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ARTICLE 1

General Provisions

Sec. 14-1-10. Standards adopted.

(a) The Board of Trustees has adopted the Design Criteria and Construction Standards ("Standards") set forth in this Chapter to govern various aspects of development and construction within the Town. Presented in these Standards are the minimum design and technical criteria for the design and construction of additions and modifications to the following:

(1) Water system;
(2) Sanitary sewer system;
(3) Street and roadway system;
(4) Stormwater system; and
(5) Private infrastructure.

(b) Such Standards are applicable within the Town according to their terms and as provided in this Code. References in other parts of this Code to design criteria or construction standards shall be deemed to refer to the criteria and standards contained in this Chapter unless the context otherwise requires. (Ord. 389 Part 1.1, 2012)

Sec. 14-1-20. Compliance required.

Among other things, such Standards specify minimum design requirements for water and sanitary sewer facilities, streets, driveways, drainage facilities, utilities and other public and private facilities and include permit and fee requirements for driveway construction and excavations or installations in public streets or rights-of-way. All persons undertaking any activities that are subject to such Standards are required to fully comply with all such Standards and requirements. (Ord. 389 Part 1.1, 2012)
Sec. 14-1-30. Security for access permits.

(a) In cases involving driveway construction, excavations or installations in public streets or rights-of-way or other instances where an access permit is required pursuant to such Standards, as a condition of issuance of such permit, the applicant shall provide to the Town a cashier’s check or letter of credit in such amount as is established from time to time by ordinance or resolution adopted by the Board of Trustees, to be held as security for proper completion of the excavation work provided in the permit. The formula established by the Board of Trustees for determining the amount of financial security required is set forth in Appendix A to this Code. The Board of Trustees authorizes the Town staff to accept financial security provided in accordance with said formula and to approve the form of security unless, in the Town staff’s judgment, special circumstances require review by the Board of Trustees.

(b) In the event the permittee fails to complete the work provided in the permit or fails to correct any deficiency found to exist during the warranty period provided in the Standards, then the Town may utilize all or a portion of such security as necessary to complete the work or correct the deficiency, including payment of all administrative costs and reasonable attorney fees incurred by the Town as a result of such failure.

(c) After expiration of all warranty periods, and provided that the work has been completed in accordance with the permit, the remaining balance of said security, if any, shall be refunded or released.

(d) As a condition of issuance of an access permit, the permittee shall agree to indemnify and hold harmless the Town against any and all damages or claims for damages, losses, costs, charges or expenses that may be brought against it by any person by reason of the work performed pursuant to the permit and against any losses or expenses, including reasonable attorney fees, incurred by the Town by reason of such work. The Town may draw upon the cashier’s check or letter of credit deposited by the permittee to pay any such claims, damages, losses and expenses, and the permittee shall be liable to the Town for any amounts not covered by such security. (Ord. 389 Part 1.1, 2012)

Sec. 14-1-40. Security for Improvements Agreements.

(a) In cases involving infrastructure construction, not associated with a subdivision, an Improvement Agreement (IA) is required. An IA is a written contract between the Town and the applicant providing for construction of improvements, with collateral security to guarantee completion of such improvements. Such agreement shall set forth construction specifications, dates for completion, cost estimates, terms and conditions for the acceptance of improvements, the form of security and any other provisions or conditions deemed necessary by the Board of Trustees to ensure that all improvements will be completed in a timely, quality and cost-effective manner. The agreement shall be recorded in the office of the Grand County Clerk and Recorder and shall run with the land and bind all successors, heirs and assignees of the applicant.

(b) The provisions of the Town subdivision regulations, as contained in Chapter 17 of this Code, and particularly Article 6 of that Chapter, as such regulations may be amended from time to time by the Town, shall govern with respect to the inspection and acceptance of the Secured Improvements, the deposit, use and release of collateral securing completion of the Secured Improvements and all other matters relating to applicant's obligation with respect to the Secured Improvements. (Ord. 389 Part 1.1, 2012)
Sec. 14-1-50. Penalties; enforcement.

(a) Every person convicted of a violation of any provision of this Chapter shall be punished as set forth in Section 1-4-10 of this Code.

(b) Town staff are authorized to withhold or revoke any permits, certificates or other approvals for any construction or activity which are not in compliance with the provisions of this Chapter.

(c) In addition to other remedies provided by law, the Board of Trustees may authorize appropriate actions and proceedings in law or in equity to prevent any violation of the provisions of this Chapter; to prevent unlawful construction; to recover damages; to restrain, correct or abate a violation; and to prevent illegal occupancy of a building, structure or premises. (Ord. 389 Part 1.1, 2012)

ARTICLE 2

Drawings and Submittals

Division 1

Plan Submittal Requirements

Sec. 14-2-10. General.

(a) Per the subdivision regulations of the Town, as contained in Chapter 17 of this Code, all subdivision design and improvements shall be in accordance with these Standards, current adopted version, and shall be prepared, signed and sealed by a professional engineer, licensed by the State, who prepared and/or directed preparation of the construction plans.

(b) The project design and construction must also comply with all applicable federal, state and local regulations, including but not limited to Occupational Safety and Health Administration (OSHA) standards and the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) requirements and shall be in accordance with the minimum standards of other applicable regulatory agencies and service providers. Review and approval of local facility designs by the Town, its Engineer or other agencies shall not relieve the engineer of record from responsibility for adequate design.

(c) If the Town determines that it is in the Town's best interest to oversize a waterline or sanitary sewer line through any development to ultimately serve future development, the Town may require such oversizing as a condition of development/plan approval. The terms and conditions of payment for and/or cost sharing of such oversizing shall be addressed by separate agreement. (Ord. 389 Part 1.1, 2012)

Sec. 14-2-20. Preliminary construction plan submittal.

Construction plans at the preliminary plan submittal stage must contain sufficient information and detail to determine that all Town standards can be satisfied. Three (3) copies of the submittal shall be provided. The Town and/or its Engineer may require additional copies, documentation or calculations, if necessary, in order to complete its review. Each submittal shall, at a minimum, contain the
information required by these standards and Chapter 17 of this Code, although additional information may be required at the discretion of the Town.

(1) Construction plans. See Section 14-2-110 for requirements.

(2) Survey plat. A survey plat shall be submitted, if a preliminary plat is not required, along with the construction plans. The survey plat or preliminary plat shall indicate all existing right-of-way, adjacent property ownership, easements and other information critical to the design.

(3) Preliminary Geotechnical Report. The Preliminary Geotechnical Report shall include a representative number of test bore locations and provide site soil conditions based on those test locations. The Geotechnical Report shall include recommendations and opinions on adequacy for the intended use of sites to be developed by the proposed grading as affected by soils engineering factors, including the stability of slopes. The Geotechnical Report shall also include soil testing for corrosiveness (soil resistivity testing) for each test location and recommendations to protect ductile iron pipe, fittings, valves and other metallic elements from corrosive deterioration.

(4) Traffic Impact Analysis (TIA) and/or Traffic Impact Study (TIS). A Traffic Impact Analysis and/or Traffic Impact Study shall be required for all developments proposing ADTs > 400. The Town, at its discretion, may waive such requirement.

(5) Phasing plan. A phasing plan shall identify all improvements necessary for the project build-out condition and those improvements proposed to be constructed under each phase.

(6) Water line layout plan and fire flow requirements.

a. For a new development, a water line layout plan, including horizontal and vertical detail, shall be submitted in a digital AutoCAD format acceptable to the Town. The fire flow requirements for the proposed building product type within a development shall be submitted with the plan. This data will be entered into the Town’s hydraulic water model to determine infrastructure requirements. All improvements shall be designed in accordance with the modeling results.

b. For a development within an area where infrastructure currently exists, any upgrades required to the water system in order to provide adequate water service and fire flows for the proposed development shall be constructed by the applicant. See Article 3, Division 2, for requirements.

(7) Sanitary sewer line layout plan.

a. For a new development, a sanitary sewer line layout plan, including horizontal and vertical detail, shall be submitted in a digital AutoCAD format acceptable to the Town. The sanitary sewer hydraulic loading demands for the development shall be submitted with the plan. The capacity of the proposed and existing downstream infrastructure will be analyzed using this data to determine infrastructure requirements. All improvements shall be designed in accordance with the results of this analysis.
b. For a development within an area where infrastructure currently exists, any upgrades required to the sanitary sewer system, in order to provide adequate sewer service for the proposed development, shall be constructed by the applicant. See Article 3, Division 3, for requirements. (Ord. 389 Part 1.1, 2012)

Sec. 14-2-30. Final construction plan submittal.

(a) Final construction plans shall contain sufficient information to complete the construction of necessary improvements in accordance with these standards and Chapter 17 of this Code. Three (3) copies of the submittal shall be provided. The Town and/or its Engineer may require additional plan copies, documentation or calculations, depending on the complexity of the application.

(b) All submittals shall, at a minimum, contain the following information:

(1) Final construction plans shall include all plan and profile sheets. See Article 2, Division 2, for requirements.

(2) Final Geotechnical Report.

(c) The cover sheet of each final design drawing set shall have an "approval block" affixed thereto which provides for signatures of authorized representatives of the Town and the Town Engineer prior to construction. The "approval block" shall be a facsimile of that appended in Attachment A-1 – Approval Block. Final drawings for any public improvements submitted for approval signatures shall be signed and sealed by a professional engineer, licensed by the State. Two (2) sets of the final construction documents, including original signatures, seals and date from the Engineer of Record and two (2) electronic copies, each including one (1) PDF copy (with signatures and seals) and one (1) AutoCAD copy (format acceptable to the Town) shall be delivered to the Town within fifteen (15) days after acceptance of the final design and prior to commencement of work to install the improvements. The PDF and AutoCAD file copies can be recorded on the same disk so that only two (2) disks are required for submittal. Construction shall not begin until the design documents have been approved by the Town, the required final plans submitted to the Town and the approval block signed by all parties. (Ord. 389 Part 1.1, 2012)

Sec. 14-2-40. Construction.

(a) The applicant is responsible for all necessary permits and regulatory compliance (federal, state and local) for construction. The construction contractors shall have a copy of the executed, approved construction plans in their possession at the construction site for the duration of the project.

(b) At any time during construction, should site conditions require modification to the approved plans, the applicant shall notify the Town of the proposed change. All field modifications shall be reviewed and approved by the Town prior to construction.

(c) Any request for changes to the approved construction plans which do not change the intent of the design of the project may be agreed upon by the applicant and the Town. Approval of said changes can be made in the field and signed off on all approved sets of construction plans.
(d) Construction of, or affecting, any public infrastructure is prohibited between October 15th and April 15th, unless otherwise approved by the Town. (Ord. 389 Part 1.1, 2012)

Sec. 14-2-50. As-built plan submittal.

(a) Preliminary acceptance as-built plan submittal shall include the following:

(1) Two (2) full size paper copies of the as-built plans in twenty-four-inch by thirty-six-inch format stamped and signed by the Engineer of Record.

(2) Two (2) electronic PDF copies of the preliminary as-built plans submitted with all signatures and seals affixed.

(b) Final acceptance as-built plan submittal shall include the following:

(1) Two (2) full size paper copies of the as-built plans in twenty-four-inch by thirty-six-inch format with all original signatures and seals affixed.

(2) Two (2) electronic copies of the final as-built plans submitted in AutoCAD.dwg or AutoCAD.dxf format. The drawing shall be based on or referenced to a known coordinate system, not an assumed local coordinate system. The digital file shall utilize the Colorado State Plane Coordinate System, in feet, North American Datum 1983 (NAD 83) for horizontal control and NAVD 88 for vertical control, whenever possible. If GPS is not used, the Geographical Control Data Base (GCDB) should be used to obtain PLSS data in NAD 83 datum. The GCDB is available from the BLM at www.blm.gov/gcdb. The drawing shall include either a data dictionary to explain the layers, or a self-explanatory layering system. A permanent survey benchmark shall be shown on the plans.

(3) Two (2) PDF copies of the as-built plans with all signatures and seals affixed. (Ord. 389 Part 1.1, 2012)

Division 2
Drawing Requirements

Sec. 14-2-110. Construction plans.

(a) Drawing size shall be twenty-four (24) inches by thirty-six (36) inches and shall contain a title block, sequentially numbered sheets, scale, north arrow, date and the seal and signature of the professional engineer, licensed by the State.

(b) Existing and proposed contours shall be at one-foot-minimum intervals. Other intervals may be allowed and/or required by the Town, in developments with flat or steep terrain.

(c) Electronic media shall be provided for updating and maintaining information in the Town's Geographic Information System (GIS). The drawing shall be based on or referenced to a known coordinate system, not an assumed local coordinate system. The digital file shall utilize the Colorado State Plane Coordinate System, in feet, North American Datum 1983 (NAD 83) for horizontal control and NAVD 88 for vertical control, whenever possible. If GPS is not used, the Geographical Control Data Base (GCDB) should be used to obtain PLSS data in NAD 83 datum. The GCDB is available
from the BLM at www.blm.gov/gcdb. The drawing shall include either a data dictionary to explain the layers, or a self-explanatory layering system. A permanent survey benchmark shall be shown on the plans.

(d) Cover sheet. The cover sheet shall include the following:

(1) Certification:

These construction plans for (name of development or project) were prepared by me under my direct supervision in accordance with the requirements of these Standards.

[Name of Engineer of Record]

[Name of Firm]

The statement shall be signed and stamped by the professional engineer, licensed by the State, who prepared and/or directed preparation of the construction plans.

(2) A vicinity map, at an appropriate scale, which shows the location and name of key arterial streets/roads in the vicinity of the proposed development.

(3) Index of sheets.

(4) Agency and emergency contacts list with names, phone numbers and email addresses.

(5) A Utilities Notification Center of Colorado (UNCC) note with phone number (811) and website to be included on all applicable plan sheets.

(6) Approval signature blocks per applicable standards.

(e) Plan and profile sheets. The plan shall include but not be limited to the following:

(1) The scale shall be one (1) inch equals twenty (20) feet. A one (1) inch equals fifty (50) feet scale may be used upon written request and approval of the Town.

(2) Locations and dimensions of existing and proposed property lines, easements and rights-of-way.

(3) Existing and proposed streets and roads shall be identified.

(4) Survey line ties to section or quarter corners.

(5) Waterline improvements shall be stationed using centerline of street stationing when the design of the waterline and street are concurrent. If the waterline is constructed in an open area or is being installed under or adjacent to an existing street, the stationing shall follow the centerline of the waterline alignment.

(6) Centerline stations shall be provided for all intersecting water lines.
(7) Sanitary sewer line improvements shall be stationed along the centerline of the sanitary sewer line.

(8) Storm sewer line improvements shall be stationed along the centerline of the storm sewer line or referenced from the street stationing when the storm sewer crosses the street and doesn't extend beyond the street right-of-way on either side.

(9) Existing and proposed street/road improvements, including shared driveways, sidewalk, curb, gutter, pavement limits, trails, bridges, culverts, guardrails, handicap ramps, etc. A dashed line shall depict existing improvements and a solid line shall depict proposed improvements.

(10) Elevation and station shall be noted for all points of horizontal or vertical alignment changes.

(11) Match lines and consecutive sheet numbers.

(12) Key map.

(13) A legend to identify existing (dashed or thinner line weight and gray in color) and proposed (solid, heavier line weight and black in color) utilities and structures, size, type, height and location, as applicable, including but not limited to:

<table>
<thead>
<tr>
<th>water</th>
<th>fence lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>fire hydrants</td>
<td>ditches and/or swales</td>
</tr>
<tr>
<td>sanitary sewer</td>
<td>natural gas</td>
</tr>
<tr>
<td>storm sewer</td>
<td>electric</td>
</tr>
<tr>
<td>telephone</td>
<td>cable television</td>
</tr>
<tr>
<td>trash enclosures</td>
<td>signs</td>
</tr>
<tr>
<td>snow storage</td>
<td>guardrails</td>
</tr>
<tr>
<td>retaining walls</td>
<td>trees</td>
</tr>
</tbody>
</table>

(14) Stations and critical elevations of all utility and drainage appurtenances.

(15) All proposed water and sanitary sewer service line connections shall be shown on plans. The length of each service line constructed shall also be shown.

(16) Snow storage areas.

(f) Profile sheets. The profile shall include, but not be limited to, the following:

(1) The vertical scale shall be one (1) inch equals five (5) feet.

(2) Existing (dashed or thinner line weight and gray in color) and proposed (solid, heavier line weight and black in color) grades.
(3) Continuous stationing for the entire portion of the improvements shown in the plan view, with the centerline station for all intersecting roadways and waterlines.

(4) Existing (dashed) and proposed (solid) utilities.

(g) Grading plan. A construction sheet shall contain the proposed grading plan illustrating the extent and limits of the land disturbance. The plan shall show existing site features and estimated quantities of cut-and-fill, and shall depict existing and proposed contours using a contour interval of one (1) foot.

(h) Drainage plan. A construction sheet shall contain a preliminary drainage plan. See Article 3, Division 4, of this Chapter.

(i) Revegetation, erosion and sediment control plan. A construction sheet shall contain a revegetation, erosion and sediment control plan. See Article 5, Division 4, of this Chapter.

(j) Signage and striping plan. A construction sheet shall contain the proposed signage and striping plan. See Article 3, Division 1, of this Chapter.

(k) Detail sheets. Detail sheets shall be included within the plan set to include the pertinent details as depicted in the attached drawings to these Standards and any other details required to accurately and completely detail all improvements included within the project. (Ord. 389 Part 1.1, 2012)

Sec. 14-2-120. As-built drawings.

(a) The as-built drawings shall identify and show all existing or abandoned utilities that were encountered during construction that were not shown on the design plans or that were shown on the design plans incorrectly, as well as any field modifications or other changes to the approved construction plans.

(b) The method to show locations is by the use of centerline stations as depicted on the construction plans with suitable distances and offsets given relative to these lines.

(c) All elevation information shall be based upon an existing on-site benchmark as depicted on the approved construction plans.

(d) The as-built plan cover sheet shall include in large bold text "AS-BUILT PLANS" under the project name title. The text "As-Built Plans" shall also be included on the lower right hand side of the cover sheet, visible when the plans are rolled up. The standard plan approval block, Attachment A-1 – Approval Block, shall be removed from the title sheet and replaced with the as-built plan approval block as shown on Attachment A-2 – As-Built Plan Submittal Block. As-built plans shall be in conformance to the Attachment A-3 – As-Built Plan Required Information (Street and Storm Drainage Systems) and Attachment A-4 – As-Built Plan Required Information (Water and Sanitary Sewer Systems). As-built information shall be included on the electronic and paper copies.

(e) The following information shall be shown/corrected on the as-built drawings:

(1) Street and roadway system.
a. Locations of street and road centerline, intersection radii, edge of asphalt, edge of gravel shoulder and flowline of ditch, at fifty-foot-maximum intervals, and at all beginning and end of horizontal curves. Vertical information should be included in order to determine centerline grades, cross-slope grades, super-elevation rates, flowline grades and side slopes.

b. All existing infrastructure in the street, including but not limited to drainage appurtenances, vaults, manholes (both invert and rim elevations), inlets, catch basins, water valves, fire hydrants, etc.

c. Guardrail locations, types and alignment.

d. Retaining wall top and bottom elevations, locations, type, height and alignment.

e. Clear zone obstructions location, type and alignment.

f. All signage within the right-of-way: size, location, type and alignment.

g. Public utility easements and street right-of-way locations and widths. Dimension of the distance between the edge of right-of-way and the centerline of street improvements.

(2) Waterline improvements.

a. Location of all waterline bends, tees, crosses and other underground fittings.

b. Location of the waterline from the edge of the street and from the boundary of the right-of-way or easement.

c. Location of any specialty items, such as fire hydrants, meter vaults, pressure reducing valve (PRV) vaults, air release valve (ARV) vaults, couplings, etc.

d. Location of all valves, service lines and service line shut-off valves.

e. Note any right-of-way and easement information.

f. Note final invert elevations of all vertical bends with benchmark elevation referenced.

g. Note distance between the waterline and other underground utilities.

h. Note length, size and material of line as installed. Note pertinent inverts as needed to clearly note final location of the waterline.

i. Note permanent easement monuments and property corners where used for ties.

j. Note the parcel lot number.

(3) Sanitary sewer improvements.

a. Manhole locations, types, rims and invert elevations.
b. Location of all service lines along the sewer line, location and elevation of the plugged end of the service line and the slope of the installed service line.

c. Location of the sewer line from the edge of the street and from the boundary of the right-of-way or easement.

d. Locations of any specialty items such as clean outs, manholes, etc.

e. Note any right-of-way and easement information.

f. Note final invert elevations with benchmark elevation referenced.

g. Note distance between the sewer line and other underground utilities.

h. Note length, size and material of line as installed. Note pertinent inverts as needed to clearly note final location of the sewer line.

i. Note permanent easement monuments and property corners where used for ties.

j. Note the parcel lot number.

(4) Storm drainage improvements.

a. Manholes/inlets/catch basin locations, types, rims and invert elevations.

b. Storm line locations, materials, lengths, slopes, diameter, location of catch basins and side sewer tees, and invert elevations.

c. Public utility easement locations and widths.

d. Retention/detention system as-built volume of constructed system, pond storage and construction limits, overflow elevations and locations, discharge orifice diameters and locations. A certification letter is required from the Engineer of Record confirming that the pond volume, surface elevations, outlet structure detail and orifice diameters meet the design requirements and detail. The certification letter shall include the signature and seal of the Engineer of Record.

e. Drainage swale location, width, depth, side slopes, lengths and elevations of inlet and outlet locations.

(5) Bridge and box culvert structures.

a. Horizontal and vertical dimensions, grade and layout of all structure components.

b. Structural steel reinforcing and construction joints within the structure.

c. Elevation of structural components and of stream bank, water surface at normal flow condition and water surface at the calculated one-hundred-year flow event.

d. Guard rail location, types and alignment.
e. Location of all utility lines adjacent to and/or attached to the bridge structure.

f. All signage and lighting on or associated with the bridge structure. (Ord. 389 Part 1.1, 2012)

ARTICLE 3
Public Infrastructure

Division 1
Street and Roadway System Design

Sec. 14-3-10. Basic design policies.
All new street designs and related information shall meet the minimum standards listed within these Standards. Any design standards not included within these Standards will be subject to the minimum standards set forth in the most current publications found in Section 14-6-10 and approved by the Town. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-20. Trip generation.
(a) Average Daily Trip (ADT) generations for proposed development should be based on the type of occupancy for which the development is designed and shall be formulated from the following:

<table>
<thead>
<tr>
<th>Development Type</th>
<th>Trips Generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-family</td>
<td>8 ADT/Unit</td>
</tr>
<tr>
<td>Multi-family</td>
<td>5 ADT/Unit</td>
</tr>
<tr>
<td>Commercial</td>
<td>40 ADT/1,000 sq. ft.</td>
</tr>
<tr>
<td>Lodging</td>
<td>8 ADT/Occupied Room</td>
</tr>
<tr>
<td>Restaurant</td>
<td>30 ADT/1,000 sq. ft.</td>
</tr>
<tr>
<td>Convenience store</td>
<td>150 ADT/1,000 sq. ft.</td>
</tr>
</tbody>
</table>

(b) Other uses not listed above shall use the Institute of Transportation Engineers (ITE) Trip Generation Manual for trip generation. Other acceptable data sources may be used in cases where the Trip Generation Manual does not provide the information necessary. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-30. Street and road classifications.
The Town's streets and roads are classified according to function and ADTs. Functional classifications shall be established by the Town in accordance with the Street/Roadway Classification and Minimum Design Criteria table below. The applicant may be required to conduct traffic counts to establish or change existing street classifications.

(1) Arterial streets and roads. The arterial street and road system links towns and other large traffic generators with minimal interference to through traffic movements and higher design speeds.
The typical cross-section for an arterial street or road is shown on Attachment A-6 – Cross-Section for Arterial Street.

(2) Collector streets and roads. Collector streets and roads provide a link between arterial streets and roads and local streets. More moderate speeds are typical on collector streets and roads. The typical cross-section for a collector street or road is shown on Attachment A-7 – Cross-Section for Collector Street.

(3) Local streets. Local streets primarily provide access from collector and arterial streets and roads to adjacent neighborhoods and other developments. A local street is a street whose primary function is to provide access to residences, businesses or abutting property rather than to serve through traffic. The street shall be designed for a design speed of not less than twenty (20) mph. Posted speed limits for local streets shall be twenty (20) mph. The typical cross-section for a local street is shown on Attachment A-8 – Cross-Section for Local Street.

(4) Alleys. Alleys provide for limited access and will be subject to special review as appropriate to the land use plan.

(5) Curbs and Gutters. All arterial streets, collector streets, local streets and private streets shall include valley pans, ribbon curbs or curbs and gutter as detailed in Attachment A-11 – Curb and Gutter. On the typical street sections identified above:

Valley pans or the mountable curb and gutter shall be used in residential areas when surface flow storm drainage is proposed at the edge of the street.

Ribbon curb shall be used along the edge of street when storm drainage is proposed in a ditch section located off the edge of the shoulder.

Vertical curb and gutter shall be used in business districts where street parking abuts the sidewalk and/or when surface flow storm drainage is proposed at the edge of the street.

---

Street/Roadway Classification and Minimum Design Criteria

<table>
<thead>
<tr>
<th>Class</th>
<th>ROW Width¹</th>
<th>Roadbase Width</th>
<th>Pavement Width</th>
<th>ADT</th>
<th>Shoulder Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial highways</td>
<td>See State Highway Access Code (CDOT) for design criteria</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arterial streets</td>
<td>80'</td>
<td>56'</td>
<td>36'</td>
<td>&gt; 600</td>
<td>10'</td>
</tr>
<tr>
<td>Collector streets</td>
<td>60'</td>
<td>40'</td>
<td>24'</td>
<td>≤ 600</td>
<td>8'</td>
</tr>
<tr>
<td>Local streets</td>
<td>36'</td>
<td>36'</td>
<td>24'</td>
<td>≤ 400</td>
<td>6'</td>
</tr>
</tbody>
</table>

¹ ROW Width: Right-of-Way Width.
NOTES:
1. Increase for the minimum R.O.W./easement widths may be required by the Town to accommodate for on-street parking, drainage improvements, sidewalks, trails, excessive cut/fill slopes, intersections, clear zones, or required snow storage.
2. 
3. (Ord. 389 Part 1.1, 2012)

**Sec. 14-3-40. Horizontal alignment.**

(a) Centerline curve radius. Horizontal design criteria are established by the American Association of State Highway and Transportation Officials (AASHTO) publication, *A Policy on Geometric Design of Highways and Streets*. Criteria include centerline curve radius design, minimum tangent lengths and stopping sight distance. Compound curves and reverse curves are prohibited without prior approval of the Town. The minimum curve radius is ultimately determined by the stopping sight distance and sight triangle. The cross-slope of all crowned streets shall be two percent (2%) from the centerline to the edge. In mountainous areas, all streets shall not be crowned but shall slope toward the mountain, from the outside edge of pavement, for the full width. The outside shoulder shall slope away from the street edge.

(b) Lane widening. Lane widening may be necessary on sharper curves and where large vehicle traffic is expected and should be consistent with the design guidelines outlined in *A Policy on Geometric Design of Highways and Streets*. Turning templates may be required for streets and/or parking lot designs at the discretion of the Town.

(c) Dead-ends and turnarounds.

(1) Dead-end streets are discouraged within the Town. All dead-end streets require turnarounds or cul-de-sacs per Attachment A-12 – Cul-De-Sac and Turnarounds for Streets. All turnarounds shall provide ten (10) feet of level, treeless ground around the perimeter. Special attention should be given to provide adequate functional snow storage and sight distance. All turnarounds shall be signed "Emergency Turn Around, No Parking Anytime."

(2) The maximum length of streets ending in turnarounds shall be five hundred (500) feet. Additional turnarounds may be required for emergency services when topography dictates.

(3) All turnarounds shall be subject to review and approval of the Town.

(d) Switchbacks. A switchback is defined as a curve with a central angle of greater than one hundred twenty (120) degrees and a radius less than or equal to one hundred (100) feet. Switchbacks shall not be allowed on collector or arterial roadways. On all other streets and in mountainous terrain, when other alternatives may cause significant adverse impacts, the use of switchbacks may be allowed on a case-by-case basis, with approval from the Town. Switchbacks shall be designed with a minimum centerline radius of sixty (60) feet. Maximum centerline grades within twenty-five (25) feet of a switchback curve and throughout the curve shall not exceed four percent (4%). Super elevation shall
not exceed four percent (4%). Special attention should be given to provide adequate functional snow storage and sight distance. Widening of the streets/roadways around the curve may be necessary to allow for wide turning vehicles (i.e., fire trucks, snow plows, trash trucks, etc.). (Ord. 389 Part 1.1, 2012)

Sec. 14-3-50. Cross-sections.

(a) Surfacing requirements.

(1) All streets and roadways shall be paved with hot asphalt meeting locally available CDOT mix approved in writing by the Town. Alternate hard surfacing materials may be permitted at the discretion of the Town. Pavement thickness shall be determined from a pavement design and specification based on a Geotechnical Report prepared for the project and anticipated vehicular loading by a professional engineer licensed by the State. The CDOT Pavement Design Manual shall be used to determine vehicular loading and the pavement section of the street. The minimum pavement thickness shall be five (5) inches.

(2) Alleys in residential subdivisions shall be paved with surfacing requirements equal to the surfing requirements for streets and roadways.

(b) Crown/super-elevation. The cross-slope on all streets, including intersections, shall be two percent (2%). The maximum super-elevation rate is two percent (2%) where the longitudinal grade of the street is less than five percent (5%). Where the centerline grade of the street is five percent (5%) or greater, the super-elevation can be increased to three percent (3%). Super-elevation shall be required on all collector streets. Where super-elevation is used, the minimum tangent lengths between curves shall be consistent with the design guidelines outlined in A Policy on Geometric Design of Highways and Streets.

(c) Clear zone.

(1) The minimum clear zone required for streets shall be based on ADTs, speed, horizontal and vertical alignments as proposed by the Engineer of Record and approved by the Town. Embankment slopes steeper than 3:1 are considered critical slopes, on which a vehicle is likely to overturn. All newly constructed streets shall provide a minimum clear zone with a maximum 3:1 embankment slope. The clear zone includes any shoulders or auxiliary lanes.

(2) The clear zone width should be increased on the outside of curves to accommodate the path of an errant vehicle. Determination of the width of the clear zone should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs and accident histories. The AASHTO Roadside Design Guide may be used to determine clear zone widths for arterials and collectors. For local streets, a minimum clear zone of ten (10) feet should be provided. If these minimum clear zone widths are not feasible, guardrail installation may be required.

(d) Guardrail. The use of a guardrail is discouraged and should not be used when it is economically feasible to remove the obstruction, correct the hazardous condition or where it is determined that the guardrail would create a more serious hazard than the feature it would shield. Refer to the CDOT Roadside Design Guide for details. The use of a guardrail may be necessary if any of the following conditions exist:
(1) Roadside hazards are present within the clear zone.

(2) A street built to these Standards contains an isolated sharp curve in conjunction with a side slope steeper than 3:1.

(3) A section of street having a history of vehicular accidents.

When guardrails are considered for installation, especially for extended lengths, special provisions shall be made for adequate snow storage and removal and blowing/drifting snow. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-60. Vertical alignment.

(a) Centerline grades.

(1) The maximum centerline grade for all streets and roads is seven percent (7%). The minimum centerline grade for all streets and roads is one percent (1%). A minimum flowline grade of one percent (1%) shall be maintained around all full and partial cul-de-sac bulbs. If curb and gutter is proposed, the minimum flowline grade may be one-half percent (0.5%).

(2) Continuous grade changes shall not be permitted. The use of grade breaks in lieu of vertical curves is discouraged; however, if a grade break is necessary and the algebraic difference in grade does not exceed one-half percent (0.5%) along the street, the grade break will be permitted.

(b) Vertical curves. See A Policy on Geometric Design of Highways and Streets for the standard for rate of vertical curvature (‘K’ value) requirements. The minimum length is controlled by those standards and by stopping sight distances.

(c) Stopping sight distance. See A Policy on Geometric Design of Highways and Streets for minimum stopping sight distance requirements. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-70. Intersections.

All connections to existing asphalt streets will require the asphalt to be sawcut full depth and be paved with a neat line match to the existing surface.

(1) Skew angles. All new street or driveway connections shall intersect existing roads at ninety (90) degrees. Where this is not possible, the skew angle shall not be less than seventy-five (75) degrees from the existing street. An oblique street should be curved approaching an intersection and should be approximately at right angles for at least one hundred (100) feet there from. No more than two (2) streets shall intersect at any point.

(2) Minimum curb radius. Minimum curb radius at the intersection of two (2) local streets shall be twenty (20) feet. Minimum curb radius at an intersection involving an arterial and/or a collector street shall be at least twenty-five (25) feet unless a larger radius is deemed necessary by the Town for maintenance and emergency services. Abrupt horizontal changes in alignment within a block are discouraged; but if necessary, shall have the corners angled in accordance with standard engineering practice to permit safe vehicular movement.

(3) Horizontal offset.
a. All new street connections shall meet existing streets without an offset whenever possible. When a new development can access two (2) different streets, access shall always be to the street with the lowest classification.

b. When a street parallel to a railroad right-of-way intersects a street which crosses an at-grade railroad right-of-way, it shall, to the extent practicable, be at a distance of at least one hundred fifty (150) feet from the railroad right-of-way. Such distance shall be determined with due consideration of the minimum distance required for future separation of grades by means of appropriate approach gradients.

(4) Grades. All intersections shall utilize vertical curves. The minimum design speed for all vertical curves at intersections shall be fifteen (15) mph. Intersections shall be designed with a minimal grade whenever practical. In hilly or rolling areas, at the approach to an intersection, a leveling area shall be provided having not greater than a four percent (4%) slope for a distance of sixty (60) feet, measured from the edge of pavement or back of curb and gutter. The four percent (4%) only applies when intersecting streets are either local streets, private streets and/or shared private drives. The maximum allowable slope is the greater of the slope measured at the centerline or edge of pavement on the approaching minor street. On all streets approaching arterials or collector streets, the maximum grade shall be two percent (2%) for a distance of sixty (60) feet measured from the edge of pavement or back of curb and gutter.

(5) Corner sight distance. The corner sight distance is measured from a point on the local street at fifteen (15) feet back from the edge of the collector street pavement flowline and measured from a height of eye at three and one-half (3½) feet on the local street to a height of object at four and one-quarter (4¼) feet on the collector street. The distance shall be ten (10) feet for a local-local street intersection measured from the pavement flow line. The minimum corner sight distance is defined in the table below. Using the plan and profile of the intersection, the Engineer of Record shall verify that these minimum sight distances can be attained.

<table>
<thead>
<tr>
<th>Design Speed (mph)</th>
<th>Corner Sight Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>225</td>
</tr>
<tr>
<td>30</td>
<td>335</td>
</tr>
</tbody>
</table>

Sight distance shown is for a stopped passenger car to turn left onto a two-lane street with no median and grades of three percent (3%) or less. For other conditions, the time gap must be adjusted and the required sight distance recalculated. Truck traffic entering onto streets requires longer sight distances. Any proposed public or private street or driveway regularly used by truck traffic may require an individual analysis. When the criteria for sight distance cannot be met, the Town may deny the access, prohibit right or left turns by vehicles entering the street or require speed change lanes. (Ord. 389 Part 1.1, 2012)
Sec. 14-3-80. Pedestrian facilities.

Sidewalks and trails shall be included with the project design and construction plan set. The type, width and surface of the trail required depend upon the topography and general layout of the subdivision. See Attachment A-13 – Sidewalks and Trails and Attachment A-14 – Handicap Ramps.

(1) Trail separation. Separation between public rights-of-way and trails is encouraged unless topography or other physical constraints necessitate a trail adjacent to a public right-of-way. The minimum distance between public rights-of-way and trails shall be ten (10) feet horizontally. Grade differential or differing surfaces shall be provided between trails and public rights-of-way to discourage crossover by vehicles, pedestrians and bicycles.

(2) Trail width. Detached, paved, eight-foot-wide trails shall be provided adjacent to arterial and collector streets.

(3) Trail construction. The type of construction for trails shall be compatible with the anticipated use. All trails shall be constructed to provide stable sub-grades suitable for support of heavy equipment and pavement.

(4) Trail signage and markings. Way-finding and directional signs may be required at the discretion of the Town. Warning signs, stop signs and pavement markings shall be required at all intersections and street crossings.

(5) Easements. Trails may overlap with other easements, provided that any overlapping easement does not compromise the functional use of any other easement.

(6) Sidewalk width and location. Sidewalks shall be a minimum of eight (8) feet wide on each side of the street and shall be required in the Business Zone District and in all Mixed Use, Accommodation, Lodging and Commercial zoned planning areas in all Planned Development Districts (PDDs). Sidewalks in residential areas shall be required on at least one (1) side of the street if trails are not provided and shall be a minimum of five (5) feet wide. The typical sidewalk and trail is shown on Attachment A-13 – Sidewalks and Trails.

(7) ADA requirements. All trails and sidewalks shall be ramped at intersections and other pedestrian crossings and constructed in accordance with handicapped accessibility standards of the Americans with Disabilities Act (ADA). The typical handicap ramp is shown on Attachment A-14 – Handicap Ramps.

(8) Drainage. Adequate drainage measures shall be provided along and across trails and sidewalks to prevent erosion damage and to allow free passage of drainage flows. Surface drainage shall not sheet flow across a trail or sidewalk. Drainage shall cross a trail or sidewalk at specified locations. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-90. Signage and striping.

(a) All signs, striping, markers, delineators, signals and other traffic control devices must conform to the Manual on Uniform Traffic Control Devices (MUTCD) and the Colorado Supplement to the MUTCD.
(b) Pavement striping material and application shall be in accordance with the CDOT Standard Specifications for Street and Roadways Construction for epoxy paint materials and installation per Section 627.05 Epoxy Pavement Marking and for thermoplastic pavement markings per Section 627.06 Thermoplastic Pavement Marking. The area to be covered by the thermoplastic pavement marking shall be ground down one-eighth (⅛) of an inch so that the top of the thermoplastic pavement marking is flush with the street surface.

(c) Thermoplastic pavement markings shall be used for cross-walk lines, stop bars, turn lane lines at intersections, turn arrows and school zone markings. Epoxy pavement marking shall be used for centerline striping, no passing zone lines and edge lines along streets.

(d) All required street identification signage and no parking signs shall be consistent with Fraser's current standard signage content detail and installation standards. Speed limit signs, stop signs, emergency turn around signs, striping and other traffic control devices shall meet current Town installation standards. All signage shall be installed by, and paid for by, the applicant following approval by the Town. The applicant should contact the Town for the current signage content detail and installation requirements.

(e) No signs are permitted within the public right-of-way without the approval of the Town.

(f) All sign sheeting shall conform to ASTM D4956-04 and the retroreflectivity requirements as defined in the MUTCD. All sign posts shall be the POZ-LOC Socket System as manufactured by Northwest Pipe Traffic Systems or approved equal. The sign post wall shall have a minimum thickness of eight-hundredths (0.08) of an inch, a minimum weight per foot of one and ninety-six hundredths (1.96) pounds per foot and be hot dipped galvanized. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-100. Traffic Impact Analysis (TIA).

A Traffic Impact Analysis, when required, shall be based on the projected traffic needs twenty (20) years after construction or build-out of the development and shall encompass the needs from existing development, future development and the proposed development. Trip generations from future development over the design period shall be based on zoning, existing land use, proximity to developed areas, historic growth and other factors expected to influence development. See Sections 14-3-20 and 14-3-30 for vehicle trip calculations and street classifications. The TIA shall be prepared by a professional engineer, licensed by the State of Colorado, and shall contain, but not be limited to:

(1) A description of the proposed land use, a site plan and an overall plan view of proposed streets within the development and all accesses to the Town streets with offset distances to other intersections (including driveways) within one thousand five hundred (1,500) feet of the site.

(2) On-site issues, including number and location of driveways, parking needs and layout, circulation, pedestrians, truck access and operations, transit and safety.

(3) Description of and maps depicting existing street and transportation conditions affected by the development.
(4) Identification of traffic congestion, street classifications and possible deficiencies of the existing transportation system affected by the development. This should address and anticipate "seasonal" traffic volumes, effects of phased construction and opening day/planned special events.

(5) Anticipated nearby land development (planned or under construction) and associated traffic, along with the anticipated trip generation, and daily and peak-hour traffic volumes of the proposed development, at full build and at any interim construction phase.

(6) The impacts of the development on the existing street and transportation system and the need for potential improvements to existing streets, such as horizontal alignment and vertical alignment.

Based on the results of this analysis, a Traffic Impact Study (TIS), including traffic counts, may be required by the Town. The applicant/developer is responsible for any permits and approvals required by the Colorado Department of Transportation. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-110. Traffic Impact Study (TIS).

A Traffic Impact Study, when required, shall be prepared by a professional engineer licensed by the State and shall include, but not be limited to, the following information:

(1) A scaled map of the vicinity showing all streets and highways adjacent to the site; a scaled map of the study area, including land uses; a scaled map of the immediate access area; and a scaled plan showing on-site anticipated vehicular circulation patterns.

(2) Map identification and textual consideration of all accesses that are existing and possible future access locations, including signal locations for at least one-half (½) mile in each direction along the street, as well as all potential roadway and signal improvements.

(3) Evaluation of current daily and peak hour traffic data and twenty-year projections, including turning movements at all intersections and any key year midpoints, assuming a build out of the study area based upon zoning, comprehensive plans and growth estimates.

(4) An evaluation of the level of service and capacity for all design and traffic operation elements, including mainline street and affected intersections.

(5) An analysis of the clear zone and the horizontal and vertical sight distances.

(6) Accurate and understandable diagrams.

(7) All assumptions and adjustment factors.

(8) An analysis of all reasonable alternatives, including no build or alternative street access.

(9) Current and projected travel speed, travel time and delay time within the study area that will be impacted by the access proposal.

(10) Site traffic generation rate estimates and resulting trip generation distribution and assignments.
(11) Analysis of queue lengths for all turn lanes affected to the twentieth year.

(12) A safety analysis, including conflict points, turning movements and three (3) years of accident history.

(13) A conceptual design showing all geometric elements and their approximate dimensions, with analysis of any element of the access that will be below standard.

(14) Sources of information, data and references.

(15) The existence of any current traffic problems in the local area, such as a high accident location, confusing intersection or an intersection in need of a traffic signal.

(16) The current projected level of service of the street system adjacent to the development, which will be significantly affected.

(17) The sensitivity of the adjacent neighborhoods or other areas that may be perceived as impacted.

(18) The proximity of the site driveways to the other access points or intersections.

(19) The ability of the adjacent existing, or planned, street system to handle increased traffic or the feasibility of improving the roadway system to handle increased traffic.

(20) Other specific problems or deficiencies that may be affected by the proposed development or affect the ability of the development to satisfactorily accommodate seasonal traffic volumes, phased construction and opening day/special events. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-120. Pavement design.

(a) Design.

(1) Structural sections shall be designed for all new streets or existing streets being upgraded due to increased traffic. The applicant shall provide a pavement design report performed by a Geotechnical Engineer, licensed by the State, prior to approval of the final street design. The structural section shall include the asphalt and/or concrete street surface and the aggregate street sub-base. Aggregate sub-base shall be Class 6 road base material and/or Class 6 road base material in combination with other locally available CDOT aggregate classifications to meet the design requirements for the street per the Geotechnical Report pavement design.

(2) The final pavement design for all streets must meet all the procedures and requirements within the CDOT Pavement Design Manual. Minimum as-built thickness of asphalt shall be five (5) inches.

(3) Hot mix asphalt shall be placed only on properly prepared unfrozen surfaces which are free of water, snow and ice. The hot mix asphalt shall be placed only when both the air and surface temperatures equal or exceed the temperatures specified in the following table and the Engineer determines that the weather conditions permit the pavement to be properly placed and compacted.
Placement Temperature Limitations in F°

<table>
<thead>
<tr>
<th>Compacted Layer Thickness in Inches</th>
<th>Minimum Surface &amp; Air Temperature (F°)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Top Asphalt Lift</td>
</tr>
<tr>
<td>&lt; 1 ½</td>
<td>60</td>
</tr>
<tr>
<td>1 ½ — &lt; 3</td>
<td>50</td>
</tr>
<tr>
<td>3 or more</td>
<td>45</td>
</tr>
</tbody>
</table>

* Note: Air temperature is to be taken in the shade. Surface is defined as the existing base on which the new pavement is to be placed.

If the temperature falls below the minimum air or surface temperatures, paving shall stop. If more than two (2) lifts of asphalt are proposed, consult with the Town for placement temperature requirements.

(b) Construction/testing requirements.

(1) The sub-base and base shall be placed and compacted in uniform layers that do not exceed eight (8) inches depth after compaction. All asphalt shall be placed in multiple lifts with each lift being one and one-half (1½) inches minimum or three (3) inches maximum after compaction. The top lift of asphalt shall be placed within fourteen (14) days following installation of the bottom lift of asphalt. In the event that the top lift is not placed within the fourteen-day time frame, prior to placement of the top lift of asphalt, a Geotechnical Engineer shall inspect the existing asphalt lift to ensure that it is free of dirt and debris and is structurally sound to properly bond to the top lift of asphalt. The Geotechnical Engineer shall also certify that the completed asphalt structure has not been compromised by this delay and that it meets the approved pavement design.

(2) Paving shall not start until sub-grade compaction tests are taken meeting the requirements of the plans, these standards and final pavement design. Compaction for the street base course shall meet ninety-five percent (95%) of Standard Proctor density of the material within two percent (2%) of optimum moisture content as determined by AASHTO T-180. Compaction testing for embankment and base course shall be performed every two hundred (200) linear feet on every other lift staggered within the street unless otherwise recommended by a Geotechnical Engineer, licensed by the State and approved by the Town.

(3) Compaction for the hot mix asphalt shall meet a density of ninety-two percent (92%) to ninety-six percent (96%) of the maximum theoretical density, determined by CP-51. Field density determination shall be made in accordance with TCP-81. Testing shall be performed on each lift at intervals of one (1) test per two hundred (200) linear feet per lane. Test locations on each lift and each lane shall be staggered.

(4) At completion of construction, as part of the preliminary acceptance, the Town will select representative locations to take asphalt corings as confirmation of asphalt depth and consistency of the asphalt section. The Town will contract directly with a company to perform this work and will back charge the applicant for the cost. The Town may elect to waive this requirement if sufficient water valves and manholes are present within the street project to verify asphalt depths throughout the project from the concrete/asphalt collar installation process. (Ord. 389 Part 1.1, 2012)
Sec. 14-3-130. Grading.

Slopes should be gradual at all intersections to allow for sufficient snow storage and not interfere with the intersection sight triangle. All specifications for earthwork compaction, moisture content, materials and construction limitations shall be based on recommendations within the Geotechnical Report and within the appropriate utility standards and these street/roadway standards.

(1) Retaining walls.

   a. Retaining walls required for public improvements shall be located within the Town right-of-way. Additional right-of-way or easements may be required in these areas to protect the slope and design features of the retaining wall. Retaining walls for improvements on private property shall not extend into the public right-of-way or easements. Retaining walls shall not be installed over any utility without sleeving and prior written approval of the Town and the utility owner.

   b. All retaining walls over four (4) feet in height, measured from bottom of footing to top of wall, shall be designed by a professional engineer, licensed by the State. Design calculations, layout and construction details must be provided with final plans for review and approval by the Town. Gabion baskets shall not be used within the Town right-of-way. Retaining walls shall not be positioned near flowlines unless proper design and erosion control installation has been addressed. The applicant shall obtain all necessary permits.

(2) Slopes. The maximum cut/fill slope requirement is three (3) vertical feet to one (1) horizontal foot. Slopes exceeding the 3:1 grade shall not be considered usable snow storage. Slopes shall be protected from erosion. (Ord. 389 Part 1.1, 2012)

Division 2
Water System Design

Sec. 14-3-210. General.

(a) The Town operates and maintains the municipal water system. The system consists of five (5) pressure zones, water supply wells and transmission lines, booster pump stations, water treatment facilities and distribution lines, pressure reducing valves and water storage tanks. The five (5) pressure zones and their respective service areas are defined as:

<table>
<thead>
<tr>
<th>Pressure Zone</th>
<th>Respective Service Area (elevation in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>8,600 to 8,680</td>
</tr>
<tr>
<td>Yellow</td>
<td>8,680 to 8,860</td>
</tr>
<tr>
<td>Green</td>
<td>8,860 to 9,080</td>
</tr>
<tr>
<td>Red</td>
<td>9,080 to 9,300</td>
</tr>
<tr>
<td>Purple</td>
<td>9,300 to 9,460</td>
</tr>
</tbody>
</table>

(b) Maps of existing service areas can be viewed at the Town Hall.
(c) Three (3) water storage tanks and a series of pumps provide the water pressure to operate the system. The existing Blue Zone tank is an underground concrete tank. The overflow of the Blue Zone tank is at elevation 8795.0 (NGVD 29 Datum).

(d) The Yellow Zone tank currently serves portions of development on East Mountain and West Mountain (US Highway 40 being the division line). An additional Yellow Zone tank is proposed for West Mountain as development continues. The existing Yellow Zone tank is an underground, post-tensioned concrete tank. The overflow of the Yellow Zone tank is at elevation 8964.2 (NGVD 29 Datum).

(e) The Green Zone tank currently serves a portion of development on East Mountain. An additional Green Zone tank is proposed for West Mountain as development continues. The existing Green Zone tank is an underground prestressed concrete tank. The overflow of the Green Zone tank is at elevation 9174.0 (NGVD 29 Datum).

(f) The Red Pressure Zone on East Mountain is served by water booster pumps at the Green Zone tank site. A future Red Zone tank is proposed for West Mountain at some future point required by development.

(g) The Purple Pressure Zone is proposed for West Mountain at some future point required by development. It will serve an area proposed for development by booster pumps from the West Mountain Red Zone tank.

(h) The Blue Zone System is connected to the Yellow Zone and Green Zone systems through a pressure reducing valve (PRV) located in Old Victory Road. The Yellow and Green Zone systems are connected by booster pumps and two PRVs to control the pressure and flow within their respective zones. In the event of a fire within a lower pressure zone, water stored in the upper pressure zone water storage tanks is available to meet fire flow requirements. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-220. Basic design policies.

All new water system designs and related information shall meet the requirements of these Standards and the requirements and approval of the State of Colorado Design Criteria for Potable Water Systems. Any design standards not included within these Standards shall be subject to the minimum standards set forth by the American Water Works Association or in other current publications found in Appendix 14-A to this Chapter. In all cases, the more stringent standards and design criteria shall be applicable. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-230. Water system hydraulic model.

(a) The Town has prepared a water system hydraulic model. The hydraulic model was prepared using the layout and detail of the existing Town municipal water system components, flow rates and water pressures at various fire hydrant locations.

(b) The hydraulic model is utilized to forecast flow rates and water pressures for system extensions to determine if the proposed development improvements meet minimum current requirements of the National Fire Code standards. (Ord. 389 Part 1.1, 2012)
Sec. 14-3-240. Required easements.

(a) Where the municipal water system is to be located out of the public right-of-way, the applicant shall be responsible for obtaining easements required for the construction, maintenance and operation of the facilities. The legal description for the easements shall be prepared by a Registered Land Surveyor in the State. Easements shall be in a form acceptable to the Town and shall be shown on the design and as-built drawings. The Town will not approve the design documents until all required easements have been deeded to the Town.

(b) The minimum width of easements for a single pipeline shall be thirty (30) feet. Temporary construction easements shall have a minimum width of forty (40) feet. An easement containing both a water line and a sewer line shall be no less than thirty-six (36) feet. Wider easements shall be required for deep sections of pipeline, multiple lines, steep terrain or where otherwise required by the Town. Deep sections of pipeline is defined as the water line depth of cover exceeding nine (9) feet and/or the sanitary sewer line depth of cover exceeding seven (7) feet. Easement widths for deep lines are determined using Attachment A-5 – Utility Easement Widths.

(c) For any service line curb stop located outside of a public right-of-way or utility easement, a rectangular shaped utility easement shall be provided. The rectangular easement shall extend two (2) feet on each side of the service line from the boundary of the right-of-way or utility easement to four (4) feet behind the curb stop. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-250. Water system infrastructure.

(a) Groundwater well design and construction. Water wells that are to be designed and constructed for the Town shall meet the State Rules and Regulations for Water Well Construction, Pump Installation, and Monitoring and Observation Hole/Well Construction. (Water Well Construction Rules) 2 CCR 402-2.

(b) Water well and meter house structures. All water well appurtenances related to the operation of a production well for the Town shall be installed indoors of a structure per Attachment A-36 – Water Well Meter House Elevations and Attachment A-37 – Water Well Meter House Floor Plan and Foundation. Electrical services and/or photovoltaic solar powered services shall be provided to the site in order to operate lighting, heat and pump controls, as well as all necessary telemetry and SCADA control systems, as defined in Subsection (c) below.

(c) Telemetry and Supervisory Control and Data Acquisition systems. Telemetry and Supervisory Control and Data Acquisition (SCADA) systems shall be provided at all new water system production and distribution facilities and shall be compatible and conform to the detail of the Town's existing telemetry and SCADA systems, as determined by the Town.

(d) Water storage tanks.

(1) Water storage tanks shall be underground, circular post-tensioned concrete storage tanks. Storage tanks shall be sized and located to meet the requirements of the area to be served and as approved by the Town. Multiple tanks within the same pressure zone shall be designed, detailed and built to operate in unison. The pressure set points shall be coordinated to provide equal pressures within the system.
(2) The concrete underground tanks shall have a reinforced concrete floor slab, post-tensioned concrete walls and roof slab. Columns shall be incorporated to assist in support of the roof. Eighteen (18) inches of soil material shall cover the roof for insulation and aesthetics. The tank shall be designed in conformance with AWWA Standard D115-95.

(3) Two (2) four-foot by six-foot access hatches shall be installed within the roof slab. Access hatches shall be lockable and stainless steel. One (1) hatch shall be configured for personnel accessibility and the second for equipment accessibility. Each hatch shall be installed at a height of eighteen (18) inches above finish grade to prevent soil and debris from falling into the tank from the surrounding area. The tank shall have a separate inlet and outlet piping located at opposite sides of the tank floor to promote water circulation when filling and withdrawing water from the tank. Connection to the water distribution system will utilize check and gate valves to control the inlet and outlet flows from a valve structure adjacent to the tank. Tank vents and screens shall be located sufficiently above finish grade to prevent them from being covered by drifting snow. A floor drain will be located at the center of the tank to drain the tank if necessary. The drain pipe will be operated with a gate valve and the drain line will release water to an external, above-ground location. The drain pipe shall include a one-way flap gate at the external, above-ground location, installed on a concrete headwall, to open only when in use and be normally closed to prevent animal/rodent access into the pipe. An internal tank overflow will be installed to the same drain line to prevent overfilling the tank.

(4) Electrical services and conduit shall be installed at each roof access point necessary to connect services from one (1) tank hatch to the other and shall be buried in a straight line between the hatches and at a depth as required by the NEC.

(e) Pressure reducing valve (PRV) vaults.

(1) Pressure reducing valves (PRVs) are required to interconnect the pressure zones within the Town municipal water system at locations required by topography to adequately service development within the Town.

(2) The pressure reducing valves shall be installed inside a below-ground precast rectangular watertight concrete vault as detailed in Attachment A-32 – Underground PRV Vault – Plan View and Attachment A-33 – Underground PRV Vault – Section View. The PRV bypass gate valve shall be installed with a locking valve box as detailed in Attachment A-26 – Locking Valve Box Detail.

(3) The PRV vault shall include two (2) pressure reducing valves connected in parallel, with capability to isolate either PRV for maintenance. One (1) PRV shall be designed and set to operate with the system minor flow requirements. The second PRV shall be designed and set to operate with the system major flow requirements. The Town will review the PRV location, sizing and proposed settings in conjunction with their hydraulic model. The PRV vault shall be accessible through a watertight manhole frame and cover. All pipe/vault wall penetrations shall be watertight. A sump shall be incorporated into the vault floor to contain minor water spills during operation and maintenance. All piping within the PRV vault shall be installed on a horizontal plane with no binding connections and with adequate pipe clearances from all walls for maintenance and repair. Pipe stands shall be installed to adequately support all piping and valves. (Ord. 389 Part 1.1, 2012)
Sec. 14-3-260. Potable water distribution system.

(a) Design, layout and sizing.

(1) The water distribution system shall be designed to meet the more stringent of the following two (2) conditions:

   a. Maximum hourly demand with pressures not less than forty (40) psi at any point of the distribution system; or

   b. Maximum daily demand rate plus fire flow demand (as determined by ISO guidelines) with delivery pressures of not less than twenty (20) psi at the hydrant.

(2) The nominal minimum size water distribution main shall be eight (8) inches. The Engineer of Record should review the output detail of the water hydraulic model to determine if oversizing of any lines is required for transmission purposes.

(3) Dead-end lines are discouraged and will only be allowed with prior approval from the Town. In mountainous areas dead-end lines shall be minimized by making appropriate tie-ins (looped lines) whenever practical, in order to provide increased reliability of service, reduction of head loss and maximization of water quality parameters within the system. The maximum length of any dead-end line shall not exceed five hundred (500) feet in length. Any dead-end line approved shall have a blow-off device installed at the end of the line; as a minimum this device shall be a fire hydrant assembly.

(4) Water main sizing, layout and connections shall be coordinated with the Town’s Water System Engineer during the review process. The systems shall be designed to maximize interconnections, creating loops within the system and strengthening the Town’s water system. Where certain lines may also serve a transmission function, in the opinion of the Town, the Town may direct that such lines be oversized, and the applicant’s Engineer shall so design the system. In this case, the Town will pay the incremental oversize costs.

(5) State regulations require a ten-foot-minimum horizontal separation measured from the outside of the pipe to the outside of the pipe between the potable water line and any line carrying water of lesser water quality than potable water (i.e., sanitary sewer, raw water, storm sewer, irrigation water, etc.). When located in public streets, potable water pipelines shall be located approximately eleven (11) feet north or east of, and parallel to, the roadway centerline. Curved water line alignments shall be avoided. Whenever a crossing must occur where a nonpotable line passes within ten (10) feet horizontally of a water main, and where the water main is not at least eighteen (18) inches vertically clear above the nonpotable line, special construction will be required in accordance with Attachment A-23 – Pipe Crossing Detail, and Attachment A-24 – Pipe Encasement Detail. The distance shall be measured horizontally from the outside edge to the outside edge of the pipe.

(6) A ten-foot centerline to centerline separation shall be maintained between the waterline and all dry utilities and between the sanitary sewer and all dry utilities, unless otherwise approved by the Town. Dry utility cabinets, risers, pedestals or other appurtenances shall not be located within this ten-foot separation distance, within the right-of-way or within a ten-foot radius of any fire
hydrant, unless otherwise approved by the Town. The applicant is referred to all other utility providers to determine their respective minimum separation criteria and requirements from the Town's utilities and then design its site and utility layout to meet the more stringent of requirements.

(b) Materials.

(1) Pipe. All water mains shall be either ductile iron pipe or C-900/C-905 PVC pipe except in areas found to have high levels of corrosiveness, as determined by the Geotechnical Report. In those cases, where the soil has a high level of corrosiveness as identified by the Geotechnical Engineer, C-900/905 PVC pipe may be required by the Town. HDPE DIPS (Ductile Iron Pipe Size) waterline may be considered by the Town in specific applications and shall only be used in the Town water system with prior written approval from the Town.

(2) Ductile iron pipe. Ductile iron pipe shall conform to ANSI A21.51, Pressure Class 250 psi minimum, Thickness Class 52 minimum thickness. Pipe joints shall be push-on type in accordance with ANSI A21.11. Pipe shall have a cement mortar lining meeting AWWA 104 and bituminous exterior coating.

(3) C-900/C-905 PVC Pipe. AWWA C-900/C-905 Polyvinyl Chloride Pipe (PVC), Pressure Class 235 psi (DR 18), shall conform to Cell Class 12454 per ASTM D1784. Standard laying length shall be twenty (20) feet, plus or minus one (1) inch, with integral bell and spigot joints. Pipe joints shall be push-on type with provision for expansion and contraction at each joint with an elastomeric seal.

(4) HDPE DIPS Pipe. HDPE DIPS (Ductile Iron Pipe Size) pipe PE4710, Pressure Class 250 psi (DR 9) or PE3608, Pressure Class 250 psi (DR 7.4), shall conform to AWWA C901 and AWWA C906. Standard laying lengths shall be forty (40) to fifty (50) feet in length. All pipe joints shall be fused welded per the pipe manufacturer's standards.

(5) Fittings. Fittings shall be ductile iron or cast iron, minimum two hundred fifty (250) psi minimum working pressure, conforming to AWWA C153 or C110 with mechanical joint connections meeting AWWA C111. Lining and coating shall match pipe.

(6) Pipeline insulation. For normal depth of bury and overburden, insulation shall be Dow STYROFOAM 60, or approved equivalent. For heavy traffic or other high-compaction service, Dow STYROFOAM 115 shall be used.

(7) Tracer wire and test stations. Tracer wire shall be continuous loop twelve-gauge stranded copper tracer wire with watertight insulation for direct bury, installed in the trench above the water line. Test stations shall be located adjacent to each fire hydrant and shall include the C.P. Glen 4 with heavy cast iron locking cover and four-point terminal box as manufactured by C.P. Test Services, Inc., or equal approved by the Town. The tracer wire shall be installed in accordance with Attachment A-17 – Tracer Wire Detail. Splices in tracer wire shall only be made using solderless, 3M Type DB4-6 Low Voltage Direct Bury Splice Kit or equal approved by the Town.

(8) Sheathing. All ductile iron pipelines, valves and fittings shall be polyethylene sheathed in accordance with ANSI A21.5, AWWA C105, eight-mil minimum thickness. Installation shall
comply with Attachment A-19 – Polyethylene Wrap Detail. In certain circumstances and with technical documentation, the Town may waive the sheathing requirements.

(9) Line valves. Line valves shall be provided to allow isolation of parts of the system for maintenance or repair. They are required approximately every six hundred (600) feet and on each line at all intersections of mains to allow isolation of any line, loop or branch. Line valves are required at each fire hydrant assembly along the main distribution system line to provide isolation of a main line segment and maintain use of the hydrant. Line valves shall comply with requirements for buried valves.

(10) Buried valves. Valves shall be resilient wedge, nonrising stem and ductile iron gate valves with mechanical joint ends conforming to AWWA C500. The valve shall be fully coated, inside and outside, with a fusion bonded coating of epoxy. Valves shall have two-inch square operating nuts and open left (counter-clockwise rotation). Valves shall be Mueller Series 2360 for valves twelve (12) inches and smaller, and Series 2361 for valves fourteen (14) inches and larger; American Flow Control Series 2500 or equal approved by the Town.

(11) Valve boxes.

a. Each buried valve shall be provided with a cast-iron valve box and round cover. The box shall have a minimum inside diameter of five and one-quarter (5¼) inches, be adjustable in length and be of the screw type. The word "WATER" shall be cast on the cover. Valve boxes shall be "wide oval base" by Tyler or equal. Valve boxes shall allow for at least six (6) inches additional extension above the level required for final grade at the time of installation. The top of all valve stems (including extensions) shall be located between twenty-four (24) inches and thirty-six (36) inches below final grade. The valve stem nut shall be centered within the valve box. Valve boxes shall be installed vertical and plumb.

b. Valve boxes located within the street shall be raised to final grade with either asphalt surfacing installed adjacent to the valve box or with a concrete collar. If the valve box is set at final grade during the asphalt paving process the following procedure shall be followed:

1. Installation of the bottom lift of asphalt shall be placed over the top of the valve box.

2. The valve box shall be exposed and set to its final grade at one-half (½) inch lower than the grade of the final street surface. Any void created in the bottom lift of asphalt by exposing and raising the valve box shall be filled with compacted hot mix asphalt prior to placement of the top lift of asphalt.

3. Installation of the top lift of asphalt shall be placed and compacted maintaining the required vertical distance from the street surface to the top of the valve box. The valve box shall remain vertical and centered over the valve operator.

c. If a concrete collar is the selected method used to raise the valve box to final grade it shall be installed after the top lift of asphalt is placed and in accordance with Attachment A-28 – Valve Box Concrete Collar Detail. The surrounding area that is to be prepared for the collar shall be mechanically cored and not jack-hammered out.
d. Where water valves are located in off-road areas, open field areas or in a proposed future paved area, the water valve box shall be adjusted to final grade and a concrete collar installed in accordance with the collar detail in accordance with Attachment A-28 – Valve Box Concrete Collar Detail. Off-road/open-field condition concrete collars are required on all valve boxes located in future paved areas if the pavement is not installed within the same construction season in which the waterline construction is performed.

e. Where valve boxes are located in the shoulder of a road, the top of the valve box shall be constructed in accordance with Attachment A-27 – Manhole/ Structure/Valve Box Placement – Shoulder Area.

(12) Warning tape. Warning tape shall be installed continuously in the trench above the water line a distance of thirty (30) inches above the pipe. The warning tape shall be three (3) inches wide and blue in color, with the legend "Caution Buried Water Line Below" in black and extend continuously in the trench. If any existing warning tape is damaged in construction activities, the contractor shall splice additional warning tape to each end to provide a continuous warning tape along the water line. Warning tape shall be installed on water service lines from the tap at the main to the edge of the right-of-way or easement.

(13) Marker posts. Fiberglass reinforced composite marker posts shall be installed adjacent to each water line that is located outside of a paved road surface. The marker posts shall be installed adjacent to and within two (2) feet of each valve and change in direction of the waterline. Intervals between marker posts shall be such that there is a clear line-of-sight between marker posts. The marker posts shall be a minimum of three and one-half (3½) inches wide allowing for a three-inch decal to be placed on one (1) or both sides. The post shall extend four (4) feet above finish grade and include a minimum of eighteen (18) inches anchor depth underground. The marker posts shall be blue in color.

(14) Fire hydrants.

a. Fire hydrants shall be Mountain Specified Hydrants of the dry barrel type and conform to AWWA C502. Hydrants shall have a five-and-one-quarter-inch main valve, two (2) two-and-one-half-inch hose connections and one (1) four-and-one-half-inch pumper connection. Hydrants shall have six-inch mechanical joint connections and safety traffic flange. Fire hydrants shall be Mueller Centurion No. A-423 or Waterous Pacer WB-67 with bronze seat ring. Hydrants shall open left (counter-clockwise rotation).

b. Fire hydrant assemblies shall include both mechanical joint restraints to fittings/piping as detailed on Attachment A-21 – Mechanical Joint Restraint Details and concrete thrust blocks as detailed on Attachment A-16 – Fire Hydrant Detail and described in Subsection 14-3-260(c). The mechanical joint restraints shall be installed on all joints from the water main tee to and including the fire hydrant. Tie rods may be required in instances where necessary as determined by the Town.

c. The fire hydrant assembly gate valve shall be located a distance of three feet (3’ - 0") from the centerline of the fire hydrant in open areas. In areas where the fire hydrant is located less than three feet - six inches (3’ - 6") behind the edge of pavement, curb and gutter, and/or sidewalk, the hydrant assembly gate valve shall be located in the pavement, a distance of one foot - three
inches (1' - 3") from the edge of pavement. If conditions vary from those described herein, Fraser shall determine the location for the hydrant assembly gate valve.

d. A metal marker pole assembly shall be attached around one (1) of the hydrant's two-and-one-half-inch-hose connections. The assembly shall be designed with a spring assembly at the bottom and a red metal flag at the top. The marker pole assembly shall be approved by the Town.

(15) Blow-offs. Blow-offs are prohibited and shall not be used. Dead-end lines, when approved, shall include a fire hydrant assembly located at the end of the line.

(16) Air-release valves.

a. Air-release outlets shall be provided at high points in the water distribution system. These outlets shall take the form of a fire hydrant or an automatic air-release valve. The proposed location must be preapproved by the Town. The Town prefers the use of fire hydrants as the air-release outlet unless the water line designer determines that the automatic air-release valve is required for proper system operation based on factors such as topography, site conditions, etc. Automatic air-release valves shall be installed in a four-foot-diameter manhole in accordance with Attachment A-31 – Air Release Valve Structure. The air-release valve shall be Cla-Val Air Release Valve Series 34 AR or equal, approved by the Town. Air-release valve structures located within the street shall be raised to final grade with either asphalt surfacing installed adjacent to the access frame and cover or with a concrete collar. If the access frame and cover are set at final grade during the asphalt paving process the following procedure shall be followed:

1. Installation of the bottom lift of asphalt shall be placed over the top of the air-release structure.

2. The frame and cover of the structure shall be exposed and set to its final grade at one-half (½) inch lower than the grade of the final street surface. Any void created in the bottom lift of asphalt by exposing and raising the access frame and cover shall be filled with compacted hot mix asphalt prior to placement of the top lift of asphalt.

3. Installation of the top lift of asphalt shall be placed and compacted maintaining the required vertical distance from the street surface to the top of the access frame and cover.

b. If a concrete collar is the selected method used to raise the access frame and cover to final grade, it shall be installed after the top lift of asphalt is placed and in accordance with Attachment A-29 – Structure/Manhole Concrete Collar Detail. The surrounding area that is to be prepared for the collar shall be mechanically cored and not jack-hammered out.

c. Fire hydrants used as an air-release outlet must meet the requirement for fire hydrants in Subsection 14-3-260(b). Each fire hydrant designated as an air-release outlet within the potable water system shall be painted red. Each fire hydrant designated as an air-release outlet within the nonpotable water system shall be painted purple.

(17) Casing pipe. Steel casing pipe shall be installed at all state highway crossings, railroad crossings, waterway crossings and at major street locations, as determined by the Town. Steel casing pipe shall be installed either as a bore casing or an open trench casing. The casing shall
extend beyond the edge of shoulder, top of bank or the toe of slope a distance equal to one and one-half \((1\frac{1}{2})\) times the depth of the casing pipe, unless otherwise approved by the Town. The carrier pipe shall be push-on single gasket or mechanical joint ductile iron pipe. Three (3) skids shall be affixed to the carrier pipe for each twenty-foot pipe length. The skids shall consist of a steel skid clamp with neoprene or PVC runners. Four (4) runners shall be attached to each skid at ninety-degree positions around the pipe. The carrier pipe within the encasement pipe section, including the first two (2) joints outside the casing pipe on each end, shall have restrained joints. Reference Attachment A-25 – Bore Casing Detail. The steel casing pipe size and wall thickness shall meet the following minimum requirements:

<table>
<thead>
<tr>
<th>Carrier Pipe Nominal</th>
<th>Casing Pipe</th>
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<tbody>
<tr>
<td></td>
<td>Min. O.D.</td>
</tr>
<tr>
<td>4&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>16&quot;</td>
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<tr>
<td>8&quot;</td>
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<td>12&quot;</td>
<td>22&quot;</td>
</tr>
<tr>
<td>16&quot;</td>
<td>28&quot;</td>
</tr>
<tr>
<td>20&quot;</td>
<td>32&quot;</td>
</tr>
</tbody>
</table>

Trench-laid casings shall be installed per trenching standards and detail.

(18) Tapping sleeves. Tapping sleeves shall be used where tying a new line perpendicular to an existing water line for six-inch through twenty-inch nominal diameter pipe. Tapping sleeves shall be stainless steel and conform to ASTM A240 Type 304/304L or approved equal. Flanges shall conform to AWWA C-223. Bolts and nuts shall be stainless steel Type 304SS. The tapping sleeve assembly shall be enclosed within the polyethylene wrap. A gate valve and valve box assembly shall be connected at the tapping sleeve prior to installation of pipe. The tapping sleeve shall be ROMAC SST, FORD Model FTSS or approved equal.

(19) Pressure reducing valves. Pressure reducing valves shall be CLA-VAL, Model 90-1 as manufactured by CLA-VAL or equal approved by the Town.

(20) Drainage flap gates. Drainage flap gates shall be Waterman Model F-10 as manufactured by Waterman Water Control Specialists or equal approved by the Town.

(c) Pipeline installation.

(1) Water pipelines shall be installed in a thorough and workmanlike manner in accordance with the approved plans. Pipe shall be laid in an unwatered trench and shall not be used for draining water from the trench. Pipes are to be kept clean during installation by capping or plugging ends with a mechanical plug or other similar means. The minimum bedding and backfill requirements for pipelines and appurtenances shall be as shown on Attachment A-18 – Water Main and Service Line Bedding and Backfill Detail. The minimum cover shall be nine (9) feet from the top of the water line to finished grade. Pipelines shall not be placed deeper than ten (10) feet without prior approval by the Town.
(2) A minimum of seven (7) feet of cover will be allowed if at least two (2) inches of an approved pipeline insulation is provided for each vertical foot of cover less than nine (9) feet, as shown on Attachment A-18 – Water Main and Service Line Bedding and Backfill Detail. If insulation is installed, use approximately six (6) inches of a fine-grained material (i.e., Class 6 road base, sand or squeegee/pea gravel) for the pipe zone materials above and beneath the insulation to protect it from breakage during backfill. Prior to placement of the insulation, level and compact the trench bedding material to provide a flat, smooth surface for the insulation. Carefully place bedding material over the insulation so as not to puncture or damage the insulation.

(3) If the bottom of the excavation is soft or unstable and, in the opinion of the Town, is not a satisfactory support for the pipeline, further depth and/or width shall be excavated, refilled and compacted to six (6) inches below the pipe outside diameter (excluding bells) with trench stabilization material, as specified in Trenching, Bedding and Backfill.

(4) All pipeline fittings (i.e., bends, tees, plugs and caps) shall be installed with concrete thrust blocks adequately designed for the specific application. Thrust blocks shall be cast-in-place from concrete having a minimum compressive strength of three thousand (3,000) psi and bear against undisturbed earth on the trench wall. Minimum requirements for thrustblocks shall be as shown on Attachment A-20 – Concrete Thrustblocks.

(5) Batch plant mix or pre-mix concrete may be used for thrust block construction, provided it meets the compressive strength requirements for thrust blocks and is thoroughly mixed in accordance with the manufacturer's requirements. Stacking bags of pre-mix concrete as a substitute for placing thoroughly mixed concrete for thrust blocks is not acceptable. Splitting bags of pre-mix cement in the hole at the thrust block location and adding water is not acceptable. Only thoroughly mixed concrete placed in the thrust block locations to the detail shown in these standards for thrust blocks is acceptable.

(6) Alternate means of thrust restraint may be considered and approved for use where proved to provide similar restraint. Supplemental restraint shall be required where the Town Engineer believes the soil-bearing pressures to be inadequate or where the Town Engineer is concerned about subsequent movement due to slope or other conditions of service; see Attachment A-21 – Mechanical Joint Restraint Details, and Attachment A-22 – Length of Restrained Pipe. Valves near a fitting must be tied back to that fitting, using rodding or mechanical joints.

(d) Fire hydrant installation. Fire hydrants shall be located as required by the Town and the Fire Protection District in accordance with the International Fire Code, as adopted by the Town. The applicant shall be required to obtain the approval of the Fire Protection District for fire hydrant locations. Fire hydrant assemblies shall be installed with both mechanical joint restraints to fittings/piping as detailed on Attachment A-21 – Mechanical Joint Restraint Details and concrete thrust blocks as detailed on Attachment A-16 – Fire Hydrant Detail and described in Section 14-3-260(c). The mechanical joint restraints shall be installed on all joints from the water main tee to and including the fire hydrant.

(e) Locking valve box installation. Specific instances may be identified, in the opinion of the Town, which require a water system valve to remain in the open or closed position and only operated by Town staff. In the event a specific water valve is identified for this security, a locking valve box lid shall be installed in accordance with Attachment A-26 – Locking Valve Box Detail.
(f) Testing.

(1) All finished water lines, after pipe and fitting restraints are in place, shall be pressure and leakage tested at not less than one hundred fifty (150) psi for a two-hour period. If working pressure is greater than one hundred (100) psi, the test shall be performed at one and one-half (1½) times the expected working pressure. Unless approved by the Town Engineer, no lines longer than one thousand two hundred (1,200) feet shall be tested at one (1) time.

(2) No pipeline installation will be acceptable until the leakage is less than the amount computed by the following formula:

\[ L = \frac{SD(P)^{0.5}}{148,000} \]

Where:

- \( L \) = Allowable leakage in gallons (per hour)
- \( S \) = Tested length of pipe (feet)
- \( D \) = Nominal diameter of pipe (inches)
- \( P \) = Average test pressure during the test, psi

The following table summarizes the allowable leakage per each one-hundred (100) linear feet of pipe for the various pipe sizes and pipe pressures; calculated using the above allowable water leakage formula.

### Table 1:

**Allowable Leakage (gallons/hour) per 100 feet of Pipe.**

<table>
<thead>
<tr>
<th>Nominal Pipe Size (Inches)</th>
<th>Average Test Pressure in Pipeline (psi)</th>
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<tbody>
<tr>
<td></td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>0.01</td>
</tr>
<tr>
<td>4</td>
<td>0.02</td>
</tr>
<tr>
<td>6</td>
<td>0.03</td>
</tr>
</tbody>
</table>
(3) An electrical conductivity test shall be conducted on each of the tracer wire installation and the piping system pre-welded tab and jumper strip installation using a low-voltage, low-current test procedure to confirm that the tracer wire is continuous and functional between each test station located adjacent to the fire hydrants. The test results shall be pass/fail. The electrical load shall not exceed the capacity of the system. The electrical conductivity testing shall be contracted by the Town and back-charged to the applicant for any and all costs incurred.

(4) Results of the conductivity test shall be submitted in written format to the Town upon completion of the testing. The report information shall include the testing firm's name, address and telephone number; testing technician's name; date(s) of test; and results of the conductivity test for each section of tracer wire between test stations. The report shall be signed by the technician performing the conductivity test.

(5) All fire hydrant assemblies and distribution system gate valves shall be fully operated in the presence of the Town to ensure they are fully operable.

(6) A leak detection test shall be performed on the water lines during the last quarter of the warranty period and a written record of the test results provided to the Town. If the leak detection test cannot be performed due to inclement weather and/or site conditions, it will be delayed until a future date when the weather or site conditions allow for a safe working environment to perform the test, as determined by the Town. The leak detection testing work shall be contracted by the Town and back-charged to the applicant for any and all costs incurred.

(g) Disinfection.

(1) All water piping shall be disinfected in accordance with AWWA C651 after all construction work has been completed. Chlorine shall be added to the water at the necessary locations in the amount to form fifty (50) ppm free chlorine residual. The chlorine solution shall be left in the pipelines for not less than twenty-four (24) hours, during which time all valves and fire hydrants shall be operated in order to disinfect the appurtenances. After that length of time, the chlorine residual of the solution, at any place within the system, shall not be less than ten (10) ppm. All chlorination work must be done in the presence of the Town. At the end of twenty-four (24) hours, a bacteriological test shall be performed by a Colorado certified laboratory, acceptable to the Town, to ensure adequate disinfection. A third party independent contractor, acceptable to the Town, will
take the required samples and deliver them to the certified laboratory for testing. At the Town's discretion, they may take additional check samples and deliver the samples to a certified laboratory for testing. All costs associated with the sampling and testing shall be at the cost of the applicant.

(2) Following completion of the disinfection (chlorination) work, the applicant is responsible to dechlorinate and properly dispose of the test water in strict compliance with all local, state and federal laws, rules and regulations. Prior to disposal, provisions must be made by the applicant to assure that no chlorinated water is discharged to the ground. Acceptance or acknowledgement of the proposed method of disposal of the test water by the Town does not relieve the applicant from any and all responsibility, liability and/or damages caused by the release. (Ord. 389 Part 1.1, 2012).

Sec. 14-3-270. Abandonment of existing potable water distribution system infrastructure.

In order to maintain the safety and integrity of the water system, a watertight cap shall be provided for any water distribution system main line being abandoned. Two (2) scenarios are outlined below to provide such watertight cap:

(1) If the water main line is to be abandoned from an existing fitting, the abandoned line shall be disconnected from the fitting and a factory-made blind flange, with gasket, installed at that location. A thrust block, meeting the requirements of these standards shall be installed at that blind flange location.

(2) If the water main line is to be abandoned from a mid-point location on an existing line, the line shall either be extended to another point where it is looped into the system or it shall include an accessible fire hydrant at the end of the line. Any dead-end line within the system shall meet the requirements of these Standards for dead-end lines.

The required scenario for water system main line abandonment shall be determined by the Town. In each case, the existing infrastructure shall be disinfected in accordance with these Standards. All existing water system infrastructure being abandoned shall be physically removed from the site. The infrastructure shall not be abandoned in-place. Reference ties to constructed infrastructure associated with the abandonment shall be recorded and provided to the Town. The water system main line abandonment shall be approved and inspected by the Town. (Ord. 389 Part 1.1, 2012).

Division 3
Sanitary Sewer System Design

Sec. 14-3-310. General.

(a) The Town operates and maintains the municipal sanitary sewer collection system. The collection system, as designed, is intended to provide gravity service only. Before the start of design, the applicant shall contact the Town to confirm the appropriate connection point with the existing collection system. Sewage lift stations and force mains will not be permitted unless special conditions merit consideration for approval otherwise.
(b) The system design is based on a wastewater flow rate of one hundred (100) gallons per capita per day and an average household of two and three-quarters (2¾) people per household for a total flow rate of two hundred seventy-five (275) gallons per day. Historical peak flow rates are identified as two and one-half (2½) times the average flow rate. The standards defined herein require the peak build-out flow rate to be carried within the pipe flowing not greater than half full.

(c) Nonresidential user flow rates shall be determined and calculated as described above. These flow rates shall be reviewed and approved by the Town prior to design of proposed improvements to connect to the Town's system. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-320. Basic design policies.

All new sanitary sewer collection system designs and related information shall meet, at a minimum, these Standards. Any design standards not included within these Standards will be subject to the minimum standards set forth in other current publications found in Section 14-6-10 of this Chapter. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-330. Required easements.

(a) Where the municipal sanitary sewer system is to be located out of the public right-of-way, the applicant shall be responsible for obtaining easements required for the construction, maintenance and operation of the facilities. The legal description for the easements shall be prepared by a Registered Land Surveyor in the State. Easements shall be in a form acceptable to the Town and shall be shown on the design and as-built drawings. The Town will not approve the design documents until all required easements have been deeded to the Town unless an alternate schedule is approved by the Town.

(b) The minimum width of easements for a single pipeline shall be thirty (30) feet. Temporary construction easements shall have a minimum width of forty (40) feet. An easement containing both a water line and a sewer line shall be no less than thirty-six (36) feet. Wider easements shall be required for deep sections of pipeline, multiple lines, steep terrain or where otherwise required by the Town. Deep sections of pipeline is defined as the water line depth of cover exceeding nine (9) feet and/or the sanitary sewer line depth of cover exceeding seven (7) feet. Easement widths for deep lines are determined using Attachment A-5 – Utility Easement Widths. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-340. Sanitary sewer collection system.

(a) Design, layout and sizing.

(1) Collection sewers shall be designed to carry not less than the projected peak flow rates flowing one-half full (safety factor = 2.0), unless otherwise approved by the Town. The minimum size sewer collection line shall be eight (8) inches diameter. Sewers shall be so designed and constructed to give mean velocities, when flowing full, of not less than two (2) feet per second. Pipe slopes shall not exceed twelve percent (12%) grade.

(2) Sewers shall generally be designed with sufficient depth to serve basements by gravity. The minimum cover shall be seven (7) feet from top of sewer to finished grade. Sanitary sewers with less than seven (7) feet of cover will be considered by the Town with installation of two (2) inches of pipeline insulation installed for every one (1) foot of cover less than seven (7) feet. The minimum
cover for sanitary sewer lines installed with insulation is five (5) feet from top of sewer to finish grade. See Attachment A-38 – Sewer Main and Service Line Bedding & Backfill Detail for details.

(3) Sewer main sizing, layout and connections shall be coordinated with the Town during the review process. Where certain lines may also serve as truck line function, in the opinion of the Town, the Town may direct that such lines be oversized, and the applicant's Engineer shall so design the system. In this case, the Town will pay the incremental oversize costs.

(4) State regulations require that sewer and water lines shall have ten (10) feet minimum of horizontal separation from outside of pipe to outside of pipe. Where this separation is impractical, the Town may permit other separation requirements in accordance with applicable standards and regulations. If a water line passes within eighteen (18) inches vertical distance above a sewer main or service or if it lies within the minimum horizontal separation of the sewer, the sewer is to be encased per Attachment A-24 – Pipe Encasement Detail or modified to have "no bell" construction per Attachment A-23 – Pipe Crossing Detail. If a water line crosses under a sewer main or service line, a twenty-foot length of PVC C-900 or C-905 (as appropriate) shall be used for the gravity sewer line, Smith-Blair 229, Full Circle Collar Leak Repair Clamps shall be installed on all sanitary sewer joints within the minimum horizontal clearance requirements, and a twenty-foot length of ductile iron pipe shall be installed on the water line, centered over the centerline of the sanitary sewer.

(5) A ten-foot centerline to centerline separation shall be maintained between the sanitary sewer line and all dry utilities and between the water line and all dry utilities, unless otherwise approved by the Town. Dry utility cabinets, risers, pedestals or other appurtenances shall not be located within this ten-foot separation distance within the right-of-way or within a ten-foot radius of any fire hydrant, unless otherwise approved by the Town. The applicant is referred to all other utility providers to determine their respective minimum separation criteria and requirements from the Town's utilities and then design its site and utility layout to meet the more stringent requirements.

(6) Where required for structural reasons or to protect potable water pipelines, the sewer shall be encased in reinforced concrete having design characteristics not less than those shown on the Attachment A-24 – Pipe Encasement Detail.

(7) Manholes shall be located at a maximum spacing of four hundred (400) feet center-to-center, at changes in sewer pipeline alignment and/or grade and at the end of each line. Sewers shall be laid with uniform slope between manholes.

(8) Drop manholes are to be provided for any pipeline whose invert entering the manhole is greater than eighteen (18) inches above the invert out.

(9) Where different size pipes enter a manhole, the smaller pipe flowline shall be higher such that the top of the two (2) pipes is at the same elevation. Any variation to this layout shall require a variance. See Section 14-6-20 of this Chapter.

(10) Manhole steps shall be spaced uniformly from the top step to the bottom step for maximum operator safety when entering and exiting the manhole. Additionally, the top step and bottom step shall be installed within the tolerances defined herein. See Subparagraph 14-3-340(b)(8)b. for the spacing detail and tolerances.
(b) Materials.

(1) Pipe and fittings.

a. For pipe installations less than fourteen (14) feet deep measured from the pipe invert to finished grade and slopes less than eighteen percent (18%).

1. Pipe and fittings, fifteen (15) inches in diameter and smaller may be SDR 26 (sizes; eight-inch through fifteen-inch), AWWA C-900 (sizes; eight-inch through twelve-inch) or AWWA C-905 (size; fourteen-inch).

2. Pipe and fittings, sixteen (16) inches in diameter and larger shall be AWWA C905.

b. For pipe installations greater than fourteen (14) feet deep measured from the pipe invert to finished grade and/or slopes greater than eighteen percent (18%):

1. Pipe and fittings twelve (12) inches in diameter and smaller shall be polyvinyl chloride (PVC), AWWA C900, minimum thickness conforming to ASTM D2122.

2. Pipe and fittings sixteen (16) inches in diameter and larger shall be polyvinyl chloride (PVC), AWWA C905, minimum thickness conforming to ASTM D2122.

c. The size of each pipe segment between manholes shall be consistent. In the case where the depth of line or slope of the line exceeds the limits defined herein and the same size of pipe in C900/C905 doesn't exist with the size of downstream pipe (SDR 26 pipe), the C900/C905 pipe shall be increased to the next available size. The SDR 26 pipe shall be green. The C900/C905 pipe shall be green or white.

(2) Pipeline insulation. For normal depth of bury and overburden, insulation shall be Dow STYROFOAM 60, or approved equal. For heavy traffic or other high-compaction service, Dow STYROFOAM 115 shall be used.

(3) Manholes.

a. Manhole bases, barrels and tops shall be precast concrete units conforming to ASTM C478. Concrete for manhole inverts and other similar items shall have a twenty-eight-day compressive strength of not less than three thousand (3,000) psi. All reinforcement required shall be standard reinforcement conforming to the requirements set forth in ASTM A615, Grade 40.

b. All exterior surfaces of the manhole shall be coated with the manufacturer's epoxy coating providing a continuous waterproof coating without thin spots or exposed concrete surfaces. Where a manhole is installed in a high groundwater area, in addition to the factory-applied epoxy coating, the exterior of the manhole shall have a heavy coating of bituminous waterproofing material applied in the field. The bituminous coating shall be applied consistently to the belowground exterior surfaces and over the top of the external joint wrap.

c. The top section required for change of diameter shall be eccentric cone or flat slab if approved by the Town Engineer or shown on the Standard Details. The access step layout shall
provide consistent spacing throughout the cone and barrel sections. To bring the manhole cover to the correct elevation, the adjustment section of each manhole shall be precast concrete grade adjustment rings. These rings shall be not less than six (6) inches wide and furnished in heights to allow for one-inch adjustment. Total adjustment height with grade rings shall not exceed eight (8) inches.

d. Manholes for sewers of less than sixteen-inch diameter shall have a minimum inside diameter of four (4) feet for straight-through runs of pipe or for pipes entering at ninety (90) degrees to the out flow pipe. Manholes for sewers of sixteen-inch through twenty-one-inch diameter shall have a minimum inside diameter of five (5) feet for straight-through runs of pipe or for pipes entering at ninety (90) degrees to the out flow pipe.

e. Where pipes enter a manhole at angles less than ninety (90) degrees from any other pipe or for pipe sizes larger than twenty-one (21) inches, the applicant shall consult the Town for the required manhole diameter requirements.

f. Manhole depths shall not exceed ten (10) feet, measured from the pipe invert elevation to top of finish grade, without prior approval of the Town.

g. Manholes shall be constructed and installed in accordance with Attachment A-39 – Standard Precast Concrete Manhole, Attachment A-40 – Shallow Precast Concrete Manhole and Attachment A-41 – Drop Precast Concrete Manhole.

(4) Manhole joints: Joints between precast manhole sections are to be sealed with Rub-R-Nek LTM by Henry Company or approved alternate gasket material.

(5) External joint sealing. In addition to the gasket material used within the joints between sections of the manhole, an external joint wrap is required. The joint wrap shall be a self-adhered membrane consisting of two (2) waterproofing materials consisting of aggressive rubberized asphalt adhesive backed by a layer of high density cross laminated polyethylene as manufactured by Grace Construction Products or approved equal. The membrane strips shall be a minimum of twelve (12) inches wide.

(6) Flexible watertight boot. A flexible watertight "boot" system shall be provided to seal around the sewer line entering the precast manhole base. Acceptable products include:

a. PSX Positive Seal, as manufactured by Press-Seal Gasket Corp., Fort Wayne, Indiana;

b. Kor-N-Seal, as manufactured by NPC, Inc., Milford, NH; or

c. An approved alternative.

The sanitary sewer pipe shall protrude through the manhole wall. Where a pre-poured invert trough is present in the manhole base, the pipe shall extend to that point. Where a pre-poured invert trough does not exist, the pipe shall extend a minimum distance of six (6) inches inside the interior face of the manhole wall.
(7) Manhole covers. Manhole frames and covers shall be cast iron with the word "SEWER" cast on the cover. The frame shall provide a minimum clear opening of twenty-four-inch diameter unless otherwise approved, manhole lids shall be gasketed, unbolted lids per Neenah Model R-1500 "Self-Sealing" or approved equal. If a gasketed, bolted lid is required by the Town, it shall be Neenah Model -1915-S1, or approved equal.

(8) Manhole steps.

a. Manhole steps shall be injection-molded polypropylene encapsulating a one-half-inch diameter grade 60 reinforcing rod. and shall be M.A Industries step, Model PS-1PF, as provided by Amcor Precast, Littleton, CO, or approved equal.

b. Manhole steps shall be installed in each manhole with equal spacing of one (1) foot on center in vertical alignment from the top step to the bottom step. The top step shall be installed within the range of one (1) foot three (3) inches minimum to one (1) foot eight (8) inches maximum from the top of the lid elevation. The bottom step shall be installed within the range of ten (10) inches minimum to one (1) foot three (3) inches maximum from the manhole bench. The precast manhole barrels shall be sized vertically to accommodate this step spacing with adequate distance between barrel joints and steps to provide the structural support required for safe ingress/egress.

(9) Warning tape. Warning tape shall be installed continuously in the trench above the sewer line a distance of thirty (30) inches above the pipe. The warning tape shall be three (3) inches wide, green in color with the legend "Caution Buried Sewer Line Below" in black and extend continuously in the trench. If any existing warning tape is damaged in construction activities, the contractor shall splice additional warning tape to each end to provide a continuous warning tape along the sewer line. Warning tape shall be installed on sewer service lines from the tap at the main to the edge of the right-of-way or easement.

(10) Marker posts. Fiberglass reinforced composite marker posts shall be installed adjacent to each manhole located outside a paved road surface. The marker posts shall be a minimum of three and one-half (3½) inches wide allowing for a three-inch decal to be placed on one (1) or both sides. The post shall extend four (4) feet above finish grade and include a minimum of eighteen (18) inches anchor depth underground. The marker posts shall be green in color.

(11) Casing pipe. Steel casing pipe shall be installed at all state highway crossings, railroad crossings, waterway crossings and at major street locations and locations where the sanitary sewer passes under a significant drainage structure, retaining wall or other similar site structure as determined by the Town. Steel casing pipe shall be installed either as a bore casing or an open trench casing per the approved plans. The casing shall extend beyond the edge of shoulder, top of bank or the toe of slope a distance equal to one and one-half (1½) times the depth of the casing pipe, unless otherwise approved by the Town. The carrier pipe within the casing pipe, including the first two (2) joints outside the casing pipe on each end, shall be push-on single gasket C900/C905 PVC pipe and shall have retrained joints. Three (3) skids shall consist of a steel skid clamp with neoprene or PVC runners. Four (4) runners shall be attached to each skid at ninety-degree positions around the pipe. Reference Attachment A-25 – Bore Casing Detail. The steel casing pipe shall have fully welded joints to provide a smooth seamless transition through the casing pipe and be of the minimum size and wall thickness meeting the following requirements:
<table>
<thead>
<tr>
<th>Carrier Pipe Nominal</th>
<th>Casing Pipe</th>
<th>Minimum Wall Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>12&quot;</td>
<td>0.188&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>16&quot;</td>
<td>0.250&quot;</td>
</tr>
<tr>
<td>8&quot;</td>
<td>18&quot;</td>
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<tr>
<td>12&quot;</td>
<td>22&quot;</td>
<td>0.344&quot;</td>
</tr>
<tr>
<td>16&quot;</td>
<td>28&quot;</td>
<td>0.406&quot;</td>
</tr>
<tr>
<td>20&quot;</td>
<td>32&quot;</td>
<td>0.469&quot;</td>
</tr>
</tbody>
</table>

Trench-laid casings shall be installed per trenching standards and detail.

(c) Pipeline installation.

(1) At such time work begins to install a new sanitary sewer line into the existing sanitary sewer collection system, the contractor shall plug the new sanitary sewer line at the connection point to the existing system with a watertight plug. The plug and its installation method shall be acceptable to the Town. The plug shall remain in place until the project is complete and final acceptance is granted by the Town or the Town authorizes its removal. The Town will notify the applicant in writing at such time that the plug can be removed. The contractor shall be responsible to thoroughly clean and pump the water and debris from the line prior to removing the plug. Water and debris from cleaning the line shall be properly disposed of by the contractor in a manner acceptable to the Town.

(2) The sanitary sewer pipe shall extend through the manhole wall and shall be flush or slightly inside the interior manhole wall surface on each side (mid-point of the pipe).

(3) The sewer system shall be installed in a thorough, workmanlike manner in accordance with the design documents that have been approved by the Town. The minimum bedding and backfill requirements shall be as shown on Attachment A-38 – Sewer Main and Service Line Bedding and Backfill Detail.

(4) The minimum cover shall be seven (7) feet from top of sewer line to finished grade. Pipelines shall not be placed deeper than ten (10) feet without prior approval by the Town. A minimum of five (5) feet of cover will be allowed if approved pipeline insulation is provided, in accordance with Attachment A-38 – Sewer Main and Service Line Bedding and Backfill Detail. If insulation is installed, use approximately six (6) inches of a fine-grained material (i.e., Class 6/road base, sand or squeegee/pea gravel) for the pipe zone materials above and beneath the insulation to protect it from breakage during backfill.

(5) If the bottom of the excavation is soft or unstable and, in the opinion of the Town, is not a satisfactory support for the pipeline, further depth and/or width shall be excavated and refilled to six (6) inches below the pipe outside diameter (excluding bells) with trench stabilization material, as specified in Article 5, Division 2, of this Chapter.
(6) Each pipe length and fitting interior, interior surface of bells and exterior surface of spigots shall be cleaned of all foreign material before placing it in the trench and shall be kept clean all times thereafter. Each item must also be examined for cracks and other defects before installation.

(7) Pipe shall be cut, only whenever necessary, to conform to location of manholes or connections. All cuts shall be straight, true and at right angles to the axis of the pipe, unless otherwise noted or directed by the Town Engineer. The cutting process shall leave a smooth end without damaging the pipe. All burrs shall be removed from the ends of cut pipe and the end chamfered and lightly rasped or filed. All tools used in cutting pipe shall be subject to the Town Engineer's approval. The manufacturer's requirements for lubrication and gaskets must be followed.

(8) Pipe laying shall proceed upgrade with the spigot ends of pipe pointing in the direction of the flow, unless otherwise approved by the Town Engineer. Each pipe length shall be laid true to line and grade in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets to the flow line. Pipe shall be laid in an unwatered trench and shall not be used for draining water from the trench. Pipes are to be kept clean by capping or plugging ends with a mechanical plug approved by the Town.

(9) Full sections of pipe shall be installed whenever possible. Cut sections of pipe shall only be used as required to connect to wye branches or manholes at designated stations. Use of multiple cut sections of pipe between a manhole and a wye branch, a wye branch and another wye branch, a wye branch and a manhole or two (2) manholes is unacceptable and will be rejected.

(d) Manhole installation.

(1) Manholes shall be constructed to conform to the detail shown in the standard details and shall be set plumb. The invert channels shall be smooth and semi-circular in shape, conforming to the inside of the incoming and outgoing sewer pipelines. Changes in direction of flow shall be made with a smooth curve with as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. Where differences in invert elevations exist, sloped flow channels shall be formed so that the sewage does not undergo a vertical drop. The floor of the manhole outside of the channel shall be smooth and shall slope toward the channels not less than one (1) inch per foot and no more than two (2) inches per foot. The top circumference of the base shall be finished level and smooth to permit obtaining a watertight joint. The manhole covers shall be set with their tops at the grades set forth in the standard details.

(2) Manholes located within the street shall be raised to final grade with either asphalt surfacing installed adjacent to the manhole or with a concrete collar. If the manhole is set at final grade during the asphalt paving process the following procedure shall be followed:

a. Installation of the bottom lift of asphalt shall be placed over the top of the manhole.

b. The manhole shall be exposed and set to its final grade at one-half (½) inch lower than the grade of the final street surface. Any void created in the bottom lift of asphalt by exposing and raising the manhole shall be filled with compacted hot mix asphalt prior to placement of the top lift of asphalt. Paving rings shall not be used.
c. Installation of the top lift of asphalt shall be placed and compacted maintaining the required vertical distance from the street surface to the top of the manhole. The manhole ring and cover shall remain vertical and centered over the cone section.

d. If a concrete collar is the selected method used to raise the manhole to final grade, it shall be installed after the top lift of asphalt is placed and in accordance with either Attachment A-29 – Structure/Manhole Concrete Collar Detail or Attachment A-30 – Optional Manhole/Structure Adjustment Detail. Manhole tops without bolted, gasketed covers shall not be set at or below surrounding grade, except in paved roadways. The site shall be graded so that drainage is away from the manhole.

e. Each joint of the precast manhole barrel shall have at least one (1) continuous gasket placed on the lower ledge before the barrel immediately above is lowered into place. Joints between the precast manhole barrel sections and the cast-in-place manhole bases shall use two (2) continuous gaskets and shall be wrapped externally using the external joint sealing material. In both cases, the surface of the precast barrels and/or the cast-in-place bases shall be smooth, clean, coated with a bituminous or epoxy coating and sound. The joint surfaces shall be cleaned to remove any concrete projections or dirt which may prevent a watertight seal from being established. The joints shall be prepared and the gaskets shall be placed in accordance with the manufacturer's recommendations.

f. External joint sealing wrap shall be applied to clean, dry, epoxy-coated concrete surfaces. The wrap shall be placed with the manhole joint centered within the membrane strip and overlapped a minimum distance of eighteen (18) inches when wrapped around the manhole. The wrap shall be applied immediately prior to backfilling, so that when backfill is compacted, the earth pressure forces bituminous wrap into concrete surfaces. Temperature of manhole sections and of backfill materials must be above forty (40) degrees Fahrenheit from the time of applying wrap to the time of backfilling.

g. New sanitary sewer lines entering an existing manhole shall only be connected if an existing sewer line stub-out is present or by core drilling a hole in the existing manhole wall suitable for installation of a flexible watertight boot.

(e) Underdrains. Underdrains laid in the same trench as a sanitary sewer line are not permitted. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-350. Flushing and leak testing.

(a) Sanitary sewer line flushing and leak testing.

(1) The following testing procedures are intended to determine if the sanitary sewer line meets the Town's minimum quality standards. Alternative procedures meeting or exceeding the intent of these procedures, as determined by the Town's Engineer, may be acceptable. In any case, however, proposed alternative testing procedures shall be included in the design plans and specifications submitted to the Town for review and approval.

(2) The Town shall be notified no less than forty-eight (48) hours prior to the desired test time.
(3) The Town shall witness all tests and verify the accuracy and acceptability of the equipment utilized. The Town will review the test procedures for any section that fails to pass any test and review the method proposed by the applicant to repair the failed section. The Town shall approve all repair methods. Following the repair, the section shall be retested.

(4) Pipeline flushing. The pipelines shall be flushed as the work progresses, by means that are in accordance with good practice, to ensure that earth, sand, rocks or other foreign materials are removed from the interior of the pipeline. All debris flushed at the lower end of the new pipeline shall be caught and removed to ensure that the debris doesn't enter the Town's system.

(5) Alignment and grade. Sewer pipelines will be checked by the Town to determine whether any displacement of the pipe has occurred after the trench has been bedded. The test will be as follows:

   a. A light will be flashed between manholes or, if the manholes have not as yet been constructed, between the locations of the manholes by means of a flashlight or by reflecting sunlight with a mirror.

   b. If the illuminated interior of the pipelines shows poor alignment, displaced pipe, earth or other debris in the pipe or any other kinds of defects, the defects, as determined by the Town, shall be remedied by the contractor.

   c. The test will be repeated following completion of backfilling and any poor alignment, displaced pipe or other defects, as determined by the Town, shall be corrected at no cost to the Town.

(6) Leakage testing by exfiltration.

   a. Tests for water tightness shall be made by the contractor in the presence of the Town. The contractor shall provide assistance to the Town in development of a detailed record of the testing program. The sewer line and connections shall not leak in excess of the following rate for a twenty-four-hour test period:

<table>
<thead>
<tr>
<th>Pipe Size (in inches)</th>
<th>Leakage in Gal/Foot/24 Hours</th>
</tr>
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<tbody>
<tr>
<td>18</td>
<td>0.68</td>
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<tr>
<td>15</td>
<td>0.57</td>
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<td>8</td>
<td>0.30</td>
</tr>
<tr>
<td>6</td>
<td>0.23</td>
</tr>
</tbody>
</table>

   b. Each reach of pipeline between manholes shall be tested individually. Any individual reach that leaks in excess of the amount allowed in the previous paragraph shall be considered
as failing, and shall be repaired and retested. At the discretion of the Town, the time for leakage rate test may be shortened to four (4) hours.

c. The tests and measurement of infiltration or exfiltration shall be conducted in a manner as approved by the Town. The minimum head for the exfiltration tests shall be two (2) feet above the top of the pipe at its highest point in the test section. Sections shall be bulk-headed so that during any test the head on the sewer at its lowest elevation will not be more than ten (10) feet. This restriction does not apply to ductile-iron pipe or C-900/C-905 PVC pipe.

d. The contractor shall repair the sewer in a manner that is satisfactory to the Town and re-test until satisfactory tightness is obtained.

(7) Leakage testing by infiltration. Infiltration tests will be used if the groundwater table is likely to be one (1) foot or more above the invert of the finished sewer. Otherwise, exfiltration tests will be used. The allowable leakage rates are as tabulated in Subsection 14-3-350(a)(6)a.

(8) Low-pressure air test. At the option of the contractor, low-pressure air testing of the installed sewer pipe in accordance with ASTM F1417 procedure may be used instead of the leakage exfiltration test. The following criteria and procedure shall be utilized, unless otherwise approved by the Town:

a. Plug restraint. It is extremely important and essential that all plugs be installed and braced in such a way that blowouts are prevented. It is recommended that every plug be positively braced and that no one be allowed in the manhole adjoining a line being tested, so long as pressure is maintained in the line.

b. Relief valve. All pressurizing equipment used for low-pressure air testing shall include a regulator or relief valve set no higher than nine (9) psig to avoid over-pressurizing and displacing temporary or permanent plugs. As an added safety precaution, the pressure in the test section should be continuously monitored to make certain that it does not at any time exceed nine (9) psig.

c. Plug design. Either mechanical or pneumatic plugs may be used. All plugs shall be designed to resist internal testing pressures without the aid of external bracing or blocking. However, the contractor should internally restrain or externally brace the plugs to the manhole wall as an added safety precaution throughout the test.

d. Singular control panel. To facilitate test verification by the Town, all air used shall pass through a single, above-ground control panel.

e. Equipment controls. The above-ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge and a continuous monitoring pressure gauge having a pressure range from zero (0) to at least ten (10) psi. The continuous monitoring gauge shall be no less than four (4) inches in diameter with minimum divisions of one-tenth (0.10) psi and an accuracy of plus or minus four-hundredths (0.04) psi.

f. Separate hoses. Two (2) separate hoses shall be used to: (1) connect the control panel to the sealed line for introducing low-pressure air; and (2) a separate hose connection for constant
monitoring of air pressure build-up in the line. This requirement greatly diminishes any chance for over-pressurizing the line.

g. Pneumatic plugs. If pneumatic plugs are utilized, a separate hose shall also be required to inflate the pneumatic plugs from the aboveground control panel.

h. Laterals, stubs and fittings. During sewer construction, all service laterals, stubs and fittings into the sewer test section shall be properly capped or plugged so as not to allow air loss that could cause an erroneous air test result. It may be necessary and is always advisable to restrain gasketed caps, plugs or short pipe lengths with bracing stakes, clamps and tie rods or wire harnesses over the pipe bells.

i. Plug installation and testing. After manholes have been tested for alignment and grade and a manhole-to-manhole reach of pipe has been backfilled to final grade and prepared for testing, the plugs shall be placed in the line at both manholes and secured. It is advisable to seal-test all plugs before use. Seal-testing may be accomplished by laying one (1) length of pipe on the ground and sealing it at both ends with the plugs to be checked. The sealed pipe should be pressurized to nine (9) psig. The plugs shall hold against this pressure without bracing and without any movement of the plugs out of the pipe. No persons shall be allowed in the alignment of the pipe during plug testing. The upstream end of the line shall be plugged first to prevent any upstream water from collecting in the test line.

j. Line pressurization. Low-pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches four (4.0) psig.

k. Pressure stabilization. After a constant pressure of four (4) psig is reached, the air supply shall be throttled to maintain that internal pressure for at least two (2) minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

l. Timing pressure loss. When temperatures have been equalized and the pressure stabilized at four (4) psig, the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than three and one-half (3.5) psig. The timing pressure loss test shall then commence at a pressure reading of three and one-half (3.5) psig or any convenient observed pressure reading between three and one-half (3.5) psig and four (4) psig. (Except as adjusted for groundwater as follows.)

m. Air pressure adjustment. An air pressure correction, which must be added to the three-and-one-half psig normal test starting pressure, shall be calculated by dividing the average vertical height, in feet of groundwater above the invert of the sewer pipe to be tested, by two and thirty-one hundredths (2.31). The result gives the air pressure correction in pounds per square inch to be added. (For example, if the average vertical height of groundwater above the pipe invert is two and eight-tenths (2.8) feet, the additional air pressure above the pipe invert is two and eight-tenths (2.8) feet divided by two and thirty-one hundredths (2.31) or one and two-tenths (1.2) psig. This would require a minimum starting pressure of three and one-half (3.5) psig plus one and two-tenths (1.2) psig or four and seven-tenths (4.7) psig. The allowable pressure drop of one (1) psig and the timing in Table 1 are not affected and shall remain the same. In no case however should the starting test pressure exceed nine (9.0) psig.
n. If the time shown in Table 1 for the designated pipe size and length elapses before the air pressure drops one-half (0.5) psig, the section undergoing test shall have passed. If the pressure drop occurs before the time shown in Table 1 elapses, the test shall continue to determine if the line maintains a pressure drop of one (1) psig or less within the time noted in Table 2. If the time shown in Table 2 for the designated pipe size and length elapses before the air pressure drops one (1) psig, the section undergoing that test shall have passed.

Table 1:
Specification Time Required for a 0.5 PSIG Pressure Drop for Size and Length of Pipe Indicated for \( Q = 0.0015 \)

<table>
<thead>
<tr>
<th>Pipe Diameter (in.)</th>
<th>Minimum Time (min:sec)</th>
<th>Length for Minimum Time (ft.)</th>
<th>Time for Longer Length (sec.)</th>
<th>100 ft.</th>
<th>150 ft.</th>
<th>200 ft.</th>
<th>250 ft.</th>
<th>300 ft.</th>
<th>350 ft.</th>
<th>400 ft.</th>
<th>450 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>7:05</td>
<td>159</td>
<td>2.671</td>
<td>7:05</td>
<td>7:05</td>
<td>8:54</td>
<td>11:08</td>
<td>13:21</td>
<td>15:35</td>
<td>17:48</td>
<td>20:02</td>
</tr>
<tr>
<td>18</td>
<td>8:30</td>
<td>133</td>
<td>8.653</td>
<td>14:25</td>
<td>21:38</td>
<td>28:51</td>
<td>36:04</td>
<td>43:16</td>
<td>50:30</td>
<td>57:42</td>
<td>64:54</td>
</tr>
</tbody>
</table>
Table 2:
Specification Time Required for a 0.5 PSIG Pressure Drop for Size and Length of Pipe Indicated for $Q = 0.0015$

<table>
<thead>
<tr>
<th>Pipe Diameter (in.)</th>
<th>Minimum Time (min:sec)</th>
<th>Length for Minimum Time (ft.)</th>
<th>Time for Longer Length (sec.)</th>
<th>Specification Time for Length (L) Shown</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3:46</td>
<td>597</td>
<td>0.38</td>
<td>3:46</td>
</tr>
<tr>
<td>6</td>
<td>5:40</td>
<td>398</td>
<td>0.854</td>
<td>3:46</td>
</tr>
<tr>
<td>8</td>
<td>7:34</td>
<td>298</td>
<td>1.520</td>
<td>3:46</td>
</tr>
<tr>
<td>10</td>
<td>9:26</td>
<td>239</td>
<td>2.374</td>
<td>3:46</td>
</tr>
<tr>
<td>12</td>
<td>11:20</td>
<td>199</td>
<td>3.418</td>
<td>3:46</td>
</tr>
<tr>
<td>14</td>
<td>14:10</td>
<td>159</td>
<td>5.342</td>
<td>3:46</td>
</tr>
<tr>
<td>18</td>
<td>17:00</td>
<td>133</td>
<td>7.692</td>
<td>3:46</td>
</tr>
</tbody>
</table>

(9) Deflection.

a. All PVC sewer pipelines shall be tested for vertical deflection after placement and compaction of backfill. The method of testing shall be by deflectometer of the rigid Go/No-Go type device. Alternative methods may be permitted only as approved by the Town. Maximum allowable deflection shall be five percent (5%) of the pipe diameter. Any and all pipe with vertical deflection greater than the allowable shall be excavated, removed from the pipeline, replaced, backfilled and compacted, as specified, and retested.

b. The Town reserves the right to require the applicant to retest sewer lines after ten (10) months and up to twelve (12) months of service if the Town has concerns regarding the condition of certain sections of pipe. Sections selected for retesting will be based on the results of the initial tests, the outcome of the television inspection per preliminary television visual inspection test and deferred television visual inspection test, depth of cover or other technical factors. The applicant shall be responsible for the costs associated with such retesting.

c. The Town may elect to waive the requirement for deflection testing for any or all of the lines if, in its opinion, the internal television inspection shows no construction irregularities and/or potential areas of concern.

(b) Manhole testing. During the construction of the manholes, the contractor shall, in accordance with good practice, ensure that no earth, sand, rocks or other foreign material exists on the joint surface during assembly of the sections. The Town shall check each manhole to determine whether the manhole fulfills the requirements of the approved plans and the Town's standards.

(1) Visual examination. The Town shall visually check each manhole, both exterior and interior, for flaws, cracks, holes or other inadequacies which might affect the operation or watertight integrity of the manhole. Should any inadequacies be found, the contractor shall make any repairs deemed necessary by the Town.
(2) Leakage test. All manholes shall be tested for leakage, and all tests shall be witnessed by the Town. The leakage test shall be conducted prior to backfilling around the manhole and shall be carried out in the following manner:

a. All lines leading into or out of the manhole shall be tightly plugged.

b. The manhole shall be filled with water to a level at least two (2) inches above the uppermost step. The water shall be allowed to stand for two (2) hours to allow for normal water absorption into the manhole material. At the end of the two-hour stabilization period, if the water level in the manhole has dropped below the top step, additional water will be added to bring the level above the step, as before. Any visible external leakage or drop in water level noted within the one-hour test period shall constitute failure, and the contractor shall repair or replace the defective work and retest.

(c) Preliminary internal television visual inspection test. The applicant shall notify the Town when the sanitary sewer will be cleaned and ready for the internal visual inspection test. Upon receipt of this notification, the Town will, within a reasonable time frame, contract directly with a company to perform an internal television visual inspection test of each segment of the sewer line. A CD record of this internal inspection observation will be made of the observation prior to preliminary acceptance.

(d) Deferred internal television visual inspection test. A second internal television inspection of each segment of the sewer line shall be performed with the same format for labeling and stationing as the preliminary television visual inspection test. A CD record of this internal inspection observation will be made identical to that of the preliminary television visual inspection test. This deferred inspection is to be performed during the fourth quarter of the warranty period following preliminary acceptance of the sewer construction. If the deferred television inspection cannot be performed due to inclement weather and/or site conditions, it will be delayed until a future date when the weather and/or site conditions allow for a safe working environment to perform the inspection, as determined by the Town. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-360. Abandonment of existing sanitary system infrastructure.

In order to maintain the efficiency and integrity of the existing sanitary sewer system, a watertight cap shall be provided for any sanitary sewer system main line being abandoned. Two (2) scenarios are outlined below to provide such watertight cap:

(1) If the sanitary sewer main line is to be abandoned from an existing manhole, the abandoned line shall be cut at an approximate distance of four (4) feet from the outside wall of the manhole and a factory-made cap glued onto the end of the pipe at that location.

(2) If the sanitary sewer main line is to be abandoned from a mid-point location on an existing line, the line shall include an accessible manhole at the end of the line.

The required scenario for sanitary sewer system main line abandonment shall be determined by the Town. If the line is extended, it shall be tested in accordance with these Standards. All existing sanitary
sewer system infrastructure being abandoned shall be physically removed from the site. The infrastructure shall not be abandoned in-place. Reference ties to constructed infrastructure associated with the abandonment shall be recorded and provided to the Town. The sanitary sewer system main line abandonment shall be approved and inspected by the Town. (Ord. 389 Part I.1, 2012).

Division 4
Stormwater System Design

Sec. 14-3-410. General.

(a) The Town has adopted the Grand County Storm Drainage Design and Criteria Manual, Chapters 2 through 10, as its storm water detention/conveyance standards. All drainage appurtenances shall be designed and constructed in compliance with the details from the CDOT M&S Standards, the CDOT Standard Specifications for Street and Roadways Construction and the Urban Storm Drainage Criteria Manual. All earth drainage ways shall have a minimum flowline grade of two percent (2%). This does not apply to designed sedimentation basins. Drainage ways including roadside ditches with side slopes steeper than four (4) vertical to one (1) horizontal (4:1) shall be treated with an approved rolled erosion control product and/or slope protection. All drainage ways shall be addressed by the Engineer of Record for appropriate erosion control and rip-rap protection.

(b) Rip rap for slope protection/erosion control shall be angular hard rock with size, depth and area coverage of rip rap in accordance with design requirements of the Urban Storm Drainage and Criteria Manual. (Ord. 389 Part I.1, 2012)

Sec. 14-3-420. Basic design policies.

All new storm sewer system designs and related information shall be in accordance with these Standards. Any design standards not included within these Standards will be subject to the minimum standards set forth in other current publications found in Section 14-6-20 of this Chapter. In all cases, the more stringent standards and design criteria shall be applicable. (Ord. 389 Part I.1, 2012)

Sec. 14-3-430. Required easements.

(a) Where the municipal storm sewer system is to be located out of the public right-of-way, the applicant shall be responsible for obtaining easements required for the construction, maintenance and operation of the facilities. The legal description for the easements shall be prepared by a Registered Land Surveyor in the State. Easements shall be in a form acceptable to the Town and shall be shown on the design and as-built drawings. The Town will not approve the design documents until all required easements have been deeded to the Town, unless an alternate schedule is approved by the Town.

(b) The minimum width of easements for a single pipeline shall be thirty (30) feet. Temporary construction easements shall have a minimum width of forty (40) feet. Wider easements shall be required for deep sections of pipeline, multiple lines, steep terrain or where otherwise required by the Town. Easement widths for deep lines are determined using Attachment A-5 – Utility Easement Widths.
(c) A rectangular-shaped utility easement shall be provided as needed to provide access around each storm sewer inlet for operation and maintenance tasks. The rectangular easement shall extend three (3) feet on each side of the exterior edge of the inlet. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-440. Storm sewer piping and manholes.

All storm sewers shall be installed prior to any on-site construction. Storm sewer material may be either Reinforced Concrete Pipe (RCP) or reinforced concrete box sections. Storm sewer manholes shall be precast concrete manholes; minimum of four-foot inside diameter. Culverts shall have a minimum inside diameter of eighteen (18) inches. Reinforced Concrete Pipe (RCP) and the precast concrete manholes shall meet all applicable and current ASTM, CDOT and AASHTO Standards. The installation shall meet CDOT M&S Standards and CDOT Highway Specifications. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-450. Storm sewer inlets.

Storm sewer inlets shall be constructed of precast concrete of a size and configuration required to adequately handle the design storm water flows and the detail of the street/parking area in which they are located. All inlet grates shall be traffic rated and shall meet all applicable and current ASTM and AASHTO Standards. The installation shall meet CDOT M&S Standards and CDOT Highway Specifications. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-460. Culverts.

(a) Culverts are required at every natural flowline encountered and as conditions dictate.

(b) All culverts shall be installed prior to any on-site construction. Culvert material may be either Reinforced Concrete Pipe (RCP) or reinforced concrete box sections. Culverts shall have a minimum inside diameter of eighteen (18) inches. Minimum roadway design slopes shall be maintained from edge of pavement to top of pipe. Roadway side slopes shall not be steepened to reduce culvert length. All culvert pipes shall terminate with a flared end section and connect to all drainage features to maximize flow capacities. Corrugated Metal Pipe (CMP) shall not be allowed within the right-of-way or dedicated easements. High-Density Polyethylene (HDPE) pipe may be used under driveways but shall not be used under public or private streets. Reinforced Concrete Pipe (RCP) and HDPE pipe shall meet all applicable and current ASTM and AASHTO Standards. The installation shall meet CDOT M&S Standards and CDOT Highway Specifications.

(c) Installation. Culverts shall be laid at the grade required by the drawings and shall be installed in accordance with the following requirements:

(1) The pipe shall be protected from lateral displacement by means of a pipe embedding material as specified in Article 5, Division 2, of this Chapter. The minimum cover shall be eighteen (18) inches for roadways and twelve (12) inches for driveway culverts.

(2) The minimum grade of all culverts shall be one percent (1%).

(3) Installation of multiple pipes will require spacing between pipes of one-half (½) the diameter of the pipe, one-foot minimum spacing and four-foot maximum.
(4) Cleanout access to culverts shall be provided at least every one hundred fifty (150) feet for pipes twenty-four (24) inches in diameter or less and every three hundred (300) feet for pipes greater than twenty-four (24) inches in diameter. Cleanout access is required at every bend, vertical and horizontal.

(5) All culverts shall be installed with inlet and outlet protection and flared end sections. Culverts shall be installed such that continuous sideslope grading can be maintained per the approved plans. This may include the installation of headwalls/ wingwalls/rip-rap and level spreaders to prevent soil erosion. Slopes immediately surrounding the culvert must extend to maintain typical section grades from edge of shoulder and shall not exceed 3:1 side slopes.

(6) Driveway or street connections to a public street shall be constructed in such a way as to not impede the normal flow of drainage in roadside ditches, culverts, under-drains, bridges or other drainage works, or to cause drainage to flow onto or across the driving surface of a public street. In the event that such an impediment results in damage to a Town street, the Public Works Department will correct or remove the impediment and invoice the property owner for the costs of repairs to the road, including but not limited to labor, equipment and materials. (Ord. 389 Part 1.1, 2012)

Sec. 14-3-470. Bridge and box culvert design.

(a) Vehicular bridges are to conform to the AASHTO Standard Specifications for Highway Bridges requirements and specifications. All bridges shall satisfy HS20 load design ratings as minimum requirements. Plans are to be prepared by a professional engineer licensed in the State and are to be submitted to the Town for review and approval.

(b) Clear deck width must accommodate the full width of the traveled lanes, pedestrian walkways, railings and shoulders of approach roads. Guardrail end sections shall be provided on the approach and opposing sides of traffic flow and shall comply with the CDOT M&S Standards. All bridges shall be designed for, and provide, conduits for all utilities. The waterway area shall accommodate the one-hundred-year storm event in accordance with federal, state and Town regulations. The plans must show the contour line of the one-hundred-year storm event. (Ord. 389 Part 1.1, 2012)

ARTICLE 4

Private Infrastructure

Division 1
Street and Driveway Design

Sec. 14-4-10. Basic design policy and permitting.

All new street and driveway designs and related improvements shall meet the minimum standards within these Standards. Where access permits are required, they shall be posted and available for inspection at the work site at all times. (Ord. 389 Part 1.1, 2012)
Sec. 14-4-20. Street and driveway classifications.

Streets are classified according to function and ADTs. ADT generations are defined in Article 3, Division 1, of this Chapter. Functional classifications shall be established by the Town in accordance with the Street/Driveway Classification and Minimum Design Criteria table below. Private streets with higher ADT classifications than shown in the table below shall meet the requirements for public streets as defined in Article 3, Division 1. The applicant may be required to conduct traffic counts to establish or change existing street classifications.

(1) Private streets. A private street has the same characteristics of a local street, in that its primary use is as an access to a limited number of single-family residences or multi-family units. The street shall be designed for a design speed of not less than twenty (20) mph. The typical cross-section for a private street is shown on Attachment A-9 – Cross-Section for Private Street.

(2) Private shared drive. A private shared drive's primary use is access to a very limited number of single-family residences or multi-family units. The number of units or combination of units is limited by a maximum ADT of forty (40). The typical cross-section for a private shared drive is shown on Attachment A-10 – Cross-Section for Private Shared Drive.

(3) Individual driveway. An individual driveway is defined as a single driveway accessing only one (1) business, one (1) residence or a single-ownership property. All driveways accessing a Town street require an access permit. That portion of the driveway within the public right-of-way shall not exceed twenty (20) feet in width unless topographical conditions dictate a larger width and/or radius to accommodate emergency vehicles. In mountainous terrain, where access is dictated by site topography, the driveway width within the public right-of-way shall not exceed thirty (30) feet.

(4) Commercial driveway/parking lot drive lanes. A commercial driveway is a driveway accessing a common parking area where multiple businesses are located or a single business where large commercial vehicles enter and exit on a frequent basis. The typical cross-section for a commercial driveway shall be the same as that for a local street as shown on Attachment A-8 – Cross-Section for Local Street. All parking lot drive lanes shall be a minimum of twenty-four (24) feet wide allowing for two-way traffic. Where angle parking and/or one-way drive lanes are proposed, the Town may consider optional proposals on a case-by-case basis.

(5) Alleys. Alleys provide for limited access and will be subject to special review as appropriate to the land use plan.

<table>
<thead>
<tr>
<th>Class</th>
<th>Easement Width</th>
<th>Roadbase Width</th>
<th>Pavement Width</th>
<th>ADT</th>
<th>Shoulder Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private streets</td>
<td>32'</td>
<td>32'</td>
<td>22'</td>
<td>200</td>
<td>5'</td>
</tr>
<tr>
<td>Private shared drives</td>
<td>24'</td>
<td>22'</td>
<td>20'</td>
<td>40</td>
<td>—</td>
</tr>
<tr>
<td>Commercial Driveways</td>
<td>36'</td>
<td>36'</td>
<td>24'</td>
<td>varies</td>
<td>6'</td>
</tr>
<tr>
<td>Alleys</td>
<td>20'</td>
<td>20'</td>
<td>16'</td>
<td>min.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

NOTES:
1. Increase for the minimum easement widths may be required by the Town to accommodate for on-street parking, drainage improvements, sidewalks, trails, excessive cut/fill slopes, intersections, clear zones or required snow storage.

2. All private streets and commercial drives shall include valley pans, ribbon curbs or curbs and gutter as detailed in Attachment A-11 – Curb and Gutter.

3. On the private street or commercial driveway sections identified above, valley pans or curbs and gutter shall be used when surface flow storm drainage is proposed at the edge of the street or drive. The ribbon curb shall be used along the edge of street or drive when storm drainage is proposed in a ditch section located off the edge of shoulder.

4. The private street shoulder width of 5 feet is measured from the flow line of the concrete valley pan to outside edge of shoulder to accommodate fire trucks.

(Ord. 389 Part 1.1, 2012)

Sec. 14-4-30. Street horizontal and vertical alignment.

Street horizontal and vertical alignment shall conform with the requirements of Article 3, Division 1 of this Chapter. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-40. Street cross-sections.

Street cross-sections shall conform with the requirements of Article 3, Division 1 of this Chapter. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-50. Individual driveway cross-section.

All individual driveways shall be surfaced with a minimum thickness of six (6) inches of Class 6 roadbase material, compacted to a minimum of ninety-five percent (95%) standard dry density with the moisture content of the material within two percent (2%) of optimum, to prevent loose aggregate from tracking onto the street surface. For this reason, paving of all driveways is encouraged. Driveway grades shall be minimized wherever practical. Driveway sections which extend uphill from the Town's street and have vertical grades within the right-of-way greater than five percent (5%) shall be paved. That portion of the driveway that meets these criteria shall be paved to avoid erosion onto the public street. The minimum thickness of the paved portion of driveway which extends into the Town right-of-way shall match the existing depth of the adjacent asphalt roadway, or a minimum of five (5) inches thickness, whichever is greater. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-60. Street intersections.

Street intersections shall conform with the requirements of Article 3, Division 1. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-70. Pedestrian facilities.

Pedestrian facilities shall conform with the requirements of Section 14-3-80. (Ord. 389 Part 1.1, 2012)
Sec. 14-4-80. Signage and striping.

(a) All signs, striping, markers, delineators, signals and other traffic control devices must conform to the MUTCD and the Colorado Supplement to the MUTCD. No signs are permitted within the public right-of-way without the approval of the Town.

(b) All required street identification signage and no parking signs shall be consistent with Fraser’s current standard signage content detail and installation standards. Speed limit signs, stop signs, emergency turn around signs, striping and other traffic control devices shall meet current Town installation standards. All signage shall be installed by, and paid for by, the applicant following approval by the Town. The applicant should contact the Town for the current signage content detail and installation requirements.

(c) All sign sheeting shall conform to ASTM D4956-04 and the retroreflectivity requirements as defined in the MUTCD. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-90. Pavement design.

Pavement design for streets, private shared drives and commercial driveways shall conform with the requirements of Article 3, Division 1 of this Chapter. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-100. Grading.

Slopes should be gradual at all intersections to allow for sufficient snow storage and not interfere with the intersection sight triangle. The maximum cut/fill slope requirement is three (3) vertical feet to one (1) horizontal foot (3:1). Slopes exceeding the 3:1 grade shall not be considered usable snow storage. Slopes shall be protected from erosion. Retaining walls for improvements on private property shall not extend into the public rights-of-way or easements. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-110. Structures.

All driveways that utilize a bridge or box culvert to cross a waterway shall be designed and sealed/signed by a professional engineer, licensed by the State, and shall conform to the AASHTO Standard Specifications for Highway Bridges. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-120. Culverts.

All culverts shall be installed prior to any on-site lot construction. Culvert material may be either Reinforced Concrete Pipe (RCP) or High-Density Polyethylene (HDPE) pipe with smooth interior wall. Corrugated Metal Pipe (CMP) shall not be allowed within the right-of-way or dedicated easements. Culverts shall have a minimum inside diameter of eighteen (18) inches and maintain a twelve-inch cover from the top of the pipe to the bottom of the asphalt pavement section. Any variation to this culvert size shall require a variance; see Section 16-4-30 of this Chapter. Minimum roadway design slopes shall be maintained from the edge of the pavement to the top of the pipe. Roadway side slopes shall not be steepened to reduce culvert length. All culvert pipes shall terminate with a flared end section and connect to all drainage features to maximize flow capacities. (Ord. 389 Part 1.1, 2012)
Sec. 14-4-130. Revegetation, erosion and sediment control.

See Article 5, Division 4 of this Chapter.  (Ord. 389 Part 1.1, 2012)

Sec. 14-4-140. On-site snow storage.

Functional on-site snow storage shall be provided within the private property and shall not be placed within the street right-of-way or easements unless an off-site snow storage easement has been approved.  (Ord. 389 Part 1.1, 2012)

Division 2
Water Service Line Standards

Sec. 14-4-210. General.

(a) No service line may be connected to the public water system without prior approval from the Town. The applicant must provide adequate information describing the nature of the building or development to be connected, the proposed service line size, meter location and the proposed connection point of the service line to the main. A site plan showing the location of the proposed service line relative to other utilities on and adjacent to the property must be presented. The drawing must show the location of buildings served and parts of the site that are to be paved or otherwise intended to be kept clear of snow and must also show depth of cover over the service line.

(b) The sizing of water service lines shall be the responsibility of the applicant. Service line installation and maintenance is the responsibility of the applicant, including the costs thereof and for payment of actual costs of permitting, review and inspection provided by the Town. The service line, from the water distribution main to the point of connection to the building, is the responsibility of the owner of the property served. Repairs to the service line and obtaining the required permits are also the responsibility of the property owner.

(c) Any service line construction or maintenance within the Town right-of-way requires an access permit from the Town.

(d) All new water service facilities shall be in accordance with these standards and the International Plumbing Code as adopted by the Town, other applicable codes and generally accepted good construction practices.

(e) Connection of any water service line between a structure and the water main shall only be made after the service line has been pressure tested, disinfected, inspected and approved by the Town.  (Ord. 389 Part 1.1, 2012)

Sec. 14-4-220. Potable water services.

(a) Sizing. Sizing for potable water services shall be made in general conformance with AWWA Manual M22, Sizing Water Service Lines and Meters. When requested by the Town, the applicant shall, at its expense, furnish data, plans, calculations or other information as required for the evaluation of the service size.

(b) Service connections.
(1) Service connections shall be installed per Attachment A-34 – Water Service Line and Curb Stop and Attachment A-35 – Water Meter Assembly Installation. No connection between the water system of the Town and the water facilities of the owner may be made except in a public street adequate to accommodate this connection or in a location which provides adequate access for Town personnel and which is suitable for buried pipe.

(2) Where parallel or approximately parallel to a structural wall, the service line shall be at least five (5) feet from the wall. Penetrations through structures shall be at right angles, or close thereto, through PVC sleeves, and shall provide flexibility such that the service line will not be damaged by settlement of the structures.

(3) The water service shall be laid at uniform grade and in straight alignment. A reference mark shall be placed on the curb above the service line.

(4) Water and sewer service lines shall have ten (10) feet minimum horizontal separation measured from outside edge of pipe to outside edge of pipe. Where this separation is impractical, the Town may permit other separation requirements in accordance with applicable standards. If a water service line crosses a sewer main or sewer service, the water line shall be protected per Attachment A-23 – Pipe Crossing Detail.

(5) The minimum cover shall be nine (9) feet from the top of the water service line to the finished grade. A minimum of seven (7) feet of cover will be allowed if at least two (2) inches of approved pipeline insulation is provided per vertical foot of cover less than nine (9) feet. The insulation installation shall be in accordance with Attachment A-18 – Water Main and Service Line Bedding and Backfill Detail and the requirements of Subsection 14-3-260(b).

(6) Warning tape shall be installed in the trench continuously above the water line, a distance of thirty (30) inches above the pipe. The warning tape shall be three (3) inches wide, blue in color with the legend "Caution Buried Water Line Below" in black and extend continuously in the trench. If any existing warning tape is damaged in construction activities, a splice shall be made using additional warning tape tied to each end to provide a continuous warning tape along the water line. Warning tape shall be installed on water service lines from the tap at the main to the edge of the right-of-way, easement and/or shut-off/curb stop.

(c) Cross-connections (backflow).

(1) Cross-connections of any type that permit a backflow condition from any source other than the Town's potable water mains shall have a testable backflow prevention device in place of the type commensurate with the degree of health hazard posed. Each cross-connection may require a different type of backflow prevention device based on the degree of hazard posed as determined and approved by the Town.

(2) Each user of the Town water system shall install and maintain testable backflow prevention devices on potentially hazardous service connections, as required by Article 12 of the Colorado Primary Drinking Water Regulations, (5 CCR 1003-1). All service connections within the water system must comply with Article 12, Colorado Cross-Connection Control Manual and the International Plumbing Code, as adopted by the Town.
(3) Any hazardous cross-connection discovered shall be corrected immediately upon notice or the water service will be shut off.

(4) All new water service installations will be inspected for compliance with these backflow prevention requirements. See Chapter 13 of this Code.

(d) Pressure regulation. All services shall be equipped with a pressure reducing valve (PRV). The PRV shall be installed upstream of the water meter and be set for a downstream pressure not exceeding seventy (70) psig.

(e) Water service line materials. Thaw cables may be appropriate and recommended for all water services to facilitate in thawing of a frozen water service line. Contact your licensed plumber for specific details.

(1) Water service pipeline. The water service pipeline shall be Type K, soft copper conforming to ASTM B88, unless otherwise specifically approved by the Town. Fittings shall be brass or copper alloy. Connections shall be by compression type fittings. Flared fittings are prohibited and shall not be allowed. Soldered joints shall not be permitted underground. Splice joints are discouraged in all water service line installations.

(2) The Town may allow the use of polyethylene pipe meeting the requirements for water service lines as provided by the International Plumbing Code as adopted by the Town. All users of polyethylene pipe for water services are advised that this material is not conducive to line thawing procedures in the event that the service line freezes.

(3) Corporation stops. Corporation stops shall be used for the connection of services, two (2) inches and smaller, to the water main. Corporation stops shall be brass and conform to AWWA C800. The inlet shall be standard AWWA corporation stop inlet thread, and the outlet shall be for compression type "K" copper service pipe. Corporation stops shall be Mueller H-15000, Ford F-600, or approved equal, provided with an insulating coupling for potable service.

(4) Curb stops. Curb stops shall be placed per Attachment A-34 – Water Service Line and Curb Stop for all services two (2) inches and smaller. Curb stops shall be brass and conform to AWWA C800. Connections shall be for compression type "K" copper service pipe. Curb stops shall be Mueller H-15204, Ford B-22 or approved equal. Curb stop operating nut shall be extended as necessary for the operator extension to be located twenty-four (24) inches to thirty-six (36) inches from the top of the stop box. Stop boxes shall have the base section and lid constructed of cast iron with an adjustable steel upper section. A bronze spring friction ring assembly shall provide a seal between the upper and base section and provide one (1) foot of adjustment.

(5) Service saddles. Service saddles shall be used for all water taps on any pipe other than DIP (Ductile Iron Pipe). For DIP, three-quarter-inch taps may be made without using a service saddle on six-inch pipe. Three-quarter-inch and one-inch-size taps may be made without service saddles on eight-inch size of pipe or larger. All other DIP taps shall be made with a double strap bronze saddle, Smith Blair No. 357, Rockwell No. 323 or approved equal.

(6) Yard hydrants. Yard hydrants are prohibited and shall not be used.
(7) Stop and waste valves. Stop and waste valves are prohibited and shall not be used.

(f) Water meters.

(1) Meters shall be required on all connections to the Town's water distribution system. The applicant or property owner requesting service is responsible for the cost of the meter assembly and all labor and materials for the installation of the meter and appurtenances. See Attachment A-35 – Water Meter Assembly Installation.

(2) Meter locations must provide reasonable access for inspection and maintenance of the water meter assembly. Meter vaults or pits are prohibited.

(3) The Town will provide Sensus water meters as a component of the water meter assembly. All parts of the assembly are required for a complete and approved unit. Components for the water meter assemblies available are:

<table>
<thead>
<tr>
<th>¾” Meter Assembly</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td><strong>Product Description</strong></td>
</tr>
<tr>
<td>1</td>
<td>¾” SRII Meter (ECR) 1,000 gal. read, w/cast iron bottom, bronze bonnet</td>
</tr>
<tr>
<td>1</td>
<td>¾” #25AUB-Z3 Pressure reducing valve (watts)</td>
</tr>
<tr>
<td>1</td>
<td>¾” #007M3QT-S Non health-hazard backflow assembly (watts)</td>
</tr>
<tr>
<td></td>
<td>or 1 ¾” #009M3QT-S Health-hazard backflow assembly (watts)</td>
</tr>
<tr>
<td>1</td>
<td>¾” CH88-333-9275 Meter setter, Ford Copperhorn w/MIPT</td>
</tr>
<tr>
<td>2</td>
<td>¾” by close Brass nipples</td>
</tr>
<tr>
<td>2</td>
<td>¾” FBV-3 Brass ball valve, full port (watts)</td>
</tr>
<tr>
<td>1</td>
<td>510R MXU (transmitter) Single port, internal battery, touch read active</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1” Meter Assembly</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td><strong>Product Description</strong></td>
</tr>
<tr>
<td>1</td>
<td>1” SRII Meter (ECR) 1,000 gal. read, w/cast iron bottom, bronze bonnet</td>
</tr>
<tr>
<td>1</td>
<td>1” #25AUB-Z3 Pressure reducing valve (watts)</td>
</tr>
<tr>
<td>1</td>
<td>1” #007M1QT-S Non health-hazard backflow assembly (watts)</td>
</tr>
<tr>
<td></td>
<td>or 1 1” #009M2QT-S Health-hazard backflow assembly (watts)</td>
</tr>
<tr>
<td>1</td>
<td>1” CH88-444 Meter setter, Ford Copperhorn w/MIPT</td>
</tr>
<tr>
<td>2</td>
<td>1” by close Brass nipples</td>
</tr>
<tr>
<td>2</td>
<td>1” FBV-3 Brass ball valve, full port (watts)</td>
</tr>
<tr>
<td>1</td>
<td>510R MXU (transmitter) Single port, internal battery, Touch Read active</td>
</tr>
</tbody>
</table>
Greater than 1” Meter Assemblies: For meter assemblies larger than 1 inch, coordinate the meter assembly component requirements with the Public Works Department.

(4) When determining the type of backflow assembly necessary, the following shall apply: for all non-health hazard applications, the Watts 007 Series shall be installed; for all health-hazard applications, the Watts 009 Series shall be installed. In all cases where a fire suppression system or irrigation system is present, it shall be considered a high-health hazard application. All other applications will be determined and approved by the Town. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-230. Construction.

(a) General. The service line connection shall be constructed as shown in Attachment A-34 – Water Service Line and Curb Stop. All excavations for water service installations shall be adequately guarded with barricades and lights so as to protect the public from hazards, per existing governmental requirements. Utilities, streets, sidewalks, parkways and other public or private property disturbed in the course of work shall be restored to their original condition in a manner satisfactory to the Town.

(b) Service line excavation, bedding and backfill.

(1) All excavations required for the installation of a water service shall be open-trench work, unless otherwise approved by the Town. The services shall be bedded and backfilled in accordance with the minimum cover and/or insulation requirements of Subsection 14-4-220(b). The bedding and pipe zone material from the water main line to the curb stop shall meet the requirements of the bedding and pipe zone materials for the water main. Backfill materials shall be select native soils with six-inch maximum diameter rock.

(2) The connection to the water main shall be made in the presence of and approved by the Town. The line, valves and fittings must be leak-free under line pressure. The trench of each service line shall not be backfilled from the building to the tap until the completed line is approved by the Town. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-240. Service line connection.

The applicant for water service shall notify the Town when the service is ready for connection to the water main. The connection to the water main shall be made in the presence of and approved by the Town. The line and fittings must be leak-free under pressure. The service line shall meet the requirements of the Plumbing Code as adopted. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-250. As-built documentation.

The applicant shall submit an as-built drawing showing the location of the point of connection, the curb stop and other related improvements relative to visible and reasonably permanent surface features, such as sewer manholes, building corners, property pins and/or power/light poles. If the service line is part of a subdivision development project, the as-built information shall be submitted in accordance with Section 14-2-120. (Ord. 389 Part 1.1, 2012)
Sec. 14-4-260. Abandonment of existing service lines.

In order to maintain the safety and integrity of the water system, a watertight cap shall be provided for any water service line being abandoned. Three (3) scenarios are outlined below to provide such watertight cap:

1. If the water main is located under an existing paved street and the service line between the corporation stop and curb stop is determined to be copper, in sound condition as determined by the Town, the service can be abandoned by shutting off the curb stop, cutting the service line approximately six (6) inches from the curb stop and silver-soldering a cap on the cut service line, utilizing silver-solder.

2. If the water main is located under an existing paved street and the service line is of noncopper material or copper in poor shape, the corporation stop shall be exposed and shut off. A cap or plug shall be installed at the corporation stop.

3. If the water main is located outside the paved street surface area, the corporation stop shall be exposed and shut off. A cap or plug shall be installed at the corporation stop.

The required scenario for service line abandonment shall be determined by the Town. In each case, the curb stop box and cover should be removed. Reference ties to the curb stop or corporation stop shall be recorded and provided to the Town. The water service line abandonment shall be approved and inspected by the Town. (Ord. 389 Part 1.1, 2012)

Division 3
Sanitary Sewer Service Line Standards

Sec. 14-4-310. General.

(a) No service line may be constructed without prior approval from the Town. The applicant must provide adequate information describing the nature of the building or development to be connected, the proposed service line size and the proposed connection point of the service line to the main. A site plan showing the location of the proposed service line relative to other utilities on and adjacent to the property must be presented. The drawing must show the location of buildings served and parts of the site that are to be paved or otherwise intended to be kept clear of snow and must also show service line slope and depth of cover over the service line.

(b) The sizing of sewer service lines shall be the responsibility of the applicant. When requested by the Town, the applicant shall, at its expense, furnish data, plans, calculations or other information as required for the evaluation of the service size. The service line, from the sanitary sewer main to the point of connection to the building, is the responsibility of the owner of the property served. Repairs to the service line and obtaining the required permits are also the responsibility of the property owner.

(c) Any service line construction or maintenance within the Town right-of-way requires an access permit from the Town.
(d) All new sanitary sewer service line facilities shall be in accordance with these standards and the Plumbing Code as adopted, other applicable codes and generally accepted good construction practices.

(e) In cases where the sanitary sewer line is installed under a new street within a subdivision, the applicant is required to extend the sanitary sewer service lines to the property line prior to paving the street. This segment of the service line shall be pressure tested concurrently with the sanitary sewer main pressure test prior to paving the street. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-320. Sanitary sewer services.

(a) Sizing/capacity. The size and slope of the building service sewer shall be subject to the approval of the Town, but in no event shall the diameter be less than four (4) inches. Minimum grade and slopes shall be as follows:

<table>
<thead>
<tr>
<th>Size</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>2.0% normal; 1.0% minimum</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1.00%</td>
</tr>
<tr>
<td>8&quot;</td>
<td>0.60%</td>
</tr>
</tbody>
</table>

(b) Service connections.

(1) Where parallel or approximately parallel to a structural wall, the service line shall be at least five (5) feet from the wall. Penetrations through structures shall be at right angles, or close thereto, through PVC sleeves and shall provide flexibility such that the service line will not be damaged by settlement of the structures.

(2) Sewer and water service lines shall have ten (10) feet minimum horizontal separation measured from outside of pipe to outside of pipe. Where this separation is impractical, the Town may permit other separation requirements in accordance with applicable standards. If a water line passes within eighteen (18) inches vertical distance above a sewer main or service or if it lies within the minimum horizontal separation distance of the sewer main or service, the sewer service is to be modified to have "no bell" construction per Attachment A-23 – Pipe Crossing Detail. If a water line crosses under a sewer service, a twenty-foot length of C900 PVC shall be used for the gravity sewer line. Smith-Blair 229, Full Circle Collar Leak Repair Clamps, shall be installed on all sanitary sewer joints within the minimum horizontal clearance requirements, and no water line pipe joints shall be located within the minimum horizontal clearance requirement.

(3) The minimum cover shall be seven (7) feet from top of sewer service line to finished grade. Service lines with less than seven (7) feet of cover will be considered by the Town with installation of two (2) inches of pipeline insulation installed for every one (1) foot of cover less than seven (7) feet. The Town shall review and approve all locations where pipe depths are less than seven (7) feet. In no case shall a sanitary sewer service line have a depth less than five (5) feet. Service lines shall be installed in accordance with the details per Attachment A-38 – Sewer Main and Service Line Bedding & Backfill Detail.

(4) Wye tap saddles shall be installed for connection of each sanitary sewer service line to the sanitary sewer main line. Pre-installed wye fittings may be allowed on new sanitary sewer main
line construction, as an alternative to saddles, for connection of the sanitary sewer service lines to the sanitary sewer main line with prior written approval by the Town.

Wye tap saddles shall conform as follows:

For SDR 26 and SDR 35 PVC sanitary sewer lines: The wye tap saddle shall be a pre-manufactured 45° wye with gasket branch, gasket skirt and stainless steel straps (one strap on both the front and back of the wye tap saddle), Model YS0804, as manufactured by JM Eagle, or approved equal. The gaskets and straps shall be supplied by the manufacturer. Installation shall be in accordance with the manufacturer's recommendations.

For C-900/905 PVC sanitary sewer lines or vitrified clay sanitary sewer lines: The wye tap saddle shall be a flexible pre-manufactured 45° wye, Model TSW-4, with slip lock clamps and the Model TSPK-46 Pressure Kit for flexible saddle taps as manufactured by Fernco, or approved equal. The pressure kit includes bentonite tape (to be applied to the pipe interface with the sewer pipe), two reinforcing bars and two additional straps. Installation shall be in accordance with the manufacturer's recommendations.

The hole cut into the pipe shall be core drilled prior to placement of the saddle. If the pipe is damaged or broken, the applicant shall replace the broken or damaged pipe. Connection to lines larger than fifteen (15) inches shall be made using the above wye tap saddle assembly with extension clamps. All service line connections shall be approved by the Town prior to installation. The service line connection shall conform to the Attachment A-42 – Sewer Service Line Connection Detail.

All sanitary sewer service lines shall connect into the sanitary sewer main line. No sanitary sewer service lines shall be connected directly into a manhole.

(5) Warning tape shall be installed in the trench above the sewer line. The warning tape shall be installed continuously above the sewer line, a distance of thirty (30) inches above the pipe. The warning tape shall be three (3) inches wide, green in color with the legend "Caution Buried Sewer Line Below" in black and extend continuously in the trench. If any existing warning tape is damaged in construction activities, a splice shall be made using additional warning tape tied to each end to provide a continuous warning tape along the sewer line. Warning tape shall be installed on sewer service lines from the tap at the main to the edge of the right-of-way, easement and/or cleanouts.

(6) Each service line is to have a four-inch cleanout installed within twenty (20) feet of the building served, per Attachment A-42 – Sewer Service Line Connection Detail, Attachment A-43 Sewer Service Line Cleanout Detail – Unpaved Location and Attachment A-44 – Sewer Cleanout Collar Detail – Paved Location. Cleanouts are required for any forty-five-degree bend in service line direction and at intervals of no greater than ninety (90) feet.

(7) Cleanouts located within paved areas shall be raised to final grade with either asphalt surfacing installed adjacent to the cleanout or with a concrete collar. If the cleanout is set at final grade during the asphalt paving process, the following procedure shall be followed:

a. Installation of the bottom lift of asphalt shall be placed over the top of the cleanout.
b. The cleanout shall be exposed and set to its final grade at one-half (½) inch lower than the grade of the final asphalt surface. Any void created in the bottom lift of asphalt by exposing and raising the cleanout shall be filled with compacted hot mix asphalt prior to placement of the top lift of asphalt.

c. Installation of the top lift of asphalt shall be placed and compacted, maintaining the required vertical distance from the pavement surface to the top of the cleanout. The cleanout shall remain vertical and plumb.

If a concrete collar is the selected method used to raise the cleanout to final grade, it shall be installed after the top lift of asphalt is placed and in accordance with Attachment A-43 – Sewer Service Line Cleanout Collar Detail – Unpaved Location and Attachment A-44 – Sewer Cleanout Collar Detail – Paved Location.

(c) Sanitary sewer service materials.

   (1) Sewer service pipe shall be PVC and shall either be SDR 26 or C900 pipe. Where a different pipe material is encountered at the connection point to the sanitary sewer main, a flexible coupler shall be used. The flexible coupler shall be made of an elastomeric compound and shall be connected at each end with a stainless steel clamp. The coupler shall be leak-proof, root-proof and resistant to chemicals, UV rays and normal sewer gases.

   (2) The coupler shall be:

   a. Fernco, Part No. 1051-44;

   b. US Pipe Corp., Part No. 30552; or

   c. An approved equal.

   (3) When pre-approved by the Town, where sewer service lines of two (2) different pipe types are being connected together, the watertight connector fitting shall be a manufactured fitting specifically for connection of that size and type of pipe.

(d) Grease interceptors. Grease interceptors shall conform to the specifications in the International Plumbing Code as adopted by the Town and this Code. Grease interceptor layout and detail shall be submitted to the Town for review and approval prior to construction or installation.

(e) Oil and sand separators. Oil and sand separators shall conform to the specifications in the International Plumbing Code as adopted by the Town and this Code. Oil and sand separator layout and detail shall be submitted to the Town for review and approval prior to construction or installation. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-330. Construction.

   (a) General. The line shall be watertight and on a constant grade in a straight line, and not closer than five (5) feet from any structural bearing wall. No service connections shall be made during winter months from October 15th to April 15th without written approval from the Town. All excavations for sanitary sewer service installations shall be adequately guarded with barricades and lights so as to
protect the public from hazards per existing governmental requirements. Utilities, streets, sidewalks, trails, parkways and other public or private property disturbed in the course of work shall be restored to their original condition in a manner satisfactory to the Town.

(b) Service line excavation, bedding and backfill.

(1) All excavations required for the installations of the sewer service shall be open-trench work, unless otherwise approved by the Town. The services shall be bedded and backfilled in accordance with the minimum cover and/or insulation requirements of Subsection 14-4-220(b). The bedding and pipe zone material shall meet the requirements of the bedding and pipe zone materials for the sewer main. Backfill materials shall be select native soils with six-inch-maximum diameter rock.

(2) The trench of each service line shall not be backfilled from the building to the tap until the completed line is inspected and approved by the Town. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-340. Service line connection.

The applicant for sewer service shall notify the Town when the service is ready for connection to the sewer main. The connection to the sanitary sewer main shall be made in the presence of and approved by the Town. The line and fittings must be leak-free. The service line shall meet the requirements of the International Plumbing Code as adopted. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-350. As-built documentation.

The applicant shall submit an as-built drawing showing the location of the point of connection, each clean out and other related improvements relative to visible and reasonably permanent surface features, such as building corners, property pins or power/light poles. If the service line is part of a subdivision development project. The as-built information shall be submitted in accordance with Section 14-2-210. (Ord. 389 Part 1.1, 2012)

Sec. 14-4-360. Abandonment of existing service lines.

In order to maintain the efficiency and integrity of the system, a watertight cap shall be provided for any sewer service line being abandoned. Two (2) scenarios are outlined below to provide such watertight cap:

(1) If the sanitary sewer main is located under an existing paved street, the service line can be abandoned by cutting the service line at the property line, and then gluing a watertight cap on the cut service line.

(2) If the sanitary sewer main is located outside the paved street surface area, the service line can be abandoned by cutting the service line at the property line or at a location adjacent to the wye branch, as determined by the Town, and then gluing a watertight cap on the cut service line.

The required scenario for service line abandonment shall be determined by the Town. Reference ties to the capped end of the service line shall be recorded and provided to the Town. The sanitary sewer service line abandonment shall be approved and inspected by the Town. (Ord. 389 Part 1.1, 2012)
ARTICLE 5

General

Division 1
Other Utilities, Exterior Lighting and Landscaping Specifications

Sec. 14-5-10. Underground dry utilities.

(a) General.

(1) All utility installations within the Town right-of-way shall require submittal of all required permits and approval by the Town prior to any installation activity. All utilities must be clearly labeled on the plans and shall include the type, size, height, etc.

(2) All utility facilities located on individual site developments, including but not limited to water, sanitary sewer, natural gas, electric, telephone and cable television, shall be located underground throughout the development. Installation of any utility (including but not limited to transformers, risers, pedestals or connection boxes may be located above ground but must be adequately screened with planting material.

(3) All dry utility lines shall be designed according to the governing utility requirements and standards. The applicant is strongly encouraged to contact all utility providers for their current design standards and requirements during the preliminary phase of development, to ensure that adequate easements are provided.

(4) All access structures to buried dry utilities, such as manholes, valves and vaults located within public rights-of-way (such as streets, shoulders, sidewalks and trails), shall be traffic-rated and of heavy-duty construction, capable of safely supporting anticipated maintenance equipment and vehicular traffic. When a structure is located within a traveled surface, it shall be raised to final grade with either asphalt surfacing or a concrete collar installed adjacent to the structure.

(5) If a structure is set at final grade during the asphalt paving process, the following procedure shall be followed:

   a. Installation of the bottom lift of asphalt shall be placed over the top of the structure.

   b. The structure shall be exposed and set to its final grade at one-half (½) inch lower than the grade of the final traveled surface. Any void created in the bottom lift of asphalt by exposing and raising the valve box shall be filled with compacted hot mix asphalt prior to placement of the top lift of asphalt.

   c. Installation of the top lift of asphalt shall be placed and compacted, maintaining the required vertical distance from the traveled surface to the top of the structure. The structure shall remain vertical and centered over the utility.

(6) If a concrete collar is the selected method used to raise the structure to final grade, it shall be installed after the top lift of asphalt is placed and in accordance with Attachment A-29 – Structure/Manhole Concrete Collar Detail.
(7) Structures located in the shoulder area of the right-of-way shall be constructed in accordance with Attachment A-27 – Manhole/Structure/Valve Box Placement – Shoulder Area.

(8) Service lines from all public and private utilities shall be stubbed out for each lot in such a manner that it will not be necessary to disturb the street pavement, curb, gutter, roadside ditch, sidewalk, trails and/or right-of-way/property lines when connections are made.

(b) Installation.

(1) All dry utilities installed within the Town right-of-way shall be installed in conduit or per the utility company specification.

(2) The following are the minimum depths required within the right-of-way of the Town:

<table>
<thead>
<tr>
<th>Utility</th>
<th>Minimum Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Based on Town Standards</td>
</tr>
<tr>
<td>Sanitary sewer</td>
<td>Based on Town Standards</td>
</tr>
<tr>
<td>Electrical</td>
<td>4'</td>
</tr>
<tr>
<td>Fiber optics</td>
<td>4'</td>
</tr>
<tr>
<td>Gas</td>
<td>3'</td>
</tr>
<tr>
<td>Phone</td>
<td>3'</td>
</tr>
<tr>
<td>T.V. cable</td>
<td>3'</td>
</tr>
</tbody>
</table>

(3) A ten-foot centerline-to-centerline separation shall be maintained between the waterline and all dry utilities and between the sanitary sewer and all dry utilities, unless otherwise approved by the Town.

(c) Bridge/culvert crossing. In general, utilities are not permitted to be attached to bridges and must be placed at least four (4) feet below the ditch or creek flowline as close to the right-of-way line as conditions permit. The utility must be continued four (4) feet below the flow line elevation for a minimum distance of at least ten (10) feet on either side of the ditch bank or twenty (20) feet beyond the historic high water line as defined by the Town FEMA Flood Insurance Study. This would generally permit future bridge and channel improvements without the necessity of relocating utilities. Where utilities are permitted to be attached to bridges due to overriding conditions encountered in the field, as determined by the Town, then such utilities shall be installed as approved by the Town. (Ord. 389 Part 1.1, 2012)

Sec. 14-5-20. Aboveground utilities.

(a) The location and installation of any aboveground utility structures, such as cabinets, risers, poles, pedestals or other appurtenances within the Town right-of-way, are subject to Town approval.

(b) Aboveground utility structures shall not be placed to be in conflict with a pedestrian walkway or drainage way. Aboveground utility structures shall not be set less than ten (10) feet from the edge
of asphalt or concrete of any Town street or within a ten-foot radius of any fire hydrant, unless approved by the Town.

(c) In no case will an aboveground structure be permitted within the clear zone unless proper safety measures are in place (i.e., guardrail, steel concrete-filled bollards, etc.). (Ord. 389 Part 1.1, 2012)


(a) Commercial lighting for the Business District and all Mixed Use, Lodging and Commercial zoned planning areas in all Planned Development Districts.

(1) All commercial luminaires (a fixture and its bulb) shall be Dark Sky Compliant, which means that all exterior lighting fixtures shall be hooded and/or shaded so that zero (0) light is emitted above a horizontal plane drawn through the lowest part of the luminaire and no more than ten percent (10%) of light emitted at the eighty-degree angle. The industry standard for this terminology is full cut-off or fully shielded. Fixtures which are shielded by a structural element so as to meet the intent of a full cut-off fixture may be considered to be in compliance.

(2) There shall be no single bulb intensity which exceeds two hundred fifty (250) watts.

(3) Maximum height of fixtures shall not exceed twenty-five (25) feet.

(4) Light intensity at ground level shall not exceed two (2) foot-candles average within a maximum to minimum ratio of fifteen to one (15:1).

(5) Fixtures located on buildings shall not be located above the eave line or above the top of the parapet wall.

(6) A lighting plan shall be submitted on a site plan, indicating the location of each current and proposed outdoor lighting fixture with projected hours of use. The plan shall include a key to the proposed lighting that provides the following information:

a. Type and number of luminaire equipment (fixtures), including the "cut-off characteristics," indicating manufacturer and model number(s).

b. Lamp source type (bulb type, i.e., high pressure sodium), lumen output and wattage.

c. Mounting height with horizontal distance noted to the nearest property line for each luminaire.

d. Types of timing devices used to control the hours set for illumination, as well as the proposed hours when each fixture will be operated.

e. Total lumens for each fixture and total square footage of areas to be illuminated.

f. Surface finish/color of light pole, arm and fixture.

(7) Lighting manufacturer-supplied specifications ("cut-sheets") that include photographs of the fixtures indicating the certified "cut-off characteristics" of the fixture shall be submitted.
(8) A photometric plan, including estimated foot-candle levels with maximum and average illumination, is required for parking lots with ten (10) or more parking spaces. Maximum luminance levels should be expressed in foot-candle measurements on a ten-foot by ten-foot grid of the site. The grid shall include light contributions from all sources (i.e., pole-mounted, wall-mounted, sign and street light). Show foot-candle renderings a minimum of five (5) feet beyond the property lines. On the approved plan, it should be noted that no substitutions, additions or changes may be made without prior approval by the Town.

(b) Street lighting.

(1) All luminaires (a fixture and its bulb) shall be Dark Sky Compliant, which means that all exterior lighting fixtures shall be hooded and/or shaded so that zero (0) light is emitted above a horizontal plane drawn through the lowest part of the luminaire and no more than ten percent (10%) of light emitted at the eighty-degree angle. The industry standard for this terminology is full cut-off or fully shielded. Fixtures which are shielded by a structural element so as to meet the intent of a full cut-off fixture may be considered to be in compliance.

(2) Street lighting on public streets shall be designed to address locations that receive heavy pedestrian or vehicular use in areas that are dangerous if unlit, such as roundabouts, traffic circles, intersections, ramps or abrupt changes in grade.

(3) Street lights shall be a minimum distance of five (5) feet behind the back of the curb of the street, unless otherwise approved by the Town. If a sidewalk is proposed behind the back of curb, the street light shall be placed two (2) feet behind the back of the sidewalk. (Ord. 389 Part 1.1, 2012)

Sec. 14-5-40. Landscaping specifications.

Landscaping for the Business District and all Mixed Use, Lodging and Commercial zoned planning areas in all Planned Development Districts.

(1) All developments shall be responsive to site and natural conditions and minimize disturbance to land and existing vegetation. The landscaping plan shall demonstrate that a reasonable effort has been made to preserve existing healthy trees, shrubs and topsoil.

(2) Appropriate plant materials. Native and drought-tolerant plant species and seed mixes containing grasses and wildflowers are strongly encouraged, and noxious weeds and plants are prohibited, per the Colorado Noxious Weed Act (Section 35-5.5-101, et seq., C.R.S.). The utilization of the principles of Xeriscape landscaping is encouraged in order to conserve water resources. Bluegrass and other grasses requiring high consumption of water are discouraged. Ornamental nonliving materials, such as decorative rock, wood chips, mulch, brick and paving stones, shall be permitted to be incorporated into a landscaping plan. Landscaping designs should generally use a three-tier concept utilizing hardy, low-growing ground covers, medium height shrubs; and trees. The recommended Plant List for Fraser, Colorado, is available upon request. The Town shall review all landscaping plans.
(3) Revegetation of disturbed land. All areas disturbed by grading or construction, not being formally landscaped, shall be mulched and revegetated with seeding mulch (straw-crimped in place or hydromuch, etc.). See Article 5, Division 4, of this Chapter.

(4) Guarantee. Performance guarantees shall include the success of all landscaping improvements and revegetation for two (2) growing seasons after installation. Landscaping that dies within the two-year period shall be replaced and shall be required to live for at least two (2) years from the time it is replanted.

(5) Obstruction of signs and fire hydrants. Vegetation shall be placed so as not to block sight distances from driveways, corners and intersecting streets. Fire hydrants shall not be obstructed by landscaping.

(6) Wildfire defensible space. Creating a defensible space around a home and on property is an important step to take in order to protect your home and property from wildfire. Defensible space is an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure. It also creates an area where fire suppression operations can occur.

(7) A landscaping plan shall include, at a minimum, the following:
   a. Site plan, preferred scale of one (1) inch equals twenty (20) feet.
   b. North arrow.
   c. Property lines.
   d. Locations of existing and proposed structures on the site.
   e. Location of all existing and proposed hard surfaces.
   f. Location of existing natural features.
   g. Table listing of botanical names, the common names and the planting sizes and quantities of all plantings.
   h. Description of seed mixture and rates of application.
   i. Identify which existing trees will remain and which trees will be removed.
   j. Location and description of landscaping improvements, such as earth berms, walls, fences, screens, lights, ground cover, planter boxes, water elements and other natural materials.
   k. Irrigation plans.
   l. A statement providing that the owner and his or her heirs, successors and assigns will provide adequate maintenance for all site elements.
   m. Location of snow storage.
n. Minimum size for all deciduous trees shall be one (1) inch in caliper.

o. Minimum size for evergreen trees shall be six (6) feet in height.

p. Minimum size for all shrubs shall be American Nursery and Landscape Association (ANLA) #5 sizing.

q. The landscape plan shall include the contact information on who prepared the landscape design. A landscape plan drawn by a landscape architect or designer is preferred but is not required.

(8) Landscaping requirements.

a. Landscaped area: Fifteen percent (15%) of the lot area.

b. Tree requirement: Seventy-five percent (75%) of the landscaping area.

c. Shrub requirement: Fifteen percent (15%) of the landscaping area.

(9) Parking lot perimeter landscaping shall be required for parking lots with ten (10) or more parking spaces to minimize the visual impact of large paved surfaces. Pedestrian access to sidewalks and buildings should be considered in the design of the landscaped areas. Parking areas adjoining a street shall provide a landscape buffer between the street right-of-way and parking area. The landscaping may include a combination of plant materials (trees, shrubs and ground cover), earth berms, walls or fences, raised planters or other screening devices which meet the intent of this requirement. The landscaping plant materials shall include one (1) tree and two (2) shrubs for every twenty (20) feet of parking lot frontage.

(10) Parking lot interior landscaping islands shall be required for parking lots with twenty (20) or more parking spaces to minimize the visual impact of large paved surfaces. The intent of the landscaped islands is to provide a measure of aesthetics to the parking areas without seriously inhibiting snow plowing and storage. The landscaping shall be evenly dispersed throughout the parking lot at a ratio of one hundred (100) square feet for every ten (10) parking spaces or fraction thereof. One (1) tree and two (2) shrubs shall be provided for every ten (10) parking spaces or fraction thereof.

(11) Landscaping maintenance.

a. Landscaping maintenance shall include irrigation, fertilization, pruning and noxious weed control.

b. The applicant shall also submit suitable collateral to ensure the completion of the landscaping requirement. The collateral shall be no less than one hundred twenty-five percent (125%) of the estimated cost of the plant materials. The collateral shall be in a form of a letter of credit, cash deposit or other such legal assurance as may be deemed appropriate by the Town and approved by the Town Attorney. This amount shall be retained by the Town until the plant materials have been maintained in a satisfactory condition for two (2) years after installation. The Town may, during that time, draw upon the funds to replace plant materials which have
...died. The remainder of the collateral, if any, shall be returned to the owner of record upon the expiration of the two-year period. (Ord. 389 Part 1.1, 2012)

Division 2  
Trenching, Bedding and Backfill

Sec. 14-5-110. Trench zones.

The terms bedding zone, pipe zone and backfill zone shall refer to the trench zones identified in the Standard Drawings, Attachment A-18 – Water Main and Service Line Bedding and Backfill Detail and Attachment A-38 – Sewer Main and Service Line Bedding & Backfill Detail.

(1) Bedding zone. The bedding zone shall consist of all material placed below the pipe invert or, when permitted, the native materials graded and prepared for direct placement of the pipe.

(2) Pipe zone. The pipe zone shall consist of all material placed above the pipe invert to an elevation shown on Attachment A-18 – Water Main and Service Line Bedding and Backfill Detail and Attachment A-38 – Sewer Main and Service Line Bedding & Backfill Detail.

(3) Backfill zone. The backfill zone shall consist of all material above the pipe zone. (Ord. 389 Part 1.1, 2012)

Sec. 14-5-120. Material.

All bedding and backfill material shall have the approval of the Engineer of Record. All bedding and backfill material shall be free of frozen material, organic material and debris. The materials to be used in each trench zone are indicated on the Attachment A-18 – Water Main and Service Line Bedding and Backfill Detail and Attachment A-38 – Sewer Main and Service Line Bedding & Backfill Detail drawings using these materials are described below. All materials may be subject to gradation tests and compaction tests prior to approval of the use of that material.

(1) Granular bedding material. When used in the bedding zone and pipe zone with Ductile Iron Pipe (DIP), sanitary sewer PVC pipe or waterline PVC pipe, this material shall be a clean, well-graded gravelly material and shall conform to the following limits when tested by means of laboratory sieves:
Compaction of this bedding material is required utilizing mechanical tamping equipment within the bedding zone prior to installation of the pipe. Compaction testing shall be required.

(2) Class 6 Aggregate (CDOT) backfill material. When used in the bedding zone and pipe zone with Ductile Iron Pipe (DIP), sanitary sewer PVC pipe or waterline PVC pipe, this material shall conform to the following limits when tested by means of laboratory sieves:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Total Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>⅜”—1”</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>70—100</td>
</tr>
<tr>
<td>No. 8</td>
<td>36—93</td>
</tr>
<tr>
<td>No. 16</td>
<td>20—80</td>
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<tr>
<td>No. 30</td>
<td>8—65</td>
</tr>
<tr>
<td>No. 50</td>
<td>2—30</td>
</tr>
<tr>
<td>No. 100</td>
<td>1—10</td>
</tr>
<tr>
<td>No. 200</td>
<td>0—3</td>
</tr>
</tbody>
</table>

Compaction of this backfill material is required utilizing mechanical tamping equipment within the backfill zone prior to installation of the pipe. Compaction testing shall be required.

(3) Coarse aggregate bedding and/or backfill material. When used in the bedding zone and pipe zone with Ductile Iron Pipe (DIP), when sheathing is not required and sanitary sewer PVC pipe, this material shall be crushed rock or angular surfaced gravel and shall conform to the following limits when tested by means of laboratory sieves:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Total Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1”</td>
<td>100</td>
</tr>
<tr>
<td>¾”</td>
<td>90—100</td>
</tr>
<tr>
<td>⅜”</td>
<td>90—100</td>
</tr>
<tr>
<td>No. 4</td>
<td>0—10</td>
</tr>
<tr>
<td>No. 8</td>
<td>0—5</td>
</tr>
</tbody>
</table>

Compaction testing may not be required for this material, at the discretion of the Town.
(4) Select material. For use in the backfill zone, select material shall not be permitted unless authorized by the Town Engineer. This material shall consist of suitable material screened from the excavated earth having no rocks or stones greater in size than two (2) inches for DIP or RCP, three-fourths (¾) inch for all other gravity flow pipe and one-half (½) inch for all other pressure pipe.

(5) Trench stabilization material. This material shall be a three-fourths-inch to one-and-one-half-inch uniformly-graded, crushed rock or concrete aggregate.

(6) Backfill material.

   a. For use in the backfill zone, backfill material shall consist of suitable material from the excavated earth, meeting all the requirements of the specifications.

   b. No boulders over six (6) inches in any dimension shall be allowed in the trench backfill. (Ord. 389 Part 1.1, 2012)

Sec. 14-5-130. Bedding and backfill installation.

(a) Unless accurate results cannot be obtained, the compaction requirements shall conform to maximum dry density according to ASTM D698 standard test methods for laboratory compaction characteristics of soil using standard effort (Standard Proctor). When the ASTM D698 test is not applicable, the percentage compaction requirements shall conform to ASTM D4253 standard test methods for maximum index density and unit weight of soils using a vibratory table (Relative Density).

(b) In areas under roadways and in the public right-of-way, compaction tests shall be performed in the trench for the bedding and in the backfill zone one and one-half (1½) feet above the top of pipe and in one-foot vertical increments to finish grade. Compaction tests shall be performed for each vertical increment noted above and at horizontal intervals of every one hundred (100) feet, measured along the centerline of pipe. Where water and sewer lines are located within an easement outside the public right-of-way, the Town will determine if compaction and compaction testing are required on a case-by-case basis following a review of specific site conditions.

(c) The applicant is responsible for providing adequate materials testing and/or geotechnical engineering resources to provide the quality control requirements stipulated herein.

(1) Bedding zone installation. Bedding material shall consist of the material on which the pipe is placed in accordance with the pipe trench details. Bedding material shall be placed to the required elevation of the pipe invert. Tamping equipment shall be used to thoroughly tamp the bedding material to a minimum of ninety-five percent (95%) standard dry density or to seventy-five percent (75%) relative density. The moisture content of the material shall be within two percent (2%) of optimum.

(2) Pipe zone installation.

   a. After bedding material has been placed and approved and after the pipe has been installed and approved, the pipe zone backfill shall be installed to an elevation shown on the pipe trench details.
b. The pipe zone material shall be as specified on the details and shall be placed and compacted in distinct, separate lifts not to exceed six (6) inches of loose depth; except that the first loose lift shall not be higher than the pipe centerline (spring line). Compaction shall meet the requirements of Paragraph 14-5-130(c)(1), utilizing T bars or mechanical tamping equipment.

(3) Backfill zone installation.

a. Outside of the public right-of-way and not under driveways, streets and parking lots. After the pipe zone backfill has been placed and approved, the trench shall be backfilled. All backfill above the pipe zone backfill shall be carefully placed in the trench in lifts no greater than eighteen (18) inches. Each lift shall be compacted by mechanical equipment to ninety percent (90%) of standard dry density. After the trench is backfilled to the ground surface, a loaded dump truck or loader placed in the trench line shall compact the backfill by its wheel load. No fewer than two (2) passes shall be made. If the backfill is depressed below the finished grade elevation, the depressed area shall be refilled and compacted. The backfill shall be mounded higher than the adjacent ground to allow for settlement.

b. In roads, streets and parking lots and in the public right-of-way, backfill shall be carefully placed and compacted. Compaction shall be by mechanical tamping in eight-inch-maximum loose lifts using mechanical or hand tampers, weighing not less than twenty (20) pounds, or vibratory rollers. All other means must be approved in writing by the Town Engineer. All backfill shall be compacted to ninety-five percent (95%) of maximum standard dry density or seventy percent (70%) relative density. The material shall be within two percent (2%) of optimum moisture content. (Ord. 389 Part 1.1, 2012)

Division 3
Road and Trail Cut Standards and Regulations

Sec. 14-5-210. Permit and regulations.

(a) Generally.

(1) An access permit application shall be submitted for driveway construction or other improvements within the public right-of-way prior to commencing any work within the right-of-way. An approved access permit shall be posted at the work site and available upon request at all times.

(2) Work affecting any public improvement shall not be permitted between October 15th and April 15th unless approved by the Town.

(b) Boring/jacking. Where the installation of a utility improvement is underneath a surfaced area (i.e., roadways, trails, etc.), boring or jacking beneath the paved surface may be required at the discretion of the Town. Open-cut trenching is not allowed within a distance of ten (10) feet from the edge of any pavement. No water shall be used in boring and no tunneling shall be permitted.

(c) Asphalt cuts.
(1) All open cut road backfill shall be compacted in place to ninety-five percent (95%) of Standard Proctor density at two percent (2%) over/under optimum moisture. Compaction testing is the responsibility of the applicant. At the discretion of the Town, use of flowable-fill may be allowed to the bottom of the existing pavement section during construction. Sub-grades on all open cut roads within paved sections will require a proof of density test meeting the requirements of these standards.

(2) All cuts made in asphalt, concrete or chip seal surfaces shall be made by mechanically cutting to a true straight horizontal and vertical line. The final pavement edge shall be cut one (1) foot wider than the top of the trench excavation and shall not be made until immediately prior to patching. All street surface patches shall meet and match the existing street surface and cross-section.

(3) All excavations that are made in paved streets must be completely restored within thirty (30) days after acceptance of the sub-grade and backfill by the Town. Excavations between September 15th and October 15th shall be repaved within five (5) business days. Excavations within the right-of-way shall not be permitted after October 15th or prior to April 15th, unless otherwise approved by the Town. Temporary repairs may be made by tamping and rolling into place a cold mix asphaltic concrete. Such cold mix patches shall be removed and replaced by a permanent hot mix asphaltic concrete as soon as weather and availability of materials permit.

(4) Replacement asphalt for streets and roads shall be CDOT Grade C, placed on compacted sub-grade, nine (9) inches full depth or existing thickness plus three (3) inches, whichever is greater. Replacement concrete shall be CDOT Class A/B, placed on compacted sub-grade, seven-inch depth or existing thickness plus two (2) inches, whichever is greater. The concrete patch shall be doweled in place.

(5) Replacement asphalt for trails shall be CDOT Grade C, placed on compacted sub-grade, six (6) inches full depth or existing thickness plus three (3) inches, whichever is greater.

(6) Damaged pavement shall be repaired by appropriate methods as approved by the Town. In general, cracks are to be filled with the proper asphaltic product and the surface properly seal coated. An asphalt concrete overlay two (2) inches thick for the full width of the paved surface shall be required in those instances which, in the opinion of the Town, the riding quality or the appearance of the finished street has been impaired. Sub-grade failures caused by the applicant's operation of heavy equipment shall be rectified by reconstructing the sub-grade layers and replacing the sub-base, base and asphalt pavement within the damaged area and ten (10) feet in each direction from this damage area. In the event that asphaltic concrete base, soil cement or other base course materials are encountered during excavation, restoration shall be made in kind or as otherwise specified by the Town.

(7) Streets completed in areas of excavated and backfilled trenches or cuts that show signs of depressions or evidence of failure which have not been repaired by the applicant after reasonable notice may be repaired by the Town at the applicant's expense. (Ord. 389 Part 1.1, 2012)
Sec. 14-5-220. General policies.

(a) Construction work shall be planned so as not to create safety hazards or maintenance problems or to obstruct drainage ways. The Town shall be informed forty-eight (48) hours prior to the start of construction and shall be notified when construction is completed.

(b) No cleated or track equipment shall work on or move over paved surfaces without mats. Any damage to the pavement due to equipment operation shall be repaired immediately at the expense of the permittee. (Ord. 389 Part 1.1, 2012)

Sec. 14-5-230. Traffic control.

Adequate warning signs, barricades, lighting and other devices as specified in the Manual on Uniform Traffic Control Devices shall be provided, and maintained by the applicant. A copy of the applicant's Traffic Control Plan shall be provided to the Town as required by the access permit application. (Ord. 389 Part 1.1, 2012)

Sec. 14-5-240. Inspection and warranty.

A minimum of forty-eight (48) hours' notice is required to schedule inspections, which are available Monday through Thursday 8:00 a.m. to 3:00 p.m. and Friday 8:00 a.m. to 12:00 noon. Connection to any public water or sewer mains is prohibited on Friday, Saturday and Sunday. The Town will not make inspections during any period when climatic conditions interfere with making a thorough inspection, as determined by the Town.

(1) Preliminary inspection. Upon completion of construction of all improvements, the applicant shall notify the Town and request a preliminary inspection. During the preliminary inspection, a walk through will be performed and a punch list of any deficient items will be provided to the applicant within ten (10) days of the date of the walk through. Minor punch list items, as determined by the Town, may be completed during the warranty period. Significant punch list items, as determined by the Town, shall be satisfactorily completed prior to the start of the warranty period. If significant items, as determined by the Town, are noted during the walk through, the applicant shall satisfactorily complete the repair or replacement of those significant items and schedule a follow-up inspection with the Town.

(2) Warranty.

a. A twelve-month warranty is required for all street and roadway right-of-way projects. The warranty period shall commence upon written notice from the Town of satisfactory completion of the work performed under the approved access permit.

b. If deficiencies are noted during the warranty period, the Town will notify the applicant of the deficiencies. The applicant shall correct those deficiencies within thirty (30) days of notification by the Town.

(3) Final inspection and approval.
a. Approximately thirty (30) days prior to expiration of the warranty period, a final inspection will be scheduled (subject to weather).

b. Upon final inspection, if the Town finds the improvements are not substantially free of defects in materials and workmanship, final approval will not be granted. The applicant shall take such action as is necessary to correct any noncompliance and, upon correction of the same, shall request a follow up inspection by the Town.

c. Upon final approval, the release of any financial surety may be processed. (Ord. 389 Part 1.1, 2012)

Sec. 14-5-250. Emergency conditions.

Unplanned work required in a Town right-of-way due to an emergency event, such as an existing utility line break or leak, which is believed to be an immediate threat to the loss of life or property, may be completed without issuance of an approved permit. As soon as it is determined necessary for such emergency work to be performed, the Town shall be notified immediately. Such emergency work does not provide a waiver of any required permits or design and construction requirements in accordance with the Fraser Municipal Code. Any such requirements shall be addressed as soon as reasonably possible. Construction of utility lines to provide new service to customers does not constitute an emergency event and shall follow Fraser’s access permit process.

Division 4
Revegetation, Erosion and Sediment Control

Sec. 14-5-310. Introduction.

(a) The purpose of establishing and implementing these erosion and sediment control and revegetation criteria is to prevent degradation to water quality, downstream properties and receiving waterways as a result of the site disturbance.


Sec. 14-5-320. Regulatory requirements.

All applicants/developers are responsible for compliance with the Clean Water Act, the Colorado Water Quality Control Act, the Colorado Discharge Permitting System and any other applicable regulations. (Ord. 389 Part 1.1, 2012)

Sec. 14-5-330. Revegetation.

(a) All areas disturbed during construction shall include, at a minimum, three (3) inches of conditioned soil suitable for establishing the required vegetation cover and to prevent soil erosion. The seedbed shall be properly prepared to be firm but not compacted for successful seed to soil contact and germination. Seeding shall take place within fourteen (14) days of grading operations.
(b) The following seed mix shall be applied to all disturbed areas on public property, and is recommended for private property:

<table>
<thead>
<tr>
<th>Seed Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land Use</strong></td>
</tr>
<tr>
<td>Dry land non-irrigated reclamation</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Totals</td>
</tr>
</tbody>
</table>

**NOTES:**
1. The applied seed shall not be covered by soil thickness greater than 0.5” in depth.
2. To provide temporary erosion control prior to seed application, utilize surface roughening (on the contour or perpendicular to prevailing winds) and apply mulch.
3. Areas that require broadcast seeding shall be mulched and tackified.
4. Seed applied hydraulically shall include tackifier in the mix, as specified by the manufacturer.
5. Weed control in compliance with the Colorado Noxious Weed Act (Section 35-5.5, C.R.S.) and Chapter 7, Article 4 of this Code.

(c) For acceptance of revegetation, the requirements shall be defined as follows:

(1) Preliminary acceptance for revegetation shall be provided when the seed has germinated and there is visible surface coverage of thirty percent (30%) or more.

(2) Final acceptance for revegetation shall be provided when the seed has germinated and there is visible surface coverage of seventy percent (70%) or more. (Ord. 389 Part 1.1, 2012)

**Sec. 14-5-340. Rip rap.**

(a) Rip rap for slope protection/erosion control shall be angular hard rock with size, depth and area coverage of rip rap in accordance with design requirements of the Urban Storm Drainage and Criteria Manual.

(b) Rip rap in drainage courses or at the ends of storm sewer pipes shall be installed such that the top of the rip rap mat is at the final grade of the ditch flow line, side slope or area to be protected. Rip rap extending above the final grade shall be reworked to provide an unobstructed flow line or side slope surface. (Ord. 389 Part 1.1, 2012)
ARTICLE 6

Miscellaneous Provisions

Sec. 14-6-10. Publications, references and design aids.

The publications listed below are acceptable sources for design information not found in these Standards. These publications may be useful for variance request submittals. A publication not listed below may be used at the discretion of the Town.

(1) A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO); Sixth Addition.


(3) Colorado Department of Public Health and Environment, (CDPHE).


(5) State of Colorado, Design Criteria Considered In The Review of Wastewater Treatment Facilities (CDPHE); April 9, 2007.

(6) Colorado State Forest Service Wildfire Safety website.


(9) Design of Pavement Structures, (AASHTO); Fourth Edition.


(12) Town of Fraser Subdivision Regulations, Town of Fraser.

(13) Geographic Control Data Base, BLM.


(16) M&S Standard Plans, Colorado Department of Transportation (CDOT); 2011.
Sec. 14-6-20. Variance review procedure.

(a) Variances from these Standards, following a written request from the applicant, will be reviewed and considered to determine if the variance will produce a comparable result which is in the Town's interest and meets the objectives of public safety, function, fire protection, appearance and maintainability based upon sound engineering judgment.

(b) Two (2) full-size twenty-four-inch by thirty-six-inch copies and one (1) electronic PDF format copy of the variance request shall be submitted in writing to the Director of Public Works. The response to the variance request will be completed in a timely manner and provided in writing. The request for variance shall include a description of the requested variance and the applicable sections of the
Standards to which it references; detail of the variance, including applicable engineering drawings, site plans, descriptive reports, analysis and calculations; and any other applicable information.

(c) Variances from these Standards may be granted by the Town Manager upon completion of the review and evaluation. An appeal of the decision may be made to the Board of Trustees. (Ord. 389 Part 1.1, 2012)

Sec. 14-6-30. Definitions.

Access permit means written permission from the Town in order to work within the Town right-of-way to construct and/or maintain driveways, sanitary sewer service lines and water service lines.

Air Release Valve (ARV) means a waterline valve assembly installed at each high point within the water distribution system to release trapped air from the system.

Applicant means the person responsible for the development and/or improvements being proposed; also referred to herein as developer.

Arterial street means a public road serving a multi-family dwelling unit, more than one (1) single-family dwelling unit and/or commercial units and is maintained by the Town with an ADT of six hundred (600) or more.

Augmentation water line means a water pipeline carrying augmentation water from a source point to a discharge point and, if Town-owned, shall be installed in a public right-of-way or easement.

Average Daily Traffic (ADT) means the average twenty-four-hour volume, being the total number during a stated period, divided by the number of days in the period. Unless otherwise stated, the period is one (1) year.

Backfill means material used to replace or the act of replacing material removed during construction; also may denote material placed or the act of placing material adjacent to structures.

Base course means the layers of specified or selected material of selected thickness placed on a subbase or a sub-grade to support a surface course.

Board or Board of Trustees means the governing body of the Town.

Box culvert means a rectangular concrete structure typically used to either channel water or provide pedestrian access underneath a trail, street, railway or embankment.

Bridge means a structure, including walls or abutments, erected over a depression or an obstruction, such as water, highway or railway, and having a track or passageway for carrying traffic or other moving loads.

Clear zone is used to designate the unobstructed, relatively flat area beyond the edge of the roadway for the recovery of errant vehicles. Recoverable slopes are defined as 4:1 or flatter, and a nonrecoverable slope between 4:1 and 3:1.
Collector street means a public street serving a combination of multi-family dwelling units, businesses and/or single-family dwelling units with a maximum unit count generating six hundred (600) ADTs or less, and maintained by the Town.

Collection system means a Town-owned sewer pipeline carrying raw sewage only, and shall be installed in a public right-of-way or easement.

Commercial driveway means a driveway accessing a common parking area where multiple businesses are located or a single business where large commercial vehicles enter and exit on a frequent basis.

Commercial lighting means site lighting, including parking areas and driveways for commercial and business use, including but not limited to restaurants, office space, retail space, theatres, hotels, etc.

Construction season means April 15th to October 15th, unless otherwise approved by the Town.

Contour means a line, as shown on the plans, connecting points of equal elevation on a map of the land surface.

Contractor means the entity working on behalf of the applicant to construct the utilities or other physical improvements.

Corner sight distance means the necessary distance needed to accelerate enough so as to not slow the travel speed of other cars by more than ten (10) mph.

Critical flow means a condition which exists at the critical depth; under this condition, the sum of the velocity head and static head is a minimum.

Cross connection means any point in the water distribution system where chemical, biological or radiological contaminants may come in contact with potable water; also referred to as a reduced pressure or backflow condition.

Crown/cross slope means, on streets, each lane of the pavement sloping separately or having a unidirectional slope across the entire width of pavement, almost always downward to the outer edge.

Cul-de-sac means a local street open at one (1) end only and with special provisions for turning around (bulb, hammerhead, “T”, etc.).

Culvert means a closed conduit, other than a bridge, which conveys water carried by a natural channel or waterway transversely under the roadway.

Customer means any person, company, corporation, governmental authority or agency authorized to use the public water system under a permit issued or otherwise authorized by the Board of Trustees or the Town Manager.

Design speed means the speed the roadway is designed to be driven, which is also a speed determined for design and correlation of the physical features of a highway that influence vehicle operation. It is the maximum safe speed that can be maintained over a specific section of highway when conditions are so favorable that the design features of the highway govern.
Design vehicle means the maximum-sized vehicle that can reasonably be expected to travel upon the completed roadway.

Developer means a person, firm, joint venture, partnership or corporation which is the owner or operator of land and which seeks to have land developed; also referred to herein as applicant.

Drainage appurtenance means an inlet, storm sewer, curb and gutter, drain pipe, culvert, valley pans, etc.

Driveway means a minor roadway connection that falls into three (3) categories: private, commercial and public.

Dry utilities refers to electric, gas, communications, etc.

Easement means a right to use or control the property of another for a designated, specific purpose.

Engineer means the engineering firm or duly authorized representative (Engineer) designated by the Town to act on its behalf in all engineering-related matters.

Engineer of Record means the professional engineer, licensed by the State, responsible for the design and whose seal and signature appear on the plan set.

Erosion means the wearing away of land surface by detaching and transporting soil and rock particles by the action of water, wind or other agents.

Grade means the rate expressed in terms of percent of ascent or descent divided by the length.

Grading plan means a drawing showing an arrangement of contours intended to integrate construction and topography, improve appearance, retard erosion and improve drainage.

Guardrail means a protective device intended to make roadways safer by reducing accident severity.

Horizontal alignment means horizontal geometries for safe and continuous operation at a uniform design speed for substantial lengths of roadway, and shall afford at least the minimum stopping distance for the design speed at all points on the roadway.

Improvement Agreement (IA) means a written contract between the Town and the applicant, providing for construction of improvements, with collateral security to guarantee completion of such improvements.

Individual driveway means a single driveway accessing only one (1) business, one (1) residence or a single-ownership property.

Inspector means the Town Manager, Public Works Director, Town Engineer, agent, officers and employees of the Town or other person so designated by the Town Manager to perform inspections pursuant to these Standards.

Intersection means a location where two (2) streets or roadways join at, or approximately at, right angles.
**Local facilities** are those facilities generally designed primarily to serve individual subdivisions or plats. Examples include: the water distribution system, sanitary sewer collection system and storm drainage collection system.

**Local street** means a public street serving a combination of multi-family dwelling units, businesses and/or single-family dwelling units with a maximum unit count generating four hundred (400) ADTs or less and maintained by the Town.

**Minimum turning radius** means the radius of the outside of the outer front tire or overhang depicting the minimum turning path of the design vehicle.

**Oversize costs (sanitary sewer system):** This item is applicable to part of the costs of a sanitary sewer collection system to be installed within, or for, a subdivision; that the Town has also assigned a trunk line function which results in the need for a larger pipeline. Oversize costs are the difference between the actual costs of the line size required by the Town and the line size required by the applicant; however, for purposes of determining oversize, the minimum line size shall be assumed to be eight-inch diameter for sewer. Engineering and inspection costs are assumed to be proportional to estimated or experienced construction costs.

**Oversize costs (water system):** This item is applicable to part of the costs of a water distribution line to be installed within, or for, a subdivision; that the Town has also assigned a transmission function which results in the need for a larger pipeline. Oversize costs are the difference between the actual costs of the line size required by the Town and the line size required by the applicant; however, for purposes of determining oversize, the minimum line size shall be assumed to be eight-inch diameter for water. Engineering and inspection costs are assumed to be proportional to estimated or experienced construction costs. Incremental costs will be allowed for line fittings, valves, vaults and other appurtenances if a size increase is required.

**Owner** means the land's record title holder or lessee with planning powers.

**Permit** means written permission of the Board of Trustees authorizing connection to a water main or sewer main of the Town granting the applicant a license to use the water or sewer system or to receive water or sewer service from the system owned, operated or served by the Town.

**Person** means any individual, firm, company, association, society, corporation or group.

**Phasing** means constructing the development in phases. Access, drainage and utility service shall be constructed with each phase and connect to the existing infrastructure in such a manner as to provide an adequate level of service as determined by the Town.

**Point of Curvature (PC)** means the beginning of horizontal curvature, tangent to previous segment.

**Point of Tangency (PT)** means the end of horizontal curvature, tangent to next segment.

**Point of Vertical Curvature (PVC)** means the beginning of vertical curvature, tangent to previous segment.

**Point of Vertical Inflection (PVI)** means a point of two (2) intersecting grades.
**Point of Vertical Tangency (PVT)** means the end of vertical curvature, tangent to next segment or a multi-family dwelling unit.

**Potable water line** means a Town-owned water transmission and/or distribution pipeline carrying treated potable drinking water and shall be installed in a public right-of-way or easement.

**Pressure Reducing Valve (PRV)** means a waterline valve assembly used to reduce pressure within the waterline by mechanical means.

**Private shared drive** means a private shared drive serving a combination of multi-family dwelling units and/or single-family dwelling units with a maximum unit count generating forty (40) ADTs or less and is not maintained by the Town.

**Private street** means a private street serving a combination of multi-family dwelling units and/or single-family dwelling units with a maximum unit count generating two hundred (200) ADTs or less and not maintained by the Town.

**Public Works Director** means the Director of Public Works of the Town; also referred to herein as the Public Works Director.

**Pump back waterline** means a water pipeline carrying nonpotable water from a lower elevation point to a higher elevation point for discharge to a designated point and, if Town-owned, shall be installed in a public right-of-way or easement.

**Raw water supply line** means a Town-owned water supply pipeline carrying untreated raw water only and shall be installed in a public right-of-way or easement.

**Regional facilities** means those facilities generally serving the Town's service areas as a whole. Examples include: water sources, water treatment plants and tanks, water supply, transmission and distribution lines, sanitary sewer trunk lines and waste water treatment facilities.

**Right-of-way** is a general term which identifies a tract of land dedicated to the Town, usually in a strip, acquired for or devoted to transportation purposes.

**Roadway** means a portion of a traveled way, including pavement, curb and gutter and shoulders, designed primarily for motorized vehicular movements. The terms *roadway* and *streets* are used herein interchangeably.

**Shoulder** means the paved or unpaved portion of a roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use and for lateral support of base and surface courses.

**Sight distance** means the distance needed for a driver to detect an unexpected or otherwise difficult-to-perceive information, source or condition in a roadway environment that may be visually cluttered; recognize the condition or potential threat; select an appropriate speed and path; and initiate and complete the maneuver safely and efficiently.
**Slope:** Side slopes are defined herein as a specific horizontal distance for every specific vertical distance. As an example, a slope of 3:1 is a slope of three (3) feet horizontal to every one (1) foot vertical.

**Stopping Sight Distance (SSD)** means the sum of the brake reaction distance and the braking distance. SSD is measured from the driver's eyes, three and one-half (3½) feet above the road surface, to an object two (2) feet high on the road.

**Street Supervisor** means the individual designated by the Town to be responsible for the day-to-day operation and maintenance of the Town street system.

**Streets** means a portion of a traveled way, including pavement, curb and gutter and shoulders, designed primarily for motorized vehicular movements. The terms *streets* and *roadway* are used herein interchangeably.

**Sub-base** means the layer or layers of specified or selected material, of designed thickness, placed on a sub-grade to support a base course.

**Sub-grade** means the top surface of a roadbed upon which the pavement structure and shoulders, including curbs, are constructed.

**Super-elevation** means the vertical distance between the heights of inner and outer edges of roadway pavement used to prevent vehicles from sliding outward, or to counteract all the centrifugal force of a vehicle traveling at an assumed speed or roadway banking.

**Survey plat** means a plat map of a property depicting characteristics of the land, including but not limited to property corners, adjacent platted document detail, utility easements and other relevant information.

**Traffic control device** means any sign, signal marking or installation placed or erected under public authority for the purpose of regulating, warning or guiding.

**Vertical alignment** means an element of road design intended to provide adequate sight distance, safety, comfortable driving, good drainage and pleasing appearance. Stopping sight distance requirements controls minimum lengths of crest vertical curves.

**Water main** means a Town-owned water transmission and/or distribution pipeline carrying potable water only and shall be installed in a public right-of-way or easement.

**Water service line** means the privately owned water line extending from the water main to the customer's building and shall include the tap on the main, corporation stop, curb-stop valve and box and meter installation. (Ord. 389 Part 1.1, 2012)
APPENDIX 14-A

List of Attachments

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These designs, plans, and contract documents are reviewed for concept and general conformance to the Town’s minimum standards only, and the responsibility for design adequacy shall remain with the Engineer of Record. This review does not imply responsibility by either the Town of Fraser or the Town’s Engineer for completeness, accuracy or correctness of calculations. The review does not imply that quantities of items indicated on the Plans are the final quantities required. The review shall not be construed for any reason as acceptance of financial responsibility by the Town of Fraser or any of the reviewing parties for additional items and additional quantities of items shown that may be required during the construction phase.

Approved for construction **within one (1) year** of the earliest of these dates:

By ____________________________  ____________________________  
Town Engineer  Date

By ____________________________  ____________________________  
Town of Fraser  Date

By ____________________________  ____________________________  
East Grand Fire Protection District #4  Date

Note: East Grand Fire Protection District #4 signature line shall only be required on projects extending or modifying Fraser’s Water Distribution System.

**Approval Block**

**Town of Fraser**

Attachment A-1  Revised January 2015
These As-Built plans were prepared in accordance with the Minimum Design Criteria and Construction Standards of the Town of Fraser. The plans reflect the as-built conditions of the project incorporating all modifications, change orders and field adjustments made to the plan set approved for construction, last dated ____________________.

By ___________________________ Date ____________________________
Contractor

By ___________________________ Date ____________________________
Engineer of Record

By ___________________________ Date ____________________________
Developer

Approval of the As-Built Plan does not imply acceptance of the project. It only implies acceptance of form and format. It is the Developer's project team's responsibility to provide accurate complete As-Built information.

Town of Fraser

By ___________________________ Date ____________________________

As-Built Plan Submittal Block

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. REFER TO TOWN OF FRASER MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS FOR SPECIFIC MATERIAL AND INSTALLATION REQUIREMENTS.

Town of Fraser
Attachment A-2 Revised January 2015
GENERAL NOTES:

LOCATE:
- STORM SEWER BENDS
- INLETS
- FLOWLINE ELEV. & INVERT ELEV
- STORM SEWER MANHOLES
- INVERT ELEVATIONS & RIM ELEVATIONS
- ALL BUILDING PERIMETER DRAIN LINES.

NOTE:
- ANY KNOWN R.O.W. & EASEMENT INFORMATION
- DISTANCES TO EDGE OF PAVEMENT & TO R.O.W. OR EASEMENTS
- FINAL INVERT ELEVATIONS W/ BENCHMARK ELEVATION REFERENCED.
- LENGTH, SIZE, MATERIAL & SLOPE OF LINE AS INSTALLED.
- DISTANCES BETWEEN UNDERGROUND UTILITIES.
- PERMANENT EASEMENT MONUMENTS & PROPERTY CORNERS (PC) WHERE USED FOR TIES
- SERVICE STREET ADDRESSES.

As-Built Plan Required Information
(Street and Storm Drainage Systems)

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. REFER TO TOWN OF FRASER MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS FOR SPECIFIC MATERIAL AND INSTALLATION REQUIREMENTS.

Town of Fraser
Attachment A-3 Revised January 2015
As-Built Plan Required Information
(Water and Sanitary Sewer Systems)

These details are provided for standardization purposes only. This detail represents minimum design standards which may require upgrading for specific applications. Refer to Town of Fraser minimum design criteria and construction standards for specific material and installation requirements.

Town of Fraser
Attachment A-4

Revised January 2015
Utility Easement Widths

**SINGLE PIPE EASEMENT**

MINIMUM EASEMENT WIDTH = 36 FEET

**EASEMENT REQUIREMENT FOR DEEP TRENCHES**

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>Depth of Cover</th>
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<tbody>
<tr>
<td>8&quot; - 14&quot;</td>
<td>36 FEET</td>
</tr>
<tr>
<td>16&quot; - 20&quot;</td>
<td>38 FEET</td>
</tr>
</tbody>
</table>

**COMBINED SEWER & WATER EASEMENT**

MINIMUM EASEMENT WIDTH = 30 FEET

For easement widths where the depth of the waterline cover exceeds 9 feet or the depth of the sanitary sewer cover exceeds 7 feet, use the following formula and round up to the nearest foot.

**EASEMENT WIDTH = WS + WD + WW**

WHERE:

- WS = PIPE OUTSIDE DIA(FT) + 1 FT + [(HS (FT) - 1 (FT)) x 1.5]
- WD = ACTUAL HORIZONTAL DISTANCE (EDGE TO EDGE), MIN. 10 FT
- WW = PIPE OUTSIDE DIA(FT) + 1 FT + [(HW (FT) - 1 (FT)) x 1.5]
**Cross-Section for Arterial Street**

**Note:** The pavement width from Table 3.3 is measured from flowline to flowline of the curb and gutter as shown on Attachment A-11 – Curb and Gutter.
COLLECTOR STREET CROSS SECTION

*FINAL PAVEMENT DESIGN & BASE COURSE THICKNESS SHALL BE DETERMINED BY A LICENSED PROFESSIONAL ENGINEER

NOTE: THE PAVEMENT WIDTH FROM TABLE 3.3 IS MEASURED FROM FLOWLINE TO FLOWLINE OF THE CURB AND GUTTER AS SHOWN ON ATTACHMENT A-11 — CURB AND GUTTER.
LOCAL STREET CROSS SECTION

*FINAL PAVEMENT DESIGN SHALL BE DETERMINED BY A LICENSED PROFESSIONAL ENGINEER

NOTE: THE PAVEMENT WIDTH FROM TABLE 3.3 IS MEASURED FROM FLOWLINE TO FLOWLINE OF THE CURB AND GUTTER AS SHOWN ON ATTACHMENT A-11 – CURB AND GUTTER.

ABBREVIATION LEGEND:
UE – UTILITY EASEMENT
SSE – SNOW STORAGE EASEMENT
PRIVATE STREET CROSS SECTION

*FINAL PAVEMENT DESIGN & BASE COURSE THICKNESS SHALL BE DETERMINED BY A LICENSED PROFESSIONAL ENGINEER

NOTE: THE PAVEMENT WIDTH FROM TABLE 3.3 IS MEASURED FROM FLOWLINE TO FLOWLINE OF THE CURB AND GUTTER AS SHOWN ON ATTACHMENT A-11 — CURB AND GUTTER.

Cross-Section for Private Street

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. REFER TO TOWN OF FRASER MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS FOR SPECIFIC MATERIAL AND INSTALLATION REQUIREMENTS.

Town of Fraser
Attachment A-9
Revised January 2015
PRIVATE SHARED DRIVE CROSS SECTION

Cross-Section for Private Shared Drive

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. REFER TO TOWN OF FRASER MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS FOR SPECIFIC MATERIAL AND INSTALLATION REQUIREMENTS.

Town of Fraser
Attachment A-10
Revised January 2015
**GENERAL NOTES**

1. On curves 3 degrees or sharper, curbs and/or gutters are to be placed on the arc of the curve unless otherwise noted on the plans. A maximum chord length of 10 feet may be used when the degree of curve is less than 3 degrees.

2. Concrete shall be 4000 PSI Fibermesh.

3. Profile grade of curbs and gutters shall be located at the flow line.

⚠️ Expansion joints shall be installed when abutting existing concrete or fixed structure. Expansion joint material shall be ½ in. thick and shall extend the full depth of contact surface. Expanding joint shall be placed every one hundred (100) feet measured along the sidewalk and at all changes in direction.

 sobą Gutter cross slopes shall be ½ in./ft. when draining away from curb and 1 in./ft. when draining toward curb.

---

**Curb and Gutter**

These details are provided for standardization purposes only. This detail represents minimum design standards which may require upgrading for specific applications. Refer to Town of Fraser minimum design criteria and construction standards for specific material and installation requirements.
Cul-De-Sac and Turnarounds for Streets

NOTE:

WHERE DRIVEWAYS ARE PROPOSED FROM CUL-DE-SACS AND TURN AROUNDS, ADDITIONAL SNOW STORAGE EASEMENTS SHALL BE REQUIRED AS DETERMINED BY THE TOWN.

These details are provided for standardization purposes only. This detail represents minimum design standards which may require upgrading for specific applications. Refer to Town of Fraser minimum design criteria and construction standards for specific material and installation requirements.
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Sidewalks and Trails

GENERAL NOTES
EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR FIXED STRUCTURE. EXPANSION JOINT MATERIAL SHALL BE 1/2 IN. THICK AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE. EXPANSION JOINT SHALL BE PLACED EVERY ONE HUNDRED (100) FEET MEASURED ALONG THE SIDEWALK (OR CONCRETE TRAIL) AND AT ALL CHANGES IN DIRECTION.

CONCRETE SIDEWALK SECTION

DETACHED TRAIL SECTION

TRAIL SURFACING SHALL BE CONSTRUCTED OF EITHER CONCRETE OR ASPHALT. ALTERNATE SURFACE MATERIAL MAY BE CONSIDERED BY THE TOWN.
GENERAL NOTES

1. AVOID PLACING DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, FIRE HYDRANTS, OR OTHER OBSTRUCTIONS IN FRONT OF RAMP ACCESS AREAS.

2. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB TO BE INCLUDED IN THE COST OF THE CURB RAMP.

3. TRUNCATED DOME SECTION SHALL BE CAST-IN-PLACE COLORED CONCRETE, CORE 10 STEEL, OR VITRIFIED POLYMER MEETING THE REQUIREMENTS AND DETAIL OF THE ADA REGULATIONS.

Handicap Ramps

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. REFER TO TOWN OF FRASER MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS FOR SPECIFIC MATERIAL AND INSTALLATION REQUIREMENTS.
Drive Cuts

NOTES:

1. CONCRETE DEPTH SHALL BE SIX (6) INCH MINIMUM DEPTH.
2. FIELD MODIFY THE APRON SECTION IF VERTICAL CURB IS NOT LOCATED ADJACENT TO THE DRIVE ENTRANCE.

NOTE: CURB CUTS ARE TO BE PLACED MONOLITHIC WITH CURB & GUTTER.

SECTION A-A

VERTICAL CURB DRIVE CUT

NOT TO SCALE

Drive Cuts

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADE FOR SPECIFIC APPLICATIONS. REFER TO TOWN OF FRASER MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS FOR SPECIFIC MATERIAL AND INSTALLATION REQUIREMENTS.

Town of Fraser
Attachment A-15

Revised January 2015
THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. REFER TO TOWN OF FRASER MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS FOR SPECIFIC MATERIAL AND INSTALLATION REQUIREMENTS.

NOTE:
HYDRANTS SHALL BE RESTRAINED WITH THRUST BLOCKS AND RESTRAINED MECHANICAL JOINT FITTINGS UNLESS TIE RODS ARE REQUIRED AS DETERMINED BY THE TOWN OF FRASER.

CLEAR OF OBSTACLES TO ACCESS HYDRANT (360° ACCESS/WALKING PAD, TYP. ALL SIDES). PAD SHALL BE AT FINISHED GRADE AROUND THE HYDRANT AND FULL 6'-0" WIDE AT THE STREET EDGE (I.E., BACK OF CURB, BACK OF SIDEWALK, EDGE OF RIBBON CURB). FINISH GRADE SHALL BE 3:1 MAXIMUM GRADED FROM THE CLEAR ZONE LIMIT.

EXTEND HYDRANT UP TO MAXIMUM OF 12' WITH NO MORE THAN 2 EXTENSIONS. IF A GREATER EXTENSION IS REQUIRED, USE VERTICAL THRUST BLOCKS IN HYDRANT BRANCH LINE.

CONCRETE THRUST BLOCK AGAINST UNDISTURBED BANK. DO NOT OBSTRUCT DRAIN HOLE.

6" GATE VALVE WITH WIDE OVAL BASE & VALVE BOX

TOP OF OPERATING NUT OR EXTENSION

MECHANICAL JOINT RESTRAINT

MJ SWIVEL TEE

TIE RODS WITH "STAR" TIE BOLTS ENCAPSULATED IN POLYETHYLENE WRAP, OR "PROTECTO WRAP", PROVIDE (2) 3/4" GREASED STEEL (SEE NOTE) RODS.

X" X 6" MAIN LINE TEE W/ THRUST BLOCK. (USE TAPPING TEE, IF SHOWN ON PLANS).
These details are provided for standardization purposes only. This detail represents minimum design standards which may require upgrading for specific applications. Refer to Town of Fraser minimum design criteria and construction standards for specific material and installation requirements.
Bedding and Backfill Detail

Town of Fraser
Attachment A-18

THESE DETAILS ARE PROVIDED FOR STANDARDIZATION PURPOSES ONLY. THIS DETAIL REPRESENTS MINIMUM DESIGN STANDARDS WHICH MAY REQUIRE UPGRADING FOR SPECIFIC APPLICATIONS. REFER TO TOWN OF FRASER MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS FOR SPECIFIC MATERIAL AND INSTALLATION REQUIREMENTS.

Water Main and Service Line Bedding and Backfill Detail

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Town of Fraser
Attachment A-18
Revised January 2015
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**FIELD INSTALLATION-POLYETHYLENE WRAP**

**STEP 1**

PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH.

**STEP 2**

PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TurnerS OF TWO-INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END.

**STEP 3**

ADJACENT TUBE OVERLAPS FIRST TUBE AND IS SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE AND HELD IN PLACE BY MEANS OF PIECES OF THE PLASTIC TAPE AT APPROXIMATELY THREE TO FIVE FOOT INTERVALS.

**Polyethylene Wrap Detail**

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**Town of Fraser**

Attachment A-19 Revised January 2015
Concrete Thrustblocks

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**Town of Fraser**
Attachment A-20

Revised January 2015
## DIP MECHANICAL JOINT RESTRAINT

### WEDGE DETAIL

### BOLT HOLE DETAIL

### DIMENSIONS

<table>
<thead>
<tr>
<th>NOMINAL PIPE SIZE</th>
<th>NO. OF BOLTS</th>
<th>NO. OF WEDGES</th>
<th>K2 INCHES</th>
<th>J INCHES</th>
<th>F INCHES</th>
<th>M INCHES</th>
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<tr>
<td>6&quot;</td>
<td>6</td>
<td>3</td>
<td>11.12</td>
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<td>7.00</td>
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<td>8&quot;</td>
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<td>10&quot;</td>
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<td>6</td>
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<td>14.00</td>
<td>11.20</td>
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<td>8</td>
<td>17.88</td>
<td>16.25</td>
<td>13.30</td>
<td>1.25</td>
</tr>
</tbody>
</table>

**DIP NOTES:**

1. AS MANUFACTURED BY EBBA IRON INC. (MECHANICAL 1100 SERIES), OR UNI-FLANGE (SERIES 1500)
2. DIMENSIONS FOR 16" AND 20" D.I. PIPE NOT SHOWN.
3. OTHER MECHANICAL JOINT RESTRAINT DEVICES MUST BE APPROVED BEFORE INSTALLATION.

**C-900/905 NOTES:**

1. AS MANUFACTURED BY SMITH BLAIR (BELL JOINT LEAK CLAMP 274)
2. DIMENSIONS FOR 16" AND 20" D.I. PIPE NOT SHOWN.
3. OTHER MECHANICAL JOINT RESTRAINT DEVICES MUST BE APPROVED BEFORE INSTALLATION.

### Mechanical Joint Restraint Details

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**Town of Fraser**

Attachment A-21

Revised January 2015
### Length of Restrained Pipe

<table>
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<th>Pipe Size</th>
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<th>10&quot;</th>
<th>12&quot;</th>
<th>14&quot;</th>
<th>16&quot;</th>
<th>18&quot;</th>
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</thead>
<tbody>
<tr>
<td>Fitting</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>90° Bend</td>
<td>45’</td>
<td>60’</td>
<td>74’</td>
<td>86’</td>
<td>98’</td>
<td>108’</td>
<td>120’</td>
<td>132’</td>
</tr>
<tr>
<td>TEE, Plug</td>
<td>45°</td>
<td>13’</td>
<td>18’</td>
<td>22’</td>
<td>25’</td>
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<td>Valve</td>
<td>22½</td>
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<td>7’</td>
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<tr>
<td>11½° Bend</td>
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<td>17’</td>
<td>1’</td>
<td>2’</td>
<td>2’</td>
<td>2’</td>
<td>3’</td>
<td>3’</td>
</tr>
</tbody>
</table>

**NOTES:**
1. LENGTH OF RESTRAINED PIPE MEASURED EACH WAY FROM VALVES AND BENDS.
2. CLAMPS, RODS & MEGALUGS NOT ALLOWED FOR 24" & LARGER PIPES.
3. D=DIAMETER, L=LENGTH, G=GRADE, M.S.=MILD STEEL, H.S.=HIGH STRENGTH.
4. BASED ON 150 PSI INTERNAL PRESSURE.
5. LENGTH REFERS TO THE AMOUNT OF PIPE WHICH MUST BE RESTRAINED TOGETHER AND IS NOT NECESSARILY THE LENGTH OF THE RODS.
6. LENGTH OF RESTRAINED PIPE CHART IS ALSO FOR THE LENGTH OF JOINT RESTRAINT FOR MEGALUGS, OR OTHER RESTRAINT SYSTEMS.
7. CROSSES MUST BE RESTRAINED IN ALL APPLICABLE DIRECTIONS.
8. 12" AND SMALLER IN-LINE VALVES AND TEE'S SHALL HAVE A MECHANICAL JOINT RESTRAINT DEVICE ON EACH SIDE OF THE FITTING OR VALVE.
9. IF A VALVE IS WITHIN DISTANCE "L" OF A FITTING, THE VALVE MUST BE TIED TO THAT FITTING.
10. A SECOND VALVE WILL BE REQUIRED TO BE CLOSED WHEN-excavating next to existing valve.
11. IF D.I.P. IS POLYETHYLENE WRAPPED, TIE RODS ARE TO BE ENCLOSED INSIDE THE WRAP.
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Pipe Crossing Detail

WHERE THE PVC SANITARY SEWER LINE CROSSES ABOVE THE WATER LINE, INSTALL A SMITH-BLAIR 229, FULL CIRCLE COLLAR LEAK REPAIR CLAMP ON ALL SANITARY SEWER JOINTS WITHIN A 10' HORIZONTAL DISTANCE OF THE CROSSING AND INSTALL A FULL LENGTH (20' MINIMUM) LENGTH OF DIP WATER LINE CENTERED OVER THE CROSSING.

NOTE: ACCEPTABLE ALTERNATE METHOD.

Town of Fraser
Attachment A-23
Revised January 2015
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Pipe Encasement Detail

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NOTE:

1. CONCRETE SHALL NOT BE LEANER THAN 1 CEMENT; 2–1/2 SAND; 5 STONE AND SHALL NOT HAVE LESS THAN 3,000 PSI COMPRESSIVE STRENGTH AT 28 DAYS.

2. PLACE CONCRETE AGAINST EITHER SOLID FORMWORK OR UNDISTURBED SOIL.

3. USE GR. 40 REINFORCING BARS.

4. USE ONLY IF SANITARY SEWER IS BELOW THE WATER LINE. DO NOT PLACE OR SPILL CONCRETE ON WATER LINE.
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NOTE:
TRENCH Laid CASINGS SHALL BE DESIGNED AND INSTALLED TO CONDUIT STANDARDS.

Bore Casing Detail

Revised January 2015
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Locking Valve Box Detail

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1. **U-BOLTS (2) AND LOCK BAR**
   - Shall be provided by Fraser at applicant's expense

2. **24" MANHOLE RING AND BOLTED, WATER TIGHT COVER NEENAH MODEL R-1916-D OR EQUIVALENT**

3. **5" CLEARANCE BOTTOM OF MANHOLE RING TO TOP OF VALVE BOX**

4. **CONCRETE COLLAR**
   - 12" minimum thickness
   - Fiber mesh concrete

5. **6" MANHOLE ADJUSTMENT RING**
   - Set on Class 6 subbase

6. **EMBED U-BOLT INTO CONCRETE**

7. **LOCK BAR WILL BE PADLOCKED HERE USING FRASER PADLOCK**

8. **INSTALL CONCRETE COLLAR ½" BELOW FINISH HMA GRADE, ¼" BELOW FINISH CONCRETE PAVEMENT GRADE**
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NOTES:
1. "D" = \(\frac{3}{4}\)" FOR H.M.A. PAVEMENT OVERLAYS OR SURFACE TREATMENTS
2. "D" = \(\frac{3}{4}\)" FOR H.M.A. PAVEMENT RECONSTRUCTION OR NEW CONSTRUCTION
3. "D" = \(\frac{1}{2}\)" FOR CONCRETE STREETS
4. THIS DETAIL APPLIES TO BOTH ASPHALT AND CONCRETE STREETS
5. RING AND COVER TO MATCH SLOPE OF FINISHED STREET

Manhole/Structure/Valve Box Placement -Shoulder Area

This document is a revised plan for the shoulder area with specific details for the placement of manholes, structures, and valve boxes. It includes specifications for asphalt paved roadways, shoulder edges, and pavement edges. The design is not to scale and is intended for standardization purposes only. Additional requirements and specifications are provided in the Town of Fraser minimum design criteria and construction standards.
Valve Box Concrete Collar Detail

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NOTES:
1. "D" = \( \frac{3}{4} \)" FOR H.M.A. PAVEMENT OVERLAYS OR SURFACE TREATMENTS
2. "D" = \( \frac{3}{4} \)" FOR H.M.A. PAVEMENT RECONSTRUCTION OR NEW CONSTRUCTION
3. "D" = \( \frac{3}{4} \)" FOR CONCRETE STREETS
4. VALVE BOX MUST BE PLUMB AND CENTERED OVER THE VALVE NUT
5. THIS DETAIL APPLIES TO BOTH ASPHALT AND CONCRETE STREETS
6. USE FIBER MESH CONCRETE. NO REINFORCEMENT REBAR.

Town of Fraser
Attachment A-28  Revised January 2015
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1. A SEALER SHALL BE USED BETWEEN ALL ADJUSTING RINGS AS REQUIRED
2. DROP-IN RISER RINGS NOT ALLOWED
3. SET AND TILT RING AND COVER TO MATCH SLOPE OF FINISHED STREET
4. "D" = 6" FOR H.M.A. PAVEMENT OVERLAYS OR SURFACE TREATMENTS
5. "D" = 5" FOR H.M.A. PAVEMENT RECONSTRUCTION OR NEW CONSTRUCTION
6. "D" = 4" FOR CONCRETE STREETS
7. THIS DETAIL APPLIES TO BOTH ASPHALT AND CONCRETE STREETS

Structure/Manhole Concrete Collar Detail
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Optional Manhole / Structure Adjustment Detail

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Town of Fraser
Attachment A-30
Revised January 2015
Air Release Valve Structure

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Town of Fraser
Attachment A-31

Revised January 2015
Underground PRV Vault - Plan View

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Town of Fraser
Attachment A-32
Revised January 2015
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Underground PRV Vault - Section View

NOTES:
1. SEE PLAN VIEW AND ADDITIONAL NOTES.
2. ALL PIPING WITHIN THE VAULT SHALL BE LEVEL.
3. VAULT STRUCTURE THICKNESS DIMENSIONS MAY VARY WITH SITE CONDITIONS. VAULT TO BE BUILT TO WITHSTAND A MINIMUM OF H2O TRAFFIC LOADING.
4. STRUCTURE TO BE WATER TIGHT
5. APPLY EXTERNAL JOINT SEAL SELF ADHERING MEMBRANE AS MANUFACTURED BY GRACE CONSTRUCTION PRODUCTS 1/2" WIDE OR APPROVED EQUAL, TO ALL EXTERIOR JOINTS.

Town of Fraser
Attachment A-33
Revised January 2015
1. Placement of curb stop is to be on the property/right-of-way line (unless otherwise approved).

2. Owner’s responsibility for repairs extends to the corporation stop at the water main.

3. Town of Fraser is not responsible for any damage that may occur due to a leak on a service line. This is the responsibility of the owner of the property to which the service line is connected.

4. If the depth of cover is less, use insulation per attachment A-18. The "goose neck" at the corporation stop may have less cover and may require insulation even if the rest of the service line does not.

5. No couplings allowed between curb stop and meter setting.

6. No landscaping (shrubs, boulders, etc.), retaining walls or fences allowed within 4 feet of the curb stop and meter pit, and no trees within 10 feet of curb and meter pit.

7. All water and sanitary sewer service shall have a minimum horizontal separation of ten feet.

Water Service Line and Curb Stop

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NOTES:
1. PROVIDE CLEAR AND UNOBSURCTED 4 FT. BY 4 FT. MINIMUM ACCESS TO THE METER ASSEMBLY.
2. COPPERHORNS/SETTERS SHALL BE INSTALLED SO THE METERS ARE IN A HORIZONTAL POSITION.
3. A SECURE SUPPORT IS REQUIRED FOR COPPERHORNS/SETTERS.
4. METERS SHALL NOT BE INSTALLED IN CRAWL SPACES WITH LESS THAN 48” CLEARANCE, OR AS APPROVED BY FRASER.
5. PROPERTY OWNERS ARE RESPONSIBLE TO EXTEND WIRING FROM THE METERING UNIT TO THE TRANSMITTING UNIT TO BE LOCATED ON THE STREET SIDE, EXTERIOR WALL OF THE STRUCTURE AND NOT LESS THAN FOUR (4) FEET ABOVE FINISHED GRADE.
6. WIRING SHALL NOT BE SPLICED.

Water Meter Assembly Installation

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NOTES:
1. INTERIOR WALLS AND CEILING SHALL BE 3/4" EXTERIOR PLYWOOD PAINTED WHITE.
2. ALL WALLS AND CEILING SHALL BE INSULATED WITH R-19 FIBERGLASS, 23".
3. FRAMING SHALL BE 2" X 6" – 24" O.C. WOOD FRAMING.

Water Well Meter House Elevations

Town of Fraser
Attachment A-36
Revised January 2015
**Water Well Meter House Floor Plan and Foundation**

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---

**TYPICAL FLOOR PLAN**

- **Electrical Disconnect and Transfer Switch**
- **Electrical Panels**
- **Exterior of Foundation**
- **Interior Wall**
- **Concrete Pad** 42” x 36” x 6”
- **Underground Dip** from well

---

**TYPICAL FOUNDATION DETAIL**

1. Interior shall include one four bulb fluorescent with light switch, two single gang outlets, and one 60” baseboard heater with t-stat; 120v.
2. Interior components may be reoriented to fit site, but shall be accessible from entry door.

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**NOTES**

Revised January 2015
**Sewer Main and Service Line Bedding & Backfill Detail**

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**Note:**
Clay dams may be required by site conditions as determined by Fraser.

**Town of Fraser**
Attachment A-38

Revised January 2015
Standard Precast Concrete Manhole

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Town of Fraser
Attachment A-39

Revised January 2015
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Shallow Precast Concrete Manhole

Town of Fraser
Attachment A-40
Revised January 2015
Drop Precast Concrete Manhole

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Town of Fraser
Attachment A-41
Revised January 2015
Sewer Service Line Connection Detail

7' MINIMUM COVER, FOR 5' TO 7' COVER, PROVIDE 2" INSULATION BOARD, STYROFOAM HI-60 OR EQUAL (ADDITIONAL 2" FOR EACH FOOT UNDER 7' OF COVER).

ANGLE MAY BE REDUCED IF REQUIRED TO ACHIEVE MINIMUM COVER, WITH PRIOR APPROVAL FROM FRASER.

SERVICE LINE TO BE INSTALLED AT GRADE PER STANDARDS

INSTALL WATERTIGHT CAP W/ 4" x 4" MARKER POST OR CONNECT TO BUILDING SEWER

WYE TAP SADDLES SHALL BE USED FOR ALL CONNECTIONS.

PRE-INSTALLED WYE FITTINGS MAY BE ALLOWED WITH APPROVAL FROM FRASER.

FOR PCV (SDR) SADDLES—MODEL YS0804 (JM EAGLE) W/STRAP @ EACH END OR APPROVED EQUAL.

FOR PVC (C900/905) OR VCP SADDLES—MODEL TSW4 W/CLAMPS, AND TSPK-46 PRESSURE KIT (FERNCO) OR APPROVED EQUAL.

Sewer Service Line Connection Detail

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Town of Fraser
Attachment A-42

Revised January 2015
Sewer Service Line Cleanout Detail - Unpaved Location

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Town of Fraser
Attachment A-43

Revised January 2015
Sewer Cleanout Collar Detail - Paved Location

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NOTES:
1. "D" = 1/2" FOR H.M.A. PAVEMENT OVERLAYS OR SURFACE TREATMENTS
2. "D" = 3/4" FOR H.M.A. PAVEMENT RECONSTRUCTION OR NEW CONSTRUCTION
3. "D" = 1" FOR CONCRETE STREETS
4. CLEANOUT MUST BE PLUMB
5. THIS DETAIL APPLIES TO BOTH ASPHALT AND CONCRETE STREETS

Sewer Cleanout Collar Detail - Paved Location

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Town of Fraser
Attachment A-44
Revised January 2015