# TOWN OF HOTCHKISS

# STANDARD SPECIFICATION

# AND TYPICAL DRAWINGS

# FOR INFRASTRUCTURE CONSTRUCTION

**APRIL**, 2006

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# CHAPTER 1 - GENERAL REQUIREMENTS

#### 0. 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.

# 1. 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 insure 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 and to insure 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.

#### 2. 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. Provisions of Town ordinances more stringent than with these Standards shall control.

#### 3. INTERPRETATION

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

(A) 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.

- (B) 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.
- (C) 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 a Utility Extension Agreement 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 insure compliance with these Standards.
- (D) 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. AMENDMENTS AND REVISIONS

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

# 5. DEFINITIONS AND ABBREVIATIONS

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

5.01. <u>Town</u> shall mean the Town of Hotchkiss, Colorado. When referencing an individual, the <u>Town</u> shall mean a designee of the Town Board of Trustees.

5.02. <u>Town Code</u> shall mean the official adopted Town Code and Regulations of Hotchkiss, Colorado.

5.03. <u>Engineer</u> shall mean the Town Engineer, Town of Hotchkiss, Colorado, or his authorized representatives acting on behalf of the Town.

5.04. <u>Inspector</u> shall mean an authorized representative of the Town and/or Town's Engineer at the site of work.

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5.05. <u>Owner's Representative (OR)</u> shall mean any person or persons (including Engineer) authorized by the Town of Hotchkiss acting on behalf of the Town.

5.06. <u>Developer</u> 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.

5.07. <u>Developer's Engineer</u> - 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.

5.08. <u>Developer's Representative</u> shall mean any person or persons authorized by the Developer to act on behalf of the Developer

5.09. <u>Contractor</u> 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.

5.10. <u>Public Improvements</u> 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.

5.11 <u>Designated Private Construction Work</u> 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 built on private property.

5.12. <u>Record Drawings</u>: 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".

5.13 <u>Responsible Party</u>: 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 and applicable private improvement projects related to these Standards and Specifications and may include but not be limited to the Contractor, Developer, Permittee, Builder, Engineer, Consultant, and Owner.

5.14. <u>Utility</u> shall include the water and sewer utilities of the Town of Hotchkiss and all other utilities (e.g. power, telephone, cable, gas, etc.) provided by other entities.

# 5.15. Expressions

5.15a. 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 is intended. Similarly, the words "approved", "acceptable", "satisfactory" shall refer to approval by the Town or its designated Representative.

5.15b. 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 Hotchkiss, Standard Specifications and Typical Drawings for Infrastructure Design and Construction, including all parts, supplements and revisions pertaining thereto.

5.15c. 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.

# 5.16 ABBREVIATIONS

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

AASHT(	D American Assoc.of State Highway and Transportation
	Officials
ACI	American Concrete Institute
ADA	American Disabilities Act
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APWA	American Public Works Association
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWWA	American Water Works Association
CDPHE	Colorado Department of Public Health and Environment
CDOT	Colorado Department of Transportation
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CUHP	Colorado Urban Hydrograph Procedure
CWCB	Colorado Water Conservation Board
DIP	Ductile Iron Pipe
EPA	US Environmental Protection Agency
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."
MUTCD	Manual on Uniform Traffic Control Devices
NFIP	National Flood Insurance Program
NPDES	National Pollution Discharge Elimination System

OR	Owner's (Town's) Representative
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)
USGS	United States Geological Survey

#### 6. ENFORCEMENT

#### 6.01 Authority of the Town

6.01.a The Town Engineer or OR designated by the Board of Trustees shall have the authority on behalf of the Town to ascertain that all design and construction of infrastructure, surface improvements, and facilities are equal to or better than the minimum requirements set forth in the Town Standards and in other known applicable State and Federal requirements.

6.01.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.

6.01.c The Town's inspector 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 inspector 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 inspector will have the authority to reject materials until the Town resolves any and all questions at issue.

6.01.d The Town and its inspector 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.

6.01.e The Town will have the authority to stop work whenever such stoppage may be deemed necessary.

6.01.f. The Town's inspector 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 shall 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 inspector will not relieve, in any degree, the responsibility or the obligation of the Responsible Party. 6.01.g. 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.

#### 6.02 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 19 of these Standards.

#### 6.03 DEVIATIONS

6.03.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.

6.03.b Whenever there are practical difficulties involved in carrying out the provisions of these procedures, 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.

#### 7. RESPONSIBLE PARTY RESPONSIBILITIES

7.01 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.

7.02 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.

7.03 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

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and employees.

7.04 The Responsible Party shall be solely responsible for locating all existing underground installations, including service connections, in advance of excavating. Town maps and databases, where available, 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, by the appropriate party, in the field prior to proceeding with design where interferences may occur or with work in the area as applicable.

# 8. PLANS FOR REVIEW

8.01 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 a registered professional engineer licensed in the State of Colorado. Street plans may also be prepared and stamped by a qualified licensed land surveyor.

8.02 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.

8.03 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 2.0 acres in which case the minimum scale shall be 1" = 100'. 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. 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 mains, service lines, other utilities, culverts, etc). Sewer plans shall show location, dimensions, stationing, and grades of mains, manholes, elevations, 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.

8.04 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.

8.05 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 determine that the materials meet the intent of these Standards. The Responsible party should be aware of the Operation and Maintenance submission requirements in Section 21.

8.06 The cost of plan review and enforcement of these Standards and related Town ordinances and regulations will be based on the Town Code as amended from time to time. The minimum fee shall be \$50.00, plus out-of pocket costs the Town incurs for engineers, technical review, attorney's fees and/or other reasonable expenses.

8.07 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 rechecked as outlined in the next paragraph.

8.08 If resubmittal of plans is required, the resubmitted plans shall indicate all revisions (including those not requested by the Town) from the previous submittal. It is suggested that the responsible party also provide a letter explaining how each of the Town's comments has been addressed.

8.09 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. EASEMENT REQUIREMENTS

The following are the minimum easement requirements:

Front	utility	10'
Rear	ι.	5'

Side lot easements are required when there is a potential need.

For easements for uses other than wire utilities in the front utility easement, the following minimums are required:

Absolute minimum	10'
Minimum if equipment is needed to	maintain or replace 15'
For single subsurface utility	5' + (3 * invert depth)
For ditches and drainages	12' + top bank width
For multiple sub-surface uses	15' + 5' between utilities
	& 3' between utility &

# easement edge

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

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

# 10. SUBMITTALS

The Responsible Party shall provide submittal information including samples, drawings, reports, field notes, 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 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.

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

# 11. RESPONSIBILITY FOR DESIGN AND CONSTRUCTION

The Town shall have full authority to review and approve all submittals and construction for compliance with these 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

#### 12. PRE-CONSTRUCTION MEETINGS

#### 12.01 Pre-Bid Meeting:

On projects where the Responsible Party will be receive 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 conference shall be held prior to commencing construction. In attendance shall be the Responsible Party, his Contractor including the on-site project superintendent, any major sub-contractors and/or suppliers, 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 and testing schedule.

# 13. NOTIFICATIONS BY RESPONSIBLE PARTY

13.01 The Responsible Party shall notify the Town at least 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 at least one work 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 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 Section 19 below. Non-regular work hours is defined in Section 14.01 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 used 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 13.02 Notification 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 period, nor include Saturdays, Sundays, or legal holidays. All other work hours shall be considered "non-regular".

#### 14.02 Authority of the Town

14.02.a The Town reserves the right to provide full-time construction inspection of all infrastructure and improvements which the Town will ultimately own and/or 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 complaints from the Responsible Party will be reviewed promptly by the Town. (See also Section 6.01)

14.02.b The Town's representative, when provided, is involved to insure that the Work complies with these specifications. The Town's representative has the authority to reject defective material, defective workmanship, and to suspend Work until such time as the Contractor shall correct the situation in question, subject to final decision by the Town.

# 14.03 Responsibility of Responsible Party

The responsibilities listed here are in addition to those in Section 7 and elsewhere in these documents.

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

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

14.03.c. The Responsible Party shall not cover or enclose work until it has been 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 Responsibly 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.

14.03.d. If Work is performed during non-regular hours as defined in Paragraph 14.01 above without authorization of Town and Work is covered during that period, Work must, if requested by the Town, it shall be uncovered for Town's observation and replaced at Responsible Party's expense in accordance with paragraph 14.03.c.

# 14.04 Delivery and Storage of Materials

Deliver 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. Store and handle products as prescribed by manufacturer or as specified in the specifications in a manner to protect from damage by moisture, weather, abuse or construction operations. 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.

# 14.05 Work Conditions

14.05.a. Protect Public Safety: The Responsible Party shall maintain the condition of the work site such that public safety and welfare is protected.

14.05.b. Workmanship shall be the very best. Lack of quality in workmanship shall be considered sufficient reason for rejection of Work in part or in whole.

14.05.c. Site Maintenance and Cleaning: Throughout the construction period, the Responsible Party shall 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. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws. Do not burn or bury rubbish and waste materials on project site. Do 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. Do not dispose of wastes into sewers, streams or waterways.

The Responsible Party shall also take care to avoid "tracking" debris onto any public street and will be responsible for the promptly cleaning all debris which is tracked. Maintain rights of way and surrounding properties free from accumulations of waste, rumble, debris, and rubbish caused by construction operations. Wet down dry materials and rubbish to lay dust and prevent blowing dust as frequently as necessary. At reasonable intervals during progress of

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work, clean site and public properties, and dispose of waste materials, debris and rubbish in a legally allowable manner. Provide on-site trash receptacles for collection and storage of waste materials in a orderly manner which will not impede normal or emergency access or people and equipment, nor obstruct drainage. Remove waste materials, debris and rubbish from the site and legally dispose of them at public or private dumping areas off Owner's property.

14.05.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 all 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.

# 14.06 Defective Materials

All materials installed must conform with these Standards and shall be free of defects of manufacture or damage. 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.

# 14.07 Unacceptable or Unauthorized Work

14.07.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.

14.07.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 as is required above for unacceptable work or take other actions the Town feels are appropriate. Those actions may include issuing a stop work order 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 or provide Town selected third party verification that the work meets all the requirement of the approved plans and specifications.

# 15. PROTECTION OF FACILITIES, PROPERTY AND IMPROVEMENTS

# 15.01 Protection of Existing Facilities and Improvements

15.01.a. The Responsible Party shall contact the Utility Notification Service of Colorado at 1 (800) 922-1987 at least three business days in advance of work.

15.01.b. The Responsible Party shall notify all utility companies and interested and impacted parties prior to commencement of work in order to insure that there will be no unnecessary or unplanned interruptions of services during construction.

The Responsible Party at all times shall take proper precautions for 15.01.c. the protection of and prevent damage to public and private property including utility lines, manholes, valve boxes, survey monuments, fences, plantings, and other structures and improvements. Hand excavation and support of existing lines shall be used where necessary. 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 shall hold the Town harmless from any liability or expense for injuries, damages, or repairs to such facilities. The Responsible Party shall at all times take proper precautions for the protection of and replacement or restoration of driveway culverts or pans, street intersection culverts, pans, or aprons, storm drains or inlets, fences, irrigation ditches and crossings and diversion boxes, mail boxes, shrubbery, flowers and ornamental trees, driveway approaches and all other public and private installations and improvements that may be encountered during construction.

15.01.d. 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 resurfaces with the presently existing type of surfacing whenever existing surface is destroyed. Such work shall be in accordance with these standards.

15.01.e. 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 for any reason including 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.

# 15.02 Utility Relocation

In the event that during construction it is determined that any underground utility conduit, including (but not limited to) 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.

# 15.03 Responsibility for Repair

15.03.a. 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.

15.03.b. 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.

# 15.04 Public Safety and Convenience

15.04.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. 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 and at the closure area 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.

15.04.b. 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.

15.04.c. 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 placed.

15.04.d. 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.

15.04.e. Use of Explosives: The use of explosives must be approved in writing by the Town and will only be authorized 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 discontinuation of any method of blasting 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	\$3,000,000
Public liability, bodily injury	\$3,000,000
single limit or equivalent, each accident	

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.

15.04.f. Protection of Potable Water Supply, Streams, Lakes, and Reservoirs:

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. He shall furnish all needed backflow devices to insure sanitary protection of the Town's water supply and measuring devices so the Town can be compensated for the water. The Owner reserves the right to curtail the Responsible Party's use of water during periods of shortage in its transmission and distribution system.

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, disinfectants, 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 stormwater management practices required in the State Stormwater Permit shall be in place before starting work. All work must conform to all applicable local, state, and federal regulations and permits.

# 16. 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 recommend a stop work order to be issued until the unsafe condition is properly remedied.

When, in the opinion of the Town, the Responsible Party has not taken 16.03 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. SANITATION FACILITIES

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 this Contract. He shall also provide proper sanitary facilities, as and where needed, for the duration of the construction.

# 18. TRAFFIC CONTROL

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 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 above under "Disruption of Service", 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.

#### 19. STOP WORK ORDER

19.01 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:

1. Violations of any condition of the Utility Extension Agreement, or of the approved construction drawings or specifications; or

2. Violation of any provision of these Standards; or

3. 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.

19.02 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 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.

19.03 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.

#### 20. PRECEDENCE OF SPECIFICATIONS AND TYPICAL DRAWINGS

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.

# 21. CHANGES TO APPROVED PLANS AND SPECIFICATIONS

21.01 All proposed changes, except field changes, to the approved plans and specifications 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.

21.02 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.

21.03 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.

### 22. RECORD (AS-CONSTRUCTED) DRAWINGS AND OPERATION AND MAINTENANCE DATA

22.01 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 Valves, fittings, appurtenances, vaults, cleanouts, and intervals or less. manholes shall be tied to a minimum of three permanent surface monuments. 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 These drawings shall also note the brand names, of the required locations. 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 and a digital copy in an AutoCAD readable and edit-able format.

22.02 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 literature on the equipment or device. If necessary, Responsible Party shall provide supplemental O and 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 Substantial Completion.

### 23. ACCEPTANCE, OPERATION AND MAINTENANCE

The requirements in this section are in addition to the requirements in the Encroachment Permit for the work.

Following the satisfactory completion of construction, all required testing as defined in applicable minimum and standard specifications, 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), the Responsible Party will be responsible for all operation, maintenance, and repair costs. During that period, the Town shall be notified when O and 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. Alternately, the Responsible Party may choose to hire the Town to perform such services, if agreed by the Town.

If during construction there have been concerns about the quality of construction related to water and/or sewer line installation and/or if the Town's representative has been unable to observe parts of the construction, the Town's representative may require that applicable parts of the relevant pipe lines be video inspected. The Responsible Party shall arrange and pay for such video inspections should they be needed.

Before the end of the first year 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 and M records. The 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. 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.

# 24. SERVICE RATES

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.

During the twelve month period when the Town is providing services, but before the one year inspection, the Town will charge users for the services and control all taps as provided in Town Ordinances and Regulations. The foregoing provisions may be modified by appropriate utility extension agreements.

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# STANDARD SPECIFICATION

#### SECTION 02200 - EXCAVATION, BACKFILL, AND COMPACTION

### PART I - GENERAL

These specifications are general in nature and are designed to cover excavation and backfill for pipe line and structure. 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. "Water Line Standards".

Where requirements for structures, embankments and/or piping are more stringent in other sections of these technical standards than the requirements herein, the more stringent shall apply.

Work shall comply with all applicable laws and regulations including "Rules and Regulations Governing Excavation Work" of the State of Colorado.

# DESCRIPTION

Work under this section includes clearing and grubbing, excavation including any dewatering for structures and pipe lines, backfilling, with moisture control, and grading, and compaction to specified elevations needed for construction of the structures, pipelines including conduits, and appurtenances for the Work. Also included are stockpiling excavated material to be used as fill and removal of unsuitable and excess soils from site.

#### 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. Carefully and accurately lay out all lines and levels of the new construction before proceeding with any Work.

#### CONFORMANCE TESTING

The Responsible Party shall arrange and pay for field testing of compacted fill materials to determine conformance with these and related specifications in these Contract Documents. Field Testing shall be performed by an independent testing laboratory acceptable to the responsibility party and the Town. Town will determine location of such tests to insure that minimum requirements are met at all locations. Each lift shall be approved by Town before the next lift is placed. If tests fail to meet the specified density or moisture content, or to pass proofrolling 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 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 shall be reimbursed by the Contractor.

At a minimum, density tests shall be taken on each 8" thick lift with one test per 150' lineal feet of trench and one per one thousand square feet of embankment.

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. The Town will also use visual observations of deflection (proof-rolling) to determine the adequacy of underlying strength, moisture control, and compaction.

#### PART II - PRODUCTS

#### MATERIALS

## <u>Submittals</u>

Responsible Party 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 material proposed for use on the project.

All fill and backfill material must be tested and proctor, and other required lab test results shall be available on site and approved by the Town before fill and backfill is started. Materials for foundation(s) shall meet the requirements in the approved foundation submittal.

Conduct 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 judgement of party conducting tests. When appropriate, determine the correct rock correction. Samples tested shall be representative of materials to be placed.

Submittal shall include optimum moisture density curve for each type of material or combination of materials encountered or utilized and Attenburg limits for each clayey materials. Samples of each tested material shall be labelled and kept of site for comparison to materials being placed.

Submittal information for materials specified by CDOT tables or maximum gradation requirements shall require sieve analysis and other parameter for which specifications are provided herein.

Materials specified to have minimum organic contents shall have organic content testing results submitted. Organic content test results shall represent organics by percent of volume and by weight. If not specified else where, the maximum organic content of backfill or embankment material shall not exceed 3%.
## 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, and may be pit run or bank run sands and gravels with 6" maximum rock size and 4" maximum rock size in the top 6" (measured perpendicular) from sub-grade with adequate binders, capable of being compacted and tested as specified hereafter unless other material is specified for the particular structure or work.

Imported materials 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.

#### Bedding and Pipe Zone Materials Classification

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

- 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, free from clods and stones greater than 3/4" in maximum dimension and free of all unsuitable materials as defined below.
- Class D Washed Rock, of single grade 1-1/2" or less, free of clay and fine particles (for gravity sewer line use only).

Backfill for waterlines shall be a low permeability Class C type material.

#### Road Construction Materials

Road construction materials are those used for road sub-base, base and finished road surfaces. 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. 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 coarse aggregate particles shall be particles having at least one fractured face. The composite base course material shall be free from organic matter and lumps or balls of clay. The class 2 and 6 materials shall meet the

# following requirements:

Gradation (% Passing)	Class 2	Class 6
4 "	100%	*
3 "	95-100%	الله يور يور الله الله الله
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

Structural subgrade and backfill materials are defined as those materials used to prepare for structural construction. Structural fills shall be the CDOT requirements for the given class of structural fill specified.

## Unsuitable Materials

Expansive materials and material that contain trash, debris, roots, organics, sludge, other deleterious substances, or frozen materials, stone or concrete having a maximum dimension larger than 6" or materials that are otherwise unsuitable for providing fill, backfill, foundation or subgrade material for structures or surfaces shall be classified as unsuitable. Materials with insufficient fines to prevent nesting of rocks and/or with more than 25% rock and those which can not be compacted to the required density shall also be considered unsuitable (unless graded clean rock is specified). 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.

# Topsoil

Topsoil shall consist of loose friable loam 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.

# Spot Subgrade Reinforcement and Sub-Grade Stabilization

Material includes sound, tough, durable crushed stone, slag or gravel, consisting of angular pieces varying from 1 inch to 4 inches in maximum diameter or other 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.

## <u>Geotextiles</u>

Geotextiles and geogrids used for stabilization shall be designed specifically for stabilization and/or soil reenforcement and a type recommended by the manufacturer for the application. Geotextiles for stabilization shall be a woven material of at least 4 oz./sy and a grab tensile strength of at least 250 x 250 psi and trapezoidal tear strength of 120 psi each way such as Mirafi 600X, Amoco 2044 or 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 large openings which are capable of interlocking with the on-site soils. For more severe problems Mirafi HP 570 maybe appropriate.

# 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 of minimum particle size passing a No. 4 sieve.

#### PART III - EXECUTION

# Existing Conditions

Prior to commencing construction the Responsible Party 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 private structures which are in need of repair. Unless sub-standard conditions are adequately documented prior to commencing construction, the Responsible Party 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.

## GRADE STAKES

Responsible Party shall arrange to establish benchmarks and monuments for horizontal and vertical control for sewer and water. Maximum distance between grade stakes shall be 50 feet. All appurtenances and structures shall be staked for location and elevation. Where finished grade of the ground will differ significantly from existing grade, vertical control shall be provided for all utilities. Contractor shall maintain benchmarks and monuments and establish all lines and grades required for construction.

#### TOLERANCES

Complete excavations and fills with suitable equipment to line and grades as shown on the approved plans within a horizontal tolerance of  $\pm$  0.10 ft and a vertical tolerance of  $\pm$  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  $\pm$  0.10 ft and a vertical tolerance of  $\pm$  0.05 ft unless otherwise noted on the approved plans or in an approved submittal.

Pipelines and structures shall be installed to within a horizontal tolerance of  $\pm$  0.10 ft and a vertical tolerance of  $\pm$  0.01 ft unless otherwise noted on the approved plans or required by an approved foundation and/or structures submittal.

Wire utilities shall be installed to within a horizontal tolerance of  $\pm$  0.50 ft and a vertical tolerance of  $\pm$  0.25 ft unless more stringent requirements are imposed by the utility owner.

# CLEARING AND GRUBBING

The area to be occupied by permanent construction, including embankments, shall be cleared and grubbed of trees, stumps, roots, brush, miscellaneous organics, 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 Responsible Party's representative and approved by the Town prior to any construction. 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 the Town.

Where present, strip existing topsoil prior to excavating operations. Depth of stripping shall be determined based on depth of the topsoil and roots. Stockpile topsoil material for replacement after all backfilling and compacting operations are completed.

## Removal of Cleared and Unsuitable Materials

Unneeded materials from the clearing operations shall become the property of the Responsible Party and shall be removed from the site of the work and disposed of in accordance with state and local regulations.

During the process of clearing or trench excavation, soils such as peat, soft clay, quicksand, or other materials which are unsuitable for bedding may be encountered. 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.

# ACCESS ROADS AND BYPASSES

The Responsible Party shall be responsible for providing all additional 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, including Town's access to their existing facilities. 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 effected property owner prior to commencing construction.

No road will be completely closed. 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.

## DUST CONTROL

The Contractor will be required to furnish and apply an environmentally acceptable dust palliative to control dust on the project sites 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 Engineer. Spreading of water or water mixture shall be done with acceptable sprinkling equipment. Such equipment shall be a type which insures uniform and controlled distribution of the palliative without ponding or washing.

## DRAINAGE

Maintain the excavations and site free from water throughout the work. 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 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 Engineer. 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 surface water into the open excavation, the saturated soil shall be removed and suitable backfill placed and compacted to grade.

#### PAVEMENT\_CUTTING

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Where trench excavation requires the removal of asphaltic pavement, the pavement shall be cut in a straight line parallel to the direction of trench excavation. 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 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. At the Contractor's option, the material may be broken into small pieces (less than 4 inches in maximum dimension) and included in the trench backfill material, except that the material may not be placed within one foot of the pipe in any direction, nor may it be nested. 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 is installed.

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

#### EXCAVATION

Perform excavation of every description to lines and grades indicated regardless of material encountered within the grading limits of the project. Utilize all suitable materials removed from the required excavation in the formation of embankments, bedding or fill. Care shall be taken to not excavate below the indicated grade, except when approved by Engineer and Town to remove unsuitable material. Foundation and structure subgrade material are intended to be placed on undisturbed ground whenever topographically and geotechnically possible.

Material removed below depths indicated shall be replaced to the indicated excavation grade with suitable material and compacted as specified, except that foundations and footings may be increased in depth to the bottom of the overdepth excavations (to make depth and bearing surface uniform).

Make excavations for footings, foundations, and similar work of adequate size to allow for placing, inspection and removal of forms, installation of any services, and observations of the work. Form sides of foundation footings unless depositing concrete directly against earth has been approved by Town. For direct-deposited concrete, trim banks to one inch wider on each side than dimensions indicated.

Protect the bottom and sides of excavations and soils around and beneath foundations from frost.

The Town must be allowed to inspect all foundation material after excavation and review all test results before the Contractor shall pour footings, foundations, and slabs.

If pumping, low density, or saturated pockets are encountered in excavations, they shall be removed. The type of fill to be placed in such pockets shall be based on the location and must be approved by the Engineer and Town (see also "Spot Reinforcement" below).

Do not exceed the angle of repose for the materials without providing necessary support.

## Stock Piling 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 two feet if soil conditions allow. With sheeted trenches, the toe of the spoil bank should be at least 3 feet from the edge of the trench.

## Sheeting, Bracing, and Shoring

Where necessary, excavation shall be braced and sheeted to provide complete safety to persons working in or around 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 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 Engineer and Town, 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, the Engineer and Town may authorize portions of the sheeting to be cut off to such depth as he may approve and permit lower portions thereof to remain in the trench.

# Ground Water

Keep ground water level below final pipe or foundation grade, and prevent entrance of water into excavation and pipelines. Water shall not be permitted to run through lengths of pipe already laid. Ends of pipes shall be capped or plugged to insure that water, dirt, animals, etc., does not enter the pipe. Should any groundwater, dirt, mud, etc., enter the pipe during installation, the Contractor shall flush the pipe thoroughly in the presence of the Town to insure complete removal of all foreign objects prior to connection to the existing system. Town may require Contractor at Reponsible Party's expense to hydrojet and/or video inspect lines where mud, debris, etc have been allowed to enter lines to assure that lines have been adequately cleaned.

When groundwater is encountered, provide necessary pumps and other equipment necessary to completely remove the water so that work can be performed in dry conditions. Maintain dry excavations throughout construction. Dewatering activities should be controlled to avoid damage to surrounding property.

# Use of Explosives

Should the use of explosives be absolutely necessary, and their use approved in writing by the Engineer and 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 with the Town and Engineer being held harmless.

# Excavation to Grade for Pipelines

Excavation for pipe shall generally be by open trenches unless otherwise specified, shown on the plans, or approved by the Engineer. Note that the Contractor may elect to install service lines by trenchless technologies where approved by the Town. 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. 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 excavation for all pipe lines shall be to a depth sufficient to provide for bedding of the pipe and a minimum cover below finished grade of the depth listed in the pipe line specifications or shown on the Drawings with appropriate bedding. 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. Additional trench depth shall be provided where site 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 grades or other future construction makes greater depth desirable.

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.

## Sequencinq

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 200' 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, or as required by the Town and/or other entities with authority, in vicinity of the work being performed.

# 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 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 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 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 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 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. Pipe bedding shall conform with materials specified above for pipe bedding.

Whenever flexible pipe is used, special care shall be employed in the pipe bedding to properly support the pipe. Flexible pipes include PVC 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) Unibell PVC Handbook and relevant Unibell recommended practice manuals.

## BACKFILL AND COMPACTION OF PIPE LINES AND STRUCTURES

The Contractor shall proceed with backfilling as soon as practicable, but not until Work is inspected by the Town and any necessary tests satisfactorily completed. Do not begin backfilling until forms have been removed, underground utility systems have been tested, and where applicable, concrete has cured sufficiently to prevent displacement or damage to restraints, footings, foundations, or walls (typically 7 days). Maintain optimum moisture content of backfill materials and compact to required density. Unless otherwise specified, unprocessed materials shall be compacted to 95% standard proctor at +/- 2% of optimum moisture and processed materials (e.g. base materials) compacted to 95% modified proctor at +/- 2% of optimum moisture. Compaction or consolidation shall follow as soon after the placing as is practical.

Construct fills and embankments to the lines and grades indicated on the drawings. Immediately prior to placing fill material, scarify the entire area upon which fill is be placed to a depth of 12 inches.

Ensure areas to be backfilled and backfill materials are free from debris, large stones, loose materials, snow, ice, and water, other objectionable material that will cause interference with compaction, and that ground surfaces are not in a frozen condition. Do not allow the nesting of rocks. Do not backfill over existing subgrade surfaces which are frozen, porous, wet or spongy. Cut out soft areas of existing subgrade and stabilize (see Stabilization requirements below).

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 during the spreading to ensure uniformity of material in each layer. Testing of each lift shall be performed prior to placing the next lift in accordance with the specified testing requirements.

## **Stabilization**

Where necessary, stabilize the subgrade material with the use of sub-grade stabilization material or a stabilization fabric depending on the type and location of the instability. If pumping is a likely problem, track equipment rather than rubber tired equipment should be used. Remove as much of the unstable material as necessary to properly stabilize unstable areas. Earthen stabilization material, when used, shall be sized based on the type of instability and shall generally conform with the stabilization material specification listed above. The material shall be placed in uniform lifts at proper moisture and compacted in a manner which will not make the surrounding area unstable.

Geotextiles shall meet the specifications listed above. Fabric shall be placed sufficiently beyond the unstable area to act as a bridge; the additional distance will depend on the type of instability and the type of fabric, but should not be less than 1.5 feet in any direction and will typically be more. Fabrics shall be placed on a smooth level surface and shall have at least 12" of cover between the fabric and finished grade unless otherwise approved by the Town.

If piping will be placed at an elevation below the elevation of the fabric, install piping before placing fabric. If fabric is cut for any reason, a patch of fabric which extends at least 2 feet past the cut in each direction shall be placed over the cut and proper fill placed over the patch.

When the Contractor encounters materials which differs materially from the information in the soils data and site information, he shall promptly notify the Project Engineer and the Town. Plans for stabilization shall be submitted to the Town for review and approval.

# Site and Structural Fills

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 loads that may be encountered.

# Capillary Water Barrier

Place capillary water barrier material under all interior slabs and at all locations shown on the plans or identified in the field. Place directly on subgrade after subgrade has been approved for density and elevation. Place in one layer to 6 inches thickness without segregation, and compact to maximum density or as shown on the plans.

# Structure and Appurtenance Backfill and Compaction

Backfill around structures and appurtenances such as vaults, foundations, valves,

value boxes, cleanouts, miscellaneous concrete structures with care to prevent damage. to etc. Materials shall be compacted to 95% standard proctor for native materials and 95% modified proctor for processed materials both at  $\pm$  2% optimum, 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 Town. 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 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. Use suitable compaction equipment for the material being compacted. Perform compaction while the material is at the specified moisture content. Moisten and aerate material as necessary to provide proper 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.

# 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 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 Standard Proctor density of 95%. 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 or compacted with machinery. Take care to avoid contact between the pipe and compaction equipment to avoid damage or displacement.

Compaction of initial backfill, and backfill materials shall be done in such a way that sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe or its installation. 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. Compaction in the pipe zone shall be to 95% Proctor (standard for unprocessed and modified for processed materials) unless authorized or noted on the plans.

#### Upper Trench Compaction

The degree of upper trench compaction required for the backfill will depend upon the location of the pipeline and the material used in the backfill. Under roads and other potential driving surfaces and all backfills and embankments which will retain a load, minimum compaction through the entire depth shall be 95% of maximum dry density as measured by Standard Proctor tests for native materials. 95% of maximum dry modified Proctor will be required for road and foundation materials. Elsewhere in easements and rights of way, the minimum compaction shall be at least 90% standard or original soil density whichever is greater unless the landowner has more stringent requirements. Unless otherwise noted on the plans, in utility easements on lands not owned by the Town, compaction shall be 95% standard unless the property owner provides a written relaxation of the requirement including holding the Town harmless. 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.

In the trench fill area above the pipe zone, pipe backfill material shall not exceed four (4) inches in largest dimension. All excess/unsuitable 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 densities.

## 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 or maintenance problems. Areas which are to receive pavements, surfacing, topsoil, or landscaping shall be graded as required to allow installation of the specific surface treatment. 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 in accordance with the topsoiling sub-section below. Tree damage shall be repaired in accordance with good horticultural practice.

The finished surface of roads 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 (3" minimun depth), and concrete damaged, 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 pavement repair so that inspection can be provided.

The respective property owner shall be the final judge of the acceptance of restoration work. The Responsible Party 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 Responsible Party's responsibility to have documented such conditions or to restore the site to standard conditions acceptable to the Town and property owner.

#### TOPSOILING

# <u>Conservation</u>

Obtain acceptable topsoil from required excavation to extent necessary. Topsoil material is subject to approval. Designate as topsoil when stockpiling for future placement. Conserve, or import if necessary, sufficient topsoil to cover a depth of 6" all disturbed areas which are not covered by or within 6" of liner, riprap, roadbase, or a structure.

#### 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.

#### Placing Topsoil

Place topsoil on all disturbed areas which are not access or road ways, covered by liner or designated to be riprapped. 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.

#### 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.

Disturbed areas shall be left in a roughened condition at all times during construction. Roughen vertical depth shall be approximately 2". Roughening shall be completed with undulations running parallel to contouring. Use erosion control logs or other suitable means to limit erosion prior to revegetation.

Preparatory to seeding, the top 4" topsoil of the surface shall be tilled into an even and loose seed bed 4" deep, free of clods, in excess of 4" diameter and brought to desired line and grade. Reseeding shall be done in accordance with the recommendations from CSU Extension, BLM, and good horticultural practice for the areas being revegetated.

In all areas where the slope is 3:1 of flatter, seeding will be accomplished by means of 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 7" apart. Seed that is extremely small shall be sowed from a separate hopper adjusted to the proper rate of application. Hydromulching will be allowed 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, 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".

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 permitted for small areas which not accessible to machine methods.

Native grass straw shall be applied at the rate of two tons per acre. 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 with 24 hours after seeding. Jute 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 or 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 4".

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

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. Protect such plantings from wildlife damage.

#### MINIMUM DESIGN STANDARDS

# CURB, GUTTER, SIDEWALKS & STREETS

## <u>General</u>

All curb, gutter, sidewalk, and street construction design, rights of way widths and street widths shall conform to the minimum requirements enumerated on the typical Town typical drawings and the requirements of the Subdivision Regulations of the Town of Hotchkiss. Care shall be taken to insure continuity of grades, widths, etc, of proposed, existing, and future installations. Deviations from these standards and specifications may be permitted, when in the opinion of the Town, the quality of the finished work would not vary materially from the intent of these requirements.

# Gravel Street Construction

Gravel streets shall only be accepted for alley construction.

# Paved Street Construction

Road structure shall meet the minimum requirements on the Town's typical drawings. Except for local residential streets, base and surface treatment for shall be designed by an engineer based on traffic load and soils conditions but in no case shall the street section be less than shown the Town's typical drawing. Street section design shall be based on a 25 year ESAL load.

All paved streets shall have curb, gutter, and sidewalk on both sides. The curb, gutter, and sidewalk shall conform with Town standard drawings and specifications for that work.

#### Street Layout

Street widths shall conform to Town standard drawings for the type of street being designed. Gravel surfaces shall have a cross slope of 3% and paved streets shall have at least 2% cross slope.

The minimum grade for all streets is 0.5 percent. The maximum grade shall not exceed 7% on any street and 5% on collectors and arterials. The minimum length of the vertical curves for all streets shall be 300 feet except where the algebraic in grades is less than 2%, vertical curves may be omitted. On local residential streets, the minimum radius of horizontal curves shall be 100 feet and 150 feet on all other streets.

In special topographic conditions, the Town may allow deviations from these requirements in order to provide the Town with better drainage or a better intersection design.

Tee intersections with the leg to of the tee in opposite directions shall have those legs at least 125' apart centerline to centerline to facilitate a reasonable line of sight between the intersections.

## Utility Street Crossings

All utilities in Town rights of way, except water and sewer lines, shall be placed in a casing of suitable strength and size for the installation.

## Service Line Installation

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All service lines shall be installed (accordance with the appropriate Town standards) prior to paving any street.

## Drainage

All streets shall be designed to provide continuous surface drainage directed to storm drain inlets and drainage courses. Grade shall permit flow without ponding. A check shall be made to be sure of continuity of drainage design between the proposed construction and existing or future construction. In no case shall surface drainage be permitted to be disposed of overland except by approved storm drainage facilities.

#### Monumentation

Provide a center monument, consistent with the Town's typical detail, for each intersection centerline. Monument shall be set by land surveyor licensed in the State of Colorado.

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#### STANDARD SPECIFICATIONS

# SECTION 02225 - SLOPE STABILIZATION AND REVEGETATION

## PART I - GENERAL

Work in this section includes the furnishing of all necessary materials and workmanship to competently and expeditiously execute the following work: fine grading, soil preparation, seeding, mulching, fertilizing, soil stabilization, and all related landscape operations to satisfactorily stabilize and revegetation the areas designated.

Prior to commencing construction on this project, the Contractor and the Town will evaluate the existing slopes, erosion problems, and vegetation to set the standards for revegetation.

#### PART II - PRODUCTS

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Topsoil - Topsoil shall consist of loose friable loam reasonably free of admixtures of subsoil, refuse, stumps, roots, rocks, brush, weeds, heavy clay, hard clods, toxic substances or other material which would be detrimental to the proper development of vegetative growth.

Fertilizer - Fertilizer shall be selected based on soil conditions.

Straw Mulch - Materials for straw mulching shall consist of straw from grasses and shall not contain seeds of noxious weeds.

Seed - All seed shall be furnished in sealed bags or containers showing the name and address of the suppler, the seed name, the lot number, net weight, the percent of weed seed content, and the guaranteed percentage of purity and germination. All seed furnished shall be free from such noxious weeds as Russian or Canadian Thistle, bindweed, Johnson grass, knapweeds, and Leafy Spurge. Seed which has become wet, moldy, or otherwise damaged will not be accepted. The seed shall included a signed certification that the seed is from a lot that has been tested by a recognized laboratory within 6 month of date of delivery to the job.

The seed mix shall be appropriate to the field conditions and shall be subject to approval of the Town.

Erosion Control Blankets - Blankets and nettings shall be biodegradeable nontoxic to vegetation or humans. Unbleached, smolder resistant jute shall consist of a heavy mesh with a uniform open weave. The yarn shall be of a sufficiently open weave to allow seedlings to push through, yet strong enough to prevent contain the mulch and prevent erosion. Blankets consisting of straw and/or coconut fibers shall be re-enforced with a photodegradable netting. The type of fiber and the netting pattern shall be designed for the type of slope, moisture intensity, and other field conditions. Under typical conditions, BonTerra S2 or approved equal is recommended for slopes of 3.5:1 to 2.5:1. BonTerra CS2 or approved equal is recommended for slopes 2.5:1 to 1.5:1. Materials for slopes steeper than 1.5:1 will reviewed by the Town on a case by case basis. In no case shall a blanket be used which does not meet or exceed the conditions for which the manufacturer approves of its use.

# PART III - EXECUTION

Evaluate Existing Vegetation - 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.

Soil Preparation - Topsoil shall not be placed until the areas to be covered have been properly prepared and grading operations in the area has been completed. Topsoil shall be placed and spread in areas where there is less than 6" of topsoil to achieve a total depth of 6" in areas to be seeded or planted. A reasonably even, loose, moist seed bed, free of weeds, rocks, clods, construction debris, and other foreign and/or other deleterious matter shall be established. Work in any organic or soil enhancement material prior to fine grading. Fine grade all areas to eliminate all visible surface undulations, rounding the tops and bottoms of all slopes and provide positive drainage for all potential surface water runoff. On slopes steeper than 4:1, the surface shall be cat tracked up and down the side slope prior to, or just after, seeding to creat depressions to help hold seed and moisture.

Seeding - Broadcast or drill the seed at the coverage rate recommended by the seed supplier for the field conditions. Hydromulching will be allowed if adequate water will be applied to the seed to keep the mulch continuously moist until the seedlings are established.

Where shrubs were present prior to the disturbance, it is recommended that the same type shrubs be re-planted at approximately the same density as originally present, unless the slope prohibits such plantings.

Mulching - Grass straw mulching shall be applied at a rate of two tons per acre. It shall be uniformly crimped in with a crimper or other approved means to a depth of at least three inches. Mulching and crimping shall occur within 24 hours of placing seed. If seeded area is disturbed prior to mulching, it shall be reseeded before the mulch is placed. Mulching activities shall not occur during windy weather.

Soil Retention Coverings - Jute 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 or 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 4".

Soil blankets shall be installed to be in full contact with the ground and stapled in accordance with manufacturer recommendation for the field conditions.

Watering - Top soil shall be moistened prior to placing any seed. After seeding, and mulching the seed shall be watered with sufficient quantity and frequency to encourage germination and strong seedling development at least over the first year.

Evaluation of Success - The success of the slope stabilization and revegetation effort will be determined by field examination after one year. No sloughing of the side slope will be allowed. Erosion gullies shall be the same size or smaller than those observed prior to construction. The vegetation present after the one year shall be at least at 80% of the density prior to construction based on plant counts rather than total coverage.

Warranty - In addition to the provisions required elsewhere all revegetation shall have a two year warranty. If the success of the stabilization and revegetation effort is inadequate at or before the one or two year evaluation, the deficient Work shall be remedied as soon as growing conditions allow and the two year warranty for the Work shall begin again at the time the remedial action is completed. .

#### STANDARD SPECIFICATIONS

# SECTION 02500 - STREET CONSTRUCTION

## PART I - GENERAL

## Scope

The work covered by this specification concerns the furnishing of all labor, equipment and materials and performing all operations in connection with the construction of streets in strict accordance with this specification, related specifications, and the applicable drawings.

#### Related Work Specified Elsewhere

Section 02200 - Excavation, Backfill and Compaction Section 03000 - Concrete

References to CDOT standards refer to the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, most current edition.

#### QUALITY ASSURANCE

#### Qualification of Asphalt Concrete Producer

Use only materials which are furnished buy a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.

# Qualification of Testing Agency

A certified testing agency acceptable to the Town shall establish job-mix formulas and perform the quality control sampling and testing required during excavation, subgrade, sub-base, base, and paving operations.

#### <u>Design Criteria</u>

Provide final surfaces of uniform texture, conforming to required grades and cross-sections and in compliance with the requirements for density, thickness and surface smoothness.

Maintain material within allowable tolerances of the governing standards as required under the sections for submittals and products.

#### TESTING

Testing for conformance with these and related specifications shall be in accordance with the tests specified herein for the particular materials and work being tested and with tests defined in related sections of these sections.

Proof-rolling per CDOT 203.13 shall be done using heavy construction equipment or loaded trucks driven over the sub-grade and deflections noted. Soft and yielding material and portions of the subgrade which show deflection shall be scarified and re-rolled or shall be removed and replaced with base course material, placed and compacted as specified herein. Subgrade shall not be approved for base course construction until it is uniformly hard and unyielding.

#### PART II - MATERIALS

#### SELECT BORROW MATERIAL

Select subgrade material shall be a well graded mixture of sound mineral aggregate particles meeting the requirements of Class 2 base material in the Town's Standard Specification Section 02200 - Excavation, Backfill, and Compaction containing sufficient, proper quality bonding material to secure a firm, stable foundation when placed and compacted on the roadway.

If tests reveal that material being procured is not of suitable quality for which it is intended, the Contractor shall provide other material as approved by the Town.

#### SUB-GRADE STABILIZATION

Sub-grade stabilization material shall conform rock, geotextile, or geo-grid requirements in Section 02200.

#### SUB-BASE

The bottom of the excavation for the pavement (or road surface) or top of the fill shall conform to the lines, grades and cross sections shown on the plans.

Class 2 sub-base material as specified in Section 02200 shall be placed on subgrade. The material supplied shall be a well graded mixture, consisting of sound aggregate particles and sufficient filler or other proper quality binding material, which when placed and compacted will result in a firm, dense, unyielding foundation.

#### ROAD BASE COURSE

Class 6 base course as specified in Section 02200 shall be placed as shown on the plan. The material supplied shall be a well graded mixture, consisting of sound aggregate particles and sufficient filler or other proper quality binding material, which when placed and compacted will result in a firm, dense, unyielding foundation.

Bearing value and/or stabilimeter tests may be required to properly evaluate the quality of the material. Coarse aggregate shall show a loss of not more than 50% when tested in accordance with AASHTO standard method of test for abrasion of coarse aggregate by use of the Los Angeles machine, designation: T-96 (ASTM C131)

#### Soil Sterilant

Soil Sterilant shall meet the requirements of EPA and CDPHE for preventing the growth of vegetation. All herbicides shall be currently registered with the Colorado Department of Agriculture and the USEPA. All herbicides shall be supplied to the project in labelled containers. The label shall show the name of the product, chemical composition and directions for use.

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#### Root Control Fabric

A geotextile root control fabric for protecting paved areas against tree root intrusion shall divert roots away from sidewalks and pavement by either a controlled release of a chemical which will not harm the tree such as Biobarrier root control fabric manufactured by Reemay Inc. at (800) 321-6271 (or in Colorado through Buckley Powder at (800) 333-2266) or be means of a heavy polyethylene (0.08" or thicker) which deflects roots downward such as Root Solutions by Vespro Inc. at (800) 554-0914 or equal.

# Prime Coat and Tack Coat

Prime and tack coat materials shall be an asphalt of a grade approved by the Engineer, typically conforming with the CDOT Standard Specifications Table 702-6 for prime coat and with 702 rapid setting emulsion with a high viscosity manufactured from polymer modified asphalt for tack coat.

#### PAVING MATERIALS

The asphaltic surface course shall be composed of mineral aggregate and bituminous material, mixed in a central mixing plant, and shall be placed on the prepared base in conformity with the cross section and grades shown on the plans. Furnish to Town with Rice test results of the asphalt to be furnished.

## Aggregates

Aggregate shall meet the requirements of Section 703.04 of the CDOT Standard Specifications for SX except where more stringent requirements are specified herein. Aggregate shall be composed of sound, tough, durable pebbles or fragments. The use of recycled asphaltic materials in the aggregate is prohibited. The aggregate shall be free from vegetable matter, lumps, or balls of clay, adherent films of clay or other matter that would prevent thorough coating with bituminous material and shall be free of an excess of flat or elongated pieces.

Coarse aggregate shall be crushed stone, crushed gravel or crushed slag conforming to ASTM D692. Fine aggregate shall be crushed stone, crushed gravel, natural sand, or slag screenings conforming to ASTM D1073. Aggregate shall be composed of coarse and fine aggregate combined in the proper proportions as follows:

<u>Sieve Size</u>	Percent Passing	
3/4"	100%	
1/2"	80 - 95%	
3/8"	60 ~ 88%	
NO. 4	44 - 72왕	
NO. 8	30 - 58%	
No. 50	7 - 27%	
No. 200	2 - 10%	

When tested for abrasion, coarse aggregate shall show a loss of not more than

45% when tested in accordance with AASHTO standard method test for abrasion of coarse aggregate by use of the Los Angeles machine, designation: T-96 (ASTM C131).

At least 60% of all mineral aggregate not passing the No. 4 sieve shall have at least one fractured face. The mineral aggregate retained on the No. 8 sieve shall be clean, free from disintegrated stone, vegetable material or other deleterious substances. Material passing the No. 200 sieve shall be less than one-half the material passing the No. 8 sieve. The material passing the No. 40 sieve shall have a liquid limit of not more the twenty-five (25) and a plasticity index of not more than six (6). Tests for liquid limit and plasticity index shall be made in accordance AASHTO Standard Methods T89 and T90 respectively. If sufficient fine material of satisfactory quality is not naturally present in the mineral aggregate, it shall be added. Material consisting of finely powdered limestone, portland cement, hydrated lime or other approved materials may be used for the filler.

#### PAVING ASPHALT

The paving asphalt shall be a homogenous product derived from asphaltic crudes, and shall be free from water and any mineral matter other than naturally contained in the asphalt. The paving asphalt shall meet the requirements for PG 58-28, SX aggregate and 50 Gyration (or alternate if approved by Town) and shall contain an anti-strip additive of a percentage as determined by a job mix formula. Sampling and testing of paving asphalt shall be in accordance with applicable AASHTO and ASTM Tests.

## Determination of Percentage of Bituminous Material

The percentage of bituminous material, by weight, to be added to the aggregate will usually be between 5-3/4% and 6-1/4% of the weight of the dry aggregate. The exact percentage to be used shall be fixed by the Contractor on the basis of preliminary laboratory tests and field sieve analysis of the aggregate furnished. The Engineer reserves the right to review these tests and to order any changes in the percentage of bituminous material deemed necessary during the progress of the work.

#### PAVEMENT MARKINGS

Pavement marking materials shall conform with requirements of Section 713.15 of the CDOT standards.

#### PART III - EXECUTION

#### CLEARING AND GRUBBING

Clearing and grubbing shall be in accordance with the Section 02200 for excavation, backfill, and compaction except as further defined below.

# REMOVAL OF EXISTING CURB, GUTTER, AND SIDEWALK

Cut the concrete at contraction or expansion joints, full depth either side of the portion to be removed. Cut shall be by abrasive or diamond cutting blade only. When removing curb and gutter, a cut shall also be made between asphalt and lip of gutter. Concrete shall then be broken with breaker equipment beginning in the middle and working to the cut lines. Material can then be removed away from the street so as not to damage adjacent concrete or asphalt. Materials shall be disposed of in a legally acceptable manner.

Contractor is responsible for any damage to adjoining private property, concrete, asphalt, etc. and shall repair all damage.

Concrete will not be allowed to repair asphalt surfaces.

When eliminating a curb cut and apron, the curb and gutter section must be removed and constructed to the full height curb and gutter. No capping will be allowed.

# REMOVAL OF EXISTING ASPHALT

Cutting wheel shall be used to obtain a vertical cut along all edges which will need to match existing asphalt. A second cut will be required just prior to paving to provide a clean joining surface. Asphalt removed shall be hauled to an approved disposal site. Such removal shall be part of unclassified excavation.

## ROOT CONTROL FABRIC

Place root control fabric at the locations designated on the plans and as directed by the Town, to a depth of at least 30" unless otherwise approved. Additional depths may be required depending on the type of fabric provided and the type of structure being protected. Surround the designated vegetation and anchor the fabric in accordance with manufacturers recommendation and the typical drawings.

# SCARIFY AND RECOMPACT

Contractor after excavating to the proper line and grade for subgrade or base preparation shall thoroughly scarify the native materials to a depth of 12" below the base or subgrade and shall adjust the material to +/-2% of optimum moisture and recompact to 95% standard proctor. Proof-rolling per CDOT 203.13 and compaction and moisture testing shall be provided by Contractor and observed and approved by the Town. Grades shall conform to the designed elevations for the sub-grade preparation to +/-0.1'. Surface unevenness shall not exceed 1" in 10'.

# SUB-GRADE STABILIZATION

Where deflection is observed, sub-grade stabilization will be required. Typically that will require a layer of geotextile or geogrid placed below the class 2 base course or other method approved by the Town on a case by case basis. Materials and Work shall meet the requirements of Section 02200.

#### SUB-BASE PLACEMENT AND COMPACTION

Prepare the sub-grade and place and compact the class 2 base materials to within +/-0.1' of base elevation at a minimum of 95% proctor density at +/-2% optimum moisture in accordance with Section 02200. Surface smoothness shall not deviate from subgrade design more than 3/4" in 10'. Contractor shall provide sufficient grade stakes at centerline and edges of work to facilitate complying with the above construction tolerances.

#### Grade Staking

Grade stakes shall be provided by the Responsible Party for flow line and centerline at a minimum of 50' intervals except through vertical and horizontal curves where intervals shall be reduced to provide needed curve information.

#### Placing and Spreading

Each layer of sub-base material including stabilization shall be placed in layers not to exceed eight (8) inches in loose depth. No sub-base material shall be placed upon a soft, spongy or frozen subgrade or other subgrade, the stability of which is, in the opinion of the Town, unsuitable for the placement thereof. Demonstration of compaction testing, grade and surface smoothness testing must be performed for the Town before proceeding to the base placement process. Perform at least one density and moisture test for every 1500 square feet of surface area.

#### BASE COURSE

Base course shall meet the above requirements of Class 6, constructed on the prepared sub-base in accordance with these specifications and to the grade indicated on the approved plans.

#### Grade Staking

Grade stakes shall be provided by the Responsible Party with the tops at top of base course grade prior to placement of base material. Staking shall be along centerline and 1/4 crown locations at a minimum of 50' intervals except through vertical and horizontal curves where intervals shall be not more than 25'.

#### Placing and Spreading

The base course material shall be deposited and spread in a uniform layer and without segregation of size to such loose depth that when compacted will achieve specified densities and shape. The base course shall be rolled with a vibrating roller. Water shall be added as needed to produce a stable condition such that when heavy construction equipment or loaded trucks are driven over the base course it is uniformly hard and unyielding. The material shall be compacted to a minimum density of 95% of modified proctor density.

No base course material shall be placed upon a soft, spongy or frozen sub-base or other sub-base, the stability of which is, in the opinion of the Town, unsuitable for the placement thereof.

Final shaping of the class 6 base course shall be performed immediately prior to pavement of asphalt or concrete.

#### <u>Testinq</u>

Base course shall be placed and compacted across a full section of the project and tested in the presence and at the locations designated by the Town. Demonstration of grade and surface smoothness testing must be performed for the Town before proceeding to the concrete and/or asphalt placement process. Tests may include proof-rolling per CDOT 203.13, nuclear density measurements, sand cone tests, or other such tests requested by the Town. Perform at least one density and moisture test for every 1000 square feet of surface area.

## Allowable Tolerance

Grades shall conform to the designed elevations for the sub-grade preparation to 1/4" plus or minus. Surface unevenness shall not exceed 1/4" in 10'. Contractor shall keep the base course compacted to 95% proctor and moist so that the asphalt is placed on base materials which are +/-2% of optimum moisture content.

#### ASPHALT PAVING

#### GENERAL

All asphalt paving shall conform and all work shall be done in accordance with CDOT Standard Specifications unless more stringent requirements are specified herein.

## JOB\_CONDITIONS

#### Weather Limitations

Apply bituminous prime and tack coats only when the ambient temperature in the shade is a minimum of  $50^{\circ}$  F and when the temperature has not been below  $35^{\circ}$  F for 12 hours immediately prior to application.

Do not apply when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.

Construct asphalt concrete surface course only when atmospheric temperature is above 40° F, when the underlying base is dry, and when weather is not rainy or likely to rain during paving operation.

#### Grade Control

Establish and maintain the required lines and grades, including crown and crossslope, for each course during construction operations.

#### Traffic Control

Maintain access for vehicular and pedestrian traffic during paving operations. Provide flagmen, barricades, warning signs, and warning lights for movement of traffic and safety to cause the least interruption to the work and inconvenience to the public. Comply with Town approved traffic control plan.

# Soils Sterilization

Prior to applying prime coat, where weeds and vegetative growth are in the opinion of the Town likely to adversely impact pavement performance, sterilize

said areas in accordance with Section 217 Soil Sterilization of the CDOT Standard Specifications.

#### PREPARATION FOR PAVEMENT

#### Asphalt Distributor

The distributor shall be in good mechanical condition and shall be capable of uniformly distributing the prime coat throughout a reasonable range of widths, pressures, temperatures, and application rates.

Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and thermometer for measuring temperatures of tank contents. They shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically.

#### Prime Coat

The grade of asphalt and the rate of application shall be approved by the Town and shall be determined by considering the condition of the base course, temperature, and other conditions affecting application. After approval by the Town, when the prepared base is thoroughly dry and satisfactory to receive the prime coat, the surface shall be cleaned by sweeping or other approved methods. The cleaning shall be continued until the embedded aggregates are uncovered but not dislodged, and dust, mud and foreign matter removed. The equipment used to apply the prime coat shall be of the proper type and condition of maintenance to distribute the materials evenly and smoothly in the quantity specified. The material shall be heated to the proper temperature when applied, and shall only be applied when the outside temperature is above 50 °F. Apply enough material to penetrate and seal, but not flood, the surface. The prime coat shall be permitted to cure until thorough and proper penetration has been obtained, but at no time shall the curing period be less than twenty-four (24) hours. Pools of bituminous material occurring in depressions shall be removed from the surface before applying the asphalt surfacing. Blot with sand and remove loose sand before paving. Protect surfaces of curb and gutter, sidewalks and other structures to prevent any asphaltic oil from being sprayed on them. Any surfaces inadvertently sprayed will be thoroughly cleaned at the expense of the Contractor.

All spots unavoidably missed by the distributor or areas which are inaccessible to the distributor shall be hand sprayed.

All vertical contact surfaces of curbs, gutters, manholes and other structures projecting into or abutting asphalt concrete pavement shall be primed by brushing with hot asphaltic oil prior to placing the pavement.

At no time during the period of curing shall traffic be allowed upon the primed surface.

# Tack Coat

Whenever new asphaltic pavement is placed on existing pavement, a bituminous tack coat shall be applied to the existing pavement prior to placing the new pavement.

The surface to receive the tack coat shall be dry and cleaned by an approved method until all dust, debris and foreign matter are removed. The tack coat material shall be applied at a rate and temperature approved by the Town which will provide a very thin coating uniformly distributed over the entire area to be covered, typically 0.05 - 0.15 gallons per square yard. The tack coat shall not be applied when the outside temperature is below <u>50°F</u>. Apply no more tack coat than necessary for the day's operation.

Apply tack coat to primed surfaces if "dusting" has occurred which will result in poor bonding between treated surface and bituminous pavement.

#### Plant Mixed Asphalt Surfacing

#### Mixing Formula

No work shall be started on the paving project nor any mixture accepted until the Contractor has submitted and had approved by the Town a satisfactory job mix formula based upon tests of the materials to be furnished. The formula shall be submitted in writing to the Town, indicating the definite percentage for each sieve fraction of aggregate and for asphalt and include the maximum Rice density. The intended temperature of completed mixture at the time it is discharged from the mixer must be between 260° and 300° F. The material shall be delivered to the job site as measured behind the paver screed at a minimum of 235°F.

Should a change in sources of material be made, a new job-mix formula shall be established and approved by the Town before the new material is used.

#### Mixing Plant

The paving plant shall be of standard design and contain all the necessary components to ensure proper mixing of the materials. The plant shall be subject to approval by the Town. The Town and/or its representatives shall have access at any reasonable time to all parts of the plant for the verification of weights and portions, character of materials and determination of temperatures used in the preparation of the mixture. All materials shall be mixed in accordance with standard procedures.

#### Transporting Asphalt

Transport asphalt concrete mixtures from mixing site in trucks having tight, clean, smooth, metal beds.

Coat hauling compartments with lime-water mixture to prevent asphalt concrete mixture from sticking. Elevate and drain compartment of excess solution before loading mix.

When the asphalt is subject to cooling during long haul, it shall be covered with a tarp in the truck to maintain proper temperature for laying. The asphalt shall not be hotter than 315° fahrenheit at the plant. During periods of cold weather or for long-distance deliveries, provide insulation around entire truck bed surfaces and provide covers securely fastened.

#### EQUIPMENT

Provide the size and quantity of equipment to insure a uniform continuity of operation and to complete the work specified within the project time schedule.

## Bituminous Pavers

Pavers shall be self contained, power-propelled units, provided with an activated screed or strike-off assembly, heated if necessary, that shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture and control pavement edges to true lines and grades without the use of stationary forms.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation and shall be equipped with a distributor system to place the mixture uniformly in front of the screed.

#### Rolling Equipment

Rollers shall be self-propelled steel-wheeled rollers, pneumatic-tired rollers, or vibrating rollers, capable of reversing without backlash.

The number and weight of rollers and number of passes shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

## Hand Tools

Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified.

#### PLACEMENT

Prior to placement of the surface course, the base shall be cleaned of all dirt or other foreign matter. When the new pavement abuts the old paving, cut back the old pavement in accordance with the cutting provisions above and paint the edge of the old pavement with a coat tack coat. The asphaltic pavement shall . be placed only when the base is at appropriate moisture content and weather conditions are suitable. While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment. No surfacing shall be placed unless the atmospheric temperature in the shade is at least 40°F and rising, or 50°F if falling, and other weather conditions are suitable. In no case shall pavement be laid on foundations in which frost is present.

## Allowable Tolerances

<u>Density</u> - Compare density of in-place material against laboratory specimen of the same asphalt concrete mixture. Field densities shall be at 94 +/-2% of Rice value.

<u>Thickness</u> - In-place compacted thicknesses will not be acceptable if exceeding the following allowable variations from thicknesses shown on the drawings:

## 02500-10

- 1. Individual samples : +/-1/4 inch
  Pavement course: +/-1/4 inch
- 2. Overall average of samples: The compacted average thicknesses of both base course and surface course, computed by summing the individual sample thicknesses and dividing by the total number of samples, shall be no less than that specified on the drawings for each layer, respectively.

<u>Surface Smoothness</u> - Finished surfaces of each asphalt concrete course shall be checked for smoothness using a 10-foot straight edge applied parallel to and at right angles to the centerline of paved areas. Surfaces will not be acceptable if variation exceeds  $3/16^{\circ}$  in 10'.

## PLACING THE MIX

The asphalt concrete mixture will be placed by a paving machine as specified, capable of spreading the mixture true to line, grade, and crown.

The mixture shall be spread at a temperature of not less the 250° F. The desired temperature shall be set by the Engineer and shall be maintained within plus or minus  $30^{\circ}$  F.

Hand placing and spreading will be permitted only in inaccessible and small areas.

Place each course in one or more lifts to provide a nominal compacted thickness conforming to the indicated grade, cross-section, finish thickness, and density, as specified and shown on the approved drawings. No more than 3 inches compacted thickness shall be placed in one lift unless approved by the Town based on available compaction equipment and test results for that equipment.

# Continuity of Operations

It is essential to place the mixture in as continuous an operation as practicable to insure a good plant mix asphalt paving with good riding qualities and uniform density.

The paver speed shall be maintained in balance with the plant production, and a sufficient number of trucks should be available to assure uniform capacity operation of the asphalt plant and pavers. Defects caused by unnecessary stopping due to lack of coordination between mixing, hauling, and lay down shall be removed and replaced at Responsible Party's expense.

## Paver Placing

Paving operations shall begin along the concrete gutter or low side of street and in direction of traffic flow and work toward crown from both sides of the street.

After the first truckload of the day has been spread, the loose and compacted depths shall be checked so that a ratio can be established for the correction

of loose depth.

If segregation of materials should occur, the spreading operation will be stopped immediately and not resumed until the cause is determined and corrected.

Any asphalt mix which clings to the sides of the hopper shall be continually loosened and pushed into the active mix. No mix shall be retained in the hopper when there is a delay in the asphalt concrete supply.

Immediately after any course is screeded, and before roller compaction is started, the surface shall be checked. Any area showing an excess or deficiency of bituminous material shall be removed and replaced and all irregularities in alignment and grade shall be corrected by the addition or removal of mixture.

# Hand Placing

Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperatures.

The mixture will be spread, tamped, and finished to a uniform density and to the correct depth. The surface will be checked as required under paver placing.

#### <u>Joints</u>

Carefully make joints between old and new pavements, or between successive days' work, to ensure a continuous bond between adjoining work. Saw cut existing old pavement so that an even vertical surface is exposed. Apply tack coat and butt new pavement up to saw cut edge of existing pavement.

Construct joints to have the same texture, density, and smoothness as the adjacent section of asphalt concrete course.

Clean contact surfaces, free of sand, dirt or other objectionable material and apply tack coat. Also apply tack coat to contact surfaces of old pavement joints and concrete surfaces before placing mixture against them.

Cut back edge of previously placed course to expose an even surface of full course thickness.

Offset longitudinal joints in succeeding courses not less than six (6) inches. Offset transverse joints in succeeding courses not less than 24 inches.

When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface of full course thickness.

## COMPACTING THE MIX

A minimum of two rollers will be required and as many additional rollers as necessary shall be used to compact the asphalt mixture at the proper temperature to obtain the specified pavement density.

Begin rolling operations as soon after placing when the mixture will bear weight

of roller without excessive displacement. Delays in rolling of fresh mixture shall not be tolerated.

The roller wheels shall be kept moist with only enough water to avoid picking up the material. A detergent may be added to the water, but no oil will be permitted for this purpose.

Do not permit heavy equipment, including rollers, to stand on finished surface before it has thoroughly cooler or set.

Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

The lanes placed in the paving operation shall be rolled in the following order:

- 1. Transverse joints.
- 2. Longitudinal joints.
- 3. Outside edge
- 4. Breakdown rolling. Start rolling longitudinally at extreme lower side of sections and proceed toward the high side. Roll to slightly different lengths on alternate roller runs.
- 5. Intermediate rolling. Same as breakdown rolling.
- 6. Finish rolling.

The line of rolling should not be suddenly changed or the direction of rolling suddenly reversed, thereby displacing the mix.

If rolling causes displacement of materials, the affected areas shall be loosened at once with lutes or rakes and restored to the original grade with loose material before being re-rolled.

## TESTING

Tests for conformity with the specified crown and grade shall be made by the Contractor in the presence of the Town immediately after initial compression, and any variation shall be corrected by removing or adding materials and continuing the rolling.

The finished surface shall not vary more than one-quarter (1/4) inch for the wearing course when tested with a sixteen (16) foot straight edge applied parallel with or at right angles to the center line.

After completion of final rolling, the smoothness of the course shall again be tested, and the humps or depressions exceeding the specified tolerances or that retain water on the surface shall be immediately corrected by removing the defective work and replacing with new material or by adding additional material.

# Depth of Asphalt Control

Conduct tests of in-place compacted thickness to insure the required thicknesses are achieved as specified on the drawings and herein.

When there are questions about the compaction or thickness, a minimum of one core sample for every 300 square yards may be required to measure thickness and Marshall stability and flow.

#### Density Control

Conduct tests for density control during compaction operations in accordance with the requirements of ASTM D2950 - Tests for Density of Bituminous Concrete In-Place by Nuclear Method.

Conduct a minimum of one compaction test on bituminous pavement for every 200 square yards at locations designated by the Engineer.

For the determination of composition, compaction and density of the pavement, the Contractor shall remove suitable size samples of the completed pavement if directed by the Engineer. Samples for each day or fraction thereof when mixtures are placed may be taken by the Engineer. The Contractor shall replace the pavement where the samples are removed, and these replacements shall be installed by the Contractor free of charge. After the samples have been removed from the completed pavement, they will be tested by an approved testing lab for density and composition. If the deficiency in composition of compaction exceeds the limits of toleration from the specified, satisfactory corrections shall be made.

## PAVEMENT MARKINGS

Crosswalks and striping shall be installed as shown on the plans after the pavement work completed. Asphalt shall be ground sufficiently to recess the marking material and make it flush with the pavement. Markings shall be installed in accordance with Section 627 of the CDOT standards.

#### CLEANING AND PROTECTION

#### <u>Cleaninq</u>

After completion of paving operation, clean surface of spilled asphalt materials and other foreign matter.

#### Protection

After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than six hours. Provide barricades and warning devices as required to protect pavement and the general public. Cover openings of structures in the area of paving until permanent coverings are placed.

#### Patching

Remove and replace defective areas. Cut-out and fill with fresh, hot asphalt concrete. Compact by rolling to specified surface density and smoothness. Remove deficient areas for full depth of course. Cut sides perpendicular and parallel to direction of traffic with edges vertical. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

## ADJUSTING UTILITY GRADES

All existing manholes, drop inlets, and valve boxes shall be adjusted to final grade. Where spacer rings are installed, they shall have a wide slotted flange for support as approved by the Town. If any existing manhole rings and covers or valve boxes are found to be defective, they shall be replaced as directed by the Town.

Set frames of subsurface structures from 1/8" to 1/4" below final grade as a part of this work, including existing frames and new frames.

#### Placing Frames

The existing frames are to be stored while a temporary cover is used to support equipment while the paving operation is being completed to finish grade. The temporary frame is to be removed and the existing or new frames are then installed and adjusted to finish grade and slope.

The area between the frames and existing pavement is then filled with hot asphaltic concrete or concrete and compacted with the use of a hand tamper.

The same sequence is to be followed for water valve boxes, except that no temporary frames are required.
# MINIMUM DESIGN STANDARDS

#### SECTION 02721 - SEWER SYSTEM SPECIFICATIONS

## 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.

#### DESIGN FLOW

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 75 gallons per capita per day with a peak hour factor of 2.5. Minimum residential population density shall be figured on a basis of 3.5 persons per house, 3.5 houses per acre, and 70 percent of total land area developed as residential unless otherwise designated, subdivided, or restricted.

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 200 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 in the sum of the peak flow as computed above.

Sewers 15 inches in diameter and smaller shall carry the design flow at a maximum flow depth of half the pipe diameter. Sewers 18 inches in diameter and larger may be designed to flow up to three quarters full at 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.

#### PIPING DETAILS

Piping materials shall meet the requirements specified in the Standard Specifications for Sewer Mains. 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.

Normally sanitary sewer mains shall be 8 inch diameter or larger to facilitate maintenance. Service connections shall be 4 inch diameter or larger. Six inch sewer mains may be installed under special conditions where up to residential connections will be made to the line, if approved by the Town. Smaller force mains may be used under certain conditions with approval of the Town.

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

4 inch $2.0 \text{ or } 1/2$ inch m	
	er foot
6 inch 1.00	
8 inch 0.50	
10 inch 0.35	
12 inch 0.25	
15 inch 0.20	
18 inch or larger as approved by the Town	

When pipe is exclusively PVC, the minimum grade can be reduced by approximately 20% with approval by the Town.

Under special conditions, slopes slightly less than those required for the 2.0 feet per second velocity when flowing full may be permitted. Such decreased slopes will only be considered where the depth of flow will be 0.3 of the diameter or greater for design average flow. Whenever such decreased slopes are selected, the design engineer must furnish with his report, computations of the depth of flow in such pipes at minimum, average, and daily or hourly rates of flow. It must be recognized that decreased slopes may cause additional sewer maintenance expense and if in the Town's opinion the expense will be excessive, it will not permit the reduced slopes.

Sewer on slopes of 20% or greater shall be anchored securely with concrete anchors or equal. Spacing shall be not over 30 feet on center for slopes from 20 - 35% and not over 20 feet for slopes 35 - 50%. Where velocities greater than 15 feet per second are attained, special provisions shall be made to protect against displacement by erosion and shock.

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 18 inches and larger. A minimum of 0.10' foot drop shall be provided in manholes with a maximum change in direction of 45 degrees for lines 18 inches and larger and 0.20 feet for changes in direction greater than 45 degrees. For lines less 18 inch 0.10 foot of fall through the manhole is required for changes in direction of less than 60 degrees and 0.20 feet for greater than 60 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. Services 6" in diameter and greater shall enter the sewer main at a manhole.

Provide a flexible joint in the pipe 12 to 18 inches from all manhole walls and other solid structures.

Where underdrains are to be constructed under sewer mains (or other locations), cleanouts or manholes shall be provided at each manhole or at 400 foot maximum

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intervals for the underdrain. Use of drop manholes must be approved by the Town. In general, drop manholes should be provided when the change in elevation through the manhole is in excess of 24 inches.

Minimum cover on sewer mains shall normally be seven and one half foot to ground surface. Bury of 7 to 14 feet is considered normal. Depths outside this range will require specific approval of the Town.

### SERVICE CONNECTIONS

Full body wyes shall be provided in the sewer main for service connections at each building site located inside the property line a minimum of five feet and shall be shown on the plans. Whenever possible, service lines shall be installed perpendicular to the main and shall be located 10 feet inside the downhill property line. Tapping saddles will only be allowed with approval of the Town for circumstances which necessitate their use. 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 crown of the sewer main. Service lines shall be stubbed across the property line through the width of the utility easement and the end sealed with a watertight seal and marked with a  $2 \times 4$  or steel fence post brought to grade. Minimum cover for service lines shall be 3 feet at property line where there will be no basements. Minimum slope of 4" Riser connections shall be installed where the service lines shall be 2%. 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.

Sewer mains shall be extended to a point at least 10 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 at 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 below a manhole.

#### LIFT STATIONS AND FORCE MAINS

The need for pumping facilities and the design of these facilitiies shall be discussed with the Town prior to beginning design. The use of lift stations is discouraged unless truely 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. Lift stations should do not require entering a confined space. In most cases, the Town will require self-priming solid handlings, centrifugal pumps stations. Unless a deviation is specifically approved by the Town, lift stations and wet wells at a minimum shall comply with Colorado Department of Public Health and Environment Design Criteria.

Where necessary and with approval of the Town, force mains shall be constructed 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. Force mains shall enter the gravity sewer system in a separate manhole and discharge shall include a turn down fitting. 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.

## INVERTED SIPHONS

The use of inverted siphjons 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 rodding. In general, sufficient head 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.

#### CONSTRUCTION

In general, construction shall conform with the Standard Specifications for Sewer Mains as well as with the Excavation and Backfill Specifications. 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.

In places where the sewer has less than four feet of cover, provisions shall be made to protect pipe from impact loading. 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. Where design velocities exceed 15 fps, special provisions shall be made to protect against pipe displacement by shock and/or erosion.

Underdrains, where required, shall be formed by substituting 1-1/2 inch well graded washed rock or gravel for the sewer pipe bedding and covering the sewer pipe and bedding with plastic sheeting or geotextile appropriate to the application and approved by the Town.

## PROTECTION OF WATER SUPPLIES

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 or polluted water into the potable supply.

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 lateral 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. Unless than 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.

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 ductile iron pipe for a distance of 10 feet on each side of the sewer. 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 sewer lines or services cross above water mains or services the water mains must be protected at a minimum by installation of an impervious and structural sewer (e.g. ductile iron pipe or heavy walled PVC pipe) and/or impervious and structural encasement for a distance of 10 feet on each side of the water pipe. In all cases, there shall be no joints within ten feet on each side of the water line. When the sewer line is above the water, then 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 watertightness.

There shall be a minimum clear distance vertically of 6" 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.

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.

#### MISCELLANEOUS REQUIREMENTS

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.

Grease and sand/oil traps shall be installed where required by the provisions of the Colorado Uniform Plumbing Code or determined to be necessary by the Town to protect the Town sewage collection and treatment facilities. Grease and sand/oil traps shall be maintained in accordance with good operating practice so as to prevent grease and sand/oil from being discharged to the Town collection system. Improperly maintained grease traps are a hazard to safety, health and public welfare.

# TESTING

Testing of sewer lines and services, manholes and appurtenances shall conform with the requirements of the applicable portions of the Standard Specifications of the Town regarding lamping, video, in- & exfiltration, and pressure testing.

#### STANDARD SPECIFICATIONS

### SECTION 02722 - SEWER LINE CONSTRUCTION

## PART I - GENERAL

### DESCRIPTION

Work specified in this Section includes furnishing and installation of sewer collection and interceptor piping, valves, cleanouts, appurtenances, and manholes, and testing requirements for drain and sewage piping systems. In addition to the requirements herein, pressurized lines shall comply with applicable portions of the Section 02713 - Standard Specifications for Water.

#### Related Work Specified Elsewhere

Section 02200 - Site Preparation, Trenching, Backfilling and Compacting Section 02713 - Standard Specifications for Water Line Section 02721 - Sewer Specifications Minumum Design Standards

## PROTECTION OF WATER SUPPLIES

Requirements for Protection of Water Supplies is included in the Section 02721 Sewer Specifications - Minimum Design Standards.

#### SUBMITTALS

Submittals shall comply with General Requirements.

In addition, furnish manufacturer's certifications that materials were manufactured and tested in accordance with applicable ASTM designations, together with a report of all test results.

## HANDLING AND STORAGE

Storage and handling shall be in accordance with Storage and Handling Requirements in the Section 02713 - Standard Specifications for Water Line and all manufacturer's recommendations.

PART II - PRODUCTS

PIPE MATERIALS

# POLYVINYL CHLORIDE (PVC) PIPE

Service	Open channel gravity lines
Conformance	SDR 35, 3034 PVC sewer
Pressure Rating	Gravity
Joints	Unibell bell and spigot
Deflection	±1/2" in 10'
Service Conformance	Submerged and pressure applications ASTM 2241 SDR 21

Pressure Rating	200 psi working pressure
Joints	Unibell bell and spigot
Fittings	AWWA C151/A21.51 (over 3" pressure applications)
	Solvent weld PVC Class 200 or bell and spigot (effluent
	headers)

# DUCTILE IRON PIPE AND FITTINGS

Conformance	AWWA C151/A21.51, all bolts and nuts stainless steel
Pressure Rating	100 psi working pressure
Joints	Super Bell-tite
Lining	Interior - Coal tar epoxy or polyethylene coating
Coating	Coal tar with polyethylene wrap and seal ends

# **CLEANOUTS**

Materials for cleanouts shall conform to specifications listed on the typical drawing for gravity and pressure cleanouts.

# MANHOLE MATERIALS

# Bases, Risers, Cones and Tops

Material	Precast Concrete
Conformance	ASTM C-478
Cement	Type II, Type V is sulfate resistance required
Joints	Watertight flexible gasket

Manholes shall have integral base and barrel section with pipe openings and boots fabricated into the manhole during construction. Contractor shall form invert in the field or may use precast invert, but in either case the opening shall flare at springline and at the top of the pipe shall be at least 50% wider than the largest pipe diameter in the manhole. All inverts shall have a smooth invert 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.

In non-traffic areas, the manhole frame and cover shall 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, cast iron covers will be required. In both cases, the assembly shall have a clear opening of 24 inches.

A good fit will be required between the frame and cover to prevent rattling in traffic and leakage of dirt and water. To insure 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. Other means of opening the manhole shall be approved by the Town before the material is purchased. Aluminum lids shall have a locking nut to secure them in place.

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#### Manhole Steps

Epoxy coated cast iron, aluminum alloy, 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 between 12 and 20 inches.

## Non-Shrink Grout

Commercial factory-mixed product made especially for intended use including a highly corrosive environment, and an approved type.

Plastic Gasket Joints

Type Preformed flexible plastic Conformance Fed. Spec. SSS-S-00210 (GAS-FSS), Type I Rope and Form ASTM C-433

Bolts and Hardware - All bolts, nuts, and miscellaneous hardware shall be stainless steel.

### Tracer Wire and Marking Tape

Tracer wire shall be insulated 12 gauge. Tracer wire shall be fastened to all non-metallic pipes and shall be fastened to and brought to the surface at all valves and other metallic structures along the line.

Marking (warning) tape at least 4" wide labelled "sewer" shall be placed 12" above pipes of all materials.

## VALVES AND APPURTENANCES

### PLUG VALVES

<u>Plug Valves</u> Plug valves shall be eccentric, non-lubricated type.

# Non-Lubricated Plug Valves

Туре	Non-lubricated eccentric
Class	175 lb. WOG (minimum)
Service	Drains
Port Area	80% of full pipe ( minimum) - 100% 4" and smaller
Connections	125 lb. ANSI flanged
Materials	Semi steel body. Valves not having a round port shall
	have welded overlay of high nickel content on surfaces
	contacting the plug face. Upper and lower plug stem
	journals shall have stainless steel bearings, stem
	packing shall be adjustable or self adjusting.

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Plugs	Faced with Buna-N or Neoprene	
Operator	Wrench on valves smaller 6" (except where noted otherwise)	1
	Enclosed worm and gear on valves 6" and larger	

### Buried Service Valves

Valves for buried service inside vaults shall be handwheel actuated type, totally enclosed with gasket seals on all shafts and on valve and actuator covers. Provide valve box, tee activator, and any necessary adapters. Use valves with 2" operating nut for valves 2" and larger.

#### Floor Stand Operations

In a vault or structure provide floor stand and operator extension with any necessary adapters for use with plug valves.

Floor Stand: Wrench operated, 32 inch minimum height; bolt to concrete slab; provide wrench with each unit.

Lubrication: Provide means of lubricating valve from operating level by hand or pressure gun.

Indicator: Provide means to determine whether valve is open or closed.

## VALVE BOXES

Location	All buried valves, not in vaults					
Туре	Screw, adjustable					
Material	Cast iron, 3/16-inch minimum thickness					
Size	5-inch minimum diameter. Depth as required by cover.					
Provide	Suitable cast iron bases and covers					
Coating	Bituminous varnish					
Service Designation	Cast appropriate name in cover					
Operator Extension	1" dia cold rolled steel rod (where depth greater than					
	5 ft)					

### AIR RELEASE VALVES

<u>Air/Vac Release Valve</u>	
Locations	High spot in pressurized lines
Service	Sewer
Size	1-inch screwed inlet
Valve	Crispin pressure air/vac valve Type N, or equal.

# SLIDE GATES

#### General

Slide gates shall be furnished and installed complete with frames, gates, stems, manual operators, anchor bolts and all other parts and accessories required for proper installation. All slide gates shall be products of the same manufacturer.

# <u>Desiqn</u>

Gates shall be designed to fit into the structures as shown on the plans.

Gates shall be designed for a maximum differential pressure equal to the depth of the plate. Leakage shall be less than 0.1 gpd/ft of seal surface.

Design Considerations: Liberal safety factors shall be used in the design of all equipment. Working stresses shall not exceed the lower value of: one third of the yield strength, or one fifth of the ultimate strength of the material.

# <u>Workmanship</u>

All parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed on the field without any fitting, chipping, or re-machining. Like parts shall be interchangeable. Each gate shall be completely assembled in the shop to insure that all parts fit together properly.

<u>Gate Type</u>

Self-contained, rising stem

<u>Guides</u>	
Material:	Extruded aluminum or fiberglass reinforced polyester.
Type:	Embedded or wall mounted as required per location.
Design:	Provide maximum rigidity, 3 lbs. per foot minimum weight; embedded frames shall be designed so that the waterway is not obstructed when the gate is open.
Reinforcement:	Guides extending above the operating floor shall be sufficiently strong so that no further reinforcement is required.
Yoke:	Shall support operating bench stand; construct from two rolled sections, welded to guides; shall permit vertical removal of Gate.
Gate	
Materials:	Aluminum plate, 1/4-inch minimum thickness or fiberglass reinforced polyester laminate
Reinforcing	As required to limit maximum deflection to 1/360 of gate span under maximum head.
Operator	
Type :	Handwheel operated bench stand
Handwheel:	Diameter, sized so that required operating pull shall not exceed 40 lbs.
Bench stand:	Fully enclosed, equipped with roller bearings above and below operating nut.
Operating Stem:	Stainless steel, $1-1/2$ inch maximum diameter, L/R less than 200.
Stem Covers:	Provide rigid transparent plastic stem cover for each gate.

### PART III - EXECUTION

#### PREPARATION

### Earth Excavation

The Contractor shall do all excavation of whatever substances encountered to depth shown on drawings in accordance with Site Preparation, Excavation, Backfill, and Compaction Specification. Excavation for manholes and other accessories shall have 15" minimum clearance on all sides.

## INSTALLATION

Except as noted below, pipe installation shall conform with the requirements of Section 02220 - Excavation, Backfill, and Compaction Standard Specification.

Pipe shall be thoroughly inspected prior to installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Damaged pipe or pipe which does not meet the deflection tolerances for gravity pipe, shall be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the Engineer.

All foreign matter or dirt shall be removed from the interior and ends of the pipe before they are lowered into position in the trench and prior to connection.

#### Laying Sewer Pipe

All installation work shall conform with applicable portions of ASTM C-12, pipe manufacturer's installation instructions and recommendations, and with this section and referenced sections of the contract documents. If there are conflicts, the more stringent specification shall apply.

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.

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 and the bedding 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.

Lay all pipe straight between changes in alignment and at uniform grade between changes in grade. All pipe shall be placed true to line and grade and 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 placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home 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 depth of the joint. The pipe shall then be properly set and brought to correct line and grade. The pipe shall then be secured in place by installation of bedding material and backfill, in accordance with the plans and Section 02200 of these specifications.

If, in making any joint, previous lengths are disturbed, such lengths must be uncovered and relaid.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Cutting of pipe for inserting closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

### Manhole Construction and Installation

Wherever practical precast manhole bases and barrels shall be used. 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 1-1/2" wash rock. The rock 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.

Cast in place manhole bases shall be constructed with 6 sack (no flyash), 4000 psi concrete, placed on uniform compacted base and in conformance with the Town's typical drawings. Bases shall extend at least eight inches below the invert of the pipe and shall be benched to at least two inches over the top of the pipe. The invert channel shall flare at springline (see typical drawing).

Precast manhole barrel sections shall not be placed on the foundation until it has reached sufficient strength to provide support without damage. The joint between the manhole base and the barrel section shall be made with a flexible butyl resin joint sealing compound. Each succeeding precast section shall be joined in a similar manner and smoothly finished, inside and out.

All pipes shall be connected to the manhole 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.

Precast concrete adjustment rings shall be used 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 12". The top elevation of the manhole shall be adjusted to match final street grade with the top of the lid being 1/4" +/-1/8" 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 eighteen inches above grade and a locking ring and cover shall be installed. Where the surface is gravel, the manhole shall be set 1/2" below finished gravel surface, sloped to match the surface.

#### 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. Carefully cut out as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench shall be ground out for a new invert with a hand grinder 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 downstream invert shall be plugged during construction to prevent storm and non-sewage flow from entering the system. The Contractor shall pump out and clean the manhole before removing the plug. Cement mortar shall be used to smoothly finish the new invert and to seal the new line, both inside and outside, so the junction is watertight.

## Service Connections

All sanitary sewer service lines that connect to the sewer system shall comply with these contract documents and the Uniform Plumbing Code. Pipe installation shall be in accordance with pipe installation requirements elsewhere in this Section and Sections 02200 and 02713 and the Town's typical drawings.

Whenever possible, service lines shall be installed perpendicular to the main and, if there is no existing service, shall typically be located 10 feet inside the downhill property line. Full body wyes shall be provided in the sewer main for service connections at each building site and for each legal existing service. Where Contractor believes tapping saddles must be used, he shall submit a request, with justification, for use of a saddle to Town for review and approval prior to installation. Taps shall be located at  $45^{\circ}+/-10^{\circ}$  above springline. The branch (tap) of the wye shall be angled upwards so that the upper invert of a one-eighth bend will have an elevation equal to or higher than the inside centerline of the sewer main.

Service lines should be stubbed to property line at a 2% slope, the end sealed with a water tight seal and marked with green painted 2 x 4 brought to grade and backed by a steel fence post. Where there is a utility easement along the property line, the service line shall be stubbed across the utility easement to the property end of the easement and capped and marked as above.

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.

Install cleanouts on service lines at all changes in direction or grade. For

long service lines, install at least one cleanout for every 100 feet of service line. Area around the top of a cleanout shall be graded so that water runs away from the cleanout. Top of cleanout shall be protected from all potential surface impacts.

Service connections will not be allowed at manholes except when the diameter of the service line is 50% or greater than 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.

As-built measurements shall be made by the Contractor to reference the wye and riser connection to the nearest manhole as well as the depth from the finished grade elevation to the invert of the stub before backfill is completed. Said measurements shall be carefully and accurately made and recorded and shall be shown on the as-built plans furnished to the Town prior to acceptance.

Backfill service lines in accordance with backfill requirements for sewer mains.

# Construction of Manholes

Construct manholes in accordance with the typical drawings. Set bases on a solid, stabilized and level sub-foundation. The base shall have a minimum of five inches between the low invert of the manhole and the inside base to allow room for the construction of a channel.

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. After pipe is in position, fill joint solidly with a nonshrink grout. 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.

Fill all lifting holes and imperfections in the interior and exterior manhole walls with non-shrink cement mortar.

Install manhole cover rings on a minimum of one and a maximum of six precast adjusting rings (not to exceed 12" height) above the precast top or cone of the manhole. Set manhole frames in a full bed of mortar to the grade called for on the plans.

## Cleanouts, Risers, Stubs and Wyes

Place cleanouts, risers, stubs and wyes as shown on the plans. Record as-built measurements to reference the wye, riser connection, and cleanouts to the nearest two surface monuments before backfill so they can be shown on the record plans.

## Deflecting Pipe

Sewer line shall be laid to a straight line and grade. If there is an obstruction that potentially requires deviating from the requirement, submit

circumstance and proposed resolution to Town for review and written approval of a deviation.

# Valve Installation

Follow the published instructions of the manufacturers of all items furnished.

The completely assembled valves, shall be shop-inspected for proper seating. Seat facings shall be machined and wedges adjusted to exclude a 0.004" thickness gauge between the frame and disc seating surfaces. The gate disc shall be fully opened and closed in its guide system to insure that it operates freely. Floor stands and bench stands shall be shop-operated to insure proper assembly and operation.

Set valve in locations called for plumb and square. Insure that proper seal is provided and that valves and appurtenances operate smoothly and freely without putting undo force on the valve, piping or the structure.

### Valve Box Installation

Set box plumb; place directly over valve, with top of box flush with finished grade.

#### Pipe Cover

Where not otherwise specified, open channel flow pipe shall have a minimum cover of four feet (4') and five feet (5') for full pipes.

# FIELD QUALITY CONTROL (TESTING)

# <u>General</u>

Contractor shall provide all the tools, equipment, labor, and monitoring necessary to carry out the testing described below and shall perform the testing except when said testing is specified to be performed by in an independent testing agency in which case the requirement of Section 01000 shall apply. In either case, the cost of all testing to demonstrate conformance with the specifications, except the field density testing specified in Section 02200, shall be paid by the Contractor. Contractor shall provide notice of schedule of tests in conformance with the requirements of Section 01000 and all testing in order to be valid must be observed by Engineer.

# Infiltration/Exfiltration

The finished non-pressurized lines shall be of such tightness that leakage will not exceed 50 gallons per day per inch of diameter per mile when field tested by actual infiltration/exfiltration conditions.

Any line or section of line not meeting the above limits shall be corrected by the Responsible Party at his expense.

# Soil Compaction Tests

Conduct compactions tests in accordance with Section 02200.

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#### 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 (where 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 Engineer. Misalignment shall be less than 3% of pipe diameter.

# Video Inspection of Line Interior

At the completion of segments of sewer lines, the lines shall be jetted with water. After water ceases to flow, video each segment to demonstrate cleanliness, proper jointing, proper tap installation, conformance to alignment and grade, and proper roundness. Video work shall be done in coordination with ovalation testing so the video records the testing results of the "Go-No Go" gauge. In addition a small steady flow of water shall be present during the video so that any variability in grade of line installation can be identified. Any locations shown to have a sag of 3/8" or more shall be corrected.

## Tests for Pressure Lines

Test sewer lines which will be subject to positive pressures in accordance with the testing provisions "hydrostatic testing" in Section 02713.

### Air Test - Gravity Flow Lines

Conduct an air test on all gravity lines in conformance with Uni-Bell publication B-6-90. Special attention shall be paid the safety admonishments provided in that publication.

At his option, the Contractor may conduct an initial air test of the sewer mainline after densification of the backfill but prior to installation of any connections. Such preliminary tests will be for the Contractor's convenience and need not be performed in the presence of the Town. Where existing services are to be connected to the new main, install the full bodied wye for each service between two manholes and extend the new service line to the point of connection with the existing service line, then cap the new line and perform the air test in the presence of the Town. Once that section of line is approved by the Town, the connection between the new and existing service lines, including installation of any cleanouts on the service line can be completed.

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) exceeds that shown in Unibell B-6 Table 2, 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.

<u>Safety:</u> 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.

# 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, 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 in writing the Responsible Party if problems are detected. The Responsible Party shall promptly make arrangements to correct the problem in accordance with the Town's warranty provisions.

### Manhole Tests

Infiltration - Inspect all joints for infiltration leaks. Repair all visible leaks prior to acceptance.

Exfiltration Test - Conduct exfiltration tests on all manholes by plugging all sewer pipes connected to the manhole and filling the manhole to within 6" of the rim of the manhole. Allow the water to stand a minimum of 4 hours for absorption to take place in the wall. Add additional water to bring the surface back to the mark. After a carefully timed interval varying from one hour to two hours, record the drop in elevation of the water surface and convert to the amount of water lost. Whenever the loss exceeds 0.25 gal/hr., the location of the leak shall be determined and repaired. Repair all visible leaks prior to acceptance. Vacuum Test - 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:

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

Manholes shall be both infiltration and exfiltration tested or vacuum tested.

TABLE I

MINIMUM SPECIFIED TIME REQUIRED FOR A <u>1.0 PSIG PRESSURE DROP</u> FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

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

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#### MINIMUM STANDARDS

# SECTION 02901 POWER, PHONE, GAS, IRRIGATION, AND OTHER BURIED UTILITIES

#### GENERAL

All new power and phone within the Town limits shall be buried.

Open ditches for irrigation within new subdivisions and developments are prohibited unless specifically approved by the Town for extenuating circumstances.

All buried power, phone, gas, cables, and other buried wire utilities installed within Town rights of way or easements shall conform with these basic requirements and with the requirements of the appropriate utility owner. Where there is a conflict, the more stringent requirement shall apply. Before installation of any buried utility, installer shall have the approval of the Town and the utility owner and shall obtain all necessary permits. All work within the Town right of way or in a Town easement shall also conform with all applicable Town Requirements.

### DEPTH OF BURY

Primary power shall have a consistent depth of bury at 4' below finished grade. Secondary power shall have a depth of bury of at least 2' below finished grade. Other wires such as phone and cable shall also have a bury depth of at least 2' below finished grade. Gas lines shall have at least 32" of cover.

#### BEDDING

All wires shall be bedding in select bedding material for a minimum of 6" around the wires. PVC pipes and encasements and any HDPE pipe shall be bedded in accordance with the requirements of Section 02200. If the native materials are rock or other unsuitable bedding material, over excavation of 6" of material and replacement with select material is required.

### MARKING TAPE

Marking tape, 4" wide minimum, shall be placed 12" above each of the buried utilities. The tape shall be labelled for the utility below.

## SEPARATION FROM OTHER UTILITIES

Minimum separation between most utilities from any other utility shall be 5' except that secondary power and/or phone may be located a minimum of 2' from primary power. Separation requirements from water lines are defined in the Water Standards.

#### UTILITIES WITHIN PUBLIC RIGHTS OF WAY

When utilities other than Town owned water and sewer lines are in public rights of way, they shall be encased in PVC pipe for the entire length the wires are inside the right of way. PVC shall be schedule 80 for primary power, and schedule 40 for other buried utilities.

# CROSSING OTHER UTILITIES

When power lines cross other utilities, the power lines shall be encased for at least 5' on either side of the crossing in Schedule 40 PVC pipe.

# IRRIGATION

Irrigation pipes shall meet the requirements of Section 02713 Water Line Construction for water line materials, construction, and installation unless otherwise approved by the Town.

#### MINIMUM DESIGN STANDARDS

### CURB, GUTTER, SIDEWALKS & STREETS

# <u>General</u>

All curb, gutter, sidewalk, and street construction design, rights of way widths and street widths shall conform to the minimum requirements enumerated on the typical Town typical drawings and the requirements of the Subdivision Regulations of the Town of Hotchkiss. Care shall be taken to insure continuity of grades, widths, etc, of proposed, existing, and future installations. Deviations from these standards and specifications may be permitted, when in the opinion of the Town, the quality of the finished work would not vary materially from the intent of these requirements.

## Gravel Street Construction

Gravel streets shall only be accepted for alley construction.

# Paved Street Construction

Road structure shall meet the minimum requirements on the Town's typical drawings. Except for local residential streets, base and surface treatment for shall be designed by an engineer based on traffic load and soils conditions but in no case shall the street section be less than shown the Town's typical drawing. Street section design shall be based on a 25 year ESAL load.

All paved streets shall have curb, gutter, and sidewalk on both sides. The curb, gutter, and sidewalk shall conform with Town standard drawings and specifications for that work.

# Street Layout

Street widths shall conform to Town standard drawings for the type of street being designed. Gravel surfaces shall have a cross slope of 3% and paved streets shall have at least 2% cross slope.

The minimum grade for all streets is 0.5 percent. The maximum grade shall not exceed 7% on any street and 5% on collectors and arterials. The minimum length of the vertical curves for all streets shall be 300 feet except where the algebraic in grades is less than 2%, vertical curves may be omitted. On local residential streets, the minimum radius of horizontal curves shall be 100 feet and 150 feet on all other streets.

In special topographic conditions, the Town may allow deviations from these requirements in order to provide the Town with better drainage or a better intersection design.

Tee intersections with the leg to of the tee in opposite directions shall have those legs at least 125' apart centerline to centerline to facilitate a reasonable line of sight between the intersections.

## Utility Street Crossings

All utilities in Town rights of way, except water and sewer lines, shall be placed in a casing of suitable strength and size for the installation.

### Service Line Installation

All service lines shall be installed (accordance with the appropriate Town standards) prior to paving any street.

# Drainage

All streets shall be designed to provide continuous surface drainage directed to storm drain inlets and drainage courses. Grade shall permit flow without ponding. A check shall be made to be sure of continuity of drainage design between the proposed construction and existing or future construction. In no case shall surface drainage be permitted to be disposed of overland except by approved storm drainage facilities.

## Monumentation

Provide a center monument, consistent with the Town's typical detail, for each intersection centerline. Monument shall be set by land surveyor licensed in the State of Colorado.

#### SECTION 03000 - CONCRETE

# PART I - GENERAL

Scope of Work

Work covered by this section of the specifications consists of all the concrete work detailed on the approved plans and specified in other sections of these specifications.

All work shall conform with most recent edition of ACI and AASHTO standards unless more stringent requirements are contained herein.

#### Related Work Specified Elsewhere

Section 02200 - Sitework Excavation, Backfill, and Compaction Section 02500 - Street Construction

# Submittals

Contractor shall furnish test data to demonstrate that the materials (including sands, gravels, and water) provided for the concrete and the concrete itself meets the requirements of the Town Standards. Submittal data shall also be furnished for all admixtures proposed for use along with test data that the admixtures are appropriate for the application and design mix. At a minimum, the product submittal shall include: the mix design (as detailed in "Concrete Proportioning" below) of each material submitted for the Work which includes admixtures and additives, source of water, if potable, or test results if not potable, 28 day cylinder break test results of each material submitted which is representative of the material with all additives and admixtures, from the batch plant to be used for the project, and submittal information and manufacturers recommended usages and dosages of all additives and admixtures.

For the curb, gutter, valley pan, and sidewalk, a construction schedule shall be furnished which indicates how the concrete will be placed. If a slip form paver is to be used, Contractor shall submit information that demonstrates that the paver is appropriate for the project and that the paver operator has at least 25 hours of experience operating the specific paver on similar projects.

Contractor shall submit a curing schedule which addresses the need to keep concrete continuously moist (without using curing compound) for the first 24 hours after final finishing unless the temperatures during the first 24 hours will not exceed 75°F.

PART II - PRODUCTS

#### MATERIALS

## Cement

Cement for concrete shall be a standard brand of portland cement conforming to Standard Specifications for Portland Cement, Designation C-150, of the American Society for Testing and Materials and Section 701 of the Colorado Department of

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Transportation Specifications. The type to be used shall be Type I-II low alkali cement unless soils conditions require a Type V cement.

When suitable facilities (such as those recommended by the Concrete Plant Manufacturers' Bureau and/or approved by the Engineer) are available for handling and weighing bulk cement, such facilities shall be used. Otherwise, the cement shall be delivered in original unopened bags of the manufacturer and the type of cement plainly marked thereon, each bag to contain 94 pounds of cement.

Cement shall be stored in such manner as to permit ready access for the purpose of inspection and identification and so as to be suitably protected against damage by contamination or moisture. Cement should be free of lumps or indications of other possible impurities. Should any lot of bulk cement delivered to the site show evidence of contamination, the Town may require that such lot be removed from the site.

## Sand and Aggregate

Aggregate shall conform to ASTM Standard Specifications for Concrete Aggregates, Designation C-33. Prior to delivery of the aggregates, the Contractor shall furnish samples for testing and shall notify the Town as to when and where they will be available. Samples shall be taken in the presence of the Town.

Aggregates which are found to have a silica released to alkali reduced ratio greater than one, when tested in accordance with ASTM C 289 shall be used only, when approved by the Town, but only when low-alkali cement is used. Low alkali cement shall conform to the requirements for portland cement, as specified in ASTM C 150 and, in addition, shall contain no more than 0.60 percent by weight of alkalies and calculated as  $Na_20$  plus 0.659  $K_20$ .

For concrete work that is less than 12" in thickness, the nominal size of the coarse aggregate shall not exceed three-fourths inch (3/4"). Concrete which is greater than twelve inches (12") in thickness shall have coarse aggregate which shall not exceed one inch (1"). Gradation shall meet the limits specified in Table 2 of ASTM C 33. (See also Table 703-2, CDOT <u>Standard Specifications for Road and Bridge Construction</u>). The sand particles shall be clean, hard, dense, durable, uncoated rock fragments that will pass a screen having 3/16 or 1/4 inch square openings. The sand shall be well graded from fine to coarse and shall be free from injurious amounts of dirt, organic matter, and other deleterious substances.

#### <u>Air Entraining Agent</u>

An air entraining agent shall be used and provide the concrete with entrained air in the amount specified in "Concrete Proportioning" below. Air entrainment shall be by means of an admixture conforming to ASTM C 260. Air content shall be determined by a pressure method in accordance with ASTM C 231. If air entraining agent has frozen it will be rejected.

# Miscellaneous Admixtures

Other admixtures, if used, shall have the written approval of the Town and shall conform with appropriate ASTM standards. The use of calcium chloride will not

be permitted unless approved in writing by the Town for a specific justifiable application. When approved by the Town for a specific design mix, flyash shall meet the requirements of ASTM C618 Class F flyash.

### Reinforcement Material

Steel reinforcement bars shall conform to Standard Specifications for Concrete Steel Reinforcing Bars, Designation A-615, Grade 60, and A-305, of the American Society for Testing and Materials (ASTM). Deformations of reinforcing steel bars shall comply with the latest revision of ASTM A 305. The use of cold twisted bars will not be permitted. Welded wire fabric shall be electrically welded and meet the requirements of ASTM A-185 for Welded Steel Wire Fabric for Concrete Reinforcement.

Fiber reenforcement shall be used for all curb, gutter, valley pans, and sidewalk. Fibers shall be mixed into the concrete as part of the batching process.

#### <u>Water</u>

Water shall be from a source known to be of potable quality unless otherwise approved by the town. Water will be tested in accordance with, and shall meet the suggested requirements of AASHTO T 26 and in addition, the total dissolved solids shall not exceed 400 mg/l. The amount of water shall be adjusted to take into account the moisture content and the requirements of workability of the aggregate. The water used for mixing with concrete shall be free from oil, vegetable matter, salt, acid, alkali, and other deleterious substances. Use of heated water requires prior Town approval.

### Expansion Joint Material

Expansion joint material shall be non-extruding preformed joint filler and shall conform to ASTM Specification D1751 or D1752.

#### Curing Compound

Membrane curing compounds for concrete shall be the pigmented type conforming to the requirements of AASHTO-M-148 and/or ASTM-C-309.

#### <u>Snap\_Ties</u>

Snap ties shall all be at least 1" deep cone style. Snap ties used in concrete which is below the high water line of the river shall have a waterstop on the rod.

#### PART III - EXECUTION

#### Tolerances

All concrete work shall be completed the lines and grades on the plans within these tolerances:

Variation of the constructed linear outlineIn 10': +/-1/4"from the position in plan or from the levelIn 20' or more: +/-1/2"or grades shown or variations from plumb orIn 20' or more: +/-1/2"

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finished surface.

Variation in the thickness of flatwork, slabs, and walls.

Minus 1/4" Plus 1/2"

Variation in the locations and sizes of slabs and wall openings.

# Concrete Proportioning

The determination of the concrete design proportions and its workability shall be solely the Responsible Party's responsibility and shall be established, using the cement and water contents provided herein, on the basis either of laboratory trial batches designed in accordance with the latest revision of ACI 211.1 (Recommended Practice for Selecting Proportions for Normal Weight Concrete) or of field experience with appropriate lab test results for the materials to be employed.

The concrete shall have a compressive strength of not less than four thousand (4,000) pounds per square inch at twenty-eighth (28th) day after pouring. The minimum cement content of this concrete shall be six (6) standard 94-pound sacks of cement per cubic yard of concrete. Not more than 10% flyash (pozzolan) may be used as part of the six standard sacks. If the concrete will be exposed to deicing compounds in the first two years, maximum flyash will be allowed as a substitute for cement is 6%. The water-cement ratio shall not exceed 0.46 for the curb, gutter, valley pan, and sidewalk, and 0.42 for the structural concrete, including moisture in sands and aggregates and water added in field adjustments. Slump shall not exceed 3-1/2" when half the concrete in the truck has been If greater slump is required (and approved in writing by the Town), placed. additional water may be added with a proportional increase in cement to maintain the same water-cement ratio or the use of water reducing agents may be proposed, with sufficient support data, for review and approval by Town.

Entrained air shall be 5% +/-1 %.

Where concrete is to be subject to traffic loads in less than 10 days, concrete mix shall be designed to achieve a laboratory compressive strength of at least three thousand (3,000) psi in 72 hours without the use of high early cement.

Submit design mix(es) and test results to Town to demonstrate that said mix including any admixtures proposed meets the requirements of these specifications. Responsible Party shall select design mix keeping in mind workability of the mix in general as well as how the mix will be conveyed to the final location (e.g. if a pumper truck will be used, the mix needs to account for the reduction of workability during conveyance). Note that if the test data for the design mix has a lower water/cement ratio than the design mix, the allowable W/C will be based on the test data rather than the design mix.

Calcium chloride shall not be used.

Plus or Minus 1/4"

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Ready-mix shall be mixed and delivered in accordance with the ASTM Specifications for Ready-Mixed Concrete, Designation C94 unless more stringent requirements are listed herein and shall meet the requirements for air entrainment set forth herein.

Prior to actual delivery of any concrete, furnish Town representative with a report giving the dry weights of fine and coarse aggregate gradation and quantities, types, and name of admixture (if any) and of water per cubic yard of concrete that will be used in the manufacture of each class of concrete to be furnished. Also furnish evidence satisfactory to the Town that the materials to be used and proportions selected will produce concrete of the quality specified. Whatever strengths are attained, the quantity of cement used shall not be less than the minimum specified.

# Batching and Mixing

The sand and coarse aggregate shall be weighed and shall be proportioned on the basis of integral bags of cement unless the cement is weighed. Weighing equipment of the beam type may be used. The supplier or contractor shall provide equipment and shall maintain and operate the equipment as required to accurately determine and control the amount of each separate ingredient entering the concrete. Batching shall be such that combined inaccuracies in feeding and measuring the materials will not exceed 1-1/2% for water and weighed cement and 2% for sand and each size of coarse aggregate.

Batching and mixing shall be in accordance with ASTM C94, Specifications for Ready Mixed Concrete and CDOT Section 412. Job mixed concrete will not be accepted except for volumes of less than 1/2 cubic yard. The concrete shall be uniform in composition and consistency throughout the mixed batch, and from batch to batch, except where changes in composition or consistency are directed. The stationary mixing (prior to adding water) time shall be between 50-90 seconds. Excessive overmixing requiring the addition of water to preserve the required consistency will not be permitted. From the time water is added to the mix or cement comes in contact with aggregate, until the concrete is deposited in place, shall not exceed 45 minutes if hauled in non-agitating trucks, and 90 minutes if hauled in agitating or mixing trucks.

A mix ticket in general accord with Colorado Department of Transportation standards must accompany each truck of concrete and a copy provided to the Town's Inspector upon arrival on the project site. The minimum information on the ticket shall include: date, mixing plant, truck number, class of concrete or mix design number, time charged, mixing and batching times, number of mixing revolutions and time, yards of material in truck, pounds of cement (per yard & total), pounds of sand (per yard & total), pounds of aggregate (per yard & total), gallons of water (per yard & total), actual percent of moisture in sand, actual percent of moisture in aggregate, ounces of admixture for each admixture or additive (per yard & total) and batch plant inspector's signature. Any water added at the jobsite must be accurately metered and the quantity added noted on the mix ticket.

Truck mixers will be permitted only when the mixers and their operation are such

that the concrete throughout the mixed batch and from batch to batch is uniform with respect to consistency and grading.

Any concrete retained in truck mixers so long as to require additional water to permit satisfactory placing shall be wasted.

If concrete arrives on site which is too stiff for placement, before placing concrete from a truck, at the Contractor's request and approval of the concrete supplier, the concrete may be remixed with a small amount of water under careful supervision only if <u>all</u> the following conditions are met: 1. maximum allowable water cement ratio is not exceeded, 2. maximum allowable slump is will not be exceeded, 3. maximum allowable mixing and agitating time (or drum revolutions) are not exceeded (maximum is 300 revolutions from addition of initial water); 4. concrete is remixed for at least half the minimum required mixing time or number of revolutions (minimum revolutions is 70 so minimum of 35 are required for remixing), and 5. no more than 1/4 cubic yard has been discharged from the truck. The mix ticket must contain adequate accurate information to know whether the above conditions will be met.

Retempering of any concrete is forbidden.

If plasticizers are to be used, they must be approved as part of the design mix during submittal process. If approved for use, they should be added in the field only after air and slump tests have been run and prior to beginning the pour from the truck.

### Forms

Forms shall be of suitable material and of type, size, shape, quality, and strength to enable construction as designed. The forms shall be true to line and grade, mortar tight, and sufficiently rigid to resist any appreciable amount of springing out of shape during placing of concrete. The responsibility for the adequacy shall rest with the Contractor. All dirt, chips, sawdust, nails, and other foreign matter shall be completely removed from forms before any concrete is deposited therein. The surfaces of forms shall be smooth and free of irregularities, dents, sags, and holes, that would appreciably deface the finished surface. Forms previously used shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being reused, and the reuse of forms shall be subject to approval of the Town. Where practical, all structural forming shall be done with plywood.

Forms for all surfaces that will not be completely enclosed or hidden below the permanent surface of the ground shall be made of surfaced lumber or material which will provide a surface at least equally satisfactory. Any lumber or material which becomes badly checked or warped prior to placing concrete will be rejected.

Forms, clamps, and/or bolts approved by the Town shall be used to fasten forms. The use of twisted wire loop ties to hold forms in position will not be permitted, nor shall wooden spreaders be used unless authorized by the Town are removed promptly during placement. Clamps or bolts shall be of sufficient strength and number to prevent spreading of the forms. They shall be of such type that they can be entirely removed or cut back 1 inch below the finished surface of the concrete (cone shape) and in watertight applications should have a waterstop on the snap tie. Forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales, all based on the rate and force of concrete pour.

Forms shall be so constructed that portions, where finishing is required, may be removed without disturbing portions of form to remain.

Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly treated with an approved releasing agent that will leave no objectionable film on the surface of forms that can be absorbed by the concrete. Care shall be exercised that no releasing agent is deposited on previously placed concrete.

Forms for all surfaces that will not be completely enclosed or hidden shall be made of surfaced lumber or material which will provide a surface at least equally satisfactory. Any lumber or material which becomes badly checked or warped prior to placing concrete may be rejected.

Unless otherwise designated on the plans, all exposed edges shall have a 3/4 inch chamfer. Forms for curved surfaces shall be so constructed and placed that the finished surface will not deviate appreciably from the arc of the curve.

Forms shall remain in place until the concrete has cured to 75% of specified 28 day strength unless otherwise approved by the Design Engineer. Any early removal of forms shall be solely at the Contractor's risk.

## Reinforcement

Bars shall be accurately positioned in accordance with ACI standards and as shown on drawings, terminating 2" (3" if formed against earth) away from edges and expansion joints, and shall be firmly and securely held in position by wiring at intersections and elsewhere as needed to prevent shifting of bars, and not less than 50%, with wire not smaller than No. 16 and by using concrete, plastic, or metal chairs, spacers, metal hangers, supporting wires, and other approved devices designed for that purpose and of sufficient strength to resist crushing under full load. The use of wooden supports or metal supports that are exposed at the surface of the concrete will not be permitted.

Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted.

Before placing reinforcing steel in forms, the reinforcing steel shall be thoroughly cleaned of mortar, oil, dirt, loose mill scale, loose or thick rust, and coatings of any character that would destroy or reduce the bonds. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved.

Placement of rebar shall conform with ACI standards. Bundled bars shall be tied

together at not more than six foot centers. Bars shall overlap at least 36 bar diameters and also be securely tied or otherwise secured so that there is no possibility of displacement when concrete is poured. Splices of bars shall be made only where shown on the approved plans. Welding of reinforcing steel will be permitted when authorized in writing by the Design Engineer and the Town and shall be in accordance with American Welding Society Standard Specifications for Highway and Railroad Bridges.

Bends and hooks in bars shall be made in the manner prescribed by the ACI. Bars shall not be bent nor straightened in a manner that will injure the material. Bars with kinks or unspecified bends shall not be used.

Welded wire fabric shall be held firmly in place and shall be spliced not less than two meshes. Lifting fabric into place as concrete is placed is not allowed. Support of welded wire fabric shall be by using plastic, concrete, or metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under full load. The use of wooden supports will not be permitted.

Reinforcement materials at time of concrete pouring shall be free of loose, flaky rust and other coatings or films that could interfere with bonding to the concrete.

# Placing Concrete

Concrete for valley pan, curb, gutter, and sidewalk are intended to be placed using slip-forms where practical.

Where a schedule for pouring concrete is shown on the plans, no deviation will be permitted therefrom unless approved in writing by the Design Engineer and the Town. The placing of concrete for a given pour shall start at the low point and shall proceed upgrade, unless otherwise permitted by the Town.

Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent separation or loss of materials, or decrease in slump in excess of one inch in the concrete as it is delivered to the job. Any concrete which has become so stiff that proper placing can not be assured, shall be wasted. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery end without separation of materials.

Fresh concrete shall not be permitted to fall from a height greater than 3 feet without the use of adjustable length pipes or "elephant trunks".

The use of chutes in conveying or depositing concrete will be allowed only at the discretion of the Design Engineer and the Town; and whenever they are used, they shall be laid at such inclination as will permit the flow of concrete of such consistency as required. The use of additional water in mixing the concrete to promote free flow in chutes of low inclination will not be allowed. Where necessary in order to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet. Columns shall be poured preferably through pipes of adjustable length and not less than six (6) inches in diameter.

If the Contractor intends to use a pumper to place the concrete, he should notify Town in advance, and the design mix should take into account the reduced workability of pumped concrete.

Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Formed concrete shall be placed in continuously approximately horizontal lines, with depths generally not to exceed 18 inches per lift. Concrete shall be placed at such a rate that it is at all times plastic and flows readily between bars and/or through the slip form machine. If additional concrete is to be placed, care shall be taken to remove all laitence and to roughen the surfaces of the concrete to insure that fresh concrete is deposited upon sound concrete surfaces. Concrete which is contaminated by foreign materials shall not be used, nor shall retempered concrete be used.

All concrete shall be thoroughly consolidated during placement to obtain maximum practicable density, free from rock pockets of coarse aggregate, and snugly closed against all surfaces of forms and embedded materials. Concrete shall be thoroughly worked around reinforcement and waterstops and into the corners of the forms.

The maximum time allowed from the start of batching of a load to complete placement of the load shall be 90 minutes. In cooler weather, this time can be increased with Town approval as long as the concrete remains workable and cool without the addition of water. When long hauling times are necessary, water shall not be added until the truck reaches the job site. In such cases, delivery trucks shall be capable of providing adequate mixing to insure the same quality product as if it had been batched at the plant.

Concrete when deposited shall have a temperature of not more than  $85^{\circ}$  F and not less than  $40^{\circ}$  F in moderate weather and at least  $50^{\circ}$  F when the mean daily temperature drops below  $40^{\circ}$  F.

Mixed concrete, after being deposited, shall be consolidated until all voids are filled and free mortar appears on the surface. With the exception of concrete placed in slope paving and aprons and concrete placed under water, all concrete shall be compacted by means of high-frequency internal vibrators of a type, size, and number appropriate for the particular pour. The number of vibrators employed shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases at least 2 vibrators of adequate length shall be available at the site of the work in which more the 2 c.y. of concrete is to be placed. The vibrators shall not be attached to or held against the forms or the reinforcing steel. The locations, manner, and duration of the application of the vibrators shall be used such as to secure maximum consolidation of the concrete without causing segregation of the mortar and coarse aggregate and without causing water or cement paste to flush to the surface. The use of vibrators for extensive

shifting of the mass of fresh concrete is prohibited. Layers of concrete shall not be tapered off in wedge-shaped slopes but shall be built with square ends and level tops.

The use of approved external vibrators for compacting concrete will be permitted only when approved in advance by the Town, for concrete that is inaccessible for adequate compaction, and provided the forms are constructed sufficiently rigid to resist displacement or damage from external vibration.

During the placing of concrete, care shall be taken that methods of compaction used will result in a surface of even texture free from voids, water, or air pockets, and that the coarse aggregate is forced away from the forms in order to leave a mortar surface. Spades or broad-tined forks shall be provided and used to produce the desired results if necessary.

All porous and fractured concrete shall be removed by chipping openings into the concrete as directed, and the chipped openings shall be filled with drypack, mortar, or concrete as directed.

Exposed surfaces of concrete shall be brought to uniform surfaces and worked with suitable tools to a reasonable smooth wood-float or steel-trowel finish as directed.

Horizontal members or sections shall not be placed until the concrete in the supporting vertical members or sections has been consolidated and settlement has occurred.

# Concrete Wastewater Containment

Removal of concrete waste and washout water from mixer trucks, concrete finishing tools, concrete saw and all concrete material removed in the course of construction operations or cleaning shall be performed in a manner that prevents waste material from entering waters of the State as defined in CRS 25-8-103 (19). A minimum of 10 days prior to the start of concrete operations, the Contractor shall submit in writing a method of containing concrete wastewater to the Town for approval. Wastewater generated from concrete saw and finishing operations shall be disposed of in a manner which prevents the wastewater from entering waters of the State.

# Protection Against Effects of Rain

In order that concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the Contractor will be required to have material available on site at all times for the protection of the edges and surfaces of all unhardened concrete. Such protective material shall consist of material which will protect the surfaces from finish damage or a localized shift in cement water ratio. When rain appears imminent, all placement operations shall stop, forms shall be placed against the sides of work and protective covering shall be placed over the surface of the unhardened concrete.

### Slip Form Construction

Slip form paving equipment shall be provided with travelling side forms of sufficient dimensions, shape, and strength to support concrete laterally for a sufficient length of time during placement to produce pavement of the required cross section, and it shall spread, consolidate, screed, float-finish the freshly placed concrete is such a manner as to provide a dense and homogenous pavement.

The concrete shall be distributed uniformly into final position by the slip form paver and the horizontal deviation in the alignment of the edges shall not exceed 1" from the required alignment.

The concrete, for the full width, shall be effectively consolidated by internal vibration, with transverse vibrating units, or with a series of longitudal vibrating units. Internal vibration shall mean vibration by means of vibrating units loaded within the specified thickness of pavement section and at a minimum distance ahead of the screed equal to the pavement thickness.

After the concrete has been given a preliminary finish by finishing devices incorporated in the slip form paving equipment, the surface of the fresh concrete shall be checked by the Contractor with a straightedge to the tolerances and finish required below.

# <u>Joints</u>

The work shall be so executed that construction joints will occur at designated places shown on approved drawings and Town typical drawings unless specifically permitted otherwise by the Town. The Contractor shall complete, by continuous depositing of concrete sections of work comprised between such joints. The joints shall be kept moist until adjacent concrete is placed.

Construction joints shall be saw cut into concrete slabs as soon as the concrete has cured sufficiently to allow saw cutting without fraying the edges or damaging the set of the concrete.

All construction joints shall be roughened prior to concrete set and cleaned prior to placement of additional concrete.

Expansion and contraction joints in the concrete shall be formed where shown on the drawings, where specified, and as directed. In general, such joints shall have smooth abutting surfaces, painted, or separated and sealed as detailed on the drawings. No reinforcement shall be extended through the joints except where specifically noted or detailed on the approved drawings.

Transverse joints shall be located at intervals of eight (8) feet in 8' sidewalk, and at 5' in five foot sidewalk. For valley pan, and curb and gutter joints shall be at 8'. The joints shall be sawcut or formed with zip strip and penetrate approximately 1/4 depth of the concrete. Tooled joints will not be permitted in sidewalks and only acceptable elsewhere with Town approval. Saw cutting shall begin as soon as the concrete has cured sufficiently to allow saw cutting without fraying the edges or damaging the set of the concrete. Joints shall be filled with a urethane caulk to provide a smooth surface between panels of concrete.

Expansion joints shall be formed into the work approximately every one hundred (100) feet in sidewalks, valley pans, and curb & gutter sections and at crosspans and shall extend for the full depth and width of the concrete. Expansion joint material shall also be installed between new structure slabs and existing concrete slabs, around fire hydrants, meter cans, poles, etc. and shall also be between the end of the sidewalk and the curbs. Smooth dowels shall connect between joints in sidewalk, valley pan, and curb and gutter sections. Expansion joint material must be set vertical and with the top edge flush with the finished surface. Plugs of concrete will not be permitted anywhere within the expansion space. The joint shall be edged with a suitable edging tool.

## Removal of Forms

To facilitate satisfactory progress with the specified curing, and enable earliest practicable repair of surface imperfections, non structural concrete forms shall be carefully removed as soon as the concrete has hardened sufficiently to prevent damage.

At his option, the Contractor may leave the forms in place for such longer periods as are, in his opinion, required or desireable for the Work quality, but must still provide proper curing.

## Surface Finish

Concrete slabs shall be carefully spread, consolidated, floated to the grades indicated on the drawings and after floating be uniform in grade so as to contact a ten (10) foot straightedge within a plus or minus of one-eights inch (1/8"). A float finish shall be achieved by placing an excess of material in the form and removing or striking off the excess with a template, forcing the coarse aggregate below the mortar surface. Creation of concave surfaces shall be avoided. After the concrete has been struck off, the surface shall be thoroughly worked and floated with a suitable floating tool. After having taken initial set sufficient to bear the weight of cement finishers, the surface shall be finished to a texture that conforms to requirements of the use of the surface and unless otherwise noted shall be a light broom finish perpendicular to the length of the walk and all edges tooled with a 1/2" radius edger then broomed to remove the tool marks.

The use of water to facilitate finishing work is prohibited as is plastering, dusting or topping of the surface. The Contractor shall schedule his pours to allow for proper finishing without the need to add water in the finishing process. Any activity which will alter the water cement ratio so as to dilute the concentration of cement in a given location is prohibited. If there is a need for mortar to finish the concrete, Contractor shall mix cement and water in the same water/cement ratio as is in the ready mixed concrete. Finishing aids, if submitted and approved in writing by the Town, may only be used in accordance to manufacturers instructions in a manner that will not alter the surface water cement ratio. Ŕ.
Ordinary surface finish shall be performed on the exposed surfaces of structures. On surfaces which are to be buried underground or surfaces which are completely enclosed, the removal of fins and form marks and the rubbing of mortared surfaces to a uniform color for cosmetic purposes will not be required (but all defects must be corrected).

Immediately after the forms have been removed, all form bolts shall be removed to a depth of at least 1 inch below the surface of the concrete and the resulting holes or depressions cleaned and filled with mortar. Mortar shall consist of 1 part by volume of cement, 2 parts of sand, and sufficient concrete glue to aid adhesion. Mortar shall be mixed up to 45 minutes in advance of use. Care shall be exercised to obtain a perfect bond with the concrete. After the mortar has thoroughly hardened, the surface shall be rubbed with a carborundum stone in order to obtain the same color in the mortar as in the surrounding concrete. All fins caused by form joints and other projections shall be removed and all pockets cleaned and filled. Mortar for filling pockets shall be treated as specified for bolt holes.

In the judgement of the Town, if rock pockets or other defects are of such extent or character as to affect the impermeability or strength of the structure materially or to endanger the life of the steel reinforcement, the Town may declare the concrete defective and require the removal and replacement of the work.

# Curinq

Exposed surfaces of concrete shall be protected from the direct rays of the sun for at least three days.

All concrete shall be kept continuously moist for at least ten days after the concrete has been placed.

As soon after the completion of the finishing operations as the condition of the concrete will permit, without danger of consequent damage thereto, all exposed surfaces shall be sprayed with a curing compound conforming to ASTM C 309 and C 156 and approved by the Town, unless the temperature during curing is expected to exceed 75°F in the first 24 hours. In the latter case, the hardened concrete shall be kept continuously moist for the first 24 hours (using moisture), in accordance with the Design Engineer approved curing schedule, and then the curing compound applied. The impervious membrane forming curing compound shall be applied under pressure through a spray nozzle in such a manner and quantity as to entirely cover and seal all exposed surfaces of the concrete with a uniform film. Use of other curing methods must be approved by the Town in writing.

If, due to weather conditions, materials used, or for any other reason, there is any likelihood of the fresh concrete checking or cracking prior to the commencement of the curing operations, it shall be kept damp by use of an approved admixture such as ConSpec's Aqua-Film (or equal) applied at a rate of not more than 0.05 gal/sf until all danger of such checking or cracking is past or until the curing operations are started in the particular area affected.

The membrane, however, shall not be applied to any surface until all of the finishing operations have been completed. Until finishing is completed, such surfaces being kept damp with wet burlap or by using Aqua-Film or equal at a rate of no more than .05 gal/sf) until the membrane is applied.

All surfaces of which a bond is required, such as construction joints, shear planes, reinforcing steel, and the like, shall be adequately covered and protected before starting the application of the sealing medium thereon; and any such surface with which the seal may come in contact shall immediately thereafter cleaned. Care shall be exercised to avoid and prevent any damage to the membrane seal during the curing period. Should the seal be broken or damaged before the expiration of 10 days after the placing of the concrete, the break shall be immediately repaired by the application of additional impervious membrane over the damaged area.

When tops of walls are cured by membrane sealing method, the side forms, except metal forms, must be kept continuously wet for the 10 days following the placing of the concrete. If wall forms are removed prior to the expiration of the 10 days curing time, a curing membrane shall be applied to the exposed concrete immediately upon the removal of the forms.

When air temperatures below 35° F. are anticipated, new concrete work shall be covered and heated to a temperature of not less than 50° F. Such heating shall be maintained for the duration of the cold weather, or 72 hours, whichever is less. When air temperatures below 15° F. within 96 hours of placement are anticipated, tenting will be required or all concreting shall cease. When artificial heating is employed, special care shall be taken to keep the concrete from drying out. When freezing temperatures are anticipated, the Town, at its discretion, may require a fourth test cylinder to be left on site and protected as the work for 72 hours, then cured and tested at 7 days. If test indicates that the concrete in the cylinder has frozen, the Town may require additional testing of the concrete in the pour to determine if that concrete froze. If it determined that the concrete in the Work has frozen, the concrete shall be replaced.

### Protection of Placed Concrete

The Contractor shall be responsible to protect all placed and finished concrete from damage including but not limited to vandalism until such time as the concrete has cured. It will be the responsibility of the Contractor to communicate and coordinate with any effected parties to adequately protect the concrete until it has adequately cured.

# Opening to Traffic

The concrete shall be closed to traffic including driveway usage (except for sawing and sealing equipment) after concrete is placed until it reaches a compressive strength of 2500 psi under ordinary field conditions or 3,000 psi

in lab conditions.

# Application of Structural Loads to Structural Concrete

Footers, walls, and abutments shall not be loaded with additional dead loads until the concrete has been properly cured to a minimum of 75% of the specified design strength.

Cast-in-place concrete shall be braced and shored as required to prevent deformation until concrete has been properly cured to a strength of a minimum of 75% of the specified design strength. Removal of shoring, bracing and forms shall be performed in a manner to prevent damage to the structure.

Additional structural loads (heavy equipment, vehicles, construction materials etc.) are not permitted by the concrete until all concrete has been cured to the design strength.

### Testing and Strength

Each truck shall arrive on site with a certified mix ticket providing the information required above. Prior to placing any concrete, a copy of the mix ticket shall be furnished to the OR. Lack of a certified mix ticket shall allow the OR to reject the batch immediately.

Compression test cylinders and slump and air entrainment tests may be made as work progresses by the Town's designee. Contractor may, at his expense, run any additional tests he desires for his convenience. Any concrete which fails to meet the air or slump specifications will be rejected immediately and the entire batch of concrete shall be removed from the site.

Test cylinders may be required on each pour as directed by the Town, and a minimum of 3 cylinders shall be taken for each 50 cubic yards of concrete placed each day. Contractor may have additional specimen prepared and broken if he so chooses in order to determine when the concrete has reach a specific strength. Test cylinders shall be prepared in the manner required in ASTM C 31. Specimen shall be cured and tested in accordance with ASTM C 192, C 39, C 78, and C 93 as applicable except for cylinders which are to be field cured and used to determine field strength and whether the concrete has frozen. The test specimen shall not be disturbed for 24 hours after they are taken and shall then be delivered to a testing facility which is mutually satisfactory to the Contractor and Town.

Of the three cylinders taken concrete quality control, one shall be tested at 7 days and the other 2 at 28 days. The 7 day specimen shall have a minimum strength of 80% of the design 28 day strength and 100% of strength shall be achieved by 28 days. Additional test cylinders shall be taken at Contractor's expense, if Contractor intends to test concrete strength at intervals other than 7 and 28 days.

Concrete which fails to meet the strength requirements as indicated by the

cylinders tests shall be cored at the Contractor's expense or nondestructive testing may be approved by the Town. If further tests indicate that the concrete is less than 100% of the rated strength required by the plans and specifications, the Town may require the Responsible Party to replace all inadequate concrete at his expense, or may require an extended warranty, with bond, based on the problems the Town expects to encounter. Typically the Town will reject concrete that is less than 90% of specified 28 day strength.

## Tolerance in Thickness

Before final acceptance of the work, at the option of the Town, the concrete thickness may be determined by coring at 200 foot intervals to determine the depth of each core in accordance with AASHTO T-148. Locations for the cores shall be determined by the Town.

Where the measurement of the core is not deficient by more than 5% from the thickness specified, the Town will accept the work. If samples are found to be deficient by 5% or more, 2 additional cores will be taken at 25' intervals. If the average of the 3 cores is not deficient by 5%, the Town will accept the work. If the 3 core average is deficient in thickness by more than 5% the Town may require an extended warranty with bond; if its deficient by more than 10%, the Town may reject the work.

If Town determines that the deficiency will result in problems, the concrete shall be removed and replaced. Replacement bounds shall be full plates of walkway, curb and gutter, or slab.

### Surface Smoothness

Should the finished concrete fail to meet the surface smoothness required, when checked with a 10' straightedge, the Town may require repairs, an extended warranty, or replacement at its discretion.



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 MAY BE WASHED ROCK. SHARP AND ABRASIVE MATERIALS ARE PROHIBITED.

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date: 2/01	CONSOLIDATED CONSULTING SERVICES PO BOX 738, DELTA, CO 81416					
DWG: H_TYP	STD	BEI	DDING	DETAIL		







SHAFT ON OPERATING NUT WHEN DEPTH GREATER THAN 6'. VALVE BOX SHALL BE SUPPORTED ON BODY OF VALVE

DWG: H\_TYP BURIED VALVE DETAIL











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	FLOW LINE CURB & GUTTER	CURVE 2 R=40. (MIN) -60'	• VARIES	now/PROPERTY LINE
CURVE	1	CUI	RVE 2	
20'00'00"   60.0'   STREET WIDTH	20.94'   10.58'   D1	220'00'00" 40.0'	153.59' 50.0' 11 D.3	91.99'
38'(MIN)	64.28'	49.61	80.82'	
			TOWN DATE: 2/01 DWG:	OF HOTCHKISS CONSOLIDATED CONSULTING SERVICES PO BOX 738, DELTA, CO B1418 DE SAC ALT


















#### MINIMUM DESIGN STANDARDS

#### SECTION 02712 - WATER DISTRIBUTION SYSTEM

### 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), be approved by NSF and UL for use with potable water, 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 approval. Jointing material used in joining pipe shall meet pipe manufacturer's specifications and AWWA Standards as well as the Town's standards.

Pipe, valves, hydrants, fittings, and appurtenances shall meet the requirements in the Town's Water Standards, Section 02713.

### MINIMUM FLOW

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. The required flow may be from more than one hydrant provided the additional hydrants are accessible to all possible fire locations.

Commercial and industrial flows shall be designed based on the nature of the business. References such as CDPHE design criteria, Ten State Standards, and Insurance Services Office (ISO) guidelines shall be used 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 1200 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.

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 30 psi residual pressure during required fire flow and peak residential flows. Pressure zones shall conform to existing Town zones as approved by the Town.

#### LINE SIZE

Size and location of all water lines shall be designed by a competent, an engineer licensed in Colorado, 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 less than 3 residential taps. The minimum line size shall be 6 inches except that four inch mains may be installed on permanent deadends less than 100 feet long which serve one or two houses and when a permanent flushing hydrant is provided, provided that the houses are no more than 300' from a standard hydrant with full fire flow. Any lines that temporarily

deadend and that will be tapped for service before being extended shall be provided with a temporary flushing hydrant.

If the Town anticipates future expansion from the area which would require a larger main than that required by the proposed development, 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.

### WATER LINE LOOPING

Water mains shall be designed through a subdivision so that a continuous loop is provided for an alternate source of water, better circulation, and more even pressure.

### NON POTABLE WATER FOR IRRIGATION

To minimize the impacts of growth on the Town's water treatment plant capacity, the use of non-potable water for outdoor non-potable uses is required where practical. Materials and installation shall comply with the Town's Section 02713 Water Line Construction except that non potable water shall be distributed in purple colored PVC pipe, SDR 16 minimum and any exposed spigots shall be clearly labelled "non-potable water". Pressure within the non-potable distribution system shall be minimized to reduce potential confusion with the potable distribution system.

### VALVE SPACING

A sufficient number of valves shall be provided on water mains to facilitate flushing and 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. 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, valves should be placed at least at quarter mile intervals with more frequent intervals being required on larger lines and in densely populated areas.

Valves shall be placed at each fire hydrant and permanent flush hydrant. 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.

### **HYDRANTS**

Fire hydrants shall be placed at the intervals recommended by the State Insurance Services Office, generally, at 500 foot intervals such that no building shall be more than 300' from a 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 Hotchkiss Fire District. 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 concrete encasement of the sewer or other solution on a case by case basis.

All hydrants shall be dry barrel. Use of hydrants which require antifreeze is prohibited.

#### SERVICE CONNECTIONS

The installation of service lines and taps will be performed by the Town public works staff (and the expenses reimbursed by the Developer), or with Town approval, under Town supervision. Service connection materials and installation shall conform with Standard Specifications for Water Service Connections.

Service lines shall be installed perpendicular to the main and shall be located 10 feet inside the uphill property line or in the middle of the lot as approved by the Town. 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 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 or the top shall be marked with a steel fence post painted blue.

#### CROSS CONNECTIONS

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.

#### PROXIMITY STATEMENT

Potable water lines shall not be laid closer horizontally than 10 feet from sewer and other non-potable lines and the water lines shall be at a higher elevation than the non-potable. 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 the non-potable line shall be encased with a 20' PVC casing pipe centered around the water line crossing. Should the non potable line be above the water line, then 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. Installation shall be in accordance with the requirements of the Town Minimum Standards for Water and CDPHE and Uniform Plumbing Code requirements.

Force main sewers require a separation from the water main of at least 10 feet measured horizontally. There shall be a two foot vertical separation at crossings. When a potable line will cross within 10' of a pressure non-potable line, there shall be a casing pipe around the non-potable pipe and the ends of the casing shall have a water tight seal and have adequate structural support.

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 must be provided.

Water lines shall have at least 5 foot horizontal separation from gas and wire utilities.

# TESTING

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

#### STANDARD SPECIFICATIONS

#### SECTION 02713 - WATER LINE CONSTRUCTION

#### PART I - 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 this document, and all applicable Colorado Department of Public Health and Environment (CDPHE) and EPA regulations.

### Description

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.

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.

The Town will work with the Contractor to establish in the field the final location for new lines, fittings, valves, hydrants, etc. The Contractor shall make such excavations, in advance, as are necessary to determine the exact location of existing utilities which affect new construction.

#### Related Work Specified Elsewhere

Section 02200 - Excavation, Backfill, and Compaction Specifications Section 02712 - Minimum Standards - Water Line Construction Section 02714 - Water Service Connections Specifications

#### Proximity Statement

Requirement for separation between potable water lines and other non-potable lines is defined in the "Proximity Statement" sub-section of the Minimum Water Standards section of the Town's Standard Specifications.

### <u>Submittals</u>

In addition to the requirements in the General Requirements sub-section, submit manufacturer's information showing all materials conform with specifications.

#### PART II - PRODUCTS

All materials shall be new, unused, 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

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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 require a particular brand or model (to match materials in use) to minimize the parts inventory and/or O and M requirements. Pressure ratings listed are minimum requirements. When static pressures can exceed 125 psi higher rated pipe, fittings, and valves will be required by the Town based on field conditions. All materials listed in the Minimum Water Standards shall conform with those specifications.

All materials which will come in contact with potable water must have NSF 61 approval.

# Ductile Iron Pipe

Conformance	AWWA C151
Thickness	Class 52
Pressure Rating	150 PSI
Joints	Neoprene Gasket AWWA Clll Mechanical joint or push on
	Joint as required, both with conductivity strap
Fittings	ANSI/AWWA C153 when available or C110
Coating	Wrap pipe in polyethylene tubes and seal

### Plastic Pipe (PVC)

Conformance	AWWA C900 or C909 DI equiv (Use SDR 21 Cl200 under 4")			
Thickness	Class 150			
Pressure Rating	150 PSI			
Joints	Rubber Gasket, integral bells			
Fittings	Ductile Iron AWWA C153 when available or Cl10			
	Under 4" conform w/general quality requirements of AWWA			
Restraints	Concrete and Megalug 2000 series or equal			

# High Density Polyethylene (HDPE) Pipe

Conformance	AWWA C906 and NSF 61, DI size				
Thickness	DR 9				
Pressure Rating	200 PSI operating pressure				
Joints	Butt fusion, Heat welded				
Fittings	NSF 61, 200 psi, HDPE butt fused, heat welded when				
available or Ductile Iron AWWA C153 or C110, 250					
	where specified or if HDPE not available				
Restraints	Concrete & Megalug 2000 series or equal for DI fittings				
Service	HDPE Only where specifically approved in writing by Town				

### Gate Valves 3-inch and Larger

Conformance	AWWA C506			
Material	Iron Body, bronze mounted			
Туре	Resilient seat, non-rising stem			
Pressure Rating	150 PSI			
Coating	Epoxy inside			

Joints	Flange or Mechanical Joint end as required			
	typically flanged to fitting, mechanical joint to pipe			
Operating Nut	2" Square, (buried)			
	Handwheel (non buried service)			
Operation	Open by turning counterclockwise			
Acceptable Models	Mueller RS or Waterous RW (Only these products will be accepted by Owner)			

# Valves Smaller than 3-inch

Туре	Ball Valves			
Pressure Rating	125 PSI working pressure			
Construction	Bronze			
Construction	Bronze			
Operator	Lever			
Operation	Open by turning counterclockwise			
Туре	Ford, Mueller or equal curb stops and curb boxes			
Pressure Rating	125 PSI working pressure			
Construction	Brass			
Gate	Stainless steel plug disc			
Operator	Cast Iron handwheels			
Operation	Open by turning counterclockwise			
Valve Box				
Туре	Slip type, two piece 5 1/4"			
Base	Suitable for valve size and operating mechanism			
Material	Cast Iron, 1/4" minimum wall thickness			
Cover	Cast Iron, traffic type, marked "WATER"			
Location	All buried valves with 2" operating nut			
Fire Hydrants				
Conformance	AWWA C502			
Material	Cast iron body, fully bronze mounted			
Pressure Rating	150 PSI			
Туре	Breakaway traffic w/easily replaced flange			
Size	6" w/ 6" mechanical joint inlet, 5' minimum bury			
Joints	Megalug 2000 series 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 hex, open counter-clockwise			
Main Shut off	Gate valve per spec. above			
Acceptable Model	Waterous Pacer w/std. nozzle cap (Only this model will be accepted by Owner)			
Yard Hydrants	·			
Service	Potable water, frost free, with vacuum breaker			
Size	3/4" NPT inlet, 3/4" hose bib lockable, 5' bury			
Valve	Clayton Mark 5440 or equal			

<u>Air Valves</u>

At high points in water mains where air can accumulate, provisions shall be made to remove air by means of air relief values or other means approved by the Town. Air relief values shall be placed in vaults which allow convenient service of the value 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

#### Cross Connection Control Valves

Where there is a potential of backflow, either backpressure or backsiphonage, of a hazardous liquid into the potable water supply, the hazardous liquid shall be isolated from the potable supply by a backflow prevention device such as a 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. The valve 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. Isolation valves shall be installed on each side of the device in vaults which allow for convenient testing and maintenance of the valves. Provide testing valves and ports to properly test function integral with valve.

### Reduced Pressure Backflow Preventor

Pressure Rating	Non-shock cold water - 150 PSI		
Conformance	Cross Connection Control Institute		
Acceptable Models	Febco, Watt		
Connections	125 lb. ASA flanged		
Materials			
Accessories	Outside lever w/ spring		
Valves	Isolation gate valves on each side		

### Miscellaneous Valves

Plans for all large 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.

<u>Bolts and Hardware</u> - All bolts, nuts, and small miscellaneous hardware shall be stainless steel.

<u>Compression Couplings</u> - Compression couplings 2" or smaller shall be Mueller or Ford.

### Tracer Wire and Marking Tape

Tracer wire shall be fastened to all pipes and shall be fastened to and brought to the surface at all valves and other metallic structures along the line. Tracer wire shall be insulated 12 gauge.

Marking tape at least 4" wide labelled "water" shall be placed 12" above pipes of all materials.

### PART III - EXECUTION

In addition to requirements herein, Contractor shall follow manufacturer's recommended procedures in all handling and installation operations.

### FIELD LOCATIONS

The Town will work with the Contractor to establish in the field the final location for new lines, fittings, valves, hydrants, etc. 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 current and future installation and to minimize construction problems.

### Service Disruption

When possible, any construction operations which will result in disruption of services to consumers, shall be done at a time which is least disruptive to those who will be without service. Work shall be scheduled so as to minimize the length of the disruption. For disruptions to commercial entities, late night work may be required. Notice of the time and day of the shutoff and the estimated length of the time the utility will be out of service should be given by Contractor to effected consumers 24 hours in advance. Notice shall be by personal contact and/or written notice at each structure. When unexpected disruptions in service occur, Contractor shall notify consumers as expeditiously as possible of when service will be restored.

### RECEIVING, HANDLING, AND STORAGE

Upon receipt, make overall inspection that pipe and materials have been received in good condition. Pipe and fittings should be inspected for any damage or imperfections and problem materials should be marked rejected and set aside. Town reserves the right to inspect all materials received and reject any which does not meet the requirements of Town specifications and standards.

Pipe and appurtenances should be unloaded, handled, and stored in accordance with manufacturer's recommendations. Pipe and appurtenances 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.

Products too large to store in a building shall be stored under cover and a minimum of 6" above ground. Products which rust or are damaged by the elements shall be restored to new condition prior to installation or said materials or equipment will be rejected.

Pipe, valves, hydrants, fittings, and other appurtenances shall be loaded and unloaded by lifting with hoists or skidded to avoid shock or damage. 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. Avoid dragging pipe spigot rings on the ground and 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 to prevent damage or distortion to the equipment and to insure proper performance. Valves shall not be lifted by operating stems.

Only the amount of pipe and fittings necessary to insure 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. Strung pipe shall not be left over night along a road way. PVC pipe stored for a prolonged period of time shall be protected from sunlight. Pipe discolored by UV light shall be rejected.

### ALIGNMENT AND GRADE

Pipe shall be laid and maintained to the required line and/or grade shown on the approved plans with fittings, valves, hydrants, and appurtenances at the required locations with spigots centered in the bells. 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. All changes in direction in excess of 7°, or the maximum deflection recommended by the manufacturer, shall require fittings and/or several short joints of pipe 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 infrastructure, both known and unknown, may be determined, and he 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. 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 Responsibility Party. Deviations from the line and/or grade shall be approved by the Town and the Responsibility Party's engineer or arrange with the owners of the infrastructure or improvements 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.

### 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.

# PIPE LAYING

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 pipe will be rejected.

<u>Inspection before installation</u> - 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 promptly marked and removed from the job by the Contractor.

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 utilized. 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 Fittings shall be thoroughly cleaned, with a wire brush, if approved means. If the pipe laying crew can not keep pipe clean while placing the necessary. 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 Should the Contractor repeatedly fail to prevent dirt or other assembled. material from entering the line, he will be required to clean each section of pipe with a pipeline scraper or swab as it is installed. If the cleanliness of the line is still in question, the Town may require the line be hydrojetted and video inspected at contractor's expense to confirm that it is clean. Providing access to all sections which are required to be video'd, then cleaning and reassembling pipe, shall be the responsibility of the Contractor. If pipeline

cleanliness is in question, the tablet method of disinfection will not be permitted.

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 approved for potable use. The spigot end shall be centered in the bell and the pipe pushed home manually with a bar and brought to correct line and grade. Use of excessive force will not be permitted. 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 depth of the joint. Care shall be taken to insure that no damage is done to the pipe, collar, gasket, or bell when the pipe is being homed.

Any section of pipe, fittings, valves, or hydrants already laid and found have had the grade or joint disturbed or to be defective shall be taken up 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. Proof of such acceptance shall be submitted to and approved by the Town prior to any welding. 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. The Town shall approve the test results prior to the welder commencing welding on the pipe.

Flange and mechanical joints shall be made with properly sized machine bolts and nuts, unless high strength cast iron, or high strength wrought iron are required by soil conditions and approved by Town. All components of these types of joints shall be cleaned before jointing. Only one (1) gasket will be permitted in a flange joint. For mechanical joints, 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° apart. Final tightening shall be of uniform torque as required by the manufacturer in the same alternating sequence. All fittings and their connections shall be wrapped in a 10 mil polyethylene plastic and taped closed. Deflection at a mechanical joint shall not exceed either the manufacturer's recommendation or Table 1 in AWWA C600.

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 may rise 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 (See "Keeping Pipe Clean" above).

<u>Sequencing</u> - 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.

<u>Cutting of Pipe</u> - 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.

<u>Connection to and Crossing of Existing Lines</u> - When new pipe is to be connected to or cross 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 allow for approval of 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. Coordinate timing of the cut with Town and effected 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.

<u>Crossings</u> - Details for crossing roadways, canals, ditches, and arroyos (draws) are covered in the specification entitled "Crossings". All river and canal crossings shall be submitted to the Town for specific review and approval.

<u>Setting of Fittings, Valves, and Hydrants</u> - 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.

<u>Dead Ends</u> - All unconnected ends of pipe shall have a valve, plug, or cap installed on it with appropriate restraint. In general, plugs shall be inserted into the bells of all dead-end fittings. A reaction or thrust block and joint restraint system shall be provided at each plug or cap.

<u>Valves and Valve Boxes</u> - Valves, of the type shown on the approved plans, shall be installed as shown on the Town typical drawing and in accordance with the Minimum Standards adopted by the Town. 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 be set so as to not transmit shock or stress to the valve and shall be centered over the valve nut.

<u>Joint Restraint</u> - A joint restraint system such as Megalug 2000 and a reaction or thrust block shall be provided at each bend, tee, cross, valve, plugs, caps, hydrant, 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, 3500 psi at 28 days mix approved by the Town. Maximum water in concrete shall be 5 gallons per sack of concrete. The concrete shall be poured between the pipe 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. Joints shall be wrapped with plastic and taped closed.

<u>Hydrants</u> - 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 gate valve of the same diameter as the branch piping, 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.

<u>Air Valves</u> - 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 least 3.5 feet below finished grade. A frost-free lid shall be provided. Adequate insulation shall be installed around the valve to protect it from freezing. When the air valve is not installed directly over the main, a separate curb stop shall be installed in the air valve pit. <u>Cross Connection Control Valves</u> - 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 shall have sufficient space around and access to the valve to allow for proper testing.

<u>Vaults</u> - Vaults where 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. A 24" minimum access hatch shall be provided over the manway steps to allow access to the vault. Vaults shall be include either a floor drain or sump depending on groundwater conditions.

<u>Concrete Encasements</u> - Concrete mix shall be the same as for thrust blocks. Prior to placing the concrete for cradles or encasement, temporary supports consisting of concrete blocks or bricks shall be used to support the pipe in place. Size and frequency of such support shall be the minimum which will support the pipe. No encasement shall be poured until the Town has inspected and approved the pipe to be encased and its support. Reinforcement for pipe line encasement shall include #4 hoops on 12" centers and at least 4 #4 longitudinal bars unless otherwise shown on the approved plans.

### 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. Backfill shall not be wheel compacted until there is a minimum of 36" of compacted cover over the top of the pipe. Bedding shall be fined grained and relatively impermeable rather than a graded material.

### HYDROSTATIC TESTING

The Contractor shall be required to perform hydrostatic tests on all water mains, laterals, valves, hydrants, dead ends, and service lines in accordance with AWWA specifications C600. Prior to making the test the Contractor shall advice the Town of the time and place of the test so that adequate inspection can be provided. Prior to performance of the test all air shall be bled from the lines. Use air relief valves, hydrants, or other means. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such high points so the air can be expelled as the line is filled then the corps closed. 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 at his expense.

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 as well as the lines in between will hold the test pressure. No pipe installed will be accepted if the leakage is greater than that determined by the following formula:

	N*D* √P	where:	L	==	allowable leakage (gal/hr)
ե ≕			Ν	æ	number of joints in the line
	7400		D		nominal pipe diameter (in.)
			$\mathbf{P}$	-	test pressure (psi)

Nor shall leakage exceed 10 gallons per inch diameter per mile per 24 hours. During the test, the test pressure shall not lose more than 10 psig without being pumped back up to the test pressure. The total gallons of water required to keep and/or 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 criteria, 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 value shall be tested to insure that it operates properly and provides watertight seal under  $1 \frac{1}{2}$  times operating pressure in the closed position.

# DISINFECTION OF POTABLE WATER LINES

<u>General</u> - Flushing and disinfection of potable water lines shall be done in accordance with the procedure set forth in AWWA C601 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. <u>Preliminary Flushing</u> - 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 the pipe contains dirt or heavy encrusted matter that in the opinion of the Town will not be removed during the flushing operation, the Contractor shall clean and swab the interior of the pipe with a 5% hypochlorite disinfecting solution. Contractor must take care to prevent any damage as a result of flushing activity.

### Chlorine Application

In general chlorine shall be applied using the continuous feed method. The tablet method may be used on short extensions (up to 1500 ft.) of small diameter mains (12-inch and smaller).

<u>Continuous Feed Method</u> - Introduce water into the line at a constant rate while adding chlorine at a minimum concentration of 50 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 25 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.

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° C (41° F). Because preliminary flushing cannot be used with this method, tablet method shall only be used when scrupulous cleanliness has been exercised. Even if tablets have been placed, if the line has become dirty, the line will need to be flushed as required above and a different method of disinfection utilized. If this method is allowed, place tablets in each section of pipe in sufficient number to produce a dose of Refer to Table 3 of AWWA C601 for the required minimum number of 50 mg/l. 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 and the residual chlorine concentration after 24 hours must exceed 25 mg/l. If the residual is less, disinfection must be repeated.

<u>Final Flushing</u> - 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. Treat and dispose of any super-chlorinated water and flushing water in a legally acceptable manner with no damage to property.

### BACTERIOLOGICAL 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 per 1000 feet of line 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 corp stop prior to sampling.

<u>Repetition of Procedure</u> - If the original disinfection fails to produce satisfactory samples, remove the line from service and repeat the disinfection procedure until satisfactory results are obtained.

# DISINFECTION REPAIRS AND EXISTING MAINS

The procedure outlined in this section applies primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure require disinfection of the clamp and other parts attached to the main.

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

<u>Swabbing with Hypochlorite Solution</u> - The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with a 5% hypochlorite solution before they are installed.

<u>Flushing</u> - 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. Lines shall be flushed in a manner which not cause any environmental harm or any damage to property.

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.

#### STANDARD SPECIFICATIONS

#### SECTION 02714 - WATER SERVICE CONNECTIONS

### PART I - GENERAL

<u>Work Included</u> - Water service connections shall be installed as designated on the approved plans. These shall be served off the water line parallel to their property line unless otherwise indicated. Service lines shall be perpendicular to the main unless otherwise approved by the Town. Installations shall be in accordance with details shown on the standard drawing.

Service connections for all pipe diameters and classes shall be made by means of a saddle with corporation stop. There shall be no direct taps.

# Related Work Specified Elsewhere

Excavation and Backfilling Water Line Construction

### PART II - PRODUCTS

The Town has, based on experience, selected the specific products listed below for the quality of the specific products and models. These are the same products that are used by the Town in Town constructed installations. Unless specifically stated for a particular product, alternate products will not be accepted.

<u>Corporation Stops</u> - Corporation ball stops shall be of all bronze with individually lapped ground keys. Inlet shall be Mueller pipe thread. Outlet shall be for use with copper tubing, with compression joint. Stops shall be Mueller H-15000, Ford FB600, Hayes or approved equal.

<u>Service Saddles</u> - Service saddles shall be cast ductile with painted steel double strap, with O-Ring gasket seal on main. Gaskets shall be neoprene. Saddles shall be brass Romac Style 202-B. No direct taps will be allowed.

<u>Angle Meter Valve</u> - inverted key angle meter valve Ford BA23-332W, copper by meter coupling with padlock wings and ball valve.

Yokes - Ford Model VBHC82W with dual check anti-backflow valve, ball valve, padlock wings, dual purpose connection or Mueller H-1410-2 or McDonald equivalent Only.

<u>Meter Cans</u> - Minimum 20" diameter, 36" tall or as needed to maintain 48" bury on service line without a grade break to the meter can. Can shall have co-molded plastic walls with insulated middle section strong enough to support 20,000 vertical load. Bottom of can shall include an integral flange to prevent settling. The top of the can shall include an integral shelf to support the required insulating pad at the top of the can. The inside wall shall be bright white. <u>Lids</u> - Ford with frostproof No. W4 Wabash style double lid cover with large  $(1 \ 1/32")$  pentagonal bolt.

<u>Service Pipe</u> - Pipe for water service shall be type "K" copper tubing conforming to ASTM B-88-62 and NSF standards for potable water service unless other types of tubing are specified on the Town approved drawings.

<u>Reduced Pressure Backflow Preventive</u> - Backflow device for 3/4" and 1" service shall be a Febco 825Y Reduced Pressure Device, and shall be installed in a location suitable for the plumbing and for servicing and testing the gauge, typically with the building being served. For services greater than 1", the reduced pressure device and its installation will be subject to review and approval by the Town.

<u>Meter</u> - Residential meters shall be 5/8" x 3/4", piston magnetic drive consisting of 3 main components, main case, measuring chamber, and hermetically sealed register. The case shall be bronze, and the register shall read in gallons with 10 gallons per revolution. (Frost protection will be required, so bottom plates of cast iron or equal will be required.) Inlets and outlets are to have iron pipe threads. Meter make and model shall be consistent with current Town requirements with remote and radio reader capability.

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.

#### PART III - EXECUTION

<u>General</u> - 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 Town in all cases owner responsibility for the service line shall begin at the meter. Out of town responsibility will be begin at the connection to the Town owned main.

Installation of service lines shall be by open cut, unless otherwise approved in writing by the Town, with bedding, backfill, and compaction in conformance with Standard Water Line Specifications and Standard Specifications for Excavation, Backfill, and Compaction.

Depth of Bury - All water services shall have a minimum of 4 feet of bury.

<u>Meter Lid Elevation</u> - The lid for the meter can shall be sufficiently high to be readily visible but shall be adjusted to blend to finished grade of the surrounding property and landscape. Property owners shall be responsible to keep the ground around the meter can an appropriate elevation for access to the meter. <u>Installation</u> - 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.

Copper tubing shall only be cut and flared with tools especially designed for those purposes.

Service lines shall be installed so that they can be tested with the water main from which they are served.

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