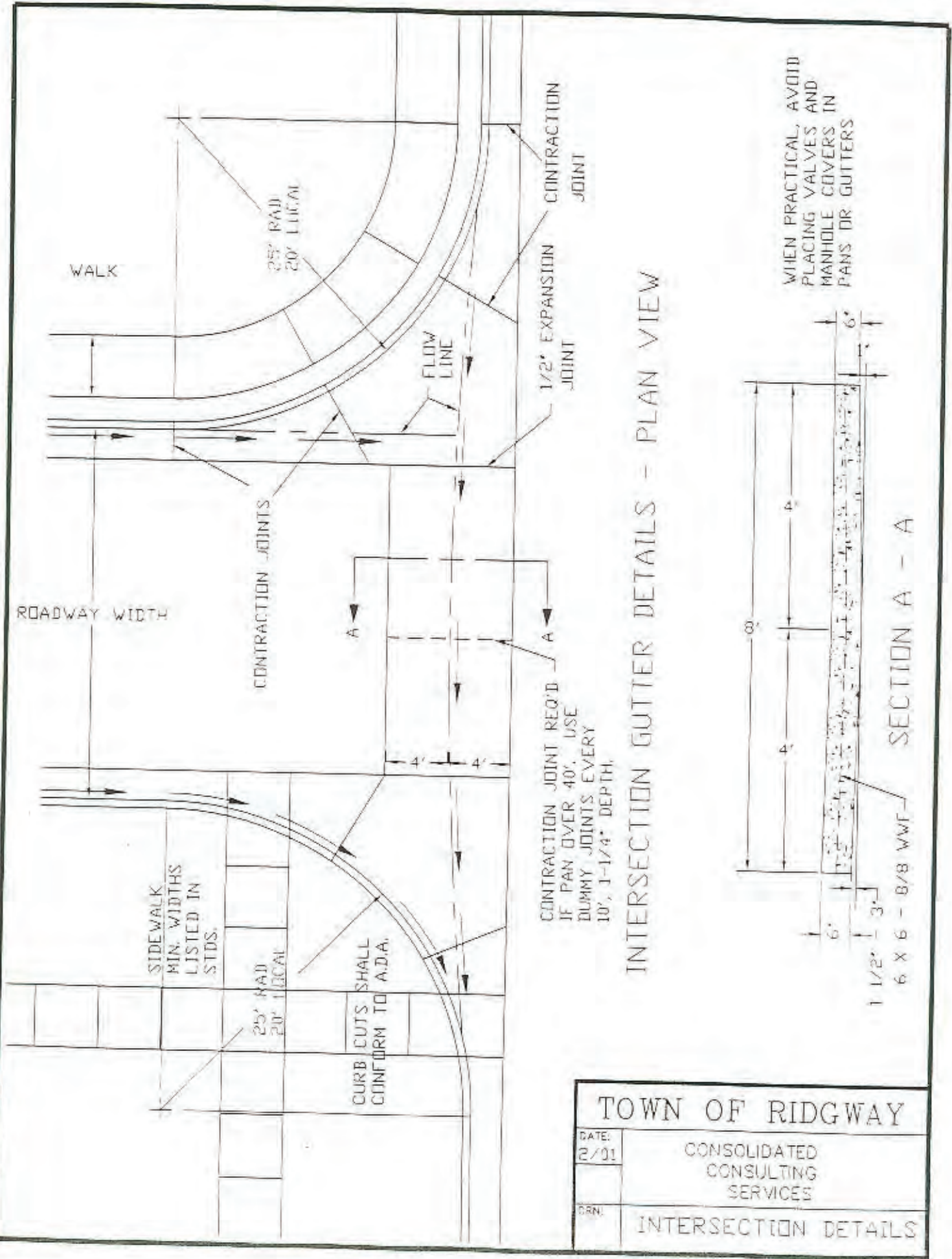
DATE: 6/10/20 SHEET:



VALLEY DRAIN DESIGN
N.T.S.

VALLEY PAN DETAILS

TOWN OF RIDGWAY	
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
DRN:	VALLEY PAN DETAIL

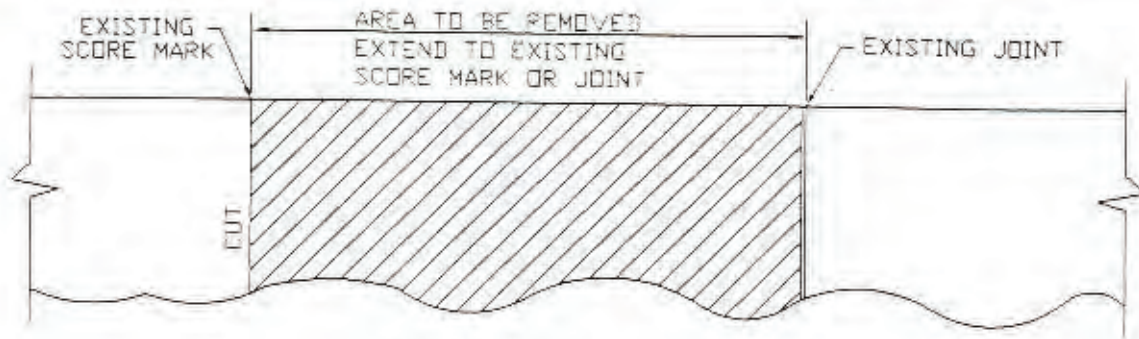


CONTRACTION JOINT REQ'D
 IF PAN OVER 40'. USE
 DUMMY JOINTS EVERY
 10', 1-1/4" DEPTH.

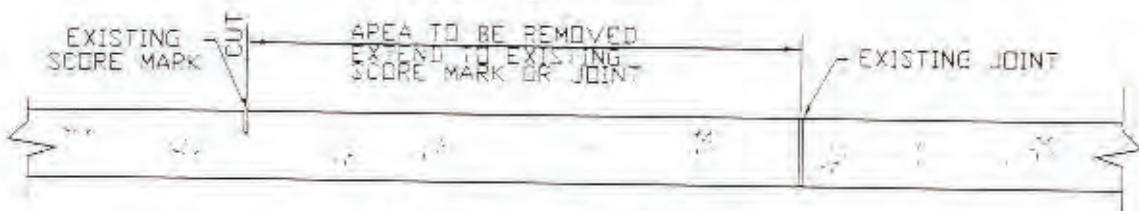
INTERSECTION GUTTER DETAILS - PLAN VIEW

WHEN PRACTICAL, AVOID
 PLACING VALVES AND
 MANHOLE COVERS IN
 PANS OR GUTTERS

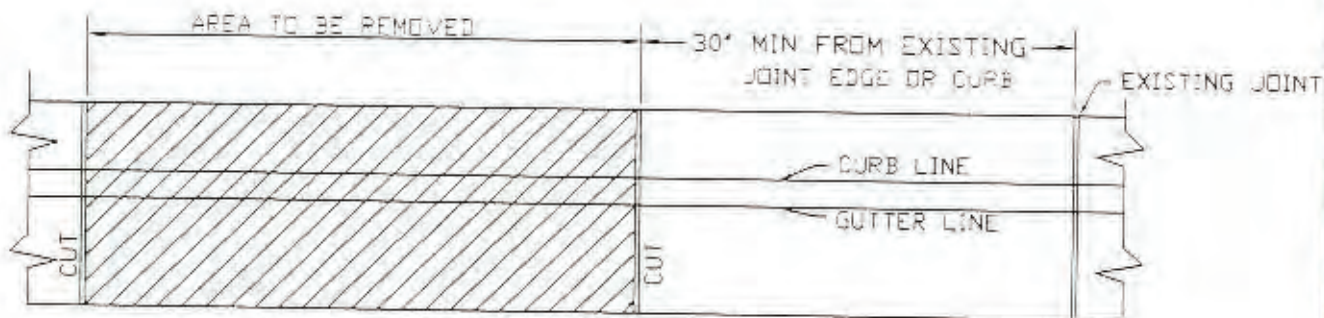
TOWN OF RIDGWAY	
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
DRN:	INTERSECTION DETAILS



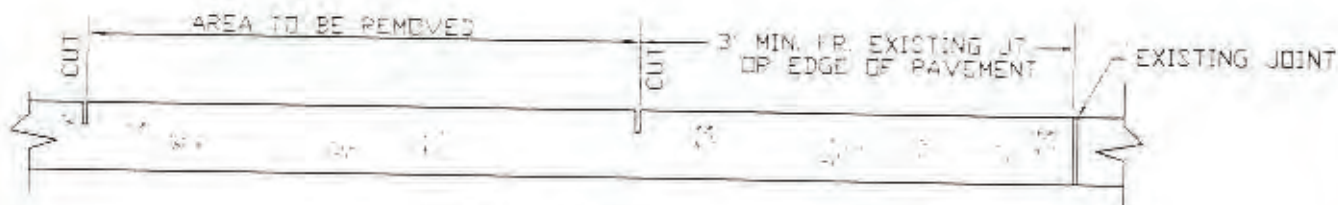
SIDEWALK PLAN



SIDEWALK SECTION

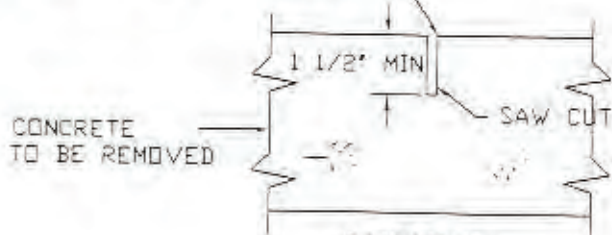


CURB PLAN



PAVEMENT SECTION

REMAINING EDGE TO BE SMOOTH AND TRUE WITH NO SHATTER

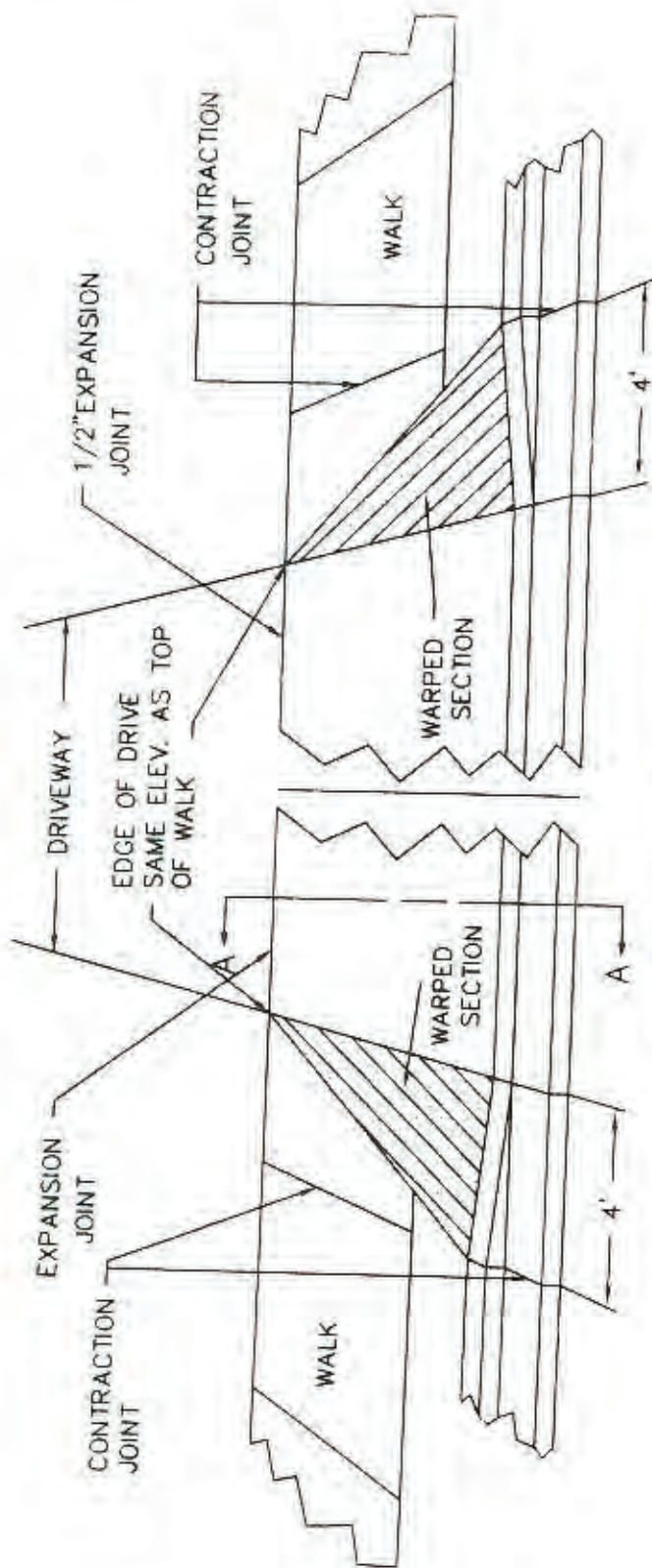


SECTION SHOWING CUT

WHEN DISTANCE FROM 'AREA TO BE REMOVED', TO EXISTING JOINT IS LESS THAN MINIMUM SHOWN, 'AREA TO BE REMOVED' SHALL BE EXTENDED TO THAT JOINT OR SCORE MARK.

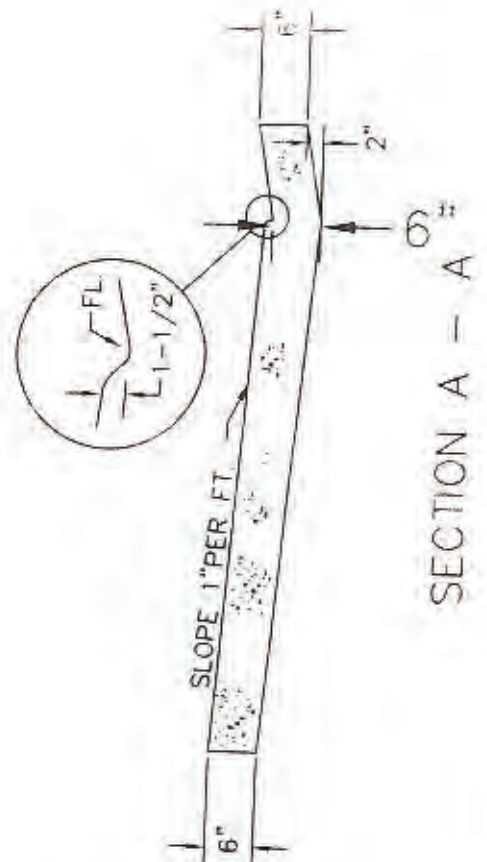
TOWN OF RIDGWAY

DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
ORN:	PAVEMENT REMOVAL



DRIVEWAY DETAILS

PERSPECTIVE VIEW



SECTION A - A

DRIVEWAY WIDTH

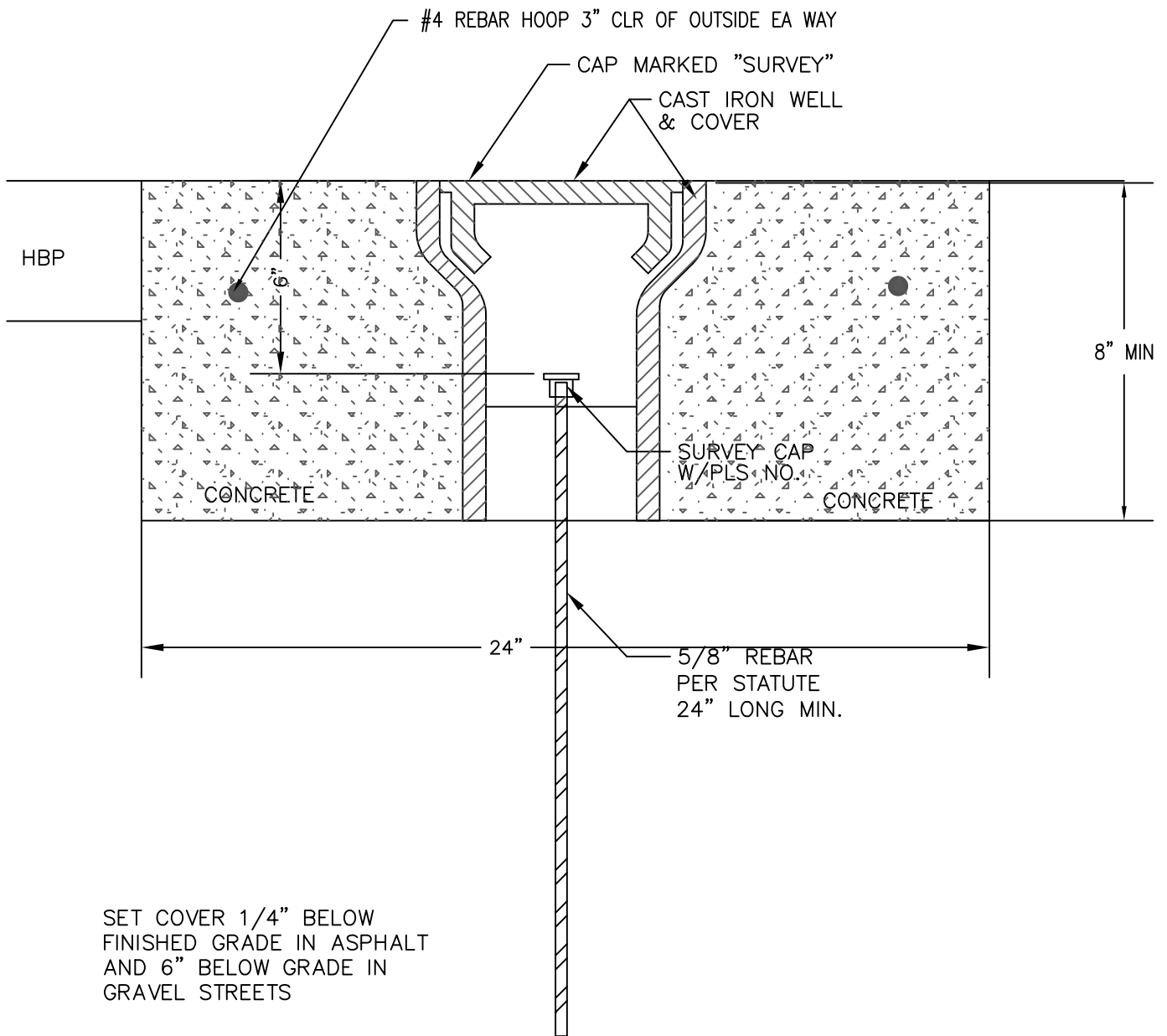
MINIMUM	12'
1, 2 FAMILY	22'
RESIDENTIAL, MAX	25'
BUSINESS, MAX,	35'

NOTES:

1. WHEN STREETS ARE HARD SURFACED DRIVEWAY SHALL BE HARD SURFACED FROM PROPERTY LINE TO THE STREET
2. DRIVEWAY WARP SECTIONS MUST MEET ADA.

3/12/07 - ADD NOTE RE: SURFACING

CHK:	TOWN OF RIDGWAY
DATE: 3/07	CONSOLIDATED CONSULTING SERVICES PO BOX 738, DELTA, CO 81626
#_DTP	DRIVEWAY DETAILS



CENTERLINE MONUMENT DETAIL

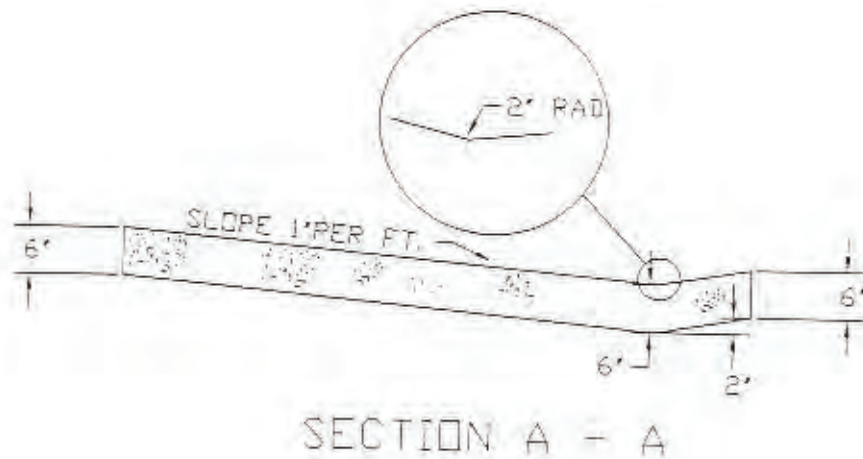
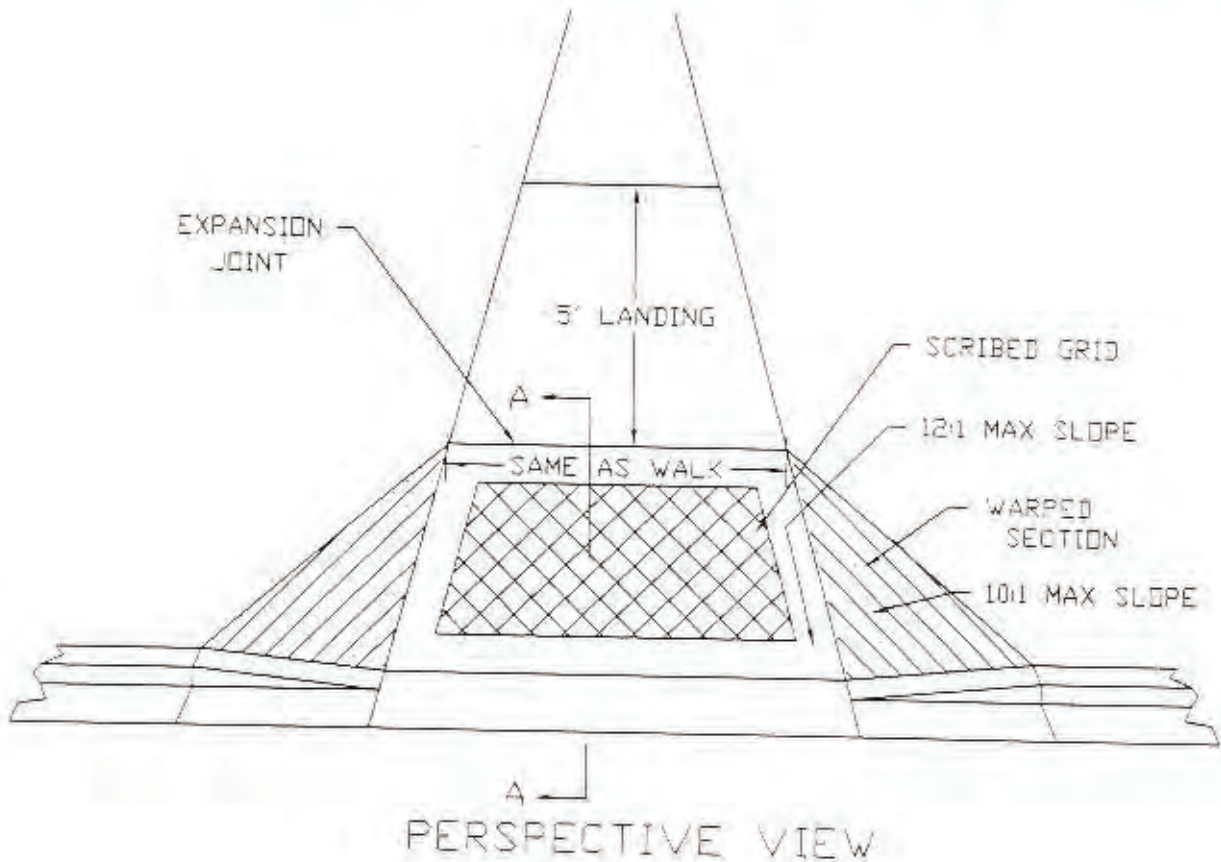


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**CENTERLINE
 MONUMENT**

DATE: 6/10/20

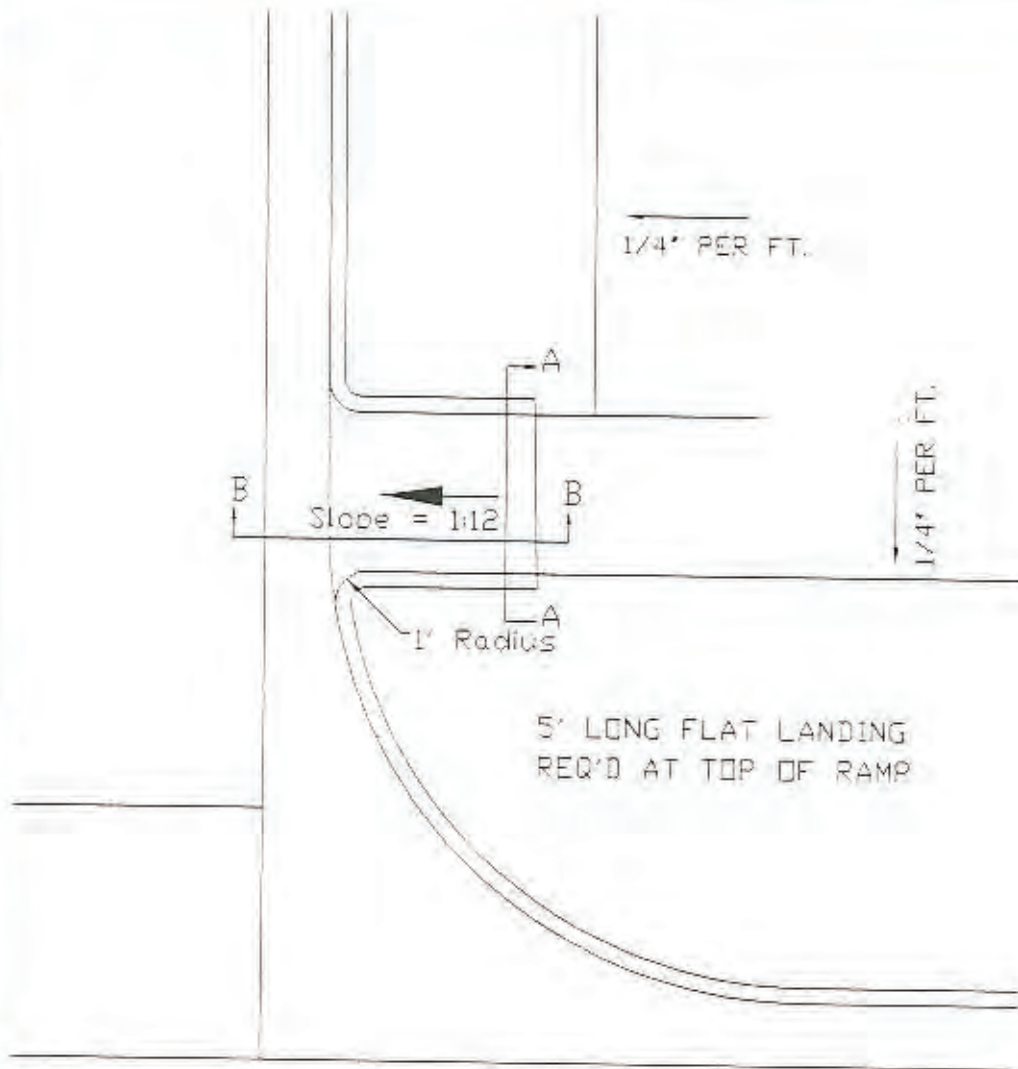
SHEET:



WHEEL CHAIR ACCESSIBLE TYPICAL

WALKWAYS AND CURB CUTS SHALL CONFORM WITH CURRENT A.D.A. REQ'TS

TOWN OF RIDGWAY	
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
DRN:	HANDICAP RAMP 1 OF 2



6" CONCRETE
5' WIDE X 6' LONG

WHEEL CHAIR CURBING

TAPERS FROM 10" TO 4"
IN 6 FEET



SECTION A-A

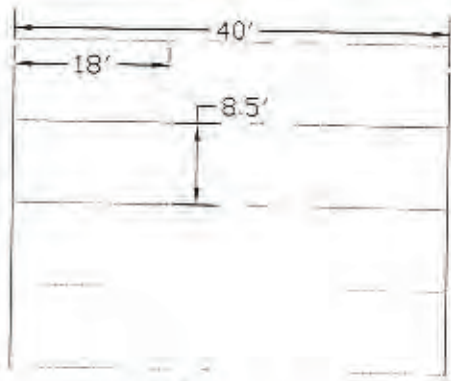


SECTION B-B

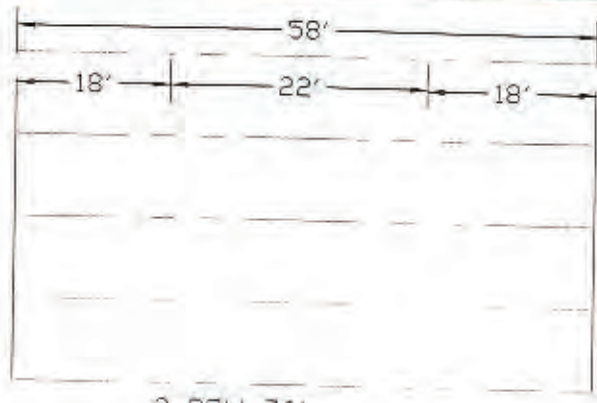
WALKWAYS AND CURB CUTS
SHALL CONFORM WITH
CURRENT A.D.A. REQ'TS

TOWN OF RIDGWAY

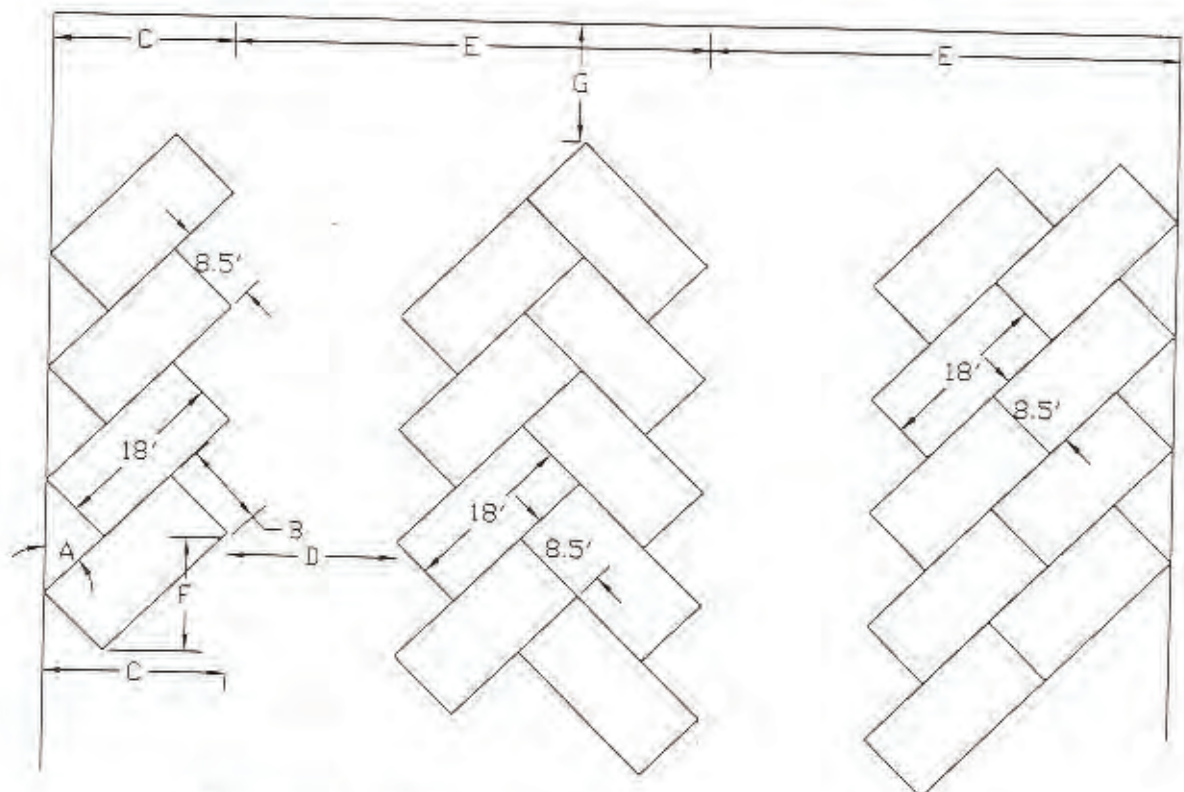
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
DRN:	HANDICAP RAMP 2 OF 2



1 ROW



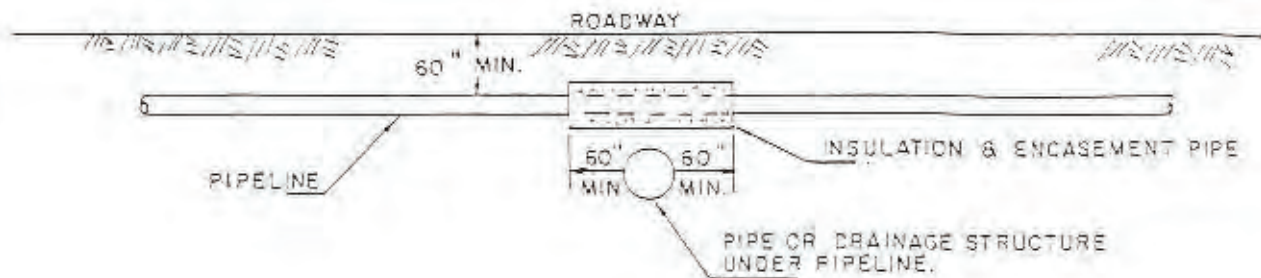
3 ROW 76'
4 ROWS 94'



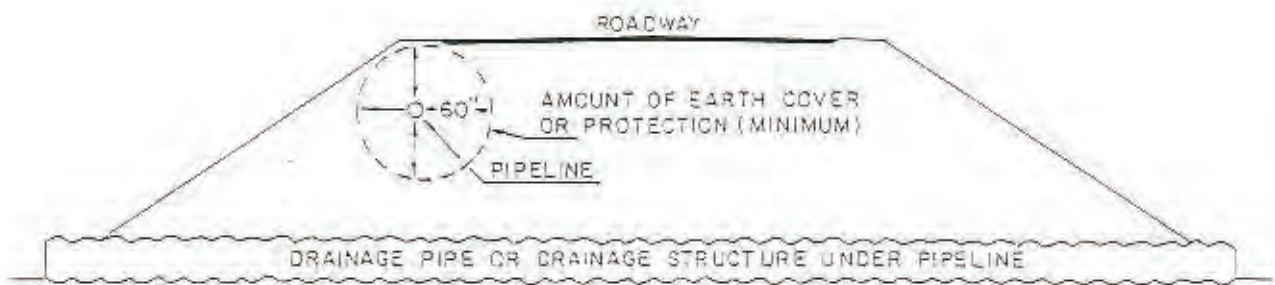
STALL AND AISLE DIMENSIONS

A	B	C	D	E	F	G	# stalls/ in "X" length	Area/ car
90	8'6"	18'0"	22'0"	58'	8'6"	18'0"	X/8.5	247
60	8'6"	18'10"	17'6"	55'	8'6"	18'0"	(X-11)/9.8	270
45	8'6"	17'6"	12'6"	47'	8'6"	18'0"	(X-17)/12	282

TOWN OF RIDGWAY	
DATE: 2/01	CONSOLIDATED CONSULTING SERVICES
DRN:	PARKING LOT SPACING

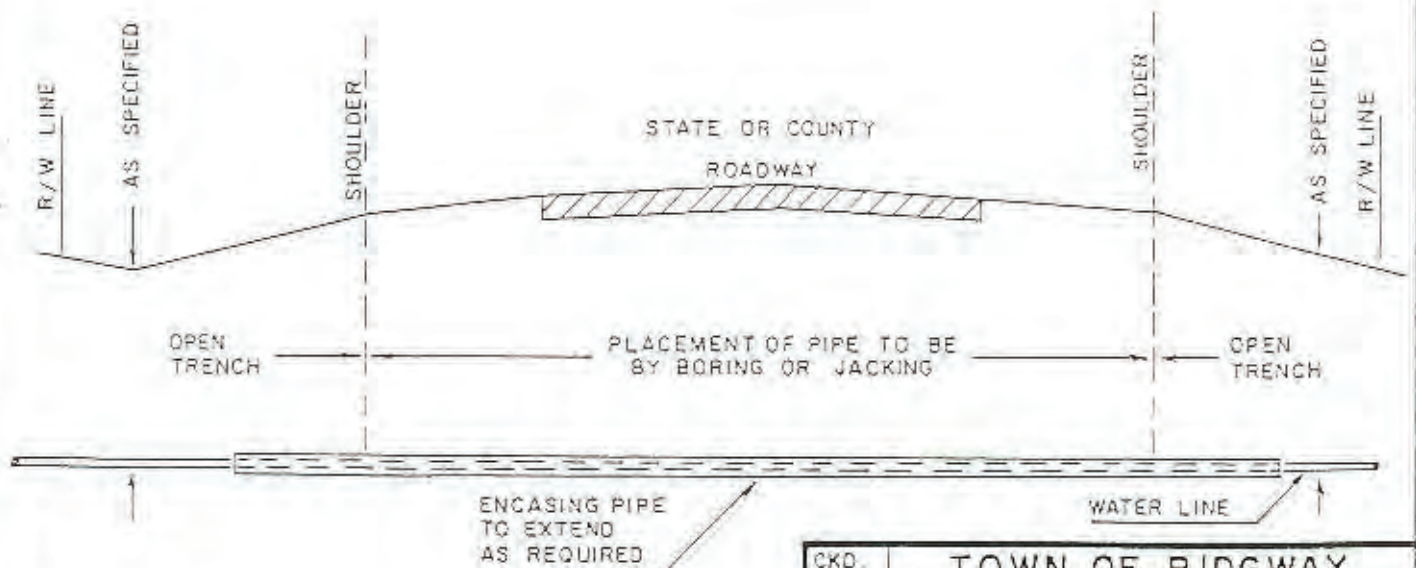


NOTE: FOR INSULATION AND ENCASEMENT OF PIPELINE SEE "DETAILS OF INSULATED PIPE" DRAWING.



NOTE: IF THERE IS LESS THAN 60" OF COVER MATERIAL AROUND PIPELINE, THEN THE PIPE MUST BE INSULATED.

IF THERE IS LESS THAN 24" OF COVER THE PIPELINE & INSULATION MUST HAVE AN ENCASEMENT PIPE AROUND IT.



NOTE: ENCASING PIPE TO EXTEND FROM RIGHT-OF-WAY LINE TO RIGHT-OF-WAY LINE ON STATE HIGHWAY CROSSINGS.

CKD.	TOWN OF RIDGWAY
	ROADWAY CROSSINGS
DATE	CONSOLIDATED CONSULTING SERVICES
DRN.	