

LEADVILLE SANITATION DISTRICT

APPENDIX A: MINIMUM DESIGN CRITERIA AND CONSTRUCTION STANDARDS



July 2022

LEADVILLE SANITATION DISTRICT

RULES AND REGULATIONS

WITH DESIGN STANDARDS

The Board of Directors of the Leadville Sanitation District hereby declares that the following Rules and Regulations have been prepared and adopted to provide for the construction, administration and operation of the sanitary sewage system of the District.

The Board of Directors hereby expressly reserve the right to make any lawful addition and/or revisions to these Rules and Regulations when and as they may become advisable to properly manage the District and to promote the peace, health, safety and welfare of the people residing in the District. These Rules and Regulations are supplementary to, and are not to be construed as, any abridgement of any lawful rights of the Board as outlined in the Colorado Revised Statutes governing Special Districts, including the right to disconnect or to refuse permission to connect any sewer service for violation of these Rules and Regulations or the plumbing code of the State of Colorado.

Adopted the 2nd day of November, 2022

Effective January 1, 2023

By: _____

President

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SECTION 1:

GENERAL INFORMATION AND SUBMITTAL STANDARDS

1.1 GENERAL

Local sewerage facilities are considered to be engineered improvements which are designed for specific applications. All designs, drawings and specifications must be prepared by, or under the direction of a Professional Engineer registered in Colorado, whose seal must be on a record set of documents. Local collection systems are the responsibility of the Developer, who is responsible for design and construction and the costs thereof and for payment of actual costs of design reviews and other reviews and inspections provided by the Leadville Sanitation District (District). All sanitary sewer collection system plans, construction drawings, specifications and record drawing information shall be submitted, reviewed, and approved by the District. All submitted information shall be in a clear, concise, and legible form. Incomplete or absent information may result in the submittal being rejected.

The standard details and specifications contained herein are minimum design standards which the District will accept in order to facilitate perpetual operation and maintenance procedures. In addition to these standards, the Applicant's Engineer must also design in accordance with the latest version of the Design Criteria for Domestic Wastewater Treatment Works, WPC-DR1 (Design Criteria) of the Colorado Department of Public Health and Environment (CDPHE). Where CDPHE's and the District's standards differ, the more restrictive of the conditions shall apply. Review and approval of local facilities designs by the District or its Engineer shall not relieve the Engineer of Record from responsibility for adequate design.

1.2 REGULATORY COMPLIANCE

All work shall comply with all applicable federal, state, county, and local regulations.

1.3 DRAWINGS AND DEVELOPMENT SUBMITTAL REQUIREMENTS

1.3.1 CONSTRUCTION PLANS

All construction plans, drainage reports, soils reports, and pavement designs shall be prepared by, or under the direction of, a Colorado Licensed Professional Engineer, and shall be part of the submittal process. Throughout the preliminary and final plat review process, any of the documents listed above that are submitted to the District shall contain the date, the seal, and signature of the Engineer. If the signed and sealed documents are not final, they can be identified as "preliminary", "for review" or "not for construction". The engineer should be aware that whenever unusual or serious problems are anticipated in conjunction with a proposed design or construction, additional information and analysis beyond the minimum requirements of these specifications and criteria shall be required.

Prior to the construction or installation of any Local Facilities, the Developer shall submit Design Documents to the District for review and approval. The Applicant shall be responsible for the District's cost for plan review. An electronic copy is to be submitted by email. Each construction drawing set shall have an "approval block" affixed thereto which provides for the signatures of authorized representatives of the District. The "approval block" shall be a facsimile of that appended to Drawing A.1.

After completion of construction, the Developer shall provide to the District a complete set of record drawings ("as-builts") for the facilities. The record drawings shall show adequate dimensioned ties to reasonably permanent surface features for all buried facilities to allow for future locating. The Developer shall submit an electronic copy to the District Engineer in the latest AutoCAD format (version, or other approved by the Engineer). As-builts shall be in general conformity to Drawing A.2.

The District is not responsible for the accuracy and adequacy of the design or dimensions and elevations on the plans. The District, through the acceptance of the construction plans, assumes no responsibility for the completeness and/or accuracy of the construction plan.

Unless otherwise approved by the District, each drawing shall be 24-inch by 36-inch and shall contain a title block, sheet number, scale, north arrow, date and the seal and signature of the Colorado Licensed Professional Engineer responsible for plan preparation. In addition, an electronic copy (.pdf format) shall be provided by email, on a USB or other acceptable electronic format.

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

The drawing shall be based or transformed to a known coordinate system, not an assumed local coordinate system. If GPS Lat/Long is not used for this reference, the Geographic Coordinate Data Base should be used to obtain relative coordinates available from the Bureau of Land Management (BLM). A permanent survey benchmark shall be shown on the plans.

1.3.2 COVER

The plan must include a statement on the cover sheet:

- "These construction plans for (name of development or project) were prepared by me (or under my direct supervision) in accordance with the requirements of the Leadville Sanitation District Minimum Design Criteria and Construction Standards."
- Name of Engineer
- Name of Firm

The statement shall be signed and stamped by the Colorado Licensed Professional Engineer who prepared or directed preparation of the construction plans.

The plans must also include the following elements on the cover sheet:

- A vicinity map, at the appropriate scale, which shows the location and name of all arterial streets/roads within one mile of the proposed development and all streets/roads within the proposed development.
- Index of sheets.

1.3.2A PLAN

The plan view shall include but not be limited to, the following:

- The scale shall be a minimum of 1-inch = 100-feet.
- Locations and dimensions of existing property lines, setbacks, easements, and Right-of-Way.
- Names of streets / roads.
- Survey line ties to Section or Quarter corners. Survey shall utilize the State Plan Coordinate System, Colorado North Zone (3451), North American Datum 1983 (NAD83).
- Match lines and consecutive sheet numbers.
- Key map.
- A legend to identify location and alignment of existing (dashed) and proposed (solid) utilities and structures (include size, type, height, and location, as applicable).
- Pipe size, material, and length
- Manhole locations
- Stations/coordinates and critical elevations of all utility and drainage appurtenances.
- All on-site slopes shall be shown on plans.

1.3.2B PROFILE

The profile view shall include but not be limited to, the following:

- Existing (dashed) and proposed (solid) grades.
- Continuous stationing/coordinates in the plan view with the centerline station/coordinates clearly labeled.
- Existing (dashed) and proposed (solid) utilities.
- Pipe size, material, length, slope, and invert elevations
- Manhole locations, diameter, depth, and invert elevations

1.3.2C REVEGETATION, EROSION AND SEDIMENT CONTROL PLAN

A construction sheet shall contain the following:

- Detention Pond/Water Quality Pond
- Erosion Control: size, type, location
- Sediment Control: size, type, location
- Revegetation: type, location

1.3.3 CONCEPTUAL PLAN

The conceptual plan submittal and process shall address the applicable regulations. The Applicant shall be responsible for the District's cost for plan review.

1.3.4 PRELIMINARY PLAT

The construction plans submitted at the preliminary plat stage must contain sufficient information to determine that all Standards can be satisfied. Construction plans must be submitted as part of the preliminary plat submittal and process.

1.3.5 FINAL PLAT

The final plat submittal and process shall address the applicable regulations.

1.3.6 CONSTRUCTION

The Applicant is responsible and shall obtain all necessary permits (local, state, and/or federal) for construction.

Prior to utility or roadway installation, the applicant shall install necessary erosion control measures including functioning detention ponds.

Prior to winter shutdown, the applicant shall contact the District to perform a walkthrough of the construction site to verify erosion control measures are in place for spring runoff.

Before Preliminary or Final Acceptance, the District may review the construction. The Applicant shall be responsible for the District's cost for site inspections and construction observations. The District should be notified of any significant deviation from the approved construction plans. The District shall approve any change to the construction plans approved at final plat that will result in a variance, prior to starting any construction that will be impacted by the change.

1.3.7 POST CONSTRUCTION

The District shall review and compare all construction with the construction plans approved at final plat and any design revisions made during construction. The Applicant shall be responsible for the District's cost for site inspections and substantial completion walkthroughs. A request for review may be denied if snow accumulation is present.

1.3.7A PRELIMINARY ACCEPTANCE

Preliminary acceptances will only occur if improvements associated with construction plans are 100% complete (unless phased with the approval of the District).

Prior to Preliminary Acceptance the following items shall be supplied to the District:

- A letter requesting Preliminary Acceptance from engineer/landscape architect/geotechnical engineer
- Record drawings for the improvements shall be submitted at the time the letter requesting security release is submitted. Release of security shall not occur if the District determines deviations are present which have not received prior approval.
- Quality control test results shall be submitted for all phases of the project in accordance with the schedule for minimum materials sampling, testing and inspection as found in CDOT's Materials Test Procedure Module.
- Photos (if applicable)
- Field Notes (if applicable)
- Any addendums/changes to the final plat submittal.
- Any other pertinent information associated with the construction.
- Locations and dimensions of existing property lines, setbacks, easements, and Right-of-Way.
- Names of streets / roads.
- Survey line ties to Section or Quarter corners. Survey shall utilize the State Plan Coordinate System, Colorado North Zone (3451), North American Datum 1983 (NAD83).

If any substantial variations or discrepancies are discovered between the approved construction plans and the improvements actually constructed, the Applicants engineer shall propose and recommend a solution or alternative solutions to the District for review and approval. If no proposed alternative will satisfy the requirements of these Standards, the engineer shall submit a variance request, or the Applicant shall reconstruct the deficient public improvements to comply with the approved construction plans.

The release of security shall be contingent on District review and acceptance.

1.3.7B FINAL ACCEPTANCE

Consideration of Final Acceptance shall be no less than two years from Preliminary Acceptance. Prior to Final Acceptance the following items shall be supplied to the District:

- A letter or letters stating that the improvements have been free of defects for the past two years by the appropriate utility company, special district, or city for all utilities and roads.
- A letter requesting Final Acceptance from engineer/landscape architect/geotechnical engineer shall be signed, stamped, and sealed.

If upon final inspection of the improvements, the District finds the improvements are not substantially free of defects in materials and workmanship or have not been repaired or maintained as required, the District shall issue a written notice of noncompliance within 14 days after the final inspection specifying the respects in which the improvements are not substantially free of defects in materials and workmanship or have not been repaired and maintained as required.

The Applicant shall thereupon take such action as is necessary to cure any noncompliance and, upon curing the same, shall request a new final re-inspection from the District. A re-inspection fee shall apply.

The release of security shall be contingent on District review and acceptance.

1.3.7C CERTIFICATIONS

The following certifications shall be required on letterhead with stamp, seal, and date and shall address the appropriate construction plans / documents that the professional is approving. Such certifications shall be submitted to the District upon request for Preliminary and Final Acceptance.

- Engineer. The licensed engineer of record shall review the information required above and state that the actual construction and materials used are in substantial compliance with the District accepted construction design plans.
- “I _____, A DULY LICENSED PROFESSIONAL ENGINEER IN THE STATE OF COLORADO, STATE THAT CONSTRUCTION HAS BEEN COMPLETED IN SUBSTANTIAL COMPLIANCE WITH THE CONSTRUCTION PLANS APPROVED BY THE LEADVILLE SANITATION DISTRICT, AS DETERMINED BY REVIEW OF THE RECORD DRAWINGS AND DURING PERIODIC ON-SITE OBSERVATIONS DURING AND AFTER THE COURSE OF CONSTRUCTION AS DETERMINED BY ME OR UNDER MY DIRECT SUPERVISION. DATE: _____.”

- Geotechnical Engineer. The geotechnical engineer of record shall supply the District with a letter stating that, based on the results of the quality control test results; construction was completed in substantial compliance with the geotechnical recommendations approved by the District.
- “I _____, A DULY LICENSED PROFESSIONAL ENGINEER IN THE STATE OF COLORADO, STATE THAT CONSTRUCTION HAS BEEN COMPLETED IN SUBSTANTIAL COMPLIANCE WITH THE FINAL GEOTECHNICAL REPORT APPROVED BY THE LEADVILLE SANITATION DISTRICT, AS DETERMINED BY COMPLETION AND REVIEW OF THE QUALITY CONTROL TEST RESULTS AND DURING PERIODIC ON-SITE OBSERVATIONS DURING AND AFTER THE COURSE OF CONSTRUCTION AS DETERMINED BY ME OR UNDER MY DIRECT SUPERVISION. DATE: _____.”

1.3.8 RECORD DRAWINGS.

The record drawing submittal shall accompany the request for Preliminary Acceptance of the construction improvements.

Identify and show on the "Record Drawings" 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.

The method to show locations (both for proposed construction and Record drawings) is by the use of centerline stations/coordinates as depicted on the construction plans with suitable distances and offsets given relative to these lines.

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

Record drawings are to be provided by a State of Colorado Licensed Professional Surveyor. All required record drawing information shall be clearly shown with the original approved design information and all field design revisions made during the construction process (design information should be shaded back). A stamped hardcopy of the Record Drawings shall be submitted along with an electronic copy in ACAD format. Each sheet of the Record Drawings shall include the following statement along with the licensed professional surveyor's stamp and date of execution.

"I, _____, A DULY LICENSED PROFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO, STATE THAT THE INFORMATION CONTAINED IN THESE RECORD DRAWINGS ARE THE RESULTS OF A FIELD SURVEY AND ARE TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF, AS DETERMINED BY ME OR UNDER MY DIRECT SUPERVISION ON THIS DATE: _____."

1.4 REQUIRED EASEMENTS

Where Local Facilities are to be located out of the public right-of-way, the Developer shall be responsible for obtaining easements required for the construction, maintenance, and operation of the facilities. The District will not accept alignments that could present access or construction problems in present or in the future (e.g., steep slopes or difficult vehicular access).

The legal description for the easements shall be prepared by a Professional Land Surveyor, registered in the State of Colorado. Easements shall be in a form acceptable to the District and shall be shown on the construction drawings. The District will not approve the Contract Documents until all required easements have been deeded to the District.

1.5 CHECKLIST

Checklist for Preliminary Acceptance of District Facilities. To be completed after construction and prior to any service connections.

1. Construction of all district facilities completed to District Standards and to the approved plans.
2. All facilities tested to District Standards and accepted by the District. (Furnish copies of soils compaction and materials tests).
3. Permanent survey monuments set at the comers of all easements.
4. Record drawings meeting District Standards and sealed by a registered Professional Engineer.
5. Furnish a summary of total construction costs (including design costs) of all applicable sewer facilities. Include only facilities to be deeded to the District.
6. Warranty Deed for all facilities to be owned by the District.
7. Two-Year Warranty Period to begin after the date of preliminary acceptance, except that if deficiencies are identified and repaired, a new two-year maintenance bond for the repaired Work is to begin starting on the date of preliminary acceptance of the repaired Work.
8. Payment of all fees and confirmation from District's attorney that the applicant for dedication of the facilities is not in default under any agreements within the District.

SECTION 2: SEWER SYSTEM STANDARDS

2.1 GENERAL

No service line may be constructed without prior approval from the District. 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.

The sizing of sewer service lines shall be the responsibility of the Applicant. When requested by the District, Applicant shall, at his expense, furnish data, plans, calculations, or other information as required for the evaluation of the service size. Service lines are the responsibility of the Applicant, who is responsible for design and construction and the costs thereof and for payment of actual costs of review and inspection.

Ownership: The service line, from the main to the point of connection to the building(s) is the property of the Owner of the lot served. Repairs are the responsibility of the property Owner, who is responsible for obtaining the necessary permits for the work.

All sanitary sewer service lines are to be constructed in accordance with applicable codes, generally accepted good construction practices, and the minimum standards and criteria contained in this document. The details are provided for standardization purposes only and represent minimum design standards which may require upgrading for specific applications.

2.2 SANITARY SEWER SERVICE CONNECTIONS

2.2.1 SIZING/CAPACITY

The size and slope of the building service sewer shall be subject to the approval of the District, but in no event shall the diameter be less than 4 inches. Minimum grade and slopes shall be as follows:

Table 1 – Minimum Grade and Slopes

Diameter (inch)	Minimum Grade and Slope
4	2.0% Normal; 1.0% Minimum
6	1.00%
8	0.60%

2.2.2 SERVICE CONNECTION

No connection between the sewer system of the District and the sewer facilities of the Owner may be made except in a public street adequate to accommodate sewer facilities or in a similar place to which the District has as free a right of access as it would have in a public street.

Where parallel or approximately parallel to a structural wall, the service shall be at least 5-feet from the wall. Penetrations through structures shall be approximately at right angles and shall provide flexibility such that the service will not be damaged by settlement of the structures.

Water and sewer service lines shall have 10 feet minimum of horizontal separation. Where this separation is impractical, the District may permit other separation requirements, in accordance with applicable standards. If a sewer service line passes over a water main or service, or if it lies within 10 feet of the water main or service, the sewer service is to be modified to have "no bell" construction per Drawing A.7.

The minimum cover shall be 7 feet from top of sewer service line to finished grade. A minimum of 5 feet of cover will be allowed if at least 2 inches of an approved pipeline insulation is provided in accordance with Drawing A.5. If the service line passes beneath a paved area (or other areas likely to be kept clear of snow) within the property line of the property served, the line is to be insulated per Drawing A.5.

The Applicant for a building sewer service shall notify the District when the service line is ready for connection to the public sewer, and the connection to said public sewer shall not be made until after inspection and approval. The service line shall meet the requirements of the most recent edition of the Uniform Plumbing Code. The connection to the sewer shall be made in the presence of and approved by the District Inspector. The trench of each sewer service line must be open (not backfilled) from the building to the tap, to allow inspection prior to backfilling.

If practical, pre-installed wye fittings shall be used for service connections; otherwise the connection of the building service sewer to the public sewer shall be made as follows:

- A saddle tee shall be used to connect 4-inch or 6-inch sewer service lines to 8-inch to 15-inch sewer mains.
- No saddle wyes are allowed.
- The service line connection shall conform to Drawing A.8
- Each service line is to have a 4-inch cleanout installed within 20-feet of the building served, per Drawing A.10.
- Cleanouts are required for any significant change in service line direction and at intervals of no greater than 90-feet.

2.2.3 PIPE MATERIALS

Sewer service pipe shall be PVC, with a thickness not less than SDR 35 and conforming to ASTM D3034. Sanitary Sewer Service Pipe shall be green or other acceptable color (no white pipe — white PVC is reserved for other applications).

For pipeline insulation at normal depth of bury and overburden, material shall be Dow STYROFOAM 60, or approved equivalent. For heavy traffic or other high-compaction service, shall be Dow STYROFOAM 116. Minimum width shall be 2-feet or 16-inches + pipe diameter.

2.2.4 SEWER INSTALLATION

The sewer system shall be installed in a thorough, workmanlike manner in accordance with the Design Documents that have been approved by the District and the manufacturer's installation instructions.

If the bottom of the excavation is soft or unstable, and in the opinion of the District, is not a satisfactory support for the pipeline, further depth and/or width shall be excavated and refilled to 6-inches below the pipe outside diameter (excluding bells) with Trench Stabilization Material, as specified in Section 3.7B.

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. Service line shall be watertight and on a constant grade in a straight line, and not closer than 5-feet from any bearing wall.

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 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 District's approval. The manufacturer's requirements for lubrication and gaskets must be followed.

Pipe laying shall proceed upgrade with the spigot ends of pipe pointing in the direction of the flow (bell upstream), unless otherwise approved by the 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.

2.3 BASIC DESIGN GUIDELINES

2.3.1 DESIGN CRITERIA

Collection sewer system design is intended to provide gravity service only. Before the start of design, the Developer is to contact the District Engineer to confirm the connection point with the existing sewer system. Sewer line sizing is to be approved by the District. The District may direct the Developer to provide sewer line capacity in excess of the Developer's requirements. In such cases, the District will reimburse the developer for the incremental cost of the oversize. Sewage lift station and force mains will not be permitted unless specifically authorized by the District.

2.3.1A GENERAL

1. Sanitary sewer mains shall be 4-inch, 6-inch, 8-inch, or 12-inch pipe as described in this section, or as approved by the District.
2. Sanitary sewer mains shall be designed to carry not less than the projected peak flow rates flowing half full (safety factor = 2.0), unless otherwise approved by the District.
3. Sanitary sewer mains shall be clearly and permanently marked at not greater than 5-foot intervals with the pipe diameter, PVC cell classification (if applicable), manufacturer, plant, shift, ASTM, date designations and service designation.
4. Size of mains should be chosen to attain a velocity greater than 2 feet per second for proper sewer main flushing during peak flow.
5. Per ASTM D3034, products not manufactured in the U.S. shall be tested at an acceptable laboratory in the U.S.
6. Sewers shall generally be designed with sufficient depth to serve basements by gravity. The minimum cover shall be 7 feet from top of sewer to finished grade. A minimum of 5 feet of cover will be not be allowed unless approved by the District. See Drawing A.5 for detail.

2.4 SANITARY SEWER COLLECTION SYSTEM LAYOUT

2.4.1 LOCATION

2.4.1A PUBLIC RIGHT-OF-WAY

1. Sanitary sewer services in streets and other public right-of-ways shall be parallel to the right-of-way lines and placed at the centerline of the road, or as approved by the District.

2.4.1B EASEMENTS

1. Sanitary sewer mains in easements shall be parallel to the easement lines and placed within the center of the easement.
2. Minimum width of easements for pipelines shall be 30 feet.
3. Temporary construction easements shall have a minimum width of 40 feet.
4. Wider easements may be required for deep sections of pipeline, multiple lines, storm sewers, or where otherwise required by the District.
5. Easement to contain a water line and a sewer line shall be no less than 36 feet.

2.4.2 SEPARATION

2.4.2A HORIZONTAL

1. Sanitary sewer mains shall be separated a minimum of 10 feet horizontally from water and storm sewer lines.
2. Sanitary sewer mains shall be separated a minimum of 5 feet horizontally from all other utilities.
3. Where this separation is impractical, the District may permit other separation requirements, in accordance with applicable standards. The preference is to have water lines installed above sewer lines.
4. If a water line passes under a sewer main or service, or if it lies within 10 feet of the sewer, the sewer is to be encased per Drawing A.6. Using pressure-rated pipe for the sewer in accordance with Drawing A.7 may also be an acceptable remedy.
5. 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 Drawing A.6.
6. When specifically authorized by the District, other encasement alternatives may be permitted per Drawing A.6. For potable water pipeline crossings, a 20-foot length of specified C900 DR-25 PVC may be used for the gravity sewer line. Center a 20-foot length on the water pipe with watertight transition couplings for connections to the sewer.

2.4.2B CROSSINGS

1. Sanitary sewer mains shall be separated a minimum of 18 inches vertically from water and storm sewer lines, and all other utilities.
2. Sanitary sewer mains shall be below water mains, per Drawing A.7.

2.4.2C UNDERDRAINS

1. The District does not allow the use of underdrains laid in the same trench as a sanitary sewer line.

2.5 SANITARY SEWER MAINS (GRAVITY)

2.5.1 PVC GRAVITY SANITARY SEWER PIPING (NON-PRESSURE)

2.5.1A PURPOSE

1. Non-pressure PVC pipe for gravity sanitary sewer application is the standard pipe used for gravity sanitary sewer piping and fittings.
2. PVC pipe may also be used for sanitary sewer mains greater than 10 feet deep.

2.5.1B PIPE AND FITTINGS

1. ASTM D3034, T-1 wall, SDR 35, non-pressure pipe
2. Cell classification: ASTM D1784
3. Pipe length: 12-20 feet standard manufactured length for construction

2.5.1C JOINTS

1. Joints shall be of the “slip on” type with integrally cast bell having an elastomeric gasket. For non-standard sewer line applications (e.g.: steep terrain; crossing or streams, ditches, or drainages), the District Engineer will issue project-specific requirements on request.
2. ASTM D3212 and F477 - Rubber gasket with one compression gasket ring, integral bell and spigot type
3. Designed to hold pipe in alignment, provide flexibility, separate the ends of pipe lengths, resist applied earth pressures, and provide fluid tightness
4. Rubber rings: ASTM F477

2.5.2 PVC DRAIN OR VENT PIPE (NON-PRESSURE)

2.5.2A PURPOSE

1. Non-pressure PVC pipe is the standard pipe used for 1-inch and 4-inch diameter combination air release/vacuum breaker valve interior and exterior discharge vent piping and fittings.

2.5.2B PIPE AND FITTINGS

1. Schedule 40 in accordance with ASTM D1784, ASTM D1785, ASTM D2466, ASTM D2122, and ASTM F412.

2.5.2C JOINTS

1. Solvent weld per manufacturer's recommendation
2. Threaded: ANSI/ASME B1.20.1

2.5.3 UNDERGROUND TYPE PLASTIC LINE MARKER

2.5.3A PURPOSE

1. Underground metallic marking tape shall be used for all buried lines.

2.5.3B DESIGN CRITERIA

1. Metallic marking tape shall be on top of the pipe bedding, a minimum of 1 foot above the top of the pipe
2. Tape shall be manufacturer's standard permanent, continuous-printed plastic tape with metallic core, intended for direct-burial service
3. Not less than 6-inches wide x 4 mils thick
4. Provide green tape with black printing reading "CAUTION SANITARY SEWAGE LINE BURIED BELOW"

2.5.3C MANUFACTURERS

1. Allen Systems, Inc.
2. Emed Co., Inc.
3. Seton Name Plate Corp.
4. Or accepted substitution

2.6 CORROSION CONTROL

2.6.1 GENERAL

Polyethylene encasement for metallic pipe and fittings shall be provided as a minimum corrosion protection measure. Additional corrosion control, such as sacrificial anode cathodic protection, may be necessary as determined by the District.

2.6.2 POLYETHYLENE ENCASEMENT MATERIAL

2.6.2A PURPOSE

1. Polyethylene encasement material is used to protect ductile iron pipe, fittings, and valves from corrosion due to aggressive soils.

2.6.2B STANDARDS

1. Polyethylene encasement material shall be manufactured in accordance with ANSI/AWWA C105/A21.5, AWWA Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

2.6.2C DESIGN CRITERIA

1. **Materials.** Polyethylene encasement shall be linear low-density polyethylene film with minimum thickness of 8 mils.
2. **Color.** Polyethylene encasement shall be clear.
3. **Installation.** Flat tube material shall be used for pipe and fitting encasement; flat sheet material shall be used for valve encasement. Encase ductile iron fittings and valves in polyethylene per AWWA C105, Method A, secured with polyethylene compatible adhesive tape. Overlap polyethylene onto PVC pipe a minimum of 6 inches. Before backfilling, inspect polyethylene for rips, punctures and other damage and repair following AWWA C105.

2.6.3 CATHODIC PROTECTION

2.6.3A PURPOSE

1. Cathodic protection provides additional protection from corrosion to ductile iron and steel pipe in aggressive soils or within the water table and shall be utilized as determined by the District.

2.6.3B STANDARDS

1. Sacrificial anode cathodic protection shall comply with NACE SP0169, NACE Standard Practice for Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

2.6.3C DESIGN CRITERIA

1. Design of the cathodic protection shall be based on site specific soil data in the geotechnical report.
2. Design criteria and proposed cathodic protection system shall be reviewed and approved by the District.

2.7 TRACER WIRE

2.7A PURPOSE

1. Tracer wire is used on all buried sanitary sewer force main and collection system pipe, regardless of material, to provide a convenient and more accurate way to locate buried water lines.

2.7B STANDARDS

1. All tracer wire shall comply with ASTM D1351.

2.7C DESIGN CRITERIA

1. **General.** Tracer wire shall be installed on all sanitary sewer mains, regardless of pipe material.
2. **Description.** Tracer wire shall be a standard, UL listed, single strand, No. 12 American Wire Gauge (AWG), insulated solid copper wire, coated with 45 mil Type HMW – PE blue insulation compliant with ASTM D1351 specifically designed for direct bury in corrosive soil or water.
3. **Installation.** Tracer wire shall be installed on top of the pipe, taped to the top of the pipe every 3 to 4 feet, and taped on each side of every joint, with 2-feet of tracer wire coiled within each valve box. Test stations with a 4-inch locking lid shall be installed at all valves/valve boxes.

2.8 MANHOLES, HATCHES, AND APPURTENANCES

2.8.1 CONCRETE MANHOLES

2.8.1A PURPOSE

1. Concrete manholes shall be used for any changes in sanitary sewer main direction, changes in sanitary sewer main diameter, or specialty valves, where they provide sufficient access and room for inspections, adjustments, and maintenance.
2. Drop manholes (per Drawing A.4) are to be provided for any pipeline whose invert entering the manhole is greater than 18-inches above the invert out.

2.8.1B STANDARDS

1. Manholes barrels, tops, and reducing sections shall be precast concrete in accordance with ASTM C478.
2. The top section required for change of diameter shall be eccentric cone or flat slab is approved by the District or shown on the Standard Details.

2.8.1C MANUFACTURERS

1. Front Range Precast
2. Copeland Precast
3. Rinker Materials
4. Oldcastle Infrastructure
5. Or accepted substitution

2.8.1D DESIGN CRITERIA

1. **Spacing.** Manholes shall be spaced a maximum of every 400 feet within the sanitary sewer system and shall also be located 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. The site shall be graded so that drainage is away from the manhole.
2. **General.** Minimum wall thickness of either 6-inches or 1/12 of internal diameter, whichever is greater. Manholes shall be reinforced. All reinforcement required shall be standard deformed reinforcement conforming to the requirements set forth in ASTM A615, Grade 40. Grade rings as required and cast steps into units. Use concrete that will attain a 28-day compressive strength of not less than 4,500 psi with a cement content of not less than 6 sacks per cubic yard. Openings to be precast per plan. Sawcut in field only if no other option. To bring the manhole cover to the correct elevation, the adjustment section of each manhole shall be pre-cast concrete grade adjustment rings. These rings shall be not less than 6 inches wide and furnished in heights to allow for 1-inch adjustment. Total adjustment height with grade rings, shall not exceed 18 inches.
3. **Invert Channels.** 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 of 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 the sewage does not undergo a vertical drop. The invert channels may be formed directly in the concrete of the manhole base. The floor of the manhole outside of the channel shall be smooth and shall slope toward the channels at 1/2 inch per foot.
4. **Concrete Riser Sections.** The top of the concrete manhole shall be 12 to 18 inches from the final grade line. Concrete extension collars shall be used to bring the manhole ring and cover up to ground line. Manhole lids should be adjusted to the final grade plus or minus 1 inch in landscaped areas and 1/4 inch to 1/2 inch below final grade in paved areas. Grade rings shall be constructed of concrete in accordance with ASTM C478 and Material Specification: Normal Weight and Precast Concrete.
5. **Base Beams.** Concrete manhole base beams shall be constructed of precast, reinforced concrete. The beams shall be 12 inches wide by 9 inches deep by 8 feet long.
6. **Base Slabs.** Concrete manhole base slabs may be cast-in-place or precast. The minimum slab thickness shall be 8 inches. The top circumference of the base shall be finished level

and smooth to permit obtaining a watertight joint between the precast manhole sections and the cast in place base. Pre-cast manhole bases may be allowed as an alternate. If allowed, a flexible watertight "boot" system shall be provided to seal around the sewer line. Acceptable products include: PSX Positive Seal, as manufactured by Press-Seal Gasket Corp, Fort Wayne, Indiana; Kor-N-Seal, as manufactured by NPC, Inc., Milford, NH, or approved alternative. If precast bases are accepted, they shall only be placed on a compacted granular (3/8-inch angular aggregate) well compacted and screeded level.

7. **Joints.** Each joint of the precast manhole barrel shall have at least one 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 continuous gaskets and shall be grouted inside and outside using approved non-shrink grout. In both cases, the surface of the precast barrels and / or the cast in place bases shall be smooth and sound. The joint surfaces shall be cleaned to remove any concrete projections or dirt which may prevent a water-tight seal from being established. The joints shall be prepared, and the gaskets shall be placed in accordance with the manufacturer's recommendations.
8. **Joint Sealant.** In addition to the gasket material used within the joints between sections of the manhole, an external joint wrap is required. Joint sealant shall be a flexible plastic gasket conforming to ASTM C990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants. Wrap is to be no less than 8-inches wide. Manufacturers: Ram-nek, ConSeal CS-102 and CS-202, or accepted substitution.
9. External Joint Sealing Wrap is to be applied to clean concrete surfaces per manufacturer's requirements. Must be applied immediately prior to backfilling, so when backfill is compacted the earth pressure forces bituminous wrap into concrete surfaces. Temperature of manhole sections and of backfill materials must be above 40 deg. F from time of applying wrap to time of backfilling.
10. **Manhole Steps.** Steps shall be 1/2-inch grade 60 steel bar, drop-front type, with copolymer polypropylene plastic coating (see Drawing A.3). Steps shall be M.A. Industries, Model PS2-PF, or accepted substitution.
11. **Fabrication.** Minimum manhole inside diameter shall be 5-feet, or as approved by the District. Manholes shall be constructed and installed in accordance with Drawing A.3 and Drawing A.4. Precast lid and cones shall have the same or greater reinforcement and wall thickness as vault or manhole section with capability for H-20 loading. Vault joints shall be shiplap or tongue and groove with double mastic gaskets, with each joint to set equally and tightly. Access opening shall be minimum 24-inches clear, or as approved by the District. Base may be precast concrete, monolithic base, or cast-in-place. Manhole steps shall be spaced 12-inches on center with vertical alignment above largest bench or open area. Use precast concrete grade rings to adjust manhole height. The rock subbase shall be 1-1/2-inch minus, well-graded gravel over compacted subgrade. Water shall be clean and free of deleterious substances.

12. **Plugs and Caps.** Use pipe plugs or caps provided by the pipe manufacturer and approved by the Engineer for pipe stub outs.
13. **Cleanouts.** Provide pipe extension to grade with ferrule and countersink cleanout plug. Provide round cast-iron access frame over cleanout, with heavy duty secured scoriated cover with lifting device cast with the word "SANITARY".
14. **Reinforcement.** Reinforcing steel shall comply with ASTM A615 Grade 60 requirements. Welded wire fabric shall comply with ASTM A1064.
15. **Concrete.** Minimum compressive strength shall be 4,500 psi at 28 days. Cement shall comply with ASTM C150, Portland Cement, Type II. Aggregates shall comply with ASTM C33 and be free of deleterious substances.
16. **Gaskets.** Gaskets (O rings) for connecting PVC pipe to manhole sections shall be specifically manufactured for that purpose. All gaskets shall comply with ASTM C923 and FS SS-S-210A. Rubber gaskets shall be Neoprene, 40+5 hardness when measured by ASTM D2240, Type A durometer. Manufacturers: Press-Seal Kwik Seal, ConSeal CS-102 and CS-202, or accepted substitution.
17. **Frames and Castings.** Frames and castings shall comply with ASTM A48 with asphalt varnish coating hot dip applied at foundry, 6 mils thick Class 30b.
18. Outside each manhole where the pipe enters/exits, within 12 inches of the manhole base, the Contractor shall install a bell section of pipe or approved coupling as indicated on the Standard Details.

2.8.2 MANHOLE RINGS, COVERS, AND RISERS

2.8.2A PURPOSE

1. Manhole rings, covers, and risers are used in conjunction with vaults and manholes and provide access to these buried structures.

2.8.2B STANDARDS

1. Manhole rings, covers, and risers shall be made of gray iron in accordance with the requirements of ASTM A48/A48M, Standard Specification for Gray Iron Castings (Class 35B), or ductile iron in accordance with the requirements of ASTM A536, Standard Specification for Ductile Iron Castings.
2. The manhole covers shall be set with their tops at the grades set forth in the Standard Details. When a manhole top is above the ground line, compacted backfill shall be placed around the exposed section as shown on the Standard Details. Manhole tops without bolted, gasketed covers shall not be set at or below surrounding grade, except in paved roadways.

2.8.2C MANUFACTURERS

1. Composite
2. Castings, Inc.
3. D&L Foundry
4. Deeter Foundry, Inc.
5. EJ
6. Saint-Gobain PAMREX

2.8.2D DESIGN CRITERIA

1. **General.** Manhole rings, covers, and risers shall be heavy duty and designed, manufactured, and tested in accordance with the requirements of AASHTO M306, Standard Specification for Drainage, Sewer, Utility, and Related Castings. Manhole rings and covers shall be cast-iron, heavy-duty traffic type, ASTM A48, Class 35B. Grind bearing surfaces to ensure flat, true surfaces. Covers to seat at all points on ring. Covers to be cast with "SEWER" in 2-inch-tall flush letters.

2.8.3 HATCHES

2.8.3A PURPOSE

1. Hatches are used in conjunction with specialty vaults to provide watertight access to these buried structures.

2.8.3B STANDARDS

1. ASTM C1802 may be consulted for additional guidance in constructing fabricated metal access hatches.

2.8.3C MANUFACTURERS

1. Bilco
2. Or accepted substitution

2.8.3D DESIGN CRITERIA

1. **Performance.** Cover shall be reinforced to support a minimum live load of 300 psf with a maximum deflection of 1/150th of the span. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing. Operation of the cover shall not be affected by temperature. Entire hatch, including all hardware components, shall be highly corrosion resistant.
2. **Construction.** Hatch shall be single leaf. Cover shall be 1/4-inch aluminum diamond pattern. Channel frame shall be extruded aluminum with bend down anchor tabs around the perimeter. Hinges shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts. A

removable exterior turn/lift handle with a spring-loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug.

3. **Lifting Mechanism.** Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4-inch gusset support plate.
4. **Hardware.** Hardware shall be Type 316 stainless steel throughout. Heavy forged Type 316 stainless steel hinges, each having a minimum 1/4-inch diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame. Cover shall be equipped with a hold open arm which automatically locks the cover in the open position. Cover shall be fitted with the required number and size of compression spring operators. Springs and spring tubes shall be Type 316 stainless steel. A Type 316 stainless steel snap lock with a fixed handle shall be mounted on the underside of the cover.
5. **Installation.** The installer shall comply with the hatch Manufacturer's installation instructions. Provide a 1-1/2-inch drain coupling. A removable exterior turn/lift handle with a spring-loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug.
6. **Finish.** Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

2.8.4 GROUT MANUFACTURERS

2.8.4A NON-SHRINK, NON-METALLIC GROUT

1. Master Builders, Masterflow 928
2. Burke, Non-Ferrous Non-Shrink
3. M.R. Meadows, Sealtight 588
4. Sonneborn, Sonogrout G.P.
5. Tamms, TammsgROUT 621
6. Sika, SikaGrout 212
7. Or accepted substitution

2.8.4B EPOXY GROUT

1. Burke, BurkEpoxy Anchoring Grout
2. L&M Inc., EpogROUT
3. Sika, Sikadur 42 Grout-Pak
4. Or accepted substitution

2.8.5 TESTING MANHOLES

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 District shall check each manhole to determine whether the manhole fulfills the requirements of the Drawings and District's Standards.

2.8.5A VISUAL EXAMINATION

The District 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 District.

2.8.5B LEAKAGE TEST

All manholes shall be tested for leakage and all tests shall be witnessed by the District. The leakage test shall be conducted prior to backfilling around the manhole and shall be carried out in the following manner:

1. All lines leading into or out of the manhole shall be tightly plugged.
2. The manhole shall be filled with water to a level at least 2 inches above the uppermost step. The water shall be allowed to stand for two 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.
3. **Vacuum Testing.** At the option of the Contractor, vacuum testing of the installed manholes may be used instead of the leakage test. All pipes entering and exiting the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

The test head shall be placed at the top of the manhole and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of 10-inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head shall be closed, and the vacuum pump shut-off. The time shall be measured for the vacuum to drop to 9-inches of mercury.

The manhole will be declared unacceptable if the time to drop from 10-inches of mercury to 9-inches of mercury is less than 60 seconds. This test interval is valid for 48-inch MH of up to 24-feet deep, 60-inch MH up to 18-feet deep and 72-inches MH up to 14-feet deep. The District Engineer will establish test intervals for other situations on a case-by-case basis.

2.9 FLUSHING, TESTING AND ACCEPTANCE

2.9.1 SANITARY SEWER LINE TESTING

The following testing procedures are intended to determine if the sanitary sewer line meets the District's minimum quality standards. Alternative procedures meeting or exceeding the intent of these procedures, as determined by the District, may be acceptable. In any case, however, proposed alternative testing procedures must be included in the design plans and specifications.

The Contractor shall notify the District - no less than 48 hours prior to the desired test time.

The District shall witness all tests and verify the accuracy and acceptability of the equipment utilized. The District will inform the Contractor regarding acceptable methods of repair in the event that one or more sections fail to pass any test.

2.9.1A PIPELINE FLUSHING

The Contractor shall flush the pipelines, 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. Flushed material shall not be permitted to enter the District's downstream sewers.

2.9.1B ALIGNMENT AND GRADE

Sewer pipelines will be checked by the District to determine whether any displacement of the pipe has occurred after the trench has been bedded. The test will be as follows:

1. Each section between manholes will be lamped by Contractor in the presence of engineer
2. A true circle will be required in the lamp tests to indicate a properly constructed sewer line
3. Repair any sections not passing the lamp test at Contractor's expense.

2.9.1C LEAKAGE TESTING BY EXFILTRATION

Tests for watertightness shall be made by the Contractor in the presence of the District. The Contractor shall provide assistance to the District in development of a detailed record of the testing program. The sewer and connections shall not leak in excess of the following rate for a 24-hour test period, as shown in Table 2:

Table 2 – Maximum Allowable Sewer Leakage

<u>Pipe Size</u> <u>Inches</u>	<u>Leakage</u> <u>Passing by Weight</u>
18	68%
15	57%
12	45%
10	38%
8	30%
6	23%

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 re-tested.

At the discretion of the District, the time for leakage rate test may be shortened to 4 hours.

The tests and measurement of infiltration or exfiltration shall be conducted in a manner as approved by the District. The minimum head for the exfiltration tests shall be 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 10-feet. This restriction does not apply to ductile-iron pipe.

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

2.9.1D LEAKAGE TESTING BY INFILTRATION

Infiltration tests will be used if the groundwater table is likely to be 1 foot or more above the invert of the finished sewer. Otherwise, exfiltration tests will be used.

2.9.1E LOW-PRESSURE AIR TEST

At the option of the Contractor, low-pressure air testing of the installed sewer pipe may be used instead of the leakage exfiltration test.

The following criteria and procedure shall be utilized, unless otherwise approved by the District.

1. **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.
2. **Relief Valve.** All pressurizing equipment used for low-pressure air testing shall include a regulator or relief valve set no higher than 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 9 psig.
3. **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 throughout the test as an added safety precaution.
4. **Singular Control Panel.** To facilitate test verification by the inspecting Engineer, all air used shall pass through a single, above ground control panel.
5. **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 0 to at least 10 psi. The continuous monitoring gauge shall be no less than 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of +0.04 psi.
6. **Separate Hoses.** Two 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.
7. **Pneumatic Plugs.** If pneumatic plugs are utilized, a separate hose shall also be required to inflate the pneumatic plugs from the above ground control panel.
8. **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.
9. **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 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 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.

- 10. Line Pressurization.** Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig.
- 11. Pressure Stabilization.** After a constant pressure of 4.0 psig is reached, the air supply shall be throttled to maintain that internal pressure for at least 2 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.
- 12. Timing Pressure Loss.** When temperatures have been equalized and the pressure stabilized at 4.0 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 3.5 psig. The timing pressure loss test shall then commence at a pressure reading of 3.5 psig, or any convenient observed pressure reading between 3.5 psig and 4.0 psig. (Except as adjusted for groundwater as follows.)
- 13. Air Pressure Adjustment.** An air pressure correction, which must be added to the 3.5 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 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 2.8 feet, the additional air pressure above the pipe invert is 2.8 divided by 2.31 or 1.2 psig. This would require a minimum starting pressure of 3.5 plus 1.2 or 4.7 psig). The allowable pressure drop of 1.0 psig and the timing in Table 3 are not affected and shall remain the same. In no case however should the starting test pressure exceed 9.0 psig.
- 14. Determination of Line Acceptance.** If the time shown in Table 3 for the designated pipe size and length, elapses before the air pressure drops 1.0 psig, the section undergoing test shall have passed.

Table 3 – Specification Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for 1 = 0.0015

1 Pipe Diameter (in.)	2 Minimu m Time (min:sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length Shown (min:sec)								
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.	
4	3:46	597	.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692L	17:00	17:00	25:38	32:03	38:27	44:52	51:16	57:41	

2.9.1F DEFLECTION

All PVC sewer pipelines shall be tested for vertical deflection after placement and compaction of backfill unless testing is specifically accepted by the District. Method of testing shall be by deflectometer of the rigid GO/No-GO type device. Alternative methods will be permitted only by written permission of the District. Maximum allowable deflection shall be 5 percent 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 detested.

The District reserves the right to direct the Developer to retest sewer lines after twenty four months of service if the District has concerns about the condition of certain sections of pipe. Sections would be selected for retesting based on the results of the initial tests, the outcome of the television inspection (per Section 2.9.1G Television Inspection), depth of cover, or other technical factors. The Developer shall perform such retesting at no cost to the District.

2.9.1G TELEVISION INSPECTION

The Developer shall perform a television inspection of each segment of the sewer line and provide a digital video file to the District. The format for labeling and stationing of this record is to be approved by the District prior to performing the TV inspection. The Developer is to provide one week prior notice of this TV inspection, so that a representative from the District may be present to observe the inspection in progress. This inspection is to be performed no earlier than 10 months after preliminary acceptance of the sewer construction by the District. The digital video file is to be submitted to the District no later than 11 months after the date of preliminary acceptance. This work is to be performed at no cost to the District.

The District will use this record as a basis to direct the Developer to perform additional deflection tests or provide Warranty work under the terms of the Two-Year Warranty, if out-of-spec situations are observed.

2.10 GRINDER PUMP SYSTEMS

2.10.1 GENERAL

A private grinder pump system is a privately owned and maintained pumping system, including all mechanical and electrical components and appurtenances, which is designed to convey wastewater generated within a structure or group of structures to the District owned sanitary sewer system. A private grinder pump system is required where the property cannot be served by a gravity sewer connection.

2.10.2 REQUIREMENTS

A private grinder pump system will only be considered where a thorough study of all alternatives clearly indicates a gravity collection and disposal system is not practical or feasible.

Prior to the project design, it is the responsibility of the design engineer to contact the Leadville Sanitation District Engineer to determine the following:

1. Will the District allow the construction of a private grinder pump system? Has a study of all alternatives been clearly documented to the District Engineer?
2. Are there additional requirements due to the project's location?
3. Does the designer have the latest version of the design requirements?

2.10.2A SINGLE PROPERTY SERVED BY GRINDER PUMP SYSTEM

A private grinder pump system and force main shall discharge to the gravity sewer system at a private manhole located on private property adjacent to the property line. The manhole will be the responsibility of the property owner. The point of connection shall be no more than one foot above the flow line of the receiving manhole. Inside drops will not be permitted. The connection shall include an approved flexible seal. An odor control system may be required as determined by the District.

The sides and bottom of the force main discharge manhole shall be epoxy lined. The lining shall be a solventless, 100% solids corrosion resistant epoxy coating. Acceptable Manufacturer(s) are Sikagard 62 or approved equal.

A standard gravity sewer service in accordance with the District's current rules, regulations and details shall be installed connecting the private manhole to the District's collection system. The minimum cover shall be 7 feet from the top of the sewer service line to finished grade. The service line is the property of the Owner of the lot served. Repairs are the responsibility of the property Owner.

The private grinder pump system, including all mechanical and electrical components and appurtenances, shall be designed and installed in accordance with the manufacturer's recommendations. No visible leakage will be permitted in the grinder pump wet well.

2.10.2B SUBDIVIDED PROPERTY SERVED BY GRINDER PUMP SYSTEM

When an applicant is proposing to subdivide property and multiple property owner's will connect to the District's collection system, it is recommended to install a new epoxy lined manhole and gravity sewer main. The private grinder pump system and force mains shall connect to the District owned manhole and gravity sewer main.

The sides and bottom of the manhole shall be epoxy lined. The lining shall be a solventless, 100% solids corrosion resistant epoxy coating. Acceptable Manufacturer(s) are Sikagard 62 or approved equal. The point of connection shall be no more than one foot above the flow line of the receiving manhole. Inside drops will not be permitted. The force main connections shall include an approved flexible seal.

The manhole and gravity sewer main shall be installed in accordance with the District's current rules, regulation and details. Engineering plans shall be prepared and submitted to the District Engineer for review. An odor control system may be required as determined by the District.

2.10.3 APPROVAL FOR UTILIZATION

The District requires the use of progressing cavity type pumps. Those currently approved by the District include the Environment-One semi-positive displacement grinder pump. Companies and/or manufacturers requesting District approval of their grinder pump shall be required to submit technical data to the District and pay for the District's engineering review of their product. Costs for the engineering review will be determined prior to the review and must be paid to the District in advance.

The grinder pump manufacturer shall provide a factory-trained serviceman to perform installation, startup, and field-testing prior to final approval by the District of the service connection. The manufacturer shall submit to the District the manufacturer's start-up authorization form describing the results of the tests performed for each grinder pump station tested, and bearing the signature of the manufacturer's authorized technician, signifying approval of the installation and test results.

2.10.4 USAGE

Each individual lot and/or residential unit served by a low-pressure sewer system shall have a separate grinder pump unit and force main. Electrical service shall be supplied to the grinder pump unit by the structure it serves.

Multi-family structures consisting of two or more units shall be served by individual grinder pump systems and individual force mains. Power to each grinder pump system shall be provided by the unit it serves.

No private force main/discharge pipeline from a private grinder pump system may be connected to another private force main/discharge pipeline from another private grinder pump system for an adjacent property. No single grinder pump system shall provide service to premises and structures with plumbing systems that are under separate ownership.

SECTION 3:

SITE PREPARATION, TRENCHING, BACKFILLING, AND COMPACTION

3.1 INTRODUCTION

The purpose of this Chapter is to prescribe the standards and procedures to be followed by the contractor and/or his representative in demolition, site preparation, making proper excavations, backfilling, and compaction of installations within the District, and to define the position of the District in administering this regulation.

The work to be performed shall include the demolition and removal from the site of all designated: buildings, slabs on grade, retaining walls, steps, asphalt, rubbish, stumps, trees, shrubs, fencing, buried tanks, pipe etc.; on site wells shall be sealed; depressed areas are to be filled and graded to drain. These Standards shall apply to all new construction within the District.

In public right-of-ways, wherein the District will assume the maintenance of materials installed, the work to be performed shall also include topsoil removal and replacement, unclassified excavation, placing and compacting embankment, shaping and compacting subgrades, etc., for drainage ways, parks, concrete slabs on grade, etc.

3.1.1 LOCAL LAWS, ORDINANCES AND CODE

The Contractor shall be licensed with and bonded to the District and shall comply with all current federal, state, county and local laws, codes and ordinances pertaining to demolition, wrecking, clearing and grubbing operations.

3.1.2 PROTECTION AND PUBLIC IMPROVEMENTS

The Contractor will be held responsible to ensure the protection of all existing public improvements including, but not limited to, fire hydrants, street lights, traffic lights, parking meters, traffic signs, catch basins, manholes, valves, survey monuments, overhead utility lines and poles, and any existing underground sprinkler or utility lines which may be damaged during the execution of the District contract or developer project. It will be the Contractor's responsibility to replace all public improvements so damaged at his own expense. Existing manhole rings and covers, valve boxes and sprinkler heads found defective shall be replaced, as directed by the District and/or Engineer.

The Contractor shall take proper precautions for the protection of and replacement or restoration of driveway culverts, street intersection culverts or aprons, storm drains or inlets, fences, irrigation ditches crossings and diversion boxes, mailboxes, shrubbery, flowers, ornamental trees, driveway approaches and all other public or private installations that may be encountered during the performance of work. He shall provide each property with access at all times during

construction. Existing driveways shall be cut, filled and graded as required or as directed by the City of Leadville Street Department to provide permanent access. Existing driveways shall be resurfaced with the then existing type of surfacing, whenever surfaces are destroyed.

3.1.3 DISCONNECTION OF EXISTING UTILITIES

Before starting demolition of any structure, the Contractor shall arrange for the disconnection of all utility service connections, such as water, sewer, cable T.V., telephone, gas and electrical power connected thereto. Disconnects shall be made in accordance with the regulations of the utility that controls the supply of service involved.

Underground services are to be cut, capped and marked at point of disconnect to facilitate future location of the line. Caps of underground storm and sanitary sewer shall consist of a plug being placed in the line and the opening then sealed with concrete. Markings of the end of the line shall consist of a 4 x 4 wooden stake or metal fence post driven into the ground and then tagged to note the type of facility.

The Lake County Public Works Department and/or District will provide a representative to be on site to observe and approve the Contractor's disconnect of the water and sewer services at the main line. It shall also be the responsibility of the Contractor to backfill all holes to finished grade and install concrete or asphalt surfacing when the holes excavated are in streets or paved areas. The Contractor will be given written approval and acceptance for disconnects that are proper. The Contractor shall correct any unsatisfactory disconnects.

3.1.4 EQUIPMENT OPERATED IN STREETS

The Contractor shall be permitted to operate only pneumatic-tired equipment over any paved surface and shall be responsible for any damage to street surface resulting from his operations.

3.1.5 TEST RESULTS

All subgrade test results including trench compaction, subgrade preparation and stabilization etc. on private developer projects must be submitted to the District for approval prior to placement of any asphalt or surface concrete. Minimum materials testing frequencies should be confirmed before testing and submission.

3.2 DEMOLITION, CLEARING AND GRUBBING

3.2.1 FENCES

Where existing fence or corner markers are to be removed, site corners shall be marked by 1/2-inch rebar, 18-inches long, firmly implanted at ground level by the Contractor.

3.2.2 TREES AND SHRUBS

Trees not impeding demolition of structures or performance of the work will not be removed except as designated. Trees and shrubbery designated for removal will include stumps and roots to a minimum depth of 3 feet below existing or finished grade, whichever is lower. Downed

trees, brush and rubble shall be removed from the site. A tree shall be defined as having a trunk that is greater than 12 inches in diameter when measured 4 feet above the existing ground surface.

Trees scheduled to remain shall be carefully protected from damage during performance of the work. Any damage due to the Contractor's operations shall be repaired by suitable tree surgery methods. Damaged trees shall be replaced, as approved by the City, at the Contractor's expense.

3.2.3 CESSPOOLS, PRIVIES, BURIED FUEL AND SEPTIC TANKS

Tanks that may exist on project sites shall be completely removed and contaminated soils remediated. The void created shall be filled by the Contractor to finished grade. Underground motor fuel storage tanks shall be excavated and removed. The Contractor shall notify Leadville/Lake County Fire Rescue twenty four hours in advance of the time he proposes to start excavation in the vicinity of the tanks.

3.2.4 BUILDINGS

The demolition of buildings shall include the removal from the site of all roofs, walls, chimneys, basement walls, supporting walls, footings, footing posts, caissons, basement floors, including all pipes, conduits and similar appurtenances lying therein or beneath for a depth of 2 feet below grade.

3.2.5 SLABS ON GRADE

All concrete and asphalt slabs on grade shall be removed from the site. This shall include, but is not limited to, floor slabs, driveway and garage slabs, sidewalks, curbs, crosspans, gutters, etc.

3.2.6 WALLS

Retaining walls and their footing shall be removed in their entirety, from the site.

3.2.7 SALVAGE

Unless otherwise specified; all materials, salvageable or otherwise, to be removed from the site is considered as being the property of the Contractor performing the work.

3.2.8 FILLING AND GRADING

Depressions resulting from the removal of structures, basement walls, footings, buried tanks etc., shall be filled and compacted with clean fill materials so as to eliminate hazards of cave-in, accumulation and ponding of water. Under no circumstances shall organic building material, broken concrete over 1 foot in diameter, or asphalt be considered as approved fill material.

Immediately following demolition and removal of rubbish from the site, the Contractor shall grade the entire contract area by filling, compacting, and leveling the site to existing adjacent grades. Grading and cleanup of the site must be complete and acceptable before any consideration will be given to making final payment for the work on District projects.

3.2.9 TOPSOIL

The Contractor shall salvage within the project limits, or acquire when needed, loose friable loam reasonably free of admixtures of subsoil, refuse, stumps, rocks, roots, brush, weeds or other material which would be detrimental to the proper development of vegetative growth for use as topsoil.

Topsoil shall be placed and spread at locations and to the thickness shown on the plans, after the areas to be covered have been properly prepared and grading operations in the area have been completed and accepted. Soil so placed shall be keyed to the underlying subgrade by the use of harrows, rollers or other equipment suitable for the purpose, followed by applying water in a fine spray by nozzles or spray bars in such a manner and extent that wash or eroding will not occur.

3.3 EXCAVATION

See Section 4.6 GRADING AND EXCAVATION.

3.4 EMBANKMENT

Areas to receive embankment and/or structural backfill material and the top of cut areas shall first be stripped of all vegetation, organic material, asphalt, concrete, and materials unsuitable for use in embankments. Topsoil shall be stockpiled for reuse and unsuitable material disposed of.

Under no circumstances shall organic building material, broken concrete (greater than 1 ft. diameter), or asphalt be considered as approved embankment material. Within the limits of the embankment area the subgrade shall be windrowed or deep plowed to a depth of 12 inches and the moisture content increased or reduced as necessary to bring the moisture within +/- 3% of optimum. This windrowed or deep plowed layer shall then be rolled and compacted to the relative compaction specified for the type of soil. The remainder of the embankment volume shall then be constructed in 6 inch lifts of suitable material, containing +/- 3% of optimum moisture content for sandy soils and compacted to the relative compaction specified for the soil classification. Rollers shall be of a tamping type conforming to CDOT standards. In-place density tests of embankment material shall be taken every 250 lineal feet along the roadway or per every 200 cu. yd. of embankment, whichever is less. Results shall report densities (maximum dry and relative) to nearest 0.1 lb./cu. ft., moisture content (optimum and in place) to nearest 0.1%, and compaction (relative and required) to nearest 1%. Gradation in accordance with ASTM C136 and Atterberg Limits in accordance with ASTM D4318 shall be taken for each type of embankment soil placed. A moisture density curve determination for each embankment soil type placed in accordance with ASTM D 1557/AASHTO T-180 (A-1, A-3, A-2-4 and A-2-5 soils only) or ASTM D 698/AASHTO T-99 (all other soils) shall also be submitted to the Engineer.

In connection with normal grading operations, the Contractor shall use trucks, tractors, bulldozers and other pieces of equipment in the most effective manner by routing the equipment over the entire embankment or roadway width.

3.4.1 COMPACTION

Maximum dry densities of all soil types encountered or to be used will be determined in accordance with AASHTO T-99 or T-180. The percent of relative compaction required will be equal to or greater than minimum values as hereinafter shown for the various classes of soil and type of compactions.

Table 4 – Minimum Relative Compaction

Soil Classification (AASHTO M 145)	AASHTO T 99 Minimum Relative Compaction	AASHTO T 180 Minimum Relative Compaction
A-1	100	95
A-3	100	95
A-2-4	100	95
A-2-5	100	95
All Others	95	(not applicable)

Compacted subgrade ready to receive subbase material shall conform to the lines, grades and cross-section called for on the plans. Subgrade is to be established by survey.

3.5 SUBGRADE FOR SLABS ON GRADE AND PAVING

3.5.1 GENERAL

Subgrade areas to be occupied by concrete curbs, gutters and sidewalks, base course or asphaltic concrete shall, at a minimum, be stripped of all topsoil and excavated to a depth of 12 inches below final subgrade level, be backfilled in two 6-inch lifts, and compacted to establish final subgrade level. This work shall be done with particular care in accordance with all requirements herein.

3.5.2 PREPARATION

Subgrade soils shall be free of organic material, roots, sod, weeds, wood, ice, snow, or other deleterious matter and all rocks greater than 6 inches in diameter. Subgrade soil shall be windrowed, tilled in place using a Bomag type rototiller or otherwise completely removed to a minimum depth of 12 inches below final subgrade level, moisture treated to within 2 percent of optimum moisture content (-1% to +3% optimum for A-6 or A-7-6 soils), and replaced and compacted in 6-inch lifts to densities as shown for the soil type in Section 3.4.1 COMPACTION. Scarifying in place soils by means of discing or ripping is not acceptable. Minimum removal depth must be verified by District and/or City prior to replacing soil in excavated area. A moisture density curve determination in accordance with ASTM D 1557/AASHTO T-180 (A-1, A-3, A-2-4 and A-2-5 soils only) or ASTM D 698/AASHTO T-99 (all other soils), Atterberg Limits and gradation test of each soil type removed and replaced shall be submitted to the Engineer. In place compaction testing frequency for the subgrade shall be a minimum of each six-inch lift on replacement materials with one test for every 250 feet alternating each lane with more tests taken if necessary to establish that compaction requirements are being met. Results shall report densities (maximum dry and relative) to nearest 0.1 lb./cu. ft., moisture content

(optimum and in place) to nearest 0.1%, and compaction (relative and required) to nearest 1%. Soft and yielding material and other portions of the subgrade which will not compact when rolled or tamped shall be removed as directed by the Engineer and replaced with suitable material. Additional or alternate subgrade preparation may be required as recommended by the geotechnical and/or pavement design report submitted by the Geotechnical Engineer on developer projects or as called out on the construction plans. No paving, subbase, or base shall be placed on soft, spongy, frozen or otherwise unstable subgrade that is considered unsuitable by the Engineer.

3.5.3 WETTING AND COMPACTING

Embankments, bases of cuts, natural foundations, base courses and surface courses shall be wetted and rolled to obtain the densities required. The Contractor shall use his equipment to consolidate each layer of embankment in the most effective manner. Each layer shall be compacted by routing the loaded hauling equipment over the entire width and spreading equipment shall be operated so as to produce a dense, stable fill. Successive layers of material shall not be placed until the layer under construction has been thoroughly compacted. Where methods in use do not consolidate materials to required densities, rollers or mechanical tamping units of the type ordered by the Engineer shall be used.

Concurrently with the rolling or tamping operations, the materials shall be wetted by uniformly sprinkling each layer or course of material being placed, to within 2% of optimum moisture content (-1% to +3% optimum for A-6 or A-7-6 soils). Sprinkling shall be done in such a manner that areas of dry material alternate with areas of saturated material and pools of water will be avoided.

Where mechanical tampers are used as ordered by the Engineer, they shall be operated at all times with an air pressure not less than 80 psi at the tamper. Successive blows with the tamper shall overlap at least one-fourth the width of the tamper foot.

3.5.4 STABILIZED SUBGRADE PREPARATION

The subgrade to be stabilized shall be free of roots, sod, weeds, wood, ice, snow, or other deleterious matter and stones greater than 6 inches in diameter. Material in the stabilized zone shall have a soluble sulfate content less than 0.5 percent. If the subgrade soils have a soluble sulfate content greater than 0.5 percent, the mix design for the stabilized subgrade shall be addressed to prevent adverse sulfate reactions. The subgrade shall not be treated when the ambient air temperature falls below freezing or the subgrade material is below 40 degrees F, and shall conform to ACI 306R-16 "Guide to Cold Weather Concreting".

3.6 HOUSEKEEPING, RESTORATION AND CLEANUP

3.6.1 SURPLUS EXCAVATION

All surplus excavated material shall be removed from the job site by and to locations provided by the Contractor. Written permission shall be obtained by the Contractor, before disposal of excess material on private property, and a copy of said permission shall be furnished to the Engineer.

The District relinquishes all right and title to the surplus material unless otherwise specified.

Excess material shall not be wasted on any public ROW without written permission from the Engineer.

3.6.2 CONCRETE CURB, GUTTER, VALLEY GUTTER AND SIDEWALK

The Contractor shall replace in like kind all curb and gutter and valley gutter that are damaged during construction. The replacement shall be of equal or better quality than found at a minimum concrete thickness of 6-inches. Separate payment will be made for replacing curb and gutter and valley gutter removed for the installation of a pipeline on District projects. Minimum removal length shall be 5 feet from an existing control joint. If, after removal of the minimum 5 feet, less than 5 feet of concrete remains to the next control joint, then the entire length to the next control joint shall be removed and replaced.

3.6.3 REPAIR OF TREE DAMAGE

Any trees along the alignment of conduits that are damaged by the Contractor shall be repaired and treated accordingly. All broken limbs shall be sawed off evenly and cut faces painted with an approved compound. All repairs and treatments shall be done in accordance with the forestry regulations of the authority having jurisdiction and at Contractor's expense.

3.7 PIPE BEDDING AND BACKFILL

A. Trench Zones

The terms "Bedding Zone", "Pipe Zone" and "Backfill Zone" shall refer to the trench zones identified in the Standard Details, Drawing A.5.

- 1. Bedding Zone.** The Bedding Zone shall consist of all material placed below the pipe invert.
- 2. Pipe Zone.** The Pipe Zone shall consist of all material placed above the pipe invert to an elevation 6-inches above the top of pipe.
- 3. Backfill Zone.** The Backfill Zone shall consist of all material above the Pipe Zone.

B. Material

All bedding and backfill material shall have the approval of the Engineer. 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 Standard Details and 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. The test results shall be submitted to the District for approval and verified as to their accuracy. These tests shall be performed at no cost to the District or its agents. The minimum bedding and backfill requirements shall be as shown on the appended Drawing A.5.

4. **Sand bedding or sand backfill material.** This material shall be a clean, well-graded sand and shall conform to the following limits when tested by means of laboratory sieves:

Table 5

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
3/8-inch	100
No. 4	70 – 100
No. 8	36 – 93
No. 16	20 – 80
No. 30	8 – 65
No. 50	2 – 30
No. 100	1 – 10
No. 200	0 – 3

5. **Roadbase bedding material or Roadbase backfill.** This material shall be Class 6 aggregate base course as specified by the State of Colorado Department of Highways; and shall meet the following gradation:

Table 6

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
3/8-inch	100
No. 4	30 – 65
No. 8	20 – 55
No. 200	3 – 12

6. **Squeegee Sand.** This material shall be clean, well graded and conform to the following limits when tested by means of laboratory sieves:

Table 7

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
3/8-inch	100
No. 4	20 – 80
No. 8	10 – 25
No. 16	0 – 10
No. 200	0 – 2

7. **Granular Bedding or Granular Backfill Material.** This material shall be imported crushed rock or angular surfaced gravel and meet the following gradation (ASTM D448, No. 67):

Table 8

<u>Sieve Size</u>	<u>Total Percent Passing by Weight</u>
1-inch	100
3/4-inch	90 – 100
3/8-inch	20 – 55
No. 4	0 – 10
No. 8	0 – 5

8. **Select Material.** Select Material shall not be permitted unless authorized by the Engineer. This material shall consist of suitable material screened from the excavated earth having no rocks or stones greater in size than 2 inches for DIP or RCP and 3/4-inch for all other pipe.
9. **Trench Stabilization Material.** This material shall be a 3/4 to 1-1/2-inch uniformly graded, crushed rock or concrete aggregate.
10. **Backfill Material.** Backfill Material shall consist of suitable material from the excavated earth, meeting all the requirements of the Specifications.

No boulders over 6 inches in any dimension shall be allowed in the top 12 inches of the trench. All boulders shall be carefully placed so that no damage will be done to the pipeline. No backfill material shall have boulders larger than 24 inches in any dimension. Boulders larger than 8 inches in any dimension shall be carefully lowered into the trench until the backfill is 4 feet over the top of the pipe.

C. Bedding and Backfill Installation

1. **General.** 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. 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 or ASTM D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

When required by the District, the Contractor shall excavate backfilled trenches for the purpose of performing compaction tests at locations and depths required by the District. The Contractor shall be responsible for reinstalling and compacting the test excavations at no additional cost to the District.

2. **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 95 percent maximum dry density or to 75 percent relative density.
3. **Pipe zone installation.** 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 details on the drawings.

The backfill material shall be as specified on the details and shall be placed and compacted in distinct, separate lifts not to exceed 6 inches of loose depth; except that the first loose lift shall not be higher than the pipe centerline (springline). If select backfill materials are permitted in this zone but acceptable select backfill material (suitable for placement within 12 inches of the pipe barrel) is not available at any particular location, the Developer shall use imported granular backfill material. Compaction shall meet the requirements of "Bedding Zone Installation," utilizing T-bars or mechanical tamping equipment.

4. **Backfill Zone Installation in open areas.** 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 2 feet. Each lift shall be compacted by mechanical equipment to 90 percent of laboratory 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 less than two 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.
5. **Backfill zone installation in roads and streets.** Beneath all traveled ways in roads and streets, highway shoulders and within 15 feet of pavement in State Highway Department rights-of-way (unless otherwise specified on the plans) backfill shall be carefully placed and compacted up to the limit of base course material or to gravel. Compaction shall be by mechanical tamping in 8-inch maximum loose lifts using mechanical or hand tampers, weighing not less than 20 pounds, or vibratory rollers. All other means must be approved in writing by the Engineer. All backfill shall be compacted to 95% of maximum laboratory dry density or 70 percent relative density. The material shall be within 2.0 percent of optimum moisture content.

The Contractor may request approval of alternate means of compaction. Such request must be submitted to the District in writing. Approval of the compaction method will be made by the District only in writing. Use of specified or approved compaction methods does not relieve the Contractor or Developer from providing a completed project meeting the intent of this Specification.

SECTION 4:

EARTHWORK, REVEGETATION, AND EROSION CONTROL

4.1 INTRODUCTION

Erosion and resulting sedimentation are naturally occurring processes which have the potential to be rapidly accelerated as a result of land disturbing activities associated with development. The purpose of establishing and implementing these Earthwork, Revegetation, and Erosion Control Criteria is to prevent degradation to downstream properties and receiving waterways as a result of the site disturbance process within the District.

See the Roadway Design Standards and Construction Specifications for Lake County, Colorado (RDS), for guidance regarding erosion and sediment control.

4.2 REGULATORY REQUIREMENTS

The Federal Clean Water Act (CWA), implemented through the Environmental Protection Agency (EPA) requires authorization to discharge stormwater associated with construction activities through the National Pollutant Discharge Elimination System (NPDES). In Colorado, the NPDES is administered through the Colorado Department of Public Health and Environment – Water Quality Control Division (CDPHE-WQCD). Currently any and all construction activities disturbing more than one acre are required to comply with the provisions stipulated in a General Permit for Stormwater Discharges Associated with Construction Activity. The owner or operator of the construction activity shall submit this General Permit Application at least 10 days prior to the anticipated date of land disturbing activities to:

Colorado Department of Public Health and Environment
Water Quality Control Division
WQCD-Permits
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530
(303) 692-3517

The main provision with the Permit is the development and implementation of the Stormwater Management Plan (SWMP).

ACCEPTANCE OF THE SWMP (if required) BY THE CITY AND DISTRICT IS REQUIRED PRIOR TO FINAL PLAT ACCEPTANCE. SWMP APPLICATION TO THE STATE MUST BE APPROVED PRIOR TO COMMENCING ANY CONSTRUCTION.

THE CITY AND DISTRICT SHALL HAVE AUTHORIZATION TO ISSUE A STOP WORK ORDER FOR FAILURE TO COMPLY WITH THE PROVISIONS OF THE PERMIT AND/OR THESE CRITERIA. CITY AND DISTRICT STAFF MAY REQUIRE EMERGENCY MITIGATION MEASURES.

4.2.1 CALIFORNIA GULCH SUPERFUND SITE

Projects located within the California Gulch Superfund Site, as defined in Section 15.36.020 of the Leadville Colorado Municipal Code, version May 25, 2021, have additional requirements. Contractors performing work within these areas must:

1. Review Ordinance No. 2013-13, which is provided as Chapter 15.36 of the Leadville Colorado Municipal Code, version May 25, 2021, and as Section 3.2 of the Lake County Land Development Code.
2. Obtain the Lake County Best Management Practices handout for managing potentially contaminated soils in the city and Lake County. Sign and return the accompanying affidavit to the Leadville Building Services Department.
3. Where required (including excavation and removal of any earthen materials including, but not limited to, native dirt, native soil, mine waste rock or mine tailings, slag, flue dust, or smelter waste, in excess of ten cubic yards), obtain a Letter of Approval from the Colorado Dept. of Public Health and Environment.

4.3 BEST MANAGEMENT PRACTICES (BMPs)

The purpose of this section of these Standards is to provide a guideline for acceptable practices to be utilized within the District. The Erosion and Sediment Control industry has experienced rapid progress over the last decade and is continuing to expand. As such, the design engineer is strongly encouraged to utilize the latest advances in selection methodology and information now available. The greatest benefits to enhancing water resources are realized if Erosion Control is thought of as preventative in nature whereas Sediment Control is treatment.

The NPDES requirements are strict, and the penalties associated with non-compliance are severe. Planning, designing, and implementing a thorough SWMP are the most effective way to protect water resources, thereby complying with the NPDES requirements. These Erosion and Sediment control BMPs are intended to eliminate non-point source pollution to receiving waterways as a result of the land development process during construction activities. Establishing vegetated cover capable of providing equal or greater erosion control benefits as compared to historic conditions is the goal of the Erosion Control BMPs. The maintenance requirements of the Sediment Control BMPs are described in these Standards cannot be overemphasized, that is to say if they are functioning properly, accumulated sediment will need to be removed. As construction progresses, the SWMP and associated BMPs will need to adapt to the changing conditions of the site. In addition to these construction BMPs, Administrative Control BMPs are equally as important. Administrative BMPs include ideas and methodology concerning the manner in which construction occurs. Education, training, and coordination of all involved parties is an effective way to limit the erosion on a project, thereby limiting the need for sediment control, and is a prime example of Administrative Control BMPs.

4.4 EROSION AND SEDIMENTATION CONTROL BEST MANAGEMENT PRACTICES (BMPs)

This section provides a set of criteria and technical guidance for erosion and sediment control and material management. Erosion control measures limit erosion of soil from disturbed areas including stockpiled material at the construction site. Sediment control measures prevent the transport of sediment off-site to downstream properties and stormwater conveyances. Materials management is the practice of containing and controlling all materials used in order to eliminate potential pollutants from leaving the site, entering the storm sewer system or drainage way. The site's erosion and sediment controls and material management BMPs must be inspected and maintained by the owner/operator daily.

4.4.1 GENERAL BMPs

4.4.1A BMP – STOCKPILES

1. **BMP Application.** Straw Wattle or Rock Bag used for stockpile containment. If stockpiles are located within 100 feet of a waterway, including conveyances to them, additional sediment controls must be provided. A weighted down wattle or rock bag must be installed on the downstream side of all stockpiles.
2. **BMP Installation.** Install in an arced position on the downhill side of stockpiles. Place two feet from the toe of the stockpile to allow for ponding. Instruct persons accessing the stockpiles with equipment to work around the BMP or temporarily relocate it. Damaged BMPs must be replaced immediately.
3. **BMP Maintenance.** Sediment entrapment BMPs (wattles or rock bags) must be cleaned and repositioned daily. Broken or crushed BMPs must be replaced immediately. Any materials spilled from the BMP when damage occurs must be removed from the site and disposed of.

4.4.1B BMP – INLET PROTECTION

1. **BMP Application.** An approved design for protecting inlets must be installed at all storm sewer inlets directly downstream of and within work area.
2. **BMP Installation.** Install around entire inlet or from curb to curb.
3. **BMP Maintenance.** Inlet protection must be repositioned or replaced at the end of every day. Sediment and debris accumulated at inlet protection must be removed and disposed of daily.

4.4.1C BMP – INLET PIPE PROTECTION

1. **BMP Application.** An approved design for protecting pipes during storm sewer inlet re construction must be installed within the inlet at all pipe connections.
2. **BMP Installation.** Install at piping within inlet.

3. **BMP Maintenance.** Inlet protection must be repositioned or replaced at the end of every day. Sediment and debris accumulated within the inlet must be removed and disposed of daily. After inlet construction is completed, all dirt, materials and pipe protection must be removed and disposed of and an approved inlet protection installed.

4.4.1D BMP – CURB SOCKS

1. **BMP Application.** Curb Socks used for sediment entrapment downstream of work area.
2. **BMP Installation.** Curb Socks must be installed within gutters, contacting the curb and set at a 45-degree angle.
3. **BMP Maintenance.** Curb Socks must be repositioned or replaced if broken daily. Accumulated sediment must be removed and disposed of daily.

4.4.1E BMP – STREET SWEEPING (NON-STRUCTURAL BMP)

1. **BMP Application.** Street sweeping either by machine or manually for the removal of excess materials on the roadway, sidewalks, or gutters.
2. **BMP Maintenance.** Street sweeping must be conducted at the end of each day. This includes the removal of materials in the gutters or accumulated at sediment entrapment BMPs.

4.4.1F BMP – VEHICLE TRACKING CONTROL

1. **BMP Application.** Tracking pads used where vehicles enter or exit hard surfaced areas to limit the transport of materials onto impervious areas.
2. **BMP Installation.** Tracking pads must be installed anywhere that vehicles or equipment come in contact with unpaved surfaces regardless of if the area is public or private. This includes road shoulders. Materials most commonly used are recycled concrete or 1½-inch rock.
3. **BMP Maintenance.** Additional rock must be added to tracking pads when original pad material begins to fill with dirt. At the end of the project the areas where tracking pads were installed must be restored to the original condition.

4.4.1G BMP – STABILIZED STAGING AREAS

1. **BMP Application.** Areas designated for equipment and material storage.
2. **BMP Installation.** Staging areas whether on private or public areas must remain organized and clean. The staging area may be used for equipment and construction material storage, sanitary waste receptacles and other waste receptacles. All fluids or hazardous materials stored at the staging area must be stored inside or covered on pallets.

3. **BMP Maintenance.** Organize and clean the staging area daily. Do not allow dumpsters to become over full or store waste piles on site. All waste piles must be contained.

4.4.1H BMP – CONCRETE WASHOUT

1. **BMP Application.** A washout pit or portable washout bin used to contain concrete waste and wash water associated with concrete or masonry operations. If small amounts of concrete are to be prepared on site, containment is still required.
2. **BMP Installation.** All types of concrete mixing or washing must be contained either by a pit, portable bin, or baby pool. Mixing concrete or washing out concrete trucks or equipment on site without approved containment is prohibited.
3. **BMP Maintenance.** Accidental spills must be cleaned up immediately. Containers that are full must be removed from the site and properly disposed of.

4.4.1I BMP – WASTE MANAGEMENT

1. **BMP Application.** All waste generated on site must be contained. At no time will construction debris or waste generated at the site be allowed to be stored on site, uncontained.
2. **BMP Installation.** Dumpsters and trash bins must be provided on site and placed in a designated area.
3. **BMP Maintenance.** Receptacles must be emptied frequently. Liquids may not be placed within the receptacles if there is a possibility they could leak.

4.4.1J BMP – MATERIAL MANAGEMENT

1. **BMP Application.** Construction materials including stockpiles and equipment must be stored in a designated area.
2. **BMP Installation.** Perimeter BMPs must be installed at all stockpiles, at pipe storage areas, and where equipment is stored on impervious surfaces that may contribute grease, oil, or dirt to the site.
3. **BMP Maintenance.** Materials must be kept organized and neatly stored. Perimeter BMPs must be repositioned or replaced if damaged, daily.

4.4.1K BMP – FUELING/MAINTENANCE OPERATIONS

1. **BMP Application.** If equipment undergoes fueling, maintenance or repair on site, BMPs must be used.
2. **BMP Installation.** A drip pan or container will be used during on site fueling, maintenance or repair operations. Absorbents will be available should a spill occur.

3. **BMP Maintenance.** Spills will be cleaned up immediately. Fluids leaking from any vehicle or equipment will be cleaned immediately and that vehicle or piece of equipment repaired or removed from the site.

4.4.1L BMP – SANITARY WASTE MANAGEMENT (PORTABLE TOILETS)

1. **BMP Application.** Portable sanitary waste receptacles required on site for use by all personnel.
2. **BMP Installation.** Portable receptacles must be secured in place and not positioned on an impervious surface. Receptacles must be located at least 3-feet from all impervious areas, flow lines, ditches, creeks or storm sewer inlets.
3. **BMP Maintenance.** Receptacles must be checked daily and routinely maintained. In the event materials are spilled from a receptacle, immediate clean-up is required. If a contracted company must respond for the clean-up and the response time is unknown, absorbents must be applied to the spill by the onsite contractor immediately.

4.4.1M BMP – STABILIZATION

1. **BMP Application.** To be installed on all disturbed areas that will not be seeded or paved. All areas disturbed with a final grade slope of 3:1 or greater will require the installation of seeded slope protection matting.
2. **BMP Installation.** Matting must be installed with continuous contact with the soil and trenched in at the top of the slope or where matting begins. Pins must be used according to product installation specifications to secure the product.
3. **BMP Maintenance.** Matting/Blanketing must be inspected daily and repositioned or replaced if needed.

4.4.2 EROSION CONTROL BMPs

4.4.2A SOIL STABILIZATION TECHNIQUES

Exposed soil shall be stabilized and protected from erosive forces as soon as possible, but no later than 14 days of achieving finished grade or if the area will remain dormant (disturbed, but not at finished grade). Appropriate soil stabilization techniques include:

1. Mulching
2. Rolled Erosion Control Products or Turf Reinforcement Mats (RECPs or TRMs)
3. Proprietary Geosynthetics
4. Bonded Fiber Matrix (BFM)

4.4.2B TEMPORARY REVEGETATION

In addition to the soil stabilization techniques applied, Temporary Revegetation is required on all disturbed areas having a period of exposure of one year or longer prior to final stabilization.

Temporary seeding shall consist of an annual grass cover crop and may be applied:

1. Hydraulically
2. Drilled
3. Broadcast

4.4.2C PERMANENT REVEGETATION

Permanent Revegetation is required on all disturbed areas that are either at finished grade or expected to remain dormant for a period longer than one year. Permanent seeding shall consist of an appropriate native perennial cover crop as recommended by the Natural Resource Conservation Service (NRCS) office in Longmont, Colorado, or accepted substitution.

4.4.2D OTHER EROSION CONTROL BMPs

Other Erosion Control BMP's recommended by the District include:

1. Limiting areas of disturbance
2. Limiting Directly Connected Impervious Areas (DCIA)
3. Establishing buffer strips
4. Planning, scheduling & phasing construction around times of heaviest expected precipitation and snowmelt
5. Transitioning changes in slope
6. Terracing long slopes
7. Surface roughening and contour furrowing

4.4.3 SEDIMENT CONTROL BMPs

4.4.3A TEMPORARY DIVERSION DIKES OR CONTINUOUS BERMS

Temporary Diversion Dikes or Continuous Berms controls shall be required on all disturbed slopes of 3:1 and greater than 20-feet in length or as soil condition and tributary area dictates. These dikes or berms must divert stormwater to a properly stabilized channel, slope drain or rundown to limit rill and gully erosion. This BMP can be designed at the top, mid and/or base of a disturbed slope, following the contour, to effectively limit sediment transport from the disturbed area and may be constructed of the following materials:

1. Compacted Soil
2. Straw Wattles
3. Aggregate Bags
4. Proprietary Geosynthetics

4.4.3B SEDIMENT BARRIERS

Sediment Barriers are perimeter controls designed to pond sediment laden stormwater as a result of overland sheet flow and slowly allows this stormwater to filter through the media as sediment settles out. This BMP shall be required around the perimeter of disturbed areas, at the base of disturbed slopes or as soil condition and tributary area dictates. Proper design of this BMP limits the tributary area to ¼ Acre per 100 lf of barrier, following the contour, to effectively limit the transport of sediment laden stormwater. Sediment barriers may be constructed of the following materials:

1. Silt Fence
2. Straw Wattles
3. Aggregate Bags
4. Geotextile Wrapped Brush Barriers
5. Proprietary Geosynthetics

4.4.3C CHANNEL STABILIZATION

Channel stabilization controls shall be required in all drainage ways where Froude numbers are expected to exceed 0.8 for the minor storm recurrence interval rainfall or as soil condition and tributary area dictates. Proper design of these BMPs either limits stormwater velocities or armors the channel to limit erosion from occurring therefore eliminating sediment transport. Techniques, materials and methods for channel stabilization within the District include:

1. Check Dams
 - a. Aggregate
 - b. Straw Wattles
 - c. Proprietary Geosynthesis
2. Channel Linings
 - a. Aggregate
 - b. RECP/TRM
 - c. Proprietary Geosynthesis

4.4.3D ENERGY DISSIPATION

Energy dissipation controls shall be required at all culvert inlets and outlets. Additionally, energy dissipation controls may be necessary at the terminus of drainage ways, slope drains and/or rundowns to effectively limit erosive forces and sediment transport. Proper design and selection of these BMPs reduce turbulent flow and limit hydraulic jumps within a stabilized area. Techniques, materials and methods for channel stabilization within the District include:

1. Riprap
2. Aggregate Drop Structures
3. Level Spreaders
4. Proprietary Geosynthetics

4.4.3E INLET PROTECTION

Inlet protection controls shall be required at all storm, sewer and/or culvert inlets. The intent of this BMP is to pond sediment laden runoff, allowing sediment to settle out prior to entering the conveyance structure. Proper design and selection of this BMP must allow the conveyance structure to accept the design flow prior to any major inundation as well as have the structural stability to withstand the forces generated by these focused flows. Inlet protection may be constructed of the following materials:

1. Block and Aggregate
2. Aggregate Bags
3. Proprietary Devices

4.4.3F VEHICLE TRACKING

Vehicle tracking controls shall be required wherever construction traffic will enter onto an improved road from a construction site. Additionally, as sediment is tracked onto an improved road, the road shall be removed of accumulated sediment at the end of each workday. Proper design and placement of this BMP limits construction access to controlled points of ingress and egress before and after construction of the road base.

4.4.3G SEDIMENT ENTRAPMENT FACILITIES

Sediment entrapment facilities shall be required on all construction sites of one acre or larger. The minimum required volume of the sediment basin shall be calculated based on 1800 cubic feet per tributary acre. The sediment basin shall incorporate a stabilized spillway capable of passing stormwater flows generated by the one-hundred-year recurrence interval rainfall. The sediment basin can easily be incorporated into the design of a permanent stormwater detention facility and generally provides the most functional and economical solution to implementing this BMP. The sediment basin is designed to effectively slow the velocity of stormwater runoff and allow the suspended sediment to settle; as such, the basin shall be dredged of accumulated sediment prior to becoming half full. Proper design and placement of this BMP serves as the final measure in eliminating sediment laden stormwater runoff from leaving the construction site.

4.5 LANDSCAPING

The objective of a Landscape Plan is to provide a sustainable approach to ensure revegetation of the disturbed site, and to improve aesthetics of the built facilities in a sustainable manner upon completion of a new development. Landscaping shall be designed anticipating mature vegetation and shall not interfere with roadway site distances or overhead lines. If necessary, irrigation designs and costs shall be included in the construction plans and cost estimate. The landscaping plan shall be designed anticipating fully mature plantings.

4.6 GRADING AND EXCAVATION

4.6.1 PERMITS REQUIRED

No person shall do any grading, excavation or fill without first obtaining an Excavation Permit. A separate permit is required for each block, measured intersection to intersection, on which excavation work will occur. If construction disturbs any part of the right-of-way of a state highway, a separate permit shall be obtained from the Colorado Department of Transportation.

4.6.2 APPLICATION FOR AN EXCAVATION PERMIT

An excavation application shall be submitted at least 4 business days prior to any grading, excavation or fills in the District, in accordance with Chapter 12.12.030 of the Leadville Colorado Municipal Code, version May 25, 2021. Each application shall be accompanied by two sets of plans and specifications, supporting data and the information specified in the Excavation Permit Application. The permit may have conditions placed upon it in accordance with these Standards.

4.6.3 GENERAL EXCAVATION GUIDANCE

Excavation will be unclassified and shall consist of the excavation of all material of whatever character encountered within the limits of the project, including but not limited to surface boulders, muck, rock, concrete foundations, slabs, stripping, excavation for ditches or channels, borrow, etc.

Excavation operations shall be conducted, so that material outside the limits of slopes will not be disturbed, and to provide adequate drainage at all times. Insofar as practicable, all suitable materials shall be used in the formation of embankments and backfilling. Materials that are considered unsuitable or surplus by the Engineer shall be disposed of by the Contractor at his expense.

All excavations shall be made to subgrade elevations and shall be true to grade. Material below subgrade elevation in cuts shall not be loosened by plowing or other methods during the progress of the work except with the approval of the Engineer. No excavation shall be made below subgrade elevation except to remove spongy material, vegetable matter or other undesirable materials. In the event the Contractor over excavates an area, he shall replace the excavated material with satisfactory material and thoroughly compact same at his own expense.

Whenever excavation greater than 12 inches below subgrade elevation is required to remove spongy material, vegetable matter, or other material and is ordered by the Engineer, the Contractor shall remove the same to the satisfaction of the Engineer and shall replace it with satisfactory material in layers not to exceed 6 inches in thickness and thoroughly compact and moisture treat each layer before the next layer is placed. The volume of material ordered to be removed shall be paid for at the unit price for excavation. When such excavations are backfilled with suitable material from other excavations in the project, no separate payment will be made. In the event the Engineer orders such excavations to be filled with material from borrow, the Contractor will be paid at the unit price for "Select Subgrade Material" when called for in the proposal.

The Contractors shall not deposit surplus or undesirable materials on private property without first securing the written consent of the property Owner and filing a copy of said consent. When approved, disposal of surplus material shall be kept below the grade designated by the Engineer.

4.6.4 HAZARDS

Whenever the District determines that any existing exaction or embankment or fill has become a hazard to life or limb, or endangers property, or adversely affects the safety, use or stability of a public way or drainage channel, the owner of the property upon which the excavation or fill is located, or other person or agent in control of said property, shall within the period specified therein repair or eliminate such excavation or embankment to eliminate the hazard and to be in conformance with the requirements of these Standards.

4.6.5 ENVIRONMENTAL HAZARDS

Offsite fill material shall be free of environmental hazardous materials. Applicants for a permit shall ensure that fill material hauled from an offsite location is free of environmental contaminants. The source of fill material shall be identified prior to application for an excavation permit. If directed by the District, the Applicant shall have testing performed on a representative sample(s) of the fill material to determine if environmentally hazardous materials are present in the fill.

4.6.6 FILL MATERIAL

4.6.6A FILLS AND EMBANKMENTS

1. Use excess earth from on-site excavation for fills and embankments if practical
2. Obtain additional material from Owner-designated borrow area if necessary
3. Free from rocks or stones larger than 12 inches in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials
4. No rocks or stones larger than 6 inches in upper 18 inches of fill or embankment. Where allowed, distribute rocks and stones through the fill to not interfere with compaction.
5. Fill and embankment material must be acceptable to Geotechnical Engineer
6. Import fill: free of vegetation and debris, non-expansive and maximum plasticity index of 15 (when tested using ASTM D4318)

Table 9 – Gradation for Fill Material

Sieve Size (Inch)	Percent Passing by Weight
3	100
No. 4	50-100
No. 200	35 (maximum)

4.6.6B STRUCTURAL FILL

Imported structural fill, such as ½-inch minus, CDOT Class 7 Aggregate Road Base, conforming to the following:

1. Gradation: 1-inch –100% passing (percent finer by weight ASTM C136), No. 8 Sieve – 20-85% passing, and No. 200 Sieve – 15% (maximum)
2. Liquid Limit: 30 (maximum), Plasticity Index: 6 (maximum)

4.6.6C CONTROLLED LOW STRENGTH MATERIAL (FLOW FILL)

1. Comply with District requirements and ACI 229 for the use of flowable fill within the right-of-way or for public utility trench backfill.
2. Product shall be a lean, sand-cement slurry, “flowable fill” or similar material with a 28-day unconfined compressive strength between 50 and 200 psi

4.6.7 EROSION AND SEDIMENTATION CONTROL

The Applicant conducting the grading activity shall install and maintain temporary and permanent erosion and sedimentation control measures in compliance with these Standards.

4.6.8 VALID PERIOD

All excavation permits shall be valid for only the dates specified on the permit. If, after work is commenced under an approved permit, it becomes necessary to perform work for a longer period of time than what the permit specifies, the permittee shall notify the District and City immediately and shall file a supplementary application for the additional work prior to and as a condition of commencing such additional work.

4.6.9 DISPLAY OF PERMIT

Each permit issued shall be kept at the grading site while the work is in progress and shall be exhibited upon request to any police officer or other authorized representative of the District and/or City.

4.6.10 SURETY DEPOSIT

The District shall require a \$1,000 surety deposit in the form of cash or letter of credit for minor utility installation (service lines) or any grading less than 20 cubic yards. For projects grading larger than 20 cubic yards, the District may require a surety deposit in the amount of 150% of the cost estimate to complete the work. The surety deposit is required to ensure that the work, if not completed in accordance with the approved plan and specifications, will be completed or corrected to eliminate hazardous conditions. Allowable sureties include a company (corporate) check, cashier's check, bond, or irrevocable letter of credit.

4.6.11 PENALTIES

Every person convicted of a violation of any provision of this Chapter shall be punished in accordance with these Standards and Chapter 12.12.180 of the Leadville Colorado Municipal Code, version May 25, 2021. Additionally, the convicted person may be required to replace the graded, excavated, or filled land to its original condition.

4.7 REVEGETATION AND SEEDING

All areas disturbed during construction that require revegetation shall receive a minimum of 4-inches topsoil replacement or an approved design from a landscape architect.

Revegetating disturbed areas of construction is critical to prevent soil erosion. Establishing vegetative cover capable of limiting erosion potential to that of pre-disturbed levels is necessary. Effective revegetation limits raindrop impact erosion, facilitates infiltration, reduces runoff and reduces negative impacts caused by noxious weeds (such as root establishment and out-competing native vegetation). The following seed mix is recommended by the Chaffee County Noxious Weed Department (referenced by the Lake County Conservation District) and shall be implemented on all sites disturbing soil:

DRY NATIVE MOUNTAIN MIX

- Mountain Bromegrass (20%)
- Streambank Wheatgrass (15%)
- Thickspike Wheatgrass (15%)
- Slender Wheatgrass (10%)
- Rocky Mountain Fescue / Arizona Fescue (10%)
- Beardless Bluebunch Wheatgrass (10%)
- Sandberg Bluegrass (10%)
- Prairie Junegrass (5%)
- Bottlebrush Squirreltail (5%)

NOTES:

- The applied seed shall not be covered by a soil thickness greater than 0.5-inches in depth.
- Seeding shall take place on all disturbed areas and stockpiles expected to remain dormant for a period greater than 30 days.
- To provide temporary erosion control prior to seed application, utilize surface roughening (on the contour or perpendicular to prevailing winds) and apply mulch.
- Seed shall be planted with drill seeding equipment, whenever possible.
- Areas that require broadcast seeding shall be mulched and tackified.
- Broadcast seed at 50 pounds per acre with 2-5 pounds per 1,000 square feet on small areas

4.8 REFERENCES AND DESIGN AIDS

- Environmental Protection Agency
- Colorado Department of Public Health & Environment
- Mile High Flood District (formerly the Urban Drainage and Flood Control District)
- Erosion Control Technology Council
- International Erosion Control Association
- International Stormwater BMP Database
- National Resource Conservation Service (NRCS)
- Lake County Conservation District
- Lake County Land Development Code
- Leadville, Colorado Municipal Code

SECTION 5: ROAD CUT STANDARDS, REGULATIONS AND RIGHT-OF-WAY USE PERMITS

5.1 ADOPTION

The Lake County Roadway Design Standards and Construction Specifications, codified in Chapter 10 of the Lake County Land Development Code, as amended from time to time and published by the Lake County Board of County Commissioners, 505 Harrison Avenue, P.O. Box 964, Leadville, CO 80461, is hereby adopted by reference as if fully set out in this chapter.

Drawing A.1 – Standard Approval Block

THESE DESIGNS, PLANS AND CONTRACT DOCUMENTS ARE REVIEWED FOR CONCEPT AND GENERAL CONFORMANCE TO THE DISTRICT MINIMUM STANDARDS ONLY, AND THE PRIMARY RESPONSIBILITY FOR DESIGN ADEQUACY IS TO REMAIN WITH THE ENGINEER OF RECORD. THIS REVIEW DOES NOT IMPLY RESPONSIBILITY BY EITHER THE LEADVILLE SANITATION DISTRICT OR THE DISTRICT ENGINEER FOR THE 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 DISTRICT FOR ADDITIONAL ITEMS AND ADDITIONAL QUANTITIES OF ITEMS SHOWN THAT MAY BE REQUIRED DURING THE CONSTRUCTION PHASE.

APPROVED FOR CONSTRUCTION WITHIN ONE YEAR OF THE EARLIEST OF THESE DATES:

BY _____ DATE
DISTRICT ENGINEER

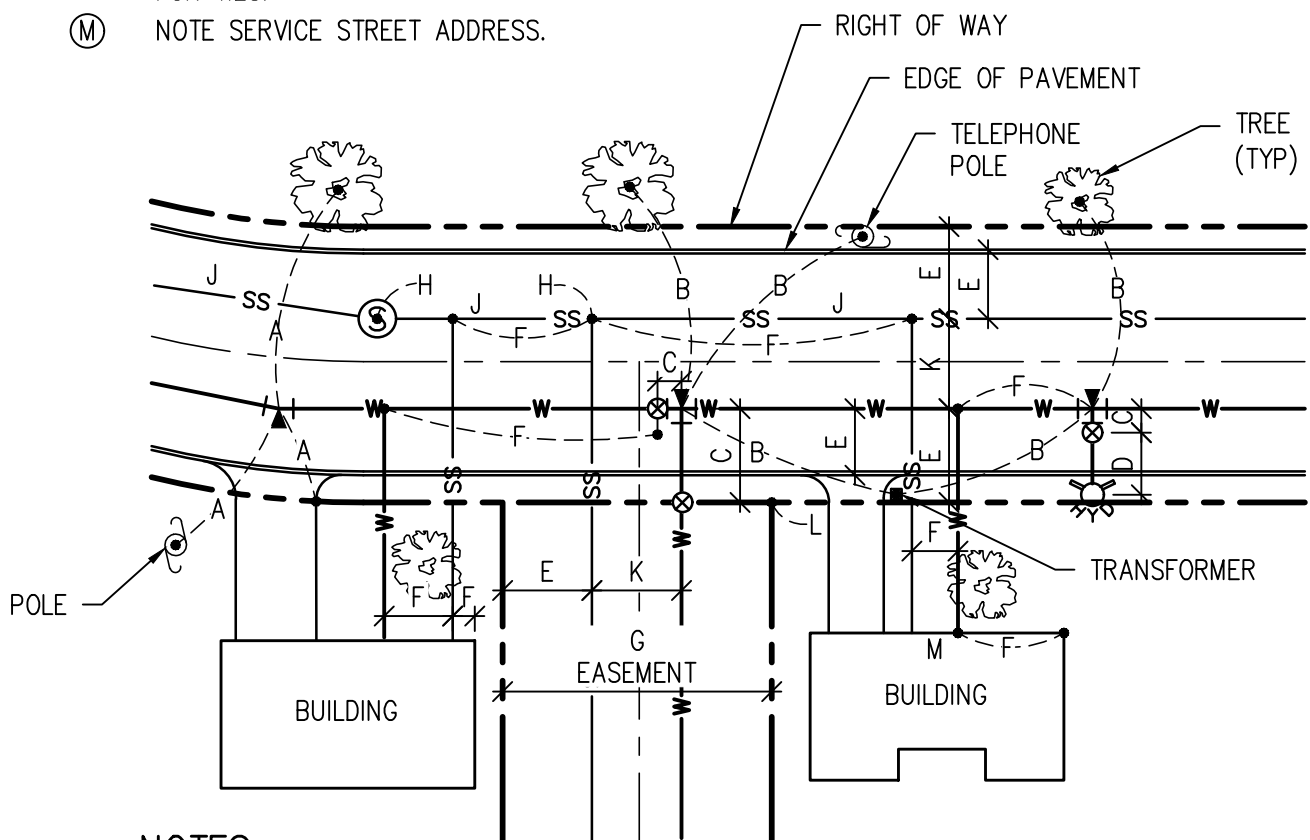
BY _____ DATE
LEADVILLE SANITATION DISTRICT

LEADVILLE SANITATION DISTRICT STANDARD DETAILS
STANDARD APPROVAL BLOCK
MAY 2022

DRAWING # A.1

Drawing A.2 – Typical “As-Recorded” Drawing Information

- (A) LOCATE WATER LINE BENDS. (TO MOST PROMINENT PHYSICAL FEATURE
- (B) LOCATE WATER LINE TEES AND CROSSES.
- (C) LOCATE ALL VALVES SERVICES AND MAINS.
- (D) LOCATE ANY SPECIALITY ITEMS. (E.G. FIRE HYDRANTS, METER VAULTS, ARV VAULTS, PRV VAULTS, COUPLINGS, ETC...)
- (E) NOTE DISTANCE TO EDGE OF PAVEMENT AND R.O.W. OR EASEMENTS.
- (F) LOCATE ALL SERVICE TAPS AND LINES.
- (G) NOTE ANY KNOWN R.O.W. AND EASEMENT INFORMATION.
- (H) NOTE FINAL INVERT ELEVATIONS WITH BENCHMARK ELEVATION REFERENCED.
- (J) NOTE LENGTH, SIZE, MATERIAL AND SLOPE OF LINE AS INSTALLED.
- (K) NOTE DISTANCES BETWEEN UNDERGROUND UTILITIES.
- (L) NOTE PERMANENT EASEMENT MONUMENTS AND PROPERTY CORNERS (PC) WHERE USED FOR TIES.
- (M) NOTE SERVICE STREET ADDRESS.



NOTES:

1. AS RECORDED DRAWINGS TO SCALE.
2. AS RECORDED TO BE SEALED BY THE DESIGN ENGINEER.
3. DRAWINGS TO BE FURNISHED IN AUTOCAD FORMAT.
4. FINAL APPROVAL FOR JOB WILL NOT BE GIVEN UNTIL AS-RECORDED DRAWINGS ARE DELIVERED TO THE DISTRICT

LEADVILLE SANITATION DISTRICT STANDARD DETAILS

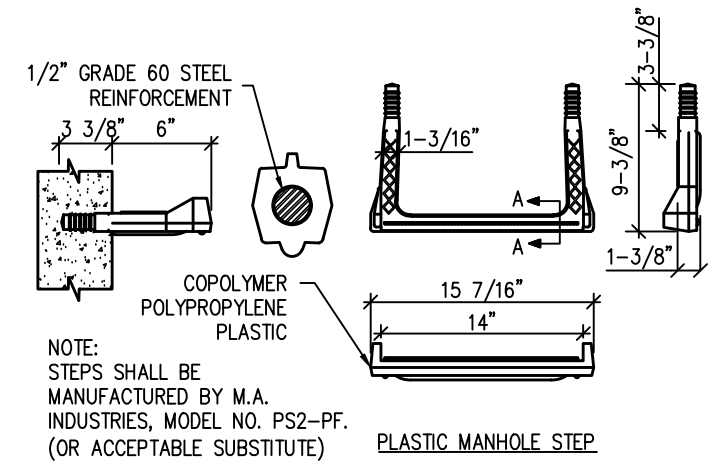
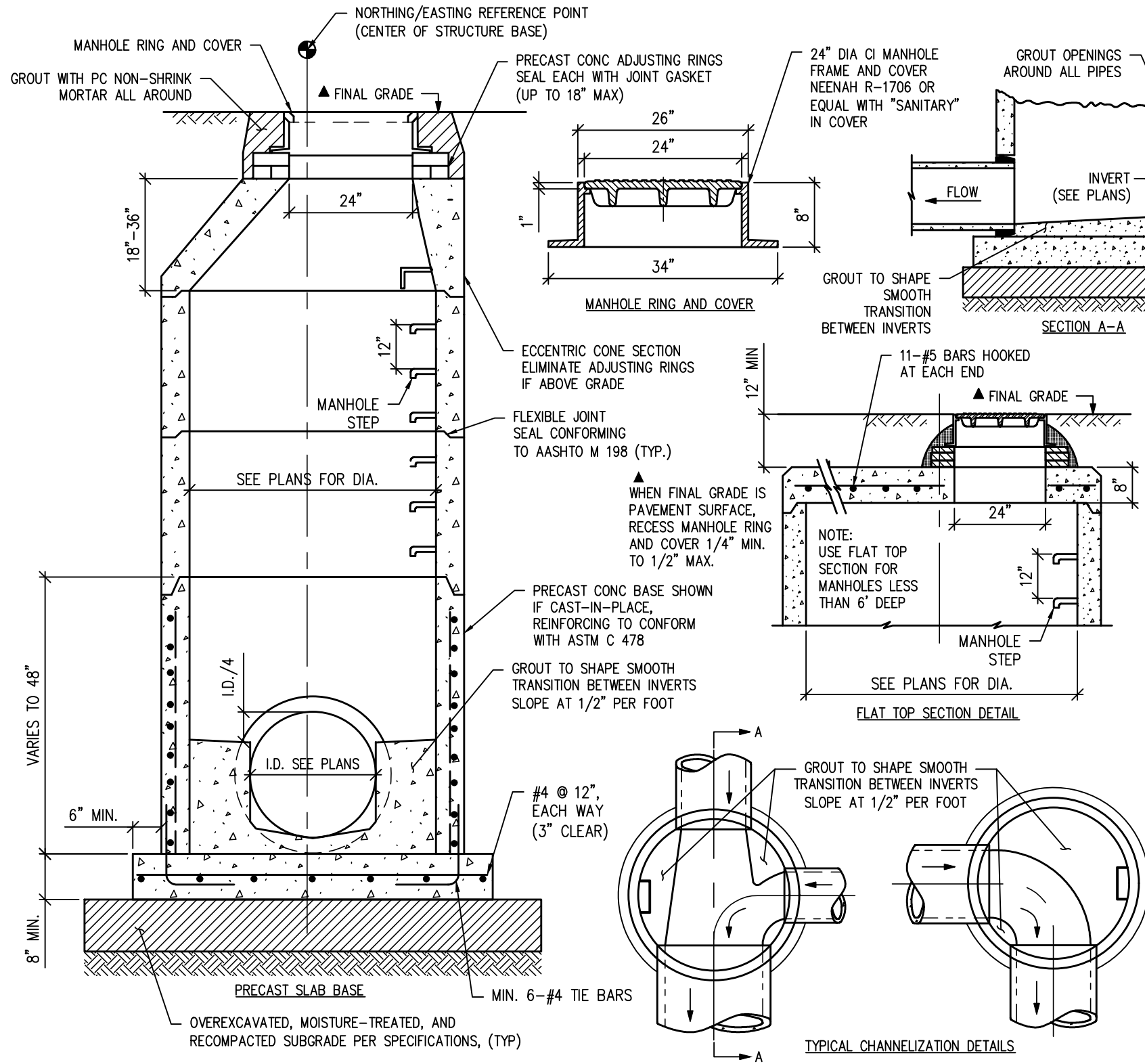
TYP "AS-RECORDED" DRAWING PROCEDURES

MAY 2022

DRAWING # A.2

Drawing A.3 – Standard Precast Concrete Manhole

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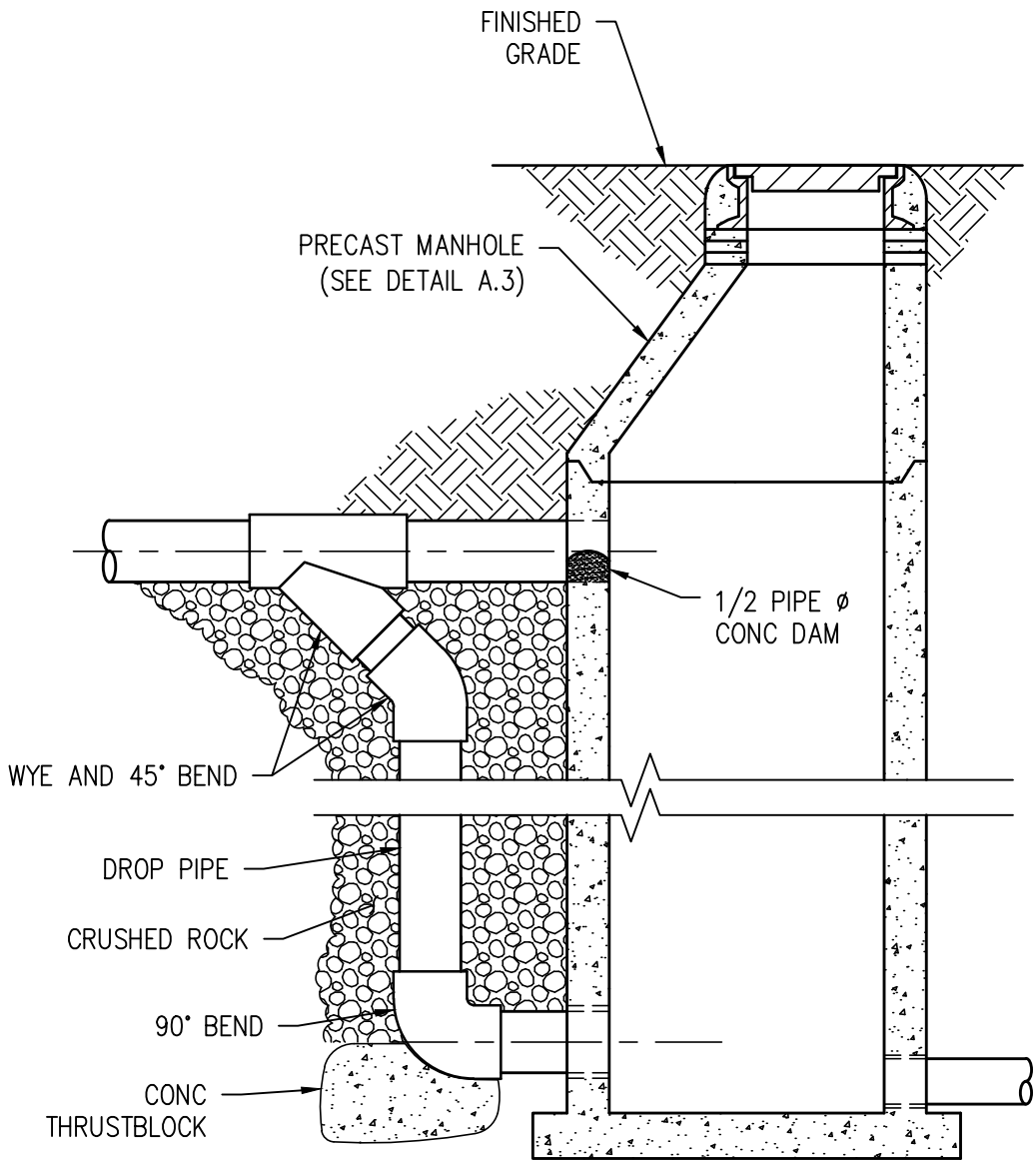


NOTES:

1. SINCE ALL PIPE ENTRIES INTO THE BASE ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK.
2. THE PRECAST FLAT TOP MAY BE USED ON ANY MANHOLE.
3. THE MANHOLE RING FRAME SHALL BE SET IN A BED OF GROUT. THE FRAME SHALL BE SURROUNDED WITH A CEMENT GROUT IN UNPAVED AREA, OR A CONCRETE COLLAR IN PAVED AREA.
4. DESIGN OF BOX BASE IS BASED ON STRAIGHT RUNS OF PIPE OR CHANGE IN DIRECTION OF LESS THAN 45°. SPECIAL DESIGN IS REQUIRED FOR 45° OR GREATER.
5. PRECAST MANHOLES AND REINFORCEMENT SHALL CONFORM TO AASHTO M 199 (ASTM C 478).
6. CAST-IN-PLACE MANHOLES SHALL BE CLASS B CONCRETE.
7. STEPS SHALL BE REQUIRED WHEN THE MANHOLE DEPTH EXCEEDS 3 FT.-6 IN. AND SHALL CONFORM TO AASHTO M 199.
8. ALL REINFORCING STEEL SHALL BE GRADE 60 AND EPOXY COATED. VERTICAL STEEL SHALL BE PLACED AT CENTERLINE OF WALL. ALL BARS SHALL HAVE A 2 IN. MINIMUM CLEARANCE.
9. ALL PIPE ENTRIES INTO THE BASE OF MANHOLE SHALL BE CONNECTED BY OPEN CHANNELIZATION ADJUSTED FOR PIPE SIZE, SHAPE, SLOPE, AND DIRECTION OF FLOW. DETAILS SHOWN ARE TYPICAL FOR INSTALLATIONS WITH ALL INVERTS OF SAME RELATIVE ELEVATION. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, SPECIAL BASE/CHANNEL DETAILS WILL BE SHOWN ON THE PLANS.
10. FLOW CHANNELS AND INVERTS SHALL BE FORMED BY SHAPING WITH CLASS B CONCRETE OR APPROVED GROUT.
11. STUB-OUTS SHALL EXTEND 2 FT. MINIMUM BEYOND OUTSIDE WALL SURFACE OF MANHOLE AND BE SATISFACTORILY PLUGGED.
12. THE SLOPE OF THE MANHOLE COVER SHALL MATCH THE ROADWAY PROFILE AND CROSS SLOPE.
13. BASE SLABS SHALL BE POURED MONOLITHICALLY WITH BOTTOM RISER SECTION.
14. PRECAST MANHOLE BASES SHALL FIT THE CONDITIONS AND LOCATIONS FOR WHICH THEY ARE INTENDED WITHOUT ANY FIELD MODIFICATIONS. ANY MANHOLE BASE WHICH REQUIRES FIELD CUTTING OR MODIFICATION IN ORDER TO FIT THE LOCATIONS INTENDED WILL BE REJECTED BY THE ENGINEER AND REMOVED AND REPLACED BY THE CONTRACTOR AT NO COST TO THE OWNER.
15. FOR FULL DETAIL, SEE CDOT DETAIL M-604-20.

LEADVILLE SANITATION DISTRICT STANDARD DETAILS
TYPICAL PRECAST MANHOLE DETAIL
MAY 2022
DRAWING # A.3

Drawing A.4 – Standard Drop Manhole

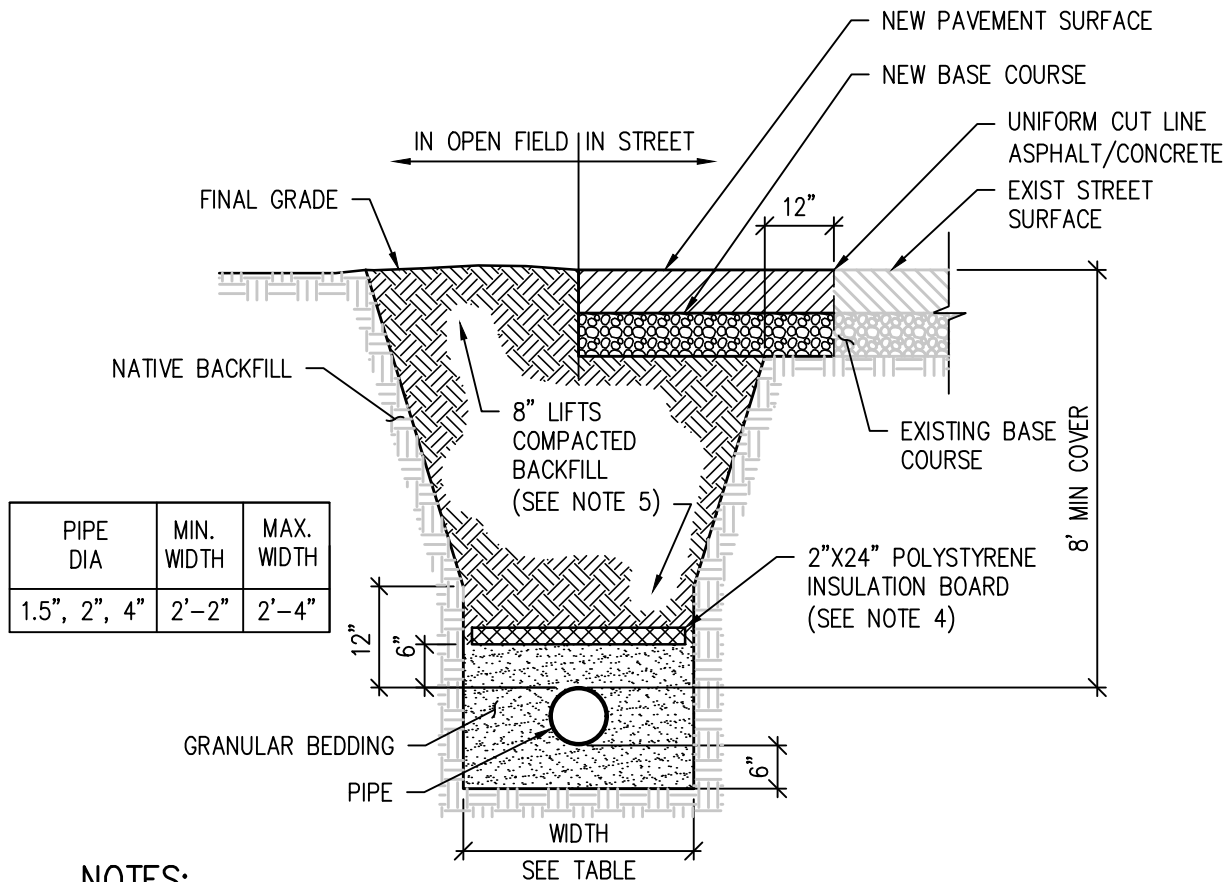


LEADVILLE SANITATION DISTRICT STANDARD DETAILS

DROP MANHOLE
MAY 2022

DRAWING # A.4

Drawing A.5 – Typical Sanitary Sewer Trench



NOTES:

1. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKMEN AND THE PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH LOCAL, STATE, FEDERAL AND OSHA SAFETY REGULATIONS
2. SHOULD THE TRENCH BE EXCAVATED WIDER THAN ALLOWED, A CONCRETE CRADLE SHALL BE PLACED WITH 2500 PSI CONCRETE FROM TRENCH BOTTOM TO PIPE SPRINGLINE
3. MINIMUM COVER TO BE 8' BELOW EXIST GRADE
4. POLYSTYRENE INSULATION BOARD CAN BE USED TO ACHIEVE MINIMUM REQUIRED BURY DEPTH. TWO INCHES OF INSULATION BOARD IS EQUIVALENT TO ONE FOOT OF NATIVE SOIL COVER
5. COMPACTED BACKFILL TO 90% STD PROCTOR DENSITY IN NON-DRIVING SURFACES AND 95% UNDER PAVEMENT
6. PAVING SHALL COMPLY WITH LOCAL AUTHORITY JURISDICTION

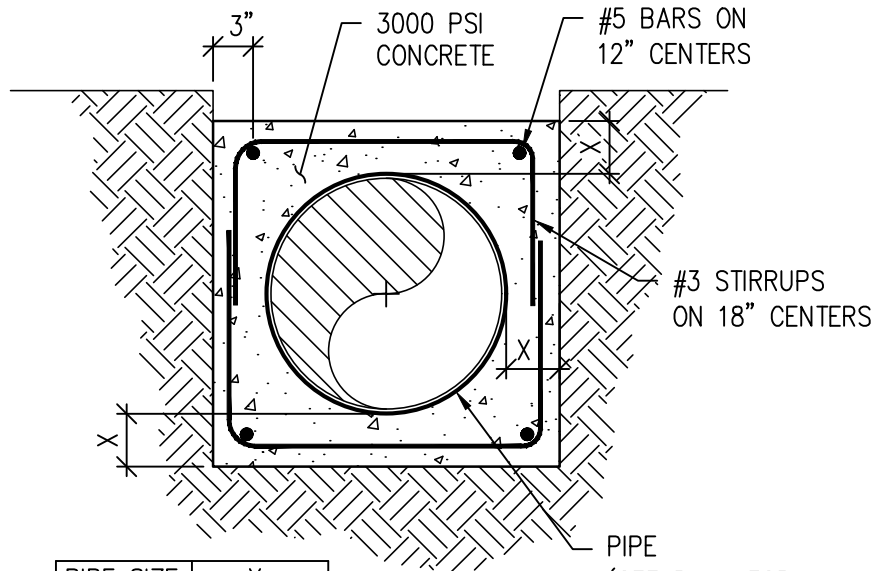
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

TYPICAL WATER AND SANITARY TRENCH

MAY 2022

DRAWING # A.5

Drawing A.6 – Sewer Pipe Encasement



PIPE SIZE	X
4"	4"
6"	4"
8"	4"
12"	4"
18"	5"
24"	6"
36"	6"

NOTE:

PROVIDE FLOWABLE FILL MATERIAL, NO REINFORCEMENT, AT ROAD AND DITCH CROSSINGS, 10' BEYOND EACH SIDE.

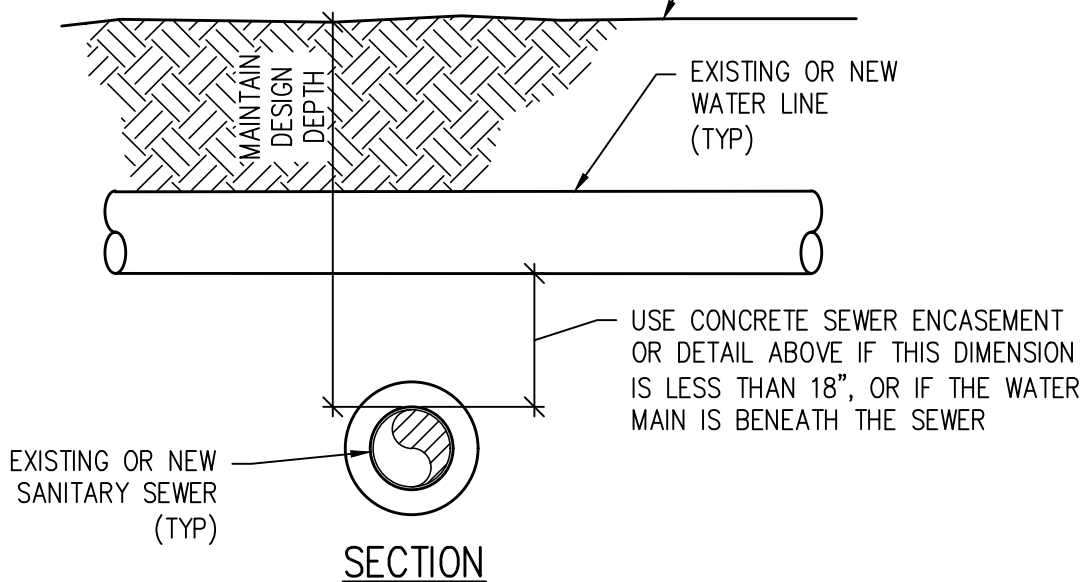
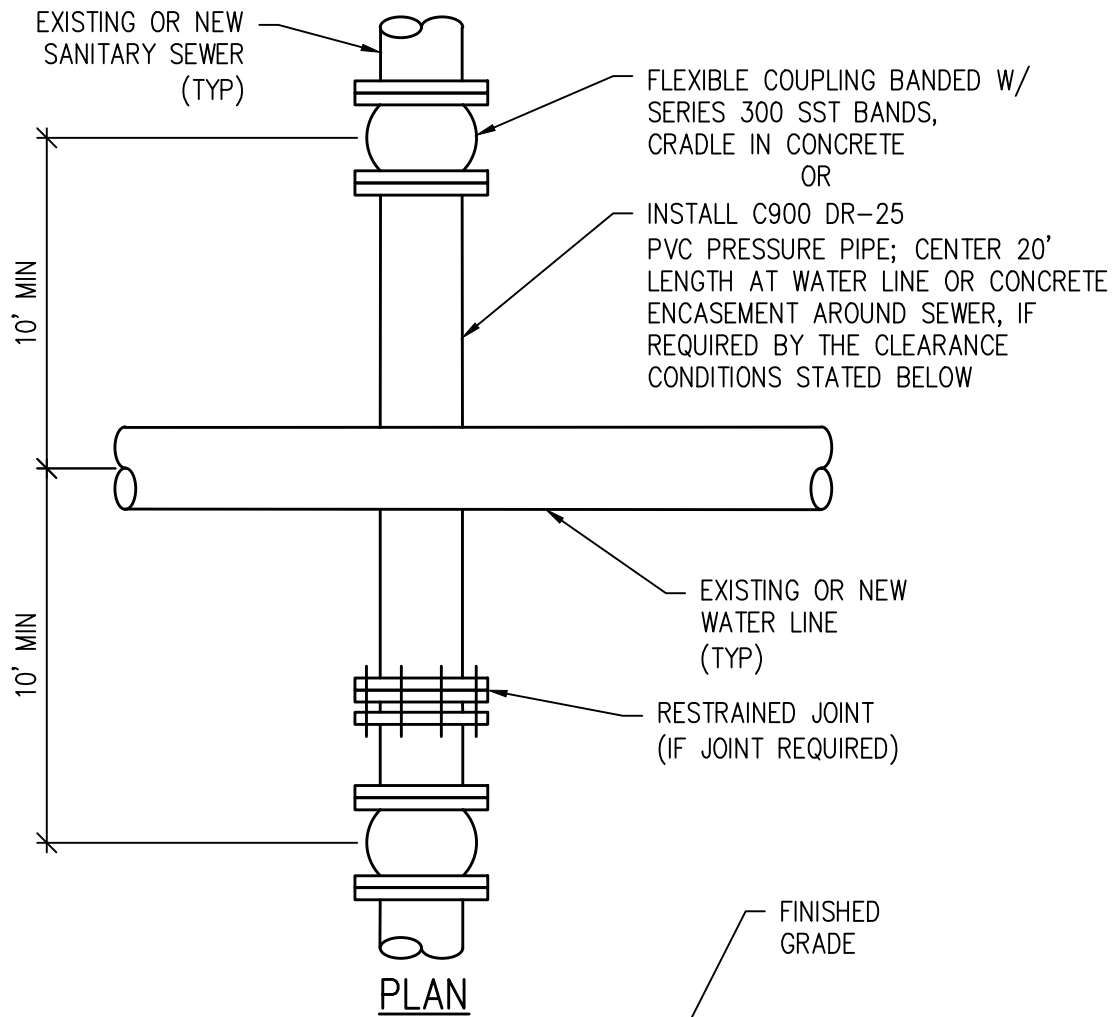
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

PIPE ENCASEMENT DETAIL

MAY 2022

DRAWING # A.6

Drawing A.7 – Sewer Crossing Water Line



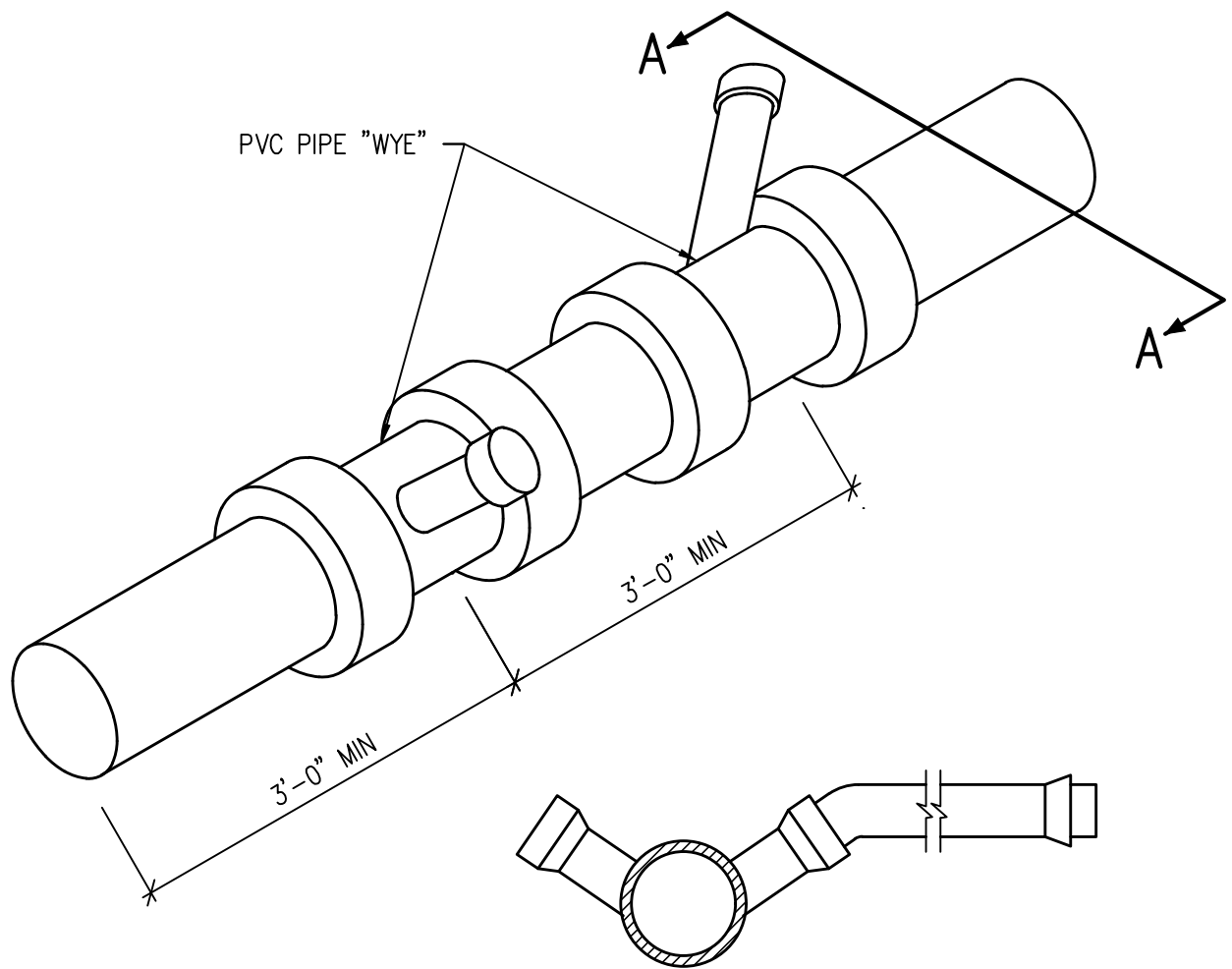
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

SEWER CROSSING WATER LINE DETAIL

MAY 2022

DRAWING # A.7

Drawing A.8 – Sewer Service Connection



SECTION A-A

NOTES:

1. SANITARY SEWER SERVICE TAPS SHALL BE LOCATED ON THE MAIN AT THE 2 O'CLOCK OR 10 O'CLOCK POSITION.
2. THE MINIMUM DISTANCE BETWEEN ANY TWO CONSECUTIVE FITTINGS SHALL BE 3 FEET, MEASURED BETWEEN FITTING CENTERLINES.
3. SANITARY SEWER SERVICE TAPS SHALL NOT BE MADE WITHIN 3 FEET OF A PIPE JOINT, OR 5 FEET FROM EDGE OF MANHOLE BASE.
4. A MAXIMUM OF FOUR SERVICE TAPS ARE ALLOWED PER 20 FOOT LENGTH OF PIPE.
5. ALL SANITARY SEWER TAPS SHALL USE "WYE" STYLE FITTINGS. TEES ARE NOT ALLOWED.
6. SERVICE CONNECTIONS TO MANHOLES SHALL BE PERFORMED IN ACCORDANCE WITH THE "SERVICE CONNECTION TO DEAD-END MANHOLE" CONSTRUCTION DETAIL.
7. TAPS IN STAGGERED CONFIGURATION AT 10 O'CLOCK OR 2 O'CLOCK POSITION

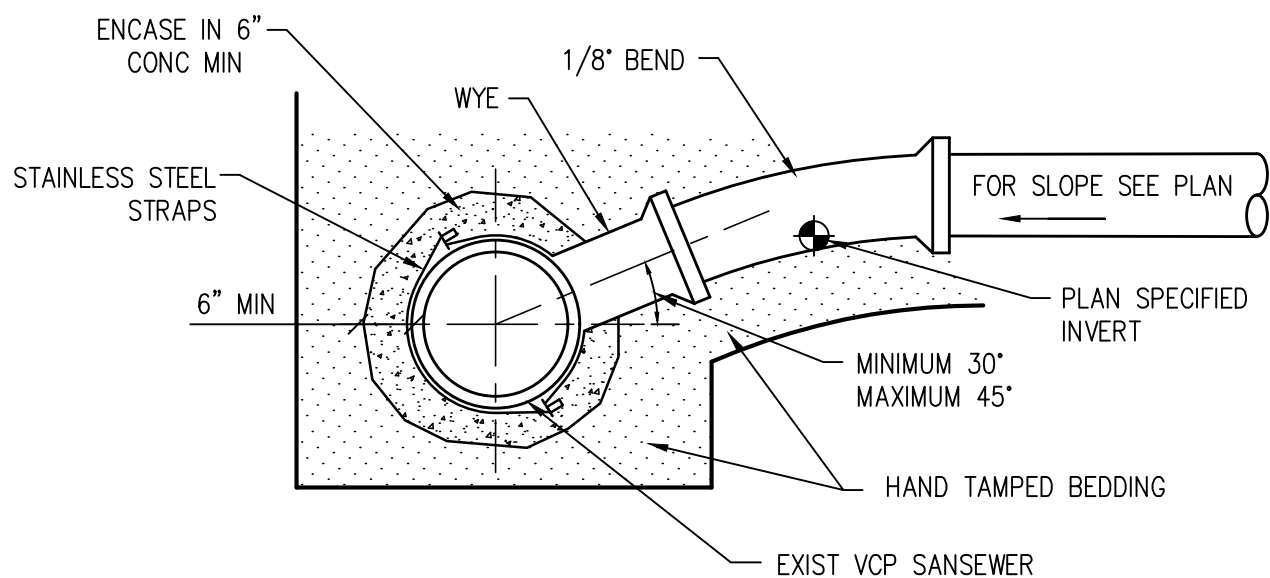
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

SEWER SERVICE CONNECTION

MAY 2022

DRAWING # A.8

Drawing A.9 – VCP Sanitary Sewer Tapping



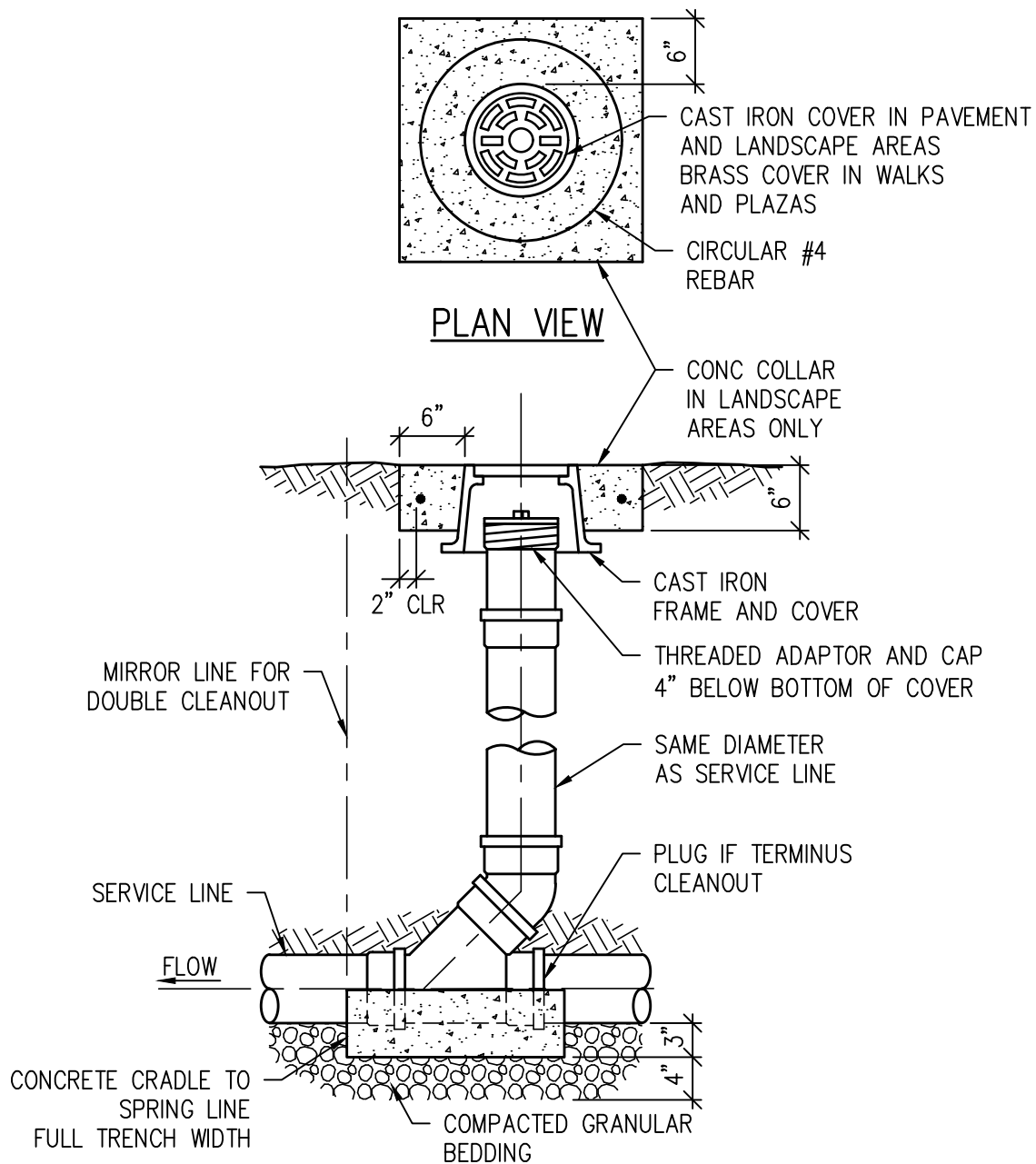
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

VCP SANITARY SEWER TAPPING

MAY 2022

DRAWING # A.9

Drawing A.10 – Service Line Cleanout



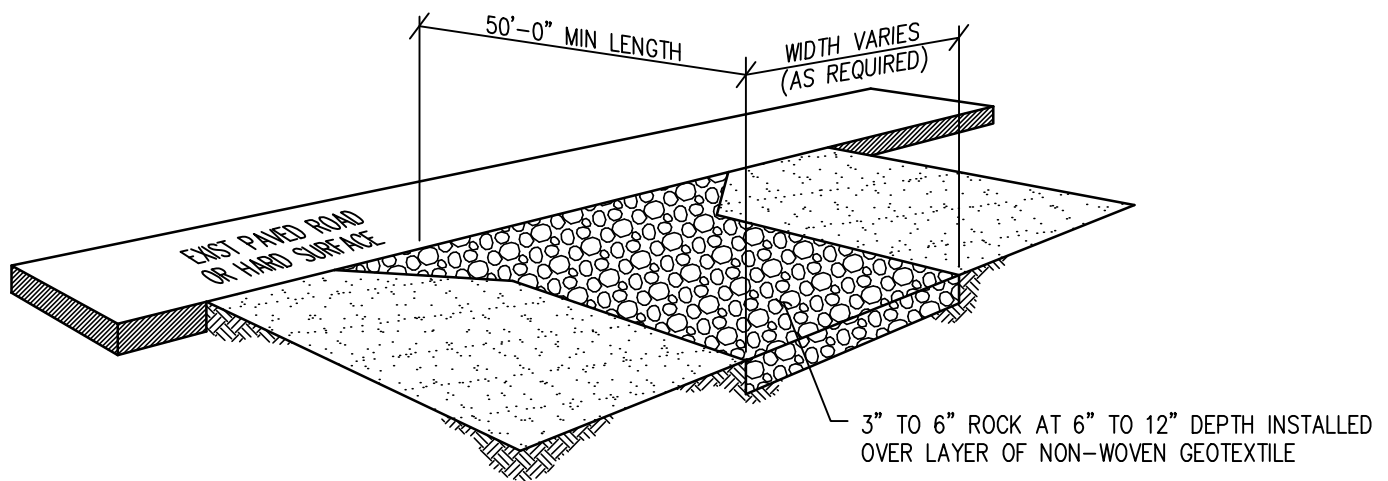
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

SERVICE LINE CLEANOUT

MAY 2022

DRAWING # A.10

Drawing A.11 – Vehicle Tracking Control



NOTES:

1. VEHICLE TRACKING CONTROL PADS SHALL BE INSTALLED AT ALL INGRESS/EGRESS POINTS WHERE VEHICULAR ACCESS TRANSITIONS FROM PAVED SURFACES TO DISTURBED SURFACES.
2. THE VTC PAD SHALL CONSIST OF HARD, ANGULAR, DENSE, AND DURABLE STONE. ROUNDED STONE, BOULDERS, RECYCLED ASPHALT, AND RECYCLED CONCRETE ARE NOT ACCEPTABLE.
3. ANY CRACKED OR DAMAGED CURB AND/OR GUTTER SHALL BE REPLACED BY THE CONTRACTOR.
4. PAD WILL BE REPAIRED AND REFRESHED AS NEEDED TO MAINTAIN FUNCTION AND INTEGRITY.
5. VTC PADS SHALL BE INSTALLED AT ALL CONCRETE WASHOUT AREAS AND AT STABILIZED STAGING/STORAGE AREAS.

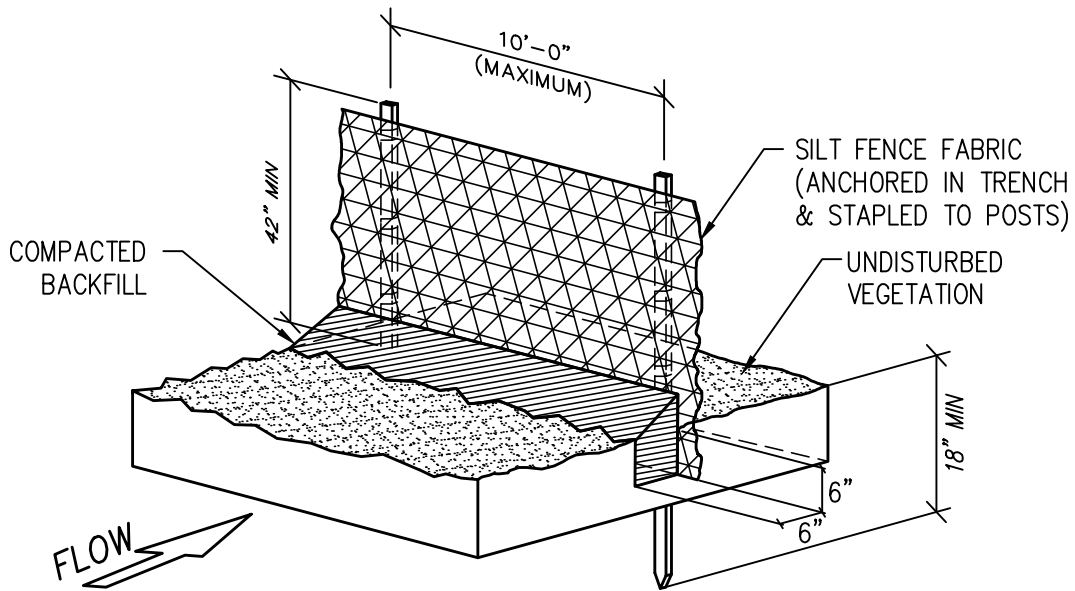
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

VEHICLE TRACKING CONTROL

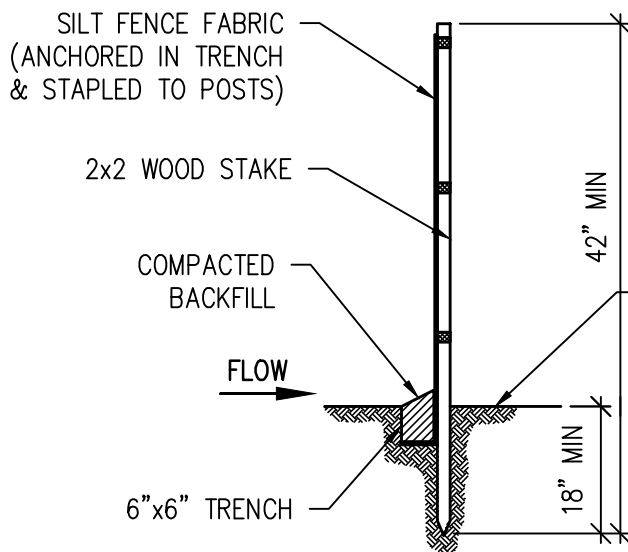
MAY 2022

DRAWING # A.11

Drawing A.12 – Silt Fence



SILT FENCE INSTALLATION



NOTE:

EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL LANDSCAPING IS COMPLETED, OR AS DIRECTED BY THE LOCAL JURISDICTION.

UNDISTURBED VEGETATION ON DOWN GRADIENT SIDE

SECTION

NOTES:

1. SILT FENCE TO BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES UNLESS NOTED OTHERWISE
2. REMOVE UPSTREAM SEDIMENT WHEN SEDIMENT REACHES A DEPTH OF 6 INCHES
3. HOLES AND OTHER AREAS OF COMPROMISE SHALL BE REPAIRED AS THEY OCCUR

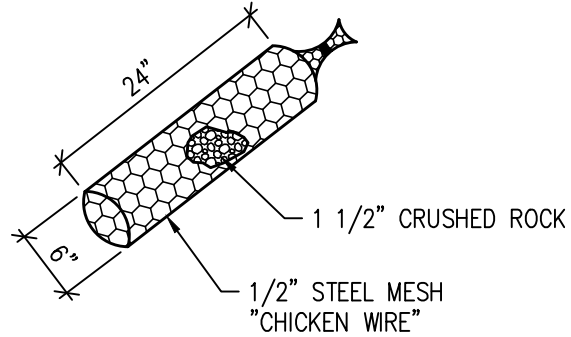
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

SILT FENCE

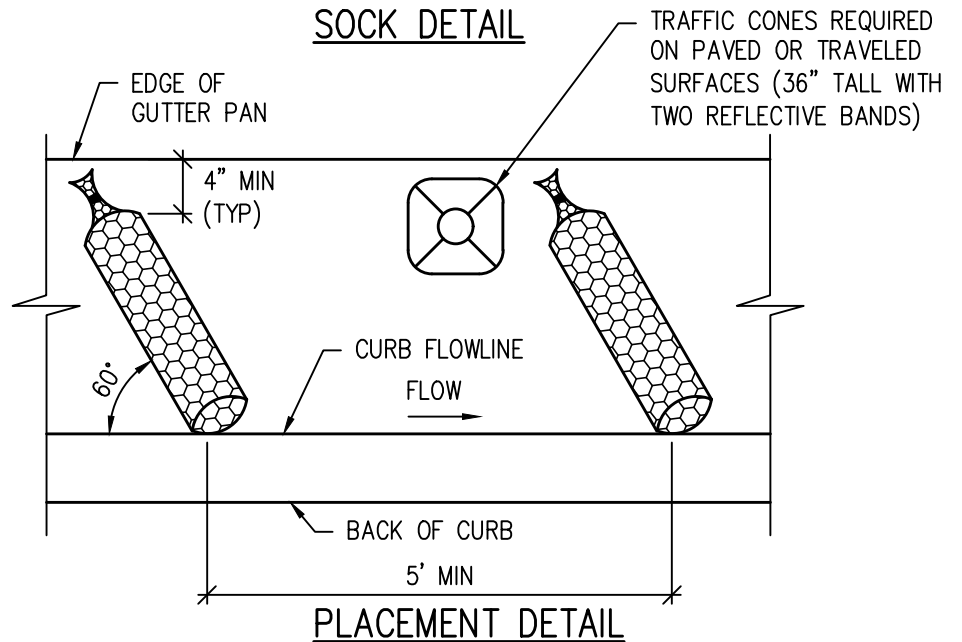
MAY 2022

DRAWING # A.12

Drawing A.13 – Curb Sock



MAX SPACING ALONG STREET GRADE	
STREET SLOPE	CURB SOCK SPACING
0.50%	100
1.00%	100
2.00%	75
3.00%	50
4.00%	50
5.00%	25
6.00%	25
7.00%	25
8.00%	25



NOTES:

1. SOCKS WILL BE USED UPGRADIENT OF INLET ANGLED AS SHOWN AND FLUSH WITH CURB.
2. AT INLETS, NO LESS THAN THREE 6-INCH DIAMETER SOCKS MUST BE USED IN SEQUENCE, SPACE NO MORE THAN FIVE FEET APART.
3. INCLINE AT 30° FROM PERPENDICULAR, OPPOSITE DIRECTION OF FLOW.

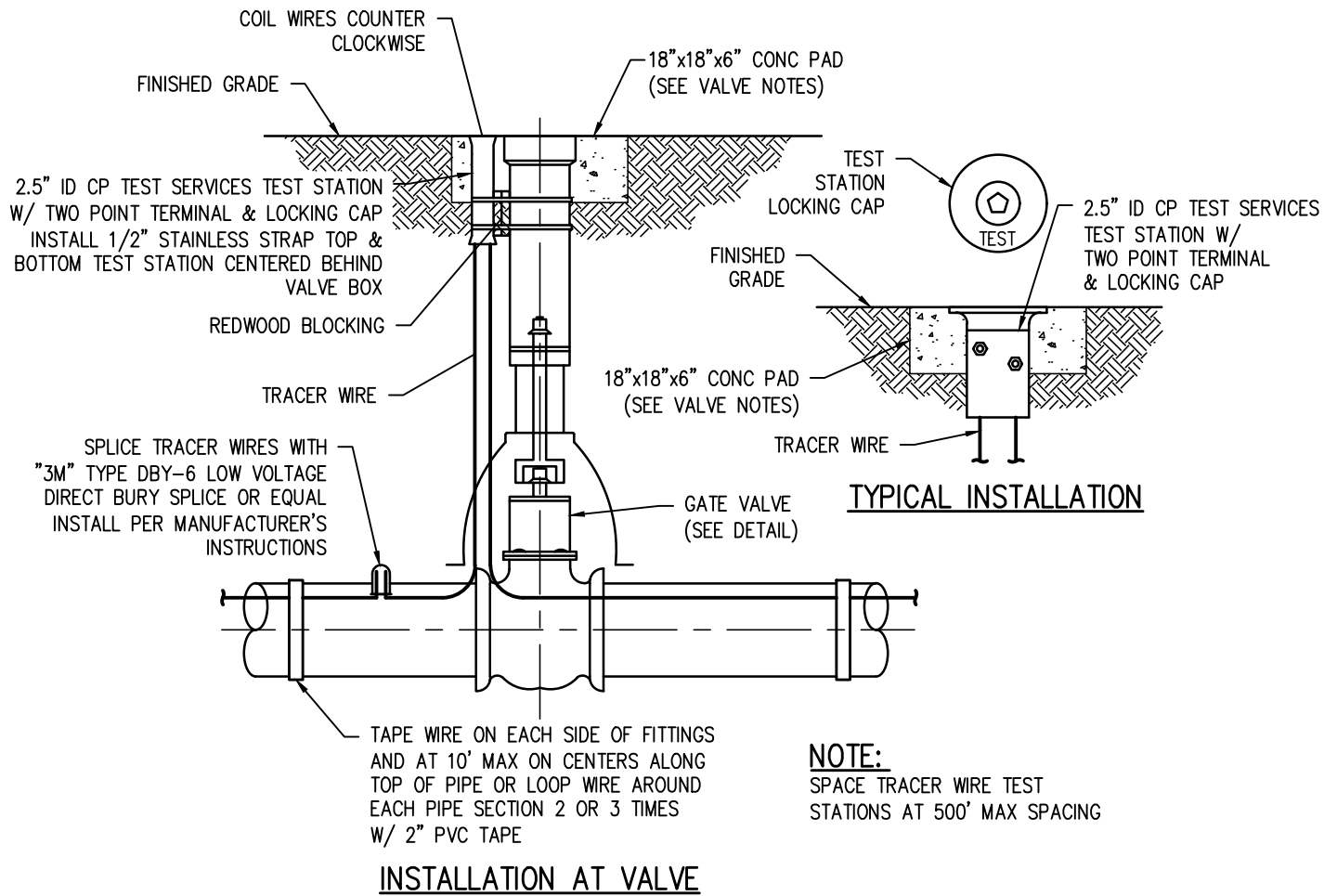
LEADVILLE SANITATION DISTRICT STANDARD DETAILS

CURB SOCK

MAY 2022

DRAWING # A.13

Drawing A.14 – Tracer Wire



LEADVILLE SANITATION DISTRICT STANDARD DETAILS

TRACER WIRE

MAY 2022

DRAWING # A.14

Checklist A.15 – Construction Checklist

LEADVILLE SANITATION DISTRICT

CONSTRUCTION CHECKLIST

Project Name:

Date:

Contact Name:

Contact Address:

Contact Phone Number:

Contact E-mail:

See Section 1.3.6 of the Minimum Design Criteria and Construction Standards, Construction.

Lake County Permits and Applications

- Driveway Permit
- Excavation Permit
- Building Permit
- Land Use Applications

Other Permits and Requirements

- City of Leadville Permits (if applicable)
- State Permits (if applicable)
- Federal Permits (if applicable)
- Stormwater Maintenance
- Erosion Control
- Water / Sewer Application and Tap Fees

Approved By:

Date:

Checklist A.16 – Preliminary & Final Acceptance Checklist

LEADVILLE SANITATION DISTRICT

PRELIMINARY & FINAL ACCEPTANCE CHECKLIST

Project Name:

Date:

Contact Name:

Contact Address:

Contact Phone Number:

Contact E-mail:

See Section 1.3.7 of the Minimum Design Criteria and Construction Standards, Post Construction.

Preliminary Acceptance

- Preliminary Acceptance Request Letter
- Record Drawings
- Utility Acceptance Letters
- Leadville/Lake County Fire-Rescue Letter (regarding acceptable fire flow tests)
- Quality Control Test Results
- Construction Photographs
- Field Notes
- Addendums/Changes to Final Plat Submittal
- Other Pertinent Information

Final Acceptance

- Letter Stating Free of Defects for Two (2) Years
- City of Leadville Letter (regarding operational fire hydrants)
- Final Acceptance Request Letter (signed, stamped, and sealed)

Approved By:

Date:
