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SECTION 100
TITLE, SCOPE AND GENERAL CONDITIONS

110.00 TITLE

These regulations shall be known as the Elbert County Construction Standards & Specifications, 2019 Edition, and may be cited as such. They shall be referenced to herein as the CONSTRUCTION STANDARDS & SPECIFICATIONS.

110.01 Purpose

The purpose of these CONSTRUCTION STANDARDS & SPECIFICATIONS is to provide acceptable standards of design, construction, quality of materials, use, location, and maintenance of public and private infrastructure and common facilities including, but not limited to, water supply systems, sanitary sewer systems, storm drainage systems, roadways, landscaping, irrigation, open space, parking lots and appurtenances. In no way shall these CONSTRUCTION STANDARDS & SPECIFICATIONS supersede or replace any adopted County Resolution.

120.00 SCOPE

The provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS shall apply to the construction, enlargement, alteration, moving, removal, conversion, demolition, repair, and excavation of public and private improvements or common facilities specifically regulated herein except where an approved Planned Urban Development Plan (P.U.D.) or Final Plat specifically states otherwise. The provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS apply to Elbert County contracts, developer contracts and private contracts.

Alterations, additions, or repairs to existing improvements shall comply with all requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS unless specifically exempted by the / DPW Director or his designee.

120.01 Federal and State Laws

The Contractor shall comply with all current federal and state laws. The Contractor shall obtain all necessary permits as required by these CONSTRUCTION STANDARDS & SPECIFICATIONS prior to commencement of the work. The Contractor shall notify the DPW Director or his designee twenty-four (24) hours before the start of the work or when work shall be resumed following a delay.

120.02 Jurisdiction

These Construction Standards shall apply to all land within the unincorporated areas of the County, except where superseded by State of Colorado (Department of Transportation or Department of Public Health and Environment) jurisdiction.
121.00  Alternate Materials and Methods of Construction

The provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS are not intended to prevent the use of any material or method of construction not specifically prescribed by these procedures. Alternate materials or methods shall be submitted for approval by the DPW Director or his designee. Sufficient evidence or proof shall be submitted to substantiate the alternate. Details of alternate approval shall be recorded and made part of the project files.

122.00  Modifications

In individual situations, Elbert County may grant modifications. The specified procedure shall be demonstrated to be practical and that the modification conforms to the intent and purpose of the specified procedure. The requested modification shall not lessen any design requirement. The document(s) granting a modification shall be placed in the project files.

123.00  Tests

Whenever there is insufficient evidence of compliance with the provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS or evidence that any material or construction does not conform to the requirements, the DPW Director or his designee require the Contractor to perform tests to demonstrate compliance. Test methods shall be as specified by the CONSTRUCTION STANDARDS & SPECIFICATIONS or by other recognized test standards. If there are no recognized and approved test methods for the proposed alternate, the DPW Director or his designee shall determine test procedures. All tests shall be made by an approved agency. Elbert County shall retain reports of such tests in accordance with the Elbert County Records Retention Policy.

124.00  Organization, Enforcement and Interpretation

124.01  Authorization

The DPW Director or his designee is authorized and directed to enforce all provisions of the CONSTRUCTION STANDARDS & SPECIFICATIONS, and for such purposes he shall have the powers of a peace officer. The DPW Director or his designee may appoint a civil engineer, construction Representative/Inspector, or other employee to act in his behalf.

124.02  Stop Work Order

If work is being done contrary to the provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS, the DPW Director or his designee may issue a written order to stop the work. The written notice shall be served on any persons engaged in doing orcausing the work to be done. Upon receipt of the stop work order, all work shall cease until authorized by the DPW Director or his designee to proceed.
124.03 Interpretation

These CONSTRUCTION STANDARDS & SPECIFICATIONS are composed of written engineering standards, materials specifications and detail drawings. The interpretation of any Section, or of any difference between Sections, when appropriate, shall be made by the DPW Director or his designee, and his interpretation shall be binding and controlling in its applications.

125.00 Liability

The DPW Director or his designee, or his authorized representative charged with the enforcement of these CONSTRUCTION STANDARDS & SPECIFICATIONS, acting in good faith and without malice in performing his duties, shall not be personally liable for any damage that may accrue to persons or property as a result of any act or by reason of any act or omission in the discharge of his duties.

126.00 Violations

It shall be unlawful for any person, firm, or corporation to construct, enlarge, alter, repair, move, improve, remove, excavate, convert, demolish or operate any public improvements or common facilities or permit the same to be done in violation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

127.00 No Waiver of Legal Rights

Elbert County shall not be precluded or stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work from showing the true amount and character of the work performed and materials furnished by the Contractor, or from showing that any such measurement, estimate or certificate is untrue or incorrectly made, or that the work or materials do not conform in fact to these CONSTRUCTION STANDARDS & SPECIFICATIONS.

128.00 Use of Elbert County Rights-of-Way (R.O.W.) or Dedicated Easements.

128.01 Permission to Occupy R.O.W.

All persons desiring to place facilities within the public R.O.W., if not otherwise granted by contract or written agreement, shall obtain permission from the BOCC and pay required fees in order to occupy an Elbert County R.O.W. or dedicated easement. For construction in the public R.O.W., refer to Section 151.00 Public/Private Improvement Permit (PPIP), Grading Permit, and Over-Excavation Permit of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

128.02 Insurance and Indemnification
Indemnification: The Applicant, for itself and its related entities, agents, employees, subcontractors, and the agents and employees of said subcontractors, shall hold Elbert County harmless, defend, and indemnify Elbert County, its successors, assigns, officers, employees, agents, and appointed and elected officials from and against all liability or damage and all claims or demands whatsoever in nature, and reimburse Elbert County for all its reasonable expenses, as incurred, arising out of the installation, maintenance, operation or any other Work or activity in the public right-of-way or by the Applicant related to its use thereof, including, but not limited to, the actions of the Applicant, its related entities, agents, employees, subcontractors, and the agents and employees of said subcontractors, or the securing of and the exercise by the Applicant of the Permit rights granted in the Permit, including any third party claims, administrative hearings, and litigation; whether or not any act or omission complained of is authorized, allowed, or prohibited by this ordinance or other applicable law.

128.03 Performance Bond/Letter of Credit

Before any Permit required by this chapter shall be issued to an Applicant, the Applicant shall file with Elbert County a bond or letter of credit in favor of Elbert County in an amount equal to the total cost of restoration of all public and private infrastructure the Applicant may disturb to a condition equal to or better than that existing before the project began. The cost of restoration may include, without limitation, removal of defective materials, re-compaction of subgrade and base material, and construction of surface improvements, including labor and materials. The bond or letter of credit shall be executed by the Applicant as principal and by at least one surety upon whom service of process may be had in the state. The bond or letter of credit shall be conditioned upon the Applicant fully complying with all provisions of Elbert County ordinances, rules and regulations, and upon payment of all judgments and costs rendered against the Applicant for any material violation of Elbert County ordinances or state statutes that may be recovered against the Applicant by any person for damages arising out of any negligent or wrongful acts of the Applicant in the performance of Work done pursuant to the Permit. Elbert County may bring an action on the bond or letter of credit on its own behalf or on behalf of any person so aggrieved as beneficiary. The bond or letter of credit shall be approved by the Elbert County Attorney as to form and as to the responsibility of the surety thereon prior to the issuance of the Permit.

128.04 Performance Warranty/Guarantee

Any warranty made hereunder shall serve as security for the performance of work necessary to repair the public R.O.W. if the Applicant fails to make the necessary repairs or to complete the work under the Permit.

The Applicant, by acceptance of the Permit, expressly warrants and guarantees complete performance of the work in a manner acceptable to Elbert County and warrants and guarantees all work done for the warranty period. Refer to Section 200.00
ACCEPtANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The Applicant agrees to maintain and to make all necessary repairs during the warranty period. This warranty shall include all repairs and actions needed as a result of:

A. Defects in workmanship
B. Settling of fills or excavations
C. Heaving or cracking
D. Any unauthorized deviations from the approved plans and specifications
E. Failure to barricade
F. Failure to clean up during and after performance of the work and comply with B.M.C. 8-10-010 regarding control of construction materials and debris.
G. Failure to replace pavement markings or otherwise comply with repaving or reconstruction Schedule.
H. Any other violation of this chapter or the ordinances of Elbert County.

The warranty period shall begin on the date of Elbert County’s Construction Acceptance of the work. If repairs are required during the warranty period, those repairs shall also be warranted until the end of the warranty period starting with the date of Construction Acceptance. It is not necessary that a new warranty period be provided for warranty repairs.

At any time prior to completion of the warranty period, Elbert County may notify the Applicant of any needed repairs. Such repairs shall be completed within twenty-four (24) hours if the defects are determined by Elbert County to be an imminent danger to the public health, safety and welfare.

Should the Applicant fail to complete non-emergency warranty work in a timely manner, upon giving the Applicant ten calendar days written notice Elbert County may perform the work at the Applicant's expense. If the cost of the warranty work performed by Elbert County exceeds the amount of the financial security, the Applicant shall be liable for the additional costs. If there is a dispute as to the amount owed, the Applicant may provide financial security to Elbert County to fully secure such payment until resolution of any appeal under this chapter.

129.00 Scope of Work

130.00 WORK CONDITIONS

130.01 Working Hours

All work to be completed on the project shall be performed during regular working hours, 7:00 A.M. until 7:00 P.M. Monday through Friday. Restricted hours may be included
with conditions of the BOCC Resolution approving the project, or within the work permit.

The Contractor shall not perform overtime work outside of regular working hours or the performance of work on Saturday, Sunday or any Elbert County observed holiday without receiving written consent from the DPW Director or his designee. Request for work outside regular working hours shall be received two working days prior to the proposed date of the work. Refer to Section 150.00 PERMITS AND INSPECTIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

At the discretion of the DPW Director or his designee, a formal or informal hearing before the BOCC may be conducted to assist in determining the appropriateness for permitting work outside of regular working hours. All costs of notification and hearing shall be borne by the proponent of or Applicant for the permit.

130.02 Emergency Work

When, in the opinion of Elbert County, the Contractor has not taken sufficient precautions for the safety of the public or the protection of the work to be constructed, or of adjacent structures or property which may be injured by processes of construction on account of such neglect, and an emergency may arise and immediate action is considered necessary in order to protect public or private, personal or public interests, Elbert County, WITH OR WITHOUT NOTICE to the Contractor or the Developer, may provide suitable protection by causing such work to be done and material to be furnished and placed as Elbert County may consider necessary and adequate.

The cost and expense of such work and material so furnished shall be borne by the Contractor or developer and shall be paid upon presentation of the bills.

The performance of such emergency work under the direction of Elbert County shall in no way relieve the Contractor of responsibility for damages which may occur during or after such precaution has been taken.

In an emergency threatening loss of life or extensive damage to the work or to adjoining property, and where the Developer or Contractor is unable to obtain special instructions or authorization from Elbert County after diligent attempts to obtain such special instruction or authorization in sufficient time to take the necessary action, the Developer or Contractor is hereby permitted to act at his own discretion to prevent such threatening loss or damage.

130.03 Final Cleanup

Upon completion of the work, the Contractor shall remove from the project area all surplus and discarded materials, rubbish, and temporary structures, and leave the project area in a neat and presentable condition. The Contractor shall restore all work that has
been damaged by his operations, to general conformity with the specifications for the item or items involved.

Final cleanup shall include inspection of the interior of all manholes, stormwater inlets and facilities within the construction limits for construction materials, dirt, stones, or other debris deposited therein by the activities of the Contractor, and removal of the debris.

131.00 Control of Work

131.01 Authority of the Department of Public Works / Road & Bridge Division

The DPW Director or his designee has the authority to stop the work whenever such stoppage may be deemed necessary. The DPW Director or his designee has authority to resolve issues regarding the quality and acceptability of materials furnished, performance of the work, interpretation of the plans and specifications, and acceptable fulfillment of the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

The DPW Director or his designee may define the schedule and/or priority of the work to be completed on the project. The Contractor shall comply with this schedule. Any revision to the schedule shall be authorized in writing by the DPW Director or his designee.

131.02 Authority and Duties of the Elbert County Representative/Inspector

The Elbert County Representative/Inspector is authorized to observe and inspect all work completed and all material furnished. Observations and inspections may include all procedures and the preparation, fabrication and manufacture of materials to be used. The Elbert County Representative/Inspector is not authorized to revoke, alter, or waive any requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The Elbert County Representative/Inspector is authorized to call the attention of the Contractor to any failure of the work or materials to conform to these CONSTRUCTION STANDARDS & SPECIFICATIONS. The Elbert County Representative/Inspector is also authorized to issue a “Correction Notice” when inspection of the project reveals violation(s) of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The Elbert County Representative/Inspector shall have the authority to reject materials and procedures until any questions at issue can be resolved by the DPW Director or his designee.

The Elbert County Representative/Inspector shall not act as foreman or perform other duties for the Contractor, or interfere with the management of the work performed by the Contractor. Any “advice” which the Elbert County Representative/Inspector may give the Contractor shall not be construed as binding upon the DPW Director or his designee or Elbert County in any way or release the Contractor from fulfilling all of the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The
presence or absence of the Elbert County Representative/Inspector shall not relieve the responsibility or the obligation of the Contractor.

Elbert County shall—at all times—have reasonable and safe access to the work whenever it is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

131.03 Suspension of Work

In case of suspension of work for any reason, the Contractor shall take precautions as necessary to prevent damage to the project, to provide for adequate drainage and to install any necessary barricades, signs, or other facilities, at his expense, as directed by the DPW Director or his designee / and as required by these CONSTRUCTION STANDARDS & SPECIFICATIONS. Necessary precautions shall be taken before the Contractor leaves the job site.

131.04 Removal of Unauthorized and Unacceptable Work

Work which does not conform to the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS or which results in an inferior or unsatisfactory product shall be considered unacceptable work.

Unacceptable work—whether the result of poor workmanship, poor design, use of defective materials, damage through carelessness, or any other cause—found to exist prior to Final Acceptance of the work shall be immediately removed and replaced or corrected at the expense of the Developer, in a manner acceptable to Elbert County. This expense includes the total and complete restoration of all disturbed surfaces to a condition acceptable to Elbert County.

131.05 Contractor’s Responsibility, Character of Workers and Equipment

Contractor shall employ resources for completing work to full completion in the manner and time required by the contract. All workers shall have skill and experience to perform the work assigned to them. When workers are primarily conversant in a language other than English, each crew shall have at least one person that is fluent in both English and the primary language of the workers.

Any person employed by the Contractor or by any subcontractor who does not perform the work in a proper and skillful manner shall, at the written request of the DPW Director or his designee / , be removed by the Contractor or subcontractor and shall not be employed on the project without the approval of the DPW Director or his designee.

All equipment used on the project shall be of size and mechanical condition to meet requirements of the work and to produce a satisfactory quality of work. Equipment used shall not cause injury to the roadway, adjacent property, or other roadways.
131.06 Situation Variances

Where any particular requirements contained in this Section of these CONSTRUCTION STANDARDS & SPECIFICATIONS can be shown to be inappropriate when applied to an out-of-the-ordinary situation, variances to said minimum requirements shall be considered and may be authorized by the DPW Director or his designee. The proposed variance in the requirements shall result in a level of safety, service, and quality equal to or greater than that intended by the application of said requirements. These CONSTRUCTION STANDARDS & SPECIFICATIONS shall govern when inconsistencies with approved construction plans occur, unless written permission is granted by the DPW Director or his designee.

131.07 Elbert County Capital Improvement Projects

It is recognized that the requirements contained in these CONSTRUCTION STANDARDS & SPECIFICATIONS are not necessarily sufficient for plans, specifications and contract administration purposes for Elbert County administered capital improvement projects. Accordingly, the DPW Director or his designee is authorized to develop and/or approve such additional requirements and procedures necessary for bidding, award, and construction administration for such projects. Said additional requirements and procedures shall be consistent with these CONSTRUCTION STANDARDS & SPECIFICATIONS and all applicable provisions of other Elbert County ordinances and resolutions.

131.08 Requirements of Other Jurisdictions

Where proposed street construction shall affect other agencies such as the CDOT, adjacent cities and counties or ditch companies, said construction shall be subject to the review of said agencies. Generally, where more than one requirement is imposed, the more restrictive requirement shall govern. Exceptions shall be authorized by the DPW Director or his designee in writing.

132.00 Control of Materials

132.01 Samples and Tests

To determine if materials comply with contract requirements and these CONSTRUCTION STANDARDS & SPECIFICATIONS, samples may be collected and/or tests performed at the source or job destination, at the discretion of the DPW Director or his designee. Collection of samples and completion of tests shall be in accordance with standard practices except where methods and procedures for sampling and testing materials are otherwise set forth in these CONSTRUCTION STANDARDS & SPECIFICATIONS.
The Contractor shall furnish—at his expense—all samples, tests and reports required by the DPW Director or his designee and shall provide such facilities for collecting and forwarding them. When requested by the DPW Director or his designee, a written statement providing the origin, composition and process of manufacture of a material shall be provided by the Contractor.

132.02 Storage of Materials

Materials shall be stored so as to assure the preservation of quality and suitability for the work. Stored materials shall be subject to inspection at any time prior to use in the work and shall meet all requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS at the time they are used. Materials shall be stored in a manner that facilitates inspection. With the DPW Director or his designee's written approval, portions of the rights-of-way not required for public travel may be used to store materials and equipment. Any additional storage space required shall be provided by the Contractor at his expense.

132.03 Defective Materials

Materials not in conformance with contract requirements or these CONSTRUCTION STANDARDS & SPECIFICATIONS shall be considered defective and shall be rejected. Rejected materials shall be removed from the work site within seventy-two (72) hours.

140.00 GENERAL CONDITIONS

141.00 Protection of Public, Private and Utility Interests

141.01 Operation of Existing Utility System Controls

141.02 Permits Required by Other Agencies

Developers or Contractors proposing to place facilities in the vicinity of existing public, private or utility infrastructure shall obtain a written agreement from the responsible managing agency. This shall include, but not be limited to irrigation ditches, airports, railroads, the CDOT, communication utilities, gas and electric utilities, and neighboring governmental entities.

Refer to Section 630.00 EROSION CONTROL of these CONSTRUCTION STANDARDS & SPECIFICATIONS for NPDES permit requirements.

141.03 Public Convenience and Safety

Fire hydrants shall be visible and accessible to the Fire District from the street at all times. No obstructions shall be placed within ten (10) feet of a fire hydrant.
Unless otherwise specified, the Contractor shall give written notice to the proper authorities in charge of streets, waterlines, gas lines, electric service, cable television and other conduits, railroads, poles, manholes, catch basins and all other property that may be affected by the Contractor's operations, at least seventy-two (72) hours before breaking ground. The Contractor shall not hinder or interfere with any person in the protection of such property, or the operation of utilities at any time. The Contractor shall obtain all necessary information—including field locations—in regard to existing utilities, shall protect such utilities from injury, and shall avoid unnecessary exposure of utilities that could cause injury to the public. The Contractor shall obtain all necessary information in regard to the planned installation of new utilities, cables, conduits and transformers. The Contractor shall make proper provisions and give proper notification so that new utilities and equipment can be installed without unnecessary inconvenience to the public.

**THE CONTRACTOR SHALL GIVE SUFFICIENT WRITTEN NOTICE TO PROPERTY OWNERS ADJACENT TO PROPOSED WORK.**

141.04 Interruption of Services

Before starting site work, the Contractor shall plan and coordinate for the disconnection or interruption of all services; such as water, sewer, cable T.V., telephone, gas, electric power and traffic. Disconnection and/or interruptions shall be made in accordance with the regulations of the utility that controls the supply of the service. Whenever the flow of traffic is affected, a Traffic Control Plan shall be provided in accordance with Section 141.12, Traffic Control, Barricades, and Warning Signs, of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

The local Metro District shall provide a representative to be on site to observe and approve the Contractor's disconnection or interruption of the water and sewer services. Twenty-four (24) hours prior to the interruption of service, the Contractor shall notify all users whose service shall be interrupted in order for them to make provisions for necessary water storage. No line in service shall be shut down for more than a four (4) hour period at one time.

141.05 Protection of Paved Surfaces

Only pneumatic-tired equipment shall be allowed to operate over paved surfaces. The Contractor shall be responsible for any damage to the street surface resulting from his operation.

141.06 Protection of Streams, Lakes and Reservoirs

The Developer or Contractor shall take all necessary precautions to prevent pollution of streams, lakes, and reservoirs with fuel, oil, bitumen, calcium chloride, or other harmful materials.
They shall conduct and schedule their operations to avoid or minimize siltation of streams, lakes and reservoirs. A plan for erosion protection shall be submitted to Elbert County for approval before starting work and shall conform to all local, state and federal regulations.

141.07 Protection of Public and Private Installations

The Contractor shall take proper precautions at all times 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, mail boxes, shrubbery, flowers, ornamental trees, driveway approaches, and all other public and private installations that may be encountered during construction. The Contractor shall have the responsibility of providing each property with access to and from the property during the time of construction. Existing driveways shall be cut, filled, and graded as required and as directed by the DPW Director or his designee to provide permanent access. Existing driveways shall be resurfaced with the presently existing type of surfacing whenever the existing surface is destroyed.

141.07.01 Existing Structures, Trees and Utilities to Remain

Prior to any disturbance of soils, concrete or asphalt materials, all utility line locations shall be marked on the ground with location equipment by a certified utility location agency. All utility locations shall be plainly marked by coded paint symbols on pavement or by marked stakes in the ground at the Contractor’s expense.

No tree located within Elbert County ROW shall be removed without written permission from the DPW Director or his designee. Circumstances warranting tree removal shall include, but not be limited to the following:

A. Insufficient horizontal clearance between roadway and tree which may be a driving hazard and or inhibit sight distances;
B. Dead or dying trees;
C. Tree roots causing damage to roadways or other infrastructure;
D. Trees inhibiting drainage and or roadside maintenance;
E. Any circumstances which may create health, safety, and operational hazards related to tree location;
F. Trees that need to be removed for roadway and or drainage improvements.

All existing poles, wires, fences, property line markers and other structures which, in the opinion of the DPW Director or his designee, shall be preserved in place without being temporarily or permanently relocated shall be carefully supported and protected from damage by the Contractor.

Underground utilities may exist within or immediately adjacent to areas of proposed construction. Where possible, locations of such utilities shall be
indicated on the approved plans. The completeness and accuracy of the utility locate information presented is unverified and without guarantee. Utility locate information is supplied to provide the Contractor with approximate locations of utilities in and near proposed construction areas to anticipate probable or possible obstructions and the extent to which construction may be affected.

**ALL UNDERGROUND UTILITY LOCATOR MARKINGS SHALL BE MARKED WITH WATER-BASED PAINT THAT DOES NOT LAST MORE THAN FORTY-FIVE (45) DAYS. IF AFTER FORTY-FIVE (45) DAYS THE MARKINGS REMAIN, THEY SHALL BE REMOVED BY THE CONTRACTOR.**

All utility services shall be supported by suitable means so that services do not fail during construction or if settling of soils occurs. Where any shallow pipe exists or is constructed which may have been distressed by the Contractor’s construction operations, the DPW Director or his designee may require the Contractor to submit video of the pipe for inspection.

141.07.02 Relocation, Removal and Replacement of Existing Structures and Utilities

If the Contractor encounters structures and/or utilities, they shall be relocated or removed and replaced.

141.07.03 Correcting Damage

In the case of damage, repairs and/or replacements shall be made at the Contractor’s expense. The Contractor shall notify the property owner of the type and extent of the damage. The Contractor and property owner shall agree to a time schedule to repair the damage, and if property owners do not wish to make the repairs themselves, the Contractor shall repair the damage. If damage is not repaired within the timeframe agreed to by the property owner and the Contractor, Elbert County may have repairs made at the Contractor’s expense.

141.08 Protection and Restoration of Property and Survey Monuments

The Developer and Contractor shall use every reasonable precaution to prevent the damage or destruction of public or private property such as poles, trees, shrubbery, crops, fences, and survey monuments adjacent to or interfering with the work, and all overhead structures such as wires, cables, within or outside of the rights-of-way.

The Contractor shall protect and support all water, gas, sanitary sewer, storm sewer or electrical pipes or conduits, and all railway tracks, buildings, walls, fences or other properties that are liable to be damaged during the execution of his work. He shall take all reasonable and proper precautions to protect persons, animals, and vehicles from injury. Wherever necessary, or directed by the DPW Director or his designee, the
Contractor shall erect and maintain a fence or railing around any excavation or work site and place a sufficient number of amber lights about the work and keep them burning from twilight until sunrise. He shall employ one or more watchmen for additional security wherever they are needed or required by the DPW Director or his designee.

The Contractor shall not prevent the flow of water in the gutters of the street and shall use proper means to permit the flow of surface water along the gutters while the work is progressing.

The Contractor shall protect and carefully preserve all land boundary and Elbert County survey control monuments. Any monument that may be disturbed shall be referenced and replaced by a Colorado Registered Professional Land Surveyor. All monuments disturbed or removed by the Contractor, through negligence or carelessness on his part or on the part of his employees or subcontractors, shall be replaced at the Contractor's expense. Replacement of any monument shall be completed in accordance with the requirements set forth in Section 141.10 Survey Monuments of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Developer and Contractor shall be responsible for the damage or destruction of property resulting from neglect, misconduct, or omission in his manner or method of execution or non-execution of the work or caused by defective work or the use of unsatisfactory materials. They shall restore such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, rebuilding, or replacing it as may be directed, or they shall otherwise make good such damage or destruction in an acceptable manner. Developer and Contractor shall be responsible for the repair of underground pipes, wires, or conduits damaged by them or their subcontractors.

Developer and Contractor shall be liable for all damage caused by storms and fire, and shall under no circumstances, start fires without first securing the necessary permits and approval of the authority having jurisdiction even though they may be ordered or required to do such burning. In burning brush, stumps, or rubbish, care shall be taken not to damage any standing trees, shrubs or other property.

141.09   Surveys

Surveys shall conform to Colorado Bylaws and Rules of Procedures and rules of Professional Conduct of the State Board of Registration for Professional Engineers and Professional Land Surveyors, latest edition.

141.10   Survey Monuments

Permanent survey monuments, including the replacement of monuments, range points and lot pins shall be set in accordance with the requirements of Articles 51 and 53 of Title 38, Colorado Revised Statutes, and as required by the Bylaws and Rules of Procedure of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors.
141.11 Dustproofing

The Contractor shall take all necessary steps to control dust arising from operations connected with the work. When ordered by the DPW Director or his designee, the Contractor shall dustproof the construction area by sprinkling with water, by constructing windrows, or as otherwise directed by the DPW Director or his designee.

141.12 Traffic Control, Barricades and Warning Signs

All construction, maintenance, park or utility work being completed within the Public Rights-of-way shall have a Traffic Control Plan (TCP) approved by the DPW Director or his designee. The TCP is a plan for guiding and handling traffic safely through the construction work zone. The TCP shall provide safe methods for movement of pedestrians, bicyclists, and motorists that travel through the work zone and a safe area for all workers engaged in the construction activity. The TCP shall show the location, spacing and scheduling of the usage of advance warning signs, barricades, pavement markings and other control devices. All control devices shall be installed and maintained in accordance with the “Manual on Uniform Traffic Control Devices” (MUTCD) and the “CDOT Work Zone Safety Handbook”, latest editions.

Requirements contained in these manuals shall be strictly enforced during the progress of the work.

**THE TCP SHALL BE JOB SPECIFIC.** In order for a TCP to be approved by the DPW Director or his designee, it shall contain—as a minimum—a scaled drawing showing the project area and the street(s) that are affected by the project. The drawing shall include the following information:

A. Location and spacing of properly planned traffic control devices.
B. The length of time that the construction shall be in progress.
C. The name and phone number(s) of the Contractor's designated traffic control supervisor.
D. Any special notes or information on how the traffic control operation is to be handled.

The Contractor shall be responsible for the following:

A. Obtain a Public/Private Improvement Permit (PPIP) from the Elbert County Department of Public Works Road & Bridge Division.
B. Provide timely notification to, and coordination with, all affected agencies including the following:
   1. Appropriate Fire and Rescue
   2. Elbert County Sheriff Department
   3. 
4. Elbert County Department of Public Works Road & Bridge Division

5. Utility Companies

C. Inform occupants of abutting properties of access limitations made necessary by the work.

D. Schedule and expedite the work to cause the least inconvenience to the public. Construction or repair work shall not be permitted at or in the vicinity of signalized intersections or on major streets and state highways without advance approval of the DPW Director or his designee and CDOT as applicable.

E. Furnish, install and maintain required traffic control devices and facilities, as required throughout the life of the contract, including periods when the work is not underway.

F. Provide flagmen when required.

G. Ensure that survey crews and other employees working in or adjacent to a traveled roadway wear personal protection equipment as required.

H. Provide adequate safeguards for workers and the general public.

I. Patrol the construction site as required to ensure that all devices are in place and operating at all times.

J. Remove traffic control devices when they are no longer needed.

Projects that affect traffic on arterial streets and/or connectors may require an off-duty police officer/Sheriff on the job site to direct traffic during peak hours of 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. Work shall be scheduled and expedited in a manner to cause the least inconvenience to the public.

Intersections and driveways shall be closed for a minimum amount of time. The Contractor shall coordinate driveway closures with property owners with final approval by the DPW Director or his designee.

No work is allowed on Holiday-Restricted Streets (major shopping routes) between November 1 and January 1 unless approved by the DPW Director or his designee.

Unless otherwise approved by Elbert County, construction operations are limited to one-half of the roadway at any time. Maintenance activities on arterial streets shall be planned and scheduled to minimize interference with traffic. Except for emergency situations, no maintenance work shall encroach into a moving lane of traffic between the hours of 7:00 to 9:00 AM or from 4:00 to 6:00 PM unless otherwise authorized by Elbert County. All temporary traffic lanes shall be a minimum of ten (10) feet in width unless otherwise authorized. In addition, lane clearance shall be a minimum of five (5) feet from an open excavation and two (2) feet from a curb or other vertical obstruction.

A suitable surface shall be provided for the temporary traffic lanes in work areas. When traffic is diverted from the existing pavement, a temporary surface shall be provided as required by the DPW Director or his designee.
Construction equipment not actively engaged in construction, employee vehicles and official vehicles of the agency shall not be parked in the vicinity of the work in such a manner as to further restrict traffic flow. Vehicles and equipment in continuous or frequent use may be operated or parked in the same traffic lane as the work obstruction. Construction spoils or materials may be similarly stored in this area or on the nearby roadway or sidewalk area, provided that four (4) feet of sidewalk is kept clear for pedestrian use. To prevent the spoil bank from occupying too great a space at its base, toe boards may be used to keep it two (2) feet from the edge of the excavation on one side and two (2) feet from the edge of the traffic lane on the other.

Whenever necessary, trenches and excavations shall be bridged to permit an unobstructed flow of traffic.

A. Bridging shall be secured against displacement by using adjustable cleats, angles, bolts, or other devices.
B. Bridging shall be installed to operate with minimum noise.
C. The trench shall be adequately shored, to support the bridging and traffic.
D. Steel plates used for bridging shall extend a minimum of one foot beyond the edges of the trench. Temporary paving materials shall be used to feather the edges of the plates to minimize wheel impact.
E. Steel plates used for bridging shall be designed by a P.E.

When the work area encroaches upon a sidewalk, bike lane, walkway or crosswalk area, special consideration shall be given to pedestrian and bicyclist safety. Effort shall be made to separate pedestrians and bicyclists from the work area.

All work shall be barricaded at all times. Between sunset and sunrise, the work area shall be properly lighted. The Contractor shall be responsible for all damages to work due to failure of barricades, signs, lights, flagmen and watchmen.

141.13 Use of Explosives

Detonation of explosives by Developers or Contractors shall only be by permit authorized by the BOCC after review and recommendation by the County Administrator.

The following information shall be submitted to the County Manager, or their designee, at least thirty (30) days prior to the detonation of explosives:

A. A graphic plan showing locations of proposed explosive use and improvements (including structures, wells, waterways, irrigation ditches, etc.) on the property, surrounding land uses, and improvements on adjacent properties within a distance equal to 1000 feet plus the maximum distance of vibration as specified in the report described below.
B. A geotechnical report prepared by Colorado Registered Professional Engineer describing the geology of the area and the impacts of explosive
use in the area, including wave attenuation and travel distance and potential impacts on improvements in the area.

C. An analysis of alternatives to explosives, including safety, time, and monetary comparisons of all alternatives.

The Developer or Contractor shall use the utmost care to protect life and property in the detonation of explosives. Audible signals warning persons of danger shall be given before detonation of explosives.

If the detonation of explosives within Elbert County is permitted, the Developer or Contractor shall submit to the County Manager, or their designee, a certificate of insurance for coverage of detonation of explosives in the minimum following amounts: $2,000,000 for property damage, each accident; and $2,000,000 for public liability, bodily injury, single limit or equivalent, each accident. Elbert County shall be named as an additional insured on the insurance policy.

141.14 Storage of Explosives

In addition to Elbert County requirements for use of explosives, the Developer or Contractor shall obtain a Fire District permit for the storage, handling and use of explosives.

142.00 Use of Metro District Water

The Contractor may obtain permission to use Elbert County / Metro District water during construction as follows:

A. Request the District representative to install a meter and appurtenances on a hydrant and agree to pay the appropriate fees and deposits.

B. Agree to pay water utility charges for installation, use and removal of the meter, and to pay for all damage other than normal wear.

C. Notify District Representative immediately when use of meter is no longer required.

143.00 Pavement Cuts

ALL UNDERGROUND UTILITY INSTALLATIONS CROSSING ARTERIALS OR STREETS CONSTRUCTED, RECONSTRUCTED, OR OVERLAID WITHIN FIVE (5) YEARS SHALL BE DONE BY BORING, EXCEPT FOR EMERGENCY REPAIRS.

An exception may be granted when a plan is submitted to overlay the entire street (block to block), or as approved by the DPW Director or his designee.

All street cuts shall be saw-cut prior to street patching. An approved asphaltic patch, rotomilling, or base course trench surfacing shall be placed the same day street cuts are made, unless approved by the DPW Director or his designee. Cold mix, roto milling, or base course
shall be maintained free of surface ruts and the street shall be cleaned of mud and dust until the permanent resurface is in place. Pavement cuts shall have permanent patching within five (5) working days, unless otherwise approved by Elbert County.

**THE APPLICANT SHALL BE RESPONSIBLE FOR MAINTENANCE OF THE PERMANENT PATCH FOR A PERIOD OF ONE YEAR.**

If a street cut is required, the Contractor shall make every effort to install a permanent, hot mix, asphalt patch within twenty-four (24) hours. The Contractor shall place a temporary, cold mix, asphalt patch in all street cuts immediately after completing backfill and compaction if a permanent hot mix asphalt patch cannot be installed within twenty-four (24) hours of completion of utility installations. The Contractor shall submit a schedule for the permanent patch installation to the DPW Director or his designee for approval.

When pavement cuts are required, the following conditions shall be met so as to avoid interference with traffic:

A. Pavement cuts in streets shall be open only between 9:00 A.M. and 4:00 P.M.; and
B. Two-way traffic shall be maintained at all times around the construction area. A Traffic Control Plan (TCP) shall be prepared in accordance with Section 141.12 Traffic Control, Barricades and Warning Signs of these **CONSTRUCTION STANDARDS & SPECIFICATIONS** and submitted to the DPW Director or his designee for approval prior to the start of construction.

143.01 Pavement Cut Repair Requirements

Pavement cut repairs shall be performed according to the following requirements:

A. Areas to be repaired shall be saw cut so that edges are straight.
B. Edges of areas to be repaired shall be milled a minimum of twelve (12) inches wide and two (2) inches deep.
C. The excavated area shall be re-compacted to ninety-five (95) percent modified proctor as per ASTM-T-99 and edges cleaned prior to the application of tack coat. Tack coat shall be applied to the edges of the excavated area prior to placement of new material.
D. Asphalt in the repair area shall be six (6) inches minimum thickness or one (1) inch thicker than existing asphalt, whichever is greater.
E. Hot bituminous material shall be placed in the excavated area and compacted to a Rice density between ninety-two (92) and ninety-six (96) percent, or to a minimum Marshall density of ninety-five (95) percent.
F. Finished patch shall be smooth and conform to the grade of the existing asphalt. Heat scarifications may be required by the DPW Director or his designee.
G. Work area shall be cleaned at the end of each working day.
H. Refer to the Detail Drawings for additional pavement cut repair requirements.

144.00 Cable Installation

144.01 General

Unless otherwise approved in writing by the DPW Director or his designee, all cable installation shall be within public rights-of-way or within a dedicated utility easement. All cable shall be installed at a minimum depth of twenty-four (24) inches in accordance with the requirements of Article 300-5 of the NEC.

144.02 Underground Installation

All underground installation shall be in accordance with Article 300-5 of the NEC.

144.03 Overhead Installation

All overhead installation shall be in accordance with Article 230-24-(b) of the NEC.

150.00 PERMITS AND INSPECTIONS

151.00 Public/Private Improvement Permit (PPIP), Grading Permit and Over-Excavation Permit

It shall be unlawful for any person, organization, firm or corporation to construct, enlarge, alter, repair, move, improve, remove, excavate, convert or demolish any public or private improvements or common facilities regulated by these CONSTRUCTION STANDARDS & SPECIFICATIONS without first obtaining either a Public/Private Improvement Permit (PPIP), a Grading Permit, or an Over-Excavation Permit for such work from the Department of Public Works.

151.01 Application for Permit

All Elbert County construction related permits may be found online at Elbert County’s website (www.elbertcounty-co.gov) or at the Department of Public Works Road & Bridge Division. Available permit applications include:

A. Public/Private Improvement Permit
B. Grading Permit
C. Over-Excavation Permit
D. 
E. Driveway Permit

An Applicant for a permit shall complete and submit an application online at Elbert County’s website or on a form furnished by the Department of Public Works Road &
Bridge Division a minimum of five (5) working days prior to the anticipated starting date, except in case of emergency. Each application shall:

A. Identify and describe the work to be covered by the permit for which the application is made.
B. Describe the land on which the proposed work is to be done by legal description, street address, or similar description that shall readily identify and clearly locate the proposed work.
C. Indicate the type of work or improvement intended.
D. Be accompanied by plans, diagrams, computations and specifications, and other data as required in these CONSTRUCTION STANDARDS & SPECIFICATIONS.
E. Be accompanied by a Traffic Control Plan as defined in these CONSTRUCTION STANDARDS & SPECIFICATIONS.
F. State the valuation and the quantities of the work to be performed.
G. Be signed by the Applicant or his authorized agent, who may be required to submit evidence to indicate such authority.
H. Submit a starting and completion date.
I. Provide other data and information as may be required by the DPW Director or his designee.
J. If grading includes over-excavation and re-compaction for structures, comply with additional requirements of Section 162.01 Preliminary Reports and Section 162.02.05 Earthen Cut/Fill Investigation Report of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
K. Include all applicable fees. CAPITAL IMPROVEMENT PROJECTS AND OTHER ELBERT COUNTY PROJECTS MAY BE EXEMPT FROM FEES BY ELBERT COUNTY, IF APPROVED BY THE DPW DIRECTOR OR HIS DESIGNEE /

151.02 Permit Issuance

The application, plans, specifications and other data filed by an Applicant for a permit shall be reviewed by the DPW Director or his designee. The plans may be reviewed by other Elbert County departments. If the DPW Director or his designee that the work described in an application for a permit, including plans and other data, conforms to the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS, other pertinent laws and ordinances, and that all required fees have been paid, a permit may be issued.

Permitted plans shall have a signed DPW Director or his designee Statement. Refer to Section 161.02. General Requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The approved plans and specifications shall not be changed, modified, or altered without authorization from the DPW Director or his designee, and all work shall be performed in conformance with the approved plans. One set of approved plans, specifications, and computations shall be retained by Elbert County, and one set shall be maintained at the work site at all times during the progress of the work.
A pre-construction conference may be required prior to the issuance of any permits for construction. Attendance shall include the DPW Director or his designee, Elbert County Representatives / Inspectors, the Developer/Owner, Design Engineer, General Contractor, Sub-Contractors and others as appropriate. The DPW Director or his designee shall be notified two working days (forty-eight [48] hours) before construction is to begin.

The issuance of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS or of any regulations of this jurisdiction. No permit presuming to give authority to violate or cancel the provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS is valid.

The issuance of a permit based on plans, specifications or other data shall not prevent the DPW Director or his designee from requiring the correction of errors in the plans, specifications and other data, or from stopping construction operations, which are in violation of these CONSTRUCTION STANDARDS & SPECIFICATIONS or any other regulations of this jurisdiction.

151.03 Permit Expiration

Every permit issued by the DPW Director or his designee under the provisions of this section shall expire if the work authorized by the permit is not substantially complete by the date noted on the permit. Before the work can be recommenced, a new permit shall be obtained. If substantial changes have been made or required by Elbert County during this period, or more than one year has expired, the Applicant shall pay a new, full permit fee.

Any Applicant holding a valid permit may apply, in writing, for an extension of the completion date noted on the permit. The request shall be based on good cause and shall be acceptable to Elbert County. The DPW Director or his designee may extend the completion date for up to six months without an additional fee, provided that circumstances beyond the control of the Applicant have prevented completion of the work. No permit shall be extended more than one (1) time.

151.04 Permit Suspension or Revocation

The DPW Director or his designee may suspend or revoke any permit issued under the provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Suspension or revocation of a permit may occur when: (a) the permit is issued in error, (b) is based on incorrect information supplied by the Applicant, or (c) the permit has been issued in violation of any ordinance or regulation of any of the provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS. No refund of permit fee shall be made for a revoked or a suspended permit.

152.00 Weekend, Holiday and After-Hours Work
Weekend, holiday, or after-hours work shall only be permitted for construction which is specifically covered by an approved Public/Private Improvement Permit (PPIP), Grading Permit, Over-Excavation Permit, or in an emergency. Weekend and holiday work hours shall be from 8:00 A.M. to 5:00 P.M. only. **NO WORK SHALL BE PERMITTED WITHOUT THE SPECIFIC APPROVAL BY THE DPW DIRECTOR OR HIS DESIGNEE.** All applicable Elbert County Ordinances shall be strictly adhered to during the approved work period. All work shall comply with approved plans, contract documents, these **CONSTRUCTION STANDARDS & SPECIFICATIONS** and all other Elbert County requirements. No work shall be permitted without written approval by the DPW Director or his designee or the Construction Inspection Supervisor.

### 153.00 Permit Fees

#### 153.01 Plan Review Fees

The permit fee shall be calculated from the latest permit fee schedule adopted by the Elbert County BOCC.

#### 153.02 Violation Fee Required for Performing Work Without a Permit

All work for which the required permit has not been obtained shall cease upon written notice of the DPW Director or his designee. Following the issuance of a Stop Work Order by the DPW Director or his designee, an investigation shall be made before a permit is issued for un-permitted work.

A violation fee shall be collected whether or not a permit is subsequently issued. The violation fee shall be equal to the amount of the permit fee. The minimum violation fee shall be the same as the minimum fee set forth in the permit application form. The payment of the violation fee shall not exempt any person from compliance with all other provisions of these **CONSTRUCTION STANDARDS & SPECIFICATIONS** nor from any penalty prescribed by law.

### 154.00 Inspections

All construction work for which a PPIP, Grading Permit, Over-Excavation Permit or Driveway Permit is required shall be subject to inspection by the DPW Director or his designee or Elbert County Inspector/Representative, and certain types of construction shall have continuous inspection. All Metro District utilities to be inspected by an authorized Metro District representative.

It shall be the responsibility of the person performing the work authorized by a permit to notify the DPW Director or his designee or his authorized representative that such work is ready for inspection. Every request for inspection shall be filed at least forty-eight (48) hours before such inspection is desired unless otherwise stated in these **CONSTRUCTION STANDARDS & SPECIFICATIONS**.
STANDARDS & SPECIFICATIONS. An inspection request may be in writing or by telephone, at the option of the DPW Director or his designee.

It shall be the responsibility of the person requesting an inspection required by these CONSTRUCTION STANDARDS & SPECIFICATIONS to provide access to and means for proper inspection of all work. All work shall be inspected by the DPW Director or his designee. The DPW Director or his designee has the authority to halt construction when, in his opinion, these CONSTRUCTION STANDARDS & SPECIFICATIONS and/or standard construction practices are not being followed, or the work is otherwise defective. Whenever any portion of these CONSTRUCTION STANDARDS & SPECIFICATIONS are violated, the DPW Director or his designee shall give the Contractor written notice listing deficiencies to be corrected and may order further construction stopped until all deficiencies are corrected. If the deficiencies are not corrected within the time limit specified in the notice, the DPW Director or his designee may invoke enforcement options and/or draw upon performance guarantees under which the work is being performed.

ELBERT COUNTY MAY EMPLOY PRIVATE CONTRACT CONSULTANTS AND OR INSPECTION PROFESSIONALS TO SUPPLEMENT ELBERT COUNTY PLAN REVIEW/ANALYSIS AND OR INSPECTIONS AT THE DEVELOPER’S COST.

ELBERT COUNTY MAY REQUIRE THE DEVELOPMENT TO HIRE A QUALIFIED PRIVATE CONTRACT INSPECTION PROFESSIONAL OR A COLORADO REGISTERED PROFESSIONAL ENGINEER AT THE DEVELOPER’S COST TO CERTIFY TO ELBERT COUNTY THAT THE WORK WAS COMPLETED IN ACCORDANCE WITH THESE CONSTRUCTION STANDARDS & SPECIFICATIONS.

LANDSCAPING THAT IS PRIVATELY OWNED AND MAINTAINED BY A HOMEOWNERS ASSOCIATION (HOA) OR OTHER PROPERTY MANAGEMENT ENTITY SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THESE CONSTRUCTION STANDARDS & SPECIFICATIONS. COMPLIANCE TO THESE CONSTRUCTION STANDARDS & SPECIFICATIONS SHALL BE CERTIFIED BY A QUALIFIED THIRD PARTY APPROVED BY ELBERT COUNTY AND PAID BY THE DEVELOPER.

The procedure for final inspection and acceptance is specified in Section 200 Acceptance Procedures of these CONSTRUCTION STANDARDS & SPECIFICATIONS or in the contract documents.

154.01 Additional Inspections and Re-inspections

The DPW Director or his designee may make or require additional inspections of any work as deemed necessary to ascertain compliance with the provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
A re-inspection fee may be assessed for each inspection or re-inspection when the work identified for additional inspection or re-inspection is not complete, or when identified corrections have not been made.

Re-inspection fees may be assessed when the permit is not in the possession of the permit holder at the work site, when the approved plans are not readily available to the Elbert County Representative/Inspector, for failure to provide access on the date for which inspection is requested, or for deviating from plans approved by the DPW Director or his designee.

The Applicant shall request a re-inspection in writing and shall pay the re-inspection fee. Where re-inspection fees have been assessed, no additional inspection of the work shall be performed until the required fees have been paid.

The intent of this subsection is not to require a re-inspection fee the first time a job is rejected for failure to comply with the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The intent is to minimize the practice of requesting an inspection before a job is ready for an inspection or re-inspection.

**160.00 PLANS AND SPECIFICATIONS**

Plans, engineering calculations, diagrams and other data shall be submitted in one or more sets, as required by the DPW Director or his designee, with each application for a permit. Elbert County shall require that plans, computations and specifications be prepared and designed by a Colorado Registered Professional Engineer. Landscape plans shall be prepared and designed by a landscape architect. ALL ROADWAY PLANS SHALL INCLUDE A GEOTECHNICAL REPORT.

The preparation of the Record Documents, as required in Section 211.02 Record Documents of these CONSTRUCTION STANDARDS & SPECIFICATIONS, shall be based on field inspections performed under the direct supervision of the design engineer responsible for the original approved engineering construction drawings. Field inspection reports shall be submitted along with Record Documents.

If the design engineer responsible for the original approved engineering construction drawings is changed prior to preparing Record Documents, the replacement design engineer shall agree in writing to accept the responsibility for final approval and acceptance of the public improvements.

EXCEPTION: The DPW Director or his designee may waive the submission of plans, calculations, etc., if he finds that the nature of the work is such that a review of plans is not necessary to obtain compliance with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

**161.00 Construction Plan Requirements**
All construction plans shall be checked for conformance with the CONSTRUCTION STANDARDS & SPECIFICATIONS prior to approval by the DPW Director or his designee. This approval shall be for conformance to Elbert County design standards and other requirements. Engineering design shall remain the responsibility of the professional design engineer. One set (blueline or photocopy) of the final plans shall be submitted to the Department of Public Works for review prior to approval. This set shall be returned marked with changes that are required or recommended. A GEOTECHNICAL REPORT IS REQUIRED FOR ALL PUBLIC ROADWAYS DESIGNS.

161.01 Construction Plan Submittal Requirements

Upon final approval by the DPW Director or his designee, submit the following:

A. One set of the construction plans, unbound, 24” x 36” white paper with 22’x34’ borders such that a scalable 11’x17’ version can be reproduced, easily read font size, signed and sealed by a Colorado Registered Professional Engineer. Landscape and irrigation plans shall be sealed by either a licensed Landscape Architect or Professional Engineer. Each plan shall have the DPW Director Statement and signature line. See Section 161.02 General Requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS for the DPW Director Statement. Elbert County shall scan the plans into its “read-only” data file and shall retain the original. The Developer or Engineer shall submit a second paper set (either 11” x 17” or 24” x 36”), signed and sealed by a Colorado Registered Professional Engineer, for signature by the DPW Director to be returned to the Developer.

B. An AutoCAD digital copy of the construction plans. Confirm version acceptability with Elbert County’s GIS Division. “X-referenced” files shall be tied to Elbert County’s GPS network system.

The Contractor shall keep a set of the signed approved plans on the job site for the duration of the project. Should circumstances warrant changes to the approved plans or specifications, written approval shall be obtained from the DPW Director. Copies of approved revisions shall be given to the Developer or Contractor and the design engineer. It shall be the duty of the design engineer and the Contractor to record all changes on the Record Documents as they occur. Record Documents shall be submitted at the completion of the project in compliance with Section 200.00 Acceptance Procedures of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

161.02 General Requirements

Plans and specifications shall adhere to the following general requirements:

A. Be developed for an 11” x 17” format.
B. Have text with an easily read font size.
C. Be drawn to scale.
D. Have sufficient clarity to indicate the location, nature and extent of the work proposed.
E. Provide sufficient detail to demonstrate conformance with the provisions of the CONSTRUCTION STANDARDS & SPECIFICATIONS and relevant laws, ordinances, rules and regulations.

The following items shall be shown on all plans:

A. Title Block (lower right-hand corner preferred)
B. Scale (For 11” x 17” drawings, 1” = 100’ horizontal and 1” =10’ vertical for plans and profiles are preferred. These would be 1” = 50’ and 1” = 5’ respectively on a 22” x 34” format.)
C. Date and revision
D. Name of Professional Engineer or firm
E. Professional Engineer's seal and signature
F. Drawing number(s)
G. DPW Director or designee Statement

Each set of construction plans shall include:

A. Cover or title sheet that identifies the project, Developer and design professionals and date of the documents
B. General Notes supplied by Elbert County and contained in this section. Additional project specific information may be provided as Supplemental Notes.
C. Material lists identifying the type, size and quantity of materials to be installed
D. Vicinity map with sufficient detail to locate the project
E. Overall summary drawings at a reasonable scale (1” = 100’ for example). The summary drawing(s) shall show all water, reuse water, sanitary sewer, storm drainage and street facilities to be completed, and other pertinent information that would add to the overall understanding of the project.

161.02.01 DPW Director or designee Statement

The following DPW Director Statement shall be placed on all types of drawings, including landscape and irrigation plans. The DPW Director Statement shall be located in the lower right-hand corner near the title block. Following is the DPW Director Statement:

“All work shall be constructed to ELBERT COUNTY CONSTRUCTION STANDARDS & SPECIFICATIONS. This drawing has been reviewed and found to be in general compliance with these CONSTRUCTION STANDARDS & SPECIFICATIONS and other Elbert County requirements.

THE ENGINEERING DESIGN AND CONCEPT
161.02.02 Landscape Maintenance Superintendent Statement

The following Landscape Maintenance Superintendent Statement shall be placed on all landscape and irrigation plans. The Landscape Maintenance Superintendent Statement shall be located below the DPW Director Statement. Following is the Landscape Maintenance Superintendent Engineer Statement:

“All work shall be constructed to ELBERT COUNTY CONSTRUCTION STANDARDS & SPECIFICATIONS. This drawing has been reviewed and found to be in general compliance with these CONSTRUCTION STANDARDS & SPECIFICATIONS and other Elbert County requirements. THE DESIGN AND CONCEPT REMAINS THE RESPONSIBILITY OF THE PROFESSIONAL LANDSCAPE AND IRRIGATION SYSTEM DESIGNER WHOSE SIGNATURE APPEARS HEREON.”

Landscape Maintenance Superintendent (or Designee) Date

161.02.03 Variance Statement

Any proposed variance from these CONSTRUCTION STANDARDS & SPECIFICATIONS shall be submitted as a written request to the DPW Director or designee. Following is the Variance Statement (if necessary):

The Applicant is requesting a variance from the Elbert County CONSTRUCTION STANDARDS & SPECIFICATIONS for the following:

1. (List all applicable items)

DPW Director or Designee Date

161.03 Plan Details

A. Vicinity map
B. Key map / sheet index
C. Legend containing all symbols used in the plans, usually located on a general or summary plan

D. All proposed and existing buried infrastructure on a single plan. For areas where showing all proposed and existing infrastructure provides too much information to be readable at 1” = 50’ scale, provide “blow-up” details with a reduced scale for clarity (1” = 20’ or 1” = 10’ for example).

E. North arrow

F. Property lines; indicate lots to be served by solid lines; other property lines dotted, all consistent with the project legend

G. Ownership or subdivision information

H. Street names and easements with width dimensions

I. All other pertinent structures. Examples include, and are not limited to, houses, curbs, water courses, etc.

J. Utility conflict areas

K. Match lines

L. References to detail sheets

161.04 Profile Details

A. Vertical and horizontal grids with scales

B. Ground surface existing (dotted) and proposed (solid)

C. Existing utility lines where crossed, or in close proximity. The intent is to provide sufficient information to avoid conflicts with, and damage to existing utilities. Use “blow-up” details at a reduced scale for clarity

D. Benchmarks. All elevations shall be referenced to one or more of Elbert County’s Global Positioning System (GPS) Monuments.

E. Existing manhole invert and rim elevations and identification number(s)

F. Use “blow-up” details at reduced scale for clarity

161.05 Water Supply Construction Details

In addition to the above general plan and profile details, all water supply construction plans shall include the following items:

A. Proposed water mains – general plan: Provide a summary table with all pipe sizes, material specification reference (i.e. AWWA C900, etc.), pressure class, and approximate quantity by size and pressure class.

B. Proposed water mains – plan and profile:
   1. Diameter
   2. Length
   3. Materials and types of joints
   4. Location dimensions including existing or proposed

C. Fittings:
   1. Tees
   2. Crosses
   3. Reducers
4. Bends
5. Plugs
6. Blow-offs
7. Air/vacuum valves
8. Restraints
D. Valves, including existing
E. Fire hydrant
F. Plan, profile and complete details for off-site transmission mains, pump stations, special valves, and vaults, tanks, etc.
G. Standard bedding detail (cross-section)
H. Complete material list for each plan and profile drawing
I. Sequence of construction

161.06 Sanitary Sewer Construction Details

In addition to the general plan and profile details, all sanitary sewer construction plans shall include the following:

A. Proposed sanitary sewer mains – general plan: Provide a summary table with all pipe sizes, material specification references (i.e. ASTM C-76, etc.), strength class, and approximate quantity by size and strength class.
B. Proposed sanitary sewer mains – plan and profile
   1. Diameters
   2. Materials
   3. Gradients
   4. Flow direction arrows
   5. Length between manholes
C. Proposed manholes, cleanouts, and grease interceptors
   1. Stationing and other number designation
   2. Elevation of inverts in and out of manhole
   3. Elevation of manhole rim
D. Location control dimensions
E. Manhole stub-outs
F. Proposed future extensions
G. Proposed wye and riser connection for services
H. Proposed service connections or stub-ins
I. Standard bedding cross-section
J. Proposed concrete encasement
K. Proposed cut-off walls
L. Complete material list for each plan and profile drawing
M. Sequence of construction

161.07 Storm Drainage Construction Details

In addition to the above general plan and profile details, all storm drainage construction plans shall include the following:
A. Proposed storm drainage – general plan: Provide a summary table with all pipe or conduit sizes, material specification reference (i.e. ASTM C-76), strength class, and approximate quantity by size and strength class.

B. Drainage area plan; an overall plan of the area under study showing:
   1. North arrow
   2. Contours (maximum two-foot intervals)
   3. Location and elevation of County benchmarks
   4. Property lines
   5. Boundary lines (counties, districts, tributary area, etc.)
   6. Streets and street names and approximate grades
   7. Subdivision (name and location by section)
   8. Existing irrigation ditches, including ditch name(s) and ownership(s)
   9. Existing drainage ways including gutter flow directions
   10. Drainage sub-area boundaries
   11. Easements required
   12. Proposed curbs and gutters and gutter flow directions
   13. Proposed cross pans and flow directions
   14. Proposed piping and open drainage ways
   15. Flow calculations for 2-, 5-, and 100-year storm runoff
   16. Path of 100-year storm runoff flows
   17. Critical minimum finished floor elevations for protection from 100-year runoff
   18. Proposed inlet locations and inlet sizes

C. Proposed pipes:
   1. Plan showing stationing and flow direction arrows
   2. Profile
   3. Hydraulic Grade Line
   4. Energy Grade Line
   5. Pipe diameter, length, material and strength class
   6. Grades
   7. Inlet and outlet details, including station number, structure designation, dimensions, and invert elevations
   8. Manhole details including station number, manhole designation, diameter or dimensions, and invert elevations
   9. Typical bedding detail

D. Proposed open channels:
   1. Plan showing stationing
   2. Profile
   3. Grades
   4. Typical cross section(s) with major and minor storm event water surface elevations
   5. Lining details
   6. Water surface profile
   7. Energy grade line
E. Proposed special structures (manholes, headwalls, open channel structures, trash gates, etc.):
   1. Plan
   2. Elevation
   3. Details of design and appurtenances

161.08 Street Construction Details

In addition to the above general plan and profile details, all street construction plans shall include the following:

A. Key map (sheet index)
B. Overlot grading plan
C. Typical sections of street construction showing structure, dimensions and pavement design(s)
D. Existing irrigation ditches to be removed or piped
E. Proposed curb, gutter and sidewalk
F. Proposed crosspans including flow direction
G. Storm drainage facilities
H. Location and elevation of Elbert County GPS Monument benchmarks.
I. Horizontal curve data, with radii, tangents, points of curvature, (P.C.), intersection (P.I.) and tangency (P.T.)
J. Stations and elevations of radius points (back of curb)
K. Proposed profile of centerlines and flow lines of curb, and property line with horizontal stationing and percent slope
L. Proposed edge drains, including depth, flow direction, discharge locations, cleanout locations, cross-section details
M. Stations, lengths, and elevations of vertical curve P.C., P.I. and P.T.
N. Percent slope of tangent lines
O. Limits of construction
P. Show sufficient existing or future construction to assure continuity of construction
Q. Stations and elevations of drainage facilities and other structures
R. Streetlight and underground service cable locations
S. Street sign locations

161.09 Area Grading Plan Details

All construction plans shall include an Area Grading Plan that includes all pertinent information necessary to construct a structure on each lot. The Area Grading Plan shall follow the approved Drainage Plan. At a minimum, the following shall be included:

A. Grading and drainage patterns of existing lots adjacent to subdivision
B. Lot types (A, B, Transitional (T), Walkout (WO), Garden Level (GL), etc.)
C. Lot corner elevations
D. Building Envelopes
E. Building top of foundation (T.O.F.) elevations
F. Elevations of ground outside of building to ensure proper drainage away from the foundation
G. Elevations and grades of all drainage swales and side lot lines
H. Elevations of all high points
I. Drainage easements on and adjacent to subject property

161.10 Erosion Control Plan Details

All construction plans shall include an erosion control plan as specified in Section 630.00 Erosion Control of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Erosion control plan drawings shall use the same base map as that for the Drainage Plan and shall include, at a minimum, the following information:

A. A general location map with sufficient detail to identify drainage flow entering and leaving the development and general drainage patterns
B. Major construction (i.e., development, irrigation ditches, existing detention facilities, culverts, storm sewers) along the path of drainage
C. Basins and divides identified with topographic contours
D. Specifications and details for erosion control measures
E. A transition grading/drainage plan for construction activities that are phased or sequenced. All residential developments shall require a transition grading plan.

161.11 Cut and Fill Plan

All subdivisions shall include a cut and fill plan. The cut and fill plan shall use the same base map as the grading plan. An Earthen Cut/Fill Investigation Report that complies with Section 162.00 Engineering Reports of these CONSTRUCTION STANDARDS & SPECIFICATIONS shall be submitted for any project with proposed cuts and/or fills greater than three (3) vertical feet. The plan shall include the following information:

A. Limits of cut and fill
B. Depths of cut and fill (spot locations)
C. Depth to groundwater at monitoring locations
D. Slopes (percent)

161.12 Easement Widths

Water, sanitary sewer, and storm sewer easements shall be a minimum of thirty (30) feet in width for buried utility lines up to ten (10) feet deep. For utility lines deeper than ten (10) feet, the easement width shall be calculated according to the formula shown in the Detail Drawings.

161.13 Specifications and Support Documentation
The following items shall also be included with submitted construction plans:

A. Reference on plans to ELBERT COUNTY CONSTRUCTION STANDARDS & SPECIFICATIONS
B. Reference on plans to other agency CONSTRUCTION STANDARDS & SPECIFICATIONS that are required or proposed
C. Where reference to other commonly available CONSTRUCTION STANDARDS & SPECIFICATIONS shall not suffice, copies of specifications are to be provided
D. Copies of written approval from other affected agencies as required
E. Where work shall occur outside of the boundaries of the project (over lot grading, for example), copies of written approval from the adjoining private property owners shall be provided
F. Soils and other test data and design calculations for street structural sections, drainage facilities and other appurtenances as required
G. Digital copy of all reports, including graphics.

161.14 Irrigation and Landscape Specifications and Support Documentation

The following requirements apply for submitted irrigation and landscaping plans:

A. Submit (2) sets of 24” x 36” and (1) set of 11” x 17” scaled plans.
B. Include ownership/dedication, development responsibility and maintenance responsibility information for each tract and outlot (on the coversheet). Specify acreages.
C. Include grading plans.
D. Show property lines. Property lines for tracts and outlots to be maintained by Elbert County shall be staked, and the stakes shall be maintained by the Developer or Contractor until Construction Acceptance of the public irrigation and landscaping improvements.
E. Show irrigation and landscaping to be maintained by Elbert County on separate plan sheets from irrigation and landscaping to be maintained by a private entity, such as a Homeowners Association (HOA) or a property management company. If irrigation and landscaping owned by Elbert County is to be maintained by a private entity, it shall be shown on the plans with red lines and text.
F. Include a signature box on the coversheet for approval by the Landscape Superintendent or designee.
G. Include mower access ramps for median islands.
H. Provide engineering shop drawings for all park structures, including benches, trash cans, shelters, playgrounds, backstops etc.
I. Specify playground surface(s).
J. Denote sidewalk radii.
K. Design sidewalks to be flared at intersections.
L. Include all applicable Detail Drawings from these CONSTRUCTION STANDARDS & SPECIFICATIONS.

161.15 Irrigation Construction Details

In addition to general plan and profile details, all irrigation construction plans shall include the following items:

A. Bold line types for irrigation and lightened line types for landscaping
B. Zone information, including clock letters; zone numbers; valve, head and nozzle specifications; the number of heads per zone and the precipitation rate in GPM/GPH per zone

If irrigation is not installed within one (1) year of the date plans are approved by Elbert County, the Developer or Contractor may be required to re-submit irrigation plans to Elbert County for approval.

161.16 Landscape Details

In addition to the above general plan and profile details, all landscaping plans shall include the following items:

A. Plant ledger
B. Plant counts
C. Sightline triangles based on street speed limits
D. Existing streetlights, utility boxes, manholes and street signs
E. Bold line types for landscaping and lightened line types for irrigation
F. Delineated native areas and manicured areas
G. Edger along bed areas adjacent to turf areas
H. Mulch type (rock, cobble, wood mulch etc.)
I. No small, angular areas of turf
J. Drought tolerant bluegrass in passive parks and R.O.W.

162.00 Engineering Reports

All engineering reports shall include on the title page: (a) the type of report (preliminary or final); (b) the project name; (c) the preparer’s name, date, and firm; and (d) P.E. seal of preparer.

Preliminary and final engineering reports shall be organized to follow the general outline of required topics presented in the following sections.

162.01 Preliminary Reports

The following preliminary reports shall accompany all PUD and preliminary plat applications.
A. Utility Report (2 copies)
B. Drainage Report (2 copies)
C. Traffic Analysis Report (3 copies)
D. Geotechnical Studies (2 copies)
E. Earthen Cut/Fill Investigation Report (2 copies)
F. A digital copy, in Acrobat Portable Format (pdf), that is identical to the hardcopy of all above reports and graphics shall be submitted.

162.01.01 Preliminary Utility Report Requirements

Preliminary utility reports shall include the following information and data as a minimum:

A. Sanitary Sewer
   1. Layout and connection(s) to the sanitary sewer system
   2. Average and peak flow rate calculations
B. Water System
   1. Layout and connection(s) to the water system
   2. Potable water demand peak and average rate calculations

162.01.02 Preliminary Drainage Report

Drainage report calculations and supporting data required as set forth herein shall be prepared in accordance with the UDFCD Urban Storm Drainage Criteria Manual. A preliminary drainage report shall include as a minimum, the following:

A. General Information:
   1. A map showing project location, description of the property, acreage, topography, identification of major drainageways involved, proposed type of development, access and maintenance responsibility, identification of wetlands and a reference to any flood hazard area delineation study and Drainage Outfall System Master Plan applicable to the site
   2. A map of the tributary drainage basin determining the location and magnitude of flows from upstream of the site based on current development or zoning, which ever provides the highest runoff volumes
   3. A conceptual drainage plan showing how intercepted and on-site flows shall be received and transported
   4. Designated points of discharge from the site, accompanied by a general analysis of how existing downstream facilities shall handle this discharge
   5. Required rights-of-way for drainage easements and detention areas
6. A discussion of how site characteristics (soils, vegetation, erodibility) shall influence both wind and water erosion

7. A general discussion of the type of erosion control program necessary to prevent sediments from leaving the site

B. Hydraulic Calculations:
   1. Historic and proposed initial and major storm run-off quantities from the site under development. Evaluation of the historic drainage for the initial and major storm shall include:
      a. Basin length, slope, time of concentration, intensity (show intensity duration curves used), and flow rates. The evaluation of proposed run-off quantities shall be based on the developer’s plans for the site. An evaluation shall be performed for the same items listed for historic drainage to the extent that they are known or can be estimated.

   2. Storm Water Detention:
      a. Storm water storage volume required
      b. Location of storage areas. The storage areas shall be shown and designated. If the ultimate land use of a parcel is not known, the storage volume required shall be numerically written with a statement designating how the required storage is to be apportioned as parcels of property are sold off for the ultimate development.

162.01.03 Preliminary Traffic Analysis Report

Required information for the preliminary traffic report shall include, but not be limited to the following:

A. Land use, site and study area boundaries
B. Existing and proposed site uses
C. Existing and proposed roadways and intersections
D. Existing and proposed roadways and intersection capacities and volumes
E. Trip generation and design hour volumes
F. Trip distribution
G. Trip assignments
H. Existing and projected traffic volumes
I. Levels of service of all affected intersections for the design hour
J. Future traffic impact analysis
K. Short term horizon - one year after occupancy
L. 20-year planning horizon (DRCOG 20-year planning horizon)

162.01.04 Preliminary Geotechnical Report Requirements

Geotechnical and soils investigation studies are required for foundation design, pavement design, earthen cut/fill analysis, and over excavation and compaction for structures. These categories may be combined into one report when the
purpose of the investigation includes these facets of design. Each topic shall be presented as a “stand alone” chapter in the report. A preliminary geotechnical report shall include the following information at a minimum:

A. General Information:
   1. Past and present land uses and features
   2. Proposed use of the land when developed
   3. Surface drainage characteristics
   4. A general geologic report on the area and a discussion of the soil profiles and subsurface features
   5. Potential areas of slope instability

B. Unusual Land Uses and Conditions: Preliminary report shall identify all unusual land uses such as landfills, open dumps, wetlands, leach fields, areas of natural springs, faults, mines, etc. These shall be presented in a written and graphical format of suitable scale.

C. Earthen Cut/Fill Investigation:
   1. Earthen Cut/Fill Analysis: Preliminary report shall identify grading of cuts and fills exceeding thicknesses of three (3) feet on the property. The report shall define depths to groundwater prior to and after proposed grading. The report shall also identify the soil types, their density or consolidation state, ditches, utilities, and structural and morphological features such as fractures, slip planes, deformations, and/or hummocky topography, which indicate previous or potential land sliding, and any other potential unique conditions that could cause instability.
   2. Over Excavation and Compaction for Structure Development: Preliminary report shall identify swell potential on the site and propose an established goal, method and procedure for minimizing and evaluating the risk to foundations, slabs on grade, and other flatwork in accordance with the foundations risk analysis required by the Uniform Building Code and as amended by the Elbert County.

162.02 Final Engineering Reports

The following final reports shall accompany all site development plan and final plat applications:

A. Utility Report (2 copies)
B. Drainage Report (2 copies)
C. Traffic Analysis Report (3 copies)
D. Geotechnical Studies (2 copies)
E. Earthen Cut/Fill Investigation Report (3 copies)
F. Construction Traffic Routing Plan (2 copies)
G. A digital copy, in Acrobat Portable Format (pdf), that is identical to the hardcopy of all above reports and graphics shall be submitted.
162.02.01 Final Utility Report

Final utility reports shall include the following information and data as a minimum:

A. Sanitary Sewer
   1. Layout and connection(s) to the sanitary sewer system
   2. Average and peak flow calculations
   3. Maximum and minimum slope and velocity
   4. Available existing downstream capacity
   5. Master plan map (24” x 36” preferred), drawn to a standard engineering scale, showing existing and proposed facilities, as well as all pertinent geographic and infrastructure features for the area around, and including, the proposed development

B. Water
   1. Layout and connection(s) to the potable water system
   2. Potable water demand (peak and average)
   3. Fire flow demand
   4. Peak instantaneous demand and meter sizing
   5. Available pressure and capacity
   6. Irrigation water demand. Note whether potable or reclaimed water is proposed for irrigation use. If connection to a reclaimed water system is proposed, provide a separate report containing all items listed for the potable system, except fire flow demand, regarding the use of a reclaimed water for irrigation. Include information demonstrating that the reclaimed water system has sufficient capacity to include the proposed use.
   7. Network model of system serving development in both written format and digital format. The digital model shall be integrated with the water model, and the written discussion shall detail the impacts to the existing system.
   8. Master plan map (24” x 36” preferred), drawn to a standard engineering scale, showing existing and proposed facilities, as well as all pertinent geographic and infrastructure features for the area, around and including the proposed development

162.02.02 Final Drainage Report

Drainage report calculations and supporting data required as set forth herein shall be prepared in accordance with the UDFCD Urban Storm Drainage Criteria Manual. A final drainage report shall include as a minimum, the following:

A. Introduction:
   1. Site Location (include a map at a useable scale)
      a. County, county, street grid
b. Adjacent development

2. Site Description
   a. Acreage
   b. Existing topography, ground cover, and use
   c. A discussion of how site characteristics (soils, vegetation, erodibility) shall influence both wind and water erosion

3. Existing drainage facilities, major channels, flood hazard zones, irrigation ditches, location of wetlands

4. Proposed project description

5. Flood hazard and drainage studies relevant to site

B. Historic Drainage System:
   1. Major Basin:
      a. Relationship to major basin channel
      b. Major basin drainage characteristics, topography, runoff

2. Sub-Basin and Site Drainage:
   a. Initial and major storm
   b. Offsite flows
   c. Existing drainage patterns: (1) channelized or overland flow; (2) volumes; (3) points of discharge from site; (4) effect of historic flows upon adjacent properties

C. Proposed (Developed) Drainage System:
   1. Criteria:
      a. Size of basin and sub basin
      b. Hydrologic method
      c. Design storm frequencies (initial and major)

2. Runoff:
   a. Developed flow rates and paths
   b. Erosion control methods for both high and low flow conditions

3. Detention:
   a. Volumes required and provided for major and minor storm events
   b. Release rates and method of release for major and minor storm events
   c. Excess storm water passage
   d. Depths of ponding in parking areas

4. Streets:
   a. Depth and velocity of flow for initial and major storms.
   b. Storm drainage system

5. Open channel flow:
   a. Type of channel (lining)
   b. Maximum depth and velocity
   c. Sediment control
   d. Erosion control methods for both high and low flow conditions

6. Storm sewers and culverts
D. Rights-of-way Requirements:
   1. Boundaries
   2. Present and future ownership
   3. Access and responsibility for maintenance

E. Analysis of Upstream and Downstream Effect:
   1. Include changes in flow depth, stream velocity, and erosion rates to the next parcel of property under separate ownership, both upstream and downstream. Similar analysis shall be pre-formed and reported for all parcel(s) between the subject property and a recognized channel capable of handling the flow from the site being analyzed.

F. Conclusions:
   1. Discuss impact of proposed improvements. Discussion shall include benefits and adverse impacts with solutions to mitigate impacts.
   2. Compliance with FEMA regulations for areas in the flood hazard zone.

G. Detailed Calculations (Appendices):
   1. Runoff (historic and developed)
      a. Separate time of concentration (Tc) for each design point (Rational Method)
      b. Runoff coefficient or permeability coefficient
      c. Existing drainage facilities carrying flows—shall include flow for entire tributary area for each design point
      d. Irrigation ditch flows
   2. Detention:
      a. Storage Volumes required and provided
      b. Peak inflow to detention ponds for initial and major storms
      c. Peak discharge from detention pond based on outlet structure design for initial and major storms
      d. Outlet structure type/design
      e. Head at entrance
      f. Emergency overflow release design
   3. Streets (refer to Section 6 of the Streets Chapter of the Urban Drainage Criteria Manual):
      a. Depth and velocity of flow for both initial and major storm.
      b. Inlet capacities and depths at inlets
   4. Open Channel Flow:
      a. Roughness coefficient
      b. Trickle channel
      c. Depth and velocity for initial and major storms
      d. Channel protection
      e. Minimum freeboard
      f. Hydraulic grade line
   5. Hydraulic Structures (pipes, culverts, inlets, etc.):
a. Culvert capacity using standard nomographs
b. Storm sewer capacity at each design section
c. Inlet capacity
d. Flow depth or headwater depth at inlet
e. Drops
f. Weirs
g. Streets, gutters, and crosspans

162.02.03 Final Traffic Analysis Report

The final traffic analysis report shall include, but not be limited to the following:

A. Site location and study area boundaries
B. Existing and proposed site uses
C. Existing and proposed roadways and intersections
D. Existing and proposed roadways and intersection laneage, capacities and volumes
E. Trip generation and design hour volumes
F. Trip distribution
G. Trip assignments
H. Existing and projected traffic volumes
I. Critical lane capacity analysis, where required
J. Traffic signal analysis including warrant analysis and progression analysis with existing and proposed signal locations
K. Levels of service of effected intersections for the design hour
L. Traffic accident investigations of existing conditions and what effect proposed development shall have
M. Parking lot analysis and traffic circulation analysis, if necessary, in commercial and industrial areas
N. Future traffic impact analysis:
   1. Short term horizon - one year after occupancy
   2. 20-year planning horizon
O. Traffic signage and striping plan
P. Compliance/deviations from Elbert County’s most current transportation master plan
Q. Sight obstructions, visibility and line of site analyses
R. Master plan map (24” x 36” size preferred), drawn to a standard engineering scale, showing existing and proposed facilities, as well as all pertinent geographic and infrastructure features for the area around, and including, the proposed development

162.02.04 Final Geotechnical Report

Geotechnical and soils investigation studies are required for foundation design, pavement design, earthen cut/fill analysis, and over-excavation and compaction for structures. These categories may be combined into one report when the
purpose of the investigation includes these facets of design. Each topic shall be presented as a “stand alone” chapter in the report. A subsurface investigation for foundation and/or roadway design shall include the following information and data as a minimum:

A. General Information:
   1. Past and present land uses and features
   2. Proposed use of the land when developed
   3. Structure type
   4. Historic characteristics of groundwater for the area
   5. Surface drainage characteristics
   6. A general geologic report on the area and a discussion of the soil profiles, subsurface features and bedrock characteristics
   7. Potential slope instability based on proposed cuts and fills. Quantify the potential settlement to structures, roads, utilities and other improvements in fill areas and discuss proposed mitigation techniques.

B. Investigation Details:
   1. Type of equipment used in obtaining data
   2. Date of drilling
   3. Boring logs which show: (1) the elevation of the existing ground; (2) the elevation of the top of each soil stratum encountered and the soil classification of each stratum encountered; (3) the water level at the time of boring and the level at a later date; and (4) standard penetration test results for each soil stratum. Each hole shall be referenced to a fixed benchmark.
   4. A sketch of the tested area accurately showing the locations of the borings

C. Site Conditions/Foundation Design:
   1. Specific information including swell potential of the soil and the effect on foundations
   2. Recommendations regarding foundation types and any special procedures that may pertain to construction
   3. The effect of ground water on construction and methods to deal with any problems that may exist
   4. Recommendations regarding allowable soil bearing pressures and unconfined shearing strength
   5. Methods of prevention of swell and shrinkage of expansive soils and minimizing their effect on structures
   6. Recommendations regarding pavement design, including pavement thickness, subgrade stabilization, locations for edge drains and twenty (20) year design life criteria
   7. Natural moisture content of the soil strata
   8. Specifications for any unusual or special construction materials required

D. Unusual Land Uses/Conditions:
1. Identify all unusual land uses such as landfills, open dumps, wetlands, leach fields, areas of natural springs, faults, mines, etc. These shall be presented in a written and graphical format of suitable scale.

162.02.05 Earthen Cut/Fill Investigation Report

The following information shall be included in the Earthen Cut/Fill Investigation Report for any proposed vertical elevation change greater than three (3) feet.

A. Existing topographic information
B. Existing groundwater depths, one soil boring in any area requiring a cut of 5,000 cubic yards or greater
C. Ditches, utilities, structural and morphological features such as fractures, slip planes, deformations, and/or hummocky topography that indicate previous or potential land sliding, and any other potential unique conditions that could cause instability
D. Proposed topographic information map identifying cut and fill areas with color identification at three-foot increments
E. Proposed goals/reasons to modify existing topographic conditions.
F. Design and construction procedure and design for earthen cut and fill areas shall include at a minimum:
   1. Full-time geotechnical engineering observation and testing
   2. Clearing the job site of all surface material including trees, brush, and rubbish prior to work
   3. Scarifying any area to be filled eliminating any opportunity for the excavated surface either to become a weak slip plane for ground displacements, or to obscure fractures, slip planes and any other structural features that could cause instability
   4. Soil benching limits and methods in fill areas to eliminate any potential for the development of instability along actual or potential slip planes in excessively steep slopes
   5. Surface and subsurface water routing to eliminate potential saturation of material in any cut or fill areas
   6. Compaction requirements in fill areas identifying material types, moisture requirements, maximum fill layer thicknesses prior to compaction, and compaction requirements
   7. Material requirements for placement of fill, if soil needs to be graded and stockpiled for use in specific areas
   8. Moisture content and density criteria for the specific materials and loading conditions associated with fills beneath foundation footings, basements, floor slabs, and near surface flatwork
   9. Compaction equipment including recommendation for types of equipment and procedure for use on the site
10. Testing requirements including frequency. Moisture content and density testing shall be done at varying depths in fill areas to assure proposed construction methods are successful.

11. Seasonal limitations on placement of fill material.

12. Summary report of the above information bound and submitted to Elbert County at the completion of the work. The summary report shall include an as-built “area grading plan” at a useable scale that shows cut areas, fill areas, cut and fill elevations, both surface and buried cut and fill slopes, and other site-specific information as required.

G. Construction procedure for over-excavation and recompaction for structures shall include the following at a minimum:

1. Report detailing the goal and desired outcome of the work.

2. Excavation shall extend at least twenty (20) feet on all sides outside of proposed building envelope to protect structure and future concrete flat work.

3. Guidelines for work including items suggested and required in item “F.” above.

4. Slab on grade risk analysis prior to the earthen cut and fill on 30 percent of the lots broadcast over the work area.

5. Slab on grade risk analysis following over-excavation and recompaction for structure lots as required by the Uniform Building Code and as amended by Elbert County.

6. Summary report which includes:
   a. Project goal
   b. Prior to over-excavation and recompaction, slab on grade risk analysis
   c. Project guidelines and testing results
   d. Following over-excavation and recompaction, slab on grade risk analysis
   e. Summary table comparing slab on grade risk analyses before and following over-excavation and recompaction.
   f. Certification by Project Geotechnical Engineer that: (1) earthen cut/fill requirements were followed; (2) all requirements have been met; and (3) any lots which may be allowed to have slabs on grade have been identified.

7. Procedures for structure construction to ensure that material removed from an over-excavation and recompaction area for foundation construction is replaced to the requirements for item “G.” above, and a checklist is developed and certified by the builder prior to issuance of the certificate of occupancy that material around the foundation has been replaced to the requirements for item “G.” above.

8. The builder shall create a monitoring program for a minimum of ten (10) percent of the structures on the site. The monitoring program shall, at a minimum, measure slab to beam movement and...
provide visual inspection of flat work during the builder warranty period for the structure. The details and data of the monitoring program shall be available upon request.

162.02.06 Construction Traffic Routing Plan

Construction traffic within Elbert County shall proceed over a truck route or on such routes as are designated by the BOCC at the time the development is approved. A construction traffic routing plan shall be provided along with the Final Engineering Reports at the time approval for the development is sought.

170.00 DEFINITIONS AND ABBREVIATIONS

171.00 Definitions

Whenever the following terms are used in these CONSTRUCTION STANDARDS & SPECIFICATIONS, they shall be defined as follows:

A. **Approved by Elbert County** - Shall mean approved by the DPW Director or designee.

B. **Bonds** - Performance, labor or material payment bonds, irrevocable letters of credit and other instruments of security furnished by the developer or Contractor and his surety in accordance with the Subdivision Agreements or other Agreements with Elbert County.

C. **Elbert County** - Elbert County acting through the DPW Director or designee.

D. **Common Facilities** - Facilities serving or held in common title by the owners or occupants of two or more dwelling units or commercial or industrial enterprises and covered by these CONSTRUCTION STANDARDS & SPECIFICATIONS.

E. **Contractor** - A person that undertakes to construct, alter, move, demolish, repair, replace, excavate or add to any public or private improvements or common facilities covered by these CONSTRUCTION STANDARDS & SPECIFICATIONS.

F. **Days** - Calendar days unless otherwise specified.

G. **Developer** - The person or persons legally responsible to Elbert County for construction of improvements. For Capital Improvement Projects, Elbert County is the Developer.

H. **Engineer** – The DPW Director or designee

I. **Equipment** - All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and tools and apparatus necessary for the proper construction and acceptable completion of the work.

J. **gpcd** - Gallons per capita per day

K. **gpm** - Gallons per minute

L. **GRC** - Galvanized rigid conduit.
M. Inspector - The authorized representative of the Engineer assigned to make detailed inspections of construction work to assure compliance with these CONSTRUCTION STANDARDS & SPECIFICATIONS and the plans as approved by Elbert County.

N. MGD - Million gallons per day

O. Plans - Profiles, cross sections, and drawings, and supplemental drawings, approved by Elbert County, which show the locations, character, dimensions or details of the work.

P. psi - Pounds per square inch

Q. Public Improvements - Improvements under the ownership or control of Elbert County including but not limited to the components of the water system, sewer system, street system, park system, and storm drainage system covered by these CONSTRUCTION STANDARDS & SPECIFICATIONS. The term also includes similar improvements being built in connection with a subdivision, which are intended to be dedicated to Elbert County.

R. PVC (Polyvinyl Chloride) - A strong, tough plastic based on resins made by the polymerization of vinyl chloride or copolymerization of vinyl chloride with minor amounts (not over 50%) of other unsaturated compounds, which are fashioned into sheets, tubing, pipe, conduit, containers, insulation, etc.

S. Work Hours - Seven (7) A.M. until seven (7) P.M. of the same day, Monday through Friday.

T. Special provisions - Special directions, provisions or requirements peculiar to the project and not otherwise detailed or set forth in the specification.

U. CONSTRUCTION STANDARDS & SPECIFICATIONS - The body of directions, provisions, and requirements contained herein, describing the method or manner of construction and the qualities and quantities of the materials and work to be furnished.

V. Substantial Completion - That date, as determined by the DPW Director or designee, when the construction project or a specified part thereof is sufficiently completed, in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS, so that the project or a specified part can be utilized for the purposes for which it is intended.

W. Supplier - An individual, firm or corporation having a direct contract with a developer or Contractor or with any subcontractor for the manufacture or furnishing of any part of the supplies and/or materials to be used at or incorporated in, work at the site.

172.00 Abbreviations

A. AASHTO - American Association of State Highway and Transportation Officials.

B. ACI - American Concrete Institute

C. AISC - American Institute of Steel Construction
D. ANSI - American National Standards Institute
E. APWA - American Public Works Association
F. ASA - American Standards Association
G. ASTM - American Society for Testing and Materials
H. AWG - American Wire Gauge
I. AWWA - American Water Works Association
J. BPR - Bureau of Public Roads
K. CDOT - Colorado Department of Transportation
L. DPW – Department of Public Works
M. FCC - Federal Communications Commission
N. IMSA - International Municipal Signal Association
O. IPCEA - Insulated Power Cable Engineers Association
P. ITE - Institute of Transportation Engineers
Q. NEC - National Electrical Code as approved by the American Standards Assoc.
R. NEMA - National Electrical Manufacturers Association
S. NFPA - National Fire Protection Association
T. UBC - Uniform Building Code
U. UDFCD - Urban Drainage and Flood Control District
V. UPC - Uniform Plumbing Code
W. UL - Underwriters Laboratories, Inc.
X. USDA - United States Department of Agriculture

173.00 Terms

Whenever, in these CONSTRUCTION STANDARDS & SPECIFICATIONS, the words “as ordered”, “as directed”, “as required”, “as permitted”, “as allowed”, or words or phrases of like import are used, it shall be understood that the order, direction, requirement, permission, or allowance of Elbert County is intended. Similarly, the words “approved”, “reasonable”, “suitable”, “acceptable”, “approved”, “properly”, “satisfactory”, or words of like effect and import, unless otherwise specified herein, shall mean approved, reasonable, suitable, acceptable, approved, proper, or satisfactory in the judgment of Elbert County. Whenever, in these CONSTRUCTION STANDARDS & SPECIFICATIONS, the words (“DPW Director or designee”) are used, it shall be understood that Elbert County employee named therein shall be whoever is designated by the County Manager or whoever may be the authorized designee of the (“DPW Director”).

174.00 Specifications by Reference

All specifications, i.e., ASTM, ACI, etc. made a portion of these CONSTRUCTION STANDARDS & SPECIFICATIONS by reference shall be the latest edition or as approved by the Elbert County BOCC.

Throughout these CONSTRUCTION STANDARDS & SPECIFICATIONS, any section referenced shall be deemed to include all sub-sections of that section. Any portion of these
CONSTRUCTION STANDARDS & SPECIFICATIONS that may be applicable to any other section, whether referenced or not, shall apply.
## SECTION 200
ACCEPTANCE PROCEDURES

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SECTION 200
ACCEPTANCE PROCEDURES

201.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

210.00 SCOPE

Elbert County generally accepts public improvements associated with the following types of projects:

A. Residential Development
B. Commercial / Industrial Development
C. Capital Improvement Projects

Elbert County shall issue two types of acceptances for public improvements: (1) Construction Acceptance, which begins the warranty period and (2) Final Acceptance, which ends the warranty period.

Public/Private improvements, to include water systems, sanitary sewer systems, irrigation systems, storm water systems, parking lots, landscaping, sidewalks or trail systems owned and maintained by a Homeowners Association, Metro District or property management group, shall be constructed to comply with all applicable Elbert County CONSTRUCTION STANDARDS & SPECIFICATIONS. Private improvements shall not be accepted by Elbert County.

ELBERT COUNTY DOES NOT OWN OR MAINTAIN THOSE PUBLIC/PRIVATE IMPROVEMENTS REFERENCE ABOVE.

ELBERT COUNTY MAY ONLY ACCEPT AND MAINTAIN ROADWAY(S) WITHIN SUBDIVISIONS, THAT SERVE AS THE PRIMARY COLLECTOR(S), AS “PUBLIC” ROADWAY(S). THE REMAINING ROADWAY SYSTEM WITHIN A SUBDIVISION SHALL BE THE RESPONSIBILITY OF THE GOVERNING HOA OR METRO DISTRICT.

211.00 Construction Acceptance

CONSTRUCTION ACCEPTANCE IS ISSUED BY THE DPW DIRECTOR OR DESIGNEE

211.01 Construction Acceptance Inspection

Upon completion of construction of public improvements associated with utilities, roadways, landscaping and/or irrigation, the Developer shall conduct an inspection and
shall make all necessary corrections. Prior to requesting a Construction Acceptance
inspection from Elbert County, all temporary structures, debris, mud and waste materials
shall be removed.

When public roadway(s) to be accepted are complete and ready for inspection by the
Elbert County Inspector/Representative, the Developer shall submit a written request to
Elbert County. A complete and accurate set of blue line Record Documents, and
acknowledgement, in writing, from the governing Metro District that the Public/Private
utilities/improvements were constructed, inspected and conform to the approved
construction plans, shall be submitted to the DPW Director or designee for approval.
Refer to Section 211.02 Record Documents of these CONSTRUCTION STANDARDS
& SPECIFICATIONS.

All variances from the approved construction plans shall be supported by documentation
and reflected on the As-Built Drawings. All related testing certifications and other
supporting documentation shall be submitted to the DPW Director or designee for
approval. All required certifications shall contain the signature and seal of a Colorado
Registered Professional Engineer.

Elbert County shall schedule a date and time for the inspection within ten (10) business
days of the Developer’s request. Within ten (10) business days after the Construction
Acceptance inspection, a list of deficiencies (punch list) shall be prepared by the Road &
Bridge Superintendent and presented to the Developer. Within ten (10) calendar days of
receipt of this punch list, the Developer shall begin making corrections. **ALL
DEFICIENCIES SHALL BE CORRECTED BY THE DEVELOPER WITHIN
THIRTY (30) CALENDAR DAYS OF RECEIPT OF THE PUNCHLIST.** After the
Developer has corrected the deficiencies, the Developer shall request a follow-up
inspection from Elbert County. When the public improvements pass the Construction
Acceptance inspection, the Developer and the Elbert County Construction Inspector shall
sign the punch list to indicate completion.

The above time schedule may be extended only under special circumstances and with the
written approval of the DPW Director or designee. If all deficiencies are not corrected in
the time period outlined herein, Elbert County has the right to draw upon the performance
guarantee, as specified in the Subdivision/Improvement Agreement.

211.02 Record Documents

The Record Documents shall represent the “as-built” condition of all site improvements,
and shall be based upon the addenda, change orders and other data furnished. Every
sheet of the Record Documents shall be attested to and sealed by a Colorado Registered
Professional Engineer and/or Registered Professional Land Surveyor, and every sheet
shall be stamped “RECORD DOCUMENT”.

The following information shall be included in the Record Documents:
A. All approved plan revisions that have occurred since the DPW Director or designee approved the plans.

B. For Roadways:
   1. Elevation check at a maximum of 150-foot intervals in each flow line along the street, at the PCR of each radius, at the center and ends of each crossspan and at each grade break.
   2. Elevation at the flow line on each side of storm inlets.
   3. Elevations at all design points shown on the cul-de-sac plans.
   4. All locations of pavement markings.

C. For Sanitary Sewer and Storm Sewer:
   1. Any changes from the approved plans in materials or pipe sizes.
   2. Elevation of all in and out inverts at manholes, inlets, and outlets. Distance between manholes, and between manholes and inlets or outlets.
   3. Location of all sanitary sewer service connections.
   4. Rim elevations on all manholes and drainage inlet structures.
   5. Elevation checks every 100 feet in the flow line of all drainage channels.
   6. Final detention pond volume and the final release rate per drainage criteria (as determined by a Professional Engineer).

D. For Water Mains:
   1. Any changes from the approved plans in materials or pipe sizes.
   2. Horizontal verification of water valves, tees, crosses, and fire hydrants if changed from the approved plans.
   3. Location(s) and type of restraint installed.
   4. Location of all water service connections.

E. For Public Landscaping and Irrigation Improvements:
   1. List of all plant material installed, including size and quantities (as certified by a Landscape Architect).
   2. Horizontal verification of all structures. Show pertinent physical features such as sidewalks, bike paths, fences, ponds, buildings, parking lots and athletic fields.
   3. Horizontal verification of all irrigation pipes, irrigation heads, valve boxes, wiring, electrical boxes, controllers, meters and backflow protection devices. Noted information shall include all pipe sizes, zone numbers, valve locations, head types, valve types and model numbers and controller types and model numbers.

211.03 Application for Construction Acceptance

After the public improvements have passed the Construction Acceptance inspection, the Developer shall complete an Application for Construction Acceptance of Public Roadway(s). It shall be submitted to the DPW Director or designee with a signed copy of the completed Construction Acceptance inspection list within seven (7) business days. The following items shall be submitted with the application prior to DPW Director or designee consideration for Construction Acceptance:
A. Two complete sets of 11” x 17” Record Documents.
B. A complete AutoCAD compatible digital copy of documents accurately representing the completed project as constructed.
C. Field Inspection Reports as required in Section 160.00 Plans and Specifications of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
D. A complete set of geotechnical engineering reports stamped and sealed by a Colorado Registered Professional Engineer.
E. A Final Sworn Affidavit of Construction Cost
F. Any other items or Special Provisions required by the Subdivision Improvement Agreement.

The DPW Director or designee shall review the Application for Construction Acceptance of Public Improvements for accuracy and completeness.

211.04 Memorandum of Construction Acceptance

Upon approval of the Record Documents and the Application for Construction Acceptance of Public Roadways, the DPW Director or designee shall prepare and issue a Memorandum of Construction Acceptance to the Developer that states which improvements are issued Construction Acceptance.

THE WARRANTY PERIOD SHALL BEGIN ON THE DATE OF ISSUE OF THE MEMORANDUM OF CONSTRUCTION ACCEPTANCE.

During the warranty period, the DPW Director or designee may issue the developer written notice requesting warranty maintenance or repairs of the Public Roadway(s). The Developer shall begin and complete the maintenance or repairs within the time period specified on the written notice. Elbert County may perform maintenance or make the repairs and/or draw upon the Developer’s warranty performance guarantee as specified in the Subdivision/Improvement Agreement.

After Construction Acceptance has been issued, the DPW Director or designee shall notify the Building Department that the public improvements have been completed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS and that building permits may be issued.

BUILDING PERMITS WILL NOT BE ISSUED UNTIL ALL PUBLIC OR PRIVATE IMPROVEMENTS HAVE BEEN COMPLETED AND ACCEPTANCE/APPROVAL HAS BEEN ISSUED.
211.05 Duration of Warranty Period for Public Roadway(s)

**WARRANTY PERIOD FOR PUBLIC ROADWAY(S)**

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<th>Utilities</th>
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**Refer to Section 220.00 Construction and Final Acceptance for Capital Improvement Projects of these CONSTRUCTION STANDARDS & SPECIFICATIONS.**

Note that an additional manufacturer warranty may be required for specific equipment. See equipment specifications.

If after two (2) years from Construction Acceptance of roadways the development has not been issued at least ninety (90) percent of the Certificates of Occupancy, Elbert County may extend the warranty period one (1) additional year. Refer to Section 212.02 Final Acceptance Work for Roadways of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

211.06 Warranty Performance Guarantee

Upon issuance of the Memorandum of Construction Acceptance, the DPW Director or designee may release a portion of the performance guarantee, provided that the balance of the performance guarantee is sufficient to fund incomplete improvements and possible warranty replacements and repairs. A minimum of one hundred fifteen (115) percent for roadway construction per the engineers estimated construction costs in the form of a warranty bond or letter of credit shall be held by Elbert County throughout the warranty period, unless otherwise stated in the Subdivision Improvement Agreement or as required by the DPW Director or designee.

211.07 Construction Acceptance Maintenance Responsibility for Public Improvements and Facilities

**RESPONSIBILITY FOR PUBLIC IMPROVEMENTS AND FACILITIES DURING WARRANTY**

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*SNOW REMOVAL SHALL BE THE RESPONSIBILITY OF THE DEVELOPER FOR THE DURATION OF THE WARRANTY PERIOD. ONCE THE WARRANTY PERIOD HAS CONCLUDED AND THE ROADWAYS HAVE BEEN FORMALLY ACCEPTED BY THE ELBERT COUNTY BOCC AS PUBLIC ROADWAYS ELBERT COUNTY WILL TAKE RESPONSIBILITY FOR SNOW REMOVAL AND MAINTENANCE OPERATIONS.

RESPONSIBILITY FOR PUBLIC IMPROVEMENTS AND FACILITIES DURING WARRANTY (continued)

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** as shown below, if not specified in Contract.

REFER TO SECTION 220.00 CONSTRUCTION AND FINAL ACCEPTANCE FOR CAPITAL IMPROVEMENT PROJECTS OF THESE CONSTRUCTION STANDARDS & SPECIFICATIONS.

212.00 Final Acceptance by BOCC and Release From Warranty
THE WARRANTY PERIOD DOES NOT EXPIRE UNTIL ALL WARRANTY REPAIRS AND REPLACEMENTS HAVE BEEN MADE AND APPROVED BY ELBERT COUNTY.

FINAL ACCEPTANCE IS ISSUED BY THE BOCC OF ELBERT COUNTY.

212.01 Final Acceptance Inspection

Approximately two (2) months before the end of the warranty period, the Developer shall submit a written request for a Final Acceptance inspection from Elbert County. The request shall clearly state which public improvements are ready for inspection. Elbert County shall schedule a date and time for the inspection within ten (10) business days of the Developer’s request. Within ten (10) business days after the Final Acceptance inspection, a punch list shall be prepared by the DPW Director or designee or his designee and presented to the Developer. Within ten (10) calendar days of receipt of this punch list, the Developer shall begin making corrections. **ALL DEFICIENCIES SHALL BE CORRECTED BY THE DEVELOPER WITHIN THIRTY (30) CALENDAR DAYS OF RECEIPT OF THE PUNCH LIST.** After the Developer has corrected the deficiencies, the Developer shall request a follow-up inspection from Elbert County. When the public improvements pass the Final Acceptance inspection, the Developer and the Elbert County Road & Bridge Superintendent shall sign the punch list to indicate completion.

The above-mentioned time schedules may be extended only under special circumstances and with the written approval of the DPW Director or designee.

212.02 Final Acceptance Work for Roadways

Final Acceptance work for roadways includes repairs and/or replacements to concrete and asphalt, and non-destructive deflection testing. A Colorado Registered Professional Engineer shall submit a stamped and sealed copy of the non-destructive deflection testing report to Elbert County for approval. After all concrete and asphalt repairs have been made and re-inspected by Elbert County, the final asphalt overlay shall be installed in accordance with the approved non-destructive deflection testing report, and the Developer shall request a follow-up Final Acceptance inspection. The Developer shall begin and complete Final Acceptance work within a time period acceptable to Elbert County. The time period may be extended only under special circumstances and with the written approval of the DPW Director or designee. If the Developer does not begin and complete all Final Acceptance work within this time period, Elbert County may draw upon the warranty performance guarantee, as specified in the Subdivision Improvement Agreement.

212.03 Final Acceptance by BOCC
After the public improvements have passed the Final Acceptance inspection or Elbert County has drawn upon the warranty performance guarantee and completed the public improvements, the DPW Director or designee shall prepare a Memorandum and Resolution of Final Acceptance for BOCC consideration. With BOCC approval, Final Acceptance shall be issued, the warranty period shall expire, and the DPW Director or designee shall release the balance of the warranty performance guarantee.

220.00 CONSTRUCTION AND FINAL ACCEPTANCE FOR CAPITAL IMPROVEMENT PROJECTS

Additional inspection and acceptance procedures and requirements for capital improvement projects shall be specified in the contract documents.

Maintenance of new improvements and facilities contracted by Elbert County shall become the responsibility of Elbert County, with the exception of repairs and replacements, which, in the opinion of the DPW Director or designee, shall become necessary during the warranty period.
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SECTION 300
SOILS AND EARTHWORK

301.00  GENERAL CONDITIONS

Refer to Section 100 Title, Scope, and General Conditions of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

310.00  SCOPE

All site work and earthwork shall comply with the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS and any special criteria established by Elbert County. Site work shall be completed as shown on the approved engineering plans. Site work shall consist of demolition, removal, and abandonment; clearing and grubbing; overlot grading; removal of topsoil; site preparation; embankment subgrade preparation; embankment fill; excavation, trenching, bedding and backfill of pipelines and service lines; excess excavation; structure backfill; roadway excavation, backfill and compaction; borrow; and restoration and cleanup. All workmanship and materials shall be in accordance with the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS and shall conform to the lines, grades, quantities, and the typical cross-sections shown on the approved plans, or as directed by the DPW Director or designee.

311.00  Inspections

Refer to Section 154.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Adequate inspections assure compliance to Elbert County requirements and are the basis for Elbert County’s recommendation that said improvements be accepted for maintenance and for release of performance guarantees. It is the responsibility of the Contractor to contact the DPW Director or designee / a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required inspections shall include:

A. **Erosion Control** – Ensure that the Erosion Control Plan is adhered to and Best Management Practices (BMP’s) are properly installed and maintained.

B. **Testing** – Verify that a Colorado Registered Professional Engineer (or designated representative), who practices the field of Geotechnical Engineering, is onsite and that adequate testing is performed. **FULL-TIME OBSERVATION AND TESTING IS REQUIRED FOR OVER-EXCAVATION WORK.**

C. **Certification** – Verify that the extent and depths of proposed work is certified. Verify the final grade.
The Contractor shall provide access to all Elbert County Inspectors/Representatives, and all other project quality control (QC) and/or quality assurance (QA) personnel throughout the earthwork process for observation and testing purposes. The Contractor shall not proceed with work until the project Soils Engineer has performed adequate observations and testing, unless approved by the DPW Director or designee.

All testing and retesting to meet requirements and specifications shall be at the Contractor’s expense.

320.00 DEMOLITION, REMOVAL AND ABANDONMENT

The Contractor shall remove—wholly or in part—and satisfactorily dispose of all foundations, signs, structures, fences, old pavements, abandoned pipelines, traffic control device materials and any other obstructions which are not designated on the approved plans or allowed to remain. Utilities and other items for which other provisions have been made for removal shall follow demolition; removal and abandonment procedures shown on the approved plans or as otherwise approved by Elbert County Removal of sign panels shall include all work necessary to remove the panel and its attachment hardware from the existing installation. Concrete sign post bases shall be removed. Pedestals and bases shall be removed to one (1) foot below the surrounding ground or subgrade and backfilled with suitable material.

Where portions of structures shall be removed, the remaining parts shall be prepared to accommodate the new construction. The work shall be performed in such a manner that materials left in place shall be protected from damage. All damage to portions of structures to remain shall be repaired at the Contractor’s expense. Reinforcing steel that projects from a structure to remain shall be cleaned and aligned to provide an adequate bond with new construction. Dowels shall be securely grouted with an approved grout. Depressions which result from removal of structures, footings, and other obstructions, shall be filled and compacted with clean fill materials or an approved CLSM (“Flowable fill”) mixture so as to eliminate hazards such as cave-in or accumulation and ponding of water.

Materials used for traffic detour structures supplied by the Contractor shall be the property of the Contractor. After the detour is abandoned, the Contractor shall completely remove the traffic detour structure materials and disposal of materials shall comply with Section 320.01 Disposal of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

After all demolition, removal and abandonment work is complete, the Contractor shall grade the entire contract area by properly filling, compacting, and leveling the site to existing adjacent grades or to lines and grades shown on the approved plans.

The contractor shall follow all applicable Elbert County building code requirements in addition to these CONSTRUCTION STANDARDS & SPECIFICATIONS related to the demolition of any structure within Elbert County.

320.01 Disposal
The Contractor shall make all necessary arrangements for obtaining suitable disposal locations. If disposal shall be at other than established dumpsites, the DPW Director or designee may require the Contractor to furnish written permission from the property owner on whose property the materials and debris is proposed to be placed. Materials and debris shall be disposed of in a manner approved by the DPW Director or designee / and Elbert County Environmental Health. Burning shall not be allowed without prior written approval of the DPW Director or designee, the Elbert County Environmental Department and the governing fire district.

320.02 Salvage

All salvageable material shown on the approved plans and any additional salvageable material marked by Elbert County shall be removed without unnecessary damage in sections or pieces which may be readily transported and shall be stored by the Contractor in locations approved by the DPW Director or designee. The Contractor shall be required to replace any materials lost from improper storage methods or damaged by negligence. These materials include, but shall not be limited to, manhole frames and covers; inlet grates; valves and fire hydrants; landscape plant materials; fence materials; handrails; culverts; guardrail; walkway; roadway and traffic appurtenances (traffic signals and attached hardware, including mast arms and span wire) and irrigation systems and appurtenances.

321.00 Bridges, Culverts and Other Drainage Structures

Bridges, culverts, and other drainage structures in use by traffic shall not be removed until a Traffic Control Plan has been approved by the DPW Director or designee. Refer to Section 141.12 Traffic Control, Barricades and Warning Signs of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Unless otherwise directed, the foundations or substructures of existing structures shall be removed down to one (1) foot below natural ground surface or bottom of drainageway. Where such portions of existing structures lie wholly or in part within the limits of a new structure, they shall be removed as necessary to accommodate construction of the proposed structure. Steel, concrete, and wood bridges shall be dismantled. Steel members to be salvaged shall be match-marked by Elbert County or the Contractor with waterproof paint.

322.00 Pipe and Appurtenances

All pipe and appurtenances to be taken out of service shall be completely removed or abandoned in place, as required by the DPW Director or designee.

Pipe designated to be reused shall be removed and stored, when necessary, to prevent loss or damage before relaying.
Excavation required to remove pipe or appurtenances shall be backfilled and compacted in accordance with Section 350.00 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

When pipe is to be abandoned in place, it shall be completely filled with fly ash slurry composed of approximately sixty-five (65) percent Class C fly ash and thirty-five (35) percent water, unless otherwise approved by the DPW Director or designee. Each end of the pipe shall be capped with concrete.

When removing appurtenances such as manholes, catch basins, inlets etc., any live lines connected to these appurtenances shall be properly bypassed and shall remain in operation until abandonment is complete.

When appurtenances are to be abandoned in place, the remaining structure shall be lowered to a minimum of three (3) feet below finished grade, and shall be filled with concrete with a minimum compressive strength of 3000 psi (at 28 days) to the top of the remaining structure and then backfilled and compacted to the required grades.

323.00  Pavement and Concrete Flatwork

All concrete or asphalt to remain shall have a straight, true break line and a vertical face. Concrete or asphalt may be cut with a cutting wheel, jackhammer, or saw. The DPW Director or designee may require that saw-cutting be performed. Any damage to adjacent concrete or asphalt to remain in place shall be repaired at the Contractor’s expense. The minimum depth of saw cuts in concrete shall be two (2) inches.

If areas cut for future placement of concrete or asphalt adjacent to existing asphalt or concrete are left exposed for longer than thirty (30) days or are subjected to inclement weather, the areas shall be evaluated by a Geotechnical Engineer and a recommendation shall be provided to Elbert County. An additional cut of at least six (6) inches behind and/or below the existing structure—or until competent subgrade is encountered—may be required by the DPW Director or designee.

The Contractor shall be responsible for the cost of removal and replacement of all overbreak as determined by the DPW Director or designee.

330.00  SITE PREPARATION

The Contractor shall complete all work necessary to properly prepare the site as shown on the approved plans and as specified herein. The site shall be prepared in such a manner that facilitates subsequent soils or earthwork operations. Site preparation includes clearing, grubbing, grading, tree and shrub removal, native grass stripping and removing and disposing of all debris within the limits of the project and other such areas as may be indicated on the plans or required by the work. Site preparation procedures shall be performed to comply with the approved plans or as designated by Elbert County. Adjacent vegetation and other items to remain shall be adequately preserved from injury.

331.00  Clearing
All sites to receive fill shall be cleared of organic materials, including root structures, at the Contractor’s expense. Vegetation shall be pulled or grubbed in such a manner as to assure complete and permanent removal. Branches of trees extending over the roadbed shall be trimmed to give a clear height of twenty (20) feet above the road bed surface. All surface objects and trees, stumps, roots and other protruding obstructions not designated to remain shall be cleared and/or grubbed as required. Non-biodegradable, solid objects located at least two (2) feet below the final subgrade surface may remain at the discretion of the DPW Director or designee.

Elbert County may establish clearing lines and designate items and materials to remain. The Contractor shall preserve all materials and items to remain. Paint used for cut or scarred surfaces of trees or shrubs to remain shall be an approved asphalt base paint formulated especially for tree surgery. Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

The Contractor shall scalp areas where excavation or embankment shall be made. Scalping shall include the removal of organic material such as brush, roots, sod, grass, residue of agricultural crops, sawdust, and vegetable matter from the surface of the ground.

Fill shall be placed on competent subgrade as determined by the project Soils Engineer. The Contractor shall excavate soft, yielding, over-saturated, or otherwise unsuitable soils prior to the placement of fill.

Clearing shall be performed with due consideration and protection of the general public and public and private property. Any damage to streets, parking lots, utilities, plants, trees, buildings or structures on public or private property, or to benchmarks and construction staking due to the negligence of the Contractor, shall be repaired and restored to its original condition at the Contractor’s expense. Areas proposed to be preserved shall be clearly staked or fenced off by the Contractor. It shall be the Contractor's responsibility to ensure that these areas are not damaged during the construction process. Any damaged areas shall be repaired or replaced at the Contractor's expense.

332.00 Staking and Grade Control

Control and construction stakes shall be set by field parties under the supervision of a Colorado Registered Professional Engineer or a Colorado Registered Land Surveyor who shall be paid by the Contractor. These field parties shall be available to check field control and to provide assistance to the Contractor. A set of approved plans shall be kept on the job site at all times by the Contractor.

It shall be the responsibility of the Contractor to maintain the alignment and grade shown on the approved plans. The alignment and grade elevation of forms shall be checked, and any necessary corrections shall be made before placing the concrete. When any form has been
disturbed or any subgrade thereunder has become unstable, the subgrade shall be reconditioned or replaced in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

333.00 Grading Requirements

333.01 Grading Permit and/or Over-Excavation Permit

A Grading Permit and/or Over-Excavation Permit shall be required when a property’s improvement includes 300 or more cubic yards of cut or fill and as specified in Section 151.00 Public/Private Improvement Permit (PPIP), Grading Permit, and Over-Excavation Permit of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

IF DISTURBING MORE THAN ONE ACRE A CDPHE PERMIT IS REQUIRED AND MUST BE ATTACHED TO THE GRADING/OVER-EXCAVATION PERMIT.

333.02 Grading Methods

All areas disturbed during grading operations shall have the final graded area hydro seeded or revegetated with native grasses in accordance with the requirements of Section 1000 LANDSCAPE STANDARDS FOR DEVELOPMENT PROJECTS of these CONSTRUCTION STANDARDS & SPECIFICATIONS. SEEDING SHALL BE COMPLETED WITHIN SIXTY (60) DAYS OF THE GRADING COMPLETION AND NO LONGER THAN ONE HUNDRED EIGHTY (180) DAYS OF THE COMMENCEMENT OF GRADING OPERATIONS AT THE SITE.

The Contractor shall comply with all dustproofing requirements of Section 141.11 Dustproofing of these CONSTRUCTION STANDARDS & SPECIFICATIONS for the duration of the project.

Grading shall be performed by an approved means. Areas adjacent to structures and other areas inaccessible to heavy grading equipment shall be graded by approved manual methods. Grading of filled and unfilled areas shall be to the lines and grades indicated on the approved plans. Grading shall be performed in conjunction with all necessary clearing, grubbing, stripping, filling, and compacting operations.

Final grading shall be performed to provide proper drainage for the overall site and away from site improvements that may be sensitive to moisture infiltration. In no case shall drainage from the project site be altered or controlled in a manner that may result in damage, or the potential for damage, to adjacent property or to any portion of the work from erosion or flooding.

333.03 Cut and Fill Requirements
All areas with slopes greater than fifteen (15) percent shall be benched or modified by an approved method prior to receiving fill. Benching dimensions shall be determined by the project Soils Engineer.

All fill shall be placed in a controlled state—tested for moisture and density—in locations designated in the approved plans and reports and in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS, unless otherwise approved by the DPW Director or designee. **FILL MATERIALS SHALL NOT BE PLACED, STOCKPILED OR STORED IN AN AREA THAT IS NOT DESIGNATED ON THE PLANS OR APPROVED BY THE DPW DIRECTOR OR DESIGNEE.**

The Contractor shall comply with all federal and state environmental laws, such as the Endangered Species Act, Federal Emergency Management Act, Army Corps of Engineers Wetlands Regulations, and Division of Wildlife Regulations. Contractor shall make every effort to relocate wildlife prior to grading. Relocation plans shall be approved by Elbert County. All wetlands shall be protected by silt fencing and other required Best Management Practices (BMP’s) during grading operations and until disturbed areas are fully revegetated.

Upon completion of work in which a Grading Permit or Over-Excavation Permit is required, the Contractor shall provide the following information, certified and sealed by a Colorado Registered Professional Engineer:

- **A.** An “as-built” area grading plan which shows original ground surface elevations, as-constructed ground surface elevations, limits and depths of over-excavation, lot drainage patterns and locations and elevations of all surface and subsurface drainage facilities.
- **B.** An overlot grading summary report prepared by the project Soils Engineer which states that fill placement is in conformance to approved plans and reports and includes locations and elevations of field density tests (referenced from a permanent landmark or permanent control point), summaries of field and laboratory tests and any other substantiating data and comments regarding deviations from the approved plans and reports and how they relate to or affect recommendations in the approved Geotechnical Engineering Report and grading plan.
- **C.** A geological report prepared by an engineering geologist that includes a final description of the geology of the site, including any new information disclosed during the grading and how it relates to or affects recommendations in the approved Geotechnical Engineering Report and grading plan.

### 333.04 Topsoil

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

Topsoil shall not be placed until the areas to be covered have been properly prepared and
grading operations in the area have been completed. Topsoil shall be placed, spread and
keyed to the underlying material at locations and to the thickness shown on the approved
plans.

Topsoil shall not be incorporated into any embankment fill or backfill material without
prior approval of the project Soils Engineer and the DPW Director or designee.

340.00  EARTHWORK

Earthwork shall consist of excavation, disposal, shaping and compaction of all material
encountered within the limits of the project, including but not limited to excavation of ditches
and channels, surface boulders, muck, rock, concrete foundations, slabs, stripping, etc.
Excavation shall be performed to the line and grade and typical cross-sections shown on the
approved plans or as required by the DPW Director or designee.

Excavation, dewatering, sheeting, and bracing shall be performed so as to eliminate any
possibility of undermining or disturbing the foundation of any existing structures, utilities,
pavement and concrete flatwork.

Free-running water shall be drained from all earthwork materials prior to construction of
structures, utilities, or concrete flatwork construction.

The DPW Director or designee may require the Contractor to submit a proposed earth-moving
diagram and map of proposed haul routes for approval.

340.01  Definitions

A. Suitable Material - Any earthen material that consists of onsite or similar
non-organic sands, gravels, clays, silts and mixtures thereof with a
maximum size of six (6) inches. Claystone fragments exceeding three (3)
inches in particle size are not to be incorporated in embankment material
unless specifically approved by the project Soils Engineer and the DPW
Director or designee.

B. Bedrock that breaks down to specified soil types and sizes during
excavation, hauling and placement may be considered as suitable material.

C. Unsuitable Material - Any earthen material that contains vegetable or
organic silt, topsoil, frozen materials, trees, stumps, certain man-made
deposits, or industrial waste, sludge or landfill, lignite, or other
undesirable materials.

D. Unclassified Excavation - Any and all earthen materials encountered,
including rocks and boulders, during construction. Rock formations that
can be removed by ripping with a D-9 tractor in good repair with a single
hydraulic ripper are considered as unclassified excavation.
E. **Embankment Construction** - Earthwork including preparation of the subgrade upon which embankment material shall be placed; dikes within or outside right-of-way; placement and compaction of approved material within areas where unsuitable materials have been removed; and placement and compaction of embankment materials in holes, pits and other depressions to lines and grades shown on the approved plans. Only suitable materials approved by the project Soils Engineer shall be used in construction of embankments and backfills. Claystone fragments exceeding three (3) inches in particle size are not to be incorporated in embankment material unless specifically approved by the project Soils Engineer and the DPW Director or designee.

F. **Structure Excavation** - Excavation of any and all materials over an area extending three (3) feet out from the outer most bottom edge of a proposed structure, up to existing grade or top of proposed grade (whichever comes first) at a one to one (1:1) slope. Rock formations within this area that can be removed by ripping with a D-9 tractor in good repair with a single hydraulic ripper shall be considered structure excavation.

G. **Structure Backfill** - Earthen material that is installed around and over any structure shown on the approved plans. Imported structure backfill (Class I) shall meet the general gradation of “Class 1 Structure Backfill Material” as specified in Section 703.08 of the CDOT *Standard Specifications for Road and Bridge Construction*. Onsite Class 2 structure backfill shall also meet the requirements of Section 703.08 of the CDOT *Standard Specifications for Road and Bridge Construction*. Materials which do not comply with these requirements may be used at the discretion of the project Soils Engineer and the DPW Director or designee.

H. **Rock Excavation** - Igneous, metamorphic or sedimentary rock formations that cannot be excavated with a D-9 tractor in good repair with a single hydraulic ripper.

I. **Borrow** - Backfill or embankment material which shall be acquired from designated borrow areas to make up the deficient areas which cannot be completed from excavation within work limits. All sources of borrow material shall be approved prior to use by the project Soils Engineer and the DPW Director or designee.

J. **Proof-Rolling** - The application of test loads over a subgrade surface by means of a heavy pneumatic-tired vehicle to locate weak areas in subgrade. Refer to Section 361.04 Proof-Roll Observation and Testing of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

K. **Bedding Material** - Material that is installed under and around pipelines, rip-rap, low flow channels, and any other locations required by the DPW Director or designee. The thickness and gradation of bedding materials shall comply with Section 352.00 Bedding for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

L. **Stabilization Material** - Material which shall be placed in over-excavation areas, areas with unsuitable in situ material, or areas with a high-water table in order to stabilize the existing material. Thickness of stabilization
material shall be determined and installed in the field, on a case by case basis. Gradation of stabilization material shall comply—at a minimum—with the “No. 4 Coarse Aggregate” specified in Section 703.02 of the CDOT Standard Specifications for Road and Bridge Construction, or other materials such as lime or flyash specified on the approved plans and approved by the project Soils Engineer.

340.02 Grading Tolerances

All earthwork shall perform in such a manner that final grades after excavation, compaction of backfill, placement of rip-rap, construction of channel lining, etc. shall conform to the cross-sections shown on the approved plans. The final earthwork shall comply with the design elevations, with the following allowable tolerances:

A. 0.03 feet within main drainage channel bottom limits
B. 0.3 feet at the top of any embankment where a cut side slope intersects the existing grade
C. 0.5 feet in all portions of the site not included in items a. or b. above.
D. In addition to the above tolerances, positive surface drainage shall be provided on the entire site so that no depressions or ponds are formed, regardless of depth.

It shall be the Contractor's responsibility to ensure that all portions of the site drain as shown on the approved plans.

340.03 Borrow

It shall be the Contractor's responsibility to stockpile suitable materials for use in the project. Only after the Contractor estimates that sufficient suitable backfill material is stockpiled to complete all earthwork operations of the project, shall excavated material be removed from the project site. If the Contractor fails to preserve onsite, sufficient suitable material, and removes or disposes of suitable material, suitable material shall be recovered at the Contractor’s expense.

If there is an insufficient quantity of suitable material available onsite, the Contractor shall provide additional suitable material, as defined in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

341.00 Embankment Construction

Embankment construction shall include placement, processing and compaction of all embankment material, and all related work required to ensure proper bond of materials with previously placed embankment material.

341.01 Preparation of Embankment Subgrade
No excavation shall be performed in any area until the proposed work has been staked by
the Contractor, cross-sections of existing ground are determined and plotted, and all
survey elevations and cross-sections shown on the approved plans are reviewed and
approved by the DPW Director or designee. Excavation shall be performed to the lines
and grades shown on the approved plans.

The grade shall be maintained so that the surface is well drained at all times. When
necessary, temporary drain systems shall be installed to intercept or divert surface water
that may affect the work.

Where an embankment shall be constructed, unsuitable material shall be removed from
the surface. The cleared surface shall be plowed or scarified to a minimum depth of six
(6) inches. The embankment area shall adhere to the density and moisture content
requirements shown in the following table, unless otherwise approved by the project
Soils Engineer and the DPW Director or designee:

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>Relative Compaction By Standard Proctor ASTM D698 or AASHTO T99 (percent compaction)</th>
<th>Relative Compaction By Modified Proctor ASTM D1557 or AASHTO T180 (percent compaction)</th>
<th>Moisture Content Range (with respect to Optimum Moisture Content)</th>
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<tr>
<td>A-1, A-2, A-3</td>
<td>-</td>
<td>95</td>
<td>-2 to +2 (based on AASHTO T180)</td>
</tr>
<tr>
<td>A-4, A-6, A-7</td>
<td>95</td>
<td>-</td>
<td>-1 to +3 (based on AASHTO T99)</td>
</tr>
</tbody>
</table>

Where embankments shall be placed on slopes steeper than 4:1 (horizontal to vertical),
beneches shall be excavated into the slope by a method approved by the project Soils
Engineer and the DPW Director or designee. Such slopes include natural and previously
constructed embankments. The benches shall be cut ten (10) feet horizontally into the
existing slope to create a stepped bench condition, and the vertical step shall not exceed
four (4) feet, unless otherwise approved by the project Soils Engineer and the DPW
Director or designee. All surfaces to receive embankment material shall be inspected and
approved by the project Soils Engineer immediately prior to embankment material
placement.

341.02 Embankment Material

No embankment material shall be placed until approved in writing by the Owner.

Earthmoving equipment, watering equipment, processing equipment and compaction
equipment are the responsibility of the Contractor. Equipment shall be suitable for
performing excavation and embankment work in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS and the Contract schedule. If
at any time the moisture-conditioning or processing equipment cannot apply moisture or process at a rate equal to or greater than the rate required to achieve an embankment material within the required size tolerances, uniformity, and moisture contents, embankment material placement shall be suspended at that area until it is demonstrated to the project Soils Engineer and the DPW Director or designee that all questionable areas comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Equipment shall be operated in accordance with manufacturer's recommendations and instructions and shall be maintained so that it delivers the rated energies and compactive efforts.

**IF EQUIPMENT IS DEEMED INADEQUATE, THE PROJECT SOILS ENGINEER AND/OR THE DPW DIRECTOR OR DESIGNEE MAY RECOMMEND THE USE OF LARGER OR DIFFERENT TYPES OF EQUIPMENT.**

After subgrade is properly prepared, the embankment filling operation shall begin in the deepest part of the area to be filled. Embankment material shall be placed and compacted in parallel layers until the finished rough grade is reached. Temporary gaps through the embankment shall not be allowed without approval of the DPW Director or designee. All temporary slopes shall not be steeper than 4:1 (horizontal:vertical).

**THE THICKNESS OF EACH LAYER SHALL NOT EXCEED SIX (6) INCHES BEFORE COMPACTING.**

Embankment material shall be a homogenous mixture of suitable material. No particle size shall exceed six (6) inches, and no claystone fragment shall exceed (3) three inches. The characteristics of the material shall be in accordance with that of ‘suitable material’ as defined in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The full depth of each layer shall be processed to ensure a satisfactory bonding surface for the next layer of embankment material.

In order to achieve uniform moisture content throughout the materials in the layer, wetting or drying of the material and manipulation shall be performed. Placement of material shall not proceed until excessively wet material has been dried and overly dry material has been wetted with methods approved by the project Soils Engineer. Each layer of embankment shall be properly processed by disk ing or by other approved methods so that the water is distributed uniformly throughout the layer prior to rolling and after compaction. In no case shall additional embankment material be placed until the underlying layer has been properly processed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Materials placed that do not comply with moisture and/or density specifications are subject to removal and replacement and/or reprocessing at the Contractor’s expense.

The surfaces of previously placed embankment material and foundation areas that have not had material placed on them for a period of time sufficient to allow those surfaces to
comply with the specified moisture content and/or density requirements, the surface material shall be re-processed until it complies with the requirements, prior to placement of additional material.

If hauling equipment is used to obtain compaction, the Contractor shall route its equipment at all times, both when loaded and when empty, over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. The equipment shall be operated in such a manner that hardpan, cemented soils, clay, or other chunky soil material shall be broken up into smaller particles and become incorporated with the other material in the layer.

Rock Material In Common Embankment: Excavated material that contains solid rock consisting of cobbles, boulders or rock fragments (“rock material”) less than one cubic yard in volume; a maximum thickness of one and one-half (1½) feet; and a maximum dimension of six (6) feet that cannot be processed by crushing, breaking or pulverizing, may be placed in embankments below ten (10) feet from the rough subgrade elevation with approval from the project Soils Engineer and the DPW Director or designee. In no case shall claystone fragments larger than five (5) inches in any dimension be incorporated into the embankment layers. Rock material does not include the claystone bedrock formations common throughout Elbert County. If placed, rock material shall be incorporated in layers no thicker than the thickness of the largest pieces. The rock material shall be carefully dispersed throughout the layers and throughout the embankment to avoid nesting. Rock fragments shall be spaced far enough apart to allow the Contractor's equipment to operate between the rock pieces. All voids shall be filled with fines material to obtain the required uniform density around the rock fragments.

Embankment areas that contain rock material shall be compacted with adequate equipment and sufficient passes to ensure that the embankments meet all specified moisture and density requirements for common embankment before the next lift is placed. The Contractor shall perform a test fill to demonstrate satisfactory compliance with these specifications prior to placing rock material.

The Contractor shall maintain the embankment during the warranty period.

341.02.01 Embankments Twelve (12) Feet or Less in Depth

Compaction operations shall continue until each layer of embankment material for embankments less than twelve (12) feet in height is compacted to moisture and density requirements shown in the following table, unless otherwise required by the project Soils Engineer and the DPW Director or designee:
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<td>95</td>
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</tr>
</tbody>
</table>

#### 341.02.02 Embankments Greater Than Twelve (12) Feet in Height

Compaction operations shall continue until each layer of embankment material for embankments greater than twelve (12) feet in height is compacted to the moisture and density requirements shown in the following table, unless otherwise required by the project Soils Engineer and the DPW Director or designee.

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<td>100</td>
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</table>

#### 342.00 Excavation

All excavated areas shall be graded in a manner that allows adequate drainage and does not disturb material outside the limits of slopes. Excavated areas shall be within the tolerances noted in Section 340.02 Grading Tolerances of these CONSTRUCTION STANDARDS & SPECIFICATIONS. When practical, all suitable material removed from the excavation shall be used in the formation of embankments, for backfilling, and for other purposes. Materials that are considered unsuitable material (including rock) or surplus by the DPW Director or designee shall be disposed of at the Contractor’s expense, in accordance with Section 320.01 Disposal of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

All water pumped or drained from the work shall be disposed of according to provisions of the Stormwater Discharge Permit (NPDES) in a manner satisfactory to the DPW Director or
designee Elbert County Health, without undue interference with other work or damage to pavements, other surfaces, or property.

342.01 Excavated Material

Excavated material shall be placed so as to minimize the inconvenience to occupants traveling on streets and driveways or adjoining properties. Excavated material shall not be deposited on private property unless written consent of the property owner(s) has been filed with the DPW Director or designee.

Suitable excavated material shall be used as backfill, fill for embankments, or other parts of the work in accordance with the appropriate sections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Disposal of surplus material shall be in accordance with Section 320.01 Disposal of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

342.02 Excess Excavation

If in the opinion of the project Soils Engineer or the DPW Director or designee, the material at or below the depth to which excavation for structures would normally be carried is unsuitable for the required installation, it shall be removed to such widths and depths as directed by the project Soils Engineer or the DPW Director or designee, and shall be replaced to provide a stable, non-yielding surface that is approved by the project Soils Engineer and the DPW Director or designee.

It is the sole responsibility of the Contractor to become familiar with the existing conditions and potential excess excavation at each project site. Geotechnical reports or other data provided by Elbert County may be used to assist in determining general site and soil characteristics.

If, through failure or neglect of the Contractor to conduct the excavation work in a proper manner, the surface of the subgrade is in an unsuitable condition for proceeding with construction, the unstable material shall be removed and replaced with recycled concrete, structure backfill, or other approved material at the Contractor’s expense. The condition of the subgrade shall be approved by the project Soils Engineer and the DPW Director or designee before any additional materials are placed.

343.00 Structure Backfill

Structure backfill shall comply with Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Structure backfill material shall have a liquid limit not exceeding thirty-five (35) and a plasticity index less than fifteen (15), as determined by AASHTO T 89 and T 90, unless otherwise approved by the project Soils Engineer and the DPW Director or designee.
Areas adjacent to structures and other areas inaccessible to mobile compaction equipment shall be compacted with suitable power-driven hand tampers or other approved devices. Backfilling shall consist of placing materials in horizontal, uniform layers brought up uniformly on all sides of the structure. **THE THICKNESS OF EACH LAYER OF BACKFILL SHALL NOT EXCEED SIX (6) INCHES BEFORE COMPACTING TO THE REQUIRED DENSITY.**

Backfill material shall not be deposited against the back of concrete abutments, concrete retaining walls, or the outside of cast-in-place concrete structures until the concrete has developed a strength of not less than eighty (80) percent of the required design strength. Backfill placed within two (2) feet of any structure shall be placed evenly on all sides to avoid unequal lateral pressures.

Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacement or may damage structures, shall not be used.

Unless otherwise shown on the approved plans or directed by the DPW Director or designee, all sheeting and bracing used for structure excavation shall be removed by the Contractor prior to backfilling.

The moisture content of the backfill material shall be carefully controlled. Excessive use of moisture that results in pumping, deflecting, or otherwise unstable material shall not be allowed, and all such material shall be removed and reprocessed or replaced. Dry, rocky, or otherwise poorly processed material shall also be rejected and replaced/reprocessed at the Contractor’s expense. Compaction shall not be performed or subsequent lifts placed until the backfill material has been properly processed and moisture-conditioned in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

In the event that suitable backfill material is not available on the site, the Contractor shall import Class 1 structure backfill materials as defined in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS, or other material approved by the project Soils Engineer and the DPW Director or designee. The Contractor shall not be required to excavate below the depths of excavation indicated on the approved plans to provide structure backfill material.

Where pipe is connected to a structure to be backfilled, bedding and backfilling procedures shall comply with Section 353.00 Bedding for Pipelines and Service Lines and Section 354.00 Backfill for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

The Contractor shall uniformly process, maintain proper moisture in, and properly compact each lift throughout the backfilling process. All testing shall comply with Section 355.00 Compaction Testing of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
Structure backfill shall be compacted in conformance with the Moisture and Density Requirements for Embankment Materials table in Section 341.02 Embankment Material of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Areas deficient in degree of moisture or compaction shall be reprocessed and recompacted at the Contractor’s expense

350.00 TRENCHING, BACKFILLING AND COMPACTING

This work shall consist of furnishing all labor, materials, tools and equipment for trenching, bedding, backfill and compaction for all underground utilities (inclusive of “dry” utility trenches located under roadways or within roadway R.O.W. or dedicated easement) as specified herein and shown on the approved plans. The excavation shall be made to lines and grades shown on the approved plans and as established by the DPW Director or designee. Except where shown otherwise on the approved plans and except where the DPW Director or designee gives written permission to do otherwise, all trench excavation shall be made by open cut to the depth required to construct the pipelines as shown on the approved plans. All excavation shall be ‘unclassified’, as defined in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS. All trenching shall be performed in accordance with all Occupational Safety and Health Administration (OSHA) requirements. These regulations are described in Subpart P, Part 1926 of the Code of Federal Regulations.

All excavated material which meets the requirements for backfill materials shall be stockpiled in a manner which shall not contaminate the excavated material, and shall be located a sufficient distance from the trench to avoid overloading, to avoid obstructing sidewalks, driveways, or streets, and to provide the least possible interference with traffic.

350.01 Special Conditions

A. Subsurface Investigation - Prior to the connection of any planned utility line to an existing line, the Contractor shall expose the existing utility at the points of connection in order to verify the elevations and materials of construction. The DPW Director or designee shall be notified a minimum of two (2) working days before such an investigation is performed. The Contractor shall also expose utilities as they cross each other to allow for verification of elevation and materials of construction. The DPW Director or designee shall evaluate this information and provide revisions, if required, within three (3) working days of the completion of the investigation.

B. Underground Wire, Cable, Fiber Optic, or Similar Lines - Where underground wire, cable, fiber optic or similar lines are encountered, they shall be relocated as directed by the telephone service provider and in accordance with their specifications. The Contractor shall coordinate this work with all other phases of construction to avoid further conflicts.

C. Gas and Electric Lines - Where underground gas and electric lines are encountered, they shall be relocated as directed by the gas and electric
service provider and in accordance with their specifications. The Contractor shall coordinate this work with all other phases of construction to avoid further conflicts.

350.02 Removal of Water

The Contractor shall provide and maintain adequate equipment to properly remove and dispose of all surface or ground water that enters the trench. Water shall be disposed of without damage to adjacent property and without being a nuisance to public health and convenience. The use of any sanitary sewer to dispose of trench water shall not be allowed. The trench shall be dry at all times during pipe installation. Dewatering shall be accomplished by well points, sumping or any other method approved by the DPW Director or designee.

351.00 Trench Excavation for Roadways

When excavating in concrete or asphalt areas, the limits of the trench shall be string lined and the surface cut in a vertical plane by sawing, cutting wheel or jack-hammering. If the vertical edges of a trench in a roadway ravel during construction, they shall be trued to a vertical plane to a point twelve (12) inches outside the limits of excavation prior to milling and placing the resurfacing material, in accordance with the Detail Drawings.

Surface materials such as concrete and asphalt shall be disposed of independently of the underlying soil. Suitable, non-contaminated base course and gravels shall be salvaged to be stockpiled, protected from contamination, and reused as suitable material for backfill.

Unsuitable materials shall be disposed of by the Contractor in accordance with Section 320.01 Disposal of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

352.00 Trench Excavation for Pipelines and Service Lines

The width of the trench shall comply with the requirements set forth in these CONSTRUCTION STANDARDS & SPECIFICATIONS and shall be sufficient to allow pipe to be installed and backfill placed and compacted. The allowable trench width, regardless of the type of soil encountered, the depth of excavation or method of bedding densification, shall not exceed the outside diameter of the pipe barrel plus twenty-four (24) inches, or be less than the outside diameter of the pipe barrel plus twelve (12) inches when measured at any point below the top of the pipe bell, flange or collar.

Where the width of the lower portion of the trench exceeds the maximum width herein stated, the Contractor shall furnish and install special pipe embedment or concrete encasement to protect the pipe from the additional loading. The type and quantities of special pipe embedment shall be determined by the pipe supplier, using trench loading criteria based upon saturated backfill weighing one-hundred twenty (120) pounds per cubic foot and allowance for other superimposed live loads.
352.01 Preparation of Foundation for Pipe Laying

When the excavation is in firm earth, care shall be taken to avoid excavation below the established grade plus the required specified overdepth to accommodate the pipe bedding material.

In case soft or otherwise unsuitable foundation material is encountered in the bottom of the trench, the project Soils Engineer and/or the DPW Director or designee may require removal and replacement with stabilization material to provide a suitable foundation for the pipe. If the trench bottom is wet, the project Soils Engineer shall determine whether it is stable. The bottom of sumps utilized for dewatering shall be two (2) inches minimum below the bottom of the trench excavation to prevent the upward flow of water into the excavation, which may result in unstable bottom conditions.

353.00 Bedding for Pipelines and Service Lines

All pipe shall be installed with sufficient bedding material to provide a minimum of six (6) inches of separation between the subsoil and the barrel of the pipe and shall extend to spring line. The bedding material shall be tamped under the haunches for the full length of the pipe barrel to ensure support for entire length of pipe. The pipe barrel shall be uniformly supported along the entire length of the pipe.

Bedding material for all PVC, HDPE, CPP and DIP (“flexible pipe”) shall be material that complies with the gradation of “Fine Aggregate” as specified in Section 703.02 of the CDOT Standard Specifications for Road and Bridge Construction, well-graded sand or squeegee sand which complies with the following:

### WELL GRADED SAND

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

### SQUEEGEE SAND

<table>
<thead>
<tr>
<th>Sieve size</th>
<th>Total Percent Passing by Weight</th>
</tr>
</thead>
</table>

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Bedding material for all RCP ("rigid pipe") shall consist of materials that meet the gradation of “No. 67 Coarse Aggregate” as specified in Section 703.02 of the CDOT Standard Specifications for Road and Bridge Construction.

Bedding material shall be placed to a depth of twelve (12) inches above the barrel section of all “flexible pipe” and shall be carefully tamped into place. All other pipe, unless otherwise noted, shall be bedded to spring line. Pipe shall be installed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Bedding for underdrain pipe or gravel for underdrain without pipe shall be well-graded washed rock ranging in size from one-half (½) inch minimum to one (1) inch maximum.

353.01 Bedding Compaction

All bedding material and suitable material placed to twelve (12) inches above the top of the pipe shall be carefully compacted to at least seventy (70) percent of maximum relative density in accordance with ASTM D4253 and 4254.

354.00 Backfill for Pipelines and Service Lines

Suitable backfill shall be as defined in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Clay and similar material with a liquid index in excess of thirty-five (35) and a plasticity index in excess of six (6), as determined in accordance with AASHTO T89 and T90, shall not be considered suitable for backfilling in trenches located in improved streets, roads, highways and thoroughfares, unless approved by the DPW Director or designee / .

When the excavated material is unsuitable for compaction, import material shall be approved by the project Soils Engineer and the DPW Director or designee prior to placement.

Refer to Section 822.02 Controlled Low Strength Materials (CLSM) of these CONSTRUCTION STANDARDS & SPECIFICATIONS for requirements of structure backfill (“Flowable Fill”) used to backfill pipeline and service line trenches.

Materials used above the subgrade level shall comply with the requirements for sub-base and base course materials as defined in Section 600 Hot Bituminous Pavement (Asphalt) Mix Design and Construction of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Bracing installed to prevent cave-ins shall be withdrawn in a manner that shall maintain the desired support during the backfill operations. Driven sheet pilings shall be cut off at or above the top of pipe, and the portion below the cut-off line shall be left in the ground.
354.01 Backfill Compaction

Trench backfill shall be placed in loose six (6) inch lifts, processed and moisture-conditioned, and each lift thoroughly consolidated by tamping, vibrating, or a combination thereof, until the moisture content and the relative compaction comply with the values shown in the Moisture and Density Requirements for Embankment Materials table in Section 341.02 Embankment Material of these CONSTRUCTION STANDARDS & SPECIFICATIONS for the various soil classifications and relative compaction.

For new landscape areas with trees, compaction shall be between eighty-five (85) and ninety (90) percent of the maximum Standard Proctor dry density in the top two (2) feet of soils below finished grade. Where sidewalk or concrete trail will be constructed, soils shall be scarified, moisture treated and recompacted two (2) feet wider than the footprint of the sidewalk or trail until the moisture content and the relative compaction comply with the values shown in the Moisture and Density Requirements for Embankment Materials table in Section 341.02.01 Embankments Twelve (12) Feet or Less in Depth of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Backfill of utilities, pipes, culverts, or other miscellaneous structures located in areas that will not have a hard surface shall be placed in six (6) inch lifts at ninety (90) percent of the maximum Standard Proctor dry density and within two (2) percent of the optimum moisture content. All other requirements for particle size and processing shall be met.

Processing, moisture-conditioning, and compaction shall be performed with equipment that is suitable for the specific field conditions. The equipment used shall be sufficient to obtain uniform processing, uniform moisture-conditioning, and uniform compaction throughout each lift of material placed. Vertical structures or other small, tight areas shall be compacted by hand or by equipment small enough to provide compaction within three (3) inches of the structure (or in between dual utility lines). Use of CLSM may be approved by the DPW Director or designee for such areas. It is the responsibility of the contractor to protect the installed pipe from damage resulting from compactive efforts. In no case shall soil compaction operations be performed within eighteen (18) inches (vertically) of rigid pipe or within twenty-four (24) inches (vertically) of flexible pipe; however, the material placed within this zone shall comply with the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Flooding or jetting of trenches shall not be allowed without written approval from the DPW Director or designee.
355.00 Compaction Testing

Compaction testing shall be performed at a minimum frequency of one (1) test for every one thousand (1,000) yds and no less than two (2) tests per day for embankment fill materials.

Compaction testing shall be performed at a minimum frequency of (1) test per two hundred (200) yds\(^3\) of backfill material or at least one (1) test per two-hundred and fifty (250) lineal feet per lift, whichever controls. Sand cone testing or other means of verifying nuclear moisture and density test results shall also be performed.

Testing shall be performed at various depths and locations, and at all vertical structures. The project Soils Engineer and/or the DPW Director or designee may require additional testing around structures, manholes, valve boxes, etc.

Field test results shall be submitted to the DPW Director or designee within twenty-four (24) hours of the test or on the next working day. In no case shall fill or backfill be placed on materials that did not pass moisture and density testing.

Moisture and density testing shall be performed by a qualified technician who works under the direct supervision of a Colorado Registered Professional Engineer. Final soil compaction reports shall be prepared and signed by a Colorado Registered Professional Engineer, and who is qualified to prepare such reports. Reports shall be submitted to the DPW Director or designee within one (1) week of the test.

360.00 ROADWAY EXCAVATION, BACKFILL AND COMPACTION

Prior to placement of street subgrade, base, paving and concrete materials, utilities shall be installed, utility service lines shall be stubbed to the edge of the R.O.W., and all trenches shall be backfilled and properly compacted.

Roadway excavation shall be in accordance with ‘unclassified excavation’ as defined in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS, except for areas of ‘rock excavation’, as defined in the same Section. Material and excavation for the roadway backfill shall comply with Section 341.02 Embankment Material of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

All roadway backfill shall be compacted to densities and moisture contents shown in the following table, unless otherwise required by the project Soils Engineer and the DPW Director or designee:
Soil Classification

AASHTO M145

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>Relative Compaction By Standard Proctor ASTM D698 or AASHTO T99 (percent compaction)</th>
<th>Relative Compaction By Modified Proctor ASTM D1557 or AASHTO T180 (percent compaction)</th>
<th>Moisture Content Range (with respect to Optimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1, A-2, A-3</td>
<td></td>
<td>95</td>
<td>-2 to +2 (based on AASHTO T180)</td>
</tr>
<tr>
<td>A-4, A-6, A-7</td>
<td>95</td>
<td></td>
<td>-1 to +3 (based on AASHTO T99)</td>
</tr>
</tbody>
</table>

Prior to placement and compaction of roadway fill, all existing rubble and organic material shall be removed down to existing ‘suitable material’, as defined in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The existing suitable material shall then be scarified, and roadway fill placed in accordance with Section 341.01 Preparation of Embankment Subgrade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

361.00 Subgrade

Refer to Section 350.00 TRENCHING, BACKFILLING AND COMPACTING and Section 360.00 ROADWAY EXCAVATION, BACKFILL AND COMPACTION of these CONSTRUCTION STANDARDS & SPECIFICATIONS for backfill of concrete flatwork and structures.

Refer to Section 934.00 Construction of Pavement Sections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Subgrade and subgrade treatments described herein shall consist of soils directly under pavements and concrete curb or sidewalk and shall conform to the lines, grades, and cross-sections shown on the approved plans. All work shall be observed and tested by the project Soils Engineer or representative.

The construction of subgrade shall consist of preparing the approved subgrade material to form a firm, stable foundation.

Each layer of material shall be placed and spread so that after compaction it shall conform to the width and crown of the typical cross-sections.

Soft and yielding material and portions of the subgrade which show deflection shall be scarified and recompacted or removed and replaced with base course or other material approved by the project Soils Engineer and the DPW Director or designee and compacted as specified herein.
The wetting of subgrade layers shall be done with sprinkling equipment of a type that ensures uniform and controlled distribution of the water. All wetting shall be done by uniformly sprinkling each layer of material being placed with only the amount of water needed to obtain maximum density of the material.

Concurrently with the wetting operations, the material shall be uniformly compacted by rolling. Rolling equipment shall consist of one or more of the following: rubber-tired roller, sheepsfoot roller and flat wheel steel roller.

After excavation and embankment construction are complete and the subgrade brought to final grade, it shall be rolled with a rubber-tired roller which is a minimum size of eight (8) to twelve (12) tons and other compaction equipment as required to bring the subgrade to the density and moisture content shown in the following table, unless otherwise required by the project Soils Engineer and the DPW Director or designee:

<table>
<thead>
<tr>
<th>Soil Classification AASHTO M145</th>
<th>Relative Compaction By Standard Proctor ASTM D698 or AASHTO T99 (percent compaction)</th>
<th>Relative Compaction By Modified Proctor ASTM D1557 or AASHTO T180 (percent compaction)</th>
<th>Moisture Content Range (with respect to Optimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1, A-2, A-3</td>
<td>100</td>
<td>-</td>
<td>-2 to +2 (based on AASHTO T180)</td>
</tr>
<tr>
<td>A-4, A-6, A-7</td>
<td>95</td>
<td>-</td>
<td>-1 to +3 (based on AASHTO T99)</td>
</tr>
</tbody>
</table>

No concrete or asphalt pavement, subgrade or base course shall be placed on unsuitable material.

361.01 Over-Excavation for Expansive Soils

An Over-Excavation Permit shall be required in accordance with Section 151.00 Public/Private Improvement Permit (PPIP), Grading Permit and Over-Excavation Permit of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Soils with a Plasticity Index (P.I.) over ten (10) and less than thirty (30) shall be over-excavated and recompacted to ninety-five (95) percent of maximum Standard Proctor dry density as determined by ASTM D698 or AASHTO T99. The moisture content shall be maintained between the optimum moisture content and three (3) percent over the optimum moisture content (+3%). There shall be a minimum of twelve (12) inches of soil stabilization below the pavement section included as part of the depth of treatment, and the total depth of treatment shall be in accordance with the approved pavement design.
Soils with a P.I. of thirty (30) or greater may require moisture treatment followed by pozzolan treatment (lime, cement, fly ash, kiln dust) or other subgrade stabilization method approved by the DPW Director or designee. Refer to the Minimum Over-Excavation Requirements table below. Stabilized subgrade shall extend to the back of the sidewalk for streets with attached sidewalks, and to one foot (1’) behind the back of the curb for streets with detached sidewalks.

The DPW Director or designee may waive the pozzolan treatment requirement for onsite soils that have P.I.’s of thirty (30) or greater when the following conditions exist:

- The soils have a moisture content between the optimum moisture content and three (3) percent over the optimum moisture content (+3%);
- The soils have a maximum Standard Proctor dry density of at least ninety-five (95) percent, and
- The soils exhibit a swell potential of less than two (2) percent as determined under a two hundred (200) psf surcharge.

In lieu of subgrade stabilization, a composite section designed by a Colorado Registered Professional Engineer and consisting of at least twelve (12) inches of base course may be approved by the DPW Director or designee.

Unless otherwise recommended by the project Soils Engineer and approved by the DPW Director or designee, the following minimum over-excavation requirements shall apply for expansive soils:

Minimum Over-Excavation Requirements

<table>
<thead>
<tr>
<th>PLASTICITY INDEX</th>
<th>DEPTH OF TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local and Collector Streets</td>
</tr>
<tr>
<td>10-29</td>
<td>1 foot</td>
</tr>
<tr>
<td>30-40</td>
<td>2 feet</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>4 feet</td>
</tr>
</tbody>
</table>

361.02 Base Course (For Composite Sections)

361.02.01 Materials

Base course subgrade shall consist of a foundation course composed of crushed gravel, recycled concrete or crushed stone and filler, constructed on the prepared subgrade. Material composed of uniform size particles, or which contains pockets of excessively fine or excessively coarse material, shall not be approved for use. Materials and construction shall be in accordance with the requirements of Section 304 of the CDOT Standard Specifications for Road and Bridge Construction. Gradation shall be Class 5 (1½” maximum) or Class 6 (3/4” maximum), in accordance with Table 703-2 of CDOT Standard Specifications for Road and Bridge Construction.
361.02.02 Construction

All work shall be observed and tested by the project Soils Engineer or representative. The base course material, aggregate base or recycled concrete, shall be placed on the previously prepared subgrade at the locations and in the proper quantities to conform to the cross-sections shown on the approved plans and as directed by the DPW Director or designee. Geotextile fabric shall be installed if required on the approved plans. Placing and spreading shall be done by means of a spreader machine, moving vehicle, motor grader, or by other approved equipment methods. The material shall be placed without segregation. Any segregated areas shall be removed and replaced with uniformly graded material at the Contractor's expense.

The thickness of each base course layer shall not exceed six (6) inches before compaction. If the required depth exceeds six (6) inches, and is less than twelve (12) inches, material shall be placed in two (2) or more lifts of approximate equal thickness. If uniform density cannot be obtained by six (6) inch lifts, the maximum lift thickness shall not exceed four (4) inches.

Base course material shall not be placed on a dry or dusty soil foundation which could cause rapid dissipation of moisture from the base course material and hinder or preclude proper compaction.

Excessively dry soil foundations shall have water applied to them and shall be reprocessed and recompacted. If, at any time, the subgrade construction is subjected to rain, snow or other significant events, the project Soils Engineer shall evaluate the affected areas prior to continuing with subgrade preparation and shall make a recommendation to the Contractor and to Elbert County.

Rolling shall be continuous until the base course material has been compacted thoroughly in accordance with Section 304 of the CDOT Standard Specifications for Road and Bridge Construction. Water shall be uniformly applied during compaction to obtain the specified moisture content and to aid in consolidation. The surface of each layer shall be uniformly maintained during compaction operations.

The prepared base course surface shall be smooth and free of ruts and irregularities and shall be true to line and grade shown on the approved plans and as directed by the DPW Director or designee. The base course shall be maintained in this condition by watering, drying, rolling, and/or blading until the asphalt or concrete flatwork is placed. The surface tolerance of the base course shall be in accordance with Section 301.04 of the CDOT Standard Specifications for Road and Bridge Construction.

361.03 Lime-Treated Subgrade
When required, lime treated subgrade shall comply with Section 307 of the CDOT Standard Specifications for Road and Bridge Construction. Lime-treated subgrade shall extend to the back of the sidewalk for streets with attached sidewalks, and one (1) foot behind the back of the curb for streets with detached sidewalks, as shown in the Detail Drawings.

Alternative methods of soil stabilization may be allowed with approval of the DPW Director or designee. Soil mix design procedures shall comply with the CDOT Standard Specifications for Road and Bridge Construction.

Sulfate testing shall be performed on streets to have lime-treated subgrade. The initial sampling and testing frequency shall be every five hundred (500) feet per lane. Each sample shall consist of soils evenly distributed in the top twenty-four (24) inches of the subgrade to be lime-treated. Where sulfates greater than 0.03 ppm or 0.003% by volume are discovered, additional sampling and testing within a one hundred (100) foot radius of the “hot” soils shall be performed. Testing shall occur until the areas with sulfates greater than 0.03 ppm are isolated and removed.

361.04 Proof-Roll Observation and Testing

Proof-roll observation and testing (proof-rolling) may be required to determine whether certain areas of subgrade meet compaction requirements. Where required by the DPW Director or designee, proof-rolling shall be performed as designated with a water truck loaded to a minimum of 36,000 lb. Tires shall be inflated to a minimum of seventy (70) pounds per square inch and a maximum pressure of ninety (90) pounds per square inch. Air pressure in the tires shall be maintained within a tolerance of five (5) pounds per square inch.

Within the twenty-four (24) hour time period prior to paving, subgrade compaction testing and proof-rolling with a water truck shall be required.

After passing compaction tests, the Contractor and/or Owner’s representative shall proof-roll the areas. No proof-roll inspections shall be performed until all underground utility testing is complete. Subgrade areas failing compaction testing or proof-rolling shall be delineated and reprocessed and/or removed and replaced in a manner approved by the project Soils Engineer and the DPW Director or designee. Such procedures may include over-excavation, scarification, moisture-conditioning, recompaction, and/or replacement with suitable materials that comply with the moisture and density requirements. In addition to complying with moisture and density requirements, all subgrade materials shall exhibit stability during proof-rolling. Additional compaction testing and proof-rolling may be required at the discretion of the DPW Director or designee or his designee. All proof-rolling operations shall be at the Contractor’s expense.
370.00 RESTORATION AND CLEAN UP

At all times during construction, the Contractor shall maintain the site, including partially finished structures, material stockpiles and other like areas, in a reasonable state of order and cleanliness.

The grade and condition of all unsurfaced areas shall be restored to a condition equal to or better than the grade and condition immediately prior to construction, unless otherwise shown in the approved plans and approved by Elbert County. The Contractor shall restore or replace all seeded areas, sod, trees, landscaping materials, landscape irrigation systems, fences, and any other items, to a condition equal to or better than before the work began and to the satisfaction of the DPW Director or designee. All grassed areas shall be reseeded or resodded in accordance with Section 1000 LANDSCAPING STANDARDS FOR DEVELOPMENT PROJECTS of these CONSTRUCTION STANDARDS & SPECIFICATIONS, and the Contractor shall be responsible for maintaining these areas until substantial growth occurs and Construction Acceptance. Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

All pavement and concrete flatwork shall be restored or replaced to a condition equal to or better than before the work began and to the satisfaction of the DPW Director or designee.

In the event of failure of the Developer or Contractor to complete work, correct deficiencies, or clean up a project site in a reasonable time period, Elbert County has the right to draw upon the performance guarantee, as specified in the Subdivision Improvement Agreement.
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WATER SUPPLY FACILITIES

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401.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

The governing Metro District or Homeowners Association shall be responsible for ownership and maintenance of all Water Systems. Elbert County does not own or maintain Water Systems.

401.01 Cross Connections

CROSS CONNECTIONS SHALL NOT BE ALLOWED.

410.00 DESIGN CRITERIA

410.01 General

All potable water distribution systems shall comply with the requirements of the CONSTRUCTION STANDARDS & SPECIFICATIONS for water main and service line construction and may include special criteria established by Elbert County for the overall hydraulics of the water utility system. Special criteria shall be outlined at pre-design meetings, as determined necessary by the DPW Director / Elbert County Engineer. The requirements set forth in the latest edition of the Denver Water Board Specifications shall apply for information omitted in these CONSTRUCTION STANDARDS & SPECIFICATIONS.

These CONSTRUCTION STANDARDS & SPECIFICATIONS also cover design and construction of waterlines for the transmission and distribution of reuse water (tertiary treated effluent) and for the supply of raw water (water in its natural state, prior to any treatment and taken from a natural or impounded body of water) to maintain ponds as visual amenities. The area wetted with reuse water shall be designed to avoid picnic tables, drinking fountains and playground equipment. Reuse and raw water are intended for non-potable uses such as landscape irrigation and are not intended for use on residential property and other areas with a potable water supply.

These CONSTRUCTION STANDARDS & SPECIFICATIONS shall apply to all reuse waterlines from the connection applicable Metro District’s tertiary treated effluent transmission main or existing reuse lateral to the points of use or application. Design of irrigation systems connected to the reuse water distribution system shall be in accordance with the applicable sub-sections of Section 1000 LANDSCAPING STANDARDS FOR DEVELOPMENT PROJECTS of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
CONSTRUCTION STANDARDS & SPECIFICATIONS and shall include backflow prevention. Unless otherwise specified, the provisions of Section 370.00 RESTORATION AND CLEANUP of these CONSTRUCTION STANDARDS & SPECIFICATIONS shall apply to reuse and raw waterline installation.

411.00 Design Flow Requirements

411.01 Potable Water Distribution System

The design of the potable water distribution system shall be based on the following:

**UNIT WATER DEMANDS FOR FUTURE LAND USE**

<table>
<thead>
<tr>
<th>Land Type</th>
<th>Avg. Demand</th>
<th>Max. Day/Avg. Day</th>
<th>Max. Hr./Max. Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>145 GPCD*</td>
<td>3.05</td>
<td>1.9</td>
</tr>
<tr>
<td>Commercial</td>
<td>1651 GPD/Acre</td>
<td>2.00</td>
<td>1.9</td>
</tr>
<tr>
<td>Industrial</td>
<td>1651 GPD/Acre</td>
<td>1.32</td>
<td>1.9</td>
</tr>
<tr>
<td>Park</td>
<td>3060 GPD/Acre</td>
<td>3.90</td>
<td>1.9</td>
</tr>
</tbody>
</table>

*Gallons Per Capita/Day

Minimum residential population density, household density and land usage shall be as noted on the approved PUD and/or Plat, or as determined by the Elbert County Director of Planning. Fire flows may be calculated from more than one hydrant, providing the hydrants used are directly accessible to all possible fire locations in the area served and not at the end of cul-de-sacs. Fire flows required shall be in accordance with the appropriate fire district:

411.02 Non-Potable Water Distribution System

Where reuse water is to be supplied at the necessary peak application rate, under system pressure, directly to the sprinkler heads, the following design criteria shall apply:

A. Annual Irrigation Volume: Not less than 1.0 ac-ft/yr. or more than 2.5 ac-ft/yr. times total acres irrigated.

B. Maximum Daily Irrigation Volume: 0.07 ac-ft per acre times total acres irrigated

C. Maximum Peak Flow Rate: 23.5 gpm per acre times total acres irrigated.

Where reuse water shall first be discharged to storage prior to irrigation application, the following design criteria shall apply:
A. **Annual Irrigation Volume:** Not less than 1.0 ac-ft/yr. or more than 2.5 ac-ft/yr. per irrigated acre.

B. **Maximum Monthly Irrigated Volume:** 0.65 ac-ft per acre times total acres irrigated.

C. **Maximum Peak Flow Rate:** 5.9 gpm per acre times total acres irrigated.

For non-irrigation use (storage), maximum daily, maximum peak flow and annual volume rates shall be determined on a case by case basis.

### 412.00 Operating Pressure Requirements

All areas shall be designed to provide a maximum static head of two-hundred ninety (290) feet or one-hundred twenty-five (125) psi and a minimum static head of one hundred (100) feet or forty-three (43) psi. Distribution systems shall also be designed to maintain a twenty (20) psi residual pressure during the required fire flow and a forty (40) psi residential residual during peak residential flows. The maximum pressure drop from static head to either fire flow or peak residential flow shall not exceed thirty (30) psi.

### 413.00 Fire Hydrant Spacing

In single-family residential areas, fire hydrants shall be spaced a maximum of five-hundred (500) feet apart as measured along street curb line, and at an overall spacing that shall average not less than one hydrant to two-hundred thousand (200,000) square feet accessible to the fire hydrant throughout an individual subdivision. A hydrant shall be placed in the end of each cul-de-sac. Fire hydrants at the end of cul-de-sacs shall not be considered available for firefighting purposes.

In business, industrial, and high-density residential areas, hydrants shall be spaced not greater than three hundred (300) feet apart or as approved by the applicable fire district.

Hydrants shall be spaced not greater than one thousand (1,000) feet along connector and arterial roadways without domestic water service lines.

All fire hydrant locations and spacing shall be reviewed and approved by the applicable Fire District in addition to being consistent with NFPA.

### 414.00 Fire Lines

The property owner shall maintain all fire lines extending from the valve on the Metro District water main. Valves on newly constructed fire lines shall be located on the tee at the main line. Fire lines are to be used exclusively for fire protection. Domestic water taps and irrigation taps shall not be allowed on the fire line.
415.00  Distribution System Layout

Distribution mains and lateral lines shall be located as shown on the approved plans and shall be a minimum of eight (8) inch diameter pipe.

Dead ends shall be minimized by looping whenever possible. Lines at ends of long cul-de-sacs shall be looped along lot lines to adjacent streets or in outlots whenever possible. If a utility easement is required, it shall be a minimum of thirty (30) feet wide. Dead ends shall be provided with a fire hydrant. Mains and laterals shall be extended to the boundaries of Filings or Phases and completely across the frontage of individual lots.

416.00  Valve Spacing and Marking

Valves shall be placed with a maximum spacing of six hundred (600) feet in all distribution mains and lateral lines. Spacing of valves in transmission mains may be greater than six hundred (600) feet with the approval of the DPW Director / Elbert County Engineer. Valves shall also be placed at each fire hydrant.

All waterline tees shall have a minimum of two (2) valves. All waterline crosses shall have a minimum of three (3) valves. For a succession of short blocks perpendicular to the direction of the distribution main and without residential or commercial services between them, one or more intersection(s) may have the valve in that direction omitted, but the six hundred (600) foot maximum spacing requirement shall be maintained.

Valves shall also be placed at each end of a waterline running through an easement on private property, on each side of a major creek or channel crossing, and on each side (at property lines extended) of a distribution line that provides service to a hospital, school or large industrial user.

417.00  Air Release and Vacuum Relief Valves

Combination air and vacuum relief valves shall be installed at each high point in all distribution mains and at high points of lateral lines, as required by the DPW Director / Elbert County Engineer.

Air and vacuum relief valves shall be installed in precast manholes or vaults fitted with air vents open to the atmosphere and in accordance with the Detail Drawings.

418.00  Blow-off Valves and Drains

418.01  Blow-off Valves
Provisions shall be included in the design to allow for the flushing of distribution mains and lateral lines at any low point in the system. Fire hydrants may be used for permanent blow-offs.

For temporary dead-end waterlines, a temporary blow-off valve may be permitted. The blow-off assembly shall be installed perpendicular to and on the downhill side of the waterline and shall drain to the nearest street gutter line or drainage channel. The blow-off assembly standpipe shall have a threaded end to accept a fire hose coupling. The top of the standpipe shall be between four (4) and six (6) inches below grade.

418.02 Drains

Provisions shall be included in the design to allow for the draining of transmission lines.

419.00 Pipe

All pipe used for distribution mains and lateral lines having a diameter of twelve (12) inches or less shall be PVC pipe unless otherwise approved in writing by the DPW Director / Elbert County Engineer. Distribution mains in excess of twelve (12) inches in diameter shall be subject to approval and as directed by the DPW Director / Elbert County Engineer. The design engineer shall specify the pipe class as required for specific project conditions.

419.01 Hydraulic Design

All pipes shall be designed to provide a maximum velocity of ten (10) feet per second. Distribution mains and lateral lines shall be designed using the Hazen-Williams friction coefficients and maximum head losses noted below:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Hazen-Williams Friction Coeff.</th>
<th>Max. Head Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>8” - 12”</td>
<td>C-100</td>
<td>2’ per 1,000’</td>
</tr>
<tr>
<td>14” - 16”</td>
<td>C-110</td>
<td>2’ per 1,000’</td>
</tr>
<tr>
<td>20”</td>
<td>C-130</td>
<td>1.5’ per 1,000’</td>
</tr>
<tr>
<td>Over 20”</td>
<td>As directed by the Road &amp; Bridge Superintendent / Elbert County Engineer</td>
<td></td>
</tr>
</tbody>
</table>

419.02 Location (Typical)

Water mains shall typically be located twelve (12) feet north or east of the centerline of the street unless otherwise approved by the DPW Director / Elbert County Engineer.
At street intersections, valves shall be located at the extension of property lines. Fire hydrant gate valves shall be placed near the main. All fire hydrants shall have a restrained connection directly to the tee off the main.

In all instances, water mains shall extend to the boundary line of the property or subdivision served, to the center of boundary streets or to the outside of paved areas, as noted on the approved plans. A water main serving one lot shall extend the entire length across the frontage of that lot.

419.03 Horizontal and Vertical Alignment

Methods of deflection of PVC and ductile iron pipe joints shall be in accordance with manufacturers’ recommendations only. Pipe shall not be bent. For horizontal alignment changes, pipe may be deflected at pipe joints up to a maximum of one degree (1º). Fittings are required for deflections to cross under utilities, but the contractor may request a variance from the DPW Director / Elbert County Engineer to vertically deflect pipe joints a maximum of one degree (1º).

419.04 Pipe Depths

All water main pipe shall be installed with a minimum of four (4) feet – six (6) inches of cover from finished grade of street to the top of the pipe barrel. Proposed installations greater than ten (10) feet from finished grade require DPW Director / Elbert County Engineer approval.

419.05 Relation to Waterlines

Refer to Section 516.00 Relation to Waterlines for additional requirements.

420.00 GENERAL PROVISIONS

421.00 General

Construction of all water mains within Elbert County and all water service lines that connect to water mains within Elbert County shall be in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS and the approved plans. These CONSTRUCTION STANDARDS & SPECIFICATIONS shall apply to new water system construction as well as to repairs to existing facilities. When special conditions are encountered or deviations from these CONSTRUCTION STANDARDS & SPECIFICATIONS are required by the DPW Director / Elbert County Engineer, and such changes are in the best interests of Elbert County, the decision of the DPW Director / Elbert County Engineer shall be final.

422.00 Permits Required

A Public/Private Improvement Permit (PPIP) shall not be issued until the DPW Director / Elbert County Engineer has approved the water system plans. A pre-
construction meeting with Elbert County inspection staff and the project engineer shall be scheduled and completed prior to the commencement of any construction.

423.00 Maintenance of Traffic

When street cuts are required for water system construction or repairs to existing facilities, the following conditions shall be met to avoid interference with traffic:

Street service cuts shall only be open between 9:00 a.m. and 4:00 p.m. Two-way traffic shall be maintained at all times around the construction area. A Traffic Control Plan (TCP) shall be prepared in accordance with Section 141.12 Traffic Control, Barricades and Warning Signs of these CONSTRUCTION STANDARDS & SPECIFICATIONS and submitted to the DPW Director / Elbert County Engineer for approval prior to the commencement of construction.

430.00 POTABLE RAW AND REUSE WATER MAIN CONSTRUCTION

431.00 Site Work and Earthwork

Refer to Section 340.00 EARTHWORK of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

431.01 Trenching, Backfilling and Compacting

Refer to Section 350.00 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

431.02 Preservation of Monuments

Refer to Section 141.00 Protection of Public, Private and Utility Interests of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

432.00 Materials

432.01 General

All references to the Denver Water Board Specifications cited in these CONSTRUCTION STANDARDS & SPECIFICATIONS shall mean the latest edition of the Engineering Standards of the Board of Water Commissioners of Denver, Colorado.

Pressure classes or ratings specified for materials in this section are minimums. The pressure class or rating for all materials used in a water supply system design shall be adequate for the water system pressure requirements.
432.02 Pipe

All pipe for water main construction shall be as described in Section 419.00 Pipe of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Each pipe shall be marked with the class designation and size. A six (6) inch wide detectable warning tape shall be installed above all pipe for the purpose of warning of location of buried pipeline, in accordance with the Detail Drawings. A No. 6 AWG solid, uninsulated copper wire shall be attached to all pipe for the purpose of future location, in accordance with the Detail Drawings. Installation of all pipe shall be in accordance with the manufacturers’ recommendations and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

PVC Pipe: All PVC pressure pipe for potable waterlines in sizes up through twelve (12) inch diameter shall comply with AWWA C900, pressure class 200 psi and wall thickness dimension ratio fourteen (DR-14) minimum.

PVC pipe for non-potable waterlines in sizes up through twelve (12) inches in diameter shall comply with AWWA C900, pressure class 200 psi (DR-14) and shall be purple in color. The purple color shall be a factory pigment of the PVC material, and painting of the pipe material is not acceptable.

PVC pressure pipe for potable waterlines in fourteen (14) inch through thirty-six (36) inch diameter shall comply with AWWA C905, pressure rating 165 psi (DR-25) minimum. For PVC pipe designed for a maximum safe operating pressure of 125 psi, or when required by the DPW Director / Elbert County Engineer, the minimum pressure rating shall be 235 psi (DR-18), or as determined by the design conditions.

PVC pressure pipe for non-potable waterlines in fourteen (14) inch through thirty-six (36) inch diameter shall comply with AWWA C905, pressure rating 165 psi (DR-25) or 235 psi (DR-18).

PVCO Pipe: Molecularly Oriented Polyvinyl Chloride (PVCO) pressure pipe for potable waterlines in sizes up through twelve (12) inch diameter shall comply with AWWA C909, pressure class 200 psi minimum.

Ductile Iron Pipe: All ductile iron pipe shall comply with AWWA C151. Class designation shall be as shown on the approved plans or as designated by the DPW Director / Elbert County Engineer for each individual project. Joints shall be mechanical or push-on and shall comply with AWWA C111. Ductile iron pipe shall have a standard cement mortar lining that complies with AWWA C104 and a bituminous outside coating approximately one (1) mil thick.

Ductile iron pipe used in construction of hydrant laterals and fire lines shall be thickness Class 52.
Ductile iron pipe used in construction of non-potable waterlines shall be Class 350. Ductile iron pipe (DIP) may be required for non-potable waterlines that have higher pressures and that are twelve (12) inches in diameter or less.

Ductile iron, copper, steel or other non-potable pipe material not readily available in a purple color shall be encased in purple polyethylene (poly-wrapped).

432.03 Polyethylene Wrap for Ductile Iron Pipe and Fittings

The polyethylene encasement material shall be in accordance with the Detail Drawings.

432.04 Fittings

Ductile iron fittings shall comply with AWWA C110 and/or C153. Class designation shall be compatible with the pipe class designated for the project. Joints shall be mechanically restrained. Integral restrained joints that comply with AWWA C111 may be used with approval of the DPW Director / Elbert County Engineer. Rubber gasket joints shall comply with AWWA C111. A standard thickness cement mortar lining shall be applied to comply with AWWA C104. All fittings shall receive a bituminous outside coating approximately one (1) mil thick or be lined and coated with fusion bonded epoxy coating to comply with AWWA C116. Mechanical joint restraint shall be wedge action, self-actuating, such as Megalugs. Restraints shall be protected in accordance with Section 432.18 Corrosion Protection Systems of these CONSTRUCTION STANDARDS & SPECIFICATIONS. **NO ALL-THREAD SHALL BE USED.**

432.05 Gate Valves

**ALL GATE VALVES FOR POTABLE AND RAW WATERLINES SHALL OPEN LEFT (COUNTER-CLOCKWISE), AND ALL GATE VALVES FOR REUSE WATERLINES SHALL OPEN RIGHT (CLOCKWISE).** Gate valves in sizes four (4) inches to twelve (12) inches shall be of the ductile iron body, non-rising bronze stem, resilient-seated type manufactured in accordance with AWWA C509 or AWWA C515. Class designation shall be compatible with the pipe class designated for the project.

Valves shall provide zero leakage at operating pressures up through one hundred fifty (150) psi in both directions. They shall be furnished with a two (2) inch square operating nut or hand wheel. End connections shall be furnished with all necessary joint materials and shall have a full opening flow way of equal diameter to the nominal size of the connecting pipe.

The disc shall have an integrally cast ductile iron stem nut to prevent twisting or angling of the stem. The disc casting shall be open on one side so as to form no
cavities for the accumulation of solids, and to permit the application of the protective coating. The sealing mechanism shall consist of a replaceable, contoured natural rubber disc seat ring, internally reinforced by a steel ring and molded separately from the disc. The seat ring shall be secured to the disc with self-locking stainless-steel screws and shaped so that it cannot be installed improperly. The seat ring shall seal against an accurately formed machined surface in the valve body.

Valves shall be provided with three (3) O-ring stem seals, with two (2) placed above and one (1) below the thrust collar. The two (2) upper O-rings shall be replaceable with the valve fully open and under pressure. The area between the O-rings shall be filled with a lubricant to reduce friction and to lubricate the O-ring each time the valve is operated. An anti-friction washer shall be placed above the thrust collar to further minimize operating torque. Structural design of the valve shall be such that if excessive torque is applied to the stem, failure of the pressure retaining parts shall not occur. Stem failure under such conditions shall occur externally at such a point as to enable the stem to be safely turned by use of a pipe wrench or other such readily available tool after exposure of the valve. The stem shall then be replaceable through removal of the two-bolt stuffing box.

Coatings shall be equal to or exceed AWWA C550. All internal ferrous metal surfaces shall be fully coated and holiday free to a minimum thickness of four (4) mils. The coating shall be a two-part thermosetting epoxy suitable for field overcoating and for touchup without special surface preparation or extreme heat. The supplier shall furnish detailed performance tests of adhesion, hardness and abrasion resistance of the furnished coatings. Coatings shall have a successful record of performance in valves, pipe or other allied equipment for a minimum of ten (10) years.

432.06 Butterfly Valves

**ALL BUTTERFLY VALVES FOR POTABLE AND RAW WATERLINES SHALL OPEN LEFT (COUNTER-CLOCKWISE), AND ALL BUTTERFLY VALVES FOR REUSE WATERLINES SHALL OPEN RIGHT (CLOCKWISE).** All valves having a nominal diameter of fourteen (14) inches or greater shall be geared butterfly valves designed for direct burial and shall comply with AWWA C504, Class 150-B. Class designation shall be compatible with the pipe class designated for the project.

Valves shall be of the tight-closing, rubber seat type with rubber seats which are bonded to the valve body. No metal-to-metal sealing surfaces shall be permitted. Valves shall provide zero leakage at the pressure rating of the pipe in either direction. Valve discs shall rotate ninety (90) degrees from the full open position to the tight shut position. Coatings shall be equal to or exceed AWWA C550. Valve bearings shall be sleeve-type, corrosion-resistant and self-lubricating with the load not to exceed twenty-five hundred (2,500) psi.
Valve operators shall be the traveling nut type designed to withstand three hundred (300) foot-pounds of input torque at full open or closed positions without damage to the valve or operator. Valve operators shall be fully gasketed, grease packed, designed to withstand submersion in water to ten (10) psi and operate with a two (2) inch square nut.

432.07 Pressure Reducing Valves

All pressure reducing valves shall be 150 Class suitable for a working pressure of 250 psi. Distribution main and lateral line pressure reducing valves shall be installed in a vault and contain parallel valves for high and low flow ranges. Piping shall be ductile iron through the vault walls and extend three (3) feet past the vault walls in accordance with the Detail Drawings. Oil filled differential gauges shall be installed with brass or stainless-steel ball valves.

Pressure reducing valves shall be installed at location(s) noted on the approved plans. The valve shall be capable of maintaining a constant downstream pressure regardless of varying inlet pressure and shall be hydraulically operated and diaphragm-actuated with a globe or angle pattern. It shall contain a resilient, synthetic rubber disc having a rectangular cross-section contained on three and one-half (3-½) sides by a disc retainer, forming a tight seal against a single removable seat insert. The diaphragm assembly, containing a valve stem, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted, and there shall be no pistons operating the valve or pilot controls. All necessary repairs shall be possible without removing the valve from the line. The valve shall be furnished with an indicator rod to show valve position.

The pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The control system shall include a fixed orifice.

This valve shall be similar in all aspects to a Clayton 90-91AB and/or a Clayton 90-01AS Pressure Reducing Valve (PRV) as manufactured by Cla-Val Co., or an approved equal.

432.08 Fire Hydrants

Fire hydrants shall comply with ANSI/AWWA C502 for dry-barrel fire hydrants and shall be listed by Underwriters Laboratories and Factory Mutual Research Corporation. Casting or other permanent marks shall be used to confirm that fire hydrants comply with these standards.
Fire hydrants shall also comply with the following supplementary specifications:


B. Hydrants shall be rated at 250 psi operating pressure and tested at 500 psi per Section 5.1 of AWWA C502. Production testing of each hydrant shall be performed at 500 psi to assure proper assembly and operation and detection of any imperfections. All iron parts as designated in Section 3.1.2 of AWWA C502 shall be ductile iron.

C. Hydrants shall be designed for five (5) feet pipe bury and shall not be buried below the first flange. The first flange shall be two (2) to four (4) inches above grade. A maximum of one riser shall be used, and if a riser is required, a break-away coupling shall be installed two (2) to four (4) inches above grade. INSTALLATION OF A HYDRANT RISER REQUIRES A SEPARATE, SPECIFIC INSPECTION.

D. Nozzles shall be two 2-½” hose connections 180 degrees apart and one 4-½” pumper connection. All nozzles shall be at the same elevation. Nozzle threads shall be National Standard Fire Hose coupling screw threads as described in Appendix A of AWWA C502, unless otherwise specified. Nozzles caps shall be provided with chains and gaskets. Nozzles caps shall have the same nut configuration as the hydrant-operating nut. Nozzle shall be reverse threaded into the upper barrel and mechanically locked in place.

E. Hydrant main valves shall be 5-¼” minimum and shall be of the full compression design, opening against and closing with the pressure. The main valve seat ring shall thread into a bronze sub-seat, and all gaskets sealing the seat ring shall be on a bronze-to-bronze seating surface. The seat ring threads shall not serve as pressure seal. The entire valve and rod assembly shall be removable by use of a small lightweight seat removal wrench.

F. The drain valves shall allow complete drainage of all residual water in the hydrant. The circumferential drain passage inside the hydrant shall be bronze on all surfaces. The draining system of the hydrant shall be bronze with a sliding bronze drain valve. Sliding drain valves made of rubber, plastic or leather shall not be allowed.

G. Hydrants shall be the breakaway types with a frangible groundline, and rod coupling designed to break upon traffic impact to prevent further damage to the hydrant and connecting pipe. The frangible coupling shall allow the upper section to be rotated to any desired position. Couplings which employ lug devices, or a breakaway barrel are not acceptable. Frangible bolts are not allowed.

H. Hydrant operating nuts shall be ductile iron and shall be pentagonal in shape, 1½” point to flat. The operating nut shall also
function as a weather shield. **HYDRANTS SHALL OPEN LEFT (COUNTER-CLOCKWISE).**

I. The operating mechanism shall utilize two (2) O-ring seals between the revolving nut and bronze-sheathed upper section of the valve rod. The top of the rod shall also be fitted with a travel stop nut to limit downward travel on the rod. All-weather grease shall be used to provide permanent lubrication. A thermoplastic or Teflon thrust ring shall be used to reduce friction while opening the hydrant.

J. The hydrant inlet shall have mechanical joint restraint which shall be accomplished by use of wedge action, self-actuating fittings.

K. The buried portion of the hydrant shall have a bituminous coating to comply with AWWA C116. All ferrous metal parts shall be coated to comply with AWWA C500. The bonnet and nozzle cap shall be given one shop coat of yellow color heavy duty alkyd enamel paint that complies with Federal Color No. 13538 Specifications. The remaining above ground portion of the fire hydrant shall also be shop painted chrome yellow.

432.09 Valve Boxes

All buried valves shall be provided with a valve box. Valve boxes shall be gray cast iron, ASTM A48, three (3) piece adjustable screw boxes with a round or oval base and a five and one-fourth (5-¼) inch screw-type shaft suitable for depth of cover as required. Box lids shall be marked “Water”.

All valves set at greater than normal depth shall have an extension stem provided and installed with the valve box so that the valve may be operated with a standard seven (7) foot valve key. A valve operating nut at six (6) feet or greater below final grade shall have an extension stem provided to bring the operating nut to a depth of four (4) feet below final grade. Coatings shall comply with AWWA C116. Boxes shall be Tyler Pipe screw-type cast iron valve box assembly Series 6860, or an approved equal.

Reuse valve boxes shall be model number 3TCIDEN by Castings Inc., or an equal approved by the DPW Director / Elbert County Engineer. The lid shall be triangular with a purple finish and shall be marked “NON-POTABLE WATER”.

432.10 Air Release and Vacuum Relief Valves

All combination air release and vacuum relief valves shall comply with AWWA C512. The large orifice of combination air valves shall allow air to escape during pipeline filling and to enter during drainage of the pipeline.
The valve shall consist of a body, cover, baffle, float and seat. The float shall be stainless steel designed to withstand a maximum pressure of 1,000 psi. All materials shall comply with ASTM A126 and ASTM A240.

Air release and vacuum relief valves shall be installed in a vault in accordance with the Detail Drawings. Galvanized piping or fittings shall not be allowed.

432.11 Irrigation Flow Control Valves

Reuse water service lines shall be equipped with a flow control valve to limit flow to the maximum rate approved by Elbert County. Flow control valves shall be OCV Control Valves, “Rate of Flow Valve Series 120 G” or “Cla-Val Co Model 49-01”. If the design rate of flow exceeds a maximum ratio of 4:1, an OCV Series 120 G-4 flow control valve shall be used.

The flow control valve shall be installed with the meter in a common vault in accordance with the Detail Drawings.

432.12 Blow-off and Drain Assemblies

The temporary blow-off shall be through a two-inch (2) ball valve with a two-inch (2) gate valve operating nut, box, piping and cover. Unless otherwise approved in writing by the DPW Director / Elbert County Engineer, all piping shall be threaded copper and valves shall be brass. Galvanized piping and fittings are not allowed. Refer to the Detail Drawings.

Permanent six (6) inch drains for potable waterlines shall be approved in writing by the DPW Director / Elbert County Engineer and shall be constructed in accordance with the Detail Drawings. Six (6) inch blow-offs for non-potable waterline flushing shall be constructed at all dead-ends and at other points deemed necessary by Elbert County.

432.13 Vaults

Vaults may be precast or cast-in-place and shall be constructed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Precast vaults shall be designed so that all joints and corners are waterproof. Precast and cast-in-place vaults shall be made waterproof after construction by use of sealants, epoxies, or other approved methods.

The vault roof shall be designed to support the overhead fill, any surcharge and an H-20 traffic loading. Where the cover over the roof is less than two and one-half (2-½) feet or more than five (5) feet, a cast-in-place vault is required.
Cast-in-place meter vaults shall be in accordance with the Detail Drawings and shall be constructed of CDOT Class B concrete with steel reinforcement in accordance with the CDOT M&S STANDARDS.

432.14 Manholes

Refer to Section 532.04 Manholes and Section 532.07 Cast and Ductile Iron Fittings of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Lids shall be furnished with the word “WATER” cast on top.

432.15 Manhole Base Slabs and Base Beams

Refer to Section 532.05 Manhole Bases and Base Beams of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

432.16 Sump Pits for Vaults and Manholes

Sumps with a gravity drain line or sump pump are required for vaults or manholes in areas where there is groundwater present and in all telemetry equipment and pressure regulating valve manholes and vault installations. Refer to the Detail Drawings.

432.17 Vent Pipes

Vent pipes shall be used in all vaults and manholes to allow gases to escape. Installations that contain electrical equipment shall have a blower attached to the vent system. Vent pipes shall be field located at the nearest intersection of the street property line and the side lot line. Refer to the Detail Drawings.

Above ground vent pipe shall be six and five-eighths (6-5/8) inch O.D. galvanized steel pipe, Grade 40 that complies with ASTM A53. The vent screen shall be three-fourths (¾) inch No. 9-11 flattened, expanded galvanized metal screen. Below ground vent pipe shall be six (6) inch, schedule 40 PVC with glued joints. A PVC glued joint by standard pipe thread female adapter shall be used to connect the steel pipe to the PVC pipe at ground level.

432.18 Corrosion Protection Systems

When soil resistivity is less than two thousand five hundred (2,500) ohm-centimeters (OHM-CM), but greater than one thousand (1,000) OHM-CM, ductile iron pipe and fittings may be used but the ductile iron materials shall be protected against corrosion.

Methods to provide corrosion protection of integral metallic parts of the water transmission system are as follows:
A. **Corrosion Resistant T-head Bolts and Nuts** shall be 45,000 psi minimum steel with a fluoropolymer coating and shall be either “Cor-Blue” by NSS Industries or “Blue Bolt” by Birmingham Fasteners.

B. **Ductile Iron Pipe** shall be furnished from manufacturer with cement mortar lining and bituminous coating. Pipe shall be double wrapped with polyethylene wrap and taped at each end.

C. **Butterfly and Gate Valves** shall be furnished from manufacturer with a coating equal to or exceeding AWWA C550. Bolts and nuts shall either be epoxy or fluoropolymer coated. Valves shall be double wrapped with polyethylene and taped at each end.

D. **Mechanical Joint Tees, Bends, Caps, Plugs and all other fittings** shall be furnished from manufacturer with cement mortar lining and bituminous coating. T-head bolts and nuts shall be corrosion resistant. Fittings shall be double wrapped with polyethylene and taped at each end.

E. **Mechanical Joint Restraint** (Wedge action, self-actuating, such as Megalugs) for ductile iron pipe shall be furnished from manufacturer with a bituminous coating. Mechanical joint restraint for PVC pipe shall be furnished from the manufacturer with red primer coat. T-head bolts and nuts shall be corrosion resistant. Mechanical joint restraint shall be double wrapped with polyethylene and taped at each end.

F. **Polyethylene Wrap** shall be eight (8)-mil minimum, close-laminated wrap and shall comply with the Denver Water Board Specifications Section MS-13.

G. **Damage to Epoxy and/or Other Material Coatings** shall be repaired and inspected prior to installation.

H. **Polyethylene Wrapping and Taping** shall be inspected by an Elbert County Inspector/Representative prior to backfilling.

I. **Record Documents** shall provide coordinate locations of all metallic items, including but not limited to pipe, valves and fittings to “GPS backpack” accuracy. Refer to Section 200.00 Acceptance Procedures of these CONSTRUCTION STANDARDS & SPECIFICATIONS for more information.

J. **Cathodic Protection for Steel Casings** shall be protected from corrosion by a galvanic anode cathodic protection system when directed by the Road & Bridge Superintendent / Elbert County Engineer. The galvanic anode cathodic protection system shall be comprised of two test stations placed at each end of each steel sleeve that shall connect galvanic anodes to the sleeve.

The cathodic protection system shall be designed by a Colorado Licensed Professional Engineer, accredited by the National Association of Corrosion Engineers. Installation shall be performed under the direction of a licensed Professional Engineer who is accredited by the National Association of Corrosion Engineers.
Engineers. Each cathodic protection system shall be tested under the direction of a Colorado Licensed Professional Engineer who is accredited by the National Association of Corrosion Engineers. A final, colored report on the installation and testing/monitoring procedures shall be prepared by a Colorado Licensed Professional Engineer who is accredited by the National Association of Corrosion Engineers and submitted to Elbert County.

Metallic reuse pipe shall be electrically insulated at its connection to the transmission main. New runs of metallic pipe shall be designed for electrical continuity throughout the run but shall be electrically insulated at connections with other pipelines. Bonding of joints shall be required. Ductile iron and steel pipelines shall be cathodically protected using the passive anode system.

Cathodic protection test stations shall be provided and shall be shown on the approved construction drawings.

432.18.01 Insulators

For metallic pipe, insulators shall be installed at the outlet end of the corporation stop. Insulators shall be Ford Service Insulators or an approved equal for water service lines and shall be installed in accordance with the Detail Drawings.

Refer to Denver Water Board Specifications Sections MS-21 and MS-22 for other insulators that may be required. Refer to Sections MS-27 and DD-9 for insulators for mechanical joint systems. Refer to the Detail Drawings.

432.18.02 Tape

The polyethylene seams and overlaps shall be wrapped and held in place by means of two-inch wide plastic-backed adhesive tape. The tape shall be Polyken #900 (polyethylene), Scotchrap #50 (polyvinyl) or equal. The tape shall have adhesive that shall bond securely to both metal surfaces and polyethylene film.

432.19 Tracer Wire and Warning Tape

A No. 6 AWG solid, uninsulated copper wire shall be attached to all pipes, including at least one carrier pipe inside a casing pipe, for the purpose of future location. If tracer wire is not attached to a carrier pipe, it may be cad-welded to both ends of a casing pipe and terminated in test stations within ten (10) horizontal feet from the ends of the casing pipe. Bundy KS17 copper split connectors, or equal, shall be used. Tracer wire shall be run along each fire hydrant assembly and brought to the surface in a test station located behind the fire hydrant. No tracer wire shall be allowed in valve boxes. Test stations shall
be CP Test Services, Glenn Series Glenn-4 with locking lid, 3 ½” x 4”, or approved equal. A qualified tester shall verify continuity of tracer wire and a report shall be submitted to Elbert County with other Record Documents.

**UNINTERRUPTED CONTINUITY IS A REQUIREMENT FOR CONSTRUCTION ACCEPTANCE.**

All pipelines shall have a six (6) inch wide, detectable, magnetic warning tape installed twelve (12) to eighteen (18) inches above all pipe, on top of the bedding, for the purpose of warning of location of buried pipeline. For potable and raw waterlines, the marker tape shall be blue in color with black lettering in a continuously repeating pattern with the words “CAUTION WATER LINE BELOW”. For non-potable (reuse) waterlines, the marker tape shall be purple in color with black lettering in a continuously repeating pattern with the words “CAUTION RECLAIMED WATER LINE BELOW”.

432.20 Bedding Materials

Bedding materials shall comply with Section 353.00 Bedding for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

432.21 Concrete

All concrete shall comply with Section 800 CONCRETE MIX DESIGN AND CONSTRUCTION of these CONSTRUCTION STANDARDS & SPECIFICATIONS for Portland cement concrete construction.

432.22 Plastic Liner Pipe (Sliplining)

Water main sliplining materials shall comply with Section 532.09 In-Place Rehabilitation of Existing Pipelines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

432.23 Steel Casings for Bores

Steel casing pipe shall comply with Section 532.10 Steel Casings for Bores of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

433.00 Installation

433.01 General

All work shall comply with AWWA C600, AWWA C605, and to the pipe manufacturer’s installation instructions, except as modified by these specifications.
433.02 Alignment and Grade

Field parties, under the supervision of a Colorado Licensed Professional Land Surveyor or Professional Engineer, shall determine alignment and grade of the pipe and the location of fittings, valves, and hydrants. The required minimum depth of cover between the top of the pipe barrel and the finished street grade is four (4) feet - six (6) inches. The waterline shall be installed to the required lines and grades with fittings, valves, and hydrants at the required locations. Record Documents of waterline alignment, verified by a Professional Licensed Surveyor or a Professional Engineer, shall be furnished to the DPW Director / Elbert County Engineer to comply with Section 200.00 ACCEPTANCE PROCEDURE of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Refer to Section 516.00 Relation to Waterlines for additional requirements.

433.03 Protection of Existing Underground Utilities

The Contractor shall be held responsible for the protection of public improvements as stated in Section 141.00 Protection of Public, Private and Utility Interests of these CONSTRUCTION STANDARDS & SPECIFICATIONS. It shall be the Contractor's responsibility to replace all damaged public improvements at his own expense.

433.04 Interruption of Services

Interruption of services shall comply with Section 141.04 Interruption of Services of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

433.05 Pipe Installation

Proper equipment, tools and facilities shall be provided and used by the Contractor for safe and efficient performance of the work. All pipe, fittings, valves, and hydrants shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials and to protect coatings and linings. Under no circumstances shall pipe or fittings be dropped or dumped into the trench. Any pipe or fittings that are dropped or dumped shall be removed from the work site and shall not be used.

When buried, all ductile iron pipe fittings and appurtenances shall be protected with thick polyethylene wrap. Miscellaneous steel or other ferrous pipe for blow-offs, etc., shall be similarly protected. Refer to Section 200.00 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS for survey requirements for Record Documents of waterlines.

The Elbert County Inspector/Representative shall be notified at least one working day (twenty-four [24] hours) in advance of when pipe is to be installed in any
trench. No pipe shall be covered until an Elbert County Inspector/Representative has inspected the installation.

Refer to Section 516.00 Relation to Waterlines for additional requirements.

433.06 Thrust Blocking, Restrained Joints and Fittings

Thrust blocks and mechanical joint restraints shall be used at all valves, bends, fittings with mechanical connections and dead ends in accordance with the Detail Drawings. For high pressure or special circumstances, alternative restraint systems may be considered. Alternative restraint systems shall be approved by the DPW Director / Elbert County Engineer.

The length of restrained pipe (L) in the table shown in the Length of Restrained Pipe Detail Drawing is measured from the centerline of the fitting or valve and refers to the amount of pipe which shall be restrained. Mechanical joint restraint (wedge action, self-actuating, such as Megalugs) shall be used at all valves, bends, fittings with mechanical connections and dead ends. Tie rods shall not be used. The table shall also be used for the length of mechanical joint restraint. Restraints shall be protected to comply with Section 432.18 Corrosion Protection Systems of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Crosses shall be restrained in all applicable directions, and twelve (12) inch and smaller in-line valves and tees shall have mechanical joint restraint on each side of the fitting or valve.

Thrust blocking shall be in accordance with the Detail Drawings. Care shall be taken to not block outlets, cover bolts, nuts, clamps or other fittings, and to ensure they are accessible. A bond breaker shall be placed between the pipe and the thrust block to aid in future removal. The thrust block shall bear against undisturbed earth.

Forming for thrust blocks and anchors may be bulk-heading around the shape of the thrust block or anchor with wood, burlap, or reinforced paper sacks filled with sand or earth. Wood forms shall be removed before backfilling. Newly placed thrust blocks shall be allowed to set undisturbed for a minimum of twenty-four (24) hours prior to any backfilling, tamping or compaction, unless otherwise approved by the DPW Director / Elbert County Engineer.

433.07 Setting Valves and Fire Hydrants

Hydrant runs shall not contain bends unless approved by the Road & Bridge Superintendent / Elbert County Engineer. Valve boxes shall not be installed in curb and gutter, sidewalk or crossspans.
Each hydrant shall have a six (6) inch gate valve on the hydrant run and shall be connected to the main by a six (6) inch ductile iron, polyethylene wrapped pipe. The valve shall be anchored to the swivel tee.

Hydrants shall be set with the bury line at the established finished grade. Hose nozzles shall be set parallel to the curb with the pumper nozzle facing the curb. Hydrants shall be located at least eighteen (18) inches from center of hydrant to back of curb or sidewalk. If a riser is required, a break-away coupling shall be installed two (2) to four (4) inches above grade.

Valves shall be provided with valve boxes centered and plumb over the operating nut of the valve. The boxes shall be supported to prevent any shock or stress from being transmitted to the valve. All valves shall be installed using a valve box adaptor to ensure proper centering of the valve box during backfill and to maintain valve box location. Valve boxes shall be maintained in this position during backfill. Valve box covers shall be set below the subgrade level to prevent damage during street construction and later adjusted to grade at the time of paving. If the top of the valve-operating nut is greater than six (6) feet below finished grade, a valve nut extension shall be installed to bring the operating nut up to four (4) feet below finished grade.

Hydrants shall include a drainage pit with nine (9) square feet of surface area and two (2) feet of depth below the barrel of the inlet. Pits shall be backfilled with one and one-half (1-½) inch, washed, crushed rock to a level six (6) inches above the barrel drain hole. A concrete thrust block shall be placed at the bowl of each hydrant in accordance with the Detail Drawings to prevent obstruction of the barrel drain hole.

433.08 Plastic Liner Pipe (Slip-lining)

Installation of plastic liner pipe shall comply with Section 533.09 In-Place Rehabilitation of Existing Pipelines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

433.09 Steel Casing and Carrier Pipe Installation

Installation of steel casing and carrier pipe shall comply with Section 533.10 Steel Casing and Carrier Pipe Installation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Tracer wire shall be taped to the carrier pipe before installation of carrier pipe supports and installed in the steel casing along with the carrier pipe. A test station, similar to those required at fire hydrants, shall be installed for the tracer wire in Elbert County R.O.W. near each end of the steel casing pipe. If tracer wire becomes discontinuous during installation of carrier pipe into casing pipe, tracer wire shall be welded to each end of the casing, with written approval of
Elbert County. Uninterrupted continuity shall be tested in accordance with the requirements of Section 432.19 Tracer Wire and Warning Tape of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

433.10 Cathodic Protection Test Stations

Underground pipeline test stations shall be installed at locations shown on the approved plans and in accordance with the Detail Drawings.

433.11 Plugging of Dead Ends

Temporary dead ends shall be installed with standard plugs or caps. Temporary dead ends shall be provided with blow-offs or fire hydrants, as required by the DPW Director / Elbert County Engineer. Permanent dead ends shall be provided with fire hydrants and valves. All temporary dead ends in undeveloped lots and open lands shall be marked with a blue post.

433.12 Filling and Venting the Line

The line shall be slowly filled with water and all air expelled from the pipe. Care shall be taken that all available hydrants (including hydrant gate valves), air relief valves, and other vents are open during the filling of the line. Where hydrants or other vents are not available in the line, the Contractor shall use a temporary two (2) inch blow-off for venting purposes. The rate of filling the line shall not exceed the venting capacity.

433.13 Disinfection and Flushing of Water Lines

Disinfection and flushing shall be performed in accordance with the requirements of the Colorado Department of Public Health and Environment and shall comply with AWWA C651.

The chlorine solution shall be retained in the water line for at least twenty-four (24) hours. A free chlorine residual at all hydrants and blow-offs shall be at least twenty-five (25) parts per million (ppm) at the end of the twenty-four (24) hour period. If the test is unsatisfactory, disinfection shall be repeated until a twenty-five (25) ppm free chlorine residual is obtained.

When cutting into or repairing an existing water line, disinfection and flushing shall comply with AWWA C651.

Following chlorination, the water line shall be flushed through all hydrants and blow-offs until the water runs clear with no chlorine residual in excess of that carried in the existing system. As a minimum, the total volume of the water line being tested shall be flushed. **THE CONTRACTOR SHALL BE RESPONSIBLE FOR METERING AND PAYING ELBERT COUNTY / APPLICABLE METRO DISTRICT FOR WATER USED FOR FLUSHING.**
The Contractor shall take all necessary precautions to prevent the flow of strong chlorine solution into existing water facilities and shall be responsible for damages done by heavily chlorinated water. No water lines shall be placed in service or tapped until a written release is obtained from the DPW Director / Elbert County Engineer. Sodium thiosulfate shall be used when flushing water on the ground and to waterways that do not contain fish. Vita-D-Chlor Neutral, or approved equal, shall be used when flushing to waterways with fish.

The line shall be visually inspected for turbidity. If the inspection is unsatisfactory, the line shall be flushed again. If the turbidity test fails a second time, the line shall be re-chlorinated and then re-flushed.

A twenty-four (24) hour bacteriological test for total coliform bacteria shall be performed by Elbert County. If the test is unsatisfactory, the line shall be flushed again. If the bacteriological test fails a second time, the line shall be re-chlorinated, re-flushed and re-tested.

433.14 Leakage

Pressure and leakage tests shall be conducted to comply with AWWA C600 to a pressure of one hundred and fifty (150) pounds per square inch (psi) at the low point of the section being tested for the duration of two (2) hours. The maximum length of line to be tested shall be one thousand (1,000) feet. All joints shall be watertight within tolerances allowed by AWWA C600. Leakage in excess of tolerances shall be located and made watertight by the Contractor. Pressure and leakage tests shall not be conducted until the line has passed all required disinfection and bacteriological tests.

Reuse water systems with pressures greater than one hundred and fifty (150) pounds per square inch (psi) shall be tested to a pressure of two hundred (200) pounds per square inch (psi) at the low point of the section being tested for the duration of two (2) hours.

433.15 Concrete Vaults

Refer to Denver Water Board Specifications Section MS-26.

434.00 Inspections

Refer to Section 154.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Adequate inspections assure compliance to Elbert County requirements and are the basis for Elbert County’s recommendation that said improvements be accepted for maintenance and for release of performance guarantees. It is the responsibility of the
Contractor to contact the DPW Director / Elbert County Engineer a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required inspections shall include:

A. Stockpiled Materials – Verify that materials meet CONSTRUCTION STANDARDS & SPECIFICATIONS and approved submittals, including but not limited to bedding material, pipe, fittings, valves, valve boxes and fire hydrants.

B. Excavation – Verify proper trench depths, shoring, spoil pile location, dewatering, and location and protection of existing utilities.

C. Installation – Verify proper bedding depth, alignment and grade, clean pipe and lubricants. Check that chlorine tablets are affixed to the inside of pipe and verify “slicing in” of bedding at haunches. Tracer wire is securely attached to the TOP of pipe, metallic fittings are wrapped with polyethylene, fittings have corrosion resistant bolts and nuts, and fire hydrants have proper drainage rock. Reuse waterlines shall be purple in color or have purple plastic wrap and warning tape.

D. Thrust Blocks and Restraints – Verify proper size of concrete thrust blocks and adequate bond breaker, and proper torque of bolts for mechanical restraints.

E. Backfill and Compaction – Verify proper methods of backfill and compaction, depths of lifts, moisture control, and backfill material free of large rock, organic or frozen material.

F. Loading and Testing – Verify that loading and testing methods adhere to these CONSTRUCTION STANDARDS & SPECIFICATIONS. Load line, wait at least twenty-four (24) hours, test for high chlorine residual, flush, test for reduced chlorine residual and wait at least twenty-four (24) hours. The bacteriological (“clear water”) sample shall pass prior to pressure testing in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

G. Tie In – After successful testing, tie in dead end to loop the system.

H. Service Taps – Verify proper tapping procedures. For direct taps, line is under pressure. For saddle taps, torque on the saddle is checked. Verify that there are no leaks at the corporation stop and the coupon has been removed. Verify copper service line has proper goose neck, the service line runs correctly to the yoke at the meter pit, and the water is on at the meter pit.

I. Construction Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:

1. All temporary structures, debris, mud and waste materials shall be removed from public property.
2. All relative testing certifications and documentation shall be submitted to Elbert County. Include all compaction tests. Copies of originals are acceptable.

3. All curb stop boxes are raised to grade and checked for valve accessibility.

4. All water services shall be marked with a “V” by saw cutting into the face of the curb where the service extends into the property.

5. All water valve boxes are at construction grade, straight and cleaned out to check for access to valve nut and ability to get a valve key on the nut and operate the valve. Verify that all valves that should be open are open. Tracer wire test stations shall be accessible.

6. All fire hydrants shall be checked for ability to be pressurized.

J. Final Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:

1. Each water valve box shall be cleaned out to check for access to valve nut and the ability to get a valve key on the nut and operate the valve. All valves that should be open are open. Tracer wire test stations shall be accessible.

2. All fire hydrants shall be checked for ability to be pressurized.

440.00  WATER SERVICE LINE CONSTRUCTION

441.00  General

All water service line locations shall be marked on the face of the curb by saw cutting a “V” symbol where services cross under the curb. Water service lines shall be in a separate trench, except as approved by the DPW Director or Designee, and shall be a minimum of ten (10) horizontal feet from sewer service lines. Water service lines shall be a minimum of eighteen (18) vertical inches above any sanitary sewer crossing. All water service lines shall be stubbed into the lot either ten (10) feet beyond the back of the sidewalk or curb or five (5) feet beyond any utility easement, whichever is greater, and shall be marked at the end of the water service with a wood 2x4 painted blue.

The water service line at the curb stop shall be no deeper than five (5) feet - six (6) inches. Water service lines shall be a minimum of two (2) feet inside the property line and shall not be located under a driveway unless approved by the DPW Director / Elbert County Engineer.

441.01  Excavation
All excavation shall comply with Section 342.00 Excavation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

442.00 Equipment and Materials

442.01 Water Service Lines

Water service lines shall be sized to adequately supply the requirements of the property being served. The minimum size line shall be three-fourths (¾) inch. The acceptable material for a three-quarter (¾) inch to two (2) inch service line is seamless copper tube. Three (3) inch and greater diameter service lines may be ductile iron pipe or PVC pressure pipe. High density polyethylene pipe may be an acceptable material for water service lines installed between water meters and private structures, at the discretion of the DPW Director / Elbert County Engineer. All service pipes shall conform to one of the following specifications:

A. Seamless copper tube designated as “Type K” (soft) shall be used for service lines three-fourths (3/4) inch through three (3) inches.

B. Ductile Iron Pipe or PVC pressure pipe complying with Denver Water Board Specifications may be used for three (3) inch service lines and shall be used for all service lines larger than three (3) inches.

C. High Density Polyethylene Pipe shall be PE 3408 (DR-11) with a minimum pressure rating of one hundred sixty (160) psi. PE 3408 may be used for service lines that are three-fourths (¾) inch through three (3) inches in diameter and between a water meter and a private structure, as approved by the DPW Director / Elbert County Engineer. All pipe, fittings and joints shall comply with sections 605 and 605.20 of the International Plumbing Code.

Water service lines shall be of the same type material from beginning to end, unless the appropriate insulator is installed at the junctions of dissimilar metals and unless approved by the Road & Bridge Superintendent / Elbert County Engineer.

442.02 Water Service Saddles

Water service saddles shall be required for all AWWA C909 PVC waterlines for water service taps and may be required on other PVC piping as determined by the DPW Director / Elbert County Engineer. Service saddles shall be brass or bronze and shall comply with AWWA C800.

442.03 Meters
All meters shall be purchased from applicable Metro District and shall be installed, owned and maintained by the applicable Metro District. All single-family residential meters shall be size 5/8” x ¾”, unless otherwise approved by the DPW Director / Elbert County Engineer. No meter shall be installed until the DPW Director / Elbert County Engineer has approved the proposed installation. Permanent water meters shall be installed prior to issue of the Certificate of Occupancy.

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442.05  (Left Blank Intentionally)

442.06  Outside Meter Settings

All outside meters shall be installed in a horizontal position and housed in a manhole or vault in accordance with the Detail Drawings. The installation of the water meter shall comply with the following unless otherwise approved by the DPW Director / Elbert County Engineer:

A. All meters not installed within the right-of-way shall require an easement dedication ten (10) feet wide and extending three (3) feet behind the meter.

B. The meter shall be installed in a pit, manhole or vault which shall allow free and easy access and adequate room for installation, inspection and maintenance, and shall provide protection from freezing.

C. All fittings shall be brass or copper.

D. A pressure regulator (Watts 25 AUB or equivalent) shall be installed on all water services before the meter is installed.

E. A ball or gate valve shall be installed where the water service line enters the building and the meter is installed.

442.07  Inside Meter Setting and Remote Readers

**INSIDE METERS SHALL ONLY BE USED WITH SPECIAL APPROVAL BY THE DPE DIRECTOR / ELBERT COUNTY ENGINEER.** All inside meter settings shall be installed in a manner which shall allow free and easy access and adequate room for installation, inspection and maintenance, and shall provide protection from freezing. Meters installed inside buildings shall not be more than eighteen (18) inches from the wall through which the water service line enters the building, unless otherwise approved in writing by the DPW Director / Elbert County Engineer.

Inside meter settings shall not be allowed in crawlspaces, closets or other places where free and easy access is not provided. Meter sizes one and one-half (1½)
inch and two (2) inch installed inside buildings shall be provided with a floor drain. Refer to the Detail Drawings. Installation shall conform to the following:

A. The meter setting shall be installed in the basement, a utility closet, or similar area, which shall allow free and easy access and adequate room for installation, inspection, and maintenance.

B. The meter yoke shall be a minimum of twelve (12) inches and a maximum of four (4) feet above floor level in a horizontal position and have a minimum of twelve (12) inches clearance from all surrounding obstructions.

C. A ball or gate valve shall be installed on both the upstream and downstream side of the water meter.

D. A pressure regulator, adjustable from twenty-five (25) to seventy-five (75) psi shall be installed between the meter yoke and downstream valve. The regulator shall be a Watts Model 25AUB or equivalent unless otherwise approved in writing by the DPW Director / Elbert County Engineer.

E. All fittings shall be brass or copper.

442.08 Meter Bypass Line

A bypass line shall be required for all one and one-half (1 ½) inch and larger meters, unless otherwise approved by the DPW Director / Elbert County Engineer, whether installed in an outside or inside setting. Bypass lines shall contain an independent control valve and shall not contain tees, plugs or other outlets, and shall be in accordance with the Detail Drawings. A bypass line may be required on services smaller than one and one-half (1½) inch if deemed necessary by the DPW Director / Elbert County Engineer.

442.09 Meter Check Valves

Check valves shall be required on meters where any condition exists that could cause water to flow from the property to the main.

442.10 Valves for Use with Meters

1. Gate valves three (3) inches and smaller for copper water service lines shall be brass, with non-rising stems and solid wedge disc, manufactured in accordance with ASTM B62, 125 WSP, 200 PSI WOG. Gate valves shall comply with AWWA C800 and shall be in accordance with the Detail Drawings.

Valves larger than three (3) inches for use with ductile iron water service lines shall be gate valves with cast iron bodies. All gate valves larger than three (3) inches shall be supported by adjustable steel valve supports.
442.11 Meter Couplings

All meters one and one-half (1½) inch and larger shall be installed with a coupling to allow for the removal of the meter without disturbing the pipe. Couplings shall comply with Denver Water Board Specifications Section MS-22.

442.12 Meter Yokes (Copper Setters)

Meter Yokes (Copper Setters) shall be Ford Series 80, McDonald Series 31, Cambridge Series 6040 or Mueller Series P-2474 with an angle ball valve and a padlock wing on the inlet side of meter. Water service connections shall be compression fittings, with a “110”, “Cam Pack”, or “Mac Pack” type fitting and shall be vertical.

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442.14 (Left Blank Intentionally)

442.15 Meter Pits and Covers

Meter pits for five-eighths (5/8) inch meters shall be twenty (20) inches in diameter and forty-eight (48) inches deep and shall comply with ASTM D1505 and D746 and Denver Water Board Specifications. Meter pit covers shall be tight fitting with double lids for frost protection. Meter pit covers and domes shall have non-metallic, cap-type top lids, and the inner lids shall be plastic, aluminum or rubber. Aluminum shall have a polymer coating such as an epoxy. Meter pits and covers shall comply with Denver Water Board Specifications Section MS-23 and shall be in accordance with the Detail Drawings. Placement of meter pits shall be a maximum of five (5) feet from the front property line. Meters not located in the right-of-way shall require an easement dedication ten (10) feet wide and extending three (3) feet behind the meter.

442.16 Corporation Stops

Corporation stops provide the connection for the water service line to the waterline. Services shall be a minimum of eighteen (18) inches from all pipe joints, fittings and valves. Corporation stops are also required in air and vacuum valve and large butterfly valve installations. Corporation stops are available in standard sizes ¾”, 1”, 1½” and 2”. Refer to the Detail Drawings and Denver Water Board Specifications Section MS-21. Tapered threads other than the inlet thread of corporation valves shall comply with ANSI/ASME B1.20.1. Two spiral wraps of three (3) mil PTFE (Teflon) tape shall be wrapped clockwise around the inlet threads on the closed corporation stops. Liquid sealants or other lubricants shall not be used.

442.17 Curb Stops
Curb stops are required for meters one and one-half (1 ½) inch and larger. Curb stops are set on the service line on the inlet side of the meter pit and provide a means to shut off the service line. Placement of the curb stop and stop box can vary from a maximum of five (5) feet outside the front property line to a maximum of five (5) feet inside the front property line. Curb stops shall be buried a minimum of four (4) feet – six (6) inches and a maximum of five (5) feet – six (6) inches. Placement of the curb stop and stop box outside the front property line is preferred. Refer to the Detail Drawings and Denver Water Board Specifications Sections MS-21 and MS-23. Curb stops shall not be installed under concrete or asphalt unless approved by the DPW Director / Elbert County Engineer and shall have a traffic approved curb box.

442.18 Curb Stop Service Boxes

Curb stop service boxes shall be cast iron, Buffalo type. The bottom part shaped like an inverted “U” straddling the service line, shall have a flanged bottom so as to support itself. Curb stop service boxes shall comply with Denver Water Board Specifications Section MS-22. Curb stop boxes shall be to grade and be accessible at the time of meter installation.

442.19 Brass Fitting Couplings

Couplings for brass fittings may be flared or compression.

442.20 Backflow Preventers

Backflow preventers shall be installed on all commercial water service lines on all residential water service lines that serve more than two units.

443.00 Tapping the Main

ALL TAPS SHALL BE WET TAPS. SHUT DOWN OF ANY PORTION OF THE WATER SYSTEM SHALL ONLY BE ALLOWED WHEN UNCONTROLLED CIRCUMSTANCES DO NOT PERMIT A WET TAP. ANY SHUT DOWN OF THE WATER SYSTEM MUST BE APPROVED IN WRITING BY THE DPW DIRECTOR / ELBERT COUNTY ENGINEER. TAPPING OF AWWA C905 PIPE SHALL BE MADE WITH A TAPPING SADDLE.

450.00 PUMPING FACILITIES

451.00 General
In locations where the applicable Metro District water distribution system may not be capable of providing adequate water pressure, Elbert County may require the construction of a pumping facility to provide proper service. Elbert County may not approve the installation of a pumping facility where, in the opinion of the DPW Director / Elbert County Engineer, such installation would be injurious to the operation, or future operation, of the water system. The Developer shall provide the DPW Director / Elbert County Engineer with a set of design calculations and drawings for review and approval, as required under Section 160.00 PLANS AND SPECIFICATIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

The pumping facility shall comply with all requirements of the Colorado Department of Health and of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Elbert County shall require that the Developer prepare a set of mylar record document drawings and an electronic (AutoCAD) file of the pumping facility in accordance with Section 200.00 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Upon completion of the pumping facility, the Contractor shall also provide Elbert County with two (2) copies of an “Operation & Maintenance Manual” for the facility.

452.00 Design Criteria

452.01 Pumps and Pump Station

All pertinent portions of Denver Water Board Specifications Section 5.08 shall apply. Applicable portions of Denver Water Board Specifications Section 6.46 shall also be followed.

A STANDBY GENERATOR, CAPABLE OF OPERATING THE ENTIRE STATION, SHALL BE PROVIDED. THE GENERATOR MAY BE HOUSED INSIDE A SEPARATE ALL-WEATHER ENCLOSURE.

452.02 Controls and Supervisory Control and Data Acquisition (SCADA)

All new controls, telemetry equipment, and security equipment shall be compatible with and easily integrated into Elbert County’s system. All pertinent portions of Denver Water Board Specifications Section 5.12 shall apply.

452.03 Site Improvements

Refer to Section 562.04 Site Improvements of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

460.00 TRENCHING, BACKFILLING AND COMPACTING
Trenching, backfilling and compacting shall comply with Section 350.00 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

470.00 HEALTH AND SAFETY SIGNAGE

A sign reading “NON-POTABLE RECLAIMED WATER—NOT FOR DRINKING” shall be posted at all points where consumption of the water may be attractive to the public (yard hydrants, hose bibs, etc.), in areas of public use which receive reclaimed water and at all valves, control boxes and similar features. This requirement shall not apply to sprinkler heads. Signs reading “ATTENTION: IRRIGATED WITH RECLAIMED WASTEWATER. DO NOT DRINK FROM SPRINKLERS” shall be purchased and posted by the Developer at conspicuous locations in areas irrigated with reuse water. Where signage is not feasible (such as a valve box in a street), the above wording shall be engraved on brass tags riveted to the outside and inside of the component. A signage plan shall be submitted to Elbert County and approval for it obtained before connecting to the applicable metro District’s reuse or raw water system. These signage provisions apply to both new construction and cases where an existing irrigation waterline is connected to the applicable Metro District’s reuse or raw water system.

To the extent possible, reuse components such as valve box lids, valves, valve operators, control boxes, etc. shall be painted purple. Warning signs shall be not less than one-eighth (1/8) inch thick, two (2) inches high and four (4) inches wide. “WARNING” shall be in red letters and other lettering shall be in black. Letter size and font shall be as approved by Elbert County. Signs shall be attached by stainless steel chain.

Hose bibs and yard hydrant connections shall be coupling-type, (not threaded) to prevent use of common “garden” hose and possible cross-connections.

480.00 RESTORATION AND CLEANUP

Restoration and cleanup shall be completed in accordance with Section 370.00 RESTORATION AND CLEANUP of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
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501.00  GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

The governing Metro District or Homeowners Association shall own and maintain the Sanitary Sewer System and Facilities. Elbert County does not own or maintain any part of the Sanitary Sewer System.

510.00  DESIGN CRITERIA

511.00 General

All extensions of and/or additions to Metro District sewer systems within Elbert County shall comply with the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS for sewer main and service line construction.

512.00 Design Flow

The design flow shall include the entire area tributary to the outfall point. The following wastewater flow rates, which include infiltration, shall be used:

<table>
<thead>
<tr>
<th>User Type</th>
<th>Unit Wastewater Flow Rate</th>
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<tbody>
<tr>
<td>Residential</td>
<td>90 gallons/capita/day</td>
</tr>
<tr>
<td>Industrial</td>
<td>1,500 gallons/acre/day</td>
</tr>
<tr>
<td>Commercial</td>
<td>1,000 gallons/acre/day</td>
</tr>
<tr>
<td>Park/Recreation</td>
<td>50 gallons/acre/day</td>
</tr>
<tr>
<td>Elementary Schools</td>
<td>13 gallons/student/day</td>
</tr>
<tr>
<td>Jr. &amp; Sr. High Schools</td>
<td>20 gallons/student/day</td>
</tr>
</tbody>
</table>

Maximum residential population density, household density and land usage shall be as noted on an approved PUD and/or Plat, or as determined by the Elbert County Community and Development Services Director.

Wastewater flow peaking factors shall be computed using the following equation:

\[ PF = \frac{3.8}{(ADF)^{0.17}} \]

Where ADF = annual average daily flow in MGD
The peaking factor shall not be less than two and one-half (2.5) or greater than five (5.0).

513.00 Hydraulic Design

Sewers ten (10) inches in diameter and smaller shall carry the peak design flow at a maximum flow depth of eighty (80) percent of the pipe diameter. Sewer mains twelve (12) inches in diameter and larger may be designed to flow full at the peak design flow rate.

The minimum velocity at the peak design flow rate shall be two (2) feet per second. Where actual flow shall be considerably below the design flow for several years, the DPW Director Or designee may require that the minimum velocity be attained by suitable grades at the partial peak design flow rate. Maximum allowable velocity shall not exceed ten (10) feet per second at eighty (80) percent flow depth in the pipe.

Care shall be taken to design invert elevations at manholes in such a manner that the energy gradient is consistently falling in the direction of flow. In addition, when the velocity of an upstream sewer entering a manhole at peak flow is above critical velocity, the hydraulic gradient shall be computed to ensure that a surcharge shall not occur at a service connection, and that the energy gradient shall remain level across the manhole.

514.00 Design Details

514.01 Sewer Mains

Sanitary sewer mains shall be eight (8) inch diameter or larger. Service connections shall be four (4) inch diameter or larger. Six (6) inch diameter sewer mains may be installed under special conditions where no more than four (4) residential connections are to be made, if approved by the DPW Director or designee. The following minimum grades (based on a Manning’s formula n = 0.015) shall apply:

<table>
<thead>
<tr>
<th>Sewer Diameter (Inch)</th>
<th>Minimum Grade (Percent)</th>
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<tbody>
<tr>
<td>4</td>
<td>2.0 or 1/4 inch/foot</td>
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<tr>
<td>6</td>
<td>1.0 or 1/8 inch/foot</td>
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<tr>
<td>8</td>
<td>0.40</td>
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<tr>
<td>10</td>
<td>0.28</td>
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<td>12</td>
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<td>15</td>
<td>0.15</td>
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<tr>
<td>18</td>
<td>0.12</td>
</tr>
<tr>
<td>21 or larger</td>
<td>As approved by the Road &amp; Bridge Superintendent/Elbert County Engineer</td>
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</tbody>
</table>
When approved by the DPW Director or designee for specific areas, a Manning’s n = 0.011 may be used and the above grades adjusted accordingly to maintain a minimum velocity of two (2) feet per second.

Sewer mains shall ordinarily have a minimum of eight (8) feet of cover to finished ground surface. Sewer lines shall be designed to ensure a two (2) percent minimum slope from one (1) foot below the bottom of the lowest foundation to the sewer service connection. Where pipe has less than (4) feet of cover, provisions shall be made to protect the pipe from impact and loading.

Sewer mains shall be extended at least ten (10) feet uphill from the lowest lot corner of the uppermost lot to be served adjacent to the sewer main. Sewer mains shall terminate in a manhole. Service connections shall not be made at manholes, unless otherwise approved by the DPW Director or designee. All stub-outs for future extension of the sanitary sewer shall be terminated in a pre-cast manhole base.

514.02 Manholes

Manholes shall be a minimum of forty-eight (48) inches diameter, and shall be provided at every change in direction, grade and connection to other sewer mains. The maximum spacing shall be four hundred (400) feet for lines fifteen (15) inches diameter or smaller and five hundred (500) feet for lines eighteen (18) inches diameter or larger. Where two (2) or more pipes enter a manhole, the DPW Director or designee shall approve the manhole design size. Sewer lines shall not be deflected between manholes, in line or grade.

Manholes shall be forty-eight (48) inches diameter for lines eight (8) inches to fifteen (15) inches in diameter, sixty (60) inches for lines eighteen (18) inches to twenty-one (21) inches in diameter, and seventy-two (72) inches for lines twenty-four (24) inches to thirty (30) inches in diameter. Special designed vaults are required for pipes greater than thirty inches (> 30”) in diameter.

Where pipe slope is less than five (5) percent, the manhole flow channel shall have at least two-tenths (0.2) of a foot elevation drop from the entering pipe invert to the exiting pipe invert. Where pipe slope is greater than five (5) percent, the manhole flow channel shall match pipe slope. Where the difference in entering and exiting invert elevations is less than two (2) feet, the channel shall be sloped uniformly between the pipe inverts. Where there is greater than two (2) feet of difference between entering and exiting pipe invert elevations, a drop manhole shall be considered.
Drop Manholes. When design and function dictate a drop manhole, written permission shall be obtained from the DPW Director / Elbert County Engineer. The design and proposed materials shall be approved by the DPW Director or designee. *ELBERT COUNTY PREFERENCES THE USE OF AN OUTSIDE DROP.*

Inside Drop Manhole Bowl Systems. An inside drop manhole may be allowed in special circumstances. When the entering pipe diameter is less than fifteen (15) inches and moderate flows exist, an inside drop type system may be provided with a force line hood, and the manhole shall be a minimum of sixty (60) inches in diameter. When the entering pipe diameter is greater than fifteen (15) inches and moderate flows exist, or where odor and corrosion control are a concern, an inside drop vortex flow type system may be provided, and the manhole shall be sized accordingly. The use of an inside drop vortex flow type system requires written permission from the DPW Director or designee. The design, including proposed materials, shall comply with manufacturer’s specifications and must be approved by the DPW Director or designee.

The inside drop bowl system shall consist of a plastic composite collection device that facilitates the controlled drop of wastewater into the main stream flow of a sanitary sewer manhole. The bowl shall permit easy inspection and cleaning without the need to enter the structure. Stainless steel straps shall fully support the drop pipe. Drop ends shall be used to create a high-quality transition from drop pipe to the flow channel. The bowl shall be marine grade fiberglass. The clamping pipe supports shall be 304 stainless steel with 18-8 stainless nuts and bolts. Bowl size shall be determined by entering pipe size and flow rates. Bowl shall be installed in accordance with manufacturer’s instructions.

514.03 Service Connections

Wye or tee fittings shall be provided on the sewer main for service connections at each lot or building site shown on the plans. Fittings shall be angled upward so that the upper invert of one-eighth (1/8) bend connected to the fitting shall have an elevation equal to or higher than the inside crown of the sewer main. 6-inch clean-outs shall be installed at 75-foot intervals on all sanitary sewer services. Refer to Section 543.04 Service Stub-ins to Property Line of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

515.00 Location Details

Manholes shall be located a minimum of three (3) feet from the edge of gutter pans. Sanitary sewer mains installed in local or collector streets shall be located twelve (12) feet west or south of the centerline of the streets. Service connections shall not be permitted to cross an arterial street.
Where sewer mains are installed in easements, they shall ordinarily be located in the center of the easement, provided that manholes can be located to provide reasonable access for maintenance crews.

516.00 Relation to Waterlines

Sewer lines shall be located a minimum of ten (10) feet horizontally from existing or proposed waterlines (clear separation). Where sewer lines cross waterlines, the sewer line shall have a minimum of eighteen (18) inches clear separation below the waterline. If this clearance is not feasible, the crossing shall be designed and constructed so as to protect the waterline.

When minimum clearance is not feasible, minimum protection shall consist of the installation of an impervious and structural sewer. Sewer pipe shall be encased in reinforced concrete. The encasement shall be at least six (6) inches thick around the entire pipe. Extend concrete encasement a minimum distance of ten (10) feet on either side of the waterline and to a sewer pipe joint. Ensure that encasement concrete does not prevent deflection at the pipe joint. In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of the higher pipe. When minimum clearance is not feasible, the sanitary sewer pipe may be installed in a steel casing in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS if approved by the DPW Director or designee. The DPW Director or designee shall approve the crossing design.

517.00 Grease, Oil and Grit Interceptor Design and Installation

517.01 Grease Interceptors

Grease interceptors shall be required for all food preparation establishments which could contribute or cause to contribute—directly or indirectly—any water or wastewater which contains oil and grease, including but not limited to restaurants, cafeterias, cafes, and fast food establishments. Additionally, grease interceptors shall be required for all schools, fraternal organizations, churches, hospitals, and daycare centers which have the capability to engage in food preparation. The grease retaining capacity of each grease interceptor in pounds of grease shall be equal to twice the rate of flow capacity in gallons per minute of wastewater so that the interceptor shall remove and retain ninety (90) percent of the grease discharged into it up to its required capacity of accumulated grease.

Exceptions to the grease interceptor requirement shall be those facilities granted a written variance by the Industrial Pretreatment Program, following approval of the plan review process. Variances shall apply strictly to the named facility owner/operator located at the named facility address.
Each business establishment for which a grease interceptor is required shall have an interceptor that serves only that establishment. Design and construction of grease interceptors shall be in accordance with the Detail Drawings.

The design of oil and grease interceptors shall be constructed in accordance with the design approved by Elbert County and shall have a minimum of two (2) compartments with fittings designed for grease retention. The minimum size for any grease interceptor shall not be less than eight hundred (800) gallons.

There shall be an adequate number of manholes to provide access for cleaning all areas of an interceptor, and a minimum of one (1) per ten (10) feet of interceptor vault length. Manhole covers shall be gastight in construction and shall have a minimum opening dimension of twenty-four (24) inches. In addition, an effluent sampling box shall be provided on all grease interceptors. In areas where traffic may exist, the interceptor shall be designed to have adequate reinforcement and cover.

Each grease interceptor shall be easily accessible for inspection, cleaning, and removal of intercepted grease. The use of ladders and removal of bulky equipment shall result in violation of accessibility. The interceptor vault shall be located as close to the source as practical; however, it shall be outside the facility served. In no case shall a grease interceptor be installed in any part of a building where food is handled.

The owner and lessee shall be jointly responsible for cleaning of the interceptor. It shall be maintained in efficient operating condition by regular removal of accumulated grease and solids.

The removal of grease and solids shall be performed before the capacity of the interceptor is exceeded. The owner and/or lessee shall conduct, on a monthly basis, an inspection on each interceptor. Records of these inspections shall be kept on site for a minimum of three (3) years.

Abandoned grease interceptors shall be pumped and filled as required for abandoned sewers and sewage disposal facilities.

Existing sources not connected to grease interceptors and which contribute significant amounts of oil and grease shall be identified through inspection of the wastewater collection systems by Elbert County. Once these sources are identified, they shall be required to implement Best Management Practices Plans (BMPP’s) to keep oil and grease out of the wastewater collection system.

If the BMPP’s are not successful at the facility and the facility continues to contribute significant amounts of oil and grease to the wastewater collection system, as documented by field inspections, then the facility shall be required to
install an adequately sized grease interceptor as determined by the sizing criteria described below.

The sizing criteria for grease interceptors are as follows:

(Turn-Over Rate) x (Categorical Use Factor) x 2.5 (gallons of water) x (Seating Capacity)

The varying sizing applications are broken down into the following categories and formulas:

**Category A - Restaurants/Cafeterias**

Full or limited service with the capability to serve or prepare 100 meals per day.

**Plumbing fixtures:** one pot sink, one 2 or 3 compartment sink, one hand sink, one mop sink, one floor sink, one dishwasher, and one garbage disposal that is directed to the grease interceptor.

**Equipment:** one grill, one fryer, one to three ovens

**FORMULA:** 2.0 x 1.25 x 2.5 x Seating

For each additional garbage grinder and dishwasher that is to be directed to the Grease Interceptor there shall be a factor of 0.25 added to the Categorical Use Factor (C.U.F.) For each additional “Wok” stove, deep fryer and grill there shall be a factor of 0.50 added to the categorical factor.

**Category B - Hospitals, Schools, Institutions and Care Facilities**

**FORMULA:**

**Hospitals/Schools**

2.0 x .75 x 2.5 x bed usage or seating

**Institutions/Care facilities**

x 1.0 x 2.5 x seating or bed usage

These formulas shall be adjusted by the following when necessary:

A value of .25 shall be added to the Categorical Use Factor for each dishwasher or garbage disposal directed to the Grease Interceptor above the number of one each.

A value of .50 shall be added to the Categorical Use Factor for each additional deep fryer or grill above the number of one each.
Category C- Deli Stores and Super Markets with Meat Cutting Capabilities and/or Bakeries, Retail and Wholesale Bakery Facilities and Butcher Shops

**FORMULA:** \((\text{Hours of Operation}) \times 4.0 \times 10\)

For each of the following conditions a factor of .50 is to be added to the Categorical Use Factor value of 4.0 when dealing with meat cutting:

A. More than one floor drain.
B. Complete cooking of meats.

When dealing with retail types bakeries or Super Markets that have bakery facilities in addition to a deli and/or meat cutting, the bakery shall be sized separately using the same formula as above with the deletion of the .50 adjustment and instead an addition of 1.5 shall be added to the Categorical Use Factor when dealing with bakeries that are wholesale only or are of the industrial classification.

Category D-Food Courts or “Common” Interceptors

Each case shall be sized by separating each of the potential contributors into its own category then combining the operations for a total interceptor size.

Category E- Commissaries, Commercial Kitchens and Caterers

Each facility must be sized on an individual, case by case basis. However, it should be noted that the minimum acceptable size for a commercial kitchen shall be fifteen hundred (1,500) gallons.

Category F-Food Manufacturing Types

Each case is evaluated separately. Whenever a food manufacturing operation is evaluated, a control manhole shall be required in addition to the minimum of fifteen hundred (1,500) gallons.

**517.02 In-Floor and Under Sink Grease Traps – Requires Special Review**

Users may receive approvals to install an in-floor or under-the-sink grease trap for small volume facilities, provided that: 1) the grease trap is no more than fifty (50) gallons in liquid/operating capacity; 2) proper methods are implemented (e.g. absorb liquids into solid form and dispose into trash, collect grease in container and recycle, or contract a grease hauler) and 3) detailed records of these activities are maintained and are available for review upon request.

The size of the trap depends upon the number of fixtures connected to it. The following table provides criteria for sizing grease traps:
<table>
<thead>
<tr>
<th>Total number of fixtures connected</th>
<th>Required rate of flow, gpm</th>
<th>Grease retention capacity, lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>50</td>
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<td>3</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>100</td>
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</tbody>
</table>

517.03 Oil Separators and Sand/Grit Interceptors

At repair garages, car washing facilities with engine or undercarriage cleaning capability, and at factories where oily and flammable liquid waste are produced, all oil-bearing, grease-bearing, and flammable wastes shall be discharged to a separator before emptying in the building drainage system or other point of disposal.

Oil separators shall have a depth of not less than two (2) feet below the invert of the discharge drain. The outlet opening of the separator shall have not less than an eighteen (18) inch water seal.

Where automobiles are serviced, greased, repaired or washed or where gasoline is dispensed, oil separators shall have a minimum capacity of six (6) cubic feet for the first one-hundred (100) square feet of area to be drained, plus one (1) cubic foot for each additional one-hundred (100) square feet of area to be drained into the separator.

Parking garages in which servicing, repairing or washing is not conducted, and in which gasoline is not dispensed, shall still require a separator. Areas of commercial garages utilized only for storage of automobiles are required to be drained through a separator.

Sand/grit and similar interceptors for heavy solids shall be designed and located to provide ready access for cleaning and shall have a water seal of not less than six (6) inches.

Commercial laundries shall be equipped with an interceptor with a wire basket or similar device, removable for cleaning, that prevents passage into the drainage system of solids one-half (½) inch or larger in size, string, rags, buttons, or other materials detrimental to the public sewage system.

Bottling plants shall discharge process wastes into an interceptor that shall provide for the separation of broken glass or other solids before discharging waste into the drainage system.
Slaughter room and dressing room drains shall be equipped with approved separators. The separator shall prevent the discharge into the drainage system of feathers, entrails and other material that could cause clogging.

Separators shall be designed to not become air bound where tight covers are utilized. Each separator shall be vented where subject to loss of trap seal.

Access shall be provided to each separator for service and maintenance. Separators shall be maintained by periodic removal or accumulated grease, scum, oil, or other floating substances and solids deposited in the separator.

520.00 GENERAL PROVISIONS

521.00 General

All sanitary sewer main construction within the Metro District system and all sanitary sewer service line construction connecting to Metro District sewer mains shall comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS and the approved plans. These CONSTRUCTION STANDARDS & SPECIFICATIONS govern new sanitary sewer service line construction and repairs to existing facilities within Elbert County.

522.00 Permits Required

A Public/Private Improvements Permit (PPIP) shall not be issued until the DPW Director Or designee has approved the sanitary sewer line plans.

523.00 Maintenance of Traffic

When street cuts are required for sanitary sewer facilities construction, maintenance of traffic shall comply with Section 141.12 Traffic Control, Barricades and Warning Signs of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

530.00 SANITARY SEWER MAIN CONSTRUCTION

531.00 Site Work and Earthwork

531.01 General

Site work and earthwork shall comply with Section 300.00 SOILS AND EARTHWORK of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

531.02 Trenching, Backfilling and Compacting
Except where otherwise approved in writing by the DPW Director or designee, all existing arterial and collector streets shall have pipe installed by pushing or boring. Directional boring may be approved at the discretion of the DPW Director or designee.

Trenching backfill and compaction shall comply with Section 350.00 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

531.03 Preservation of Monuments

Refer to Section 141.00 Protection of Public, Private and Utility Interests of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

532.00 Materials

532.01 Sewer Pipe

Unless otherwise approved by the DPW Director or designee, all sewer pipe and fittings shall be Polyvinyl Chloride (PVC) and shall comply with ASTM D3034 or F679 (SDR 35), or ASTM F794 and F949 for profile wall pipe. All pipe and fittings shall be subject to inspection by Elbert County. All joints shall be factory prepared compression type (elastomeric gasket joint), providing a watertight seal. SOLVENT CEMENT JOINTS SHALL NOT BE USED.

For pipe installation depths greater than twenty-five (25) feet, pipe material and bedding conditions shall be determined by engineer design calculations and submitted for approval by the DPW Director or designee.

532.02 Plugs

A gasketed plug, as recommended by the pipe manufacturer, shall be provided to seal the end of a wye connection or a dead-end stub. Plug locations shall be marked below ground with a wood 2x4 and above ground with a steel T-post with green flagging.

532.03 Manholes

All manholes shall be supplied with a Saint-Gobain REXUS or similar approved manhole cover and frame. Covers and frames shall be manufactured from ductile iron to comply with ISO 1083. Covers shall be hinged and shall incorporate a ninety (90) degree blocking system to prevent accidental closure. All covers shall be operable by one person with standard tools and shall be capable of withstanding a test load of 120,000 lbs. Frames shall be circular and shall incorporate a seating gasket. The flange shall incorporate bedding slots and bolt holes.
Manhole bases may be constructed of cast-in-place concrete or pre-cast concrete. Pre-cast reinforced concrete risers (barrel sections) and tops shall comply with ASTM C478.

The top of the manhole vault shall be a minimum of twelve (12) inches and a maximum of eighteen (18) inches below the finished street or ground surface elevation. Concrete extension risers or collars shall be used to bring the manhole ring and cover up to finished street or ground surface elevation. Manholes five (5) feet deep or less shall be constructed as shallow manholes and shall be in accordance with the Detail Drawings. Cones shall be of the eccentric type.

Steps shall have a minimum tensile strength of 38,000 psi, minimum yield strength of 35,000 psi, and an elongation of not less than ten (10) percent in two (2) inches. Steps shall carry a load of one thousand (1,000) pounds when projected six (6) inches from the wall and fifteen hundred (1,500) pounds when projected four (4) inches from the wall without permanent deformation. Steps shall be one-half (1/2) inch diameter steel-reinforcing rods completely encapsulated in Copolymer Polypropylene as manufactured by M.A. Industries, Inc. or an approved equal. Steps shall be spaced in accordance with the Detail Drawings. The minimum distance from the finished ground (street) surface to the first step shall be twenty-four (24) inches, and the maximum shall be thirty (30) inches.

Mortar for manholes shall be mixed in the following proportions by volume: One (1) part Portland cement; one-half (1/2) part hydrated lime; and three (3) parts sand or masonry cement. The cement, lime, and sand shall be thoroughly mixed dry and only enough water added to form a mortar of proper consistency. Mortar shall be used within one (1) hour after mixing with no re-tempering permitted. Mortar that has taken a partial set is prohibited from use.

532.04 Manhole Bases and Base Beams

The minimum slab thickness shall be six (6) inches. The minimum reinforcement shall be #4 reinforcing steel at twelve (12) inches on center each direction or welded wire fabric, 4x4/W4xW4. The placing, fastening, splicing and supporting of reinforcing steel and wire mesh or bar mat reinforcement shall be in accordance with the approved plans, the Detail Drawings and the latest edition of “CRSI Recommended Practice for Placing Reinforcing Bars.” Splicing of the welded wire fabric shall be by lapping one space and securing the wire mesh together. All wire fabric shall conform to the requirements of the “Wire Reinforcement Institute, Inc.”

Manhole base beams shall be pre-cast, reinforced concrete. The beams shall be twelve (12) inches wide by nine (9) inches deep by eight (8) feet long.

532.05 Concrete
Concrete shall comply with Section 800.00 CONCRETE MIX DESIGN AND CONSTRUCTION of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Type II Portland cement shall be used, unless otherwise recommended by the Geotechnical Engineer. Concrete encasement of sewer pipe shall comply with Section 516.00 Relation to Waterlines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

532.06 Cast and Ductile Iron Fittings

All cast iron manhole rings and covers and other iron castings shall comply with ASTM A48. Fittings shall be in accordance with the Detail Drawings. Ductile iron rings and covers shall comply with ISO 1083. All metal bearing surfaces between the ring and cover shall be machined or fabricated to insure good seating. Manhole lids shall be provided with non-slip pattern in surface that lies flush with the elevation of the ring. Lids shall be furnished with the words “SANITARY SEWER” cast on top.

532.07 Bedding Materials

Bedding materials shall comply with Section 353.00 Bedding for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

532.08 In-Place Rehabilitation of Existing Pipelines

In-place rehabilitation of existing pipelines may be by sliplining, pipe bursting or heat activated resin lining in accordance with plans approved by a Colorado licensed Professional Engineer.

Sewer liner pipe and fittings shall be made of a polyethylene pipe compound that meets the requirements for Type III, Grade P34 polyethylene and complies with ASTM D1248 and D3350. Both resin and manufacturing plant shall be approved by the National Sanitation Foundation. Horizontal and vertical alignment tolerances shall be specified by the design engineer.

532.09 Steel Casings for Bores

All carrier pipe through casings shall comply with ASTM C900, C905 or C909. Steel casing pipe for bores shall be seamless welded steel tubing having an inside diameter of at least four (4) inches greater than the outside diameter of the bell or joint or mechanical restraint of the carrier pipe or mechanical restraint to be installed therein. The minimum wall thickness of the tubing shall be:

<table>
<thead>
<tr>
<th>Casing O.D.</th>
<th>Min. Wall Thickness</th>
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<tr>
<td>&gt;24”</td>
<td>3/16”</td>
</tr>
<tr>
<td>27”</td>
<td>1/4”</td>
</tr>
<tr>
<td>30”-36”</td>
<td>5/16”</td>
</tr>
</tbody>
</table>
All carrier pipe joints shall have mechanical restraint inside the casing. Cathodic protection and casing end seals shall be specified per design engineer recommendations. The spacer system shall be designed and fabricated for the specific project and application for which they are furnished. The casing spacer system manufacturer must have a current ISO 9001:2000 Registered Quality Assurance Program.

Steel pipe may be re-used for a casing if it can be certified to meet these CONSTRUCTION STANDARDS & SPECIFICATIONS and is approved by the DPW Director or designee.

533.00 Installation

533.01 General

Installation of PVC sewer main shall comply with ASTM D2321.

533.02 Alignment and Grade

Field parties, under the supervision of a Registered Professional Land Surveyor or Professional Engineer licensed to practice in the State of Colorado, shall determine alignment and grade of the pipe and the location of sanitary sewer system appurtenances. The sewer line shall be installed to the required lines and grades with appurtenances at the required locations. Record Documents of sanitary sewer system alignment, verified by a Professional Licensed Surveyor or a Professional Engineer, shall be furnished to the DPW Director or designee to comply with Section 200.00 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

533.03 Protection of Existing Underground Utilities

The Contractor shall be held responsible for the protection of public improvements as stated in Section 141.00 Protection of Public, Private and Utility Interests of these CONSTRUCTION STANDARDS & SPECIFICATIONS. It shall be the Contractor's responsibility to replace all public improvements damaged at his own expense.

533.04 Sewer Pipe Installation

Proper equipment, tools and facilities shall be provided and used by the Contractor for safe and efficient performance of the work. All pipe and sanitary sewer appurtenances shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials and to protect coatings and linings. Under no circumstances shall pipe or fittings be dropped or dumped into the trench. Any
pipe or fittings that are dropped or dumped shall be removed from the work site and shall not be used.

When buried, all ductile iron pipe fittings and appurtenances shall be protected with polyethylene wrap. Miscellaneous steel or other ferrous pipe shall be similarly protected. Refer to Section 200.00 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS for survey requirements for Record Documents of sanitary sewer lines.

The Elbert County Inspector/Representative shall be notified at least one working day (twenty-four [24] hours) in advance of when pipe is to be installed in any trench. No pipe shall be covered until an Elbert County Inspector/Representative has inspected the installation.

Sewer lines shall be constructed continuously upgrade from an existing sanitary sewer except when otherwise approved by the DPW Director or designee. Special care shall be taken to lay sewer pipe to exact line and grade with spigot ends pointing in the direction of flow.

Sewer pipe shall be secured in place by installation of bedding material tamped under and along it up to a level of twelve (12) inches over the top of the pipe to comply with Section 353.00 Bedding for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Backfill material shall be installed and compacted to comply with Section 354.00 Backfill for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

All sewers shall be kept thoroughly clean and free of gravel, dirt and debris. Whenever work ceases for any reason, the unfinished end of the pipe shall be securely closed with a temporary tight-fitting plug.

533.05 (Left Blank Intentionally)

533.06 Connections to Existing Manholes

Modifications to existing manholes shall not jeopardize the structural integrity. Sewer pipe connections to existing manholes, where there is no pipe stubbed out, shall be made in accordance with the Detail Drawings. The Contractor shall core drill as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete flow channel shall be chipped to the cross-section of the new pipe in order to form a smooth continuous flow channel similar to what would be formed in a new concrete base. Non-shrink grout shall be used to finish the new channel and invert and to seal the new sewer line, so the junction is watertight.

533.07 Construction of Manholes and Clean-outs
Manholes shall be constructed in accordance with the Detail Drawings. Concrete bases shall extend at least eight (8) inches below the bottom of the pipe and at least two (2) inches over the top of the pipe. The concrete manhole bench shall slope upward at least two (2) inches per foot from the top of the pipe.

Pipes connecting to cast-in-place manhole bases shall have a water stop in accordance with the Detail Drawings. A water stop gasket shall also be used for new connections to existing manholes.

The manhole flow channel shall be made of concrete and shall conform exactly to the lower half of the pipe it connects. Changes in flow direction shall be constructed with as large a radius of curvature as possible. Flow channels shall be finished with cement mortar and left smooth and clean.

Pre-cast barrel sections shall not be placed on the base until after it has reached sufficient strength to provide support without damage. Asphalatic mastic (Ram-Neck) shall be applied between each pre-cast section bearing seat. All lifting holes and other imperfections in the interior manhole wall shall be filled with cement mortar. Manhole barrel joints shall be sealed with a double bead of asphaltic mastic and joint tape on the outside. Adjustment rings shall be sealed with non-shrink grout.

All sewer clean-outs that are not contained in manholes shall be provided with a valve box and a “sewer” lid.

533.08 In-Place Rehabilitation of Existing Pipelines

Refer to Section 532.08 In-Place Rehabilitation of Existing Pipelines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

533.09 Steel Casing and Carrier Pipe Installation

Tunneling and boring operation methods shall be approved by the DPW Director or designee. Excavation and casing installation shall be performed simultaneously. At no time shall the advancing edge of the casing trail the excavation by more than twelve (12) inches.

The casing pipe shall be installed by boring or jacking upgrade from the outlet end. When excavation exceeds the advancing edge of the casing by more than twelve (12) inches or sloughing of the hanging wall occurs such that voids are created along or above the casing, external grouting of the casing shall be required. Grouting shall be accomplished by pumping at between five (5) and ten (10) psi equal parts of Portland Cement and mortar sand mixed with sufficient water to provide a slump of less than two (2) inches through grout holes in the casing until all voids are filled. Grout holes, one (1) inch to two (2) inches in
diameter, shall be provided or drilled in the casing on four (4) foot centers along the pipe arch and at eight-foot (8’) centers along each spring line. As grouting advances each of the completed grout holes shall be plugged to a watertight condition.

Following installation of force main carrier pipe in casing pipe, tracer wire shall be taped to the force main and welded to each end of the casing. Uninterrupted continuity shall be tested in accordance with the requirements of Section 432.19 Tracer Wire and Warning Tape of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

533.10 Wyes for Service Connections

Wyes shall be angled upwards so that the flowline of a forty-five (45) degree bend connected to the fitting shall have an elevation equal to or higher than the inside crown of the sewer main. Watertight plugs shall be installed in each service connection stub. Record Document measurements shall be made to reference the wye to the nearest downstream manhole before backfilling. Record Documents shall comply with Section 200.00 Acceptance Procedures of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

534.00 Testing and Inspection

Refer to Section 154.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Adequate inspections assure compliance to Elbert County requirements and are the basis for Elbert County’s recommendation that said improvements be accepted for maintenance and for release of performance guarantees. It is the responsibility of the Contractor to contact the DPW Director Or designee a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required inspections shall include:

A. Stockpiled Materials – Verify that materials meet CONSTRUCTION STANDARDS & SPECIFICATIONS and approved submittals, including but not limited to bedding material, pipe, fittings, valves, valve boxes, and fire hydrants.

B. Community Development Excavation – Verify proper trench depths, shoring, spoil pile location, dewatering, and location and protection of existing utilities.

C. Installation – Verify proper bedding depth, alignment and grade, clean pipe and lubricants. Verify “slicing in” of bedding at haunches.

D. Backfill and Compaction – Verify proper methods of backfill and compaction, depths of lifts, moisture control, backfill material free of large rock and organic or frozen material, and proper
compaction effort and passing tests. Verify that sewer forcemain has warning tape. Verify that tracer wire has been installed on all carrier pipe contained in a casing and that it has a passing continuity test.

E. Testing – Verify that testing methods comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Verify that Elbert County has witnessed all low-pressure air tests of pipe, vacuum testing of manholes and any other testing requirements such as deflection testing. Mandrel testing for flexible pipe with depths of cover equal to 20 feet or more must be witnessed by Elbert County. Mandrel testing shall be performed by a certified third party.

Prior to Construction Acceptance, the Contractor shall conduct tests for watertightness. Tests shall be completed under the observation of the Elbert County Inspector/Representative. Low pressure air testing of the sewer lines (including services) and vacuum testing of all manholes shall be required by the DPW Director or designee. The Contractor shall provide all equipment and personnel necessary to perform the required tests. The Elbert County Inspector/Representative shall record times and pressure and vacuum readings during the test period. A test section shall not be any longer than the length of pipe between adjacent manholes.

The DPW Director Or designee may require that the first two (2) manholes, including the main between them, of all sewer projects be tested before further construction to permit initial observation of the quality of construction workmanship. The DPW Director Or designee may require additional testing during the course of construction if infiltration appears to be excessive or the quality of workmanship is questionable.

F. Construction Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:

1. All temporary structures, debris, mud and waste materials shall be removed from public property.
2. All relative testing certifications and documentation shall be submitted to Elbert County, including all compaction tests. Copies of originals are acceptable.
3. All sanitary sewer service locations shall be marked by saw cutting an “X” or “S” (or an “X” or “S” to indicate an underdrain system is present) into the face of the curb where the service extends into the property.
4. All sanitary sewer manholes are at construction grade, clean, and grouted with ladders straight. Verify that
underdrain clean-outs are clear and capped and that all sanitary sewer lines have been jetted.

Prior to requesting a Construction Acceptance inspection, the Contractor shall clean sanitary sewer mains and shall have the lines inspected with TV video equipment. A copy of the videotape and written report shall be submitted to Elbert County for review. Video shall also include an audio description of pipe and manhole deficiencies, and camera location during the inspection. Any sections that contain debris or obstructions shall be cleaned and re-videotaped. Video shall be continuous from manhole to manhole, and all notations shall correspond to the approved construction plans. If, after visual inspection of the sanitary sewer lines the DPW Director Or designee suspects that there is a problem, alignment, and/or deflection tests may be required at the Contractor’s expense.

G. Final Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1. Verify that all temporary structures, debris, mud, and waste materials are removed from public property.
2. Verify that all sanitary sewer manholes are clean.

Prior to Construction Acceptance, the Contractor shall jet rod the sewer lines, and a video inspection and written log shall be performed, recorded and submitted to Elbert County. The Elbert County Inspector/Representative shall review the recorded video and log for inadequacies in the system. If inadequacies are noted, the Contractor shall make repairs deemed necessary by the Elbert County Inspector/Representative.

534.01 Air Testing Pipeline

Air testing shall comply with UNI-BELL UNI-B-6. The portion of the line being tested shall be termed “acceptable” if the time required in minutes for the pressure to decrease from 3.5 to 3.0 psig (greater than the average back pressure of any groundwater that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:
SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE

<table>
<thead>
<tr>
<th>Pipe Diameter (in.)</th>
<th>2 Minimum Time for Minimum Time (ft)</th>
<th>3 Length for Minimum Time (ft)</th>
<th>4 Time for Longer Length (sec)</th>
<th>Specified Minimum for Length (L) Shown (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>100ft</td>
<td>150ft</td>
</tr>
<tr>
<td>15</td>
<td>7:05</td>
<td>159</td>
<td>2.671L</td>
<td>7:05</td>
</tr>
</tbody>
</table>

If groundwater is higher than the top of the pipe, the test pressure is to be increased. An air pressure adjustment shall be added to the normal test starting pressure when groundwater is present. The height of groundwater in feet shall be divided by all readings. (For example, if the height of water is eleven (11) and one half (1/2) feet, then the added pressure shall be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same. **In no case however, should the starting test pressure exceed 9.0 psig.**

Sections of pipe that fail the air test shall have the defects repaired and the pipe retested until the testing requirements are met.

534.02 Vacuum Testing Manholes

Manholes shall be tested before the ring and cover and grade adjustment rings have been installed. All pipes entering the manhole shall be plugged and braced and a vacuum of ten (10) inches of mercury shall be drawn. The vacuum pump shall be turned off and the time monitored as the vacuum drops one (1) inch. The vacuum shall not drop more than one (1) inch for the duration of the time indicated in the following table:
SPECIFIED TEST DURATION FOR DIAMETER OF MANHOLE  
(DURATION INDICATED IN MIN:SEC)

MANHOLE DIAMETER (INCHES)

<table>
<thead>
<tr>
<th>Diameter (Inches)</th>
<th>48”</th>
<th>60”</th>
<th>72”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>1.15</td>
<td>1.45</td>
</tr>
</tbody>
</table>

Manholes that fail the vacuum test shall have the defects repaired and the manholes retested until the testing requirements are met.

534.03 Deflection Testing Pipe

When required, all flexible material sewer pipelines shall be tested for vertical deflection after placement and compaction of backfill if deemed necessary by the Elbert County Inspector/Representative. Method of testing shall be by deflectometer of the rigid GO/No-GO type device or an alternative method permitted by the Road & Bridge Superintendent / Elbert County Engineer. Maximum allowable deflection shall be five (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 and retested until the testing requirements are met.

534.04 Infiltration and Exfiltration Testing

When required, infiltration and exfiltration tests shall be conducted to comply with UNI-BELL standards. Whenever the rate of infiltration or exfiltration is found to exceed the prescribed amount, the Contractor shall stop all construction. The Contractor shall make appropriate repairs by methods acceptable to the DPW Director Or designee and shall continue to test the conduit until it is proven satisfactory.

535.00 Connection to Elbert County’s Sewer System

Flow of any kind into the existing sewer system shall not be allowed until the sewer has been satisfactorily completed and approved for use by the DPW Director or designee.

540.00 SANITARY SEWER SERVICE LINE CONSTRUCTION

541.00 Trenching, Backfilling and Compacting

Trenching, backfilling and compacting shall be completed and shall comply with Section 350.00 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

542.00 Materials
542.01 Polyvinyl Chloride (PVC)

Pipe and fittings shall comply with ASTM D3034. All joints shall be factory prepared compression type (elastomeric gasket joint), providing a watertight seal. A compression stop, as recommended by the pipe joint manufacturer, shall be provided to seal the end joint of dead-end stubs.

543.00 Installation

543.01 General

Installation of PVC sanitary sewer services shall comply with ASTM D2321 and to the pipe manufacturer’s installation instructions.

543.02 Location and Alignment of Service

The sanitary sewer service may be constructed with one or more horizontal forty-five (45) degree bends between the house plumbing and the sanitary sewer main with the written approval of the DPW Director or designee. Clean-outs shall be installed to comply with the International Residential Code (IRC), the International Plumbing Code (IPC) and as described herein. Unless specific approval is obtained in writing from the DPW Director or designee, all sanitary sewer service lines shall have a minimum depth of three (3) feet.

At no time shall the service line be closer than three (3) feet to a side property line, and no service line may be constructed through or in front of an adjoining property. Sewer service lines shall be typically located a minimum of ten (10) feet to the low side of the water service or as shown on the approved plans. Generally, services shall not be located under driveways.

543.03 Crossing Sidewalk or Curb (Existing or Proposed)

In no instance shall a trench extend beneath an existing sidewalk or curb. The pipe shall be bored, jacked or tunneled through the earth under the sidewalk or curb. If the service line is installed prior to the placement of the sidewalk or curb, the trench shall be backfilled in accordance with Section 354.00 Backfill for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

543.04 Service Stub-ins to Property Line

Sanitary sewer service line locations shall be marked on the curb with an “X”. All service stub-ins shall be stubbed into the lots, ten (10) feet minimum beyond the R.O.W. or utility easement. All service stub-ins shall be plugged and marked in
accordance with Section 532.02 Plugs of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

543.05 Tapping the Main

Where wyes have not been installed in the sewer main, sanitary sewer tapping saddles shall be used. Sewer tapping saddles shall be double strapped saddles with rubber gasket pipe sealant.

A manhole shall be installed instead of a service tap when a six (6) inch connection is to be made to an eight (8) inch or smaller main. **SERVICE TAPS DIRECTLY INTO A MANHOLE SHALL NOT BE ALLOWED WITHOUT THE WRITTEN APPROVAL OF THE DPW DIRECTOR OR DESIGNEE.**

543.06 Pipe Installation

In cases where the sewer service cannot be installed a minimum of ten (10) feet horizontally from a water service, concrete encasement of the sewer line shall be required. Installation of sanitary sewer lines shall comply with Section 533.00 Installation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

In cases where the water and sewer service lines shall cross one another, installation shall comply with Section 516.00 Relation to Waterlines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

543.07 Industrial

All buildings (warehouses, etc.) constructed as a shell, with the intention of only being used for subdivided suites for commercial purposes, shall be required to install service connections extending a minimum of six (6) feet outside of the building with a clean-out for each set of proposed bathrooms or suites. All commercial and industrial facilities shall have a clean out on the outside of the building, located a minimum of three (3) feet from the building, on the service connection.

543.08 Other Requirements

Rainwater leaders, roof drains, surface drains or groundwater drains shall not be connected to the sanitary sewer system. Each sanitary sewer service system shall be separate from the drainage system. Grease, oil and grit traps shall be designed and installed where required by the provisions of the IRC.

550.00 FLOW METERING AND SAMPLING STATION CONSTRUCTION

551.00 General
Except as otherwise specifically noted on approved plans, or specified herein, all materials and installation for flow measurement and sampling stations shall comply with Section 500.00 SANITARY SEWER FACILITIES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

### 552.00 Equipment Compatibility

The Contractor shall, prior to procuring and installing any equipment, consult with Elbert County to ensure that the equipment purchased and installed is compatible in all respects to the existing sampling and flow measurement equipment owned and operated by Elbert County. Volumetric weir installation is subject to approval by Elbert County.

### 553.00 Sampling Station Manholes

Manholes shall be constructed, complete with covers, fittings, and other appurtenances, in accordance with the Detail Drawings.

### 554.00 Grating

All grating and grating treads shall be either structural fiberglass or aluminum. The design engineer shall submit design calculations and details appropriate for the application to be approved by the DPW Director or designee.

All grating shall lie flat with no tendency to rock when installed. Poorly fitted or damaged grating shall be rejected and shall be replaced by the Contractor. Steel frames cast in concrete to support grating shall be hot-dip galvanized after fabrication.

### 555.00 Weir Plates and Grooves

Weir plates and guide grooves shall be fabricated from aluminum or fiberglass with edges accurately finished. Plates shall be provided with U-shaped lifting handles. Each groove opening shall be at least one-quarter (¼) inch wider than the thickness of the plate installed therein. Grooves shall have all interior surfaces smooth.

Weir plate grooves shall be installed plumb and straight within a tolerance of three thirty-seconds (3/32) inch and with the opposite sides and bottom aligned in a single plane to prevent binding of the weir plate. If necessary, to meet this requirement, a space shall be boxed out for guides and the guides grouted in place later.

Weirs shall be v-notch weirs for flows ranging up to 0.15 MGD and shall be an eighteen (18) inch wide Cippoletti weir with flows ranging from 0.15 to 0.5 MGD. Weir design shall be reviewed by the DPW Director Or designee to insure adequate flow measurement. A staff gauge shall be read in inches.
Once the weir is in place, no flow bypass around the weir shall be allowed. Volumetric weir installation shall be approved by the DPW Director or designee.

556.00 Station Location

The location of the flow measurement and sampling station shall be such that it is easily accessible at all times by Elbert County personnel. The DPW Director or designee shall approve the location of the station.

557.00 Operation of Existing Facilities

The operation of the existing sanitary sewer system shall not be interrupted or degraded by the sample station construction.

558.00 Drawings and Data

Complete data and detailed drawings including all structural and miscellaneous metal items shall be prepared by a Registered Professional Engineer licensed to practice in Colorado and submitted to the DPW Director or designee for review and approval prior to fabrication. The Developer shall provide Elbert County with a set of Record Documents that complies with Section 200.00 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

560.00 SEWAGE LIFT STATIONS

561.00 General

The sewage lift station, as determined by the DPW Director or Designee, may be either a temporary or a permanent facility. The Developer shall provide the DPW Director or designee with a complete set of design calculations and design drawings that comply with Section 160.00 PLANS AND SPECIFICATIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for review and approval of the DPW Director or designee.

The sewage lift station shall satisfy all of the requirements of the Colorado Department of Public Health and the Environment (CDPHE) and these CONSTRUCTION STANDARDS & SPECIFICATIONS. The Developer's engineer shall prepare the “Application for Site Approval” for submittal to the Colorado Department of Health and to prepare a set of Record Document drawings of the sewage lift station that complies with Section 200.00 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Upon completion of the lift station, the Contractor shall also provide Elbert County with two (2) copies of an “Operation and Maintenance Manual” for the lift station.

Whenever a lift station is required, a discussion with the Elbert County Road & Bridge Department shall be required.
A security system is required for all lift stations, and it shall be approved by Elbert County prior to installation.

562.00 Design Criteria

562.01 Odor and Corrosion Control

The potential for odor generation shall be evaluated, and if recommended shall be provided at the lift station. The method of odor control shall be as determined by the DPW Director or designee.

The potential for corrosion shall be evaluated, and if recommended shall be provided at the lift station. The method of corrosion protection shall be as determined by the DPW Director or designee.

The manhole receiving the discharge from a forcemain shall be corrosion protected. The downstream sewer system shall be evaluated for the need for odor control and corrosion protection, and, if recommended, facilities shall be included for odor control and corrosion protection.

562.02 Wet Well Construction

The wet well shall consist of a cast-in-place reinforced concrete structure divided into two (2) compartments. The two (2) compartments shall be interconnected with a valve or gate. The dual compartments shall allow the draining of one compartment for cleaning or maintenance without affecting the operation of the station. A division box shall be provided upstream of the wet well to allow the sewage lift station flows to be directed into either or both of the wet well compartments. A removable screen, or heavy-duty grinder, as determined by the DPW Director or designee, shall be provided in the inflow into each wet well compartment to collect debris.

562.03 Pumps and Pump Station

Pumps shall be installed in a dry well adjacent to the wet well and be of a type and design acceptable to Elbert County.

The pump station shall be designed utilizing a minimum of three (2) pumps. Each pump shall be capable of pumping the peak design flow. One pump shall be located in the primary wet well. The second pump shall be located in the second overflow/maintenance wet well.

All pump equipment shall be manufactured and supplied by the same company. The pump station shall be an above ground structure sized to accommodate all of the pumps, electrical equipment and controls required to operate the facility. The
station shall be lighted, heated and well ventilated, and shall be designed for easy expansion if required by the DPW Director or designee.

The architectural finish of the station shall blend with that of the surrounding architecture as much as possible.

**A STANDBY GENERATOR, CAPABLE OF OPERATING THE ENTIRE STATION FOR A MINIMUM OF FOUR HOURS, SHALL BE PROVIDED AND LOCATED OUTSIDE THE BUILDING IN AN ALL-WEATHER ENCLOSURE.**

562.04 Controls and Supervisory Control and Data Acquisition (SCADA)

Pump operation shall feature automatic sequencing of the pump operation to balance pump wear. Pumps shall be controlled by pre-determined wet well levels measured by mercury float switches.

562.05 Site Security and Improvements

Site security shall be provided based on-site assessment and shall comply with Elbert County requirements.

A six (6) foot high chain link fence with barbless wire, or other approved material, shall be installed around the perimeter of the sewage lift station site. Upon completion of the lift station construction, all disturbed areas within the site shall be fertilized, seeded and mulched to comply with Section 1030.00 Seeding Specifications of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Depending on site location, landscaping improvements may be required by the DPW Director or designee

**570.00 RESTORATION AND CLEANUP**

Restoration and cleanup shall be completed and shall comply with Section 370.00 RESTORATION AND CLEANUP of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
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<th>Title</th>
<th>Page</th>
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<td>643.03</td>
<td>Wet Trench</td>
<td>22</td>
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<td>22</td>
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<td>643.07</td>
<td>Construction of Manholes, Inlets and Sidewalk Chases</td>
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<td>643.08</td>
<td>Construction of Open Channels and Special Structures</td>
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<td>643.09</td>
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<td>23</td>
</tr>
<tr>
<td>643.10</td>
<td>Testing</td>
<td>24</td>
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<td>644.00</td>
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<td>24</td>
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<td>650.00</td>
<td>TRENCHING, BACKFILLING AND COMPACTING</td>
<td>26</td>
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<td>660.00</td>
<td>RESTORATION AND CLEANUP</td>
<td>26</td>
</tr>
<tr>
<td>670.00</td>
<td>GRADING AND EXCAVATION</td>
<td>26</td>
</tr>
</tbody>
</table>
SECTION 600
STORM DRAINAGE FACILITIES

601.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

All enclosed Storm Water Collection Systems, Catch Basins, Curbs, Gutters and Detention/Retention Structures shall be owned and maintained by the governing Metro District or Homeowners Association. All Open Roadside Drainage Channels and Culverts will be maintained by Elbert County.

610.00 STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA

All proposed construction plans and submittals shall be accompanied by a storm drainage analysis. Appropriate drainage system design shall be submitted for approval by the DPW Director or designee for each phase of construction. Approval of the analysis and design is subject to the following conditions:

A. Construction of the system shall commence within 365 days of the date of the approval.
B. No construction has been completed on any adjacent property that may have affected the drainage pattern within the basin.

New submittals may be required by the DPW Director or designee.

The proposed construction shall not damage upstream or downstream properties. The planning and design of the drainage system shall not transfer the problem from one location to another.

Except where specified in these CONSTRUCTION STANDARDS & SPECIFICATIONS, the procedure, criteria, and standards set forth in the latest revision of the Urban Drainage Flood Control District Storm Drainage Criteria Manual—hereby referred to as the UDFCD Manual—shall be instituted for the analysis of any drainage system. Current engineering practices and drainage methodology, as well as common sense, shall be involved with the analysis of any drainage system.

The runoff analysis for a particular area shall be based on the natural, undisturbed land for that area. Any contributing runoff from upstream areas shall be based on the existing land use and topographic characteristics of those areas.
Where a master drainage plan for a given area of Elbert County is available, proposed drainage systems shall conform to that plan. Consideration shall be given as to how the proposed master plan drainage systems shall tie into the existing upstream and downstream drainage system.

In areas where a master plan is not available, major drainageways and easements shall be located to provide continuity with existing drainage conditions. These drainageways and easements shall be shown on all drainage plans.

A CONSTRUCTION STORMWATER DISCHARGE (CDPS) PERMIT SHALL BE OBTAINED FROM THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT FOR DISTURBANCE OF ANY SITE LARGER THAN ONE ACRE.

FOR CAPITAL IMPROVEMENT PROJECTS, THE CONTRACTOR IS REQUIRED TO OBTAIN A CDPS PERMIT.

Permanent stormwater quality facilities shall be designed and constructed in accordance with the UDFCD Manual (Volume 3).

The Federal Emergency Management Agency (FEMA) floodplain boundaries are available from the DPW Director Or designee and shall be shown on all preliminary and final drainage plans.

All ponding facilities shall be of the detention type. Retention facilities shall only be allowed with the written approval of the DPW Director or designee.

Construction that shall impair surface or subsurface drainage shall not be approved. Elbert County reserves the right to issue and enforce more stringent criteria shall adverse conditions exist. Designs that vary from the criteria shall require written approval of a variance by the DPW Director Or designee prior to final approval of the plans.

Natural topographic features shall be the basis of location for easements and future runoff calculations. Where defined, existing drainage patterns and slopes shall be used. The drainage facilities shall be able to handle the design flows with no erosion damage to the system.

Streets shall not be used as primary floodways for major storm runoff. The amount of runoff in the streets shall not exceed the limits established in Section 613.04 Street Flow Capacities of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

For inlet and manhole details, refer to the CDOT M&S Standards.

Stormwater detention facilities or natural drainageways are to be used whenever feasible. Any alteration to natural drainage patterns shall not be approved unless a thorough
investigation and analysis shows no hazard or liability. The DPW Director Or designee shall have final authority over any system design.

**ALL DRAINAGE FACILITIES SHALL BE IN AN EASEMENT OR PUBLIC R.O.W.**

All drainage improvements shall be as natural in appearance as possible to be aesthetically pleasing. Maintenance access shall be provided for all drainage and flood control facilities.

Irrigation ditches shall not be used as the outfall of any drainage basin.

### 611.00 Design Methods

#### 611.01 Minor and Major Design Storms

Every urban area has two separate and distinct drainage systems whether or not they are actually planned for and designed. One is the initial system, which corresponds to the minor (or ordinary) storm recurring at regular intervals. The other is the major system, which corresponds to the major (or extraordinary storm), which is unlikely to occur more often than once in one hundred (100) or more years (“100-year storm”). Since the effects and routing of stormwaters for the major storm may not be the same as for the minor storm, all storm drainage plans submitted for approval shall be submitted in detail in two separate phases: one indicating the effects of the minor storm and the other showing the effects of the major storm.

A. **Minor storm provisions:** The objectives of the minor storm planning are to minimize inconvenience, to protect against recurring minor damage, to reduce rising maintenance costs, to create an orderly drainage system and to provide a sociological benefit to the urban resident. The minor storm drainage system may include curb and gutter, storm sewer, swales, and other open drainageways and detention facilities.

B. **Major storm provisions:** The major storm shall be considered the 100-year storm. The objectives of the major storm planning are to eliminate substantial property damage or loss of life and shall be as directed and approved by the DPW Director or designee. Major drainage systems may include storm sewers, open drainageways and detention facilities. The correlation between the minor and major storm system shall be analyzed to ensure a well-coordinated drainage system.

#### 611.02 Storm Return Periods
The minor and major storm design return periods shall not be less than those shown below:

**DESIGN STORM RETURN PERIODS**

<table>
<thead>
<tr>
<th>Land Use or Zoning</th>
<th>Design Storm Return Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minor Storm</td>
</tr>
<tr>
<td>Residential</td>
<td>2-year</td>
</tr>
<tr>
<td>Business</td>
<td>5-year</td>
</tr>
<tr>
<td>Public Building Areas</td>
<td>5-year</td>
</tr>
<tr>
<td>Parks, Greenbelts, etc.</td>
<td>2-year</td>
</tr>
<tr>
<td>Open Channels and Drainageways</td>
<td>-</td>
</tr>
<tr>
<td>Detention Facilities</td>
<td>10-year$^1$</td>
</tr>
</tbody>
</table>

$^1$A two (2) year storm return period shall be used if the detention facility does not have a water quality outlet.

**611.03 Rainfall Intensities**

The rainfall intensities to be used in the computation of runoff shall be obtained from the Time-Intensity-Frequency Curves shown in the Detail Drawings.

**611.04 Runoff Computations, Rational Method**

The Rational Method shall be utilized for sizing storm sewers and for determining runoff magnitude for all watersheds.

The procedures for the Rational Method, as explained in the latest edition of the UDFCD Manual (Volume 1), shall be followed in the preparation of drainage reports and storm drainage facility designs in Elbert County.

**611.05 Runoff Coefficients**

**Rational method runoff coefficients:** The runoff coefficient (C) to be used in conjunction with the Rational Method shall not be less than those listed below:
## RUNOFF COEFFICIENTS (C) FOR RATIONAL METHOD

<table>
<thead>
<tr>
<th>Land Use or Surface Characteristics</th>
<th>Percent Impervious</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-Family</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Multi-Unit (detached)</td>
<td></td>
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<tr>
<td>Multi-Unit (attached)</td>
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</tr>
<tr>
<td>1/2 Acre Lot or Larger</td>
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<td></td>
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<tr>
<td>Apartments</td>
<td>80</td>
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<td>.63</td>
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<td>Industrial</td>
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<tr>
<td>Light Areas</td>
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<td>.57</td>
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<td>Heavy Areas</td>
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<td>.71</td>
<td>.73</td>
<td>.75</td>
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<tr>
<td>Parks, Cemeteries</td>
<td>5</td>
<td>.08</td>
<td>.18</td>
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<td>Playgrounds</td>
<td>10</td>
<td>.11</td>
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<td>.30</td>
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<td>Schools</td>
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<td>Railroad Yard Areas</td>
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<td>.24</td>
<td>.32</td>
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<td>Undeveloped Areas</td>
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<td>Historic Flow Analysis</td>
<td>2</td>
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<tr>
<td>Greenbelts, Agricultural</td>
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<td></td>
<td></td>
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<tr>
<td>Offsite Flow Analysis (when land use not defined)</td>
<td>45</td>
<td>.31</td>
<td>.37</td>
<td>.44</td>
<td>.59</td>
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<tr>
<td>Streets</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Paved</td>
<td>100</td>
<td>.89</td>
<td>.90</td>
<td>.92</td>
<td>.96</td>
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<tr>
<td>Gravel</td>
<td>40</td>
<td>.28</td>
<td>.35</td>
<td>.42</td>
<td>.58</td>
</tr>
<tr>
<td>Drives and Walks</td>
<td>90</td>
<td>.71</td>
<td>.73</td>
<td>.75</td>
<td>.81</td>
</tr>
<tr>
<td>Roofs</td>
<td>90</td>
<td>.71</td>
<td>.73</td>
<td>.75</td>
<td>.81</td>
</tr>
<tr>
<td>Lawns, Sandy Soil</td>
<td>0</td>
<td>.00</td>
<td>.01</td>
<td>.05</td>
<td>.20</td>
</tr>
<tr>
<td>Lawns, Clay Soil</td>
<td>0</td>
<td>.04</td>
<td>.15</td>
<td>.25</td>
<td>.50</td>
</tr>
</tbody>
</table>

*Refer to the graphs in the Runoff Chapter of the UDFCD Manual.

### 612.00 Detention

#### 612.01 General

Onsite detention is required for all new development, expansion and redevelopment. The required minimum detention volume and maximum release rates at these volumes for the 2-year, 5-year and 100-year storms shall be determined in accordance with the procedure and data set forth in these criteria. If the pond does not include a water quality outlet, which controls about the one and one-half (1½) year storm, the pond shall be designed to release the two (2) year historic rate.
Exemptions from the detention requirement may be granted if it can be demonstrated that the developed area does not adversely affect the downstream major drainageways (assuming the entire drainage area is fully developed) and that the water quality is maintained.

Offsite flows cannot be passed through the detention pond. Offsite areas shall be included in the drainage area contributing to the pond. In certain cases, offsite flow can be routed around the detention pond.

Parking lots that serve as detention storage ponds shall not have a storage depth of more than one (1) foot. Parking lots that serve as detention storage ponds shall place notification signs that the area ponds during a rainfall event. The signs shall be permanent and high quality and shall meet Elbert County’s specifications for traffic signs.

612.02 Equation Method

The equation method found in the Storage section of the UDFCD Manual may be used to design detention ponds for drainage areas smaller than ninety (90) acres; however, if the calculated allowable release is greater than the historic runoff, a different method shall be used to determine the storage requirements.

612.03 Sequential Detention

The sequential detention method shall be used for ponds that drain into each other. Use the Sequential Detention Form at the end of Section 600 of these CONSTRUCTION STANDARDS & SPECIFICATIONS to size sequential detention ponds.

613.00 Design Standards

613.01 Open Channels

Except as modified herein, open channels shall be designed for the 100-year storm and shall conform to the UDFCD Manual. In addition, the channel design shall also be analyzed with respect to minor storm runoff. Whenever practical, the channel shall have slow flow characteristics, be wide and shallow, and be natural in its appearance and functioning.

Channels shall be designed so that critical depth and super-critical flows are avoided. Channel capacities shall be computed from Manning's Formula for uniform flow, except at crossings and transitions where the design shall account for backwater effects.
The channel cross-section may be any type suitable to the location; however, the limitations for design for the major storm and minor storm design flows shall include:

A. **Capacity:** The channel and overbank areas shall have adequate capacity for the 100-year storm runoff.

B. **Side slopes:** Side slopes shall be as flat as practical. Side slopes of 4:1 (run:rise) shall be considered a normal minimum. Under special conditions, slopes of 3:1 may be utilized with written approval of the DPW Director or designee. The practical slope for mowing equipment is 4:1 or less.

C. **Depth:** The maximum design depth of flow for the major storm shall be limited to five (5) feet of depth in the channel cross section outside of the low-flow or trickle channel. Any design variation exceeding the maximum depth of flow shall be submitted in writing for approval by the DPW Director or designee. Critical depths and velocities shall be investigated and reported for both the major and minor storm runoffs.

D. **Freeboard:** Except where localized overflow in certain areas is desirable for additional ponding benefits or other reasons, the minimum allowable freeboard shall be one (1) foot.

E. **Bottom width:** The bottom width shall be designed to satisfy the hydraulic capacity of the cross-section recognizing the limitations on velocity, depth and Froude number.

F. **Slope of channel:** Grass-lined channel slopes are dictated by velocity and Froude number requirements. Grass-lined channels normally shall have slopes of 0.2% to 0.6%. Where the natural topography is steeper than desirable, drops may be utilized.

G. **Curvature:** The centerline curvature shall have a radius of not less than twice the design flow top width, but not less than one hundred (100) feet.

H. **Trickle channels:** Concrete trickle channels to carry low flows may be required for all new urban grassed channels. The capacity of a trickle channel shall be approximately two (2) percent of the major design flow. The shape of concrete trickle channels shall be parabolic. Where two (2) percent of the major design flow exceeds ninety (90) cfs, a low flow channel shall be required. Low flow channels shall be in accordance with the UDFCD Manual (Volume 2). **All concrete trickle channels shall have a minimum slope of one (1) percent.**

I. **Design velocity:** The maximum velocity for the major storm design runoff shall not exceed seven (7) feet per second for grass-lined channels, except in sandy soil where the maximum velocity shall not exceed five (5) feet per second. The Froude number (turbulence factor) shall be less than 0.8 for grass-lined channels. Grass-lined channels having a Froude number greater than 0.8
shall not be permitted. Minimum velocities for all channels shall not be less than two (2) feet per second for the minor storm runoff.

J. **Erosion:** All channels shall be designed with the proper and adequate erosion control features.

K. **Grass lining:** The grass lining for channels shall be in accordance with the UDFCD Manual (Volume 2).

L. **Water surface profile:** A water surface profile for the major storm runoff shall be computed for all channels and clearly shown on the construction plans submitted for approval. Computations of the water surface profile shall utilize standard backwater methods such as HEC-2 and shall take into consideration all losses due to velocity changes, drops, bridge and culvert openings, and other obstructions. A Computations Report shall be submitted along with the construction plans. The energy gradient line shall be shown on the construction plans.

M. **Roughness coefficient (n):** The value of the roughness coefficient (n) to be used in Manning's Formula shall not be less than those listed below:

### MINIMUM VALUES OF ROUGHNESS COEFFICIENT (n)

<table>
<thead>
<tr>
<th>Type of Channel and Description</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Closed Conduits:</strong></td>
<td></td>
</tr>
<tr>
<td>Concrete Pipe:</td>
<td></td>
</tr>
<tr>
<td>Culverts with bends, connections &amp; debris</td>
<td>0.013</td>
</tr>
<tr>
<td>Storm sewer</td>
<td>0.013</td>
</tr>
<tr>
<td>Subdrain with open joints</td>
<td>0.016</td>
</tr>
<tr>
<td>PVC Pipe</td>
<td>0.011</td>
</tr>
<tr>
<td>Concrete Surfaces (bottom &amp; sides):</td>
<td></td>
</tr>
<tr>
<td>Smooth finish</td>
<td>0.015</td>
</tr>
<tr>
<td>Unfinished</td>
<td>0.017</td>
</tr>
<tr>
<td>Concrete Bottom (with sides of):</td>
<td></td>
</tr>
<tr>
<td>Mortared stone</td>
<td>0.020</td>
</tr>
<tr>
<td>Dry rubble or riprap</td>
<td>0.030</td>
</tr>
<tr>
<td>Gravel Bottom (with sides of):</td>
<td></td>
</tr>
<tr>
<td>Formed concrete</td>
<td>0.020</td>
</tr>
<tr>
<td>Dry rubble or riprap</td>
<td>0.040</td>
</tr>
<tr>
<td><strong>Excavated or Dredged Channels and Ditches:</strong></td>
<td></td>
</tr>
<tr>
<td>Earthen, Straight &amp; Uniform, no brush or debris:</td>
<td></td>
</tr>
<tr>
<td>Grassed, less than 6&quot; high with:</td>
<td></td>
</tr>
<tr>
<td>Depth of flow &lt; 2.0 feet</td>
<td>0.035</td>
</tr>
<tr>
<td>Depth of flow &gt; 2.0 feet</td>
<td>0.030</td>
</tr>
<tr>
<td>Grassed, approx. 12&quot; high with:</td>
<td></td>
</tr>
<tr>
<td>Depth of flow &lt; 2.0 feet</td>
<td>0.060</td>
</tr>
<tr>
<td>Depth of flow &gt; 2.0 feet</td>
<td>0.035</td>
</tr>
<tr>
<td>Grassed, approx. 24&quot; high with:</td>
<td></td>
</tr>
</tbody>
</table>
613.02  Storm Sewers and Storm Inlets

Except as subsequently modified, the design of storm sewers and inlets shall conform to the criteria set forth in the UDFCD Manual. Storm sewers and inlets shall be of sufficient capacity to adequately carry the expected runoff from the initial design storm. Computer programs such as UDFCD’s UDSewer and UDInlet are encouraged in the design of the storm sewer system.

THE STORM DRAINAGE SYSTEM DESIGN FORM IN THE BACK OF SECTION 600 OF THESE CONSTRUCTION STANDARDS & SPECIFICATIONS SHALL BE USED IN THE DESIGN OF STORM SEWERS AND INLETS. The completed form shall be included in the drainage report.

The storm sewer system shall be installed at all locations where the allowable street capacity is exceeded or wherever ponding of water is likely to occur.

The invert elevation of storm sewer outfalls into channels shall be at least one (1) foot above the channel invert.

The minimum allowable pipe size for storm sewer systems shall be as follows:

**MINIMUM ALLOWABLE PIPE SIZE**

<table>
<thead>
<tr>
<th>Type of conduit</th>
<th>Min. Inside Pipe Dia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Trunk Sewer</td>
<td>21”</td>
</tr>
<tr>
<td>Individual laterals/Driveway Culverts</td>
<td>18”</td>
</tr>
</tbody>
</table>

Pipe diameters of less than eighteen (18) inches may be allowed; however, a variance request shall be submitted to the or designee in writing, and approval shall be obtained from the DPW Director Or designee prior to final design.

Arch pipes may be allowed where design conditions dictate, provided that the minimum cross-sectional areas are not less than those specified above. All storm sewer conduits shall have sufficient structural strength to withstand an H-20 design load.
Manholes shall be a minimum of sixty (60) inches for lines eighteen (18) inches to twenty-one (21) inches diameter, and seventy-two (72) inches for lines twenty-four (24) inches to thirty (30) inches diameter. For storm pipe larger than thirty (30) inches diameter, the DPW Director or designee shall approve the manhole design size. Where two or more pipes enter a manhole, the or designee shall approve the manhole design size.

The maximum allowable distance between manholes or other suitable appurtenances for cleanouts shall not exceed those listed below:

### MAXIMUM ALLOWABLE MANHOLE SPACING

<table>
<thead>
<tr>
<th>Inside Diameter</th>
<th>Maximum Allowable Distance Between Manholes and Cleanouts</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot; - 36&quot;</td>
<td>400 feet</td>
</tr>
<tr>
<td>36&quot; - 60&quot;</td>
<td>500 feet</td>
</tr>
<tr>
<td>60&quot; &amp; Larger</td>
<td>750 feet</td>
</tr>
</tbody>
</table>

The velocity for the minor flows in conduits shall not be less than two (2) feet per second.

Storm inlets shall be utilized at all points where ponding or sump conditions exist. Inlets shall be curb opening inlets, type "R", or grated inlets with curb openings. All inlets shall be similar and equal to those in the Detail Drawings or as approved by the DPW Director or designee.

Grated inlets shall be recommended for bicycle traffic. Grated inlets shall be Neenah Foundry model number R-3157A or R-3233 or an approved equivalent.

The theoretical capacity and spacing of storm inlets shall be analyzed using the criteria—including reduction factors—set forth in the UDFCD Manual.

The size of outlet pipes from stormwater inlets shall be based on the theoretical capacity of the inlet. All pipe outlets shall be protected in accordance with the Detail Drawings.

### Culverts

Culvert capacities shall be at least equal to the capacities of culverts designed in accordance with the procedures outlined in Federal Highway Administration Hydraulic Design Series Number 5, “Hydraulic Design of Highway Culverts”. The DPW Director or designee shall approve the shape, location and type of construction of culverts.
Culverts shall be sized to have sufficient capacity to pass all of the runoff from the major storm if twenty (20) percent of the pipe is plugged.

The following design criteria shall be utilized for all culvert design:

A. The culvert, including inlet and outlet structures, shall properly convey water and debris at all stages of flow.

B. Culvert inlets shall be designed to minimize entrance and friction losses. Inlets shall be provided with either flared end sections or head walls with wing walls. Projecting ends are not acceptable. Large structures shall be designed to resist hydrostatic uplift forces.

C. Culvert outlets shall be designed to avoid sedimentation, undermining of culvert, or erosion of downstream channels. Outlets shall be provided with either flared end sections or headwalls, with wingwalls and riprap. Projecting ends are not acceptable. Additional outlet control, in the form of riprap, channel shaping, etc., may be required.

D. Culvert slopes shall be selected to eliminate excessive velocities and scour. Generally, the minimum slope of culverts shall be limited to one-half (½) percent.

E. Headwater ponding above culvert inlets shall not be acceptable if such ponding appears likely to cause property or roadway damage, culvert clogging, saturation of fills, detrimental upstream deposits of debris, or inundation of existing or future utilities and structures.

F. Tailwater height at the outlet shall be subject to approval by the DPW Director or designee.

G. Culverts shall be analyzed to determine whether discharge is controlled by inlet or outlet conditions for both the minor storm discharge and the major storm discharge. Computations for selected culvert sizes shall be submitted to the DPW Director or designee for approval. Computer programs such as the FHWA HY8 may be used to design culverts.

H. Minimum Allowable Size: The required size of a culvert shall be based on adequate hydraulic design analysis.
   1. Circular culverts under roadways/driveways shall have a minimum diameter of twenty-four (24) inches.
   2. Oval culvert dimensions shall be forty-three (43) inches by twenty-seven (27) inches or larger.
   3. Box culverts shall have a minimum height of four (4) feet.

Smaller culvert sizes may be approved by the DPW Director or designee.

I. An overflow path shall be provided in case the culvert becomes plugged.

J. Where physical conditions dictate, multiple culvert installations may be approved by the DPW Director or designee.
K. The structural design of culverts shall conform to the methods and criteria recommended by the manufacturer of a specific type of culvert for the specified embankment conditions.

613.04 Street Flow Capacities

Except as modified herein, the criteria set forth in the UD FCD Manual shall be used to analyze and to determine the adequacy of streets as a function of the drainage system. Both the minor storm runoff and major storm runoff shall be considered, and calculations showing such runoff at critical sections shall be submitted. The following criteria shall apply in the determination of allowable street flow capacities:

A. Street, curb and gutter, sidewalks, cross pans and curb cuts shall conform to all applicable Sections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

B. Street encroachment for the minor design storm shall not exceed the limitations set forth below:

<table>
<thead>
<tr>
<th>ALLOWABLE STREET ENCROACHMENT AND DEPTH OF FLOW FOR MINOR STORM RUNOFF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Street Classification</strong></td>
</tr>
<tr>
<td>Local</td>
</tr>
<tr>
<td>Connector</td>
</tr>
<tr>
<td>Arterials</td>
</tr>
</tbody>
</table>
Where no curb exists, street encroachment shall not extend past the public R.O.W.

A storm sewer system shall be installed at all points where the maximum allowable street encroachment occurs.

C. The allowable depth of flow and inundated area for the major design storm shall not exceed the following limitations:

**ALLOWABLE DEPTH OF FLOW AND INUNDATED AREA FOR MAJOR STORM RUNOFF**

<table>
<thead>
<tr>
<th>Street Classification</th>
<th>Allowable Depth and Inundated Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local &amp; Connector</td>
<td>Lowest entry to residential dwellings and public, commercial, and industrial buildings shall not be less than twelve (12) inches above the 100-year water surface elevation. The depth of water over the gutter flowline shall not exceed twelve (12) inches.</td>
</tr>
<tr>
<td>Arterial</td>
<td>Lowest entry to residential dwellings and public, commercial, and industrial buildings shall be not less than twelve (12) inches above the 100-year water surface elevation. The depth of water at the street crown shall not exceed six (6) inches to allow operation of emergency vehicles. Depth of water over gutter flow line shall not exceed twelve (12) inches.</td>
</tr>
</tbody>
</table>

D. Cross-street flow occurs when runoff flowing in a gutter flow across the street to the opposite gutter or inlet. Allowable cross-street flow is summarized in the following table:

**ALLOWABLE CROSS-STREET FLOW**

<table>
<thead>
<tr>
<th>Street Classification</th>
<th>Initial Storm Flow</th>
<th>Major Storm Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Six (6) inches depth in crossspan</td>
<td>Twelve (12) inches of depth above gutter flow line</td>
</tr>
<tr>
<td>Collector</td>
<td>Six (6) inches of depth in crossspan</td>
<td>Twelve (12) inches of depth above gutter flow line</td>
</tr>
<tr>
<td>Arterial</td>
<td>None</td>
<td>No cross-street flow. Maximum depth of upstream gutter of twelve (12) inches.</td>
</tr>
</tbody>
</table>
620.00 GENERAL PROVISIONS

621.00 General

All storm drainage construction in the Elbert County R.O.W./Dedicated Easements shall comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS. These standards shall include new storm drainage construction and repairs and maintenance of existing facilities within Elbert County.

622.00 Approved Plans

All storm drainage construction shall be in accordance with engineered construction plans prepared under the direction of a Colorado Registered Professional Engineer. Storm drainage plans shall include an Area Grading Plan and an Erosion Control plan as defined in Section 161.09 Area Grading Plan Details and Section 161.10 Erosion Control Plan Details of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Where work is to be performed over, under or in an irrigation ditch, written approval of the ditch owner is required prior to written approval by the DPW Director or designee.

623.00 Permits Required

A PPIP or Grading Permit issued by Elbert County shall be required and shall not be issued until the DPW Director Or designee has approved the storm sewer plans. A NPDES permit shall be obtained for any disturbance of one acre or more. Refer to Section 150.00 PERMITS AND INSPECTIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements.

624.00 Traffic Control

Traffic control shall comply with Section 141.12 Traffic Control, Barricades and Warning Signs of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

630.00 EROSION CONTROL

631.00 General

Erosion and sedimentation are natural processes, the intensity of which is increased by land disturbing activities that reduce or destroy the aesthetic and practical values of neighboring properties, streams and lakes. The purpose of these erosion control criteria is to reduce intensified erosion—caused by either wind or water—to an acceptable level without placing undue burdens on the landowner, builder or community.
632.00 Requirements

Erosion control measures shall be designed in conformance with the UDFCD Manual (Volume 3). All land-disturbing activities within Elbert County shall comply with the Colorado Department of Public Health and Environment Regulations.

633.00 Submittal

A discussion that summarizes erosion control methods shall be submitted as part of the preliminary and final drainage reports, as required in Section 162.00 Engineering Reports of these CONSTRUCTION STANDARDS & SPECIFICATIONS. A detailed erosion control plan shall accompany the Area Grading Plan and approved Drainage Plan, as required in Section 161.10 Erosion Control Plan Details of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The erosion control plan shall be approved by Elbert County prior to receiving a PPIP or Grading Permit.

634.00 Erosion Control Measures

A CONSTRUCTION STORMWATER DISCHARGE PERMIT (NPDES PERMIT) SHALL BE OBTAINED FROM THE COLORADO DEPARTMENT OF HEALTH AND ENVIRONMENT FOR SITE DISTURBANCE LARGER THAN ONE ACRE.

Detailed erosion control measures shall be provided to protect the following:

A. Inlets and culverts
B. Drainageways
C. Streams or other water bodies immediately adjacent to land disturbed by construction activity
D. Cut and fill areas
E. Properties and improved streets adjacent to construction activity
F. Others as required by the Road & Bridge Superintendent / Elbert County Engineer

Temporary erosion control measures such as sediment traps, straw bales or silt fence shall be properly placed in accordance with the Colorado Department of Public Health and Environment approved Stormwater Management Plan (SWMP) (CDPS Permit) prior to any earthmoving on the site. Erosion control measures shall be kept in good repair and fully functional until erosion potential from the site no longer exists.

Permanent erosion control (sod, seed, mulching, etc.) shall be in place prior to the request for a Certificate of Occupancy or Letter of Final Acceptance.

635.00 Erosion Control Structures
Refer to the Detail Drawings for erosion control installation. When applicable, details of additional erosion control measures may be obtained from the UDFCD Manual (Volume 3).

640.00 STORM DRAINAGE CONSTRUCTION

641.00 Site Work and Earthwork

641.01 General

Site work and earthwork shall be performed in accordance with Section 300.00 SOILS AND EARTHWORK of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

641.02 Trenching, Backfilling and Compacting

Trenching, backfilling and compacting shall be performed in accordance with Section 350.00 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

642.00 Materials

642.01 Pipe

Reinforced Concrete Pipe (RCP) shall be manufactured to comply with ASTM C76. All applicable portions of Section 706 Concrete and Clay Pipe of the CDOT Standard Specifications for Road and Bridge Construction shall apply.

Polyvinyl Chloride Pipe (PVC) shall be manufactured to comply with ASTM F794/F949 (ribbed) or ASTM D3034, SDR-35 (smooth). All joints shall be factory prepared compression type (elastomeric gasket joint), providing a watertight seal.

Non-Reinforced Concrete Pipe (NRCP) shall be manufactured to comply with ASTM C14. NRCP shall be specified under the criteria of Section M-603-2 of the CDOT M&S Standards for all sizes thirty-six (36) inches diameter and smaller.

Polymer Coated Steel Pipe (PCSP) shall be manufactured to comply with AASHTO Section 36. All applicable portions of Section 707 Metal Pipe of the CDOT Standard Specifications for Road and Bridge Construction shall apply. The corrugation of the pipe shall be ¾” x ¾” x 7 ½” spiral rib. Polymer coating, grade 250/250, shall be applied prior to corrugating in conformance with AASHTO 26.3.7.
Corrugated aluminum pipe (CAP) shall be manufactured to comply with all applicable portions of Section 707 Metal Pipe of the CDOT Standard Specifications for Road and Bridge Construction. The pipe sizes shall be as shown on the project plans. The corrugation profile of the pipe shall be ¾” x ¾” x 7 ½” spiral rib. At all locations where corrugated aluminum pipe is proposed to be installed, a corrosion resistance level test shall be performed and a test report detailing any corrosion protection requirements shall be submitted to the DPW Director Or designee for approval.

Corrugated polyethylene pipe (CPP) or High-Density Polyethylene Pipe (HDPEP) shall be manufactured to comply with ASTM D3350, with the minimum cell classification of 315412C. Requirements for test methods, dimensions and markings shall comply with AASHTO Designation M-294. The minimum pipe stiffness shall be 46 psi to comply with ASTM D2412 at five (5) percent deflection.

Corrugated steel pipe (CSP) shall be manufactured to comply with all applicable portions of Section 707 Metal Pipe of the CDOT Standard Specifications for Road and Bridge Construction. The pipe sizes shall be as shown on the project plans. These conduits and coupling bands shall conform to the requirements of AASHTO M 36M (M 36).

Other storm sewer pipe materials may be approved at the discretion of the DPW Director or designee. Pipe class designation or gauge shall be as shown on the approved plans or as designated by the DPW Director Or designee for each individual project. Pipe material shall be selected based on strength and soil conditions.

All pipe shall be inspected by the Elbert County Inspector/Representative in order to allow for rejection of pipe that fails to conform to the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Defects shall be marked so as not to disfigure the rejected pipe. Rejected pipe shall be removed from the job site within twenty-four (24) hours.

642.02 Pipe Joints

All pipe joints shall be watertight. RCP and NRCP joints shall comply with ASTM C443. CPP joints shall comply with ASTM D3212. PCSP and CAP joints shall comply with AASHTO Section 26.4.2.4.f. Cement mortar joints shall be constructed with mortar mixture composed of one (1) part Portland cement to three (3) parts sand and enough water to produce a workable mix. Mortar that has started to set shall be discarded and a new batch prepared.

642.03 Manholes, Inlets and Sidewalk Chases
Manhole bases, vaults and inlets may be constructed of cast-in-place or pre-cast concrete. Manhole materials, including access ring and cover sets for all inlet types, shall comply with all applicable portions of Section 532.03 Manholes of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Inlets, except as modified above, shall be constructed in accordance with the Detail Drawings and all CDOT M&S Standards.

642.04 Manhole Base Slabs & Base Beams

Refer to Section 532.04 Manhole Base Slabs and Base Beams of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

642.05 Concrete

Concrete shall conform to Section 800.00 CONCRETE MIX DESIGN AND CONSTRUCTION of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Type II cement shall be used except where sulfate resistant cement is required. Concrete encasement of pipe shall conform to the details shown on the approved plans.

642.06 Cast and Ductile Iron Fittings

Refer to Section 532.06 Cast and Ductile Iron Fittings of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Lids shall be furnished with the words “STORM SEWER” cast on top.

642.07 Bedding Material

All applicable portions of Section 353.00 Bedding for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS shall apply.

642.08 Riprap and Filter Cloth

Riprap and filter cloth shall be installed at locations shown on the approved plans, or in locations designated by the DPW Director or designee.

Rock used for riprap shall be hard, durable, angular in shape, and be free from cracks, overburden, shale and organic matter. Neither breadth nor thickness of a single stone shall be less than one-third (⅓) its length, and rounded stone shall not be approved. The rock shall sustain the abrasion test (Los Angeles machine - ASTM C0535-69) and shall sustain a loss of not more than ten (10) percent after twelve (12) cycles of freezing and thawing (AASHTO test 103 for ledge rock procedure A). The rock shall have a minimum specific gravity of 2.50. Classification and gradation for riprap are shown below.
The riprap designation and total thickness of riprap shall be as specified on the approved plans. The maximum stone size shall not be larger than the thickness of the riprap.

**CLASSIFICATION AND GRADATION OF RIPRAP**

<table>
<thead>
<tr>
<th>Riprap Designation</th>
<th>% Smaller Than Given Size By Weight</th>
<th>Intermediate Rock Dimension (Inches)</th>
<th>d(50) * (Inches)</th>
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<tr>
<td>Type VL</td>
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<td>35-50</td>
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<td>2-10</td>
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</table>

*d(50) = Mean particle size

**To minimize vandalism, mix Types VL and L riprap with thirty (30) percent (by volume) topsoil and bury it with a minimum of six (6) inches of topsoil, vibration compacted and revegetated.

Filter cloth shall be manufactured especially for the stability of erosion control construction and made from polyethylene, polypropylene or polyester yarns in accordance with the following:

Filter cloth shall be manufactured especially for the stability of erosion control construction and shall meet the requirements of CDOT Class B drainage geotextile as specified in Section 712 of the CDOT CONSTRUCTION STANDARDS & SPECIFICATIONS for Road and Bridge Construction.

Filter material which is to be placed on top of the filter cloth (at specified thickness) prior to placement of the riprap shall meet the bedding requirements in of the UDFCD Manual (Volume 1).
When requested by the DPW Director or designee the Contractor shall furnish copies of test reports from a certified testing laboratory for the following:

A. Gradation and soundness of riprap  
B. Gradation of filter material  
C. Strength and characteristic tests for filter cloth  
D. Compaction tests of the prepared subgrade

643.00 Installation

Refer to Section 533.01 General of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

643.01 Alignment and Grade

Refer to Section 533.02 Alignment and Grade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

643.02 Protection of Existing Underground Utilities

Refer to Section 533.03 Protection of Existing Underground Utilities of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

643.03 Wet Trench

Refer to Section 352.00 Trench Excavation for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

643.04 (Left Blank Intentionally)

643.05 Storm Sewer Pipe Installation

Refer to Section 533.04 Sewer Pipe Installation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

643.06 Connections to Existing Manholes

Refer to Section 533.06 Connections to Existing Manholes of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

643.07 Construction of Manholes, Inlets and Sidewalk Chases

Manholes and inlets shall be constructed in accordance with applicable portions of Section 533.07 Construction of Manholes and Clean-outs of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
643.08  Construction of Open Channels and Special Structures

All work shall conform to details in the approved plans and supplemental specifications. Construction shall comply with Section 533.02 Alignment and Grade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

When approved, sidewalk chases shall be constructed in accordance with the Detail Drawings.

643.09  Riprap and Filter Cloth

Excavation for riprap shall conform to Section 300.00 SOILS AND EARTHWORK of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Filter cloth shall be placed according to the manufacturer’s specifications. Holes, rips or other damage to the filter cloth shall be repaired at the Contractor’s expense, in accordance with the manufacturer’s recommendations.

Stabilization material, as described in Section 340.01 Definitions of these CONSTRUCTION STANDARDS & SPECIFICATIONS, shall be placed on top of the filter cloth (where filter cloth is used) to the required thickness. The material shall be placed using equipment that shall not rip, tear or otherwise damage the filter cloth. Any damaged areas shall be promptly repaired at the Contractor’s expense. The material shall be leveled to a finished surface that is within one (1) inch of the specified thickness.

Riprap shall be placed to conform to the details shown on the approved plans. The larger size stones shall be placed first and roughly arranged in close contact. The toe trench and foundation course shall be closed first. The spaces between the larger stones shall then be filled with smaller stone of suitable size, and placed as to leave the surface evenly stepped, conforming to the contour required. The finished surface shall be even and tight and shall not vary from the planned surface grade by more than three (3) inches per foot of depth. The material may be machine placed with sufficient handwork to conform to these CONSTRUCTION STANDARDS & SPECIFICATIONS.

All riprap shall be grouted. The stones shall be laid with care to prevent earth and sand from filling the joints. Joints shall be filled with grout and the surfaces swept with a stiff broom. The work shall be protected and kept moist during hot weather for at least three (3) days after grouting or coated with a clear membrane curing compound. Grout shall consist of one (1) part cement and three (3) parts aggregate, by volume. The Portland Cement shall be Type II and aggregate shall be two (2) parts sand and one (1) part gravel passing a three-eighths (⅜) inch square mesh screen. Grout shall be mixed with enough water to permit gravity flow of grout into the interstices with limited spading and brooming. A six (6)
inch by six (6) inch concrete mow strip is required around the edges of riprap structures.

When concreting is permitted during cold weather, the temperature of the mix shall not be less than sixty (60) degrees Fahrenheit at the time of placing. Filter cloth, stabilization material, or riprap shall not be placed on frozen ground. Concrete grout shall not be placed when there is frost in the subgrade.

643.10 Testing

643.10.01 Pipe – Water Tightness

All pipe shall be tested for water tightness in accordance with manufacturer’s requirements.

A. Reinforced concrete pipe (RCP) shall be tested in accordance with ASTM C443.
B. High density polyethylene pipe (HDPE) shall be tested in accordance with ASTM D3212.
C. Polyvinyl chloride pipe (PVC) shall be tested in accordance with ASTM D3212.
D. Spiral-ribbed aluminized steel pipe (CMP, ASP) does not require watertight joints.

643.10.02 Pipe – Deflection

All flexible pipe shall be tested for deflection in accordance with Section 534.03 Deflection Testing Pipe of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

643.10.03 Manholes

All manholes shall be tested in accordance with Section 534.02 Vacuum Testing Manholes of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

643.10.04 Infiltration and Exfiltration

If deemed necessary by the DPW Director or designee, the storm sewer system shall be tested in accordance with Section 534.04 Infiltration and Exfiltration Testing of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

644.00 Inspections
Refer to Section 154.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Adequate inspections assure compliance to Elbert County requirements and are the basis for Elbert County’s recommendation that said improvements be accepted for maintenance and for release of performance guarantees. It is the responsibility of the Contractor to contact the DPW Director or designee a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required inspections shall include:

A. Stockpiled Materials – Verify that materials meet CONSTRUCTION STANDARDS & SPECIFICATIONS and approved submittals, including but not limited to: bedding material, pipe, fittings, valves, valve boxes, and fire hydrants. Verify that pipe meets roundness specifications and that bells and spigots are not cracked or chipped.

B. Excavation – Verify proper trench depths, shoring, spoil pile location, dewatering, and location and protection of existing utilities.

C. Installation – Verify proper bedding depth, alignment and grade, clean pipe and lubricants. Verify “slicing in” of bedding at haunches and that all lifting holes in RCP are plugged.

D. Backfill and Compaction – Verify proper methods of backfill and compaction, depths of lifts, moisture control, backfill material free of large rock and organic or frozen material, and proper compaction effort and passing tests.

E. Testing – Verify that testing methods comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Verify that Elbert County has witnesses all low-pressure air tests, joint testing, vacuum testing of manholes and any other testing requirements.

F. Construction Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:

1. All temporary structures, debris, mud and waste materials shall be removed from public property.

2. All relative testing certifications and documentation shall be submitted to Elbert County, including all compaction tests. Copies of originals are acceptable.

3. All storm sewer manholes and inlets are at construction grade, clean, and grouted, ladders straight, inlet protection installed, and storm sewer lines jetted. Verify that storm sewer drainage swales have erosion and sediment control measures installed in accordance with the approved plans.
Prior to requesting a Construction Acceptance inspection, the Contractor shall clean storm sewer mains and shall have the lines inspected with TV video equipment. A copy of the videotape and written report shall be submitted to Elbert County for review. Video shall also include an audio description of pipe and manhole deficiencies, and camera location during the inspection. Any sections that contain debris or obstructions shall be cleaned and re-videotaped. Video shall be continuous from manhole to manhole, and all notations shall correspond to the approved construction plans. If, after visual inspection of the storm sewer lines the DPW Director Or designee suspects that there is a problem, alignment, infiltration, exfiltration and/or deflection tests may be required at the Contractor’s expense.

G. Final Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1. Verify that all temporary structures, debris, mud, and waste materials are removed from public property.
2. Verify that all storm sewer manholes and inlets are clean.

650.00 TRENCHING, BACKFILLING AND COMPACTING

Refer to Section 350.00 TRENCHING BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

660.00 RESTORATION AND CLEANUP

Refer to Section 370.00 RESTORATION AND CLEANUP of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

670.00 GRADING AND EXCAVATION

Refer to Section 330.00 SITE PREPARATION of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
TIME OF CONCENTRATION

SUBDIVISION: _____________________________________

CALCULATED BY: ______________________________ DATE: _____________

t_c = t_i + t_t

<table>
<thead>
<tr>
<th>SUB-BASIN DATA</th>
<th>INITIAL / OVERLAND TIME (t_i)</th>
<th>TRAVEL TIME (t_t)</th>
<th>t_c CHECK (URBANIZED BASINS)</th>
<th>FINAL t_c</th>
<th>REMARKS</th>
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<tr>
<td>DESIGN (1)</td>
<td>C_s (2)</td>
<td>AREA (3)</td>
<td>LENGTH (4)</td>
<td>SLOPE % (5)</td>
<td>t_i Min (6)</td>
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### STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

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<th>DIRECT RUNOFF</th>
<th>TOTAL RUNOFF</th>
<th>STREET FLOW</th>
<th>PIPE</th>
<th>TRAVEL TIME</th>
<th>REMARKS</th>
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<td>AREA (AC)</td>
<td>C * A (AC)</td>
<td>I (IN/HR)</td>
<td>Q (CFS)</td>
<td>STREET SLOPE (%)</td>
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CALCULATED BY: _____________________________  JOB NO: _____________________________

DATE: _____________________________  PROJECT: _____________________________

CHECKED BY: _____________________________  DESIGN STORM: _____________________________

STREET DESIGN POINT:

- **Area Design**
- **Area (AC)**
- **Runoff Coeff.**
- **C * A (AC)**
- **I (IN/HR)**
- **Q (CFS)**
- **t_c (MIN)**
- **Slope (%)**
- **Street Flow (CFS)**
- **Pipe Size (FT)**
- **Velocity (FPS)**
- **t_c (MIN)**
- **Remarks**
### Sequential Detention Calculation

**Subdivision:**

**Calculated by:** __________________________ Date: ________________

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<thead>
<tr>
<th>FACILITY NUMBER</th>
<th>BASIN AREA (A) (Ac)</th>
<th>Q_i CFS</th>
<th>IMP %</th>
<th>K Ft</th>
<th>Q_i/A CFS/Ac</th>
<th>(\sum Q) CFS</th>
<th>Z Ac</th>
<th>S_m Ac-Ft</th>
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</table>

1. Facility Number: Designated number of the detention facility being analyzed.
2. Basin Area: Area of basin (sub-basin) tributary to the detention facility not including any area tributary to an upstream detention facility.
3. \(Q_i\): Peak inflow in cfs from the area described in Column 2.
4. Imp %: Percent imperviousness of the area described in Column 2.
5. K: \(K_{100} = (1.78I - 0.002I^2 - 3.56)/1000; \ K_{10} = (0.95I - 1.9)/1000\)
6. \(Q_i/A\): Peak inflow \(Q_i\) in column 3 divided by the area \(A\) in Column 2.
7. \(\sum Q\): Peak inflow into detention facility computed by summation of the peak inflow in Column 3 and the maximum release rate in Column 10.
8. Z: Equivalent inflow area computed by dividing Column 7 by Column 6 \(\sum Q/Q_i/A\).
9. Minimum \(S_m\): Minimum allowed storage volume for the respective detention facility \(V=KA\), where K is from Column 5 and \(A = Z\) from Column 8.
10. Maximum \(Q_m\): Maximum allowed release rate for the respective detention facility \(Q_{10} = 0.24Z, Q_{100} = 1.00Z\), where \(Z\) is from Column 8.
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SECTION 700
ROADWAY DESIGN, TRAFFIC CONTROL DEVICES AND STREET LIGHTING

701.00 GENERAL CONDITIONS

Refer to Section 100 Title, Scope And General Conditions of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County. This section sets forth the minimum design and technical criteria and specifications to be used in the preparation of all roadway plans.

710.00 SCOPE

All residential and commercial/industrial developments shall provide a Traffic Analysis Report that complies with Section 16.00 Engineering Reports of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

All requirements of Elbert County’s Subdivision and Zoning Ordinances shall be met. Roadway design and R.O.W. modifications shall conform to AASHTO: A Policy on Geometric Design of Highways and Streets, these CONSTRUCTION STANDARDS & SPECIFICATIONS and any other requirements determined by Elbert County.

The design and installation of traffic control devices and street lighting shall comply with all applicable portions of the latest edition of the CDOT Standard Specifications for Road and Bridge Construction, the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD), these CONSTRUCTION STANDARDS & SPECIFICATIONS and any other requirements determined by the DPW Director or designee.

710.01 Roadway Inspections

Refer to Section 154.00 Inspections and Section 931.00 Roadway Inspections of these CONSTRUCTION STANDARDS & STANDARDS & SPECIFICATIONS for required inspections during roadway construction.

720.00 ROADWAY DESIGN

Roadway Design and Technical Criteria

Elbert County has identified a Functional Street Classification Plan based on traffic volumes, land use and expected growth. This Functional Street Classification Plan designates streets as local (Types I, II, III & IV), collector (major and minor), arterial (major and minor). The following criteria apply to each classification.

721.00 Planning Principles for Local Circulation Systems
Basic considerations in the design of local circulation systems must recognize the following factors:

- Safety – for both vehicular and pedestrian traffic
- Efficiency of Service – for all users
- Livability – especially as affected by traffic elements in the circulation system
- Economy – of both construction and use of land

Each of the following principles is an elaboration on one or more of these four factors. The principles are not intended as absolute criteria, since instances may appear where certain principles conflict. The principles should, therefore, be used as guides to proper systems layout.

Ensure Vehicular and Pedestrian Access
The primary function of local streets is to serve abutting properties. Street widths, placement of sidewalks, patterns of street and number of intersections are related to safe and efficient access to abutting lands.

Minimize Through Trips
Through traffic on local and collector streets increases the average speed and volume and thus the accident potential, thereby reducing residential amenities. Through traffic can be discouraged by creating a circuitous route between neighborhoods and higher volume streets and by channelizing or controlling median crossings along peripheral routes.

Control Access to Arterials
Local circulation systems and land development patterns should not detract from the efficiency of peripheral arterial facilities. Ideally, land development should occur so that no local streets require direct access to arterial routes. The number of access points between the local circulation system and the arterial routes should be properly spaced for efficient signalization and traffic flow. The streets that do intersect the arterial system will tend to have high volumes since they are the only exit points.

Discourage Speeding
Residential streets should be designed to discourage fast movement (more than 25 M.P.H.), through the use of curvilinear alignments and circuitous routes in the street system.

Minimize Pedestrian – Vehicular Conflicts
Pedestrian travel from within the area to points outside should require a minimum of street crossings. Sometimes this may be achieved through proper design of street patterns, land arrangements and pedestrian routes. Typical methods include use of cul-de-sacs and loop streets, special pedestrian routes or walkways and the proper placement of high pedestrian traffic generators. In general, while vehicular flow must be outward oriented to the peripheral arterials, pedestrian travel should be inward-oriented to avoid these heavier vehicular flows.
Minimize Space Devoted to Street Use
It is desirable to minimize local street mileage to reduce construction and maintenance costs as well as to permit the most economic land use. Street should also have an appearance commensurate with their function. They should be in keeping with the residential character.

Relate Street to Topography
Local streets will be more attractive and economical if they are constructed to closely adhere to topography. The important role that streets play in the overall storm drainage system can be enhanced by using the topography of the area.

Layout Street to Achieve Optimum Subdivision of Land
The arrangements of streets should permit economical and practical patterns, shapes and sizes of development parcels. Streets as a function of land use must not unduly hinder the development of land. Distances between streets, number of streets, and related elements all have a bearing on efficient subdivision of an area. Access to adjoining properties should also be encouraged, and in some cases may be required.

Any subdivision of land greater than seven (7) lots will require two (2) points of access/egress unless otherwise specified.

A subdivision of land that includes greater than seven (7) lots will be required to pave the roadway(s) within the subdivision when accessed from an existing County maintained paved roadway regardless if the subdivision roadway(s) are public or private.

Subdivision applications for properties that are contiguous to an existing platted subdivision(s) and utilizing roadways through such subdivision(s) or share adjacent roads will be analyzed using the combined density of both subdivisions. This will generally require paving of the roadway(s) through the combined communities. (Example: an application for a seven (7) lot subdivision adjacent to and utilizing or sharing access to a five (5) lot subdivision will be evaluated as a twelve (12) lot subdivision).

Elbert County Public Works reserves the right to accept or reject any roadway not constructed in compliance with County specifications.

Elbert County discourages the construction of gravel roadways in a platted subdivision with greater than seven (7) lots.

A subdivision of three (3) lots or less will be reviewed on a case by case basis.

721.01 Local Type I (gravel)

a Posted Speed Limit – 25

Posted or prima facie speeds for the various street classifications shall be 5 miles per hour less than the design speed of that street.
b Traffic Volumes
Less than 200 vehicles per day.

c Limited Continuity

d Safety

Designed for the ease of access to adjacent parcels of land.

e Traffic Control

Stop signs.

f Function

Local streets provide direct access to adjacent property. Traffic carried by local streets should have an origin or a destination within the neighborhood. 10’ utility, snow storage, and signage easements shall be dedicated. When intersecting with paved road, pavement shall extend to right-of-way.

g Right-of-Way

60 feet

h Number of Moving Lanes

Two

i Access Conditions

Intersections at grade with direct access to abutting property permitted.

j Planning Characteristic

Local Streets should be designed to discourage through traffic from moving through the neighborhood. Local streets should not intersect major collectors or arterial streets. This category of Local Street shall be for residential developments. No on-street parking shall be allowed.

k Type of Curb and Gutter

None. Gravel shoulders.

l Cul-De-Sacs
Shall all have a minimum driving radius of fifty (50) feet, and can be no longer than 600 feet in length, unless a secondary access is provided.

m  Sidewalk Width

None required.

n  Street Widths

Single-family residential; 24’ graveled width plus 2-4’ gravel shoulders, parking restricted on both sides.

o  Minimum Radius or Curvature on Centerline (Horizontal)

See Table 7.2

p  Minimum Length of Vertical Curves

See Table 7.5

q  Street Grades

A minimum longitudinal centerline grade of 2.0% shall be required on all Local streets. Maximum grade is 8.0%. See Table 7.1.

r  Curb Return Radii

No curb returns however, asphalt radius at intersections shall comply with Table

If a gravel road intersects or has access off of a paved County maintained roadway the gravel road shall have a full width paved apron tying into the paved roadway 50 feet beyond the PCR from where the gravel road intersects the County roadway-maintained roadway. Subdivisions with greater than (7) lots will be required to pave the entire roadway(s) within that subdivision.

721.02  Local Type II

a  Posted Speed Limit

25 mph minimum. Posted or prima facie speeds for the various street classifications shall be 5 miles per hour less than the design speed of that street.

b  Traffic Volumes
Stop signs.

c Limited Continuity

d Safety

Designed for ease of access to adjacent parcels of land.

e Traffic Control

Less than 1,280 vehicles per day or 160 dwelling units.

f Function

Local streets provide direct access to adjacent property. Traffic carried by local streets should have an origin of a destination within the neighborhood. Utility, snow storage, and signage easements shall be dedicated.

g Right-of-Way

50 feet with curb and gutter, 60 feet gravel shoulders.

h Number of Moving Lanes

Two

i Access Conditions

Intersections at grade with direct access to abutting property permitted.

j Planning Characteristics

Local streets should be designed to discourage through traffic from moving through the neighborhood. This category of Local Street shall be for residential developments. No on street parking shall be allowed.

k Type of Curb and Gutter

Mountable type curb.

l Cul-De-Sacs
Shall all have a minimum radius of fifty (50’) feet to flow line or EOA (See Exhibits SP.21b and SP.21c) and can be no longer than 600 feet in length, unless a secondary access is provided.

m   Sidewalk Width

None required.

n   Street Width

Single-family residential; 24’ paved width plus 2-4’ gravel shoulders or 24’ flowline – flowline ((20’ paved width plus 2-2’ gutter pans) with parking restricted on both sides.

o   Minimum Radius of Curvature on Centerline (Horizontal)

See Table 7.2

p   Minimum Length of Vertical Curves

See Table 7.5

q   Street Grades

A minimal longitudinal flowline grade of 1.0% shall be required on all Local streets. See Table 7.1.

r   Curb Return Radii

See Table 7.3.

721.03 Local Type III

a   POSTED SPEED LIMIT – 25 mph

Posted or prima facie speeds for the various street classifications shall be 5 miles per hour less than the design speed of that street.

b   TRAFFIC VOLUMES

Less than 1500 vehicles per day.

c   LIMITED CONTINUITY

d   SAFETY
Designed for the safety of pedestrians and bicyclists, and the ease of access to adjacent parcels of land.

e TRAFFIC CONTROL

Stop signs, yield signs, or right-of-way rules for uncontrolled intersections.

f FUNCTION

Local streets provide direct access to adjacent property. Traffic carried by local streets should have an origin or a destination within the neighborhood. Utility line easements should be available.

g RIGHT-OF-WAY – 50 feet

h NUMBER OF MOVING LANES – Two

i ACCESS CONDITIONS

Intersections at grade with direct access to abutting property permitted.

j PLANNING CHARACTERISTICS

Local streets should be designed to discourage through traffic from moving through the neighborhood.

k TYPE OF CURB AND GUTTER

Mountable type with attached sidewalk.

l CUL-DE-SACS, KNUCKLES, & EYEBROWS

Shall all have a minimum flowline radius of forty-five (45) feet. Cul-de-sacs can be no longer than 600 feet in length, unless a secondary assess is provided, or with more than 25 dwelling units, may require all units to be sprinkled per NFPA-13D.

m SIDEWALK WIDTH

Single-family residential: 4’ wide combination w/curb.

n STREET WIDTHS

Single – family residential: 24’ paved width plus 2-2’ gutter pans. (28’ flowline – flowline with parking restricted on one side.)
MINIMUM RADIUS OF CURVATURE ON CENTERLINE
(HORIZONTAL)

MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

STREET GRADES

A minimum longitudinal flowline grade of 1.0% shall be required on all Local streets except at curb returns, knuckles, and bubbles where the minimum flowline grade shall be 2.0%. Maximum grade 6.0%. See Table 7.1.

CURB RETURN RADII

See Table 7.3

Local Type IV Commercial & Industrial

POSTED SPEED LIMIT – 25 mph

TRAFFIC VOLUMES

Less than 1500 vehicles per day.

LIMITED CONTINUITY

SAFETY

Designed for the safety of pedestrians and bicyclist, and the ease of access to adjacent parcels of land.

TRAFFIC CONTROL

Stop signs, yield signs, or right-of-way rules for uncontrolled intersections.

RIGHT-OF-WAY – 60 feet

NUMBER OF MOVING LANES – Two
h  ACCESS CONDITIONS

Intersections at grade with direct access to abutting property permitted.

i  PLANNING CHARACTERISTICS

Local streets should be designed to discourage through traffic from moving through the subdivision. Local streets should not intersect major collector’s arterial streets. This category of Local Street shall be for commercial/industrial developments with a minimum lot width of 100 feet. No on-street parking, backing or loading maneuvers shall be allowed in the street.

j  TYPE OF CURB AND GUTTER

6’ vertical curb & gutter

k  CUL-DE-SAC’S

Shall all have a minimum flowline radius of forty-five (45 feet). Cul-de-sacs can be no longer than 600 feet in length, unless a secondary access is provided, or with more than 25 lots, may require all units to be sprinkled per NFPA-13D.

l  SIDEWALK WIDTHS

Generally 5’ wide attached.

m  STREET WIDTHS

Single family residential; 22’ paved width plus 2’-2’ gutter pans (24’ flowline – flowline with parking restricted on both sides).

n  MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)

See Table 7.2

o  MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.2

p  STREET GRADES

A minimum longitudinal flowline grade of 1.0% shall be required on all Local streets except at curb returns, knuckles, and bubbles where the
minimum flowline grade shall be 2.0 %. Maximum grad 6.0%. See Table 7.1

q CURB RETURN RADII

SEE Table 7.3.

722.00 Collector

A collector is a general term denoting a roadway designed or operating with the following characteristics:

722.01 Minor Collector

a POSTED SPEED LIMIT – 30 mph

Posted or prima facie speeds for the various street classifications shall be 5 miles per hour less than the design speed of that street.

b TRAFFIC VOLUMES

Less than 7000 vehicles per day.

c CONTINUITY

Continuous for less than two miles.

d TRAFFIC CONTROL

Regulation of traffic accomplished through the use of stop signs and channelization. Traffic signals normally used only at intersections with major collectors and arterial streets. Parking is prohibited.

e FUNCTION

Collector streets collect and distribute traffic between arterial and local streets and serve as main connectors within communities, linking one neighborhood with another. Traffic carried by collector streets should have an origin or a destination within the community. Utility line easements should be available.

f RIGHT-OF-WAY - 60 FEET

g NUMBER OF MOVING LANES – Two

h ACCESS CONDITIONS
Intersections at grade with direct access to abutting property permitted unless no other access is reasonably available.

i  PLANNING CHARACTERISTICS

Collector streets should have continuity throughout a neighborhood but need not extend beyond the neighborhood.

j  TYPE OF CURB AND GUTTER

6” vertical curb & gutter

k  SIDEWALK WIDTH

5’ attached or detached.

l  STREET WIDTHS

34’ paved width plus 2-2’ gutter pans. (38’ flowline – flowline). Additional lanes may be required at intersections.

m  MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)

See Table 7.2

n  MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

o  MINIMUM LENGTH OF TANGENTS BETWEEN ALL CURVES

50 feet.

p  STREET GRADES

A minimum longitudinal grade of 2.0% shall be required along the centerline of all Collector and Arterial Streets. Maximum grade 6.0%. See Tables 7.1 & 7.5

q  CURB RETURN RADII

Minimum at street intersections with local and minor collectors shall be 25 feet and with major collectors and arterials shall be 30 feet. See Table 7.3.

722.02  Major Collector
A major collector is a general term denoting a roadway designated or operating with the following characteristics:

a  POSTED SPEED LIMIT – 35 mph

Posted or prima facie speeds for the various street classifications shall be 5 miles per hour less than the design speed of that street.

b  TRAFFIC VOLUMES

Generally greater than 7000 vehicles per day when the property which the collector serves is fully developed.

c  CONTINUITY

Continuous for less than two miles.

d  SAFETY

Designed to handle traffic volumes loading from and onto local, other collector, and arterial roadways.

e  TRAFFIC VOLUMES

Regulation of traffic accomplished through the use of traffic signs, signals and channelization.
Parking is prohibited.
Traffic signals will normally be located only at intersections with streets of higher classification.

f  FUNCTION

Major collector streets permit relatively unimpeded traffic movement and are intended for use on those routes where four (4) moving lanes are required but where a larger classified street is not warranted.

g  RIGHT-OF-WAY – 90 feet (min)

h  NUMBER OF MOVING LANES – 4

i  ACCESS CONDITIONS

Intersections at grade
Access from street of lower classification will be permitted but in all cases will be controlled by traffic control devices.
Direct access to abutting property is not permitted unless no other access is reasonably available.

j PLANNING CHARACTERISTICS

Major collector streets should be employed where traffic demands dictate. Landscaping elements are encouraged (Trees, open space, etc). Intersections with other collector and arterial streets should be at least one quarter (1/4) mile apart.

k TYPE OF CURB AND GUTTER

6” vertical curb & gutter

l SIDEWALK WIDTH

Generally 5’ wide detached.

m STREET WIDTHS

4-12’ travel lanes; 1-12’ center turn lane; 2-2 gutter pans. (64’ flowline-flowline)

n MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)

See Table 7.2

o MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

p MINIMUM LENGTH OF TANGENTS BETWEEN ALL CURVES

One hundred feet.

q STREET GRADES

A minimum longitudinal grade of 2.0% shall be required along the centerline of all Collector and Arterial Streets. Maximum grade 6.0%. See Tables 7.1 & 7.5

r CURB RETURN RADII

Shall be fifty (50) feet minimum at arterial street intersections per AASHTO and FHWA requirements. See Table 7.3
723.00  Arterial

An arterial street is a general term denoting a roadway designated or operating with the following characteristics:

723.01  Minor Arterial

a  Greater than or equal to 35 MPH Actual posted speed to be determined by the Elbert county Engineering Division prior to submittal of construction plans. Posted or prima facie speeds for the various street classifications shall be 10 miles per hour less than the design speed of that street.

b  TRAFFIC VOLUMES

c  Generally less than 12,000 vehicles per day when the property which the arterial serves is fully developed.

d  SAFETY

Designed to handle traffic volumes loading from and onto collector, and arterial roadways.

e  TRAFFIC CONTROL

Regulation of traffic accomplished through the use of traffic signs, signals and channelization.
Parking is prohibited.
Traffic signals will normally be required.

f  FUNCTION

Arterial routes permit relatively unimpeded traffic movement and are intended for use on these routes where four moving lanes and one left-turn lane are required but where a major arterial cross section would not be warranted.

g  RIGHT-OF-WAY- 100 FEET (min)

Additional R.O.W. may be required based on future transit needs as identified by Community Development Services or Department of Public Works.

h  NUMBER OF MOVING LANES – 4
ACCESS CONDITIONS

Intersections at grade
Access from street of lower classification will be permitted but in all cases will be controlled by traffic control devices.

Direct access to abutting property is not permitted unless no other access is reasonable available.

Intersection spacing shall be ¼ mile.

PLANNING CHARACTERISTICS

Arterials should be spaced from one half (1/2) to one (1) mile apart and should, where possible, be continuous. Arterials should act as boundaries between neighborhood areas.

TYPE OF CURB AND GUTTER

6” Vertical cur & gutter.

SIDEWALK WIDTH

5’ wide detached.

STREET WIDTHS

4-12’ travel lanes (minimum); 1-12” left turn lane/striped or raised median, as may be required to control access; 2-2’ gutter pans plus acceleration/deceleration lanes at intersections (64’-88” flowline – flowline).

MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)

MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

MINIMUM LENGTH OF TANGENTS BETWEEN ALL CURVES

One hundred feet.

STREET GRADES

A minimum longitudinal grade of 2.0% shall be required along the centerline off all Collector and Arterial streets. Maximum grade 6.0%. See Tables 7.1 & 7.5.
723.02  Major Arterial (4 Lane)

a  POSTED SPEED LIMIT – Greater than or equal to 35 MPH

Actual posted speed to be determined by Elbert County Road & Bridge prior to submittal of construction plans. Posted or prima facie speeds for the various street classifications shall be 10 miles per hour less than the design speed of that street.

b  TRAFFIC VOLUMES

Generally greater than 12,000 vehicles per day when the property which the collector serves is fully developed.

c  CONTINUITY

Continuous for several miles, generally connecting with inter-county and intra-county routes.

d  SAFETY

Major arterial streets permit rapid and relatively unimpeded traffic movement throughout the county, connecting major land use elements as well as communities with one another. Designed to handle traffic volumes loading from and onto collector, and arterial roadways.

e  TRAFFIC CONTROL

Regulation of traffic accomplished through the use of traffic signals and channelization.

Parking shall be prohibited.

Roadways should have a median strip between them.

f  FUNCTION

Major arterial routes permit rapid and relatively unimpeded traffic movement throughout the county, connecting major land use elements as well as communities with one another.

g  RIGHT-OF-WAY – 120 feet (min)
Additional R.O.W. may be required based on future transit needs as identified by Community Development Services or Department of Public Works.

h NUMBER OF MOVING LANES – 4

i ACCESS CONDITIONS

1. Intersections at grade
2. Intersections will normally be located at ¼ mile intervals.
3. Access from collector and arterial streets shall be controlled by traffic control devices.
4. Normally, direct access to abutting property is not permitted.
5. Abutting properties should not face on the roadway unless separated from it by a frontage road.

j PLANNING CHARACTERISTICS

Major arterials should be spaced approximately one (1) mile apart and should traverse an entire city and/or county. Major arterial streets should not bisect neighborhoods but should act as boundaries between them.

k TYPE OF CURB AND GUTTER

6” vertical curb & gutter.

l SIDEWALK WIDTH

5’ wide detached.

m STREET WIDTH

4-12’ travel lanes (minimum); 4’ to 26’ medians, striped or raised median as may be required to control access; 2-1’; median gutter pans plus necessary left turn and acceleration/deceleration lanes and 4’ median at intersections plus 2-2’ gutter pans (80’ – 102’ flowline-flowline).

n MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)

o MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

p MINIMUM LENGTH OF TANGENTS BETWEEN ALL CURVES
One hundred feet

q STREET GRADES

A minimum longitudinal grade of 2.0% shall be required along the centerline of all Collector and Arterial streets. Maximum grade 6.0%. See Tables 7.1 & 7.5.

r CURB RETURN RADII

Shall be fifty (50) feet minimum at arterial street intersections per AASHTO and FHWA requirements. See Table 7.3.

723.03 Major Arterial (6 Lane)

a POSTED SPEED LIMIT – Greater than or equal to 35 MPH

Actual posted speed to be determined by Elbert County Road & Bridge prior to submittal of construction plans. Posted or prima facie speeds for the various street classifications shall be 10 miles per hour less than the design speed of that street.

b TRAFFIC VOLUMES

Generally greater than 12,000 vehicles per day when the property which the collector serves is fully developed.

c CONTINUITY

Continuous for several miles, generally connecting with inter county and intra-county routes.

d SAFETY

Major arterial streets permit rapid and relatively unimpeded traffic movement throughout the county, connecting major land use elements as well as communities with one another. Designed to handle traffic volumes loading from and onto collector, and arterial roadways.

e TRAFFIC CONTROL

Regulation of traffic accomplished through the use of traffic signals and channelization. Parking shall be prohibited. Roadways should have a median strip between them.

f FUNCTION
Major arterial routes permit rapid and relatively unimpeded traffic movement throughout the county, connecting major land use elements as well as communities with one another.

g **RIGHT-OF-WAY – 140 feet (min)**

Additional R.O.W. may be required based on future transit needs as identified by the Planning Department.

**h **NUMBER OF MOVING LANES – 6**

**i **ACCESS CONDITIONS**

Intersections will generally be at grade.
Intersections will normally be located at ¼ mile intervals.
Access from collector and arterial streets shall be controlled by traffic control devices.
Normally, direct access to abutting property is not permitted.
Abutting properties should not face on the roadway unless separated from it by a frontage road.

**j **PLANNING CHARACTERISTICS**

Major arterials should be spaced approximately one (1) mile apart and should traverse an entire city and/or county. See Section 13.2 for intersection spacing criteria. Major arterial streets should not bisect neighborhoods but should act as boundaries between them.

**k **TYPE OF CURB AND GUTTER**

6” vertical curb & gutter.

**l **SIDEWALK WIDTH**

5’ wide detached.

**m **STREET WIDTHS**

6-12” travel lanes (minimum); 4’ to 26’ medians, striped or raised median as may be required to control access; 2-1’, median gutter pans plus necessary left turn and acceleration/deceleration lanes and 4’ median at intersections plus 2-2’ gutter pans (104’-126’ flowline-flowline).

**n **MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)**
MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

MINIMUM LENGTH OF TANGENTS BETWEEN ALL CURVES

One hundred feet

STREET GRADES

A minimum longitudinal grade of 2.0% shall be required along the centerline of all Collector and Arterial streets. Maximum grade 6.0%. See Tables 7.1 & 7.5.

CURB RETURN RADII

Shall be fifty (50) feet minimum at arterial street intersections per AASHTO and FHWA requirements. See Table 7.3.

724.00 Rural Roads

Residential developments in rural areas of Elbert County having a lot size of least 2.5 acres (gross) may use the following design criteria;

Rural Local Type V

POSTED SPEED LIMIT – 25 mph

Posted or prima facie speeds for the various street classifications shall be 5 miles per hour less than the design speed of that street.

TRAFFIC VOLUMES

Less than 1500 vehicles per day.

LIMITED CONTINUITY

SAFETY

Designated for the safety of pedestrians and bicyclists, and the ease of access to adjacent parcels of land.

TRAFFIC CONTROL
Stop signs, yield signs, or right-of-way rules for uncontrolled intersections.

f FUNCTION

Local streets provide direct access to adjacent property. Traffic carried by local streets should have an origin or a destination within the neighborhood. Utility line easements should be provided.

g RIGHT-OF-WAY – 60 feet

h NUMBER OF MOVING LANES - Two

i ACCESS CONDITIONS

Intersections at grade with direct access to abutting property permitted.

j PLANNING CHARACTERISTICS

Local streets should be designed to discourage through traffic from moving through the neighborhood. Local streets should not intersect major collectors or arterial streets. This category of Local Street shall be for residential developments with a minimum lot size of 2.5 acres (gross). No on-street parking shall be allowed.

k TYPE OF CURB AND GUTTER

None. Gravel shoulders.

l CUL-DE-SACS

Shall all have minimum pavement radius of thirty-eight (38) feet. Cul-de-sacs can be no longer than 600 feet in length without a secondary access, or with more than 25 dwelling units, may require all units to be sprinkled per NFPA-13D.

m SIDEWALK WIDTHS

None required.

n STREET WIDTHS

Single-family residential; 24’ paved width plus 2-4’ gravel shoulders, parking restricted on both sides.

MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)
See Table 7.2

o MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

p STREET GRADES

A minimum longitudinal flowline grade of 1.0% shall be required on all Local streets except at curb returns, knuckles, and bubbles where the minimum flowline grade shall be 2.0%. Maximum grade 6.0%. See Table 7.1, and Table 7.5.

q CURB RETURN RADII

No curb returns, however, asphalt radius at intersections shall comply with Table 7.3.

724.02 Rural Local Type VI

a POSTED SPEED LIMIT – 25 mph

Posted or prima facie speeds for the various street classifications shall be 5 miles per hour less than the design speed of that street.

b TRAFFIC VOLUMES

Less than 1500 vehicles per day.

c LIMITED CONTINUITY

d SAFETY

Designated for the safety of pedestrians and bicyclists, and the ease of access to adjacent parcels of land.

e TRAFFIC CONTROL

Stop signs, yield signs, or right-of-way rules for uncontrolled intersections.

f FUNCTION

Local streets provide direct access to adjacent property. Traffic carried by local streets should have an origin or a destination within the neighborhood. Utility line easements should be provided.
g RIGHT OF WAY – 60 feet

h NUMBER OF MOVING LANES – Two

i ACCESS CONDITIONS

Intersections at grade with direct access to abutting property permitted.

j PLANNING CHARACTERISTICS

Local streets should be designed to discourage through traffic from moving through the neighborhood. Local streets should not intersect major collectors or arterial streets. This category of Local Street shall be for residential developments with a minimum lot size of 2.5 acres (gross). No on-street parking shall be allowed.

k TYPE OF CURB AND GUTTER

Mountable type curb.

l CUL-DE-SACS

Shall all have a minimum pavement radius of fort-five (45) feet. Cul-de-sacs can be no longer than 600 feet in length without a secondary access, or with more than 25 dwelling units, may require all units to be sprinkled per NFPA-13D.

m SIDEWALK WIDTH

None required.

n STREET WIDTH

Single-family residential; 22’ paved width plus 2-2’ gutter pans (24’ flowline with parking restricted on both sides).

o MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)

p MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.2

q STREET GRADES

A minimum longitudinal flowline grade of 1.0% shall be required on all Local streets except at curb returns, knuckles, and bubbles where the
minimum flowline grade shall be 2.0%. Maximum grade 6.0%. See Table 7.1 and Table 7.5.

CURB RETURN RADII

No curb returns, however, asphalt radius at intersections shall comply with Table 7.3.

724.03 Rural Local/Collector

a POSTED SPEED LIMIT – 30 mph

Posted or prima facie speeds for the various street classifications shall be 5 miles per hour less than the design speed of that street.

b TRAFFIC VOLUMES

Less than 5000 vehicles per day.

c CONTINUITY

Continuous for less than two miles.

d SAFETY

Designated to handle traffic volumes loading from and onto local, other collector, and arterial roadways.

e TRAFFIC CONTROL

Regulation of traffic accomplished through the use of stop signs and channelization. Parking is prohibited.

f FUNCTION

Collector streets collect and distribute traffic between arterial and local streets and serve as main connectors within communities, lining one neighborhood with another. Traffic carried by collector streets should have an origin or a destination within the community. Utility line easements should be provided.

g RIGHT OF WAY – 70 feet

h NUMBER OF MOVING LANES – Two

i ACCESS CONDITIONS
Intersections at grade with direct access to abutting property not permitted unless no other access is reasonably available.

j PLANNING CHARACTERISTICS

Collector streets should have continuity throughout a neighborhood but need not extend beyond the neighborhood. Landscaping elements are encouraged (trees, open space, etc.). This category of rural street shall be for residential developments with a minimum lot size of 2.5 acres (gross). No parking.

k TYPE OF CURB AND GUTTER

Normally none.

l SIDEWALK WIDTH

None required.

m STREET WIDTHS

Thirty-two (32’) foot width plus two 4’ gravel shoulders. Additional lanes may be required at intersections.

n MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)

See Table 7.2

o MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

p MINIMUM LENGTH OF TANGENTS BETWEEN ALL CURVES

50 feet.

q STREET GRADES

A minimum longitudinal flowline grade of 1.0% shall be required on all Local streets except at curb returns, knuckles, and bubbles where the minimum flowline grade shall be 2.0%. Maximum grade 6.0%. See Table 7.1 and Table 7.5.

r CURB RETURN RADII
See Table 7.3. If no curbs, pavement radii at street intersections with local and minor collectors shall be 25 feet and with major collectors and arterials shall be 30 feet.

724.04 Rural Major Collector

A major collector is a general term denoting a roadway designated or operating with the following characteristics:

a POSTED SPEED LIMIT – 35 mph

b TRAFFIC VOLUMES

Generally greater than 5000 vehicles per day when the property which the collector serves is fully developed.

c CONTINUITY

Continuous for two or more miles.

d SAFETY

Designed to handle traffic volumes loading from and onto local, other collector, and arterial roadways.

e TRAFFIC CONTROL

Regulation of traffic accomplished through the use of traffic signs, signals and channelization.
Parking is prohibited.
Traffic signals will normally be located only at intersections with streets of higher classification.

f FUNCTION

Major collector streets permit relatively unimpeded traffic movement and are intended for use on those routes where tow moving lanes and a center turn lane are required but where a larger classified street is not warranted.

g RIGHT-OF-WAY-80 feet

h NUMBER OF MOVING LANES – Two

i ACCESS CONDITIONS

j PLANNING CHARACTERISTICS
Major collector streets should be employed where traffic demands dictate. Landscaping elements are encouraged (trees, open space, etc.). Intersections with other collector and arterial streets should be at least one-quarter (1/4) mile apart. This category of rural street shall be for residential developments with a minimum lot size of 2.5 acres (gross). No parking. More lanes and ROW may be required at intersections.

k  TYPE OF CURB AND GUTTER

Normally none; 4’paved plus 4’gravel shoulders.

l  SIDEWALK WIDTH

None required.

m  STREET WIDTHS

2-12’ travel lanes; 1-12” center turn lane; 2-4’ paved plus 2-4’ gravel shoulders (44’ total pavement width).

n  MINIMUM RADIUS OF CURVATURE ON CENTERLINE (HORIZONTAL)

o  MINIMUM LENGTH OF VERTICAL CURVES

See Table 7.5

p  MINIMUM LENGTH OF TANGENTS BETWEEN ALL CURVES

One hundred (100) feet.

q  STREET GRADES

A minimum longitudinal flowline grade of 2.0% shall be required along the centerline of all Collector and Arterial streets. Maximum grade 6.0%. See Tables 7.1 & 7.5.

r  CURB RETURN RADII

See Table 7.3. If no curbs, pavement radius shall comply with Table 7.3.
### Table 7.1
ROADWAY CONSTRUCTION STANDARDS

<table>
<thead>
<tr>
<th>DESIGN SPEED’ (MPH)</th>
<th>LOCAL</th>
<th></th>
<th></th>
<th>RURAL LOCAL</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TYPE I</td>
<td>TYPE II</td>
<td>TYPE III</td>
<td>TYPE IV</td>
<td>TYPE V</td>
<td>TYPE VI</td>
</tr>
<tr>
<td>25</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>MIN R.O.W. (ft.)</td>
<td>60 Single-Family</td>
<td>50/w C&amp;G</td>
<td>60 w/ gravel shoulders</td>
<td>50</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>24’ graveled width 2-4’ gravel shoulders</td>
<td>24’ 24’ paved width 2-4’ gravel shoulders Or 20’ paved width w/ 2-2’ gutter pans</td>
<td>28’ 2-12’ travel lanes 2-2’ gutter pans</td>
<td>40’ 36” paved width 2-2’ gutter pans</td>
<td>24’ paved width 2-4’ gravel shoulders</td>
<td>24’ 2-11’ Travel lanes 2-2’</td>
<td></td>
</tr>
<tr>
<td>24’ graveled Width 2-4’ gravel shoulders</td>
<td>36’ (SF) 32’ paved width 2-2’ gutter pans</td>
<td>44’ (MF) 40’ paved width 2-2’ gutter pans</td>
<td>28’ 2-12’ travel lanes 2-2’ gutter pans</td>
<td>24’ paved width 2-4’ gravel shoulders</td>
<td>24’ 2-11’ travel lanes 2-2’ gutter pans</td>
<td></td>
</tr>
<tr>
<td>SIDEWALK, CURB, GUTTER</td>
<td>None</td>
<td>Vert. or mountable</td>
<td>Mountable 5” curb with attached walk</td>
<td>Vertical 6” curb and gutter with 5” attached walk</td>
<td>NONE</td>
<td>Mountable 5” curb and gutter, no sidewalk</td>
</tr>
<tr>
<td>CURB RETURN MIN. RADII</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>E.O.A. return same as curb</td>
<td>E.O.A. Return same as curb</td>
</tr>
<tr>
<td>-Intersect. Art.</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Intersect. Coll.</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Intersect. Local</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINIMUM RADIUS AT CURVE (ft.)</td>
<td>175</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
<td>225</td>
</tr>
<tr>
<td>Per AASHTO Table 111-15, Fig. 111-17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 7.1
ROADWAY CONSTRUCTION STANDARDS

<table>
<thead>
<tr>
<th></th>
<th>LOCAL</th>
<th>RURAL LOCAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TYPE I</td>
<td>TYPE II</td>
</tr>
<tr>
<td>MIN. TANGENT LENGTH BETWEEN REVERSE CURVE (ft.)</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>MAXIMUM GRADE OF INTERSECTION -Intersect. art. -Intersect. coll. -Intersect. local</td>
<td>See Figure 7.4</td>
<td></td>
</tr>
<tr>
<td>MIN., MAX. STREET GRADIENT</td>
<td>1.0-6.0%</td>
<td></td>
</tr>
<tr>
<td>VERTICAL ALIGNMENT CONTROL</td>
<td>See Table 7.5</td>
<td></td>
</tr>
<tr>
<td>MINIMUM PAVEMENT SECTION</td>
<td>See Table 5.4 for Recommended Minimum Pavement Sections</td>
<td></td>
</tr>
</tbody>
</table>

Posted or prima facie speeds for the various street classifications are normally 5-10 miles per hour less than the design speed of that street. This is absolute minimum that would be allowed. Significantly greater curve radii are required for design of collector and arterial roadways to meet design speed criteria – See Table 7.2.
<table>
<thead>
<tr>
<th>ROADWAY DESIGN STANDARDS &amp; SPECIFICATIONS</th>
<th>SECTION 700</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table 7.1 (CONT.)</strong> ROADWAY CONSTRUCTION STANDARDS</td>
<td></td>
</tr>
<tr>
<td><strong>DESIGN SPEED’ (MPH)</strong></td>
<td><strong>COLLECTOR</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>DRIVING LANES</td>
<td>2</td>
</tr>
<tr>
<td>MIN R.O.W. (ft.)</td>
<td>60</td>
</tr>
<tr>
<td>ROADWAY WIDTH AND COMPOSITION OF CROSS-SECTION AT INTERSECTION</td>
<td>38’</td>
</tr>
<tr>
<td>ROADWAY WIDTH AND COMPOSITION OF CROSS-SECTION NOT AT INTERSECTION</td>
<td>38’</td>
</tr>
<tr>
<td>SIDEWALK, CURB, GUTTER</td>
<td>Vertical 6” curb gutter, detached walk</td>
</tr>
<tr>
<td>CURB RETURN MIN. RADII</td>
<td></td>
</tr>
<tr>
<td>-Intersect. Art.</td>
<td>30</td>
</tr>
<tr>
<td>-Intersect. Coll.</td>
<td>25</td>
</tr>
<tr>
<td>-Intersect. Local</td>
<td>25</td>
</tr>
<tr>
<td>E.O.A. Return Same as curb</td>
<td></td>
</tr>
<tr>
<td>MINIMUM RADIUS AT CURVE (ft.)</td>
<td></td>
</tr>
<tr>
<td>Per AASHTO Table 111-15, Fig. 111-17</td>
<td></td>
</tr>
<tr>
<td>MIN. TANGENT LENGTH BETWEEN REVERSE CURVE (ft.)</td>
<td>100</td>
</tr>
<tr>
<td>ROADWAY CONSTRUCTION STANDARDS</td>
<td>COLLECTOR</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>MAXIMUM GRADE OF INTERSECTION</td>
<td></td>
</tr>
<tr>
<td>-Intersect. art.</td>
<td>See Figure 7.4</td>
</tr>
<tr>
<td>-Intersect. coll.</td>
<td></td>
</tr>
<tr>
<td>-Intersect. local</td>
<td></td>
</tr>
<tr>
<td>MIN., MAX. STREET GRADIENT</td>
<td>2.0-6.0%</td>
</tr>
<tr>
<td>VERTICAL ALIGNMENT CONTROL</td>
<td>See Table 7.5</td>
</tr>
<tr>
<td>MINIMUM PAVEMENT SECTION</td>
<td>See Table 7.6 for Recommended Minimum Pavement Sections</td>
</tr>
</tbody>
</table>

Posted or prima facie speeds for the various street classifications are normally 5-10 miles per hour less than the design speed of that street. This is absolute minimum that would be allowed. Significantly greater curve radii are required for design of collector and arterial roadways to meet design speed criteria – See Table 7.2.
Table 7.1
ROADWAY CONSTRUCTION STANDARDS

<table>
<thead>
<tr>
<th>DESIGN SPEED’ (MPH)</th>
<th>MINOR</th>
<th>MAJOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45 (min.)</td>
<td>45 (min.)</td>
</tr>
<tr>
<td>DRIVING LANES</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>MIN R.O.W. (ft.)</td>
<td>100</td>
<td>120</td>
</tr>
<tr>
<td>ROADWAY WIDTH AND COMPOSITION OF CROSS-SECTION AT INTERSECTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>86’</td>
<td>4-12’ travel lanes</td>
<td>102’</td>
</tr>
<tr>
<td></td>
<td>1-12’ left turn lane</td>
<td>2-11’ left turn lanes</td>
</tr>
<tr>
<td></td>
<td>2-11’ accel/decel lanes</td>
<td>2-11’ accel/decel lanes</td>
</tr>
<tr>
<td></td>
<td>2-2’ gutter pans</td>
<td>2-2’ gutter pans</td>
</tr>
<tr>
<td></td>
<td>2’1’ median</td>
<td>2’1’ median</td>
</tr>
<tr>
<td></td>
<td>Gutter pans</td>
<td>Gutter pans</td>
</tr>
<tr>
<td></td>
<td>1-4’ median (fl-fl)</td>
<td>1-4’ median (fl-fl)</td>
</tr>
<tr>
<td>ROADWAY WIDTH AND COMPOSITION OF CROSS-SECTION NOT AT INTERSECTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64’</td>
<td>4-12’ travel lanes</td>
<td>80’</td>
</tr>
<tr>
<td></td>
<td>1-12’ left turn lane</td>
<td>1-26’ median</td>
</tr>
<tr>
<td></td>
<td>Striped median</td>
<td>2-1’ median</td>
</tr>
<tr>
<td></td>
<td>2-2’ gutter pans</td>
<td>2-2’ gutter pans</td>
</tr>
<tr>
<td>SIDEWALK, CURB, GUTTER</td>
<td>Vertical 6’curb and gutter with 5’ minimum detached walk</td>
<td>Vertical 6’’ curb and gutter with 5’ minimum detached walk</td>
</tr>
<tr>
<td>CURB RETURN MIN. RADII</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Intersect. Art.</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>-Intersect. Coll.</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>-Intersect. Local</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>MINIMUM RADIUS AT CURVE (ft.)</td>
<td>Per AASHTO Table 111-15, Fig. 111-17</td>
<td></td>
</tr>
<tr>
<td>650</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 7.2
HORIZONTAL CURVES

<table>
<thead>
<tr>
<th>DESIGN SPEED (MPH)</th>
<th>MAXIMUM CURVE (DEGREES)</th>
<th>MINIMUM CURVE RADIUS* (FEET)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>32.7</td>
<td>175</td>
</tr>
<tr>
<td>30</td>
<td>22.9</td>
<td>225</td>
</tr>
<tr>
<td>35</td>
<td>14.3</td>
<td>400</td>
</tr>
<tr>
<td>40</td>
<td>10.4</td>
<td>600</td>
</tr>
<tr>
<td>45</td>
<td>8.0</td>
<td>720</td>
</tr>
<tr>
<td>50**</td>
<td>6.7</td>
<td>850</td>
</tr>
<tr>
<td>55**</td>
<td>5.7</td>
<td>1000</td>
</tr>
</tbody>
</table>

* Adapted from AASHTO Fig. 111-17
** Super elevation may be allowed.

TABLE 7.3
CURB RETURN RADII
MINIMUM AND MAXIMUM
(Measured Along Flowline)

<table>
<thead>
<tr>
<th>THROUGH STREET</th>
<th>ARTERIAL</th>
<th>COLLECTOR</th>
<th>LOCAL SERVICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARTERIAL</td>
<td>35’ min. 60’ max</td>
<td>35’</td>
<td>35’</td>
</tr>
<tr>
<td>COLLECTOR</td>
<td>35’</td>
<td>35’</td>
<td>20’ min. 25’ max.</td>
</tr>
<tr>
<td>LOCAL</td>
<td>35’</td>
<td>35’</td>
<td>20’ min. 25’ max.</td>
</tr>
</tbody>
</table>
### TABLE 7.4
STOPPING AND PASSING SIGHT DISTANCE

<table>
<thead>
<tr>
<th>DESIGN SPEED (MPH)</th>
<th>STOPPING SIGHT DISTANCE</th>
<th>PASSING SIGHT DISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>20</td>
<td>125</td>
<td>800</td>
</tr>
<tr>
<td>25</td>
<td>150</td>
<td>1000</td>
</tr>
<tr>
<td>30</td>
<td>200</td>
<td>1100</td>
</tr>
<tr>
<td>35</td>
<td>250</td>
<td>1300</td>
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<td>40</td>
<td>275</td>
<td>1500</td>
</tr>
<tr>
<td>45</td>
<td>325</td>
<td>1650</td>
</tr>
<tr>
<td>50</td>
<td>400</td>
<td>1800</td>
</tr>
<tr>
<td>55</td>
<td>450</td>
<td>1950</td>
</tr>
</tbody>
</table>

From AASHTO “Green Book”
Table III-1, Table III-5 and Table VII-3

### TABLE 7.5
VERTICAL ALIGNMENT CONTROLS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DESIGN SPEED*</th>
<th>MAX GRADE ** (7%mtn)</th>
<th>K-VALUE RANGES CREST</th>
<th>SAG</th>
<th>MIN V.C.L. CREST</th>
<th>SAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCAL (TYPE I)</td>
<td>25</td>
<td>6%</td>
<td>25-30</td>
<td>25-30</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>LOCAL (TYPE II)</td>
<td>30</td>
<td>6%</td>
<td>25-30</td>
<td>25-30</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>LOCAL (TYPE III)</td>
<td>30</td>
<td>6%</td>
<td>25-30</td>
<td>25-30</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>LOCAL (TYPE IV)</td>
<td>30</td>
<td>6%</td>
<td>25-30</td>
<td>25-30</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>
### DESCRIPTION

<table>
<thead>
<tr>
<th></th>
<th>DESIGN SPEED*</th>
<th>MAX GRADE **</th>
<th>K-VALUE RANGES CREST</th>
<th>SAG</th>
<th>MIN V.C.L. CREST</th>
<th>SAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCAL (TYPE V)</td>
<td>30</td>
<td>6% (7%mtn)</td>
<td>25-30</td>
<td>25-30</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>LOCAL (TYPE VI)</td>
<td>30</td>
<td>6% (7%mtn)</td>
<td>25-30</td>
<td>25-30</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>RURAL LOCAL/COLL.</td>
<td>35</td>
<td>6% (7%mtn)</td>
<td>35-50</td>
<td>40-50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>MINOR COLLECTOR</td>
<td>35</td>
<td>6% (7%mtn)</td>
<td>35-50</td>
<td>40-50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>RURAL MAJ. COLL.</td>
<td>40</td>
<td>6% (7%mtn)</td>
<td>55-65</td>
<td>55-65</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>MAJOR COLLECTOR</td>
<td>40</td>
<td>6% (7%mtn)</td>
<td>55-65</td>
<td>55-65</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>MINOR ARTERIAL</td>
<td>45</td>
<td>6.0 %</td>
<td>70-105</td>
<td>65-85</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>MAJOR ARTERIAL</td>
<td>45</td>
<td>6.0%</td>
<td>115-220</td>
<td>90-125</td>
<td>110</td>
<td>90</td>
</tr>
</tbody>
</table>

*The design speed is a minimum of five (5) mph over the posted speed for each classification, except arterials. Arterials are ten (10) mph over posted and design speeds are minimum for arterials.

**The maximum grades indicated should only be used in extreme topographic conditions, e.g., mountains. The designer should strive to minimize the use of these grades for considerable lengths and on north facing slopes.

***All vertical curves in knuckles and bubbles shall have a length of 50 feet.

### TABLE 7.6
RECOMMENDED MINIMUM PAVEMENT SECTIONS

<table>
<thead>
<tr>
<th>CLASSIFICATION</th>
<th>EDLA</th>
<th>ASPHALT</th>
<th>TREATED SUBGRADE OR BASE (Inches)</th>
<th>FULL DEPTH ASPHALT (Inches)</th>
<th>PORTLAND CEMENT CONCRETE (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Residential</td>
<td>(Table 5.2)</td>
<td>3</td>
<td>6</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Commercial</td>
<td>30</td>
<td>3</td>
<td>6</td>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Industrial</td>
<td>100</td>
<td>4</td>
<td>6</td>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Minor Collector Residential</td>
<td>100</td>
<td>3</td>
<td>6</td>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Commercial</td>
<td>100</td>
<td>4</td>
<td>6</td>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Industrial</td>
<td>150</td>
<td>4.5</td>
<td>6</td>
<td>6.5</td>
<td>6.0</td>
</tr>
</tbody>
</table>
### Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>EDLA</th>
<th>Asphalt</th>
<th>Treated Subgrade or Base (Inches)</th>
<th>Full Depth Asphalt (Inches)</th>
<th>Portland Cement Concrete (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Collector Residential</td>
<td>100</td>
<td>4</td>
<td>6</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Commercial Industrial</td>
<td>150</td>
<td>4.5</td>
<td>6</td>
<td>6.5</td>
<td>6.0</td>
</tr>
<tr>
<td>Minor Arterial</td>
<td>200</td>
<td>5</td>
<td>6</td>
<td>7.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Major Arterial</td>
<td>200</td>
<td>5</td>
<td>6</td>
<td>8.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

### 725.00 Major Structures

Major structures, such as retaining walls, box culverts and bridges, that are appurtenant to proposed street and/or parking lot construction, shall conform to the structural design and loading requirements of the CDOT Standard Specifications for Road and Bridge Construction and the geometric and drainage requirements of these ROAD & BRIDGE REGULATIONS CONSTRUCTION STANDARDS & SPECIFICATIONS. Plans and supporting calculations for major structures shall be prepared by a structural engineer who is a Colorado Registered Professional Engineer. Guardrails shall be designed to comply with the CDOT Standard Specifications for Road and Bridge Construction.

### 726.00 Emergency Access

Emergency access roads shall have a minimum of R.O.W. width of twenty-two (22) feet and a minimum roadway width of twenty (20) feet.

### 727.00 Parking Lots and Private Street Systems

Parking lots shall be constructed with one (1) percent minimum and four (4) percent maximum cross-slopes throughout.

Private street systems and parking lots that are owned and maintained by a Homeowners Association (HOA) or other property management group shall be designed and constructed in accordance with these ROAD & BRIDGE REGULATIONS CONSTRUCTION STANDARDS & SPECIFICATIONS. Compliance to these ROAD & BRIDGE REGULATIONS CONSTRUCTION STANDARDS & SPECIFICATIONS shall be certified by a qualified third party approved by Elbert County. Construction shall not commence until the construction plans are approved by Elbert County.

Anytime a subdivision of land occurs that is accessed off of a private road that portion of roadway from the County road to the point of access shall at a minimum meet Type I Gravel Roadway standards.
### 728.00 Street Lane Design Criteria

#### 728.01 Acceleration and Deceleration Lanes

<table>
<thead>
<tr>
<th>Posted Speed Limit in MPH</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deceleration Length in Feet*</td>
<td>180</td>
<td>250</td>
<td>310</td>
<td>370</td>
<td>435</td>
<td>500</td>
<td>600</td>
<td>700</td>
<td>800</td>
<td>900</td>
</tr>
<tr>
<td>Acceleration Length in Feet</td>
<td>N/A</td>
<td>N/A</td>
<td>270</td>
<td>380</td>
<td>550</td>
<td>760</td>
<td>960</td>
<td>1170</td>
<td>1380</td>
<td>1590</td>
</tr>
</tbody>
</table>

* Includes Transition Taper Ratio (storage)

#### 728.02 Required Turning Lane Length

<table>
<thead>
<tr>
<th>Turning Vehicles Per Peak Hour</th>
<th>Below 30</th>
<th>30</th>
<th>60</th>
<th>100</th>
<th>200</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Lane Length in Feet</td>
<td>25</td>
<td>40</td>
<td>50</td>
<td>100</td>
<td>200</td>
<td>300</td>
</tr>
</tbody>
</table>

#### 728.03 Redirect Tapers for Through Lanes

<table>
<thead>
<tr>
<th>Posted Speed in MPH</th>
<th>30 or less</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight Taper Ratio</td>
<td>15:1</td>
<td>20:1</td>
<td>30:1</td>
<td>45:1</td>
<td>50:1</td>
<td>55:1</td>
<td>60:1</td>
<td>65:1</td>
<td>70:1</td>
</tr>
</tbody>
</table>

#### 728.04 Entering Sight Distance

<table>
<thead>
<tr>
<th>Vehicle expected to enter or cross highway</th>
<th>Posted Speed of Roadway (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Lane Roadway (ft)</td>
<td>25</td>
</tr>
<tr>
<td>Passenger Cars, Pickup Trucks</td>
<td>250</td>
</tr>
<tr>
<td>Single Unit Trucks Over 10,000 lb. GVW</td>
<td>325</td>
</tr>
<tr>
<td>Multi-Unit Trucks</td>
<td>425</td>
</tr>
<tr>
<td>Four Lane Roadway (ft)</td>
<td></td>
</tr>
<tr>
<td>Passenger Cars, Pickup Trucks</td>
<td>300</td>
</tr>
<tr>
<td>Single Unit Trucks Over 10,000 lb. GVW</td>
<td>375</td>
</tr>
<tr>
<td>Multi-Unit Trucks</td>
<td>500</td>
</tr>
</tbody>
</table>
Roundabout design shall be performed in accordance with the requirements and design criteria set forth in the published design guide by the U.S. Department of Transportation Federal Highway Association, Roundabouts an Informational Guide, June 2000 compiled by the Turner-Farbank Highway Research Center.

729.00 Structural Sections

729.01 Structural Sections for Streets

Structural sections for streets shall be designed by a Soils Engineer based on the Equivalent (18 Kip) Daily Load Applications (EDLA) for a 20 year service life. The soils analysis shall be performed in accordance with AASHTO standard methods of surveying and sampling soils. The field investigation shall consist of boring subgrade soils to a depth of at least five feet below proposed subgrade elevation. Every fourth boring shall be to a depth of ten feet. Boring spacing shall be a maximum of two hundred and fifty (250) feet and a minimum of one boring for each section of street. Borings for arterial roadway design shall be to a depth of at least ten (10) feet below proposed subgrade.

SOIL SAMPLES FOR DESIGN OF STRUCTURAL SECTION FOR STREETS SHALL BE OBTAINED AFTER GRADING OPERATIONS ARE COMPLETE AND SUBGRADE IS ROUGH CUT.

The Hveem Stabilometer or Resilient Modulus design method shall be used for arterial streets, and the Hveem Stabilometer, Resilient Modulus or the California Bearing Ratio (CBR) design method shall be used for all other streets.

The structural section may consist of a granular base with an asphaltic concrete wearing surface or stabilized subgrade with an asphaltic concrete wearing surface. The structural section shall be a twenty (20) year design section with a cross-slope of two (2) percent from flow line to centerline. The structural section extends to the back of attached sidewalk or to the back of curb if the sidewalk is detached. The DPW Director or designee may specify which type of structural section is required.
The following standards shall be used in the design of pavement sections for public and private roadways in Elbert County. These minimum pavement thicknesses may be used for preliminary planning purposes only. Final pavement designs shall be based on actual subgrade support test results. Structural credit for lime stabilized subgrade may be allowed at the discretion of the DPW Director or designee if field verification and testing documents are provided. The DPW Director or designee may require additional subgrade testing to confirm whether the pavement design thickness is satisfactory.

The following structural strength coefficients should be the maximum used for pavement design:

- Asphalt: 0.40
- CDOT Class 6 Base Course: 0.12
- Other Base Material with R value ≥ 75: 0.12

At the discretion of the DPW Director or designee, a maximum coefficient of up to 0.12 may be used for stabilized subgrade.

Portland cement concrete pavement designs may be allowed with the DPW Director or designee approval.

729.02 Structural Sections for Parking Lots

Structural sections for parking lots shall be designed by a Soils Engineer based on a soil's analysis in accordance with AASHTO T-86 standard methods of surveying and sampling soils. The Hveem Stabilometer, Resilient Modulus or the California Bearing Ratio (CBR) design method shall be used for parking lots. The structural section may consist of a granular base with an asphaltic concrete wearing surface, a full-depth asphalt section, or stabilized subgrade with an asphaltic concrete wearing surface. Based on the structural sections and the typical daily traffic volumes (shown in the Street Design Criteria table), the DPW Director or designee shall determine into which category a parking lot is placed and consequently which of these CONSTRUCTION STANDARDS & SPECIFICATIONS shall apply.

729.03 Structural Sections for Reconstruction of Existing Low Volume Roadways

Periodically, it is necessary to completely reconstruct existing roadways. It is Elbert County’s desire to accomplish reconstruction in a manner that results in a roadway surface that satisfies a 20-year pavement life in a cost-effective manner with minimal inconvenience to surrounding residences, businesses or other potential users. Such reconstruction programs shall have minimal impact to existing facilities, utilities, subgrades, or otherwise usable structures/improvements. Additionally, all design and construction techniques and procedures shall be performed in a manner that balances overall cost with impact and inconvenience to Elbert County residents. The following are guidelines that shall be considered in the design. Consultants, designers, and Contractors shall also consider other feasible options to achieve practical roadway reconstruction that is acceptable to Elbert County and the affected public.
The geotechnical report shall address the following items:

- Why the roadway is to be reconstructed
- Why failure is taking place and what type(s) of failure:
  - Drainage
  - Saturated sub-grade
  - Heaving
  - Oxidation
- Age of roadway and number of overlays placed
- Existing subsurface problems
- Drainage issues

729.03.01 Site Exploration

The DPW Director or designees shall identify the limits of proposed reconstruction for the roadway surfaces, concrete curbs and gutters, crosspans, etc. The Project Geotechnical Engineer shall perform site exploration(s) as follows:

Borings shall be conducted at a frequency of at least one (1) per five hundred (500) linear feet of roadway per lane or as necessary to achieve proper design recommendations or a minimum of two (2) per street segment or where obvious surface problems/failures features exist.

Borings shall extend to a minimum of five (5) feet below existing grade or to a depth of the proposed utility, unless utility conflicts are prohibitive. Every fourth boring shall be advanced to a minimum of ten (10) feet below the existing grade.

Sufficient sampling, including relatively undisturbed sampling, shall be performed at depths just below the surface to two (2) feet below the surface to address the stability of the existing subgrade soils. A minimum of one (1) undisturbed sample per soil type per roadway shall be obtained within this shallow zone.

Additional samples shall be obtained to evaluate the characteristics of the subsurface soils with respect to soil classification, in-situ moisture content, swell / settlement potential, subgrade support, and stability within the five (5) foot layer under the pavement.

Observations shall be made of the existing grades, drainages, landscaping, nearby water features, and other factors that may influence moisture infiltration into the pavement subgrade.

729.03.02 Pavement Reconstruction Design and Reports

The pavement design shall be based on information obtained from subsurface soil characteristics and site observations during the site exploration program and from expected traffic loading. The pavement design shall also consider the impact to the public, as well as relative cost of reconstruction. The following guidelines shall be adhered to in the design of pavement section(s) and subgrade preparation:
The default subgrade preparation for reconstructed Low Volume Pavements (EDLA < 40) shall consist of either removing the existing asphalt surface and paving the designed pavement layer over the existing subgrade OR recycling the existing asphalt surface into the underlying subgrade to a depth of at least twelve (12) inches using an in-place recycling machine, blading to the design grades, compacting to the recommended density (as determined by either AASHTO T99 or T180, depending upon subgrade classification) and paving. The Pavement Design Report shall address the feasibility of utilizing one of the above procedures for the subgrade preparation.

For subgrades with near-optimum moisture likely to exhibit minor stability problems, the asphalt shall be rotomilled into the underlying subgrade to a depth of at least twelve (12) inches, bladed to the design elevation and stabilized with twelve (12) percent Type C Fly-Ash to a depth of at least twelve (12) inches. A maximum structural coefficient of 0.10 may be used for this twelve (12) inch layer. This shall be reduced to as low as 0.06 for subgrades with clay content exceeding fifty (50) percent, based upon the Project Geotechnical Engineer’s recommendation.

If it is determined that the subgrade preparations detailed within this section may result in a poor paving platform or pose a long-term concern with respect to heave or settlement, then alternative recommendations shall be provided by the Project Geotechnical Engineer and approved by the DPW Director or designee. Such alternates shall consider cost, time, and performance and may include limited over-excavation, moisture treatment, chemical and/or aggregate stabilization, edge drains, and/or increased pavement thickness.

### 729.04 Edge Drains

Edge drains shall be required along public roadways at the discretion of the DPW Director or designee. Edge drains shall be located in order to intercept water infiltration from landscaping and storm runoff.

Edge drains shall be installed in the following locations:

- Along landscaped medians;
- Where final roadway pavement slope is less than one and one-half (1.5) percent;
- Along the “uphill” roadway edge where the roadway is located on a cut slope and the roadway pavement slope is less than two (2) percent;
- Along both roadway edges where the roadway is located at the bottom of a “valley”, with the toe of slopes on both sides of the roadway;
- Along roadways that may have poor drainage due to unusual circumstances

Edge drains are not required in areas where final grade slopes away from a paved surface at a minimum slope of two (2) percent.

All edge drains should be placed behind the curb and at a depth specified on the approved plans and backfilled with free draining three-quarters (¾) inch washed gravel protected by geotextile fabric.
730.00 SIGNAGE AND PAVEMENT MARKINGS

731.00 Signs

731.01 Street Name Signs

Street name signs shall be furnished and installed by the Contractor or Developer and may be inspected by Elbert County before and after installation. Street name signs shall have white letters on a green background, and shall comply with the following:

All signs shall be constructed with 0.080 aluminum blanks. They shall have three-eighths (⅜) inch holes punched in the center two (2) inches from the bottom and top edges, green high intensity, retro-reflective sheeting, high intensity retro-reflective letters or numbers.

The street name blank shall be nine (9) inches in height, with six (6) inch Series C upper case letters or numbers and three (3) inch FHWA Series C upper case prefix or suffix. Plate must be dog bone style.

No border, logo, or county designator shall be included with the sign

The length of the sign shall vary due to the length of the street name. FHWA Series B letters may be permitted to maintain the length of the street name sign.

Silk-screened signs are acceptable if they are manufactured with high intensity, retro-reflective sheeting and 3M “Scotchlite” Brand Process Colors transparent inks or equivalent. Signs fabricated with high intensity sheeting with translucent 3M “EC” film or equivalent are also allowed.

At every cross intersection, two (2) street name signs shall be provided for each named street. At every tee intersection, one (1) street name sign shall be provided for each named street.

Signs manufactured with sheeting and letters placed back to back on the same sign blank are not permitted.

Prior to installing custom signs and/or posts in a development, the Developer or Contractor shall obtain a signed maintenance agreement with the DPW Director or designee.

731.02 Illuminated Signs

Signalized intersections shall have eight (8) foot internally illuminated street name signs which shall be furnished and installed by the Contractor or Developer and shall be inspected by Elbert County. Signs shall be supplied by a manufacturing company approved by the County Engineer. Signs shall be provided for installation on each traffic signal mast arm at each intersection. All sign lettering shall be uppercase. Sign lettering shall be ten (10) inches in height, FHWA Series C letters. The use of FHWA Series B letters may be allowed when space requirements are limited. Suffixes shall be five (5) inches in height. Lettering shall be at least four (4) inches in height where a two-line
application is desired or three (3) inches in height where a three-line application is desired.

Borders. Signs shall not include a border, logo, or county designator.
Spacing. The spacing to the top and bottom borders should be equal. The lateral spacing to the vertical borders should also be equal. Spacing used in words, words and arrow, a letter and arrow, or a word and numeral in a line copy should be approximately one (1) to one and one-half (1½) times the uppercase letter height used in that line of copy. Excessively long street names may be allowed to have modified kern or letter widths but shall maintain the ten (10) inch required letter height.
Arrows. Arrows shall comply with the MUTCD Standard Highway Sign Handbook. A twelve (12) inch Elbert County logo shall be placed on the left face side of the sign and centered accordingly.
Color. Letters and numbers shall be white with a green background face. The sign panel shall consist of placing White 3M “3990t” translucent, high intensity, retro-reflective sheeting under green 3M “1175c” EC Film. The colors shall not fade when exposed to an accelerated test of ultraviolet light equivalent to five years of outdoor exposure.
Mechanical Specifications. The outer dimensions of the sign assembly shall be standard nominal heights of 22, or 24, inches, and standard nominal width of 8 feet. The maximum thickness of the sign shall be 1.60 inches. The maximum weight shall not exceed 75 lbs. The long edges of the sign shall be made from a single section of 6000 series aluminum extrusion. The ends caps shall be affixed to the frame with stainless steel screws. The power supply shall be mounted internally in one of the end caps. The non-electrical end cap shall be removable to enable replacing panels and components. The sign shall have a front panel that is UV, weather, abrasion and impact resistant. The front panel shall be replaceable so that maintaining agencies have the option to supply their own sheeting and electrocut film for the sign faces.
Mounting System. Signs must be supplied with underhang mounting brackets on two positions on the top of the sign. Mounting bracket shall pivot to allow the sign to swing freely. Bracket shall have a bolt hole pattern to accept Pelco SE-5015, SE-5146, or equivalent.
Environmental Specifications. The sign shall be designed and constructed to withstand 178 Km/h (110 mph) wind loads in conformance with the requirements of the AASHTO publication, "Standard Specifications for Structural Supports of Highway Signs, Luminaries and Traffic Signals", 4th Edition 2001. The sign and power supply should be able to withstand and operate at temperature extremes of -22 deg F to +140 deg F. Signs shall be tested and certified for the following environmental conditions: Exclusion of Water Test, Strain Relief Test, Temperature Test and Dielectric Voltage-Withstand Test. A representative sample of the product shall be tested in accordance with the Standards for Electric Signs (UL 48).
Luminance. The entire surface of the sign panel must be evenly illuminated with a minimum average brightness reading at the letters of 300 lux and a variation of no more than 40% for any reading from the average (minimum of 10 readings). Each background reading measured must not vary by more than 40% (minimum of 10 readings) from the average of the background brightness readings. The light transmission factor of the sign panel must provide a letter to background ratio of a minimum of 4:1.
Light Source. The light source for the sign shall be LEDs (light emitting diodes) mounted along the edges of the sign. The LEDs shall evenly illuminate a light panel that is the same dimensions of the sign face. The LEDs shall have a minimum projected life of 50,000 hours. A maximum of four LEDs per square foot shall be used.

Energy Requirements. The overall power required shall not exceed 4 Watts per square foot.

Energy Star Partner. The sign shall be an Energy Star Qualified Product.


Electrical Standards. Sign shall be listed and approved to UL 48 Standards. The outside of the sign shall be marked with the authorized listing agency mark.

Product Guarantee. Sign must be guaranteed for a minimum of three years.

Final Layout. Final layout and lettering details shall be submitted to Elbert County prior to fabrication.

731.03 Stop Signs

Stop signs shall be installed at all approaches to streets designated by Elbert County as through streets. Stop signs shall be mounted on the same support posts as street name signs where possible. All signs shall have Diamond Grade Reflective sheeting and meet the MUTCD Conventional Road Dimension charts and the MUTCD Standard Highway Signs.

731.04 Other Signs

Regulatory, warning, guide, informational, and custom signs shall be installed at locations designated by the DPW Director or designee. All signs shall have Diamond Grade Reflective sheeting and shall meet the MUTCD Conventional Road Dimension charts and the MUTCD Standard Highway Signs. School and pedestrian warning signs shall be fluorescent yellow/green with diamond grade, retro-reflective sheeting.

731.05 ‘No Parking’ Signs

‘No Parking’ signs shall have high Diamond Grade Reflective sheeting.

Both the sign post and the support post shall be of the square telescoping type, twelve (12) gauge. Holes shall be punched on all four (4) sides and along the entire length of the post.

The sign post shall be two (2) inches square by ten (10) feet, and the support post shall be two and one-quarter (2¼) inches square by three (3) feet.

731.06 Sign Dimensions

The signs shall be fabricated in accordance with the dimensions described on the MUTCD Conventional Road Dimension charts and the MUTCD Standard Highway Signs.
731.07 Sign Installation

Install per the MUTCD guidelines and the CDOT Standard Specifications for Road and Bridge Construction.

732.00 Sign Posts and Support Posts

All sign supports and sign posts shall conform to specifications for perforated square steel tubing and to ASTM A366, Standard Specifications for Cold Rolled Carbon Steel Sheets, Commercial Quality. Tubing with plain finish shall be roll-formed from 10-gauge (.135 U.S. Gauge) and 12-gauge (.105 U.S. Gauge) hot rolled steel, ASTM A1011 Grade 50 pickled and oiled. Tubing with galvanized finish shall be roll-formed from 10-gauge (.135 U.S. Gauge) and 12-gauge (.105 U.S. Gauge) hot rolled steel, galvanized material ASTM A653 Grade 50. The average minimum yield strength after cold forming shall be 60,000 PSI. Posts shall conform to the following sign dimensions:

<table>
<thead>
<tr>
<th>Total Sign Area</th>
<th>Sign Post Dimensions</th>
<th>Support Post Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2 sq. ft.</td>
<td>2” x 2” x 10’</td>
<td>2 ¼” x 3’</td>
</tr>
<tr>
<td>2 to 9 sq. ft.</td>
<td>2” x 2” x 12’</td>
<td>2 ¼” x 3’</td>
</tr>
<tr>
<td>Over 9 sq. ft.</td>
<td>2” x 2” x 12’</td>
<td>2 ¼” x 3’</td>
</tr>
</tbody>
</table>

The finished members shall be straight and shall have a smooth, uniform finish. Consecutive sizes of tubes shall freely telescope with a minimum amount of play. All holes and cut-off ends shall be free of burrs. Seven-sixteenth (3/8) inch diameter holes shall be punched on one (1) inch centers on the entire length of all sides of the tube. All posts shall be galvanized.

733.00 Pavement Markings

The Contractor shall submit a Pavement Marking Plan to the County Engineer for approval prior to beginning work. The Pavement Marking Plan shall meet the requirements outlined in the MUTCD. Markings shall consist of extrusion applied, preformed plastic, or thermoplastic material conforming to Sections 713.12 and 713.14 of the CDOT Standard Specifications for Road and Bridge Construction. The Contractor is solely responsible for placement and maintenance of all necessary temporary and permanent pavement markings until Construction Acceptance is issued.

All temporary pavement markings shall comply with Section 627 of the CDOT Standard Specifications for Road and Bridge Construction.

All permanent pavement markings shall be thermoplastic. No Low VOC Solvent Paint or Epoxy shall be installed in Elbert County R.O.W or easements. Waterborne Paint or plastic preformed materials may be allowed at the discretion of the County Engineer.
733.01  General

Pavement marking material and construction shall comply with Sections 627 and 713.12 of the CDOT Standard Specifications for Road and Bridge Construction. Placement shall comply with the MUTCD, the CDOT M&S Standards and the manufacturer’s recommendations. All pavement markings shall be 0.125 mil thick.

733.02  Typical Pavement Markings

<table>
<thead>
<tr>
<th>Marking Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Yellow Line</td>
<td>4” with a 4’ separation gap (4-4-4)</td>
</tr>
<tr>
<td>Median Yellow Line</td>
<td>4”</td>
</tr>
<tr>
<td>Yellow Passing Line</td>
<td>4” X 10’ gap spaced 30’ (ft)</td>
</tr>
<tr>
<td>White Turn Pockets</td>
<td>8”</td>
</tr>
<tr>
<td>Decel. or Accel. Lane</td>
<td>8”</td>
</tr>
<tr>
<td>White Skip Lines</td>
<td>4” X 10’ gap spaced 30’</td>
</tr>
<tr>
<td>White Edge Line</td>
<td>4”, 6” for bike lanes</td>
</tr>
<tr>
<td>White 45° Diagonal Hatch Line</td>
<td>8” at 15’ spacing</td>
</tr>
</tbody>
</table>

733.03  Typical Crosswalks and Stop Bars

When no center road lines are present, center a crosswalk bar on the road and space every next bar four (4) feet apart towards the gutter edge. Align crosswalks to pedestrian ramps. Keep crosswalk bars parallel to the traveling lane lines even if the crosswalk is skewed.

<table>
<thead>
<tr>
<th>Marking Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crosswalk Bars</td>
<td>2’ x 8’</td>
</tr>
<tr>
<td>Stop Bars</td>
<td>12” from center of road to gutter</td>
</tr>
</tbody>
</table>

733.04  Crosswalks and Stop Bars at Signalized Intersections or Mid-Crossings

Center crosswalk bars on designated travel lane markings of the road and place bars parallel and next to the gutter. Then, space bars a minimum of four (4) feet apart as necessary. Crosswalk bars shall not be placed in the wheel paths of travel lanes. Align crosswalk bars to pedestrian ramps. Keep crosswalk bars parallel to the traveling lane lines even if the crosswalk is skewed.

<table>
<thead>
<tr>
<th>Marking Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crosswalk Bars</td>
<td>2’ x 10’</td>
</tr>
<tr>
<td>Stop Bars</td>
<td>24” from travel center yellow to gutter</td>
</tr>
</tbody>
</table>

733.05  Surface Preparation

A general cleaning of the pavement surface is required prior to placing extruded thermoplastic and/or preformed thermoplastic materials. The cleaning shall remove oil,
dirt, dust, grease, and other foreign materials. It is recommended that new thermoplastic pavement markings be applied immediately after new asphalt has been placed, thereby reducing the necessary surface preparation and allowing the asphalt rollers to inlay preformed pavement marking material. If the roadway striping cannot be placed immediately following paving operations, then it is the sole responsibility of the Contractor to apply and maintain temporary pavement markings to sufficiently delineate travel lanes until permanent pavement markings can be placed. Pavement markings shall be placed within two (2) weeks of completion of paving operations.

733.06 Prior to Placement of Pavement Marking Materials

- Control Points. Set control points to ensure compliance with the approved Pavement Marking Plan.
- Conflicts. Verify that there are no conflicts between the approved Pavement Marking Plan and existing pavement markings.
- Material. Verify the pavement marking materials to be installed.

Surface Preparation. Ensure the surface is cleaned and free of moisture, oil, dirt, dust, grease, and other foreign materials. Verify whether sandblasting or primer is required.

Temperature. Check that air temperature complies with the manufacturer’s recommendations.

Signing Conflicts. Check for conflicts with signage.

733.07 Placement of Pavement Markings

During the placement of pavement markings, regular checks shall be performed to ensure that the surface is clean and dry. The Contractor shall regularly check pavement markings for good workmanship and straightness. When placing pavement markings, the following requirements apply:

- Application Procedures. Application procedures shall comply with the manufacturer's recommendations and these CONSTRUCTION STANDARDS & SPECIFICATIONS.
- Application Rate. Application rate of pavement marking materials shall comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS.
- Reflective Beads. Check that the application rate of reflective beads complies with specified requirements.
- Protection. Traffic cones shall be used to prevent damage to new pavement markings.
- Permanent Markings. Verify proper application of all permanent markings.
- Conflicting Pavement Markings. Pavement markings shall not be conflicting or confusing.
- Extruded Thermoplastic Pavement Markings. Ensure that extrusion equipment provides proper heating, mixing, and flow of material.
- Preformed Thermoplastic Pavement Markings. For the application of preformed pavement markings, consider the following:
  - Heating. Ensure that equipment provides proper heating and placement of material.
  - Existing Pavement. When placed on existing cold pavement, check for a clean, dry, and properly prepared surface. Verify if sandblasting is required. Ensure that primer, if required, has been properly applied. Check for appropriate splicing sequence.
Inlay. For hot bituminous inlay placement, ensure that the material is applied in the proper location and sequence on the new mat. Check that the pavement surface is at the recommended temperature to obtain proper inlay.

740.00 TRAFFIC SIGNALS

741.00 Control of Work

741.01 Regulations and Code

All electrical equipment shall comply with the CDOT Standard Specifications for Road and Bridge Construction. In addition to the requirements of the approved plans, all material and work shall comply with the National Electrical Code (NEC) and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

741.02 Inspection

All material delivered to the site shall be subject to inspection—prior to or during installation—as deemed necessary by the Elbert County Inspector/Representative. The Elbert County Inspector/Representative may request samples of certain materials from the factory or warehouse for testing purposes prior to delivery on the site. Material which has been rejected by Elbert County shall not be delivered to the work site, and any material rejected at the work site shall be immediately removed from the site. Failure by Elbert County to note faulty material or workmanship during progress of the work shall not relieve the Contractor of the responsibility of removing and/or replacing faulty materials at the Contractor’s expense during the warranty period.

Any work within the public R.O.W. shall require two working days [forty-eight (48) hours] prior notice to Elbert County by the Contractor or Developer.

New Traffic Signal or Design Modification, Pre-acceptance Inspection Checklist

The following checklist is a guideline offered to electrical contractors building traffic signals within Elbert County. It is recommended contractors review checklist prior to and during construction to facilitate the final inspection processes. This is offered as a guideline only and may or may not include all Elbert County requirements. It remains the contractor’s responsibility to review all applicable documents to ensure compliance with Elbert County CONSTRUCTION STANDARDS & SPECIFICATIONS.

Elbert County encourages contractor input. Please submit requests or comments to the Elbert County Road & Bridge Superintendent/Elbert County Engineer.

New Traffic Signal or Design Modification
Pre-acceptance Inspection Checklist

Intersection: ______________________
### Section A: Pre-construction Meeting

The following items shall be distributed or discussed with the contractor and ultimate signal owner. Please checkmark next to each as they are discussed.

<table>
<thead>
<tr>
<th>Inspection Points</th>
<th>Phasing diagram</th>
<th>Copy of Plans (from Contractor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection Request Form</td>
<td>Traffic control plans(s)</td>
<td>Coy of Equipment Submittals</td>
</tr>
<tr>
<td>IMSA 19-1 Cable Wiring</td>
<td>Landscaping before and after</td>
<td>Final Inspection Checklist</td>
</tr>
</tbody>
</table>

### Section AA: Heads & Pre-emption

<table>
<thead>
<tr>
<th>Heads (including ped heads)</th>
<th>Opticom Pre-emption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aligned properly w/lane and or crosswalk, and approval from signal inspector (s)</td>
<td>All detectors mounted &amp; wired properly</td>
</tr>
<tr>
<td>Water caps on top of head</td>
<td>Aligned w/direction</td>
</tr>
<tr>
<td>Mounting Brackets tight, don’t turn or twist</td>
<td>Proper Operation</td>
</tr>
</tbody>
</table>

### Section AA: Heads & Pre-emption (Cont.)

<table>
<thead>
<tr>
<th>Wiring correct in block</th>
<th>No splices in wiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamps are proper type and wattage, (LED)</td>
<td></td>
</tr>
<tr>
<td>Wiring terminates in TS Block</td>
<td></td>
</tr>
<tr>
<td>TS Block wiring in correct slots</td>
<td></td>
</tr>
<tr>
<td>Back plates installed correct</td>
<td></td>
</tr>
<tr>
<td>Proper Height</td>
<td></td>
</tr>
</tbody>
</table>

### Comments A:
# Section B: Luminaries, Communications, Pull Boxes, Pushbuttons

<table>
<thead>
<tr>
<th>Luminaries</th>
<th>Communications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heads on</td>
<td>Proper Cable</td>
</tr>
<tr>
<td>Proper wattage lamps</td>
<td>No splices – continuous run</td>
</tr>
<tr>
<td>Operates properly</td>
<td>Antennas mounted at point w/view of master.</td>
</tr>
<tr>
<td>Photo eyes function</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pull Boxes</th>
<th>Pushbuttons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduit cut low &amp; rounded off</td>
<td>Proper placement</td>
</tr>
<tr>
<td>Wires correctly marked/taped for direction *</td>
<td>Placards are correct</td>
</tr>
<tr>
<td>Gravel in box for drainage</td>
<td>PBs work correctly, send call to controller</td>
</tr>
<tr>
<td>Pull boxes not damaged, in good condition</td>
<td>PB wire stranded for low voltage</td>
</tr>
<tr>
<td>Pull box level and placed to grade</td>
<td>PB is large ADA mushroom style button</td>
</tr>
<tr>
<td></td>
<td>PB is mounted at proper height (42”) to meet ADA requirements.</td>
</tr>
<tr>
<td></td>
<td>PB is accessible from wheelchair-sidewalk extended to pole base if necessary.</td>
</tr>
</tbody>
</table>

## Comments B:

**Phasing Code/Tape Colors**

- **WB=08** Blue
- **EB=04** Orange
- **NB=02** Red
- **SB=06** Green
- **WBLT=03** Blue & White
- **EBLT=07** Orange & White
- **NBLT=05** Red & White
- **SBLT=01** Green & White

ALL PEDESTRIAN INDICATIONS SHALL BE TAPE WITH YELLOW AND THEIR APPROPRIATE PHASE.

---

# Section C: Miscellaneous & Detection

<table>
<thead>
<tr>
<th>Miscellaneous</th>
<th>Cameras</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good condition overall</td>
<td>Mounted as high as possible for the phase</td>
</tr>
<tr>
<td>All hand-hole covers in place</td>
<td>Drip loops</td>
</tr>
<tr>
<td>Wire not cut and sliced in hand-hole</td>
<td>Grommets for wires out of pole</td>
</tr>
<tr>
<td>All pole caps on, mast arm end caps on</td>
<td>No splices – continuous run</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Intersection, all signals rung out.</td>
<td>Proper Cable(s)</td>
</tr>
<tr>
<td>As-builts up to date – Accurate – copies sent to the Elbert County Road &amp; Bridge Department.</td>
<td>Other Detection</td>
</tr>
<tr>
<td>Extra wire taped off and secured in place for future use.</td>
<td>Proper mounting height and lane alignment</td>
</tr>
<tr>
<td>Landscaping returned to normal and job site cleaned up and neat.</td>
<td></td>
</tr>
</tbody>
</table>

**Comments C**

**Section D: Electronic Cabinet and Electric Service**

<table>
<thead>
<tr>
<th><strong>Electronic Cabinet</strong></th>
<th><strong>Electric Service</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 170 Model 332 Cabinet or 333 Cabinet Model 170 w/HC 11 Controller</td>
<td>Proper wire to power company per their spec.</td>
</tr>
<tr>
<td>Foundation and proper base</td>
<td>Meter pedestal installed in a good proximity to controller cabinet.</td>
</tr>
<tr>
<td>Foundation clean &amp; sealed</td>
<td></td>
</tr>
<tr>
<td>PBs, Pre-Emption, Field Wiring all terminated</td>
<td></td>
</tr>
<tr>
<td>Phasing per Elbert County spec.</td>
<td></td>
</tr>
<tr>
<td>Door on opposite of street sided (tech facing intersection with door open)</td>
<td></td>
</tr>
<tr>
<td>Surge suppressors installed</td>
<td></td>
</tr>
<tr>
<td>No sight obstructions, clear view on all approaches</td>
<td></td>
</tr>
<tr>
<td>This list is intended as a guide only and may be used by contractors to facilitate signal construction. This list does not include all traffic signal construction requirements. Signal contractors are required to review and comply with all applicable documents as called for in the construction contract. Call the Elbert County Road &amp; Bridge Department for inspection/reinspection</td>
<td></td>
</tr>
</tbody>
</table>

**Comments D:**
741.03 Traffic Control

Refer to Section 141.12 Traffic Control, Barricades and Warning Signs of these ROAD & BRIDGE CONSTRUCTION STANDARDS & SPECIFICATIONS.

741.04 Equipment List and Drawings

The Contractor shall submit a list of all materials and equipment proposed to be used in the work to Elbert County for approval. The list shall include the name of manufacturer, size and catalog number of units. Supplemental data, including detailed scaled drawings and wiring diagrams of any non-standard or special equipment, and any proposed deviation from the approved plans shall be submitted to Elbert County for approval.

The Contractor shall furnish all materials, equipment and labor needed to install and maintain temporary traffic signals during progress of the work. All intersections presently signalized shall be kept in operation until the new signal equipment is properly installed and ready for operation. If in the opinion of the County Engineer, this is not possible because the installation of new equipment is in the same location as existing equipment, the Contractor shall not proceed with any work, which may cause the present equipment to become inoperative until all necessary replacement equipment is onsite.

All new traffic signals shall be equipped with Opticom device control.

Existing traffic signals shall remain operational until changing over and connecting new equipment. Signals shall be operational at the close of each day's work, over weekends, and during times when the Contractor is not working. When removal of a signal from operation is proposed, Elbert County shall be notified in writing two working days (forty-eight [48]) hours in advance.

741.05 Coordination with Other Agencies and Contractors

The Contractor shall coordinate conduit work with the electric service company. The Contractor may contract with the electric service company to install conduits. Refer to Section 141.02 Permits Required by Other Agencies of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

741.06 Signal Pole and Signal Head Colors
Traffic signal pole primer/rust inhibitor shall be Benjamin Moore & Co. Acrylic Metal Primer MO4-01. The finish coat shall be Benjamin Moore & Co. Impervex Latex High Gloss Metal & Wood Enamel 309, “Gray” Paint Spec. 3091B-10RX-3BK-9BB-8TG per gallon.

All traffic signal heads shall be Federal Yellow in color, and the specific color shall be determined by the County Engineer.

742.00 Conduit

742.01 General

Conduit runs shown on the approved plans are tentative as to routing and may be changed, as directed by the Elbert County Inspector/Representative, to avoid underground obstructions. Any change in location from those shown on the approved plans shall require the prior approval of the County Engineer and shall be accurately recorded on as-built drawings in accordance with Section 161.00 Construction Plan Requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

742.02 Materials

All conductors shall be run in conduit except when run in metal poles. Conduit shall be Schedule 40, Type 2 PVC as specified in the NEC. Conduits shall be high-impact type that complies with industry standards and Commercial Standard No. CS-207-60. Each length of conduit and all PVC fittings (expansion joints, couplings, adapters, etc.) shall bear the label of Underwriters Laboratories, Inc. Conduit shall be sized as indicated on the approved plans.

PVC conduit shall be cut with a hacksaw and all ends squared and trimmed after cutting to remove rough edges. Connections shall be the solvent weld type except where the connection is made to a steel conduit, in which case the coupling shall be threaded on the metal conduit side.

Solvent weld joints shall conform to the PVC manufacturer's recommendations. PVC conduit shall be used only for underground installations. All conduit used above ground shall be galvanized steel.

A bare or green insulated #10 AWG copper conductor shall be run continuously in all conduit used for traffic signal circuits for bonding and grounding purposes.

Existing underground conduit that is incorporated into a new system shall be cleaned with a mandrel and compressed air.

742.03 Installation
Excavations for conduit shall be two (2) inches wider than the outside diameter of the conduit. Backfilling of the conduit trenches shall be accomplished in accordance with all applicable portions of Section 350.00 Trenching, Backfilling and Compacting of these CONSTRUCTION STANDARDS & SPECIFICATIONS. A nylon pull string shall be left in each conduit run for any future pulling of conductors. When trenching in pavement, the cut in the pavement shall be no wider than the width of the trench Road & Bridge Superintendent / Elbert County Engineer approval shall be required for cutting pavement less than five (5) years old, and special requirements may apply.

Conduit shall be installed not less than thirty (30) inches below the top back of curb grade. Conduits under railroad tracks shall not be less than forty-two (42) inches below the bottom of the tie, and/or as specified by railroad code. Conduit smaller than three-fourths (¾) inch electrical trade size shall not be used unless otherwise specified on the approved plans; however, grounding jumpers at service points may be enclosed in one-half (½) inch conduit.

Conduit size shall be consistent for the entire length of the run from outlet to outlet, and no reducing couplings shall be allowed. Conduits terminating in poles, cabinets, or pedestal bases shall extend above the foundation a maximum of four (4) inches and a minimum of two (2) inches and slope toward pole hand holes or transformer base openings.

Conduit entering pull boxes shall terminate a minimum of one (1) inch and a maximum of three (3) inches inside the box wall and two (2) inches minimum or four (4) inches maximum above the bottom and shall be sloped to facilitate convenient pulling of the wires or cables. Conduit entering through the side of a pull box shall be located near the sides and ends of the box in order to leave the major portion of the box clear. Conduits shall enter freely through boxes for allowance of expansion and contraction. Conduit required to be terminated, stubbed, and plugged shall be shown on the plans as directed by the County Engineer. All conduit ends shall be capped with standard conduit caps until the wiring is started. When caps are removed, the threaded ends shall be provided with approved insulated metal ground bushings.

The location of all conduit ends under curbs or behind structures shall be marked with a “Y”, which is at least three (3) inches high, cut into the face of the curb or wall directly above the conduit. These locations shall be shown on the Record Documents. Refer to Section 211.02 Record Documents of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Conduit bends, except for factory bends, shall have a radius of not less than six (6) times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent without crimping or flattening, using the longest radius practicable. Conduit entering controller cabinets shall be packed with duct seal after wiring is installed to prevent the entrance of gases. Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel and compressed air.
Bends in all PVC conduit shall comply with the NEC or local codes governing bending radius and number of bends allowed for rigid conduit.

When PVC conduit is installed for future use, each end shall be capped with a PVC cap. For locating purposes, a galvanized, 12-gauge steel plate twelve (12) inches square shall be placed over each conduit end.

### 743.00 Cable and Conductors

**743.01 General**

Cable and conductors shall comply with the International Municipal Signal Association (IMSA) and the approved plans. All wire shall bear the label of Underwriters Laboratories, Inc.

Insulated conductors shall be shipped in splice-free continuous lengths, in cartons or on new-bolted-type non-returnable reels plainly and indelibly marked with the name of the manufacturer, net weight, size (AWG) and length of the wire. NO SPLICES SHALL BE ALLOWED IN THE WIRE. A heavy covering of cardboard or burlap shall be used to protect the wire and reels during shipment and handling.

**743.02 Multiconductor Cable**

Multiconductor cable shall comply with IMSA Specification 19.1, except that the conductors shall be stranded. Conductor color-coding shall comply with Table II of IMSA Specification 19.1 for unpaired conductor cables. Color-coding for tracers shall run spiral and be impregnated into the conductor insulation.

The wiring of signal heads shall comply with IMSA Specification 7. Single conductor wire shall not be used for wiring signal heads.

**743.03 Wiring Installation**

Wiring shall comply with the NEC and the National Electric Manufacturers Association (NEMA) Code. Wiring within cabinets and junction boxes shall be neatly arranged and laced. Flaxsoap, or other approved lubricant, may be used for inserting conductors in conduit. No splices of cable shall be permitted in the conduit.

In all signal designs, separate conduits shall be shown for separate low voltage and high voltage conductors on the plane. Signal conductors shall be run in conduits separate from the low voltage detector lead-in.

All loop detector and lead-in wire shall run from loop detectors to the cabinet with no splicing.

Tags for identification of wires shall be furnished and installed by the contractor at cabinet locations, at pull boxes, and at terminating points, or as directed by the Elbert
County Inspector/Representative. A permanent fiber or PVC tag shall be used. Tags shall be marked as indicated on the wire layout sheets and shall indicate the direction of the run and pole number of other locations of termination points for the wire run. Confirm that spare wires are not connected to any junction. All spare wires shall be tagged and identified as spare with appropriate numbers as shown on the layout sheets. The ends of the spare wires shall be pulled into the terminal compartment or cabinet.

All wiring between the controller and the signal faces shall be multiconductor cable. The individual conductor shall be 14 gauge stranded copper wire. Separate multiconductor cables for each signal phase shall be installed around the intersection and marked with colored phasing tape at the controller and at each splice point in the pull boxes and pole bases.

743.04 Connections to Signal Heads, Pushbutton Switches and Traffic Controllers

All cable wires shall be secured to screw-type terminals in traffic signal heads, pedestrian pushbutton switches, and the traffic controller. The connectors shall be the spade-tongue type and affixed to the conductors using a tool designed specifically for the connection of the connectors to the conductors, unless Phoenix blocks are being used in the cabinet.

743.05 Wire Splicing Locations

Splices shall only be made in pole bases.

743.06 Wire Bonding and Grounding

Metallic cable sheaths, conduit, metal poles and pedestals shall be bonded to form a continuous and effectively grounded system. Bonding jumpers shall be #10 AWG copper wire, or larger, as required. Grounding of conduit and neutral at the service point shall be #8 AWG copper wire, or larger, as required. At each controller, a ground rod (electrode) shall be installed. Each ground rod shall be a one-piece solid copper rod, a minimum of one-half (½) inch in diameter and eight (8) feet in length. The rod shall be driven into the ground to a minimum depth of seven (7) feet. The ground wire shall be spliced together at the termination points and shall connect to the neutral bar at the service facility, load center cabinet, or control cabinet.

744.00 Electric Service Connection

The Contractor shall be responsible for coordinating the electric service connection with the electric service company. Electric service connections shall be made by the Electric Service Company. The contractor shall furnish two (2) conductor 6-gauge wire from the controller to the pull box, leaving two (2) feet extra of wire in the pull box.

Service points shown on the approved plans are approximate. The exact location shall be determined in the field by the Contractor, the Elbert County Inspector/Representative, and the electric service company.
The Contractor shall furnish and install conduit and conductors to the service points as shown on the approved plans. Conduit for traffic signal service shall not be less than two (2) inches in size.

Conduit and wiring specified in the wire layout sheets and shown on the approved plans shall be furnished and installed from service pole to the controller cabinet, or to the location shown on the approved plans.

745.00 Concrete Foundations

745.01 General

Foundations shall be composed of concrete that complies with Section 800 Concrete Mix Design and Construction of these. Foundations for all poles, standards, pedestals, and cabinets as shown on the approved plans, shall rest on firm ground. Forms required for cast-in-place bases shall be true to line and grade, rigid, and securely braced.

Both forms and ground, which contact the concrete, shall be thoroughly moistened prior to placing concrete. Conduit stubs and anchor bolts shall be placed in proper position and securely held in place by a template while concrete is being placed and until the concrete has properly set. After placing concrete, the anchor bolts shall be raised and lowered individually to eliminate air pockets and to align the anchor bolts prior to concrete setting. Any deviations in foundation location proposed by Contractor shall require County Engineer approval.

745.02 Poles, Standards and Pedestal Foundations

Poles, standards and pedestals shall not be installed until the foundation concrete has set at least seven (7) days. Foundations of high-strain poles shall set a minimum of ten (10).

Foundations for all poles shall have a flush top. In each case, the maximum distance behind the curb for pole locations is desired. In locations where the roadway is not curbed, the top of the foundations shall be six and one-quarter (6 1/4) inches above the grade of the edge of the pavement. Where foundations are located in the sidewalk, the foundation shall be two (2) inches above the surface of the sidewalk, and expansion material shall be placed between the foundation and the sidewalk, with the top of the expansion material level with the sidewalk surface. Foundations for traffic signal control cabinets that are located in sidewalks shall extend above the sidewalk surface as shown on the plans.

746.00 Traffic Signal Controllers

746.01 Signal Phasing and Tape Colors

Refer to Section 741.02 Inspection of these CONSTRUCTION STANDARDS & SPECIFICATIONS.
746.02 Controller Type

The controller supplier shall have a service center located in Colorado. Elbert County personnel shall be able to access the service center at any time for inspection. Failure to have an adequate service center may void the contract award. The service center shall be capable of performing any required warranty repairs or replacement. Repair or replacement of warranted items shall be completed, and the item delivered to the requested location within five (5) working days. Two (2) copies of service records shall be supplied to Elbert County for all warranty work. Each controller shall be fully warranted for materials and workmanship for a period of one (1) year from the date of receipt.

746.03 Cabinet Type

The cabinet shall be delivered to Elbert County at least one week [five (5) working days] prior to installation for bench testing, inspection, and configuration.

The cabinet assembly shall include complete wiring for local intersection system operation, as indicated in the plans. Elbert County has two selections of cabinets, the Model 332D or Model 333SD. The cabinet assembly shall consist of the following:

Model 332D
The controller cabinet shall be a double wide 332 cabinet herein referred to as a Model 332D as specified in the Contract. The cabinet shall be natural aluminum with anchor bolts in accordance with the FHWA-IP-78-16 specification. The input files shall meet the requirements of the split input file below. Unless otherwise specified in the Contract, the cabinet shall include the following:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>170E-HC11</td>
</tr>
<tr>
<td>2</td>
<td>Internal (front/back) Fluorescent Lamps</td>
</tr>
<tr>
<td>4</td>
<td>Corbin Locks</td>
</tr>
<tr>
<td>2</td>
<td>Fan Assemblies</td>
</tr>
<tr>
<td>1</td>
<td>PDA #2 w/206 Power Supply</td>
</tr>
<tr>
<td>2</td>
<td>Standard Split Input File</td>
</tr>
<tr>
<td>4</td>
<td>Model 430 Transfer Relays</td>
</tr>
<tr>
<td>2</td>
<td>Model 204 2-Circuit Flasher (cube type, 25 AMP output)</td>
</tr>
<tr>
<td>12</td>
<td>Model 200 I/O Load Switch (cube type, 25 AMP output)</td>
</tr>
<tr>
<td>3</td>
<td>Model 242 DC Isolators 3</td>
</tr>
<tr>
<td>1</td>
<td>Model 2010 ECL Monitor with Absence of Red Monitoring</td>
</tr>
<tr>
<td>1</td>
<td>EDCO SHA-1201 Surge Device Mounted</td>
</tr>
<tr>
<td>2</td>
<td>New York 330 Pull-out Drawer</td>
</tr>
</tbody>
</table>
Assembly (one on each side)
1
Auxiliary Detector Termination
Panel Assembly
1
Transient Voltage Surge
Suppression System
1
Output file with Phoenix
Connectors
1
Service Panel
1
Rack Mechanical W/2- Full
Shelves (Left Side)
4
Anchor Bolts
1
Red Monitor Kit
1
Traffic UPS (see Specifications
Below)

All cabinets shall have a powder coating base TCI WHEEL SILVER #9811-0110
Polyester TGIC powder coating and top coating shall be TCI ANTI GRAFFITI powder
paint applied 2.4 mils thick.

All cabinets shall have a protective shield over the circuit breakers to prevent them from
being accidentally turned off. The shield shall be mounted in such a way that the
switches are still readily visible to the technician and can be easily turned on or off.

For the 170 style, the mounting method shall be nineteen (19) inch rack-mount. Shelf
angles or rails, typically supplied by others, are available as optional accessories.

Model 333SD
The controller cabinet shall be a Model 333SD as specified in the Contract. The 333SD
cabinet shall include a base extension assembly. Each cabinet shall be natural aluminum
with anchor bolts in accordance with the FHWA-IP-78-16 specification. The input files
shall meet the requirements of the split input file below. Unless otherwise specified in
the Contract, the cabinet shall include the quantities of items shown in the chart in “A”
(above).

The cabinet dimensions shall be (54” wide) x (43” tall) x 26” deep).

The cabinet shall have four (4) doors and Corbin #2 Locks.

The left side of the 333SD cabinet assembly shall have shelves assembled to the EIA rack
assembly to house additional equipment such as, but not limited to, video detection,
standby uninterrupted power supply and communication equipment.

All cabinets shall have a powder coating base TCI WHEEL SILVER #9811-0110
Polyester TGIC powder coating and top coating shall be TCI ANTI GRAFFITI power
paint applied 2.4 mils thick.
All cabinets shall have a protective shield over the circuit breakers to prevent them from being accidentally turned off. The shield shall be mounted in such a way that the switches are still readily visible to the technician and can be easily turned on or off.

For the 170 style, the mounting method shall be nineteen (19) inch rack-mount. Shelf angles or rails, typically supplied by others, are available as optional accessories.

746.04 Signal Cabinet Base

The ground mounted fiberglass signal cabinet base shall be installed level and as shown on the approved plans or as directed by the County Engineer. The seam between the base and the cabinet shall be caulked both inside and outside the controller base to prevent water seepage. The cabinet shall be set flush on the cabinet base.

746.05 Signal Cabinet Locations

Visual aesthetics should be considered in the location of signal cabinets. The location of the cabinets shall be approved by the DPW DIRECTOR DESIGNEE.

746.06 Cycle Length

The County Engineer shall determine signal timing.

746.07 Spread Spectrum

The following shall be the minimum requirements for a Wireless Interconnect Package:
Operate in the license-free, spread spectrum band (902-928 MHz), utilizing frequency hopping technology
139 user-selectable channels, with 62 available hopping sequences. Two (2) shall be non-overlapping.
Completely configurable via included software.
Software features to provide “remote programming, remote maintenance and spectrum analyzer” included.
An RS232 interface capable of 1200 bps to 115.2 Kbps with an 8 or 9 bit format or 1200 bps
Bell 202 FSK (2 or 4-wire)
A maximum of 8 msec end-to-end latency
LED indicators for PWR, TX DATA, RX DATA and the active data port
DB9F connector for RS232 port and RJ22 for FSK
Receiver sensitivity of -110dBm @ 10-6 BER
Operating temperature of -40 to +80 degrees C
Operate with voltages between 6 VDC and 30 VDC., with a typical current draw of <100mA
Radio sleep mode with a maximum current draw of <1 uA
Programmable for RF output levels of 1mW, 10mW, 100mW or 1 Watt
Provide 16-bit CRC error checking with auto re-transmit
Available as Shelf Mounted, Rack-Mounted, or NEMA 4X Weatherproof Versions
Controller hardware and software ready for use upon installation
Built-in store-and-forward repeater
Encom COMMPAKTM Model 5100R or equivalent
Compatible with, and plug directly into, 170/ TSI detector rack
Draws operating power from detector card cage
RP TNC-F antenna connector
RSSI signal strength LEDs

747.08 Interruptible Power System

Operation:
The Traffic UPS shall be capable of producing-simultaneously—fully regenerated, conditioned and true sine wave, standby and continuous AC outputs.
Suggested operating mode for respective outputs during power failure: Continuous output provided for signal controllers and modems; Standby output provided for signals in flash mode operation (optional delay timer available for short-term battery run under full cycling operation).
Up to the maximum rating, the Traffic UPS shall be capable of running any combination of signal heads, whether Incandescent, LED or Neon, by any manufacturer, regardless of power factor, without overdriving the power factor LED heads which may cause early degradation, low luminosity or early signal failure.
Upon loss of utility power, the Traffic UPS shall insert battery power into the system via a supplied Power Interface Module (PIM). In case of UPS failure and/or battery depletion, the PIM will ensure that the UPS will drop out and, upon return of utility power, the traffic control system will default to normal operating mode.
The Power Interface Module shall enable removal and replacement of the Traffic UPS without shutting down the traffic control system (i.e. “hot swap” capability). Connectors shall be equipped with a “safety interlock” feature.
For 170 or “California” style cabinets, upon loss of power the Traffic UPS shall actuate the existing Flash Transfer Relays (FRS) and Mercury Contractor (MC) to force the traffic control system into Flash Mode operation.
Existing Flasher Modules and Flash Transfer Relays shall be utilized.
To facilitate emergency crews and police activities, the Traffic UPS shall be compatible with police panel functions (i.e. “Signals OFF” switch must remove power to the field wiring even when on UPS/battery power).
The Traffic UPS shall not duplicate or take over flash operation or flash transfer relay functions.
The Traffic UPS shall be capable of providing continuous, fully conditioned, regulated, sinusoidal (AC) power to selected devices such as signal controllers, modems, communications, hubs, NTCIP adapters and video equipment.

The Traffic UPS shall consist of three major components: The Electronics Module, the Power Interface Module and the Battery System.

The Electronics Module shall consist of the following:
Dimensions:
Rack-mount: Width = 19”, Depth = 12”, Height = 3.5” (2U)
Shelf-mount: Width = 19”, Depth = 12”, Height = 3.5”
Wall-mount/Unistrut Rail mount: Width = 6.9”, Depth = 9.5”, Height = 16”
Separate Power-Interface Module = Width = 6”, Depth = 2.8”, Height = 9”
True sine wave, high frequency inverter utilizing IGBT technology
3-stage, temperature compensated, battery charger
For connection from the electronics module to the power interface module and battery system, dedicated harnesses shall be provided with quick-release, keyed, circular connections and braided nylon sleeving over all conductors
Local and remote control of UPS functions
Local and remote communications capabilities
Shall be capable of accepting an NTCIP ready adapter or a spread spectrum radio modem
Separate Power Interface Module (PIM) for inserting power safely and reliably.

Mounting Configuration:
NEMA Style: mounting method shall be shelf-mount or wall-mount.
170 Style: mounting method shall be 19” rack-mount. Shelf angles or rails, typically supplied by others, are available as optional accessories.
External: A separate, stand-alone, pad-mounted, outdoor (NEMA 3R) enclosure shall be available should there be inadequate room in the signal cabinet, or should the consulting/Engineer prefer independent, external mounting.
Batter System:
The battery shall be comprised of extreme temperature, deep cycle, AGM/VRLA (Absorbed Glass Mat/Valve Regulated Lead Acid) batteries that have been field proven and tested.
The battery system shall consist of one or more strings of 6 batteries per string of extreme temperature, deep cycle, AGM/VRLA (Absorbed Glass Mat/Valve Regulated Lead Acid) batteries.
Batteries shall be certified to operate at extreme temperatures from -40 degrees C 10 +74 degrees C.
The batteries shall be provided with appropriate interconnect wiring and a corrosion-resistant mounting trays and/or brackets appropriate for all the cabinet into which they shall be installed.
The interconnect cable shall be protected with abrasion-resistant nylon sheathing.
The interconnect cable shall connect to the base module via a quick release circular connector.
The circular battery connector shall have interlocking pins to prevent turn-on if batteries are not connected, and to shut off the UPS should the batteries be disconnected.
Battery construction shall include heavy-duty, inter-cell connections for low impedance between cells, and heavy-duty plates to withstand shock and vibration.
The top cover shall use tongue and groove construction and shall be epoxied to the battery case for maximum strength and durability.
An optional lifting handle shall be available on most battery models.
Batter Specifications:
The battery system shall be certified, and field proven to meet or exceed NEMA temperature standards from -40°C to +74°C.
Ampere-Hour ratings (see table 1)
Hydrogen gas emissions: must meet Mil-Spec #MIL-B-8565J
Dimensions: (see table below)
Weights: (see table next page)

<table>
<thead>
<tr>
<th></th>
<th>Estimated Runtime (assumes 77°F / 25°C, to 1.75 volts per cell).</th>
<th>Unit Weight</th>
<th>Overall Dimensions Per Battery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inches (cm.)</td>
</tr>
<tr>
<td>Volts/ A-hrs.</td>
<td>200 Watts</td>
<td>400 Watts</td>
<td>800 Watts</td>
</tr>
<tr>
<td>12 VDC/ 16 A-h</td>
<td>3.5 Hrs.</td>
<td>1.73 Hrs.</td>
<td>52 Min.</td>
</tr>
<tr>
<td>12 VDC/ 31 A-h</td>
<td>8.8 Hrs.</td>
<td>3.8 Hrs.</td>
<td>1.8 Hrs.</td>
</tr>
<tr>
<td>12 VDC/ 39 A-h</td>
<td>11.3 Hrs.</td>
<td>5.5 Hrs.</td>
<td>2.3 Hrs.</td>
</tr>
<tr>
<td>12 VDC/ 48 A-h</td>
<td>13.7 Hrs.</td>
<td>6.7 Hrs.</td>
<td>2.9 Hrs.</td>
</tr>
</tbody>
</table>

*OP72X battery sets include six (6) batteries per et. Wired in series, each set provides 72 VDC.

Electrical Specifications:
Input Specification
- Nominal Input Voltage: 120 VAC, Single Phase
- Input Voltage Range: 85 VAC to 140 VAC
- Input Frequency: 50 or 60 Hz (+/- 5%)
- Input Configuration: 3 Wire (Hot, Neutral & Ground)
- Input Current (Max. draw): 7.2 amps, Power-Factor Corrected
- Input Protection: Input Fuse (12 amps)

Output Specification
- Nominal Output Voltage: 120 VAC, Single Phase
- Power Rating: 1 KVA (1000VA/700W)
- Output Voltage Regulation: +/- 2% for 100% step load change and from High battery to Low battery condition
- Output Frequency: 50 or 60 Hz (+/- 5%)
- Output Configuration: Keyed, circular connectors and duplex receptacle
- Output Wave Form: True Sinewave
- Overload capability: 110% for 10 minutes, 200% for ½ second
- Fault clearing: Current limit and automatic shutdown
Short circuit protection: Current limit and automatic shutdown  
Efficiency: 85% at full load  
Load Power Factor: .7 lagging through unity to .7 leading

Communication, Controls and Diagnosis:
Alarm function monitoring through the UPS shall be through a standard DB-9F connector with open collectors 40V@20mA indicating loss of utility power, inverter failure and low battery.  
An RS 232 interface shall be provided via a DB-9F connector to allow full interactive remote computer monitoring and control of the UPS functions.  
Front panel controls shall consist of no less than: Power On, Cold (DC) Start, Alarm Silence, Battery, Test, Bypass Breaker, and DC/Breaker.

Environmental Specifications:
The UPS shall meet or exceed NEMA temperature standards from -40°C to +74°C.  
The UPS shall be certified, and field proven to meet or exceed NEMA temperature standards.  A certificate of compliance shall be made available upon request.

Reliability:
Calculated MTBF shall be 100,000 hours based on component ratings.  
When Bypass and Power Interface Module are included, system MTBF shall increase to 150,000 hours.

Options:
Battery Tray to hold six (6) OP72A batteries, up to four (4) OP72B or OP72C batteries, and up to three (3) OP72D batteries.  Tray is 19” wide for use in 170 type cabinets and mounts on standard RETMA rails.  
Swing-out Battery Box, mounts on right rail inside back door of 170 type cabinets.  Box is designated to hold six (6) OP72A batteries, up to four (4) OP72B or OP72C batteries, and up to three (3)OP72D batteries.  
Adjustable Delay-timer to provide up to 10 hours of full cycling while on battery before switching to flash mode (only available where 100% low-power/LED signals and pedestrian heads are used).  Batteries must be sized properly to fully utilize this feature.  
Service pedestal-mounting option.  
One-shot ground pulse to trigger External Start upon return of AC power.  
Dial-out modem for wireless or land line communication.  
Enhanced battery charger provides accelerated charging capacity (contact factory for details and proper application).

Serviceability & Maintainability:
MTTR (Mean-Time-To-Replace or Repair):  
Electronics: 15 minutes or less  
Battery System: 15 minutes or less

746.09 Video Detection System

Detection zones shall be installed by Elbert County at signal turn-on.
The video detection system shall consist of one video camera, a video detection processor (VDP) that mounts in a standard detector rack, and a detector rack mounted extension module (EM).

The system shall include software that detects vehicles in multiple lanes using only the video image. Detection zones shall be defined using only a video menu and a pointing device to place the zones on a video image. Up to twenty-four (24) detection zones per camera shall be available.

The functional characteristics shall include the following:
- The VDP shall process video from one source. The source may be a video camera or video tape player. The video shall be input to the VDP in RS170 format and shall be digitized and analyzed in real time.
- The VDP shall detect the presence of vehicles in up to 24 detection zones per camera. A detection zone shall be approximately the width and length of one car.
- Detector zones shall be programmed via a menu displayed on a video monitor and a pointing device connected to the VDP. The menu shall facilitate placement of the detection zones. A separate computer shall not be required for programming detection zones.
- The VDP shall store up to three different detector zone patterns. The VDP can switch to any one of the three different detector patterns within 1 second of user request via menu selection with the pointing device.
- The VDP shall detect vehicles in real time as they travel across each detector zone.
- The VDP shall have an RS232 port for communications with an external computer.
- The VDP shall accept new detector patterns from an external computer through the RS-232 port.
- The VDP shall send its detector patterns to an external computer through the RS-232 port when requested.
- The extension module (EM) shall be available to avoid the need to rewire the detector rack, by enabling the user to plug an extension module into the appropriate slot in the detector rack. The extension module shall be connected to the VDP by a 10-wire cable with modular connectors and shall output contact closures in accordance with user selectable channel assignments.

The following describes vehicle detection at the intersection:
- A single detection zone shall be able to replace multiple loops. Detection zones may be placed together to indicate vehicle presence on a single phase of traffic movement.
- Layout of detection zones shall be done by using a pointing device and a graphical interface built into the VDP to mark the detection zones on the video image from each video camera. Up to three (3) detection zone patterns shall be saved within the VDP memory to prevent loss during power outages.
- The selection of the detection zone pattern for current use shall be done through a menu. It shall be possible to activate a detection zone pattern for a camera from VDP memory and have that detection zone pattern displayed within 1 second of activation. When a vehicle is detected crossing a detection zone, the detection zone shall flash a symbol on the screen to confirm the detection of the vehicle.
Detection shall be at least 98% accurate in good weather conditions and at least 96% accurate under adverse weather conditions (rain, snow, or fog). Detection accuracy is dependent upon site geometry, camera placement, camera quality and detection zone location, and these accuracy levels do not include allowances for occlusion or poor video due to camera location or quality. Detector placement shall not be more distant from the camera than a distance of ten times the mounting height of the camera.

The VDP shall provide up to 8 channels of vehicle presence detection through a standard detector rack edge connector and one or more extension modules. The VDP shall provide DZR to enable normal detector operation of existing zones except the one being added or modified during the setup process. The VDP shall output a constant call on any detection channel corresponding to a zone being modified.

For VDP and EM Hardware:
The VDP and extension module shall be specifically designed to mount in a standard detector rack, using the edge connector to obtain power and provide contact closure outputs. No adapters shall be required to mount the VDP in a standard detector rack. No detector rack rewiring shall be required.
The VDP and extension module shall operate satisfactorily in a temperature range from -29 degrees F to +140 degrees F and a humidity range from 0% Relative Humidity (RH) to 95%RH, non-condensing. The VDP and extension module shall be powered by 24 volts dc. VDP power consumption shall not exceed 450 milliamps. The EM power consumption shall not exceed 100 milliamps.
The VDP shall include an RS232 port for serial communications with a remote computer. This port shall be a “D” subminiature connector on the front of the VDP. The VDP shall utilize flash memory technology to enable the loading of modified or enhanced software through the RS232 port and without modifying the VDP hardware. The VDP and extension module shall include detector output pin out compatibility with industry standard detector racks.
The front of the VDP shall include detection indications for each channel of detection that display detector outputs in real time when the system is operational. The front of the VDP shall include one BNC video input connection suitable for RS170 video inputs. The video input shall include a switch selectable 75 ohm or high impedance termination to allow camera video to be routed to other devices, as well as input to the VDP for vehicle detection. The front of the VDP shall include one BNC video output providing real time video output which can be routed to other devices.

The following describes the camera:
The camera shall produce a useable video image of the bodies of vehicles under all roadway lighting conditions, regardless of time of day. The minimum range of scene luminance over which the camera shall produce a useable video image shall be the minimum range from nighttime to daytime, but not less than the range 0.5 lux to 10,000 lux.
The camera shall use a CCD sensing element and shall output monochrome video with resolution of not less than 350 lines vertical and 380 lines horizontal. The camera shall include automatic electronic shutter control based upon average scene luminance. The camera shall include a variable focal length lens with variable focus and zoom that can be adjusted, without opening up the camera housing, to suit the site geometry.
The camera shall be housed in an environmentally sealed enclosure. The camera enclosure shall be equipped with a sun shield that prevents sunlight from directly entering the lens. The sunshield shall include a provision for water diversion to prevent water from flowing in the cameras field of view. The camera enclosure with sunshield shall be less than 6” diameter, less than 26” long, and shall weigh less than 12 pounds when the camera and lens are mounted inside the enclosure. The camera enclosure shall include a thermostatically controlled heater to assure proper operation of the lens iris at low temperatures and prevent moisture condensation on the optical faceplate of the enclosure. When mounted outdoors in the enclosure, the camera shall operate satisfactorily in a humidity range from 0% RH to 100% RH. The camera shall be powered by 120 VAC 60 Hz. Power consumption shall be less than 40 watts under all conditions. Recommended camera placement shall be 33 feet above the roadway, and over the traveled way on which vehicles shall be detected. The camera shall view approaching vehicles at a distance not to exceed 350 feet for reliable detection. The camera enclosure shall be equipped with separate, weather-tight connections for power and video cables at the rear of the enclosure to allow diagnostic testing and viewing of video at the camera while the camera is installed on a mast arm or pole. Video and power shall not be connected with the same connector. The video signal output by the camera shall be in RS170 format. The video signal shall be fully isolated from the camera enclosure and power cabling. Coaxial cable for transmission of video signals shall be Belden #8281 or equivalent. This cable shall be suitable for installation in conduit or overhead with appropriate span wire. BNC plug connectors should be used at both the camera and cabinet ends. The coaxial cable, BNC connector and crimping tool shall be approved by the supplier of the video detection system and the manufacturer's instructions shall be followed to ensure proper connection. The power cabling shall be 16 AWG three conductor cable. The cabling shall comply with the National Electric Code, as well as local electrical codes.

747.00 Light Emitting Diode (LED) Lights

When specified in the plans, the optical units of the red indications in all vehicle signal faces shall be LED Traffic Signal Section Optical Units. The LED optical units shall be installed in accordance with the manufacturer’s instructions. The LED optical units shall not be paid for separately but shall be included in the cost of the traffic signal face.

747.01 Wattage

The wattage shall be a maximum of thirty-five (35) watts for a 12-inch ball display.

The maximum total harmonic current distortion (THD) shall be less than 20%, and the power factor shall be greater than 90%.

THD and power factor requirements shall be waived for products designed to operate at less than fourteen (14) watts.

747.02 Voltage
Operating voltage shall be between eighty-five (85) and one hundred thirty (130) VAC. Electronic circuitry shall assure proper operation of the load switch and monitor in the control cabinet.

747.03 Circuit Configuration

The LEDs shall be connected to form multiple series circuits. All series circuits shall be interconnected at intervals, forming sub circuits not exceeding fifteen (15) LEDs for the ball and arrow signals. In the event of an LED failure, these sub circuits shall limit the number of extinguished LEDs to no more than four (4) percent of the total on the ball and six (6) percent of the total on the arrow lamp.

747.04 Enclosure

The enclosure shall be dust and water-resistant and shall be approved by the County Engineer.

747.05 Operating Temperature

Operating temperature shall be between -40 degrees F and 185 degrees F.

747.06 Lens

The lens shall be replaceable, polycarbonate (UV stabilized “Lexan”) convex lens; meet ITE color standards; minimum of one-eighth (¼) inch thickness; and minimum light transmittance of 92%, free from bubbles, flaws and other imperfections. Non-polycarbonate tinted lenses shall be accepted provided that these meet ITE color standards. Chromacity shall be uniform across the face of the lens. Non-polycarbonate lenses shall also meet three and one-half (3-½) foot drop tests.

747.07 Candlepower Distribution

Candlepower distribution shall meet minimum ITE specifications. Intensity shall be measured uniform across the face of the lens. Brightness shall be maintained in the event of voltage fluctuations or voltage drops.

747.08 Beam Spread

The beam spread shall be thirty (30) degrees to each side.

747.09 Manufacturer’s Warranty

The manufacturer’s warranty shall include a repair or replacement guarantee of five (5) years and shall cover all except for accidental damage.

748.00 Speed Monitor Display (Speed Awareness Sign)
748.01 Size

For speeds of forty-five (45) mph and faster, a sign should have as a minimum eighteen (18) inch LED display. In residential areas, a twelve (12) inch LED display is required as a minimum. The radar antenna and display to be mounted behind the display windows shall be three-sixteenths (3/16) inch thick non-glare Lexan polycarbonate material or approved equal. The housing shall be at least one-eighth (⅛) inch thick aluminum with a baked powder coat enamel finish. Stainless steel tamper resistant hardware shall be standard. Brightness shall adjust automatically to ambient light conditions.

748.02 Programming

Programming of the display shall be with “one-button” access. Button shall be accessed by a key lock.

748.03 Violator Alert

Violator alert shall be set with “one button” programming in increments of five (5) mph. The display shall not indicate a speed if vehicle is exceeding the pre-set threshold limit. The display shall show violator alert option “Slow Down” in red LED or shall show flashing red and blue bars in LED.

748.04 Radar Unit

The radar unit shall be Decatur Electronics S12 or equal. The unit should use K band frequency or higher. The unit shall be single direction only. The unit shall be Federal Communications Commission (FCC) certified.

749.00 Traffic Signal Start-Up Procedures

Elbert County shall install all signal timings prior to the first turn-on. At the first turn-on, the signal shall be set in “Flash” mode for one week—to include a weekend—prior to starting normal operation. The Contractor shall have a representative present at the first turn-on (“Flash” mode) and at the start of normal operation.

750.00 STREET LIGHTING

751.00 Street Lighting Procedure

The Developer shall submit a written request for streetlight design to the electric service company. The Developer shall submit the final streetlight design to the DPW Director or designee Engineer for review and approval. At the time of inspection, all streetlights shall be installed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS and as shown on the approved plans. Developer shall pay the electric service company the total cost of design, materials and installation for all street lighting.
Streetlights in residential areas and along local and connector roadways, shall be archetype fixtures with 100-watt, high-pressure sodium lamps. The poles shall be round, tapered aluminum as shown in the Detail Drawings. The mounting height shall not exceed twenty (20) feet in residential areas. Other luminaire styles require written approval of the DPW Director or designee prior to installation.

In areas other than residential, street lighting shall be archetype fixtures with high-pressure sodium or Metal Halide lamps and shall be installed at the direction of the County Engineer.

The poles shall be round tapered steel, with mast arms as shown in the Detail Drawings. The mounting height shall not exceed forty (40) feet. Other luminaire styles require written approval of the DPW Director or designee.

Pole spacing and illumination requirements are shown below:

<table>
<thead>
<tr>
<th>Street Type</th>
<th>Average Foot Candles</th>
<th>Lamp Lumens</th>
<th>Pole Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Residential</td>
<td>0.15</td>
<td>9,500</td>
<td>300' ±</td>
</tr>
<tr>
<td>Rural Residential</td>
<td>0.15</td>
<td>9,500</td>
<td>At Intersections</td>
</tr>
<tr>
<td>Connector</td>
<td>0.25</td>
<td>9,500 to 27,500</td>
<td>200' ±</td>
</tr>
<tr>
<td>Arterial</td>
<td>0.50</td>
<td>27,500</td>
<td>150' ±</td>
</tr>
</tbody>
</table>

760.00 PRIVATE DRIVEWAY DESIGN SPECIFICATIONS

761.00 Width:

Driveways shall provide for a minimum 14-foot all-weather driving surface (not including shoulders). A 16-foot surface is encouraged to facilitate larger fire apparatus.

Driveways will be a minimum 14 feet wide with two 1’ shoulders from the property line to the residence or turnaround, whichever applies.

The minimum width of the driveway within road right-of-way shall start at 24’ tapering to 16’ (14’ driveway plus two 1’ shoulders) at property line. (See Section 12.3.6 of the Elbert County Roadway Design and Construction Standards).

762.00 Vertical Clearance:

Driveways shall have an unobstructed vertical height of 13 feet 6 inches.

Driveways shall have an unobstructed vertical height of 13 feet 6 inches.

763.00 Surface – Sub-Base:

All roadbase material shall be a minimum 6 inches thick and shall provide an all-weather driving surface capable of handling the imposed loads of fire apparatus (up to 67,000 pounds depending on the jurisdiction).
763.01 Aggregate surface – sub-base.

All roadbase material shall be a minimum 6” (compacted) and shall provide an all-weather driving surface – sub-base capable of handling the imposed loads of fire apparatus (up to 67,000 pounds depending on the jurisdiction).

The acceptable materials for an all-weather driving surface – sub-base is

- Class 5-6 aggregate
- Class 5-6 recycled concrete
- Class 5-6 recycled asphalt

Asphalt and concrete paved surfaces accompanied by a Geotech report will also be considered an all-weather surface.

Owner/contractor shall provide Elbert County with test results of the materials used.

763.02 Driveways accessing paved Elbert County/private roads.

All driveways that meet or join paved roads must be paved with asphalt and tacked at the seam.

Depth or thickness of pavement will be 4” minimum compacted.

Drive must be paved from the property line to the edge of the paved portion of the Elbert County/private road. Sub-base under pavement must be 6” (compacted) of the following:

- Class 4-7 aggregate
- Class 4-7 recycled concrete
- Class 4-7 recycled asphalt

Asphalt and concrete paved surfaces accompanied by a Geotech report will also be considered an all-weather surface.

Paved driveway access from shoulder of road to property line will be part of the final driveway inspection.

Any surface (asphalt, concrete, chip seal, etc.) applied over approved sub-base from property line to house will not be approved or inspected by Elbert County.

764.00 Approach:

All driveways must approach the roadway at a 70 -90 degree angle perpendicular to the intersecting roadway.

All driveways must approach the roadway at a 70 -90 degree angle perpendicular to the intersecting roadway.
765.00  Turning Radii:

All residential driveways 150 feet or longer in developed length shall provide a complete turnaround constructed with a minimum 40-foot center line radius as shown below:

All turns associated with the driveway system shall provide a minimum 40-foot center line radius as shown below:
Exceptions:

A: Driveways greater than 20 feet in width.


C: Turning radius may be modified when approved by the authority having jurisdiction.

All residential driveways 150 feet or longer in developed length shall provide a complete turnaround constructed with a minimum 40-foot center line radius as shown below.

All turns associated with the driveway system shall provide a minimum 40-foot center line radius as shown below:

Regulations on turn outs and turning radiuses may be superseded by local Fire District regulations, which may include the following.

Driveways greater than 20 feet in width.

Houses equipped with an approved automatic sprinkler system installed and maintained in accordance with NFPA 13D, Standard for the Installation of Sprinkler Systems in Single-family Dwellings.
Driveway Centerline

All turns associated with the driveway system shall provide a minimum 40-foot center line radius as shown below:

766.00 Slope:

The maximum slope of residential driveways shall not exceed 10% once on the private property.
Exceptions:


B: When approved by the authority having jurisdiction.

Maximum slope of a driveway will be determined by the Fire District under whose jurisdiction the residence falls under.

767.00 Bridges and Water Crossings:

Bridges and other water crossing appliances shall be designed and constructed to handle the imposed loads of fire apparatus in all-weather situations. In many cases, bridges and crossings may require the approval stamp of a professional engineer.

Bridges and other water crossing structures will be designed and constructed to handle the imposed loads of fire apparatus in all-weather situations. In many cases, bridges and crossings will require the approval stamp of a professional engineer.

768.00 Livestock Crossings:

Livestock crossings and grates shall be designed and constructed to withstand the imposed loads of fire apparatus (up to 67,000 pounds depending on the jurisdiction)

Exceptions.

A: When approved alternate means of access are provided around the grate, the provisions of 2-8 may be modified.

Livestock crossings and grates will be designed and constructed to withstand the imposed loads of fire apparatus (up to 67,000 pounds depending on the jurisdiction) In many cases, livestock crossings will require the approval stamp of a professional engineer.

When approved by the Elbert County Road and Bridge Department and the Fire District, an alternate means of access around the grate can be used. (See Section 12.3.6.3.1.2 of the Elbert County Roadway Design Construction Manual.)

769.00 Gates and Limited Access Appliances:

(See Section 12.3.6.9 of the Elbert County Roadway Design Construction Manual.)

Private dwelling gates shall provide a minimum 14-foot unobstructed width and shall be operable without special knowledge or force.

Exception:
A. Gates that utilize an approved access control device to ensure immediate access to the dwelling. Device information can be obtained by contacting the appropriate fire protection agency.

Gates shall be located a minimum of 30 feet off the roadway to ensure a safe and unobstructed traffic flow during emergency response.

Private dwelling gates will provide a minimum 16-foot unobstructed width and will be operable without special knowledge or force.

Gates that utilize a control device must be approved by the Fire District.

All gates shall open inward, outward opening gates are prohibited.

Gates will be located a minimum 30’ off the roadway shoulder to ensure a safe and unobstructed traffic flow during emergency response.

770.00 COMMERCIAL DRIVEWAY REQUIREMENTS

771.00 Width:

Driveways shall provide for a minimum of 40 foot turning radius at county road/private road.

32 feet from property line to edge of county road/private road.

Road base must be a CDOT Class VI material.

772.00 Surface:

All roadbase material shall be a minimum 6 inches thick and shall provide an all-weather driving surface capable of handling 85,000 lbs.

773.00 Approach:

All driveways must approach the roadway at a 70-90-degree angle perpendicular to the intersecting roadway.

774.00 Culverts

The minimum type is corrugated metal pipe. Depending on engineering recommendations reinforced concrete pipe might be required.

Culvert diameter-dependent on-site plan

Culvert length-minimum length is 44 feet plus flared ends
775.00  Paved surfaces

All driveways that meet or join paved roads must be paved with asphalt. Concrete may be used on a case by case basis.

Pavement thickness must be capable of handling 85,000 lbs.

Drive must be paved from the property line to the edge of the paved portion of the county road/private road. This is the minimum requirement.

Adequate sight distance for the driveway must meet County code.

Drive must have a 1% fallback measured from the centerline ditch to the property line.

All major Commercial Developments shall be required to submit a Site Plan for access approval.

780.00  CULVERTS

A minimum 18" diameter corrugated metal pipe (CMP) culvert or equivalent volume, shall be required at the established ditch flow line. A sketch plan of the installation must be submitted with the access permit application.
834.00 Cleanup ........................................................................................................... 21
835.00 Backfill of Concrete Work ............................................................................... 21
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837.00 Repairs ............................................................................................................ 22
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    838.01 Finishing .................................................................................................... 23
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SECTION 800
CONCRETE MIX DESIGN AND CONSTRUCTION

801.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

810.00 SCOPE

All Portland cement concrete work within any street, parking lot or R.O.W. or in any part of the water system, sanitary sewer system, or storm drainage system of Elbert County shall meet the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

811.00 Inspections

Refer to Section 154.00 Inspections and Section 931.00 Roadway Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Adequate inspections assure compliance to Elbert County requirements and are the basis for Elbert County’s recommendation that improvements be accepted for maintenance and/or for release of performance guarantees. It is the responsibility of the Contractor to contact the DPW Director or his designee / Elbert County Engineer a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required inspections shall include:

A. Subgrade – Verify that material on which concrete shall be placed is to the line, grade, and cross-section shown on the approved plans, is not frozen or excessively dry at the surface, and meets all compaction requirements.

B. Forms/Reinforcing Steel – Verify that forms are set to proper grade and alignment, adequately braced, and set for proper thickness of concrete. Rebar is properly placed and spaced, at least fifty (50) percent of intersections are tied, and proper distances from surface grade and forms are maintained.

C. Concrete Delivery and Testing – Confirm that mix design submittals are approved by Elbert County, and testing/sampling frequency, slump, air, and minimum/maximum air and concrete temperatures comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

D. Cure and Flush – Verify that Finished concrete complies with approved grades and alignment and is properly cured. If required by the DPW Director or his designee / Elbert County Engineer, verify that concrete pavement surfaces comply with the
smoothness requirements of Section 412.17 Surface Smoothness Test of the CDOT Standard Specifications for Road and Bridge Construction

E. General Items Include:
   1. All temporary structures, debris, mud and waste materials shall be removed from public property. Grout and seal all cracks in concrete. Fill all gouged areas of concrete with an approved epoxy. Remove and replace all areas of broken concrete. Subgrade failures shall be corrected before pouring back.

F. Construction Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

G. Final Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

820.00 CONCRETE MIX DESIGN

Concrete shall be composed of Portland cement, aggregate and water, and shall be reinforced with steel bars or steel wire fabric where required.

Concrete mix design information shall be prepared in accordance with ACI 301 Section 4.2 and submitted to Elbert County for approval. At least two (2) sets of certified twenty-eight (28) day strength test results shall also be submitted. No concrete shall be placed until the concrete mix design has been approved by the Road & Bridge Superintendent / Elbert County Engineer.

A separate mix design submittal shall be required for concrete to be pumped. Mix designs shall be prepared in accordance with ACI 211 and 304, as applicable.

821.00 Materials

821.01 Cement

All cement used in concrete work shall be Portland cement that complies with ASTM C150, Type I or Type II, except where Type V cement is required for sulfate-resistant concrete. In general, Type II cement that complies with ASTM C150 shall be used in concrete in contact with the soil, unless otherwise allowed or directed by the DPW Director or his designee / Elbert County Engineer. Cement, which for any reason has become partially set or which contains lumps shall be rejected.

The Contractor shall be responsible for proper storage of all cement until it is used. When requested by the DPW Director or his designee / Elbert County Engineer, the Contractor shall furnish the DPW Director or his designee / Elbert
County Engineer with a certificate from the manufacturer or an acceptable testing laboratory stating that the cement meets the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS for Portland cement.

821.02  Fly Ash

Fly ash may be utilized in the concrete mix design when permitted by the DPW Director or his designee / Elbert County Engineer. Fly ash shall be Class C and shall comply with ASTM C618. The pozzolanic index shall be eighty-five (85). Fly ash may replace a maximum of twenty (20) percent of the amount of Portland cement that otherwise is required to produce concrete of the specified compressive strength. Class C fly ash shall not be permitted where sulfate resistant cement is required.

The Contractor shall notify the DPW Director or his designee / Elbert County Engineer of the source of the fly ash prior to use in the project. When required by the DPW Director or his designee / Elbert County Engineer, the Contractor shall provide the fly ash analysis performed by the fly ash supplier along with the concrete mix proportions. The DPW Director or his designee / Elbert County Engineer may require a certificate from an approved testing laboratory stating that the fly ash meets the requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

821.03  Water

Water for concrete shall be clean and free from sand, oil, acid, alkali, organic matter, or other deleterious substances and shall meet the requirements for mix water as published in ASTM C94. Water from public supplies or water that has been proven to be suitable for drinking is satisfactory.

821.04  Admixtures

The following requirements apply for admixtures:

A. The Contractor shall use air-entraining admixtures for all surfaces of exposed concrete. Air entraining admixtures shall comply with ASTM C260.
B. When weather restraints, site conditions or project requirements require the ability to place concrete at a lower temperature, produce accelerated concrete setting time or increase early and ultimate compressive strengths, an accelerating admixture may be utilized in the design mix when allowed by the DPW Director or his designee / Elbert County Engineer.
C. Calcium chloride may be utilized in the design mix when allowed by the DPW Director or his designee / Elbert County Engineer.
D. Type C accelerating admixtures and Type E water reducing, and accelerating admixtures shall meet ASTM C494.

E. When concrete is to be used with reinforcing steel, a non-chloride / non-corrosive, admixture shall be used.

F. Dosage rates shall be determined by recommendation of the ready-mix company and shall be specified for daily site conditions.

821.05 Fine Aggregate

The fine aggregate shall be clean, hard, durable, uncoated particles of sand, free from injurious amounts of clay, dust, soft or flaky particles, loam, shale, alkali, organic matter, or other deleterious matter. Fine aggregate shall be well graded, and when tested by means of laboratory sieves shall comply with ASTM C33.

The fine aggregate gradation shall comply with CDOT Fine Aggregate.

821.06 Coarse Aggregate

The coarse aggregate shall consist of broken stone or gravel that is clean, hard, tough and durable, and free from soft, thin, elongated or laminated pieces, disintegrated stone, clay, loam, vegetable, or other deleterious matter. Coarse aggregate shall be well graded and when tested by means of laboratory sieves shall comply with ASTM C33. The coarse aggregate gradation shall comply with CDOT Coarse Aggregate Gradation # 467.

821.07 Fibrous Reinforcing

Fibrous concrete reinforcing shall not be used, unless approved by the DPW Director / Elbert County Engineer.

822.00 Mix Properties

Mix properties of Portland cement concrete for flatwork shall comply with the following:

<table>
<thead>
<tr>
<th>Property</th>
<th>Mix Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum compressive strength - 28 days*</td>
<td>3000 psi</td>
</tr>
<tr>
<td>Minimum cement - sacks/cubic yard</td>
<td>6</td>
</tr>
<tr>
<td>Maximum water/cement ratio - by weight</td>
<td>0.50</td>
</tr>
<tr>
<td>Slump - inches</td>
<td>1-4</td>
</tr>
<tr>
<td>Air entrainment - % by volume</td>
<td>5-8</td>
</tr>
</tbody>
</table>

* When tested in accordance with ASTM C31

The grading and composition requirements for coarse and fine aggregate for concrete shall be in accordance with the CDOT Standard Specifications for Road and Bridge
Construction. Additional concrete mix designs may be approved for decorative, non-structural concrete at the discretion of the DPW Director / Elbert County Engineer.

822.01 Colored Patterned Concrete

COLOR SHALL BE AS NOTED ON THE APPROVED DRAWINGS OR AS APPROVED BY THE DPW DIRECTOR / ELBERT COUNTY ENGINEER.

Where required on the approved plans, colored patterned concrete shall comply with the following:

A. Minimum twenty-eight (28) day compressive strength of concrete shall be 4,000 psi.
B. Air entrainment shall be six (6) percent [+ 1%] for maximum aggregate size of three-quarter (¾) inch or one (1) inch and shall be seven and one-half (7 ½) percent [+ 1%] for a maximum aggregate size of three-eighths (⅜) inch or one-half (½) inch.
C. Normal set or retarded set water reducing admixture shall comply with ASTM C494.
D. No calcium chloride shall be added to the concrete mix.
E. Matching integral color shall be used as a supplement, but not as a color hardener.
F. Color hardener shall be specially formulated for installation of patterned concrete, grade “Heavy Duty”. Color curing compound shall comply with ASTM C309 and with all applicable air pollution regulations.

822.02 Controlled Low Strength Materials (CLSM)

CLSM (“Flowable Fill”) mix designs shall be submitted to the Road & Bridge Superintendent / Elbert County Engineer for approval prior to placement. CLSM used as structure backfill, as backfill for pipelines and service lines, or to fill abandoned pipelines and appurtenances shall have a twenty-eight (28) day compressive strength between fifty (50) and one-hundred fifty (150) psi, as tested by ASTM D4832.

CLSM shall be placed in confined areas and under pipe haunches with methods approved by Elbert County. When backfilling pipelines and service lines, CLSM shall be properly layered to prevent pipe from floating.

Onsite material mix designs may be approved. Test sections may be required, and a placement plan may be required to be submitted for approval by the DPW Director / Elbert County Engineer.
The following CLSM mix properties and proportions apply:

**CLSM Mix Requirements**

<table>
<thead>
<tr>
<th>Property</th>
<th>Mix Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum 24-hour strength</td>
<td>15 psi</td>
</tr>
<tr>
<td>Maximum 28-day strength</td>
<td>50-150 psi</td>
</tr>
<tr>
<td>Maximum aggregate size</td>
<td>1” (100% Passing)</td>
</tr>
<tr>
<td>Portland Cement</td>
<td>ASTM C150 Type I-II (or Type V for sulfate resistance)</td>
</tr>
<tr>
<td>Slump</td>
<td>4” – 8”</td>
</tr>
</tbody>
</table>

**Mix Proportions (per cubic yard of concrete)**

<table>
<thead>
<tr>
<th>Material</th>
<th>lbs./yd3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>501</td>
</tr>
<tr>
<td>Water3</td>
<td>325 (39 gallons) or as needed</td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td>1700</td>
</tr>
<tr>
<td>(AASHTO No. 57 or 67)</td>
<td></td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>1845</td>
</tr>
<tr>
<td>(AASHTO M6)3</td>
<td></td>
</tr>
</tbody>
</table>

1. 40 lbs./yd3 cement and 10 lbs./yd3 Class C fly ash may be substituted for 50 lbs./yd3 cement.
2. CLSM shall flow into place without excessive segregation or bleed water.
3. The percent passing the #200 sieve shall be between 8% - 20%.

**823.00 Ready-Mixed Concrete**

The use of ready-mixed concrete shall in no way relieve the Contractor or Developer of the responsibility for proportion, mix, delivery, or placement of concrete. All ready-mixed concrete shall comply with ASTM C94.

Concrete shall be continuously mixed or agitated from the time the water is added until the time of use, and discharge from the truck should begin within ninety (90) minutes or three hundred (300) revolutions after it comes in contact with the mixing water or with the aggregates. In accordance with ASTM C94, water may be added to ready-mix concrete one time in order to get slump within range, as long as the specified water-cement ration is not exceeded.

Elbert County shall have free access to the ready-mix plant at all times. The organization supplying the concrete shall have sufficient plant and transportation facilities to assure continuous delivery of the concrete at the required rate.
The contractor shall collect delivery or batch tickets from the driver for all concrete used on the project and shall deliver them to the DPW Director / Elbert County Engineer. Batch tickets shall provide the following information in accordance with ASTM C94:

A. Name of ready-mix batch plant
B. Serial number of tickets
C. Date
D. Truck number
E. Name of purchaser
F. Specific designation of job (name and location)
G. Mix # or specific class or designation of the concrete
H. Amount of concrete in cubic yards
I. Time loaded or of first mixing of cement and aggregates
J. Water added by receiver of concrete and his initials
K. Weights of fine and coarse aggregates
L. Type, brand and amount of cement
M. Type, brand and amount of admixtures
N. Weight (in gallons) of water, including surface water on aggregates

824.00 Steel Reinforcing and Forms

824.01 Steel Reinforcing

The placement, fastening, splicing and supporting of reinforcing steel and wire mesh or bar mat reinforcement shall comply with the plans and the latest edition of CRSI Recommended Practice for Placing Reinforcing Bars. Before being positioned, all reinforcing steel shall be thoroughly cleaned of mill and rust scale and of coatings that may destroy or reduce the bond. Where there is delay in depositing concrete, reinforcement shall be re-inspected and cleaned if necessary. Reinforcement shall be carefully formed to the dimensions indicated on the approved plans by the cold bending method. Cold bends shall be made so that the inside diameter of the bend measured on the inside of the bar shall be as follows:

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Grade 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3 through #8</td>
<td>6 bar dia.</td>
</tr>
<tr>
<td>#9, #10, and #11</td>
<td>8 bar dia.</td>
</tr>
<tr>
<td>#14 and #18</td>
<td>10 bar dia.</td>
</tr>
</tbody>
</table>

The inside diameter of bend for stirrups and ties shall not be less than four (4) bar diameters for sizes #5 and smaller, and five (5) bar diameters for #6 and #8. Reinforcement shall not be bent or straightened in a manner that may injure the material. Bars with kinks or bends shall not be used except where shown on the plans. Heating of reinforcement shall not be permitted.
Reinforcing steel shall be accurately placed and secured against displacement by using annealed iron wire of not less than No. 18 gauge, or by suitable clips at intersections. A minimum of fifty (50) percent of intersections shall be secured. Where necessary, reinforcing steel shall be supported by metal chairs or spacers, pre-cast mortar blocks, or metal hangers. Splicing of bars, except where shown on the plans, shall not be allowed without approval of the DPW Director or Designee.

Welded wire fabric for concrete reinforcement shall be of the gauge, spacing, dimensions, and form specified on the plans or Detailed Drawings and shall comply with “Specifications for Welded Steel Wire Fabric for Concrete Reinforcement” (ASTM A185) or “Specifications for Welded Deformed Steel Wire Fabric for Concrete Reinforcement” (ASTM A497).

Contractor shall submit shop drawings of the reinforcement to the DPW Director / Elbert County Engineer for approval. Unless otherwise shown on the plans, the minimum clear cover for reinforcing steel shall be the following, as specified in Section 5.5 of ACI 301:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom bars on soil bearing foundations &amp; slabs</td>
<td>3 inches</td>
</tr>
<tr>
<td>Bars adjacent to surfaces exposed to weather or earth backfill</td>
<td>1½ inches</td>
</tr>
<tr>
<td>Interior surfaces</td>
<td>¾ inches</td>
</tr>
</tbody>
</table>

824.02 Forms and Form Setting

Forms shall have sufficient strength to withstand—without deformation—the pressure resulting from placement and vibration of the concrete. Forms shall be constructed so that the finished concrete shall conform to the shapes, lines, grades and dimensions indicated on the approved plans. Any form which is not clean, and which has not had the surface prepared with commercial form oil to effectively prevent bonding, staining, and softening of concrete surfaces shall not be used.

Forms may generally be wood or metal and shall have a depth equal to or greater than the slab thickness. plywood forms, plastic coated plywood forms, or steel forms shall be used for all surfaces requiring forming which are exposed to view, whether inside or outside any structure. Surfaces against backfilled earth, interior surfaces of covered channels, or other places permanently obscured from view, may be formed with forms having sub-standard surfaces.

Forms that have become worn, bent, or broken shall not be used. Each section of form shall be straight and free from warps. The Contractor shall set a minimum length of three hundred (300) feet of forms to grade prior to placing concrete.
cases where the length of one run is less than three hundred (300) feet, the Contractor shall set forms to grade for the entire run.

The face of curbs shall be formed, unless otherwise permitted by the DPW Director / Elbert County Engineer. Forms shall be secured to resist the pressure of the poured concrete without springing or settlement. The connection between sections shall be performed by a method in which the joint shall be free from movement in any direction.

Forms shall not deviate more than one-quarter (¼) inch from the design line and grade.

When concrete pavement is constructed on a curve, flexible forms shall be used having a radius of two hundred (200) feet or less, unless otherwise directed by the DPW Director / Elbert County Engineer. Face forms shall be preformed to the proper radius. Care shall be exercised to ensure the required cross section is maintained around the entire radius.

The Contractor shall provide an approved metal straight edge, ten (10) feet in length, to check the alignment of the forms prior to placing the concrete, and to check the concrete surface during the finishing operation.

Forms shall not be disturbed until the concrete has hardened sufficiently to permit removal without damaging the concrete, or until forms are not required to protect the concrete from mechanical damage. The minimum duration of time before removal of forms after placing concrete shall be one (1) day for footings and two (2) days for all other concrete. Crowbars or other heavy tools shall not be used against green concrete when removing forms. Forms shall be thoroughly cleaned before re-oiling and reuse.

825.00 Concrete Testing

The requirements of this section shall apply to testing services for all concrete curb and gutter, sidewalk, pavement, slope paving, retaining walls, structures, and for all miscellaneous concrete testing.

The required concrete testing services shall be performed by a designated concrete testing agency approved by the DPW Director / Elbert County Engineer, and that meets the requirements of ASTM E329.

A representative of the concrete testing agency shall inspect, sample, and test material and production of concrete as required by the DPW Director / Elbert County Engineer. When it appears that any material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing agency shall report such deficiency to the DPW Director / Elbert County Engineer and the Contractor.
The concrete testing agency shall report all test and inspection results to the DPW Director / Elbert County Engineer and Contractor immediately after they are performed. All test reports shall include the exact location of the work at which the batch represented by a test was deposited. The report of the strength test shall include detailed information on storage and curing of specimen prior to testing, the project number, and the location of the concrete (curb, manhole, inlet, sidewalk, paving, etc.).

The concrete testing agency or its representative is not authorized to revoke, alter, relax, expand or release any requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS, nor to approve or accept any portion of the work.

826.00 Tests Provided by the Developer

The Developer shall provide the concrete testing agency with the following:

Any labor necessary to assist the designated concrete testing agency in obtaining and handling samples at the project or from other sources of material.

Provide and maintain for the sole use of the concrete testing agency adequate facilities for safe storage and proper curing of concrete test specimens on the project site as required by AASHTO T23.

The use of concrete testing services shall not relieve the Contractor of the responsibility to furnish material and construct in full compliance with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

In the case of questionable concrete materials or work, the DPW Director / Elbert County Engineer may direct that core tests be taken on all questionable concrete placements, at the Contractor’s expense. If the concrete shows inadequate strength or other deficiencies, it shall be removed and replaced at the Contractor’s expense. If any core shows a deficiency of thickness greater than one-half (½) inch, exploratory cores shall be taken in increments as dictated by the DPW Director / Elbert County Engineer, and all concrete deficient by more than one-half (½) inch shall be removed and replaced at the Contractor’s expense.

The following services shall be performed by the designated concrete testing agency at the expense of the Developer:

A. Conduct strength test of the concrete during construction in accordance with the following procedure: Secure composite samples in accordance with AASHTO T141. Mold and cure specimens from each sample in accordance with AASHTO T23. The maximum time between sampling and casting the cylinders or beams shall be fifteen (15) minutes. If cylinders or beams cannot be returned to the laboratory and cast within the forty-five (45) minutes, they shall be cast in the field and transported to the laboratory in twelve (12) to twenty-four (24) hours. One (1) field
cured test series and one (1) lab cured test series shall be taken in
the first fifty (50) cubic yards (or fraction thereof) of the concrete
placed per day, and one (1) field cured test series and one (1) lab
cured test series shall be taken fifty (50) cubic yards after that.
One (1) field cured test series and one (1) lab cured test series shall
continue to be taken every one hundred (100) cubic yards until the
end of the workday. Special projects may require more frequent
testing, as directed by the DPW Director / Elbert County Engineer.

1. Field cured test series (if required by the DPW Director
   Superintendent / Elbert County Engineer):
   Four (4) cylinders; two (2) to be broken at seven (7) days; two (2) to be broken at
   fourteen (14) days or as directed by the DPW Director or Designee.

2. Lab cured test series:
   Six (6) cylinders; Two (2) to be broken at seven (7) days; two (2) to be broken at
twenty-eight (28) days*; two (2) to be broken at forty-five days. *If the specified
   strength is not obtained at twenty-eight (28) days, two (2) cylinders shall be
   broken at forty-five (45) days.
   B. Determine slump of the concrete sample of each strength test
      whenever consistency of concrete appears to vary, or when
      directed by the DPW Director or designee, in accordance with
      AASHTO T119.
   C. Determine air content of the concrete sample for each strength test
      in accordance with either AASHTO T152 (pressure method), T196
      (volumetric method), or T121 (gravimetric method).
   D. Sample additional concrete at point of placement and perform
      other testing or inspection services as required.
   E. The Developer or Contractor shall provide two (2) copies of all
      concrete strength test results to the DPW Director / Elbert County
      Engineer.
   F. The Developer or Contractor shall provide additional testing and
      inspection required due to changes in materials or proportions or
      irregularities in specified procedures.
   G. When the work fails to pass inspection or previous tests fail to
      meet specifications, additional tests shall be taken as directed by
      the DPW Director / Elbert County Engineer.
   H. Core samples shall be obtained and tested when samples of fresh
      concrete were not obtained and tested in accordance with the
      provisions of these CONSTRUCTION STANDARDS &
      SPECIFICATIONS. Obtaining and testing cores shall comply
      with ASTM C42. Concrete in the area represented by a core test
      shall be considered adequate if the average strength of the cores is
      equal to at least eighty-five (85) percent of the specified strength
      (f'_c), and if no single core is less than seventy-five (75) percent of
      the specified strength. Core holes shall be filled with low slump
concrete or mortar. Cores may be tested in the dry condition in accordance with ACI 301.

I. Failure of the Contractor to furnish testing as herein described shall be sufficient cause for rejection of the work in question.

830.00 CONCRETE CONSTRUCTION

831.00 Placing Concrete

Before placing concrete, debris shall be removed from the space to be occupied by the concrete. The forms and all concrete surfaces shall be thoroughly wetted. The concrete shall be placed on damp but not wet or muddy subgrade. Concrete shall be placed and compacted so that it is free from honeycomb and free from pockets of segregated aggregate. Sections of segregation or honeycomb revealed by removal of the forms shall be removed and replaced or otherwise repaired as approved by the DPW Director / Elbert County Engineer.

Concrete shall not be placed until all forms and reinforcing steel have been inspected and approved by the Elbert County Inspector/Representative or resident project inspector. Concrete shall be handled from the mixer to the place of final deposit as rapidly as possible by methods that prevent separation or loss of ingredients. The concrete shall be deposited in the forms as close as practicable in its final position to avoid re-handling. It shall be deposited in continuous layers, the thickness of which generally shall not exceed twelve (12) inches. Concrete shall be placed in a manner to avoid segregation and shall not be dropped freely more than five (5) feet. If segregation occurs, the Elbert County Inspector/Representative or resident project inspector may require the concrete to be removed and replaced at the Contractor's expense.

Concrete shall be placed in one continuous operation, except where keyed construction joints are shown on the plans or as approved by the DPW Director or designee. Delays in excess of thirty (30) minutes may require removal and replacement of concrete by the DPW Director or Designee. At the end of the work day, or in case of an unavoidable interruption of more than thirty (30) minutes, a transverse construction joint shall be placed at the point of stopping work, provided that the section on which work has been suspended shall not be less than five (5) feet long. Sections less than five (5) feet in length shall be removed. Concrete shall not be placed when the weather is stormy, dusty, or inclement to a degree that precludes good workmanship.

831.01 Vibrating

All concrete shall be compacted by internal vibration using mechanical vibrating equipment. Concrete in floor slabs, sidewalks, or curb and gutter which is not placed against form linings shall be either tamped or vibrated. Care shall be taken to vibrate only long enough to bring a continuous film of mortar to the surface.
Vibration shall stop before any segregation of the concrete occurs. Mechanical vibrators shall be an approved type as specified in ACI 309, Chapter 5. Vibrators shall not be used to move or spread the concrete.

Any evidence of lack of consolidation or over-consolidation shall be regarded as sufficient reason to require removal and replacement of concrete at the Contractor's expense. The Contractor shall be responsible for any defects in the quality and appearance of the concrete.

831.02 Workability

The consistency of concrete shall be kept uniform and shall be checked by means of certified slump tests. The workability of the concrete shall be varied as directed by the DPW Director or Designee. At all times concrete shall have a consistency such that it can be worked into corners and angles of the forms and around joints, dowels and tie-bars by the construction methods which are being used without excessive spading, segregation or undue accumulation of water or laitance on the surface. If, concrete fails to conform to the proportions of the approved mix design for any reason, such concrete shall not be incorporated in the work but shall be discarded from the project site as waste material at the Contractor's expense. **NO WATER MAY BE ADDED AT THE JOB SITE WITHOUT PERMISSION OF THE DPW DIRECTOR / ELBERT COUNTY ENGINEER.** If approval is obtained and water is added at the job site, slump tests shall be performed, and test cylinders cast at the Contractor’s expense.

831.03 Installation of Colored Patterned Concrete

Special concrete mix with integral color shall be placed and screeded to the proper grade and floated to a uniform surface in the normal manner for slabs on grade. Color hardener shall be applied evenly to the plastic surface by the dry shake method using a minimum of sixty (60) pounds per one hundred (100) square feet. Color hardener shall be applied in two (2) or more shakes, floated after each, and troweled only after the final floating.

While the concrete is still plastic, the imprinting tools shall be applied to make the desired patterned surface. The pattern shall be matched at imprint edges and joints.

Color curing compound, thinned in the proportion of one (1) part curing compound to one (1) part mineral spirits (paint thinner), shall be applied uniformly with a roller or sprayer. The coverage shall be approximately six hundred (600) to six hundred fifty (650) square feet per gallon of unthinned curing compound. At times when the air temperature is at or near freezing, the slab shall be cured using suitable curing blankets. The slab shall later be sealed with the color curing compound when the air temperature is above freezing.
Use of blankets and/or heaters may be necessary to maintain the concrete at or above fifty (50) degrees F for three (3) days after placement. The cured surface shall be cleaned to remove any residual materials.

831.04 Weather Limitations

831.04.01 Cold Weather Concreting

During extreme weather conditions, placement of concrete shall be allowed only when the temperature of the concrete placed in the forms is between 60 degrees F and 90 degrees F. Cold weather placement of concrete shall comply with ACI 306.

Concrete may be placed when the air temperature in the shade is 40 degrees F AND RISING. No concrete shall be placed, regardless of the present temperature, when the weather forecast predicts freezing weather before final set of the concrete unless special means of heating and protection are used. Protection against freezing is the Contractor's responsibility regardless of the weather forecast or climatic conditions at the time of placement.

Small structures and slabs shall be protected by completely covering fresh concrete with suitable curing blankets to prevent freezing. Large structures and vertical walls shall be protected against freezing by enclosing the structure with heating devices capable of providing uniform and even heat throughout the structure. Heaters shall be vented so that combustion gases are exhausted outside the enclosure in order to avoid carbonation of the fresh concrete.

Cold weather is defined as a period when, for more than three (3) consecutive days, the following conditions exist:
A. The average air temperature is less than 40 degrees F.
B. The air temperature is not greater than 50 degrees F for more than one half of any 24-hr. period.

Concrete placed in cold weather shall be protected from extreme temperatures as follows:
A. A temperature of at least 50 degrees F for the first seventy-two (72) hours shall be maintained.
B. After the first seventy-two (72) hours and until the concrete is seven (7) days old, it shall be protected from freezing temperatures.
C. Concrete adjacent to heating devices shall be insulated from direct heat of the unit that may dry it out prior to being properly cured.
D. Temperatures shall be measured by maximum and minimum thermometers furnished by the Contractor and installed adjacent to the concrete.

Concrete slabs shall not be placed, regardless of temperature conditions, if the supporting ground is frozen or contains frost. Use of salt or other additives to prevent concrete from freezing is not allowed. Concrete which has been frozen shall be removed and replaced as required by the DPW Director/Elbert County Engineer.

### MINIMUM EXPOSURE TEMPERATURE FOR CONCRETE FLATWORK
**FOR PORTLAND CEMENT CONCRETE = 500 lb./CY**

<table>
<thead>
<tr>
<th>Slab Thickness (inches)</th>
<th>Minimum Ambient Air Temperature Allowable For Values of Thermal Resistance (R), hr<em>ft</em>F/BTU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R=2</td>
</tr>
<tr>
<td>4</td>
<td>**</td>
</tr>
<tr>
<td>8</td>
<td>**</td>
</tr>
<tr>
<td>12</td>
<td>42°F</td>
</tr>
<tr>
<td>18</td>
<td>30°F</td>
</tr>
<tr>
<td>24</td>
<td>21°F</td>
</tr>
</tbody>
</table>

** > 50°F. Additional heat required.

831.04.02 Hot Weather Concreting

Except by written authorization, concrete shall not be placed if the temperature of the plastic concrete cannot be maintained at 90 degrees F or lower. Placement of concrete in hot weather shall comply with ACI 305.

832.00 Concrete Pavement and Flatwork

The installation of Portland cement concrete pavement, including materials, equipment, foundation and construction methods shall comply with Section 412 of the CDOT Standard Specifications for Road and Bridge Construction and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Concrete pavements shall be installed as shown on the approved plans or as approved by the DPW Director or Designee. The Contractor shall furnish steel pins to use in setting grades for concrete pavement.

The subgrade shall conform to the specified cross section. Immediately prior to placing concrete, the subgrade shall be tested for adequate compaction and moisture to a minimum depth of six (6) inches or as specified in the approved Geotechnical Report. Concrete shall not be placed on any portion of the subgrade that has not been
inspected by an Elbert County Inspector/Representative or resident inspector. There shall be no puddles or pockets of mud when the concrete is placed, and the subgrade shall be cleared of any loose material.

Curb, curb ramps, gutter, sidewalk, cross pan, and driveway construction shall conform to all applicable provisions of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

832.01 Portland Cement Treated Base

In those instances where deemed necessary by the project Soils Engineer and approved by the DPW Director or Designee, Portland cement treated base may be required.

832.02 Curb and Gutter

The section to be constructed shall be as identified on the approved plans and as shown on the Detail Drawings of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

832.03 Sidewalks

Detached sidewalks shall be a minimum of four (4) inches thick and attached sidewalks shall be a minimum of six (6) inches thick and shall be constructed as shown on the approved plans. Areas of sidewalk crossed by driveways or in parks, open spaces or greenbelts shall be constructed with a minimum of six (6) inch thick concrete.

832.04 Crosspans and Curb Return Fillets

Crosspans and curb return fillets shall be constructed twelve (12) inches thick or eight (8) inches thick one-half (½) inch (#4) reinforcing steel bars placed at eighteen (18) inch centers (each way) in residential, commercial and industrial areas. Typical crossspan sections are shown in the Detail Drawings. Where unusual conditions exist, additional reinforcing steel and special joints may be required by the DPW Director or Designee.

832.05 Curb Cuts and Driveways

Curb cuts in six (6) inch vertical curbs shall be constructed at all driveway locations and at additional locations, as shown on the approved plans and in the Detail Drawings.

832.06 Curb Ramps
Curb ramps shall be installed at locations designated by the County Engineer and as shown on the approved plans. Curb ramps shall be constructed with slopes, landings, and detectable warnings (truncated domes) as shown in the Detail Drawings. Specific installation details shall be per the manufacturer.

The following materials may be used for truncated domes:

A. Fiber reinforced polymer tiles
B. Cast iron tiles
C. Preformed cementitious tiles
D. Thermoplastic tiles

The actual truncated dome material to be installed for a specific project or location shall be designated by the DPW Director or Designee.

832.07 Joints

Joint materials shall comply with the following specifications:

<table>
<thead>
<tr>
<th>Material Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete joint sealer, hot-poured elastic</td>
<td>M173</td>
</tr>
<tr>
<td>Preformed expansion joint filler (Bituminous Type)</td>
<td>M33</td>
</tr>
<tr>
<td>Preformed sponge rubber and cork expansion joint fillers</td>
<td>M153</td>
</tr>
<tr>
<td>Preformed expansion joint fillers (fiber board)</td>
<td>M213</td>
</tr>
</tbody>
</table>

Non-bituminous type materials shall be placed in widths shown on the approved plans or three-eighths (⅜) inch wide when not specified. Bituminous type materials shall be used for concrete paving and structural construction where joint sealers are not required.

All joints shall be constructed straight and plumb and shall extend through the entire section from edge to back and to the depths specified.

832.07.01 Expansion Joints

Expansion joint material shall be provided at the following locations and shall be in place prior to placement of concrete:

A. Each end of curb return
B. Between back of sidewalk and driveway slab or service walk
C. Between new concrete and existing masonry buildings
D. As shown on the approved plans
E. As directed by the DPW Director or Designee

Reinforcing steel bars (#4, 18” long minimum) shall be used to tie together new and existing concrete pavements and flatwork. Refer to the Detail Drawings for expansion joints.
Expansion joint filler, which is one-half (½) inch thick, preformed, non-extruding bituminous-treated fiber board conforming to AASHTO Specification M-213, shall be used to form transverse expansion joints. Concrete tie-ins shall have reinforcing steel bars (#4 minimum) extending a minimum of twelve (12) inches into the concrete in each direction. Expansion joints shall be constructed at each tangent point of the curb radius, at each end of valley gutters, at approximately one hundred fifty (150) foot intervals on tangent, or at other points as directed by the DPW Director or Designee. Expansion joints shall be formed at the contact of the new construction with concrete driveways, intersecting sidewalks, or other unyielding structures unless otherwise directed by the Elbert County Inspector/Representative or resident inspector.

832.07.02 Contraction Joints

Transverse joints shall be placed at maximum intervals of ten (10) feet to control random cracking. Joints shall be formed, sawed, or tooled to a minimum depth of one-third (⅓) of the total thickness of the pavement or flatwork (no less than two (2) inches). If divider plates are used, the maximum depth of plates shall not be greater than one-half (½) depth at the finished surface and shall be no less than fifteen-sixteenths (5/16) inch thick. Refer to the Detail Drawings for contraction joint details.

The curb and gutter or sidewalk shall be divided into blocks not less than five (5) feet or more than ten (10) feet long using metal templates not less than one-sixteenth (1/16) inch or more than one-quarter (¼) inch thick. Templates shall be a minimum of four (4) inches deep. Templates shall be designed to attach securely to the forms in such a manner as to prevent movement while the concrete is being placed and consolidated. Templates shall be removed prior to the concrete taking its initial set.

If a curbing machine or other method not requiring the use of templates is approved, dummy joints formed by a jointing tool or other approved means shall be used. Dummy joints shall extend into the concrete for at least one-third (⅓) of the depth (no less than two (2) inches) and shall be approximately one-eighth (⅛) inch wide.

832.07.03 Tooled Joints

Tooled joints shall be spaced as follows:

A. Not more than ten (10) feet or less than five (5) feet apart in curb and gutter, sidewalk, and combination curb-walk
B. Joints in both directions, equally spaced at not greater than ten (10) foot intervals, as applicable in driveways
C. As directed by the DPW Director or Designee
832.08  Ponding

Ponding of water in concrete pavement and flatwork shall not exceed one-eighth (⅛) inch in depth. Where ponding exceeds one-eighth (⅛) inch in depth, pavement or flatwork shall be removed and replaced at the Contractor’s expense.

833.00  Appurtenant Concrete Structures

833.01  Forms

Refer to Section 824.02 Forms and Form Setting of these CONSTRUCTION STANDARDS & SPECIFICATIONS for requirements for appurtenant concrete structures.

833.02  Concrete Placement

Refer to Section 831.00 Placing Concrete of these CONSTRUCTION STANDARDS & SPECIFICATIONS for requirements for appurtenant concrete structures.

833.03  Expansion Joints

Expansion joint filler, which is one-half (½) inch thick, preformed, non-extruding bituminous-treated fiber board conforming to AASHTO Specification M-213, shall be used to form transverse expansion joints. Concrete tie-ins shall have reinforcing steel bars (#4 minimum) extending a minimum of twelve (12) inches into the concrete in each direction.

833.04  Curing

Curing shall comply with Section 838.00 Finishing, Curing and Protection of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

834.00  Cleanup

The exposed surfaces of concrete shall be thoroughly cleaned upon completion of the work.

WITHIN FORTY-EIGHT (48) HOURS AFTER FORMS ARE REMOVED, THE AREA BEHIND THE SIDEWALK OR CURB SHALL BE CLEANED, BACKFILLED AND GRADED TO PROVIDE A SMOOTH EVEN SURFACE.

835.00  Backfill of Concrete Work
When forms are removed and the concrete has gained sufficient strength, the space adjoining the concrete shall be promptly backfilled with suitable material, properly compacted, and brought flush with the surface of the concrete and adjoining ground surface. In embankments, the backfill shall be level with the top of the concrete for at least two (2) feet and then sloped as shown on the approved plans or as directed by the DPW Director or Designee.

**836.00 Protection Against Vandalism**

It shall be the responsibility of the Contractor to protect all concrete work against damage or vandalism. When required, a guard shall be stationed over fresh work until the concrete is sufficiently set to prevent damage at the Contractor’s expense. Concrete damaged in any way by vandals shall be removed and replaced at the Contractor's expense.

Anti-graffiti materials shall be installed as shown on the approved plans or as required by the DPW Director or Designee. Prior to installation, technical information regarding proposed anti-graffiti materials shall be submitted to the DPW Director or Designee for approval.

**837.00 Repairs**

After stripping concrete forms, any concrete found to be inconsistent with the approved plans, is out of alignment, not level, or showing a defective surface shall be removed and replaced at the Contractor’s expense as directed by the DPW Director or Designee. The DPW Director or Designee may give written permission to patch the defective area. Ridges and bulges may be removed by grinding if approved by the DPW Director or Designee. Honeycombed and other defective concrete that does not affect the integrity of the structure may be chipped out and the vacated areas filled if approved by the DPW Director or Designee.

The repaired area shall be patched with a non-shrink, non-metallic grout with a minimum compressive strength of five thousand (5,000) psi in twenty-eight (28) days. All repair areas treated with an epoxy-bonding agent shall have the approval of the Road & Bridge Superintendent / Elbert County Engineer before the repair filling is placed.

**837.01 Flatwork Repairs and Replacement**

All edges of the existing flatwork to remain shall be saw cut. Flatwork repairs and replacement shall be as directed by the DPW Director or Designee and at the Contractor’s expense.

**837.02 Concrete Structure Repairs**

Bolt-holes, tie-rod holes, and minor imperfections as approved by the DPW Director / Elbert County Engineer, shall be filled with dry-patching mortar composed of approximately one (1) part Portland cement to two (2) parts of...
regular concrete sand (volume measurement) and only enough water so that after
the ingredients are mixed thoroughly, the mortar sticks together when molded.
Mortar repairs shall be placed in layers and thoroughly compacted by suitable
tools. Care shall be taken in filling rod and bolt holes so that the entire depth of
the hole is completely filled with compacted mortar.

838.00 Finishing, Curing and Protection

838.01 Finishing

Where applicable, finishing shall be performed with a metal screed designed to
give proper shape to the section as detailed. Particular care shall be used to finish
the gutter flowline to a true uniform grade. Face forms shall be left in place until
the concrete has hardened sufficiently so that they can be removed without injury
to the curb.

The Contractor shall use at all times, a ten (10) foot straightedge for finishing
curb and gutter sections. Irregularities shall be corrected by adding or removing
concrete. All disturbed places shall be floated with a wooden or metal float that is
not less than three (3) feet long and not less than six (6) inches wide, and
screeded. No water or cement shall be added to the surface of the concrete to aid
in finishing. Edges of the concrete and joints shall be carefully finished with an
edger having a one-eighth inch (⅛) inch radius prior to the concrete reaching
initial set. Concrete shall be finally finished with a wood float and lightly
broomed to a slightly roughened surface. On grades less than one (1) percent, the
Contractor shall check for depressions before final finish so that no ponding
exists.

Exposed faces of curbs and sidewalks shall be finished to the line and grade
shown on the plans. Surface shall be floated to a smooth but not slippery finish.
Sidewalk and curb shall be broomed or combed and edged, unless otherwise
indicated by the DPW Director or Designee. After completion of brooming and
before concrete has initial set, all edges in contact with the forms shall be tooled
with an edger having a three-eighths (⅜) inch radius.

No dusting or topping of the surface or sprinkling with water to facilitate finishing
shall be permitted.

Immediately following the removal of forms, all fins and irregular projections
shall be removed from all surfaces except from those which are not to be exposed
or are not to be waterproofed. On all surfaces, the cavities produced by form ties,
honeycomb spots, broken corners or edges, and other defects, shall be thoroughly
cleaned, moistened with water and carefully pointed and trued with a mortar
consisting of cement and fine aggregate. The surface shall be left sound, smooth,
even, and uniform in color. Mortar used in pointing shall not be more than thirty
(30) minutes old. All construction and expansion joints in the completed work
shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

838.02 Curing and Protection

Fresh concrete shall be adequately protected from weather damage and mechanical injury during the curing periods. Curing processes described herein may be used at the option of the DPW Director or Designee. The selected curing process shall be started as soon as it can be performed without injury to the concrete surface. The use of a membrane-curing compound is recommended. The following curing procedures may be used subject to the approval of the DPW Director or Designee:

A. Ponding (for slabs or footings)
B. Spraying
C. Wet burlap, earth, or cotton mats
D. Waterproof paper or polyethylene plastic cover

Membrane curing compound shall not be used when the concrete surface shall be painted. The membrane curing compound shall not permanently discolor the concrete surface. Where membrane curing compound is not used, the curing process shall be as follows:

A. Surfaces being wetted by ponding, spraying, or wetted material shall be kept completely wetted, with an excess of free water on the surface, at all times for the first seventy-two (72) hours. After this period, but for the remaining four (4) days, a wetting schedule shall be followed whereby the concrete is wetted on a schedule approved by the DPW Director or Designee.

B. Surfaces being protected by waterproof paper or polyethylene plastic cover shall receive special attention during the first seventy-two (72) hours to insure there is actually free moisture on the surface of the concrete under the waterproof surface. The DPW Director or Designee may require the removal of the cover and a wetting of the surface when, in his judgment, there is insufficient moisture for curing. After the first seventy-two (72) hours the cover shall be kept tightly in place for the remainder of the curing period.
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HOT BITUMINOUS PAVEMENT (ASPHALT) MIX DESIGN AND CONSTRUCTION

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SECTION 900
HOT BITUMINOUS PAVEMENT (ASPHALT) MIX DESIGN AND CONSTRUCTION

901.00 GENERAL CONDITIONS

Refer to Section 100 TITLE, SCOPE AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

910.00 SCOPE

The intent of this section is to specify materials and methods to be used for the construction, overlaying, seal coating and pavement rejuvenating of streets, parking lots, and other miscellaneous work requiring the use of hot bituminous pavement (asphalt). This section shall cover work associated with aggregate base course, bituminous base and pavements of the plant mix type, bituminous prime coat, bituminous tack coat, rejuvenating applications and asphalt overlays. All workmanship and materials shall comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS and shall conform to the lines, grades, depths, quantities and the typical pavement cross section(s) shown on the approved plans or as directed by the Road & Bridge Superintendent / Elbert County Engineer.

920.00 ASPHALT PAVEMENT MIX DESIGN

921.00 Asphalt Mix Design Properties

All pavement shall be asphalt of the plant hot mix type unless otherwise approved in writing by the DPW Director or designee. Materials and construction shall comply with Section 403 of the CDOT Standard Specifications for Road and Bridge Construction, and have the following requirements:

A. The asphalt cement shall be a Superpave Performance Graded (PG) binder of PG 76-28 or PG 64-22. The asphalt cement content shall be as determined by the mix design. The mix design shall be determined using SHRP (Strategic Highway Research Program) and Colorado Procedure CP-L 5115 for the Superpave Method of Mixture Design. Superpave PG asphalt binders shall comply with Table 702-2 Superpave Performance Graded Binders of the CDOT Standard Specifications for Road and Bridge Construction. The asphalt contractor shall furnish certified test results from an independent asphalt testing laboratory to show compliance of the proposed Superpave PG asphalt binder with the Superpave requirements for that mix.
The gradation of the mineral aggregate shall be grading SG (1½ inch nominal), S (¾ inch nominal), or both SG and S (in varying lifts) for new street construction. In no case shall grading SG be used for a permanent final lift of asphalt; however, the Road & Bridge Superintendent / Elbert County Engineer may require the use of grading SG in a pavement section. **GRADING SX (½ inch NOMINAL) SHALL BE USED FOR THE PERMANENT FINAL LIFT OR OVERLAY OF ALL ASPHALT, UNLESS APPROVED BY THE DPW DIRECTOR OR DESIGNEE.**

The minimum SX lift thickness shall be one and one-half (1½) inches. Aggregate gradation shall be in accordance with Table 703-3 of the CDOT Standard Specifications for Road and Bridge Construction. Streets with a low EDLA \( \leq 40 \) shall contain a minimum of seventy (70) percent aggregate with two mechanically induced fractured faces. Streets with a high EDLA \( \geq 40 \) shall contain a minimum of eighty (80) percent aggregate with two mechanically induced fractured faces.

B. All mixes shall contain a maximum of twenty (20) percent native sands.

C. All mixes shall contain a one (1) percent hydrated lime anti-stripping admixture.

D. A maximum of twenty (20) percent Reclaimed Asphalt Pavement (RAP) shall be allowed in non-polymer and non-rubberized mixes, provided that all the requirements for asphalt pavement are met.

E. The asphalt mix design shall comply with the SUPERPAVE MIX DESIGN PROPERTIES and MINIMUM VOIDS IN THE MINERAL AGGREGATE (VMA) REQUIREMENTS tables that follow. A copy of the mix formula shall be submitted to the DPW Director or designee for review and approval at least seven (7) days prior to starting paving work. In the event that a current job mix formula is not available for the materials proposed for use, the Contractor shall submit a job mix formula prepared by a recognized testing laboratory for review and approval by the DPW Director or designee. A report giving the properties of the materials and certifying their conformance to or deviations from the requirements of the specifications shall accompany the job mix formula.

**NON-SUPERPAVE MIXES MAY BE APPROVED AT THE DISCRETION OF THE DPW DIRECTOR OR DESIGNEE.** Viscosity graded asphalt cements may be permitted at the discretion of the DPW Director or designee and shall adhere to the requirements of AASHTO M226, Table 2.

All asphalt pavement mix designs shall comply with the following properties:

- **This space intentionally left blank** –
### SUPERPAVE MIX DESIGN PROPERTIES

<table>
<thead>
<tr>
<th>Roadway Classification</th>
<th>Residential (Parking Lot)</th>
<th>Minor Collector</th>
<th>Major Collector</th>
<th>Minor Arterial</th>
<th>Principal Arterial</th>
<th>Principal Arterial</th>
<th>Commercial/Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Level</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Traffic Loading (Total 18 kip ESALS over 20 yr design life)</td>
<td>less than 300,000</td>
<td>300,000 to 1,000,000</td>
<td>1,000,000 to 3,000,000</td>
<td>1,000,000 to 3,000,000</td>
<td>3.0 to 10.0 million</td>
<td>&gt;10.0 million</td>
<td>&gt;10.0 million</td>
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<tr>
<td>Design Gyration (Ndesign)</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>75</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<td>Max Gyration</td>
<td>104</td>
<td>117</td>
<td>134</td>
<td>134</td>
<td>152</td>
<td>174</td>
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<tr>
<td>Hveem Stability</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Voids filled with asphalt, %</td>
<td>65-80</td>
<td>65-80</td>
<td>65-80</td>
<td>65-80</td>
<td>65-75</td>
<td>65-75</td>
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</tr>
<tr>
<td>Lottman, Tensile Strength Ratio, %</td>
<td>80 min.</td>
<td>80 min.</td>
<td>80 min.</td>
<td>80 min.</td>
<td>80 min.</td>
<td>80 min.</td>
<td>80 min.</td>
</tr>
<tr>
<td>Lottman, Dry Tensile Strength, Min. psi</td>
<td>30 min.</td>
<td>30 min.</td>
<td>30 min.</td>
<td>30 min.</td>
<td>30 min.</td>
<td>30 min.</td>
<td>30 min.</td>
</tr>
</tbody>
</table>

**NOTES:**
1) Air Void of production mixes to be within one (1) percent of design mix Air Void at optimum Asphalt Content. Air Void determination for Ndesign shall be made from samples compacted at Ndesign. Maximum Theoretical Specific Gravity of mix to be by Colorado Procedure CP-51 for the Superpave Method of Mixture Design.
2) Further investigation or corrective action is required when production stability is below the mix design stability.

### MINIMUM VOIDS IN THE MINERAL AGGREGATE (VMA) REQUIREMENTS

<table>
<thead>
<tr>
<th>Nominal Maximum Size, in (mm)¹</th>
<th>Design Air Voids of Total Mix²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.50%</td>
</tr>
<tr>
<td>1 ½ (37.5)</td>
<td>11.5</td>
</tr>
<tr>
<td>1 (25.0)</td>
<td>12.5</td>
</tr>
<tr>
<td>¾ (19.0)</td>
<td>13.5</td>
</tr>
<tr>
<td>½ (12.5)</td>
<td>14.5</td>
</tr>
<tr>
<td>⅜ (9.5)</td>
<td>15.5</td>
</tr>
</tbody>
</table>

1 The Nominal Maximum size is defined as one size larger than the first sieve to retain more than ten (10) percent.
2 Interpolate specified VMA values for design air voids between those listed.

Determination of the effect of water on the cohesion of the bituminous mixture shall be made in accordance with AASHTO T-283 (Lottman). Retained strength shall be a minimum of eighty (80) percent. The use of a one (1) percent hydrated lime anti-stripping admixture to improve the retained strength characteristics shall be required.
922.00 Asphalt Sampling and Testing

Asphalt pavement and asphalt cement sampling and testing shall be performed at the discretion of the DPW Director or designee at a minimum, a representative asphalt pavement sample shall be taken from the first one thousand (1,000) tons, and all mix properties shall be verified. On major arterials, the percent voids filled with asphalt cement, Hveem stability, and Lottman shall be verified at a minimum of every ten thousand (10,000) tons. All testing necessary to assure conformance of materials and workmanship to the specifications shall be at the Contractor's expense. Asphalt testing shall comply with ASTM D1559. Two (2) copies of all test reports shall be submitted directly to the DPW Director or designee.

At any time during construction and/or the warranty period, the DPW Director or designee may require a Colorado Registered Professional Engineer to certify the quality of materials or construction procedures, at the Contractor's expense. All commercial testing and laboratory work necessary to establish the job mix formula and to ensure conformance of materials and workmanship shall be by recognized methods and as specified in these CONSTRUCTION STANDARDS & SPECIFICATIONS. Two (2) copies of all test reports shall be submitted to the DPW Director or designee.

930.00 ASPHALT PAVEMENT CONSTRUCTION

931.00 Roadway Inspections

Refer to Section 154.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Adequate roadway inspections assure compliance to Elbert County requirements and are the basis for Elbert County’s recommendation that roadway improvements be accepted for maintenance and/or release of the performance guarantee. It is the responsibility of the Contractor to contact the DPW Director or designee a minimum of one (1) full working day (twenty-four [24] hours) in advance of the required inspections. Required roadway inspections shall include:

A. **Utilities and Culverts** – All utility pipes, conduits and culverts have been installed in accordance with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

B. **Curb and Gutter, Sidewalks and Crossspans** – Verify that all concrete improvements have been installed in accordance with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

C. **Structures** – Verify that all structures have been installed in accordance with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.
D. Subgrade/Base Course – Verify that the surface proposed to be built upon meets all requirements including, but not limited to, depth of treatment, type of treatment, moisture content, compaction and an approved proof-roll.

E. Paving and Testing – Verify that mix design and submittals are approved and comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Verify that minimum air and asphalt temperatures adhere to these CONSTRUCTION STANDARDS & SPECIFICATIONS. In the case of wind, cold temperatures or threatening weather, trucks hauling asphalt shall have a “weather-proof” tarp. The beds of trucks hauling asphalt shall be clean, and the asphalt shall be free of debris. Verify that thickness of asphalt pavement, rolling equipment and patterns, and grade of utility castings comply with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

F. Construction Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:

1. Remove and replace areas of failing asphalt. Subgrade failures shall be corrected before placing asphalt. Heating and scarifying and/or grinding and overlaying areas of failing asphalt, in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS, may be required by the DPW Director or designee.

2. Remove and replace areas that have ponding water.

G. Final Acceptance – Refer to Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. General items include:

1. Remove and replace areas of failing asphalt. Subgrade failures shall be corrected before placing asphalt.

2. The final top lift or overlay of asphalt thickness (one and one-half (1½) inches minimum) shall be in accordance with the Pavement Deflection Testing Report or as specified in the contract documents. All areas to receive a final top lift or an overlay of asphalt shall be cleaned and prepared, including, but not limited to:

   a. All lips of gutters, inlets, and crosspans shall have concrete exposed to a depth equal to the thickness of the final top lift or overlay of asphalt.

   b. All joints shall be straight (vertical) and shall have a minimum of one and one-half (1½) inches of elevation difference. This is to ensure that an asphalt mat of consistent thickness is installed from edge of gutter to edge of gutter.

   c. All weeds shall be cut, and debris, mud, and waste materials removed.
d. Before paving, tack coat shall be applied to the area(s) that are to receive a final top lift or overlay of asphalt, including exposed concrete faces and utility castings.

932.00 Delivered Mix Temperature

The asphalt mix discharge temperature from the plant mixer shall be between 320°F and 350°F for PG 76-28 binders and between 290°F and 320°F for PG 64-22 binders. The minimum delivered mix temperature, measured behind the paver screed, shall be 280°F for PG 76-28 binders and 235°F for PG 64-22 binders. The minimum rolling (initial compaction) temperature shall be 185°F.

933.00 Weather Limitations

Asphalt shall be placed only on properly constructed subgrade and interim lifts that are free from water, snow, and ice. The asphalt shall be placed only when weather conditions permit the pavement to be properly placed and finished as determined by the DPW Director or designee Engineer. Asphalt pavement mixtures shall be placed in accordance with the following temperature limitations:

<table>
<thead>
<tr>
<th>Compacted Layer Thickness (Inches)</th>
<th>Minimum Air and Surface Temp. (Degrees F and rising)</th>
<th>Top Layer</th>
<th>Other Layers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½ or less</td>
<td>60</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>&gt;1½ to 3</td>
<td>50</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>3 to 4</td>
<td>--</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>

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

The DPW Director or designee may waive minimum temperature requirements for placing prime coats and layers of asphalt below the top layer of the pavement section.

THE FINAL TOP LIFT OR OVERLAY OF ASPHALT SHALL NOT BE PLACED BETWEEN OCTOBER 1ST AND APRIL 1ST, UNLESS APPROVED BY THE DPW DIRECTOR OR DESIGNEE.

934.00 Construction of Pavement Sections

in no case shall the compacted asphalt layer thickness be greater than SIX (6) inches FOR SG MIXES, FOUR (4) INCHES FOR S MIXES, AND TWO (2) INCHES FOR sX MIXES.

934.01 Base Course Composite Sections
All work shall be observed and tested by the project Soils Engineer or representative and certified by a Colorado Registered Professional Engineer. The standard procedures for base course composite construction include the following:

A. The subgrade shall be prepared and conditioned to comply with all specifications. After passing compaction tests, the subgrade shall be proof-rolled in accordance with Section 361.04 Proof-Roll Observation and Testing of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

B. All failing areas shall be delineated by the project Soils Engineer and shall be reworked and retested until passing.

C. Upon passing all compaction tests and proof-rolls, geotextile fabric shall be installed on the subgrade if required by the approved pavement design.

D. Base course (Aggregate Base/Recycled Concrete) shall be placed on the fabric and prepared and conditioned to meet specifications.

E. After passing all compaction tests, the base course shall be proof-rolled.

F. All failing areas shall be delineated by the project Soils Engineer and shall be reworked and retested until passing.

G. Upon passing all compaction tests and proof-rolls, geotextile fabric shall be installed on the base course, if required by the approved pavement design.

H. In the event the subgrade, base course or any step of this process is subject to rain, snow or other factors after the proof-roll has been performed, the project Soils Engineer shall evaluate the areas proposed to be paved and shall and make a recommendation to Elbert County. Paving shall not commence unless approved by Elbert County.

934.02 Lime Stabilized Composite Sections

Lime stabilization shall comply with Section 361.03 Lime-Treated Subgrade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

934.03 Full Depth Asphalt Sections

Subgrade preparation for full depth asphalt sections approved by the DPW Director or designee’s hall comply with Section 361.00 Subgrade of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

934.04 Herbicide

All subgrade surfaces to be paved shall be treated with an herbicide approved by the DPW Director or designee.
934.05 Prime Coat

If required by the DPW Director or designee, subgrade shall be primed to comply with Section 407 of the CDOT Standard Specifications for Road and Bridge Construction. Bituminous material shall be MC-70 applied at the rate of two-tenths (0.20) to thirty-five one-hundredths (0.35) gallons per square yard.

934.06 Asphalt Compaction

Asphalt compaction shall comply with Section 401.17 of the CDOT Standard Specifications for Road and Bridge Construction.

Asphalt density tests shall be taken every one-hundred fifty (150) linear feet per driving lane, per lift. Pavement test sections may be required by the DPW Director or designee. Densities shall be between ninety-two (92) percent and ninety-six (96) percent of the Rice unit weight as determined by an independent asphalt testing laboratory. Other methods of determining unit weight are subject to approval by the DPW Director or designee.

**DURING THE FINAL OVERLAY OF ASPHALT, ALL VALVE BOXES AND MANHOLES SHALL BE BROUGHT TO STREET GRADE. THEY SHALL BE BROUGHT TO GRADE USING THE INTERNAL SCREW ADJUSTMENT OR ONE DROP-IN PAVING RING. NO JACK-HAMMERING SHALL BE PERMITTED.**

934.07 Tack Coat

Tack coat materials and construction shall comply with Section 407 of the CDOT Standard Specifications for Road and Bridge Construction. Bituminous material shall be SS-1 emulsion, diluted by mixing one (1) gallon of SS-1 emulsion with one gallon of clean water, applied at the rate of five one-hundredths (0.05) to fifteen one-hundredths (0.15) gallons per square yard.

934.08 Seal Coat

Seal coat materials and construction shall comply with Section 409 of the CDOT Standard Specifications for Road and Bridge Construction. The type of bituminous material, cover aggregate, and rates of application shall be as shown on the approved plans.

934.09 Rejuvenating Agent

Rejuvenating agent materials and construction shall comply with Section 407 of the CDOT Standard Specifications for Road and Bridge Construction.
935.00 TRENCH CUTS AND EXPLORATORY POTHOLE/CORE REPAIR

935.01 Trench Cuts

TRENCH CUTS IN STREETS LESS THAN FIVE (5) YEARS OLD SHALL BE ALLOWED AT THE DISCRETION OF THE DPW DIRECTOR OR DESIGNEE

Backfill of utility trenches shall comply with Section 350 TRENCHING, BACKFILLING AND COMPACTING of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Utility trench patches shall be in accordance with the Detail Drawings.

935.02 Exploratory Pothole/Core Repair

POTHOLING AND CORING STREETS LESS THAN FIVE (5) YEARS OLD SHALL BE ALLOWED AT THE DISCRETION OF THE DPW DIRECTOR OR DESIGNEE

All potholes/cores shall be patched with a temporary patch material immediately after drilling is complete if permanent patch material is not available. Within seventy-two (72) hours of drilling, potholes/cores shall be permanently patched, unless otherwise approved by Elbert County. An area to be patched shall be saw cut or jack hammered to make it symmetrical, and all spoils shall be removed. All asphalt edges shall be cleaned, dried and tacked, and all concrete edges shall be doweled and/or jointed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS. If base material is disturbed during potholing/coring, it shall be replaced with CDOT “Class 6” base course material, crusher fines, recycled concrete, or other suitable backfill material approved by the DPW Director or designee. Squeegee is not allowed as backfill material. Replacement material shall be compacted to ninety-five (95) percent of Maximum Standard Proctor Density (ASTM D698 or AASHTO T99) and shall have a moisture content within two (2) percent of the optimum.

Asphalt shall not be patched with concrete and vice versa. The asphalt patch mix shall be an approved Superpave SX (½ inch nominal) mix. Asphalt patch and concrete replacement mixes shall comply with and be placed in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS. Potholes/cores in concrete pavement shall be repaired by completely removing and replacing a portion of concrete up to construction joints and/or expansion joints. No concrete patching shall be allowed. Any colored and/or patterned concrete shall be replaced with the existing concrete color and type.

No jagged or otherwise uneven patches shall be allowed.
936.00 HEATING AND SCARIFYING

Heating and scarifying materials and construction shall comply with Section 405 of the CDOT Standard Specifications for Road and Bridge Construction.

937.00 PAVEMENT DEFLECTION TESTING

Prior to installation of the final asphalt top lift or overlay, the Developer shall furnish the DPW Director or designee with two (2) copies of a Pavement Deflection Testing Report prepared by a Colorado Registered Professional Engineer utilizing non-destructive deflection testing to assess and predict the performance of the pavement.

The Colorado Registered Professional Engineer shall have a past history and knowledge in performing these tests. Qualifications of the Colorado Registered Professional Engineer shall be submitted to the DPW Director or designee for approval before the start of work.

The pavement evaluation shall be performed in accordance with accepted engineering practices. The report shall generally incorporate the following testing and pavement evaluation techniques:

A. Environmental study (frost cycle, drainage, etc.)
B. Pavement surface evaluation
C. Soil borings in areas of high deflection
D. Pavement deflection analysis (Falling Weight Deflectometer, Dynaflex or other method approved by the DPW Director or designee)

The report shall evaluate the existing condition of the base and binder course by performance of deflection tests at a minimum of one hundred (100) foot spacing per traffic lane. The report shall determine the thickness of the final lift of asphalt to ensure that the pavement section shall meet a twenty (20) year or greater pavement life.

PAVEMENT DEFLECTION TESTING AND THE FINAL TOP LIFT OR OVERLAY OF ASPHALT SHALL ONLY BE PERFORMED BETWEEN APRIL 1ST AND OCTOBER 1ST, UNLESS PERMISSION IS GRANTED BY THE DPW DIRECTOR OR DESIGNEE.

If the pavement section is not projected to meet a twenty (20) year or greater pavement life based on the pavement deflection test results, the report shall detail the deficiencies and associated causes and shall recommend remedial measures to develop a twenty (20) year design life. The DPW Director or designee shall evaluate the report and inform the responsible party of the required pavement operations.

The final asphalt top lift or overlay shall have grading SX (½” nominal) asphalt mix, unless otherwise approved by the DPW Director or designee. IN NO CASE SHALL A FINAL TOP LIFT OR OVERLAY OF ASPHALT BE LESS THAN ONE AND
Pavement Deflection Testing is not required for Elbert County Capital Improvement Projects (CIP’s) or street reconstruction, unless otherwise specified in the contract documents.

938.00 GRINDING

Grinding shall consist of "milling", "grinding", or "cold planing" the existing pavement surface to establish a new surface profile and cross section in preparation for a bituminous overlay. After grinding, the surface shall have a grooved or ridged finish that is uniform and resistant to raveling or traffic displacement. This textured surface shall have grooves of one-quarter (¼) inch ± one-eighth (⅛) inch.

Grinding shall consist of milling the existing pavement surface from edge of gutter to edge of gutter to a minimum depth of one and one-half (1½) inches and as required by the Pavement Deflection Testing Report or specified in the contract documents, unless otherwise directed by the DPW Director or designee. Grinding around utility castings shall be to a minimum depth of one and one-half (1½) inches and as required by the Pavement Deflection Testing Report or specified in the contract documents.

The Contractor shall remove the cuttings immediately behind the grind machine by belt loader, end loader, power sweeper and/or by hand. The grinding machine shall be equipped with a pressurized watering system for dust control. Flushing into Elbert County's storm drainage system as a means of cleanup shall not be allowed.

939.00 ACCEPTANCE OF PUBLIC ROADWAYS

Workmanship shall meet all Elbert County CONSTRUCTION STANDARDS & SPECIFICATIONS. This includes thickness, crowns, drainage, areas around manholes and service covers, trench settlement and edges against curb and gutter and drain pans. Acceptance of roadways shall comply with Section 200.00 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Pavement shall not exhibit any distress such as alligator cracking, block cracking, edge cracking, potholes, trench settlement, raveling, heaving, sinking, separation from curb and gutter, patching or ponding at the completion of the warranty period. Ponding of water in asphalt pavement shall not exceed one-eighth (⅛) inch in depth. Where ponding exceeds one-eighth (⅛) inch in depth, pavement shall be removed and replaced at the discretion of the DPW Director or designee.
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### TREES, SHRUBS, ORNAMENTAL GRASSES AND PERENNIALS

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SECTION 1000
LANDSCAPE CONSTRUCTION

1001.00 GENERAL CONDITIONS

LANDSCAPING THAT IS PRIVATELY OWNED AND MAINTAINED BY A HOMEOWNERS ASSOCIATION (HOA) OR OTHER PROPERTY MANAGEMENT ENTITY SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THESE CONSTRUCTION STANDARDS & SPECIFICATIONS. COMPLIANCE TO THESE CONSTRUCTION STANDARDS & SPECIFICATIONS SHALL BE CERTIFIED BY A QUALIFIED THIRD PARTY APPROVED BY ELBERT COUNTY. Construction shall not commence until the construction plans are approved by Elbert County.

Landscape Plans shall be included with all residential subdivisions over 4 lots, commercial subdivisions, PUD’s, and industrial proposals.

Refer to Section 100 TITLE, SCOPE, AND GENERAL CONDITIONS of these CONSTRUCTION STANDARDS & SPECIFICATIONS for additional requirements that apply to all projects within Elbert County.

1010.00 SITE DESIGN AND PREPARATION

Site preparation shall be completed in accordance with Section 300.00 SITE WORK AND EARTHWORK of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

Grades shall not exceed 4:1 (horizontal:vertical) in shrub beds, mulched areas, or turf areas. Landscaping at intersections shall conform to sight line “triangles” that are selected for ten (10) MPH more than the posted speed limit. Grades shall be designed to not drain onto residential lots.

1020.00 TOPSOIL PREPARATION

1021.0 General

The Contractor shall provide all labor, equipment and materials necessary to complete the topsoil preparation for seeding and/or sodding as required by the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

If the area to be developed is undisturbed or infested with bindweed, Canadian thistle, or any other noxious or objectionable weeds, the vegetation shall be controlled by a chemical application of Round-up at a rate recommended on the chemical's label for controlling all existing vegetation. All applicable portions of Section 333.04 Topsoil of these CONSTRUCTION STANDARDS & SPECIFICATIONS shall apply.

1022.00 Materials
1022.01 Organic Materials

Organic material shall be a certified Class I or II compost product, depending upon specific project applications. Lab analysis of the organic material shall be submitted for approval prior to delivery. Organic materials shall contain less than 10 mmhos/cm of soluble salts and shall have a pH in the range of 6.0-8.2 and a 30-35% moisture content. Because of the difference in moisture content of organic materials, certification of material volume may be required.

Organic materials shall be applied at a rate of five (5) cubic yards per one thousand (1,000) square feet.

1022.02 Starter Fertilizer

Complete starter fertilizer shall be a complete starter fertilizer having the chemical analysis of Nitrogen-18, Phosphorous-46, Potash-0. Fertilizer shall be delivered to the site in new, unopened bags bearing the manufacturer's name and the chemical analysis. Fertilizer shall conform to all Colorado Department of Agriculture fertilizer laws.

Starter fertilizer shall be applied at five (5) pounds per one thousand (1000) square feet after fine grading is complete and before sod or seed is planted.

1023.00 Process

The Contractor shall cultivate the area to be sodded/seeded to a depth of six inches (6") to remove weeds and other plants that may interfere with turf establishment. All stones, sticks, and debris larger than two (2) inches in diameter shall be removed. Prior to sodding/seeding, the Contractor shall uniformly apply organic materials and starter fertilizer at the rates specified to a depth of six (6) inches with a disc, rototiller, or other suitable tilling equipment. Organic materials shall be applied when the surface is within two-tenths (0.2) of a foot of final grade. No organic material containing manure shall be stockpiled on the site for more than eight (8) hours before it is incorporated into the soil. After tilling, the areas to be sodded/seeded shall be raked, graded, and rolled to final grade with gently sloping surfaces to adequately drain surface water run-off. The finished surface shall be even and uniform, with no soil clumps or debris larger than two (2) inches in diameter. The prepared soil surface shall be on an even plane with all sidewalks, curbs, or borders for seeded areas and shall be three-fourths (¾) inch below for sodded areas.

IN NO CASE SHALL SLOPES OF SODDED OR SEEDED AREAS EXCEED FOUR (4) HORIZONTAL TO ONE (1) VERTICAL (4:1).

1024.00 Inspections
Required inspections shall include Materials, Soil Preparation and Tree, Shrub and Perennials. The Contractor shall request required inspections at least twenty-four (24) hours in advance.

1024.01 Materials Inspection

Elbert County may inspect all organic materials and fertilizer upon delivery. Unsatisfactory materials shall be removed. Weight tickets for all materials shall be submitted to Elbert County with the square footage to be amended. The Elbert County Inspector/Representative may confirm receipt of the order before materials are placed.

1024.02 Soil Preparation Inspection

Elbert County may inspect the soil preparation for conformance to the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS during or immediately following the completion of each segment of the preparation. Any workmanship deemed by Elbert County to be faulty or not in conformance with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS shall be corrected. Following is the sequence of required inspections:

A. During or after first cultivation
B. After application of specified organic materials
C. During or after second cultivation
D. After final grade is complete

1024.03 Tree, Shrub and Perennial Inspection

Elbert County may inspect plant materials for conformance to the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS. Unsatisfactory plant material shall be rejected. Inspections may be performed onsite for projects with less than twenty (20) plants and at the supplying nursery for projects with twenty (20) or more plants. All warranty replacement of plant materials shall be performed during the spring or early fall, regardless of when the warranty period ends.

1030.00 SEEDING SPECIFICATIONS

1031.00 General

The Contractor shall provide all labor, equipment and materials necessary to furnish and install seed as required by the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS. Prior to installation, seed specs shall be coordinated with and approved by the Elbert County Soil Conservation District.
The mixture or blend of grass to be used, along with the seeding rate, shall be determined by a designated County representative. In this determination the following criteria may be taken into consideration:

A. Location of seeding
B. Intended purpose of the area
C. Irrigation
D. Erosion control
E. Slope of terrain
F. Aesthetics
G. Availability of grass seed
H. Maintenance requirements
I. Compatibility with surrounding areas

1032.00 Materials

1032.01 Topsoil

Refer to Section 1020.00 Topsoil Preparation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1032.02 Starter Fertilizer

Refer to Section 1020.00 Topsoil Preparation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1032.03 Bluegrass Seed

Seed shall be furnished in sealed, unopened, standard containers and labeled in accordance with the USDA Rules and Regulations and the Federal Seed Act. Seed shall be fresh, clean, pure live seed equal in quality to the standards for "Certified Seed" and shall pass the USDA test for germination of eighty-five (85) percent and for purity of ninety (90) percent. Seed shall be free of Poa annua and all noxious or objectionable weed and shall have a maximum weed crop of one-tenth (0.1) percent. Elbert County may require tests of seed verification at the Contractor’s expense. Seed specifications and application rate may vary based on projected land use.

Bluegrass seed shall be applied at the rate of one hundred fifty (150) pounds per acre. The seed mixture shall consist of a blend of four (4) varieties of bluegrass. Seed specifications may vary based on projected land use.

1032.04 Native Seed

Seed shall be furnished in sealed, unopened, standard containers and labeled in accordance with the USDA Rules and Regulations and the Federal Seed Act.
Seed shall be fresh, clean, pure live seed equal in quality to the standards for "Certified Seed". Elbert County may require tests of seed verification at the Contractor’s expense. Seed specifications and application rate may vary based on projected land use.

1032.05 Top Dressing

Hydro-mulch shall be a one hundred (100) percent wood cellulose fiber and shall be applied at a minimum rate of two thousand (2,000) pounds per acre with a three (3) percent tacifier. Hydromulch shall be applied immediately after seed application.

Straw shall be certified weed-free and shall be used on native seeding only. Straw shall be applied over the seeded surface at the minimum rate of two thousand (2,000) pounds per acre and with partial embedment into the soil by a crimper or similar implement. Straw shall be applied immediately after seed application.

1033.00 Seeding Process

1033.01 Bluegrass Seeding

Seed shall be applied using a Brillion seeder or approved equal to drill the seed into the prepared seedbed. The seeder shall be equipped with a satisfactory feeding mechanism, an agitator, double disc furrow openers, depth bands and packer wheels. Seed shall be sown to a depth of one-quarter (¼) inch into the prepared seedbed. Seed drilling shall be performed in two (2) separate applications, crossing the area at right angles to one another to guarantee proper coverage. On sloping land, the final seeding operation shall follow the general contour. Top-dressing shall be applied immediately after seed application.

In areas where seed drilling is not feasible, a broadcast method may be substituted. If a broadcast method is used, the seeding rate shall be doubled, and the area shall be dragged after seeding and top-dressing applied.

ALL SEEDING SHALL OCCUR BETWEEN OCTOBER 1ST AND APRIL 30TH UNLESS APPROVED IN WRITING BY THE DPW DIRECTOR OR DESIGNEE

1033.02 Native Seeding

Seed shall be applied by seed drilling. Seed shall be sown to a depth of one-half (1/2) inch into a prepared seedbed. On sloping land, the seed shall be applied following the general contour. Top-dressing shall be applied immediately after seed application.
In areas where seed drilling is not feasible, a broadcast method may be substituted. If a broadcast method is used, the seeding rate shall be doubled, and the area shall be dragged after seeding and top-dressing applied.

**ALL SEEDING SHALL OCCUR BETWEEN OCTOBER 1ST AND APRIL 30TH UNLESS APPROVED IN WRITING BY THE DPW DIRECTOR OR DESIGNEE.**

1034.00  Intentionally Left Blank

1035.00  Maintenance Procedures for Bluegrass

The Contractor shall guarantee the health of the stand of grass until the entire project has been accepted by end user. Any new grass deemed by Elbert County to be thin, weak, or dead shall be reseeded according to these CONSTRUCTION STANDARDS & SPECIFICATIONS and germinated prior to the beginning of the warranty period.

The Contractor shall erect suitable signs at strategic points notifying the public to keep off the seeded areas until the lawn is well established. Any traffic damage that may occur prior to final acceptance of the work shall be repaired and reseeded at the Contractor's expense.

1035.01  Mowing

During the maintenance period, after a suitable stand of grass has been established, the Contractor shall mow all lawn areas on a routine basis using a mowing height of three inches and one half (3 ½) inches. Frequency of mowing shall be determined by the growth rate of the grass but at no time should the clippings exceed more than 1/3 the total leaf blade.

Only turf-type mowers shall be used for this operation.

1035.02  Additional Fertilizing

At the time of the first mowing, the Contractor shall apply a commercial fertilizer with the chemical analysis of Nitrogen-20, Phosphorous-10, Potash-5, plus two (2) percent iron at the rate of five (5) pounds per one thousand (1,000) square feet. When applied, the fertilizer shall be dry and free-flowing, and care should be taken to prevent burning. Fertilizer containing iron shall be cleaned off from any structures or concrete areas. Any areas disturbed or damaged by the Contractor during fertilizing operations shall be repaired in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS at the Contractor's expense.

1035.03  Watering
The Contractor shall be responsible for watering the seeded area(s) a minimum of two (2) times per day (early-morning and early evening) and for keeping areas moist until the lawn is established. The Developer shall be responsible for the cost of water usage until acceptance by HOA or POA. HOA or POA shall be responsible for the cost of water usage from the time of acceptance going forward. If the subdivision well does not all outside watering of landscaping, developers shall bring the necessary water to the site.

1036.00 Inspections

Inspections shall be completed in accordance with Section 1024.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The Contractor shall notify Elbert County for inspections of seed certification and germination.

1036.01 Inspection of Seed Certifications

Seed certification tags shall be delivered to Elbert County to verify compliance with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1036.02 Germination Inspection

When germination is complete and plants are visible, the Contractor shall notify Elbert County and request a germination inspection for approval in order to begin the warranty period. Any areas determined by Elbert County to be thin, weak or dead shall be replaced. All washouts shall be reseeded immediately after the germination inspection. No partial acceptance shall be made.

1040.00 SODDING SPECIFICATIONS

1041.00 General

The Contractor shall provide all labor, equipment and materials necessary to furnish and install all sod as required by the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS. The use of low water consumptive grasses and native ornamental grasses are encouraged.

1042.00 Materials

1042.01 Topsoil

Topsoil preparation shall be as described in Section 1020.00 Topsoil Preparation of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1042.02 Starter Fertilizer
All fertilizer shall meet the requirements of Section 1020.00 Topsoil Preparation of these CONSTRUCTION STANDARDS & SPECIFICATIONS. A starter fertilizer with a chemical analysis of Nitrogen-12, Phosphorous-12, Potash-4, with four (4) percent iron and eight (8) percent sulfur shall be applied at a rate of five (5) pounds per one thousand (1,000) square feet immediately prior to sodding.

1042.03 Sod

The sod shall consist of a blend of at least three (3) varieties of bluegrass. This blend is to be approved by the Elbert County Inspector/Representative prior to installation. Variety of sod may vary based on projected land use. An approved variety of drought tolerant sod shall be used in passive park and right of way areas to assure low water use. Approved athletic grass blends of grass shall be used in high use park areas and on athletic fields.

Sod shall be strongly rooted and free of noxious weeds, undesirable plants, roots, stones, and other foreign materials that shall be detrimental or shall hinder proper development of the sod. The sod shall be procured from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil. The sod shall be cut from living, thickly matted turf. The sod shall be mowed to a height not to exceed two and one half (2 ½) inches and thoroughly watered before the sod is cut. All sod shall be cut to provide a minimum thickness of three-fourths (3/4) inch of soil adhering to the roots. The Contractor shall furnish written proof of sod variety to Elbert County. Sod shall be tested by the Colorado State University laboratory or a certified laboratory at the Contractor's expense if requested by Elbert County.

1043.00 Sodding Process

1043.01 Care and Handling

Care shall be exercised at all times to retain native soil on the sod roots during transportation, handling and planting. Dumping sod from vehicles shall not be permitted. The sod shall be transported to the site within twenty-four (24) hours from the time it is cut, unless it can be stored to the satisfaction of Elbert County. During delivery and while in stacks, all sod shall be kept moist and protected from exposure to the wind, sun and freezing. All sod delivered to the site shall be installed within 24 hours of delivery. All damaged or dry sod shall be rejected.

1043.02 Transporting Sod On-Site

Sod may be transported on or across the site on pallets by forklift. Damage to the sod bed by vehicles shall be kept to a minimum and shall be regraded before sodding of the area. Damage caused to paving, curbs, fence, plants or other objects during sodding, shall be repaired or replaced by the Contractor at his expense as directed by Elbert County.
1043.03 Sodding

The sod bed shall be lightly watered immediately prior to installing the sod. All sod strips shall be placed tightly against each other, so no open joints are apparent. Joints between ends of strips shall be staggered at least one (1) foot between adjacent rows. At the end of walks and drives, the sod shall have the same finish grade as the abutting surfaces. At curbs, the sod shall have the same finish grade as the top of the curb. Sod placed on slopes equal to four horizontal to one vertical (4:1) shall be staked with wire pins not less than six (6) inches long and spaced not more than thirty (30) inches apart. The pins shall be driven into the ground at an angle against the flow of the water until the top of the stake is just below the top of the soil and root mat. Sod shall be installed at the bottom of the slope and shall progress upward with strips laid transverse to the slopes. Immediately after the sod has been laid, it should be tamped or rolled with approved equipment to eliminate all air pockets and to provide a smooth, even surface. Immediately after rolling or tamping the sod, sufficient water shall be applied to completely saturate the sod. The sod shall be watered as often as required to prevent drying out. In settled areas, the sod shall be removed, settled areas shall be regraded and the sod shall be reinstalled.

1044.00 Clean-up

All debris and surplus materials shall be removed from the site. All disturbed areas shall be restored to original condition or to the required new condition.

1045.00 Maintenance

The proper care and maintenance of the sodded areas shall be the responsibility of the Contractor until the work has been accepted. The maintenance operations shall begin as soon as each portion of the area is sodded. Maintenance shall consist of repair and replacement of eroded areas, watering, mowing (once sod is established), weeding, fertilizing, and re-sodding as necessary to provide an even, consistent stand of grass. All sod replacement required by Elbert County shall be done at the Contractor’s expense.

1045.01 Mowing

During the maintenance period, after a suitable stand of grass has been established, the Contractor shall mow all lawn areas on a routine basis using a mowing height of three and one half (3 ½) inches. Frequency of mowing shall be determined by the growth rate of the grass but at no time should the clippings exceed more than one-third (⅓) the total leaf blade.

Only turf-type mowers shall be used for this operation.
1045.02 Additional Fertilizing

At the time of the first mowing, the Contractor shall apply a commercial fertilizer with the chemical analysis of Nitrogen-20, Phosphorous-10, Potash-10, plus two (2) percent iron and eight (8) percent sulfur at the rate of five (5) pounds per one thousand (1,000) square feet. When applied, the fertilizer shall be dry and free-flowing, and care should be taken to prevent burning. Fertilizer containing iron shall be cleaned off from any structures or concrete areas. Any areas disturbed or damaged by the Contractor during fertilizing operations shall be repaired in accordance with these CONSTRUCTION STANDARDS & SPECIFICATIONS at the Contractor's expense.

1045.03 Watering

The Contractor shall be responsible for watering the seeded area(s) a minimum of two (2) times per day (early-morning and early evening) and for keeping areas moist until the lawn is established. The Developer shall be responsible for the cost of water usage until Construction Acceptance of the project.

1046.00 Inspections

Inspections shall be completed in accordance with Section 1024.00 Inspections of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The Contractor shall notify Elbert County for inspection of sod installation.

When sod installation is complete, the Contractor shall notify Elbert County and request a sod inspection for approval, in order to begin the warranty period. Any areas determined by Elbert County to be thin, weak or dead shall be replaced. No partial acceptance shall be made.

1050.00 LANDSCAPE IRRIGATION SYSTEMS

1051.00 General

All irrigation design plans and specifications shall be submitted to Elbert County in accordance with Section 160.00 PLANS AND SPECIFICATIONS and Section 161.00 Construction Plan Requirements of these CONSTRUCTION STANDARDS & SPECIFICATIONS. The contractor is responsible for proper landscape irrigation system coverage. Landscape irrigation system design shall ensure that only planted areas are irrigated and not paved surfaces. The DPW Director or designee shall review and approve the design plans prior to the commencement of any work.

1051.01 Turn-over Items
Upon installation of an irrigation system, the Contractor shall furnish the end user (HOA, POA, or Metro District) with the following items:

A. (1) Quick Coupler Key RB 55K-1 with Hose Swivel RB SH-1
B. (1) Drain Key
C. (1) Slotted and (1) square nut key
D. (2) Control Clock Keys
E. (1) Valve Box Key
F. (2) Irri-Tools
G. Open End or Box Wrenches, (1) 7/16” and (1) ½”
H. Transceiver Compatible with Controller
I. Battery Charger
J. Extra Battery
K. Belt Clip
L. Laminated 11”x17” as-built drawings for each controller with:
   - Color-coded valves and zones
   - Zone listing that shows the precipitation per valve, type of head per valve, and gallons per valve

1052.00 Materials

1052.01 Water License and Tap Fee

The Developer shall purchase a water license and pay all applicable tap and meter fees prior to connecting into the applicable Metro District water system. The size of the water tap shall be determined and approved by the Elbert County Chief Building Official and/or the DPW Director or designee.

1052.02 Water Tap

All taps into District water mains shall comply with the requirements of Section 440.00 WATER SERVICE LINE CONSTRUCTION of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1052.03 Water Service Line

All taps into District water mains shall comply with the requirements of Section 440.00 Water Service Line Construction of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1052.04 Meter Pit

Meter pits for drains shall be supplied by the Contractor. Meters one and one-half (1 ½) inches and larger shall include a one (1) inch ball stop drain valve on the downstream side of the meter.

1052.05 Water Meter
The water meter shall be provided by the contractor.

1052.06 Electrical Service

All electrical service lines shall be run underground and in electrical PVC conduit with a minimum of eighteen (18) inches cover. All wire shall be copper and shall be properly sized. When the irrigation controller is the only electrical service demand, a twenty (20) amp minimum metered service shall be installed. If a booster pump is required, a sixty (60) Amp (minimum) metered service shall be installed. If the irrigation controller is the only electrical demand, an un-metered flat rate service can be installed. All electrical service lines shall have yellow electrical warning tape in the trench six (6) inches above the conduit pipe. An electrical disconnect shall be mounted on the irrigation controller. Solar powered controllers may be allowed with approval by the Chief Building Official, or DPW Director or designee.

1052.07 Backflow Prevention

All backflow preventers shall be sized in accordance with manufacturer's recommended velocities, but no velocities shall exceed the normal industrial practice of seven and one-half (7 ½) feet per second through the backflow device. The device shall meet the requirements of ASSE Standard 1013; AWWA Standard Code C 506-78; and USC Foundation for Cross Connection Control and Hydraulic Research, latest edition.

Backflow preventers shall be installed in accordance with the applicable sections of the UBC. It shall have either a brass union or a bolted flange connection on both the inlet and discharge side of the device.

It shall be the responsibility of the contractor to have certified tests made of all installed backflow prevention devices.

Backflow preventers for water taps that are two (2) inches and smaller shall be a FEBCO 825-Y or 825 YA Series. Each backflow preventer shall be enclosed in a locked, stainless steel strong box with the following features:

A. Marine grade aluminum alloy construction
B. 100% stainless steel hardware
C. Flush-mounted, locking mechanism for security
D. Full-release locking mechanism for service and repair access
E. Pre-punched viewing ports

The enclosure shall be permanently affixed to the concrete pad with a ⅜” x 6” lag anchor bolt and twenty-four (24) inches of Grade 70 transport chain permanently fixed on the end of the enclosure without a padlock. Backflow preventer
enclosures shall be centered on a concrete pad with a twelve (12) inch mow strip border. The pad shall be a minimum of six (6) inches thick and all piping shall have a PVC sleeve a minimum of one (1) inch larger than pipe size.

Strong boxes shall be sized in accordance with manufacturer’s recommendations, and shall be approved by the Chief Building Official, or DPW Director or designee.

For taps two and one-half (2 ½) inches and larger, the backflow prevention device shall be a FEBCO 860 or FEBCO 880 Series.

1052.08 Booster Pump

The requirement for a booster pump shall be determined by water main static pressure and the design requirements of the irrigation system. When a booster pump is needed, it shall be a Peerless-type P.E., or equal, with magnetic starter and heater and a motor minder to monitor the pump and shut it down if necessary. The starter, heater and motor minder shall be in a vandal resistant watertight enclosure approved by the DPW Director or designee. All pumps shall include a bypass.

1052.09 Pump Enclosures

Pump enclosures shall protect equipment to thirty (30) degrees below zero. Pump house may be cast-in-place or precast concrete. Fabrication drawings shall be submitted to Elbert County for approval prior to delivery. The pump house shall have an exposed aggregate finish; heavy duty aluminum powder coated door and door jamb; non-locking doorknob with latch; and a heavy-duty slide bolt hasp assembly secured with a padlock. The pump house shall enclose all above ground, plumbing, such as piping fittings, backflow preventer, and booster pump; all electrical equipment, such as breaker panels, switches, overhead light and outlets; and irrigation controllers, heater, and ventilation. It shall have a minimum ceiling height of seven (7) feet.

All electrical equipment shall be Square D, Cuttler Hammer, G.E., or equivalent and a waterproof type. All wire shall be copper conductor and installed in conduit. Contractor shall submit detailed drawings of equipment. An alternate pump enclosure may be a pre-manufactured enclosure with all of the aforementioned features with approval by the DPW Director or designee.

1052.10 Controllers

The controller shall be housed in a stainless-steel enclosure. It shall feature a pump start, manual advance switch, lightning protection, manual operating mode, data retrieval, flow sensing and flow control. Each controller shall have a maximum of forty-eight (48) stations, which shall include a minimum of four (4)
spare stations. Controller shall be properly grounded with an eight (8) foot long solid copper grounding rod to achieve a seven (7) ohm or less grounding quality.

1052.11 Master Valves and Zone Valves

Master valves shall be installed at all connection points and shall be a Bermad 910-P Opto-switch Pulse Transmitter or an Elbert County approved master valve with a Data Industrial IR220P flow sensor. All zone valves shall be preceded by a ball valve and shall include a threaded PVC union on the lateral line (upstream) side. The zone valves shall be Rainbird EFB-CP or equivalent for zone valves two (2) inches and smaller. Three (3) inch or larger zone valves shall be Rainbird 300-BPE-PRS-D or equivalent. Zone valves shall be operated with a twenty-four (24) volt solenoid and shall be capable of allowing compressed air to flow through them. Where working pressure exceeds 80 psi, a PRS-D or approved equal regulator shall be required where pop up, drip or bubbler irrigation equipment is installed. All zone valves shall be placed in a Rainbird or approved equivalent valve box. Valve box covers shall be brought to grade using stacked valve boxes. All valve boxes shall contain three (3) inches of three quarter (3/4) inch washed rock covered with filter fabric four (4) inches below valve.

1052.12 Irrigation Heads

Consideration shall be given to water conserving equipment that minimizes spraying wherever practical.

A. Turf Areas: All heads shall have a check valve. In large turf areas, Rainbird or approved equal gear driven heads shall be used. In turf areas wider than fifteen (15) feet, gear driven heads should be used unless overly obstructed. In turf areas narrower than fifteen (15) feet where spray heads are needed, Rainbird or approved equal heads shall be used. Each irrigation head shall have a minimum pop-up height of six (6) inches and shall be installed on a PVC swing joint consisting of three (3) street elbows and one (1) eight (8) inch or longer PVC nipple.

B. Flower Bed Areas: Irrigation for a typical flowerbed design shall consist of a removable grid of Techline spaced at twelve (12) inches and delivering six-tenths (0.6) gallon per hour. Unions shall allow the grid to be totally removed for tilling. Removable sections shall be no larger than eight (8) feet by eight (8) feet. Multiple sections may be connected with unions to achieve coverage. A blow-off, air relief valve and a pressure indicating flag shall be installed in each bed.

C. Shrub Beds: Shrub beds shall be irrigated by a drip system. Drip irrigation systems shall consist of ¾-inch or 1-inch drip line with emitters installed where required. All emitters shall be pressure
compensating. All laterals not in shrub beds shall be PVC pipe. The ends of the drip line shall have a ball valve and no caps. Location of ball valves shall be shown in the Record Documents. Pressure compensating Techline irrigation system may be used if approved by Elbert County. In shrub spacings of 24-inches and greater, the Techline shall be snaked in between plants ensuring three emitters per plant. In shorter spacing, Techline shall be placed on two sides of the plant to ensure proper watering. Techline shall be staked in place under the weed mat and covered with mulch. Techline in ground cover beds shall be staked in a grid to water entire area and covered with mulch. In sloped areas, the maximum length of a bed will be 60 feet with upper and lower supply header control by ball valves to adjust the flow. The Techline will be run perpendicular to the slope. The upper ⅔ of the slope shall be spaced at manufacturer’s recommended spacing; for the lower ⅓ of the slope, increase the spacing by 25%.

D. **Trees:** Tree zones shall include the following sequence of items: ball valve, Rainbird EFB-CP or equivalent electronic control valve, ball valve, Rainbird 5LRC quick coupler or equivalent and Rainbird RWS-BCG or equivalent. In native areas and shrub beds, three (3) Rainbird RWS-BCG or equivalent shall be required per tree. In turf areas, two (2) Rainbird RWS-BCG or equivalent shall be required per tree.

1052.13 **Field Wiring**

All wire shall be buried under and to one side of the irrigation piping. All wire shall be buried with a minimum of eighteen (18) inches cover. All wiring shall be bundled every ten (10) feet.

A. **Lead Wire for Connecting Valve to Controller:** For runs less than seven thousand seven hundred (7,700) feet, the lead wire shall be #14 UF single strand, direct bury, PE jacketed, copper wire. For zones (1-24), the insulation shall be red. For zones (25-48), the insulation shall be yellow. For runs in excess of seven thousand seven hundred (7,700) feet, the lead wire shall be #12 UF.

B. **Common Wire:** All common wire shall be #12 UF single strand, direct bury, PE jacketed, copper wire with white insulation

C. **Master Valve and Flow Sensor Wires:** The Bermad 910-P master valve requires a minimum of four (4) blue, one (1) green, two (2) brown, and one (1) gray #14 AWG wire. As an alternate, the master valve shall require three (3) brown and two (2) gray wires, and the flow sensor shall require two (2) blue and two (2) green #14 AWG wires.

D. **Connectors:** Only Snap-loc water-tight connectors shall be used to make wire connections, including connections in valve boxes.
1052.14 Pipe

All PVC pipe shall be continuously and permanently marked showing the manufacturer's name, the size, and the class of the pipe. All PVC pipe shall conform to the requirements of IPS pressure pipe, ASTM D2241. Pressure pipe greater than six (6) inches shall comply with AWWA C-900. Irrigation main pipe shall be installed with tracer wire and warning tape and shall comply with Section 432.19 Tracer Wire and Warning Tape of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Tracer wire shall be terminated in isolation valve boxes.

The velocity of the water through PVC pipe shall not exceed five (5) feet per second. The velocity of the water through copper pipe shall not exceed nine (9) feet per second. Irrigation system piping shall be as follows:

A. Primary water service line (from water main) shall comply with Section 442.01 Water Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

B. Secondary water service line (from water meter to backflow preventer) shall be either ductile iron or type "K" rigid copper pipe. Copper fittings less than three (3) inches diameter shall be soldered together using lead-free solder. Three (3) inch copper fittings shall be soldered together using silver solder.

C. Irrigation main pipe less than six (6) inch diameter shall be ASTM D2241 Class 200 (SDR 21), an alternate may be approved by the DPW Director or designee. One (1) inch to three (3) inch diameter pipe shall be solvent weld type and shall use ASTM F656 purple primer and ASTM D2564 glue. Four (4) inch diameter pipe shall be intergral bell gasketed.

D. Irrigation main pipe six (6) inch diameter and larger shall be AWWA C900 Class 200 (DR-14), an alternate may be approved by the DPW Director or designee.

E. All gasketed pipe shall be restrained in compliance with Section 433.06 Thrust Blocking, Restrained Joints and Fittings of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

F. The lateral lines shall be Class 200 (SDR 21) PVC pipe, an alternate may be approved by the DPW Director or designee and shall be assembled using the same primer and glue noted in Section 1052.14 c above. No main or lateral line pipe shall be smaller than one (1) inch diameter PVC.

All gasketed pipe shall be restrained by thrust blocks and mechanical joint restraint as required in these CONSTRUCTION STANDARDS & SPECIFICATIONS. Mechanical joint restraint (wedge action, self-actuating, such as Megalugs) shall be used for fittings such as—but not limited to—directional elbows, directional tees, and gate valves. Push-on fittings may be
allowed for bends less than ninety (90) degrees with proper thrust blocks and rebar restraint.

1052.15 Quick Coupler Valves

When there is a looped mainline, quick coupler valves shall be located at various points or where directed by Elbert County. This valve shall be a Rainbird No. 5LRC or equivalent with restrained joints and shall be both vinyl-covered and locking. It shall be installed in a ten (10) inch diameter valve box as manufactured by Rainbird or approved equal.

1052.16 Manual Drain Valves

All main lines shall have a minimum of two manual drain valves, one on either side of the backflow preventer. Drain valves shall be one (1) inch diameter ball stop valves. One drain valve shall be installed inside the meter pit. One drain valve shall be installed on the downstream side of the backflow preventer. Access to the downstream drain valve shall be provided a two (2) inch diameter PVC sleeve with a “Snug Cap” or approved equal. This shall be enclosed in a ten (10) inch diameter valve box manufactured by Rainbird or approved equal. All manual drains shall discharge into a gravel sump containing a minimum of three (3) cubic feet of three-fourths (3/4) inch washed rock. The top surface of the rock shall be covered with filter fabric.

1052.17 Isolation Valves

Isolation valves shall be installed at locations noted on the approved plans and at both sides of a street crossing. Isolation valves two (2) inch diameter and larger shall be Clow or approved equal and shall comply with Section 432.05 Gate Valves and Section 442.10 Valves for Use with Meters of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Valves one and one-half (1 ½) inches diameter or smaller shall be brass gate valves with cross handles and resilient seats. Direction of valve operation shall comply with Section 432.05 Gate Valves of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1052.18 Pressure Reducing Valves

When main line static pressure exceeds one hundred (100) psi, a pressure reducing valve approved by Elbert County shall be installed in an in-ground enclosure and shall comply with these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1052.19 Sleeving
Only irrigation equipment shall be installed in irrigation sleeves. Irrigation wiring and piping installed in separate sleeves under sidewalks, curbs, roadways or similar structures shall be sleeved.

Sleeves shall be PVC IPS pressure pipe, SDR-26 or heavier, and shall be a minimum of one and one-half (1 ½) inches larger inside diameter than the maximum outside diameter (bell) of the pipe to be installed through it. Sleeves shall extend a minimum of twelve (12) inches beyond the edge of the sidewalk, curb, roadway or similar structure. The location of the sleeve shall be permanently marked on the structure that is crossed under.

1052.20 Materials for Use with Reclaimed Water

Materials used in reclaimed water irrigation systems shall comply with reclaimed water standards and shall be purple in color, or if approved, may be clearly marked as reclaimed. Materials covered by this requirement include (but are not limited to) meters, valves, quick couplers, valve box covers, irrigation heads, techline, hosebibs and warning tape. Reclaimed water connection point following the meter pit shall consist of, in consecutive order: (1) isolation valve, (1) ball stop drain and (1) quick coupler.

1053.00 Site Conditions

The Contractor shall coordinate his work with that of other trades to prevent conflicts.

Changes or alterations in the system to meet site conditions shall be subject to Elbert County approval. Contractor shall prepare a set of Record Documents Section 200.00 Acceptance Procedures of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

The Contractor shall be responsible for providing electrical requirements required for the job. The appropriate electrical utility (Xcel Energy or United Power) should be contacted for information on possible electrical sources. All electrical work, except 24 volt, shall require a separate inspection by the Elbert County Building Official.

1054.00 Excavation

All applicable portions of Section 350.00 Trenching, Backfilling and Compacting of these CONSTRUCTION STANDARDS & SPECIFICATIONS, shall apply. When approved by the DPW Director or designee, trench excavation and backfill for irrigation systems in excess of the limits noted in Section 350.00 may be allowed.

1055.00 Process

1055.01 Staking
Contractor shall ensure that all existing utilities are field located. Prior to new construction, locations of proposed irrigation lines, sprinkler heads and system equipment shall be staked. Stakes shall be color coded for materials and maintained throughout the sprinkler installation process.

1055.02 Pump House

When a pump house is used, the secondary water service line shall be extended a minimum of twenty-four (24) inches below grade on the discharge side of the pump house and a minimum of twenty-four (24) inches beyond the pump house slab or footing.

1055.03 Pipe Assembly

The adaptation from copper to PVC shall be made by using a female copper adapter receiving a male PVC adapter.

PVC pipe shall comply with Section 1052.14 Pipe of these CONSTRUCTION STANDARDS & SPECIFICATIONS. All excess glue shall be wiped from the joint with a cloth rag or similar material after assembly. Elbert County shall not allow gluing of pipe unless the temperature is forty (40) degrees and rising for one hour. Install purple insulated tracer wire and purple warning tape along all main line pipe. Install tracer wire and blue warning tape along all potable water pipe. All threaded PVC fittings shall receive a double wrap of Teflon tape prior to assembly.

1055.04 Trenching

All pipes shall be installed along the center of an excavated trench to approved lines and grades. Trenches shall be dug true to the alignments shown on the approved plans. All bends shall be made with fittings. Excavation of the trenches shall be done in a workman-like manner with a flat bottom containing no rocks or other deleterious material that may damage the pipe.

Separate trenches shall be dug for each line. No doubling up of lines in a single trench shall be allowed. Trenches shall be dug deep enough to allow the following cover over the top of the pipe:

<table>
<thead>
<tr>
<th>Main Line Size</th>
<th>Minimum Cover</th>
<th>Maximum Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>1” – 1 ½”</td>
<td>18”</td>
<td>24”</td>
</tr>
<tr>
<td>2” - 3”</td>
<td>24”</td>
<td>36”</td>
</tr>
<tr>
<td>Greater than 3”</td>
<td>36”</td>
<td>48”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lateral Line Size</th>
<th>Minimum Cover</th>
<th>Maximum Cover</th>
</tr>
</thead>
</table>
No trench shall be left open overnight without specific prior approval by Elbert County and without sufficient barricades to protect the public. Barricades shall comply with Section 141.12 Traffic Control, Barricades and Warning Signs of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1055.05 Control Valves

Control valves shall be installed eight (8) inches below the bottom of the valve box lid. Stacked valve boxes shall be used to bring the cover of the valve box to the finished grade. All irrigation boxes should be permanently marked with two (2) inch high numbers or letters as follows: Master Valve (MV), Isolation Valve (GV), Quick Coupler (QC), Grounding Rod (GR), Wire Splice (WS), Manual Drain (MD). Zone valve boxes shall be marked as follows: (Timer A, B, C, etc.–Zone #). For example, markings shall read “(A2)” or “(B19)”.

1055.06 Backfill

Backfill material shall be free of rocks one (1) inch in diameter and larger. Backfill shall comply with Section 354.00 Backfill for Pipelines and Service Lines of these CONSTRUCTION STANDARDS & SPECIFICATIONS. Compaction of soils in landscape areas shall be between eighty (80) and eighty-five (85) percent of the Standard Proctor per ASTM D698.

1055.07 Turn-On and Winterization

The Contractor shall start up the system in the spring and shall perform any necessary service work. In the fall, the Contractor shall shut down and protect the system from freezing.

1056.00 Inspections

A copy of the approved construction plans, these CONSTRUCTION STANDARDS & SPECIFICATIONS, and the project inspection sheets shall be onsite at all times. Any allowable variances from the approved construction plans shall be noted on the project inspection sheets by the Inspector/Representative.

The Contractor shall request the following required inspections twenty-four (24) hours in advance:

<table>
<thead>
<tr>
<th>Lateral Line Size</th>
<th>Minimum Cover</th>
<th>Maximum Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; - 3&quot;</td>
<td>18&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>Gear Driven Rotors</td>
<td>18&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>6&quot; Pop-Up Spray Heads</td>
<td>12&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>12&quot; Pop-Up Spray Heads</td>
<td>18&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>&gt; 3” 6” or 12” Pop-Up Spray Heads</td>
<td>18&quot;</td>
<td>24&quot;</td>
</tr>
</tbody>
</table>
1056.01 Trailer Inspection

Inspector/Representative shall inspect the storage area and equipment and materials trailer before any irrigation system installation begins. The results of the trailer inspection notwithstanding, only approved materials and equipment shall be allowed.

1056.02 Sprinkler Location Staking

Inspector/Representative shall inspect the staked locations of all lines and heads for conformance to the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS. Elbert County reserves the right to move, shift and adjust any of the stakes to better achieve the design intentions. No trenching shall be done until the inspection is complete, and the staked locations approved.

1056.03 Main Line Inspection

Prior to trench backfilling, Inspector/Representative shall inspect the depth of pipe, trust blocking, manual drain valves, sumps, control valves and wiring for conformance to the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1056.04 Pressure Test

The contractor shall pre-test the system prior to requesting an inspection. All main lines shall be pressure tested to one-hundred fifty (150) psi at the low point of the section being tested. The maximum loss shall be five (5) psi in one hour.

All valve boxes shall be opened, and ball valves shall be open and flagged for inspection. Prior to a pressure test, the zone valves shall be wired.

1056.05 Wiring Inspection

When the wiring installation has been completed, Inspector/Representative shall inspect it for conformance with the approved plans and these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1056.06 Coverage Test

1057.00 Turn-On and Winterization

In the Fall, the Contractor shall shut down and protect the system from freezing. The Contractor shall start up the system in the spring and shall perform any necessary
service work. Refer to Section 200 Acceptance Procedures of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1058.00 Acceptance and Warranty

Acceptance and warranty shall comply with the requirements of Section 200 ACCEPTANCE PROCEDURES of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1060.00 PLANTING SPECIFICATIONS

1061.00 General

The scope of work involves furnishing all plants, equipment, materials, labor and supervision necessary for the installation of plant materials as indicated on the approved plans and in these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1062.00 Materials

1062.01 Mulch and Edging

All trees shall be mulched with materials of a fibrous nature, such as shredded wood chips or shavings, which are between two (2) inches and eight (8) inches in length and are placed to a depth of three (3) inches around each tree. In specific cases, when approved by Elbert County, cobble or rock mulch may be substituted for the fibrous mulch. If edging is used, it shall be six (6) inch wide and fourteen (14) minimum gauge painted steel.

1062.02 Staking and Guying

All trees shall be staked and guyed using the following material:

A. **Stakes**: Six (6) feet tall steel tee posts
B. **Wires**: A double strand of number sixteen (16) galvanized wire
C. **Nylon straps**: One and one-half (1 ½) inch wide nylon strap with eyelets at each end.

1062.03 Ornamentals, Perennials, Shrubs and Trees

The Contractor shall furnish and install all plants shown on the approved plans.

All plant materials shall:

A. Be alive, healthy and freshly dug
B. Have a normal, well developed branch and root system
C. Show good annual growth
D. Have plump buds, well fitted for the species

Evergreen foliage shall have a good intense color. Trees shall contain a central dominant leader with evenly spaced branches. Foliage and branches shall be distributed on the upper two-thirds (2/3) of the tree. The trunk shall taper from a solid base to a more slender diameter at the top.

All plant materials shall be free from:

A. Defects or mechanical damage
B. Disfiguring knots
C. Bark abrasions and discolorations
D. Plant diseases and all forms of infestations
E. Wilted leaves
F. Insect eggs and borers

Plants with damage shall be rejected.

Plant tags stating the correct plant name and size shall be securely attached to all plant materials.

Balled roots shall be firmly wrapped with burlap or similar material and bound with rope or wires. Roots shall not be girdling, circling or potbound. Plants with broken root balls shall not be installed. Any plant that is loose in the ball shall not be installed.

All plant materials shall conform to the measurements noted in the plant specifications and on the approved plans. The following are minimum sizes:

A. Deciduous trees – two (2) inch caliper or larger
B. Coniferous Evergreen trees – six (6) feet tall or larger
C. Shrubs – number five (5) container
D. Ornamentals and perennials – number one (1) container
### BALL SIZE – DECIDUOUS TREES

<table>
<thead>
<tr>
<th>Tree Size</th>
<th>Ball Depth Minimum (in.)</th>
<th>Ball Diameter Minimum (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2” - 2-1/2” caliper</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>2-1/2” - 3” caliper</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>3-1/2” - 4” caliper</td>
<td>30</td>
<td>38</td>
</tr>
<tr>
<td>5’ - 6’ height</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>6’ - 8’ height</td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

### BALL SIZE -- CONIFEROUS EVERGREEN TREES**

<table>
<thead>
<tr>
<th>Types 1, 2 and 3</th>
<th>Types 4 and 5</th>
<th>Type 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spreading, semi-spreading, broad spreading, globe and compact upright</td>
<td>Pyramidal, upright</td>
<td>broad Columnar</td>
</tr>
<tr>
<td>Spread (Types 1 and 2) Height (Type 3) (in.)</td>
<td>Minimum diameter ball (in.)</td>
<td>Height/caliper (in.)</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>15</td>
<td>12</td>
<td>18</td>
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<tr>
<td>18</td>
<td>14</td>
<td>24</td>
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<td>24</td>
<td>16</td>
<td>30</td>
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<td>30</td>
<td>18</td>
<td>36</td>
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<td>36</td>
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<tr>
<td>96</td>
<td>52</td>
<td>111.5</td>
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<td>112</td>
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<td>112.5</td>
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<td></td>
<td>113</td>
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<td></td>
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<td>113.5</td>
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<td>114</td>
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<td>115</td>
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<td>117</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
** Notes:
A. Plant sizes and caliper measurements indicate minimum size in the size interval (e.g., “4 ½ in.” caliper indicates 4 ½ - 5 in. caliper interval).
B. Rapid growing varieties may have root balls one size smaller.
C. Check with American Standard for Nursery Stock for exact specifications of each species.)

1062.04 Weed Barrier Fabric

All shrub beds and mulched areas shall have a continuous layer of weed barrier fabric installed under the mulch. It shall be Mirafi 140NSL fabric with 4.3 oz. per square yard, or an approved equal. Bed areas with perennial plants shall not require weed barrier fabric. The fabric should be cut around plant material, and not tucked and folded.

1062.05 Backfill Mixture

**BACKFILL MIXTURE FOR ANNUAL PLANT MATERIALS SHALL BE A MIX OF ONE-THIRD (⅓) ORGANIC MATERIAL MIXED WITH NATIVE MATERIAL. REFER TO SECTION 1022.01 ORGANIC MATERIALS OF THESE CONSTRUCTION STANDARDS & SPECIFICATIONS. BACKFILL MIXTURE FOR TREES AND SHRUBS SHALL BE NATIVE MATERIAL.**

1063.00 Landscaping

Xeriscape or other landscape plans may be permitted with the approval of Elbert County.

1063.01 Street Right-of-Way (R.O.W.)

The following landscape requirements for street R.O.W. and interchanges shall apply:
### Landscape Requirements for Local and Connector Streets

<table>
<thead>
<tr>
<th>Quantity Min&amp;n#230;ums</th>
<th>Arrangement</th>
<th>Ideal Locations</th>
<th>Unacceptable Locations</th>
<th>Purpose</th>
<th>Specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECIDUOUS SHADE TREES</td>
<td>1 TREE/LOT</td>
<td>FORMAL</td>
<td>LANDSCAPE STRIPS</td>
<td>MEDIANS</td>
<td>SHADE/MASSING</td>
</tr>
<tr>
<td>CONIFEROUS EVERGREEN TREES</td>
<td>N/R</td>
<td>N/R</td>
<td>N/R</td>
<td>N/R</td>
<td>N/R</td>
</tr>
<tr>
<td>ORNAMENTAL TREES</td>
<td>1 TREE/LOT</td>
<td>INFORMAL</td>
<td>FRONT YARD</td>
<td>SIGHT TRIANGLES</td>
<td>ACCENT</td>
</tr>
<tr>
<td>DECIDUOUS SHRUBS</td>
<td>N/R</td>
<td>CLUSTERED</td>
<td>FRONT YARD</td>
<td>SIGHT TRIANGLES</td>
<td>MASSING</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INFORMAL</td>
<td></td>
<td>(SHRUBS OVER 2’-0”)</td>
<td></td>
</tr>
<tr>
<td>EVERGREEN SHRUBS</td>
<td>N/R</td>
<td>CLUSTERED</td>
<td>FRONT YARD</td>
<td>SIGHT TRIANGLES</td>
<td>MASSING</td>
</tr>
<tr>
<td></td>
<td></td>
<td>INFORMAL</td>
<td></td>
<td>(SHRUBS OVER 2’-0”)</td>
<td></td>
</tr>
<tr>
<td>PERENNIALS</td>
<td>N/R</td>
<td>N/R</td>
<td>SIGHT TRIANGLES/INTERSECTION, CORNERS, FRONT YARD</td>
<td>ALONG LENGTH OF STREET</td>
<td>ACCENT</td>
</tr>
<tr>
<td>TURFGRASS</td>
<td>FRONT YARD</td>
<td>N/R</td>
<td>LENGTH OF STREET/CORNERS</td>
<td>4:1 OR STEEPER SLOPES</td>
<td>GROUNDCOVER</td>
</tr>
<tr>
<td>MOSS ROCK BOULDERS</td>
<td>N/R</td>
<td>CLUSTERED</td>
<td>SHRUB, PERENNIAL BEDS</td>
<td>LAWN AREAS</td>
<td>ACCENT, SLOPE STABILIZATION</td>
</tr>
<tr>
<td>BERMS</td>
<td>N/R</td>
<td>N/R</td>
<td>ALONG LENGTH OF STREET</td>
<td>SIGHT TRIANGLES</td>
<td>SCREEN, VISUAL INTEREST</td>
</tr>
</tbody>
</table>

*N/R represents not relevant at this location.

### Landscape Requirements for Minor Arterials

<table>
<thead>
<tr>
<th>Quantity Min&amp;n#230;ums</th>
<th>Arrangement</th>
<th>Ideal Locations</th>
<th>Unacceptable Locations</th>
<th>Purpose</th>
<th>Specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECIDUOUS SHADE TREES</td>
<td>1 TREE/60’</td>
<td>FORMAL</td>
<td>LANDSCAPE STRIPS</td>
<td>MEDIANS</td>
<td>SHADE/MASSING</td>
</tr>
<tr>
<td>CONIFEROUS EVERGREEN TREES</td>
<td>1 TREE/90’</td>
<td>INFORMAL, INTERMIXED</td>
<td>LANDSCAPE TRACT</td>
<td>SIGHT TRIANGLES, MEDIANS &amp; WITHIN 55’ OF R.O.W.</td>
<td>ACCENT, SCREEN</td>
</tr>
<tr>
<td>ORNAMENTAL TREES</td>
<td>1 TREE/120’</td>
<td>INFORMAL, INTERMIXED</td>
<td>LANDSCAPE TRACT, MEDIANS &amp; INTERSECTIONS</td>
<td>SIGHT TRIANGLES, WITHIN 55’ OF R.O.W.</td>
<td>ACCENT</td>
</tr>
<tr>
<td>DECIDUOUS SHRUBS</td>
<td>½ OF SHRUB MATERIAL</td>
<td>CLUSTERED, INFORMAL</td>
<td>ALL</td>
<td>SIGHT TRIANGLES (SHRUBS OVER 2’-0”)</td>
<td>MASSING</td>
</tr>
<tr>
<td>EVERGREEN SHRUBS</td>
<td>½ OF SHRUB MATERIAL</td>
<td>CLUSTERED, INFORMAL</td>
<td>FRONT YARD</td>
<td>SIGHT TRIANGLES (SHRUBS OVER 2’-0”)</td>
<td>MASSING</td>
</tr>
</tbody>
</table>
### Landscape Requirements for Minor Arterials (continued)

<table>
<thead>
<tr>
<th>Quantity Minimums</th>
<th>Arrangement</th>
<th>Ideal Locations</th>
<th>Unacceptable Locations</th>
<th>Purpose</th>
<th>Specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PERENNIALS</strong></td>
<td>N/R</td>
<td>N/R</td>
<td>SIGHT TRIANGLES/INTERSECTION, CORNERS</td>
<td>ALONG LENGTH OF STREET, MEDIANS</td>
<td>ACCENT</td>
</tr>
<tr>
<td><strong>TURFGRASS</strong></td>
<td>FRONT YARD</td>
<td>N/R</td>
<td>LENGTH OF STREET/CORNERS</td>
<td>4:1 OR STEEPER SLOPES</td>
<td>GROUNDCOVER</td>
</tr>
<tr>
<td><strong>MOSS ROCK BOULDERS</strong></td>
<td>N/R</td>
<td>CLUSTERED</td>
<td>SHRUB, PERENNIAL BEDS, MEDIANS, STEEP SLOPES</td>
<td>LAWN AREAS</td>
<td>ACCENT, SLOPE STABILIZATION</td>
</tr>
<tr>
<td><strong>BERMS</strong></td>
<td>N/R</td>
<td>N/R</td>
<td>ALONG LENGTH OF STREET</td>
<td>SIGHT TRIANGLES</td>
<td>SCREEN, VISUAL INTEREST</td>
</tr>
</tbody>
</table>

*N/R represents not relevant at this location.

### Landscape Requirements for Major Arterials

<table>
<thead>
<tr>
<th>Quantity Minimums</th>
<th>Arrangement</th>
<th>Ideal Locations</th>
<th>Unacceptable Locations</th>
<th>Purpose</th>
<th>Specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DECIDUOUS SHADE TREES</strong></td>
<td>1 TREE/50’</td>
<td>FORMAL</td>
<td>LANDSCAPE STRIPS</td>
<td>MEDIANS</td>
<td>SHADE, MASSING</td>
</tr>
<tr>
<td><strong>CONIFEROUS EVERGREEN TREES</strong></td>
<td>1 TREE/100’</td>
<td>INFORMAL, INTERMIXED</td>
<td>LANDSCAPE TRACT</td>
<td>SIGHT TRIANGLES, MEDIANS &amp; WITHIN 65’ OF R.O.W.</td>
<td>ACCENT, SCREEN</td>
</tr>
<tr>
<td><strong>ORNAMENTAL TREES</strong></td>
<td>1 TREE/60’</td>
<td>INFORMAL, INTERMIXED</td>
<td>LANDSCAPE TRACT, MEDIANS &amp; INTERSECTIONS</td>
<td>SIGHT TRIANGLES, WITHIN 65’ OF R.O.W.</td>
<td>ACCENT</td>
</tr>
<tr>
<td><strong>DECIDUOUS SHRUBS</strong></td>
<td>½ OF SHRUB MATERIAL</td>
<td>CLUSTERED, INFORMAL</td>
<td>ALL</td>
<td>SIGHT TRIANGLES (SHRUBS OVER 2'-0&quot;)</td>
<td>MASSING</td>
</tr>
<tr>
<td><strong>EVERGREEN SHRUBS</strong></td>
<td>½ OF SHRUB MATERIAL</td>
<td>CLUSTERED, INFORMAL</td>
<td>ALL</td>
<td>SIGHT TRIANGLES (SHRUBS OVER 2'-0&quot;)</td>
<td>MASSING</td>
</tr>
<tr>
<td><strong>PERENNIALS</strong></td>
<td>N/R</td>
<td>N/R</td>
<td>SIGHT TRIANGLES, INTERSECTION CORNERS</td>
<td>ALONG LENGTH OF STREET</td>
<td>ACCENT</td>
</tr>
<tr>
<td><strong>TURFGRASS</strong></td>
<td>N/R</td>
<td>N/R</td>
<td>LENGTH OF STREET, CORNERS</td>
<td>4:1 OR STEEPER SLOPES</td>
<td>GROUNDCOVER</td>
</tr>
<tr>
<td><strong>MOSS ROCK BOULDERS</strong></td>
<td>N/R</td>
<td>CLUSTERED</td>
<td>SHRUB, PERENNIAL BEDS, MEDIANS, STEEP SLOPES</td>
<td>LAWN AREAS</td>
<td>ACCENT, SLOPE STABILIZATION</td>
</tr>
<tr>
<td><strong>BERMS</strong></td>
<td>N/R</td>
<td>N/R</td>
<td>ALONG LENGTH OF STREET</td>
<td>SIGHT TRIANGLES</td>
<td>SCREEN, VISUAL INTEREST</td>
</tr>
<tr>
<td><strong>SITE FURNITURE</strong></td>
<td>1 BENCH/300’</td>
<td>DISPERSED</td>
<td>ALONG LENGTH OF STREET</td>
<td>SIGHT TRIANGLES, MEDIANS</td>
<td>PEDESTRIAN USE</td>
</tr>
</tbody>
</table>

*N/R represents not relevant at this location.*
1063.02  Mow Strip

Concrete or crushed rock mow strips shall be constructed around all grouted rock areas and utilities, including fire hydrants, phone boxes, cable boxes, light fixtures and traffic controller boxes.

Mow strips shall be placed along ballfield fencing and in site specific fenced areas in Open Space. They shall be six inches (6") thick and eighteen inches (18") wide, and fencing shall be centered over the mow strip.

All materials and locations shall be determined and approved by Elbert County.

1063.03  Ditch Banks

All ditch banks, inlets or outlets lined with rock or cobblestone shall be grouted and contained by a mow strip. Materials and locations shall be determined and approved by Elbert County.

1063.04  Annual Flower Beds

Annual flower beds shall be designed for high visibility areas in parks or traffic medians. They shall have separate irrigation system specific for beds. The beds shall have six (6) inches of native soil removed and replaced with five (5) inches of approved topsoil. Elbert County may amend with organic materials at the time of planting.

1064.00  Planting

1064.01  Location Staking

The Contractor shall stake the proposed locations of all trees and shrubs on-site for approval by Elbert County prior to planting. Elbert County reserves the right to move, shift or adjust any or all of the stakes to better achieve the planting design intentions as shown on the approved drawings.

The Contractor shall arrange to have the locations of all utility lines (including but not limited to water, sewer, gas, electrical, phone and irrigation) marked prior to the inspection.

1064.02  Seasons of Planting

Planting may occur whenever the soil conditions are favorable or as authorized by Elbert County. All conifers planted in Candle growth stage shall be hand foliage watered by the Contractor for a period of one (1) week after planting.
1064.03 Planting Procedures

The size of tree pits shall be two (2) times the diameter of the root ball and deep enough so that the tree’s root flair remains two (2) inches higher than finished grade after settling has occurred. The sides of the tree pit shall taper inward to the bottom of the hole.

The size of shrub pits shall be twelve (12) inches in diameter greater than the container diameter and as deep as necessary to properly set the plant.

All plants shall be set plumb and in the center of the pit. The root ball shall be set on compacted backfill mix.

Balled and burlapped trees shall be set with backfill mixture. Backfill mixture shall be thoroughly blended prior to placement in the pit or planter bed. After placing the backfill mixture around the root ball, thoroughly water the plant to remove all voids.

**REMOVE ALL ROPES OR WIRES FROM THE BASES OF TREES AND SHRUBS. REMOVE WIRE BASKETS FROM ROOT BALLS BEFORE TREES AND SHRUBS ARE BACKFITTED. REMOVE CONTAINERS (INCLUDING ORGANIC MANUFACTURED BASKETS) FROM CONTAINER-GROWN PLANT MATERIALS PRIOR TO PLANTING.**

Plant materials stored on site shall be watered daily. Plant materials stored on site for more than forth-eight (48) hours shall be healed in with mulch.

Compaction of soils in landscape areas shall be between eighty (80) and eighty-five (85) percent of the Standard Proctor per ASTM D698.

1064.04 Pruning

After installation, broken and dead branches shall be removed. All pruning shall be performed with clean, sharp, sterile tools.

1064.05 Tree Wrapping

After installation, all deciduous trees shall be wrapped from November 1st until April 1st of the following year. The trunks of all trees shall be wrapped spirally from bottom to top, overlapping the seams and entirely covering the trunk from the ground up to the second branch. The tree wrap shall be neat, snug and secured with vinyl electric or duct tape at twenty-four (24) inch intervals or tape approved by Elbert County. Only approved four (4) inch wide tree wrap shall be used.

1064.06 Staking and Guying
Immediately after installation, all deciduous and coniferous evergreen trees shall be staked and guyed. Staking and guying shall be done with six (6) foot tall steel tee posts. Three (3) stakes in a triangle formation shall be used for coniferous trees. Two (2) stakes shall be used for deciduous trees up to three (3) inches in diameter, and three (3) stakes shall be used for trees larger than three (3) inches in diameter. Stakes shall be placed in undisturbed ground within the tree mulch ring. The tree shall be guyed using a one and one-half (1 ½) inch wide nylon strap with eyelets in each end. A double strand of galvanized wire shall be used to connect the nylon strap to the steel tee post. Proper tension on the guy wires shall be obtained by twisting the double strands of wire. Large trees may require additional tree posts and guys. Materials shall comply with Section 1062.02 Staking and Guying of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1064.07 Fertilizing

Trees and shrubs shall not be fertilized for the first twelve (12) months after installation.

1064.08 Mulching

After installation of all plant material, the Contractor shall construct a three (3) inch high earth berm built around the tree to form a saucer. The diameter of the saucer shall be twice the diameter for deciduous trees root ball and at the drip line for coniferous evergreen trees. Mulch shall be placed in the saucer to the depth of the berm and taper to the plant crown. A small gap shall be left between the tree trunk and the mulch. Mulch shall comply with Section 1062.01 Mulch of these CONSTRUCTION STANDARDS & SPECIFICATIONS.

1064.09 Shrub Beds and Mulched Areas

In areas where plants are grouped into beds, or in areas where gravel, rock or wood mulch is to be used as a ground cover, the entire bed shall be excavated to a depth of three (3) inches, a layer of weed barrier fabric shall be installed, and three (3) inches of suitable ground cover, such as wood mulch or rock, shall be placed over it. All seams in the fabric shall overlap a minimum of twelve (12) inches.

1064.10 Clean-Up

The project site shall be kept clean. Rope, wire, burlap, empty containers, rocks, clods and other debris shall be allowed to accumulate on the site. Soil excavated from plant pits and planter beds and debris shall be removed from the site. Upon completion of the planting, all excess soils, rocks and debris, which have not previously been cleaned up, shall be removed from the site or disposed of.
1064.11 Transportation of Plant Materials

All plant material shall be covered with shade cloth tarps or enclosed, so the plant material is protected from the wind and sun during transportation.

1065.00 Maintenance

The Contractor shall be responsible for all maintenance following installation of all plant material and shall continue maintenance procedures until the project has been accepted by the end user. Maintenance shall include hand watering, weeding, spraying, cultivating, trimming, mulching, wrapping, tightening and repairing of guy wires, removal and replacement of all dead materials, and resetting plants to proper grades and upright positions as required. Planting stock, replaced under warranty, shall be warranted for an additional year.

1070.00 RECREATION EQUIPMENT

1071.00 General

Selection of recreation equipment shall be approved by the DPW Director or designee prior to purchase by the Contractor. In selecting equipment, the brand, style, color, size and other criteria shall be considered and jointly selected by the Contractor and Elbert County. All installations of equipment shall be done by the Contractor.

1072.0 Ballfield Specifications

Adequate drainage shall be taken into account in ballfield designs. Infield slopes shall be between one and one-half (1 ½) percent and two (2) percent. Infield shall be designed so that drainage falls away from infield surface. Outfield slopes shall be
between one and one-half (1 ½) percent and two and one-half (2 ½) percent. Outfield shall be designed so that drainage falls away from infield surface.

1072.01 Softball Infield

Infields shall be cut on a seventy (70) foot arc from the back center of the pitching plate. Home plate shall be twenty-five (25) feet from the backstop, and the foul line shall be twenty-five (25) feet from wing fences. The pitching plate shall be located fifty (50) feet from the back point of home plate. Up to three (3) sets of base receptacles shall be provided to accommodate play of different age groups. Infields shall include at least (3) irrigation heads designated to water the infield surface.

1072.02 Baseball Infield

Infields shall be cut on a ninety-five (95) foot arc from the back center of the pitching plate. Home plate shall be thirty-five (35) feet from the backstop with foul lines thirty-five (35) feet from wing fences. The pitching plate shall be located sixty (60) feet six (6) inches from the back point of home plate. Up to three (3) sets of base receptacles shall be provided to accommodate play of different age groups. Infields shall include at least (3) irrigation heads designated to water the infield surface.

1072.03 Field Composition

The infield area shall be excavated eight (8) inches below grade and eight (8) inches of suitable infield mixture, consisting of a computer blended ninety (90) percent sand and ten (10) percent silt/clay, shall be installed, leveled, and compacted to a firm, smooth surface. All mixtures shall be approved by Elbert County prior to installation.

1072.04 Field Drainage

All areas outside of ballfield fencing such as concrete bleacher pads, walks and landscaping shall be graded to drain away from the field surface.

1072.05 Fencing

A. Fabric:
   1. All chain link fabric shall be six (6) gauge, knuckled selvage top; barbed or knuckled selvage bottom; two and one-half (2 ½) inch mesh.

B. Posts and rails:
   1. Backstop support posts shall be 4” minimum 7.29 lbs. per foot of pipe.
2. Terminal and gate posts shall be 2-7/8” O.D. minimum 4.64 lbs. per foot of pipe.
3. Line posts shall be 2-3/8” O.D. minimum 3.117 lbs. per foot of pipe.
4. Top rail and horizontal bracing shall be 1-5/8” O.D. minimum 1.836 lbs. per foot of pipe.

C. Fittings and Hardware:
1. Top rail caps, rail end caps, brace bands, tension bands etc. shall be pressed steel or cast steel; all commercial quality.
2. Nuts and bolts shall be commercial fencing quality.
3. All top rail caps shall be rounded top with no points or extrusions.

D. Wire and ties:
1. Post and rail tie wires shall be #12 ½ gauge steel.
2. Tension wire shall be #7 gauge steel wire.
3. Tension bar shall be 3/16” X ¾” steel.

E. Dimensions:
1. Backstops shall be twenty (20) feet high, twenty (20) feet across the back with ten (10) feet wings. Baseball backstops shall include a hood. The hood on baseball backstops can be nine (9) gauge fabric.
2. Wing fences and dugout faces shall be ten (10) feet high from the backstop to a point one hundred (100) feet out online.
3. Wing fences, from the ten (10) feet high section to the home run fence (if applicable) shall be four (4) high.
4. Dugout sides and backs shall be six (6) feet high.
5. Home run fences shall be eight (8) feet high.
6. All posts – terminal, line, and backstop posts shall be spaced ten (10) feet apart or less, with even spacing; except for dugouts.

1072.06 Dugout Covers

All dugouts shall be covered with a wood framed metal roofed structure to be approved by the DPW Director or designee prior to installation.

1073.00 Playground Equipment

1073.01 Proposal Submittals

The manufacturer’s representative shall provide the following items and information to Elbert County with each playground proposal:

A. Complete three-dimensional drawings of equipment.
B. Individual components specifications and schematic drawings of the play system.

C. A minimum of three (3) references for similar work recently completed. Each reference shall include a brief summary of work completed, location, and the owner’s representative name and phone number.

D. A schedule of work that includes the time it shall take to order and receive the playground equipment and the time it shall take to install once the play equipment is delivered.

E. The name and qualifications of the installer of playground equipment.

F. A letter from the manufacturer stating that the playground equipment shall meet or exceed the latest Consumer Product Safety Commission Guidelines and ASTM F1487. Letters from the manufacturers shall reference the model number or drawing numbers of each unit.

G. Copies of warranty information for playground equipment to Elbert County. Warranties shall include minimum: ten (10) years on posts and decks; five (5) years on plastic; ten (10) years on clamps, and one (1) year on all other parts.

1073.02 Safety and ADA Requirements

All playground equipment shall meet or exceed the latest CPSC Handbook for Public Playground Safety Guidelines. All play equipment and the protective ground space area around the equipment shall meet or exceed ASTM F1487 Standard Consumer Safety Performance Specifications for Playground Equipment for public use.

All playground equipment shall comply with the current ADA law using ASTM F1487. This can be accomplished either by a safety surface or a ramp system as determined by Elbert County. The safety surface shall be an ADA approved surface (poured in place) for accessing the transfer point.

1073.03 Protective Ground Space Area

The play system layout for each site shall include a safety surface area surrounded by a protective barrier. The safety surface material shall be selected by Elbert County. The safety surface area shall be installed to a depth of twelve (12) inches to eighteen (18) inches depending upon the components. A sub-surface drainage system shall be installed under each protective surface area and shall be separated from the finish surfacing by a layer of landscape fabric. The design of the drainage system shall be approved by Elbert County.

The composition of the barrier for protective ground space area shall be approved by Elbert County.
1073.04 Component Requirements

The following requirements for equipment components apply:

A. Slides shall be double walled except for tube slides.
B. All barrier handrail separation bars shall be less than three and one-half (3 ½) inch apart.
C. Upper body climbers shall have end step ladders excluding overhead flyers.
D. Components of the play system(s) for specific sites shall be approved by Elbert County. Each playground system shall include and not be limited to roofs, climbers, slides, bridges, ladders, arches, overheads, play panels, transfer points, decks, barriers, guard rails, protective barriers and swings.
E. Playground decks shall be a minimum of forty-seven (47) inch square. The maximum opening of holes in the deck surface shall be one-quarter (¼) inch.
F. Component colors shall be approved by Elbert County.

1073.05 Materials

A. Playground equipment components shall comply with the following material requirements:
B. Wooden structures shall not be allowed.
C. All decking and steps shall be PVC coated.
D. Metal slides shall not be allowed.
E. Support posts to be five (5) inch OD steel with corrosion protection and finished in powder coat with metal caps.
F. Playground decks shall be metal with PVC coating.
G. Deck to deck riser enclosures shall be metal.
H. Swing support framework shall be five (5) inch OD steel with corrosion protection and finished in powder coat with metal caps.

1073.06 Installation and Inspection

A factory representative shall supervise the unloading of all materials shipped to the individual job sites. A company representative shall conduct a post-installation inspection to certify the proper installation of playground equipment.

1080.00 WALKWAYS, MAINTENANCE PATHS AND SOFT TRAILS

1081.00 Concrete Walkways and Maintenance Paths
All walkways and maintenance paths within the parks, open land areas, or greenbelts, shall be a minimum of six (6) feet wide, and shall be constructed with a minimum of four (4) inch thick concrete. The concrete shall comply with Section 800.00 CONCRETE MIX DESIGN AND CONSTRUCTION of these CONSTRUCTION STANDARDS & SPECIFICATIONS. WALKWAYS, PATHS, OR TRAILS SHALL BE MAINTAINED BY THE GOVERNING METRO DISTRICT OR HOA.

1082.00 Soft Trails

Trails shall generally be constructed with slope less than 12.5:1 (horizontal:vertical). Short sections of trail may be constructed up to a maximum slope of 7:1, if approved by Elbert County.

1082.01 Soft Trail Subgrade

The subgrade for soft trails shall consist of twelve (12) inches of moisture density treated native material compacted to ninety-five (95) percent relative density as determined by AASHTO T-99. Moisture density tests shall be performed at two-hundred and fifty (250) foot intervals to demonstrate proper sub-grade preparation.

1082.02 Trails With Slope Less Than 12.5:1 (Horizontal:Vertical)

Soft trails with a slope of less than 12.5:1 (horizontal:vertical) shall be constructed with six (6) inches minimum of Soft Trail Aggregate. Aggregate material shall be compacted in place to ninety-five (95) minimum of the maximum standard Proctor dry density as defined in ASTM D698.

1082.03 Trails With Slope Equal To Or Greater Than 12.5:1 (Horizontal:Vertical)

Soft trails with a slope equal to or greater than 5:1 (horizontal:vertical) shall be constructed with three (3) to five (5) inches of Soft Trail Aggregate stabilized with a binder material. The depth of the aggregate will depend on the binder material proposed. Aggregate and binder material shall be compacted in place to ninety-five (95) minimum of the maximum standard modified Proctor dry density as defined in ASTM D698.

Soft trails with a slope equal to or greater than 10:1 (horizontal:vertical) shall have cross timbers installed at twenty (20) foot intervals along the trail alignment.

A. Binder Material: The binder material shall be approved by Elbert County prior to trail construction.

B. Cross Timbers: Eight (8) inch by eight (8) inch pressure treated timbers. Timbers shall be installed at fifteen (15) degrees from perpendicular to the trail centerline. The top of the timbers shall
be at the same level as the trail surface and the bottom of the timbers shall be keyed into the treated sub-grade. Each timber shall be anchored in place with three (3) – two (2) foot long #4 steel reinforcing bars (rebar). No part of the rebar shall protrude above the top of the timber.

1082.04 Cross Slope

Soft trails shall be constructed with a uniform two (2) percent slope from the high side of the trail to the low side. No crown shall be constructed. The intent of the cross grade is to provide sheet drainage of water across the trail and not along the trail.

1082.05 Soft Trail Aggregate

Soft trail aggregate shall be three-eighths (⅜) inch minus decomposed granite or crushed material approximating the following gradation:

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Range of % Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>70-100</td>
</tr>
<tr>
<td>No. 8</td>
<td>50-75</td>
</tr>
<tr>
<td>No. 16</td>
<td>30-65</td>
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<tr>
<td>No. 30</td>
<td>20-45</td>
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<tr>
<td>No. 50</td>
<td>10-30</td>
</tr>
<tr>
<td>No. 100</td>
<td>2-20</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-15</td>
</tr>
</tbody>
</table>

Submit the specific gradation proposed for the soft trail construction. Include binder details when aggregate is intended for soft trails with a slope equal to or greater than 12.5:1 (horizontal:vertical).

Soft trail aggregate material color shall be grey unless otherwise specified.

1083.00 Underpass Lighting

Lighting for pedestrian underpasses and similar applications shall be a Fail-Safe VR 2000 DW, DC 6½” Decorative Series fixture from Cooper Lighting, or equal approved by Elbert County.

1084.00 Site Furnishings

Submittals for site furnishings such as benches, picnic tables, trash cans, dog waste stations, etc. shall be submitted to Elbert County for approval prior to installation.
1090.00   TREES, SHRUBS, ORNAMENTAL GRASSES AND PERENNIALS

Acceptable trees, shrubs, ornamental grasses and perennials for landscaping in Elbert County are included in the following lists. Other plant materials may be submitted for review and approval by Elbert County. Preference shall be given to drought resistant species.
SECTION 1100
ACCESS REQUIREMENTS AND CRITERIA

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1101.00 GENERAL

Access to County roadways is approved through one of two mechanisms:

For new developments, access is granted through BOCC approval of the final plat.

To obtain access from existing developed property to County roads, the mechanism is dependent on the zoning:

A. For Planned Unit Developments, new or altered access must be obtained through the Land Use Department. This involves applying through the Community Development Services Department to amend the property final PUD plan. The application should be accompanied by appropriate plans for the proposed access and technical justification, including justification for the extent of improvements proposed at the access point.

B. For straight zoned property, application for access can be made using the Road and Bridge Department Submittal Form. This application should be accompanied by plans of the proposed access and technical justification for the access and associated public improvements.

The Road and Bridge Department staff is available to provide advice on the extent of technical justification required for any access request. It is recommended that this advice be sought prior to submitting any application.

1120.00 CRITERIA FOR ACCESS ONTO ELBERT COUNTY ROADWAYS

1121.00 State Highways

Access to State Highways is governed by the Colorado Department of Transportation, (CDOT), State Highway Access Code.

1122.00 Freeways

All new freeway access in Elbert County shall meet the requirements of the Colorado Department of Transportation CDOT.

1123.00 Arterials

An Access Permit must be obtained from the County for any private access constructed to a minor arterial.
1123.01 Minor Arterial

Generally, no private direct access shall be allowed onto a minor arterial. Private direct access onto a minor arterial may be permitted if it:

A. Does not have the potential for signalization as per the requirements of these Standards and Specifications.

B. Does have the potential for signalization, if it meets the signal spacing requirements for intersecting public streets stated below and does not interfere with the location, planning, and operation of the general street system and access to nearby properties.

Public direct access to a minor arterial, where left turns are to be permitted, must meet the signal spacing criteria following. Those that do not meet these requirements shall be limited to right turns only, unless they meet the requirements of these Standards and Specifications.

1123.02 Spacing and Signalization Criteria:

A. In general terms, full access to minor arterials shall be limited to one-quarter mile intervals, plus or minus approximately 100 feet, in order to achieve good speed, capacity, and optional signal progression.

B. However, to provide flexibility for both existing and future conditions, an approved engineering analysis of signal progression shall be made to properly locate any proposed access that may require signalization. The specifics of this analysis are detailed in the "Guidelines for Traffic Studies".

1123.03 Collectors

Private access to collectors shall be governed by the curb opening and driveway criteria following. Single family residence access to collectors is not permitted unless access to a lower function category street is not available.

Public streets shall intersect minor collectors not closer than 330 feet from each other (centerline to centerline) and shall intersect major collectors not closer than 660 feet from each other (centerline to centerline). On collectors with an ultimate projected traffic volume of less than 2500 V.P.D., intersection spacing may be 250 feet (centerline to centerline).

1123.04 Local Streets

Private access to local streets shall be governed by the curb opening and driveway criteria following.
Public streets should not intersect local roadways closer than 150 feet from each other (centerline to centerline). On a local street, the closest intersection to a collector street shall be at least 200 feet (centerline to centerline), and to an arterial street, the closest intersection shall be 200 feet (arterial right-of-way line to local street centerline).

1130.00 BASIC PRINCIPLES FOR CURB OPENINGS AND DRIVEWAYS

Certain control values for curb openings and driveways require minimum dimensions in some instances and maximum values for other dimensions. The design of curb openings and driveways within the range of these dimensions will provide for good service on the part of the motorist using the driveway while at the same time minimizing the interference to the traffic using the street. By controlling the location and width of openings or driveways along the street, it will be possible to avoid or eliminate long open stretches where motorists can indiscriminately drive onto the street. The width of opening established in these Design Standards are based on studies which indicate that the various width openings will accommodate vehicles of maximum size authorized on County streets and highways. In case of conflict between requirements in the various sections of this chapter, the more restrictive condition will normally apply. The opening or driveway width should be adequate to handle properly the anticipated traffic volume and character of traffic, as well as being within the limits specified for the type of property development. The controls established for curb openings and driveways shall apply to existing streets as well as new streets that may be developed in the future.

To the greatest extent possible all openings for driveways shall be located at the point of optimum sight distance along the street. For openings and driveways to commercial establishments and service stations there shall be sufficient space reasonably cleared of any obstructions such that drivers entering the property will give sufficient sight distance to enable them to make proper and safe movements. The profile of a driveway approach and the grading of the adjacent area shall be such that when a vehicle is located on the driveway outside the traveled portion of the street the driver can see a sufficient distance in both directions so as to enable him to enter the street without creating a hazardous traffic situation. The driveway profile grade within public right-of-way shall not exceed four (4%) percent.

Any adjustments which must be made to utility poles, streetlight standards, fire hydrants, catch basins or intakes, traffic signs and signals, or other public improvements or installations which are necessary as the result of the curb openings or driveways shall be accomplished without any cost to Elbert County. Also, any curb opening or driveway which has been abandoned shall be restored by the property owner except where such abandonment has been made at the request of, or for the convenience of the County.

Driveway approaches, whereby the driveway is to serve as an entrance only or as an exit only, shall be appropriately signed by, and at the expense of, the property owner. The
property owner will be required to provide some means of ensuring that the motorists will use the driveway either as an entrance only or an exit only, but not both.

New driveway accesses from private property to an existing graveled County road shall be required to install a minimum of six (6") inches of compacted class 6 aggregate base course or equivalent material from the right-of-way line to the edge of the traveled roadway. The width of the driveway within the RIGHT-OF-WAY shall be 24 feet and a minimum 18" diameter corrugated metal pipe (CMP) culvert or equivalent volume, shall be required at the established ditch flow line. A sketch plan of the installation must be submitted with the access permit application.

Private drive access to local, collector or arterial roadways that have no curb and/or gutter improvements shall be constructed to meet the following requirements:

Drive shall extend from right-of-way line to edge of existing driving surface and shall be constructed of:

1. County Maintained gravel roadway - A 6" thick compacted class 6 aggregate base material.,

2. County maintained paved roadway - A minimum 4" thick asphalt pavement over 6" thick class 6 aggregate base material, i.e. minimum acceptable roadway pavement design.

The drive shall be minimum of 16' wide (Maximum 22') in the County right-of-way.

An 18" diameter CMP culvert or equivalent volume, shall be installed at the established roadside ditch flowline beneath the private drive access.

**1140.00 DEFINITION OF TERMS**

Several terms are used herein which have a somewhat distinct meaning. For the purpose of clarity, the definition of some of these terms are listed below:

**WIDTH OF CURB OPENING (W)** - The width of curb opening measured at the curb line. For commercial and industrial driveways. (See Table 11.1.)

**EDGE CLEARANCE (E)** - The distance measured along curb line from the nearest edge of the curb opening to a point where the property line extended intersects the curb line.

**CORNER CLEARANCE **- At an intersecting street the distance measured along the curb line from the projection of the intersecting street flow line to the nearest edge of the curb opening.

**DISTANCE BETWEEN DOUBLE DRIVEWAYS (D)** - The distance measured along the curb line between the inside edges of two adjacent curb openings.
SETBACK (S) - The lateral distance measured perpendicular to the street RIGHT-OF-WAY line and extending from the RIGHT-OF-WAY line to the closest point of a building or gasoline service pump island.

FRONTAGE - The distance along the street RIGHT-OF-WAY line of a single property or development within the property lines. Corner property at an intersection would have a separate frontage along each street.

RESIDENTIAL - Property used primarily for residential purposes such as single family, two-family and multi-family units.

Single family - Residential - Single, detached family dwelling units or double bungalows or duplexes.

Multi Family - Residential - Three or more attached dwelling units including townhouses, condominiums and apartments.

COMMERCIAL - Establishments where the buying and selling of commodities, entertainment or services is carried on. Included are such uses as service stations, office buildings, restaurants, hotels, motels, banks, grocery stores, theaters, parking lots, trailer courts and public buildings.

SERVICE STATION - Any property where flammable liquids used as motor vehicle fuel are stored and dispensed from fixed equipment into fuel tanks of motor vehicles.

INDUSTRIAL OR WAREHOUSE - Any establishment that manufactures or stores an article or product.

1150.00 GENERAL REQUIREMENTS

1151.00 Number of Openings

SF Residential - In general, each SF residential property shall be limited to one access point.

MF Residential - In general, access shall be determined by information provided by the owner/developer in the Traffic Impact Study and by comments generated during Elbert County's review and acceptance of that study.

Commercial - In general, commercial property having less than 150 feet of frontage and located mid-block shall be limited to one access point to the street. An exception to this rule may be where a building is constructed in the middle of a lot and parking is provided for on each side of the building.

A second access point may be allowed for commercial property and service stations having more than 150 feet of frontage where there is sufficient frontage to provide for minimum and maximum requirements. For commercial property and service stations located on a corner, one access to each street may be permitted.
Industrial - Access shall be determined on a case-by-case basis. The County shall consider good traffic engineering practice and the information provided by the applicant in the Traffic Impact Study accompanying his submittal.

1152.00 Amount of Curb Opening Permitted

The total length of curb opening on a street for access to a commercial property or service station shall not exceed 40% of the property frontage. This requirement does not apply to residential type curb openings.

1153.00 Entrance Angle

In general, the entrance angle for all driveway approaches shall be as near 90 degrees to the centerline of the street as possible. The minimum angle which will be permitted is 90 degrees plus or minus 10 degrees.

1154.00 Minimum Space Between Openings (D)

The minimum spacing between curb openings shall be 35 feet measured at the curb line. This spacing will apply to the distance between drives serving adjoining properties. This does not apply to residential projects using mountable curb, gutter, and sidewalks. A 50-foot spacing applies to commercial openings.

1155.00 Joint Entrances

Whenever possible and feasible, joint entrances will be provided to serve two adjacent properties. Joint entrances are to be centered on the common property line.

1156.00 Access Approaches

Access approaches shall not be approved for parking or loading areas that require backing maneuvers within County right-of-way. All off-street parking areas must include on-site maneuvering areas and aisles to permit user vehicles to enter and exit the site in forward drive without hesitation.

If a parcel of land with direct access has been in a state of non-use for more than four years, recommencement of access use shall be considered a change in use. If the use of the access exceeds the design limitations of the access or is non-conforming with the present code, a new permit may be required.

If the use of an existing access to County right-of-way changes, or there is a change in the use of the property, a new access permit may be required. Change in access or property use may include, but not limited to, change in the amount or type of traffic, structural modifications, remodeling, change in type of business, expansion in existing business, change in zoning, change in property division creating new parcels, etc.
1160 CONTROL DIMENSIONS

To accomplish the objectives of the basic principles stated earlier, certain control dimensions are necessary. There are many variables which affect these control dimensions. Some of the variables are as follows: type of street classification, type of private property development, volume and type of traffic and width of right-of-way.

1161.00 Width of Curb Opening (W)

The total width of curb opening for properties on various Functional Street Classifications shall be in conformance with Table 11.1.

1162.00 Edge Clearance (E)

Residential
- Arterial - None (May not exceed the property line extended)
- Local - None (May not exceed the property line extended)

Commercial and Service Stations
- Arterial - 25 feet minimum
- Local - 25 feet minimum

Note: Joint access with adjoining property is encouraged. Joint access shall be the only justification for reducing the minimum edge clearance dimension.

1163.00 Corner Clearance ©

It is important to locate driveways away from major intersections. This constraint is as much for the ability to enter and leave the property as for the benefit of intersection safety and operations. Exiting a driveway during peak-hour conditions at traffic signals is difficult where the queue of standing or slow-moving vehicles never allows a sufficient gap for entry from the driveway.

1164.00 Sight Distance

Sight distance for curb openings to private property shall consist of a sight triangle conforming to the requirements of these Roadway Standards. This does not apply to driveways in single family residential projects using mountable curb, gutter, and sidewalks.

1170 UNPERMITTED ACCESS

Any access, driveway, or curb-cut which is constructed within public right-of-way without an access permit issued by Elbert County shall be subject to a "Stop Work" order and shall be removed immediately. Failure to remove the unpermitted access may result in the removal of said access by the County (the cost for removal shall be charged to the property owner from
which the access originate). Failure to obey the "Stop Work" order may result in the prosecution of the violators.

**TABLE 11.1**

**WIDTH OF CURB OPENINGS**

<table>
<thead>
<tr>
<th></th>
<th>Residential</th>
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<th>Commercial Station</th>
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<tr>
<td></td>
<td>Single-Family</td>
<td>Multi-Family</td>
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<td>Major Arterial</td>
<td>If Allowed</td>
<td>Design as Collector</td>
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<td>Minor Arterial</td>
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<tr>
<td>Minor Collector</td>
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<tr>
<td>Local</td>
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<td>30-35</td>
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</table>

**NOTE:**
1. Curb opening of thirty feet (30’) or more must be constructed as a radius curb return.
2. If a radius curb return is used, the width of the allowed driveway is measured by not counting the two (2) twenty-foot (20’) radii, or in other words, it is measured at the throat extended to flowline.
4" DIA SCHEDULE 40 STEEL VENT PIPE
SEE DET A

24" STD RING AND COVER

BREAKAWAY COUPLING
FOR 4" DIA PIPE AT GROUND LEVEL

60" DIA.
PRECAST CONCRETE FLAT MH COVER
(ASTM C478)

4" DIA SCHEDULE 40 STEEL PIPE WITH THREADED JOINTS

MASTIC SEALANT

2" THD D GATE VALVE

60" DIA. PRECAST CONCRETE MANHOLE SECTIONS (ASTM C478)

90° ELBOW

2" COMBINATION AIR RELEASE AND VACUUM RELIEF VALVE

2" THREADED TAP (CROP STOP)

GRavel fill

WATER MAIN

FOOTINGS

Screw on cap painted silver

30 - 1/2" HOLES EQUALLY SPACED. PAINTED SILVER

Painted yellow to ground level

DETAIL A

NOTE: ALL METAL SURFACES SHALL BE COATED WITH TWO COATS OF HEAVY COAL TAR PAINT.

STANDARDS & SPECIFICATIONS

REvised:

AIR RELEASE AND VACUUM RELIEF VALVE

DATE:

DRAWING NO. 200-01
4" DIA. SCHEDULE 40 STEEL VENT PIPE

24" STD. RING AND COVER

BREAKAWAY COUPLING FOR 4" DIA STEEL PIPE AT GROUND LEVEL

TOP SECTION OF VALVE BOX, TYLER 6860 SERIES OR EQUAL (EXTENSIONS IF REQUIRED), HOLE TO BE DRILLED IN FIELD OR CAST IN PLACE.

2 - 4 BRICK COURSES OR CONCRETE RINGS

60" DIA. PRECAST CONCRETE FLAT MH COVER (ASTM C478)

4" DIA SCHEDULE 40 STEEL PIPE WITH THREADED JOINTS

MASTIC SEALANT

60" DIA. PRECAST CONCRETE MH SECTIONS (ASTM C478)

OPERATOR EXTENSION

STD STEPS

MIN. 6x6 - 10x10 WWF

8' X 10' CONCRETE PAD TO REST ON UNDISTURBED SOIL

ADJUSTABLE SUPPORTS

MECHANICAL JOINT BUTTERFLY VALVE WITH OPERATOR. SEE DET. B, SHEET 2 OF 2

ELEVATION

VALVE BOX SUPPORT PLATE. 12"x12"x3/16". ANCHOR WITH 2-1/2" SS EXPANSION ANCHORS.

EXTENSION GUIDE

2" AIR RELEASE AND VACUUM RELIEF VALVE. SEE DET. A, SHEET 2 OF 2

VARIABLE
DETAIL A

- 90° STREET ELBOW
- 2" AIR RELEASE AND VACUUM RELIEF VALVE
- 3" I.D. THREADED NIPPLE (BRASS)
- 2" I.D. INLET
- 2" THREADED GATE VALVE
- MASTIC SEALANT
- 2" I.D. THREADED OUTLET (CORP STOP)
- EXISTING PIPE
- DRILL AND TAP REQUIRED SIZE HOLE IN EXISTING PIPE

DETAIL B

- 3' DOUBLE SPIGOT
- SEE DETAIL A
- MECHANICAL JOINT BUTTERFLY VALVE WITH GASKET
- MECHANICAL COMPRESSION COUPLING

1 1/4" I P THREADED OUTLET
1 1/4" I P THREADED CORP STOP MUELLER H-15025
1 1/4" COPPER TUBING
1 1/4" I P THREADED CORP STOP MUELLER H-15025
1 1/4" THREADED GATE VALVE (TYP. ONE EACH SIDE OF VALVE)
1 1/4" MUELLER CORP STOP H-15002 AND FIELD TAP (DUCTILE IRON PIPE ONLY)
NOT TO SCALE

1. This detail is for butterfly valve installations 20-inches in diameter or smaller.
2. Care shall be taken when installing valves to assure proper support of the valve. The authority may require 3/4" crushed rock to be installed under the valve to provide proper support.
3. Valves shall not be placed in concrete cross pans.
4. Operating nuts shall not be set closer than three (3) feet to final grade or deeper than five (5) feet from final grade. Operator extensions shall be connected to valve operator using set screw.
5. Butterfly valve and operator shall be polyethylene wrapped.
2" THREADED BRASS PIPE CAP IN A 6" VALVE BOX

2" BALL VALVE IN A 4 1/4" SERVICE BOX

12" PIPE OR SMALLER

BOND BREAKER

CONCRETE THRUST BLOCK

FLARED COPPER CONNECTION

BRASS STREET ELBOW

PLAN

BRASS 2" MALE I.P. THREADED X SOLDER ADAPTER COVERED W/ GREASED 2" BRASS CAP THREADED ON PIPE LOOSELY

TOP SECTION 6" VALVE BOX

COMPLETE 4 1/4" ROADWAY BOX, TYLER 6870 SERIES OR EQUAL.

2" BALL VALVE FEMALE I.P. THREAD X FLARE WITH 2" SQUARE OPERATING NUT. USE EXTENDER WITH CENTERING RING TO WITHIN 1' OF GROUND.

2" THREADED BRASS PIPE

2" TYPE K SOFT COPPER PIPE

1/8" DRAIN HOLE IN COPPER PIPE

1 CU.FT. GRAVEL

PLUG WITH 2" TAP

ELEVATION

STANDARDS & SPECIFICATIONS

REVISED:

BLOW-OFF VALVE 12" AND SMALLER PIPE

DATE: DRAWING NO. 200-05
TOP SECTION OF VALVE BOX, TYLER 6860 SERIES OR EQUAL (EXTENSIONS IF REQUIRED). HOLE TO BE DRILLED IN FIELD OR CAST-IN-PLACE.

60" DIA. PRECAST CONCRETE FLAT MH COVER (ASTM C478)

OPERATOR EXTENSION

EXTENSION GUIDE

60" DIA. PRECAST CONCRETE MANHOLE SECTIONS (ASTM C478)

MAIN SIZE X 6" TEE ROTATED 45' DOWNWARD

6" GATE VALVE

MASTIC SEALANT

6" - 45' BEND

ADJUSTABLE SUPPORT

7" SQ. CONCRETE PAD TO REST ON UNDISTURBED SOIL

VALVE BOX SUPPORT PLATE, 12" X 12" X 3/16". ANCHOR WITH 2 1/2" SS EXPANSION ANCHORS

24" STD RING AND COVER

2 - 4 BRICK COURSES OR CONCRETE RINGS

STD. STEPS

6" X 90° FLANGED ELBOW UP

MIN 6 x 6 - 10 x 10 WWF

ELEVATION

NOTES:

1. FIRE HYDRANT MAY BE USED AS AN ALTERNATE BLOW-OFF. SEE DETAIL.

2. ALL METAL SURFACES SHALL BE COATED WITH TWO COATS OF HEAVY COAL TAR PAINT.

STANDARDS & SPECIFICATIONS

REVISED: BLOW-OFF VALVE 16" + LARGER MAINS

DATE: DRAWING NO. 200-06

358
18" SQ. X 6" THICK CONCRETE COLLAR WHEN NOT IN ASPHALT

NOTE:
ALL FITTINGS TO BE MECHANICAL JOINT AND RODDED FOR PROPER RESTRAINT

3-PIECE VALVE BOX WITH 5 1/4" BARREL AND WIDE OVAL BASE, TYLER 6860 SERIES OR EQUAL

MAIN SIZE X 6" TEE ROTATED 45° DOWNWARD
2" NUT ADAPTER
6" GATE VALVE

6" - 45° BEND

6" - 90° BEND WITH THRUST BLOCK

PAINTED YELLOW

VARIES

5'-0"

3'-0"
TO PEE

4'-6" MIN.
### PIPE CASING DETAIL

<table>
<thead>
<tr>
<th>Carrier Pipe Nominal Dia.</th>
<th>Casing Pipe Min. O.D.</th>
<th>Casing Pipe Min. Wall Thick</th>
<th>Minimum Runner Size</th>
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**NOTES:**

1. Neoprene or PVC runners may be used as an alternative to treated redwood.
2. Trench laid casings shall be designed and installed to conduit standards.
FOR DETAILS SEE DETAIL A BELOW

FOR DETAILS SEE DETAIL B BELOW

ROD (TYP.)

ROD SIZE SHOULD FOLLOW RECOMMENDATION SEE TIE ROD AND CLAMP DETAILS

ELEVATION

PLAN

SECTION A-A

SECTION B-B

DETAIL A

DETAIL B

<table>
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<tr>
<th>ELBOW BAR SIZE</th>
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NOTE: ALL DIMENSIONS IN INCHES.

NOTE: NOT FOR USE WITH 18" & 20" D.I. COMPACT FITTINGS.

STANDARDS & SPECIFICATIONS

REVISED:

CLAMP DETAIL

DATE: DRAWING NO. 200-09
3000 P.S.I. CONCRETE VIBRATED IN PLACE

PIPE SIZE | NO. OF LONGITUDINAL BARS AND LOCATION
---|---
6" | 4 - NO. 4 BARS 1 EACH CORNER
8" | 4 - NO. 4 BARS 1 EACH CORNER
10" | 8 - NO. 4 BARS 3 EACH SIDE
12" | 8 - NO. 4 BARS 3 EACH SIDE
15" | 8 - NO. 4 BARS 3 EACH SIDE
18" | 8 - NO. 4 BARS 3 EACH SIDE
21" | 12 - NO. 4 BARS 4 EACH SIDE
24" | 12 - NO. 4 BARS 4 EACH SIDE
27" | 12 - NO. 4 BARS 4 EACH SIDE
30" | 12 - NO. 4 BARS 4 EACH SIDE
33" | 12 - NO. 4 BARS 4 EACH SIDE
36" | 16 - NO. 4 BARS 5 EACH SIDE

STANDARDS & SPECIFICATIONS

REvised:

DATE:

DRAWING NO. 200-10

CONCRETE ENCASEMENT
GENERAL NOTES:
1. FOR INSTALLATION IN ROADWAYS, DRIVEWAYS, SIDEWALKS, OR PARKING AREAS PRIOR APPROVAL REQUIRED.
2. NO CONCRETE FLOOR ALLOWED IN METER PIT.
3. METER PIT SHALL BE CONSTRUCTED OF ANY COMBINATION OF CONCRETE RINGS TOTAL – 48" IN LENGTH.
4. ADJUSTMENT RINGS SHALL BE 2", 3", 4" OR 6" IN HEIGHT AND SHALL BE INSERTED BETWEEN THE DOME AND TOP RING.
5. NO CONNECTIONS OR CHANGES IN PIPE DIAMETER SHALL BE MADE FROM THE MAIN TAP TO A DISTANCE OF FIVE FEET BEYOND THE METER PIT WALL ON THE OUTLET SIDE.
6. LID SHALL SAY "WATER METER"

METER SIZE | A | B | C | D
---|---|---|---|---
5/8" x 3/4" | 12-5/8" | 7-13/16" | 7-13/16" | 4"
3/4" | 14-1/4" | 9-5/16" | 8-15/16" | 5"
1" | 17-1/4" | 11-1/16" | 11-1/4" | 6"
LIST OF MATERIALS

1. RING AND COVER – J`MARK NO. J-2290 (81 LBS.) OR APPROVED EQUAL WITH INTERNAL FROST LID.
2. METER PIT – ARCO NO. 24-4 PRECAST MANHOLE (24” DIA.) OR APPROVED EQUAL.
3. SERVICE LINE – COPPER TUBING TYPE K, SAME DIAMETER AS THE METER.
4. METER YOKE ASSEMBLY – FORD 80 SERIES COPPER SETTER OR APPROVED EQUAL.
5. SHUT-OFF VALVE.
6. CORPORATION STOP. A SADDLE MAY BE REQUIRED.

ADDITIONAL NOTES

1. THE AUTHORITY SHALL INSPECT FROM THE MAIN TO THE BUILDING PRIOR TO BACKFILLING.
2. IF THE SURFACE IS NOT TO FINAL GRADE AT THE TIME OF THE METER INSTALLATION, THE PROPERTY OWNER SHALL RAISE OR LOWER THE METER PIT ACCESS MANHOLE TO MATCH THE FINAL GRADE.
3. THE METER SHALL BE A POSITIVE DISPLACEMENT ROCKWELL OR NEPTUNE TRIDENT 8, READING IN GALLONS.
4. CAP TYPE TOP LID SHALL BE CAST IRON ONLY. THE INNER LID SHALL BE CAST IRON, ALUMINUM OR RUBBER. THE ALUMINUM SHALL BE COATED WITH A POLYMER SUCH AS EPOXY. CAST IRON SHALL BE COATED WITH AN ASPHALT BASE PAINT.
LIST OF MATERIALS

1. CORPORATION STOP VALVE.
2. CURB STOP VALVE AND BOX W/ 2" OPERATOR NUT AND FLARED COPPER ENDS.
   CURB STOP VALVE BOX MUST BE A 3-PIECE BOX WITH 5-1/4" BARREL AND WIDE OVAL BASE (TYLER 6880 SERIES, OR APPROVED EQUAL).
3. SERVICE LINE - COPPER TUBING TYPE K, SAME DIAMETER AS THE METER.
4. METER - POSITIVE DISPLACEMENT ROCKWELL OR NEPTUNE TRIDENT B, READING IN GALLONS
5. RING AND COVER - J'MARK NO. J1163 (125 LBS. COVER) OR APPROVED WITH WATER CAST INTO COVER.
6. METER PIT - 48" DIA. PRECAST MANHOLE ASTM C478, FLAT TOP.
7. BALL VALVE- FORD BALL VALVE CURB STOP W/ FEMALE THREAD IRON PIPE & FLARED COPPER ENDS OR EQUAL (2 REQ.)
8. BRASS FLANGE COUPLING
9. FORD LOCK-PAK ADJUSTMENT COUPLING W/2 STAINLESS STEEL SET SCREWS.
10. STOP & WASTE VALVE W/FLARED COPPER ENDS.

NOTES

1. THE DISTRICT SHALL INSPECT FROM THE MAIN TO THE BUILDING PRIOR TO BACKFILLING.
2. IF THE SURFACE IS NOT TO FINAL GRADE AT TIME OF THE METER INSTALLATION, THE PROPERTY OWNER SHALL RAISE OR LOWER THE METER PIT ACCESS MANHOLE TO MATCH THE FINAL GRADE.
3. COUPLINGS SHALL BE PROVIDED ON UPSTREAM AND DOWNSTREAM SIDES OF METER TO ALLOW FOR REMOVAL.
4. TOP STEP 18" - 24" BELOW THE SURFACE, REMAINDER SPACED AT 12" INTERVALS.

DATE: DRAWING NO. 200-15
STANDARDS & SPECIFICATIONS
REVISED: DOMESTIC METER PIT PRESSURE REDUCING 1-1/2" AND UP
NOTE:

1. Placement of stop box can vary from a maximum of 5 feet outside the property line to the property line. Placement of the stop box outside the property line is preferred.

2. Owner's responsibility for leak repair shall be up to and including the tube nut which threads onto the curb stop. Owner's responsibility for repairs other than leak repair extends to the corporation stop.

3. ACWWA will repair leaks on service lines when notified, from the corporation stop to curb stop.

---

OWNER'S SERVICE PIPE AND RESPONSIBILITY

PROPERTY LINE

STOP & WASTE

4 ½ MIN.

COVER FOR METER PIT & STOP BOX SHALL BE INSTALLED & MAINTAINED LEVEL WITH THE ADJACENT GROUND.

SERVICE PIPE SHALL BE TYPE "K" COPPER FROM MAIN THROUGH THE METER PIT.

INSULATING COUPLING REQUIRED ON METALLIC WATER MAINS.

CORPORATION STOP

WATER MAIN

SHOULD ANY SITUATION ARISE OTHER THAN SHOWN CONCERNING THE DEPTH OR CONSTRUCTION OF SERVICE LINE OR THE PLACEMENT OF METER PIT OR STOP BOX CALL 363-790-4830 AND ASK FOR CUSTOMER SERVICES FIELD SECTION.

DIRECT TAPS ARE NOT ALLOWED. SADDLE TAPS ARE REQUIRED FOR ALL PIPE.
FIRELINE OR DOMESTIC CONNECTION WITH MAIN EXTENSION

FIRELINE OR DOMESTIC CONNECTION

FIRELINE CONNECTION WITH DOMESTIC SERVICE TEE

NOTE: 4" FIRELINE CONNECTION WITH 1-1/2" OR 2" DOMESTIC TEE SHALL BE PLUGGED AND TAPPED WITH AWWA CC THREADS FOR APPLICABLE SIZE.

1. EXISTING MAIN
2. TAPPING SLEEVE
3. TAPPING VALVE
4. DOUBLE SPIGOT PIPE
5. PROPERTY LINE VALVE
6. TIE RODS (MEGAUGS ARE NOT ACCEPTABLE)
7. PIPE CLAMP
8. CONCRETE NOZZLE
9. M.J. ANCHORING TEE (SWIVEL TEE WHERE APPLICABLE)
10. M.J. VALVE
11. DOMESTIC SERVICE TEE OR SERVICE TAP
12. POLYETHYLENE WRAPPED
13. 90° FITTING (BEND FOR 2" & SMALLER)
14. VALVE OR CURBSTOP AS NOTED ON PLANS & CONTINUE PER APPLICABLE METER DETAIL

STANDARDS & SPECIFICATIONS

2" AND LARGER FIRELINE CONNECTION

DATE: DRAWING NO. 200-17

REVISED:
NOTE:
PIPE MUST BE "FULLY" RESTRAINED
WITH EITHER RODDING OR
MECHANICAL JOINT RESTRAINT
SUCH AS MEGALUGS, OR APPROVED
EQUAL.

HYDRANT SHALL BE
PLUMB IN ALL
DIRECTIONS WITH
PUMPER NOZZLE
FACING STREET AND
SHALL BE PAINTED
YELLOW

COVER ROCK WITH
APPROVED FILTER
BLANKET OR 8 MIL
POLYETHYLENE SHEET
PRIOR TO PLACING
BACKFILL

0.25 CU.YD.
(3/4" - 3/8")
WELL GRADED
CRUSHED ROCK

1 CU. YD. (3/4" - 3/8")
WELL GRADED CRUSHED ROCK

SUPPORT BLOCKING
(IF NEEDED)

UNDISTURBED SOIL

MUELLER A-473 OR WATEROUS WB-67 OR M&H HYDRANT
GENERAL NOTES:
1. FOR INSTALLATION IN ROADWAYS, DRIVEWAYS, SIDEWALKS, OR PARKING AREAS PRIOR APPROVAL REQUIRED.
2. NO CONCRETE FLOOR ALLOWED IN METER PIT.
3. METER PIT SHALL BE CONSTRUCTED OF ANY COMBINATION OF CONCRETE RINGS TOTAL - 48” IN LENGTH.
4. ADJUSTMENT RINGS SHALL BE 2”, 3”, 4” OR 6” IN HEIGHT AND SHALL BE INSERTED BETWEEN THE DOME AND TOP RING.
5. NO CONNECTIONS OR CHANGES IN PIPE DIAMETER SHALL BE MADE FROM THE MAIN TAP TO A DISTANCE OF FIVE FEET BEYOND THE METER PIT WALL ON THE OUTLET SIDE.
6. LID SHALL SAY “WATER METER”.

<table>
<thead>
<tr>
<th>METER SIZE</th>
<th>A</th>
<th>B</th>
<th>C</th>
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<td>11-1/16&quot;</td>
<td>11-1/4&quot;</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>

(SEE DETAIL A, SHEET 9 OF 9)
LIST OF MATERIALS

1. RING AND COVER — J‘MARK NO. J–2290 (81 LBS.) OR APPROVED EQUAL WITH
   INTERNAL POST.
2. METER PIT — ARCO NO. 24–4 PRECAST MANHOLE (24” DIA.) OR APPROVED EQUAL.
3. SERVICE LINE — COPPER TUBING TYPE K, SAME DIAMETER AS THE METER.
4. METER YOKE ASSEMBLY — FORD 80 SERIES COPPER SETTER OR APPROVED EQUAL.
5. SHUT–OFF VALVE.
6. CORPORATION STOP. A SADDLE MAY BE REQUIRED.
7. RE–USE SOURCE WATERLINE.

NOTES

1. THE AUTHORITY SHALL INSPECT FROM THE MAIN TO THE BUILDING PRIOR TO
   BACKFILLING.
2. IF THE SURFACE IS NOT TO FINAL GRADE AT TIME OF THE METER INSTALLATION,
   THE PROPERTY OWNER SHALL RAISE OR LOWER THE METER PIT ACCESS MANHOLE TO
   MATCH THE FINAL GRADE.
3. THE METER SHALL BE A POSITIVE DISPLACEMENT ROCKWELL OR NEPTUNE TRIDENT 8,
   READING IN GALLONS.
4. COUPLINGS SHALL BE PROVIDED ON UPSTREAM AND DOWNSTREAM SIDES OF METER TO
   ALLOW FOR REMOVAL.
5. TRACER WIRE TO BE ATTACHED TO ALL WATER LINES.
6. CAP TYPE TOP LID SHALL BE CAST IRON ONLY. THE INNER LID SHALL BE
   CAST IRON, ALUMINUM OR RUBBER. THE ALUMINUM SHALL BE COATED WITH A
   POLYMER SUCH AS EPOXY. CAST IRON SHALL BE COATED WITH AN ASPHALT
   BASE PAINT.
7. FOR INSTALLATION IN ROADWAYS, DRIVEWAYS, SIDEWALKS, OR PARKING AREAS
   PRIOR APPROVAL REQUIRED.
8. NO CONCRETE FLOOR ALLOWED IN METER PIT.
9. METER PIT SHALL BE CONSTRUCTED OF ANY COMBINATION OF CONCRETE
   RINGS TOTAL — 48” IN LENGTH.
10. ADJUSTMENT RINGS SHALL BE 2”, 3”, 4” OR 6” IN HEIGHT AND SHALL BE
    INSERTED BETWEEN THE DOME AND THE TOP RING.
11. NO CONNECTIONS OR CHANGES IN PIPE DIAMETER SHALL BE MADE FROM
    THE MAIN TAP TO A DISTANCE OF FIVE FEET BEYOND THE METER PIT WALL
    ON THE OUTLET SIDE.
### Sectional Plan

**No Scale**

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<thead>
<tr>
<th>Meter Size</th>
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<th>C</th>
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</tbody>
</table>

**Contractor to provide pipe connection from curbstop to plug for future use**

**Section A**

**No Scale**

To RPBG Device and Irrigation

(See detail A, Sheet 9 of 9)

**Sheet 3 of 9**

**Irrigation Meter**

**Backflow Preventer**

3/4" Thru 1"

**Standards & Specifications**

**Revised:**

**Date:**

**Drawing No.: 200-21**

---

**Gravel**

**Manhole Cover**

**RPBP Device**

**Flow**

**To future re-use line**

**18" sq. x 6" thick concrete collar when not in asphalt**

**Forged brass pentagon bolt**

**Frost proof bonnet**

**Install lid 1/2" above ground**

**Meter pit ring - aluminum**

(In accordance with ASTM A132)

Or cast iron (in accordance with ASTM A48)

**Curb stop valve & stop box**

**Curb stop valve & stop box**

**Depth of hole - 3"-5"**

**Not less than 4"-5"**

**Not more than 5""**

**Plug**

**Flow**

**2" nut adapter**

**Contractor to provide pipe connection from curbstop to plug for future use**
LIST OF MATERIALS

1. RING AND COVER - J'MARK NO. J-2290 (81 LBS.) OR APPROVED EQUAL WITH
   WITH INTERNAL POST
2. METER PIT - ARCO NO. 24-4 PRECAST MANHOLE (24" DIA.) OR APPROVED EQUAL.
3. SERVICE LINE - COPPER TUBING TYPE K, SAME DIAMETER AS THE METER.
4. METER YOKE ASSEMBLY - FORO 80 SERIES COPPER SETTER OR APPROVED EQUAL.
5. SHUT-OFF VALVE.
6. CORPORATION STOP, A SADDLE MAY BE REQUIRED.
7. EXISTING DOMESTIC SOURCE WATERLINE.
8. FUTURE RE-USE SOURCE WATERLINE.
9. CURB STOP WITH 2" VALVE NUT ADAPTER AND BOX.

NOTES

1. THE AUTHORITY SHALL INSPECT FROM THE MAIN TO THE BUILDING PRIOR TO
   BACKFILLING.
2. IF THE SURFACE IS NOT TO FINAL GRADE AT TIME OF THE METER INSTALLATION,
   THE PROPERTY OWNER SHALL RAISE OR LOWER THE METER PIT ACCESS MANHOLE TO
   MATCH THE FINAL GRADE.
3. THE METER SHALL BE A POSITIVE DISPLACEMENT ROCKWELL OR NEPTUNE TRIDENT 8,
   READING IN GALLONS.
4. COUPLINGS SHALL BE PROVIDED ON UPSTREAM AND DOWNSTREAM SIDES OF METER TO
   ALLOW FOR REMOVAL.
5. CONTRACTOR TO PROVIDE CONNECTION FROM CURBSTOP TO PLUG AND ALL
   APPURTENANCES FOR RE-USE LINE.
6. TRACER WIRE TO BE ATTACHED TO ALL WATER LINES.
7. CAP TYPE TOP Lid SHALL BE CAST IRON ONLY. THE INNER Lid SHALL BE
   CAST IRON, ALUMINUM OR RUBBER. THE ALUMINUM SHALL BE COATED WITH A
   POLYMER SUCH AS EPOXY. CAST IRON SHALL BE COATED WITH AN ASPHALT
   BASE PAINT.
8. FOR INSTALLATION IN ROADWAYS, DRIVEWAYS, SIDEWALKS, OR PARKING AREAS
   PRIOR APPROVAL REQUIRED.
9. NO CONCRETE FLOOR ALLOWED IN METER PIT.
10. METER PIT SHALL BE CONSTRUCTED OF ANY COMBINATION OF CONCRETE
    RINGS TOTAL - 48" IN LENGTH.
11. ADJUSTMENT RINGS SHALL BE 2", 3", 4" OR 6" IN HEIGHT AND SHALL BE
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12. NO CONNECTIONS OR CHANGES IN PIPE DIAMETER SHALL BE MADE FROM
    THE MAIN TAP TO A DISTANCE OF FIVE FEET BEYOND THE METER PIT WALL
    ON THE OUTLET SIDE.
LIST OF MATERIALS

1. CORPORATION STOP VALVE.
2. CURB STOP VALVE AND BOX W/ 2” OPERATOR NUT AND FLARED COPPER ENDS.
   CURB STOP VALVE BOX MUST BE A 3-PIECE BOX WITH 5-1/4” BARREL AND WIDE OVAL
   BASE (TYLER 6860 SERIES, OR APPROVED EQUAL).
3. SERVICE LINE - COPPER TUBING TYPE K, SAME DIAMETER AS THE METER.
4. METER - POSITIVE DISPLACEMENT ROCKWELL OR NEPTUNE TRIDENT B, READING IN
   GALLONS
5. RING AND COVER - J’MARK NO. J1163 (125 LBS. COVER) OR APPROVED
   WITH WATER CAST INTO COVER.
6. METER PIT - 48” DIA. PRECAST MANHOLE ASTM C478, FLAT TOP.
7. BALL VALVE— FORD BALL VALVE CURB STOP W/ FEMALE THREAD IRON PIPE
   & FLARED COPPER ENDS OR EQUAL. (2 REQ.)
8. BRASS FLANGE COUPLING
9. FORD LOK-PAK ADJUSTMENT COUPLING W/2 STAINLESS STEEL SET SCREWS.
10. STOP & WASTE VALVE W/FLARED COPPER ENDS.

NOTES

1. THE DISTRICT SHALL INSPECT FROM THE MAIN TO THE BUILDING PRIOR TO
   BACKFILLING.
2. IF THE SURFACE IS NOT TO FINAL GRADE AT TIME OF THE METER INSTALLATION,
   THE PROPERTY OWNER SHALL RAISE OR LOWER THE METER PIT ACCESS MANHOLE TO
   MATCH THE FINAL GRADE.
3. COUPLINGS SHALL BE PROVIDED ON UPSTREAM AND DOWNSTREAM SIDES OF METER TO
   ALLOW FOR REMOVAL.
4. TOP STEP 18” – 24” BELOW THE SURFACE, REMAINDER SPACED AT 12” INTERVALS.
5. REFER TO IRRIGATION SYSTEM RP-TYPE BACKFLOW PREVENTER SCHEMATIC DETAIL IF
   METER TO BE USED FOR RE-USE, IRRIGATION OR EFFLUENT WATER PURPOSES.
LIST OF MATERIALS

1. CORPORATION STOP VALVE.
2. CURB STOP VALVE AND BOX W/ 2” OPERATOR NUT AND FLARED COPPER ENDS.
   CURB STOP VALVE BOX MUST BE A 3-PIECE BOX WITH 5-1/4” BARREL AND WIDE OVAL
   BASE (TYLER 6860 SERIES, OR APPROVED EQUAL)
3. SERVICE LINE — COPPER TUBING TYPE K, SAME DIAMETER AS THE METER.
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5. RING AND COVER — J’MARK NO. J1163 (125 LBS. COVER) OR APPROVED
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   & FLARED COPPER ENDS OR EQUAL (2 REQ.)
8. BRASS FLANGE COUPLING.
9. FORD LOK—PAK ADJUSTMENT COUPLING W/2 STAINLESS STEEL SET SCREWS.
10. STOP & WASTE VALVE W/FLARED COPPER ENDS.

NOTES

1. THE DISTRICT SHALL INSPECT FROM THE MAIN TO THE BUILDING PRIOR TO
   BACKFILLING.
2. IF THE SURFACE IS NOT TO FINAL GRADE AT TIME OF THE METER INSTALLATION,
   THE PROPERTY OWNER SHALL RAISE OR LOWER THE METER PIT ACCESS MANHOLE TO
   MATCH THE FINAL GRADE.
3. BRASS FLANGE COUPLINGS SHALL BE PROVIDED ON UPSTREAM AND DOWNSTREAM SIDES
   OF METER TO ALLOW FOR REMOVAL.
4. TOP STEP TO BE 18” TO 24” BELOW THE SURFACE, AT 12” VERTICAL INTERVALS.
5. REFER TO IRRIGATION SYSTEM RP—TYPE BACKFLOW PREVENTER SCHEMATIC DETAIL IF
   APPLICABLE.
TO IRRIGATION
SYSTEM MANIFOLD

VARIES PER INSTALLATION

METER PIT

CORPORATION STOP

MAIN

PLAN

INSTALL RPB P DEVICE
(FEBCO 825YA, OR APPROVED EQUIVALENT)

TYPE K COPPER
PIPE TO METER
PIT

FROM STOP &
WASTE VALVE

4'-6" MIN.

TO IRRIGATION

DETAIL A

NO SCALE

SHEET 9 of 9

STANDARDS &
SPECIFICATIONS

REvised:

IRRIGATION SYSTEM
WITH RPB P

DATE:

DRAWING NO. 200-27
NOTE:

1 - PLACEMENT OF STOP BOX CAN VARY FROM A MAXIMUM OF 5 FEET OUTSIDE THE PROPERTY LINE TO THE PROPERTY LINE. PLACEMENT OF THE STOP BOX OUTSIDE THE PROPERTY LINE IS PREFERRED.

2 - OWNER'S RESPONSIBILITY FOR LEAK REPAIR SHALL BE UP TO AND INCLUDING THE TUBE NUT WHICH THREADS ONTO THE STOP AND WASTE VALVE. OWNER'S RESPONSIBILITY FOR REPAIRS OTHER THAN LEAK REPAIR EXTENDS TO THE CORPORATION STOP.

3 - ACWWA WILL REPAIR LEAKS ON SERVICE LINES WHEN NOTIFIED, FROM THE CORPORATION STOP TO STOP AND WASTE VALVE.
# Dimensions

<table>
<thead>
<tr>
<th>Allowable Pipe Diameter Inches</th>
<th>Bolt Size</th>
<th>No. of Bolts Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3/4&quot;</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
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<td>2</td>
</tr>
<tr>
<td>8</td>
<td>3/4&quot;</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>3/4&quot;</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>3/4&quot;</td>
<td>6</td>
</tr>
</tbody>
</table>

**Notes:**

1 - The bolt shall be manufactured of “Cor-Ten” or approved equal.

2 - The bolt may be heat treated.
### Minimum Bearing Surface Area (in square feet)

<table>
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<tr>
<th>Size of Pipe</th>
<th>$11\frac{1}{4}^\circ$</th>
<th>$22\frac{1}{2}^\circ$</th>
<th>$45^\circ$</th>
<th>$90^\circ$</th>
<th>TEE or Dead End</th>
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<tr>
<td>4”</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>NA</td>
<td>1.50</td>
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<tr>
<td>6”</td>
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<td>2.25</td>
<td>4.25</td>
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<td>8”</td>
<td>1.00</td>
<td>2.00</td>
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<tr>
<td>12”</td>
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<td>4.50</td>
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<td>16”</td>
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<td>7.50</td>
<td>14.50</td>
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<td>7.00</td>
<td>14.00</td>
<td>27.75</td>
<td>51.00</td>
<td>36.00</td>
</tr>
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</table>

### Notes:

1. Bearing surfaces shown in chart are minimum.

2. Based on 150 psi internal pipe pressure plus water hammer. 4”, 6”, 8”, and 12” water hammer = 110 P.S.I. 16”, 20”, and 24” water hammer = 70 P.S.I.

3. Concrete must be minimum of 3000 psi, and cure for 24 hours before tamping or compacting.

4. Based on 3,000 psf soil bearing capacity.

5. NA = NOT APPLICABLE.
MECHANICAL JOINT RESTRAINT

WEDGE DETAIL

BOLT HOLE DETAIL

DIMENSIONS

<table>
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<tr>
<th>NOMINAL PIPE SIZE</th>
<th>NO. OF BOLTS</th>
<th>NO. OF WEDGES</th>
<th>K2 INCHES</th>
<th>J INCHES</th>
<th>F INCHES</th>
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<td>16.25</td>
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</table>
FIELD INSTALLATION—POLYETHYLENE WRAP

STEP 1
PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH.

STEP 2
PULL THE TUBE OVER THE LENGTH OF THE PIPE, TAPE TUBE TO PIPE AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TURNS OF TWO-INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END.

STEP 3
ADJACENT TUBE OVERLAPS FIRST TUBE AND IS SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE AND HELD IN PLACE BY MEANS OF PIECES OF THE PLASTIC TAPE AT APPROXIMATELY THREE TO FIVE FOOT INTERVALS.
### ROD DIAMETER, GRADE & LENGTH OF RESTRAINED PIPE

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<thead>
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<th>PIPE SIZE</th>
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<td>G</td>
<td>D</td>
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<td>2' M.S.</td>
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**NOTES:**

1. LENGTH OF RESTRAINED PIPE MEASURED EACH WAY FROM VALVES AND BENDS.
2. CLAMPS, RODS & MEGALUGS NOT ALLOWED FOR 24" & LARGER PIPES.
3. D=DIAMETER, L=LENGTH, G=GRADE
   M.S.=MILD STEEL, H.S.=HIGH STRENGTH.
4. MINIMUM 4.5' GROUND COVER REQUIRED.
5. BASED ON 150 PSI INTERNAL PRESSURE.
8. NUTS SHALL BE ASTM A307 GRADE A OR B HEXAGON HEAVY SERIES.
   HIGH STRENGTH NUTS SHALL BE ASTM A 194, GRADE 2H.
9. SEE TIE ROD DETAIL DRAWING. ALSO, TIE ROD COUPLING DETAILS,
   CLAMP DETAILS AND SET CLAMP DETAILS.
10. LENGTH REFERS TO THE AMOUNT OF PIPE WHICH MUST BE RESTRAINED
together and is not necessarily the length of the rods.
11. LENGTH OF RESTRANDED PIPE CHART IS ALSO FOR THE LENGTH OF JOINT
    RESTRAINT FOR ESBA IRON MEGALUGS OR UNIFLANGE PIPE RESTRAINT DEVICES.
12. CROSSES MUST BE RESTRAINED IN ALL APPLICABLE DIRECTIONS.
13. 12" AND SMALLER IN LINE VALVES AND TEES SHALL HAVE A MECHANICAL JIONT RESTRAINT
    DEVICE ON EACH SIDE OF THE FITTING OR VALVE. MECHANICAL JONJT RESTRAINT DEVICE SHALL BE:
    DIP – ESBA 1100 SERIES, UNI-FLANGE SERIES 1400, OR EQUIVALENT;
    PVC – ESBA MEGALUG 2000 PV SERIES,
    UNI-FLANGE SERIES 1500, OR EQUIVALENT.
14. A SECOND VALVE WILL BE REQUIRED TO BE CLOSED WHEN EXCAVATING NEXT TO AN EXISTING VALVE.
NOTES:
1. PAVING SHALL COMPLY WITH LOCAL AUTHORITY JURISDICTION.
2. TRENCH WALLS TO BE SUPPORTED AS REQUIRED BY O.S.H.A.
3. MINIMUM COVER TO BE BELOW OFFICIAL STREET GRADE.
4. MINIMUM TRENCH WIDTH = PIPE O.D. + 12"
   MAXIMUM TRENCH WIDTH = PIPE O.D. +24"
TIE ROD DETAILS

WASHER DETAIL

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<td>G</td>
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<td>6&quot;</td>
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<td>3/4&quot;, 1-1/2&quot; ALL THREAD</td>
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NOTE:
1.) SEE TIE JOINTS, ROD DIMENSIONS SHEET.
2.) SEE CLAMP DETAILS AND DIMENSIONS FOR PROPER PLACEMENT OF WASHERS.
3.) MS=MILD STEEL
    HS=HIGH STRENGTH
INSTALL A SINGLE STRAND (NO LOOPS) OF COPPER WIRE TO THE TOP OF VALVE BOX ALONG THE INSIDE OF UPPER VALVE BOX SECTION.

THERMOWELD OR USE A NO 12 COPPER CONNECTOR TYPE BURNDY NO YCS OR EQUAL.

COPPER WIRE MUST BE TAPE TO TOP OF PIPE EVERY 3 TO 4 FOOT.

WIRE TO BE TAPE ON EACH SIDE OF EVERY JOINT.

THERMOWELD OR USE A NO 12 COPPER CONNECTOR TYPE BURNDY NO YCS OR EQUAL FOR TEE CONNECTION (SEE DETAIL 'B' THIS SHEET) OUTSIDE POLYWRAP.

TYPICAL VALVE BOX (SEE DETAILS)

TRACER WIRE

TYPICAL VALVE

DETAI 'A'

DETAI 'B'

DETAIL 'A'

DETAIL 'B'
1.) Length of extension of pipe and harness rods shall be in accordance with these engineering standards.

2.) All water mains twelve (12") inches or smaller, which cross under district conduits shall be ductile iron.

3.) A bored crossing may be required by the engineer.
TYLER SERIES 6860 3-PIECE, SCREW TYPE D.I. VALVE BOX W/ 5 1/4" BARREL CENTERED VERTICALLY OVER VALVE

NOTES:
1. GATE VALVES SHALL OPEN CCW AND BE RESILIENT SEAT MEETING REQUIREMENTS OF AWWA C509.
2. FITTINGS SHALL BE WRAPPED WITH 8 MIL MINIMUM THICKNESS POLYETHYLENE SHEETING.
3. VALVE BOX TOP SHALL BE SET 1/2" BELOW FINAL ASPHALT PAVEMENT GRADE.
4. PROVIDE MARKER POST WHERE NECESSARY.
4" Dia. Schedule 40 steel post, painted yellow and filled with concrete.

Valve Size
Type of Valve
Distance to Valve

Note:
2" capital letters facing valve.

Concrete
Undisturbed Soil

STANDARDS & SPECIFICATIONS
REVISED:

VALVE MARKER POST

DATE:  DRAWING NO. 200-39
**GROUT OPENING WATER TIGHT**

**8" SPECIAL CROSS**

**8" TO 12"**

**8" SEWER**

**THREAD PLUG**

**6' I.D.**

**2 STRAPS MIN. PER PIPE LENGTH, MAX 5' SPACING**

**NOTE:**

TURN BEND TOWARD OUTLET PIPE TO FACILITATE SMOOTH TRANSITION.

**8" PVC**

**CAST GASKET 90° BEND IN BENCH MATCH CROWNS WITH OUTLET PIPE**

**PLAN**

**CAST-IN-PLACE OR PRECAST BASE**

**MANHOLE INTERIOR WALL**

**ANCHOR W/ EPOXY**

**3/8"X1" STAINLESS STEEL STRAP**

**3/8" X 2" STAINLESS STEEL NUTS & BOLTS**

**SECTION A-A**
NOTE:

1. STEPS SHALL BE LOCATED ABOVE THE EXIT PIPE IN A STRAIGHT LINE, 12" ON CENTER (O.C.) VERTICALLY.

2. 60" DIA. MANHOLES SHALL HAVE A 30" STANDARD RING AND COVER, J-MARK NO. J-1361 OR APPROVED EQUAL.

3. 48" DIA. MANHOLES SHALL HAVE A 24" STANDARD RING AND COVER, J-MARK NO. J-1161 OR APPROVED EQUAL.

4. MORTAR SHALL COVER THE LEVELING COURSES AND RING TO WITHIN 1" FROM THE SURFACE, AND SHALL BE USED ON THE INSIDE OF THE BARREL AT THE JOINTS.

5. ALL MANHOLES IN EXCESS OF 20' IN DEPTH SHALL HAVE AN INTERMEDIATE GRATING LOCATED AT THE CENTER OF THE DEPTH.

6. THE WORD "SEWER" SHALL BE BOLDLY CAST ON ALL COVERS.
SECTION A

1. STRAIGHT SECTIONS MAY BE LAID THROUGH THE MANHOLE WITH CROWN REMOVED.
2. SECTIONS NOT LAID THROUGH THE MANHOLE SHALL DROP A MINIMUM OF 0.2'.
3. BENCHES SHALL SLOPE 2 IN/FT.

SECTION B

REINFORCE BASE WITH #4'S AT 12' E.W., OR WWF 6X6-W10 x W10 ALL 3' CLEAR FROM BOTTOM.

NOTE:
4. THERE SHALL BE A JOINT MADE AT THE EDGE OF THE MANHOLE BASE.
5. THE TOP OF THE BASE SHALL BE LEVEL IN ALL CASES.
6. SHORT STUBS SHALL BE INSTALLED ON VCP AND RCP LINES WHERE THE LINE ENTERS AND LEAVES THE BASE.
4" DIA. SCHEDULE 40 STEEL POST, PAINTED YELLOW AND FILLED WITH CONCRETE

12" MH
10'

DISTANCE TO MANHOLE

NOTE:
2" CAPITAL LETTERS FACING MANHOLE

PAINTED YELLOW

CONCRETE

UNDISTURBED SOIL
NOTES: 1. PAVING SHALL COMPLY WITH LOCAL AUTHORITY JURISDICTION.
2. TRENCH WALLS TO BE SUPPORTED AS REQUIRED BY O.S.H.A.
3. MINIMUM COVER TO BE BELOW OFFICIAL STREET GRADE.
4. MINIMUM TRENCH WIDTH = PIPE O.D. + 12"
   MAXIMUM TRENCH WIDTH = PIPE O.D. +24"
CAST IRON RING AND COVER
WITH "SEWER" CAST IN

CONCRETE GRADE RINGS
ECCENTRIC CONE

PRECAST CONCRETE
MANHOLE BARREL
SECTIONS (ASTM C478)

Mastic between
joints

5 1/4"

12" (NOTE 3)

1/2"

18" MAX.

6"

48", 60", OR 72" DIA.

TYPICAL MANHOLE SECTION
WITH ECCENTRIC CONE

NOTES:
1. ALL JOINTS TO BE RUBBERNEK OR RAMNEK IF ABOVE THE WATER TABLE, FLEXIBLE PLASTIC SEALING COMPOUND IF BELOW THE WATER TABLE, AS PER SPECIFICATION.
2. ALL JOINTS SHALL BE DOUBLE SEALED WITH FLEXIBLE PLASTIC JOINT SEALING MATERIAL TO EXTRUDE INTO MANHOLE, AND BE TRIMMED OFF.
3. ALL MANHOLES PLACED IN THE "OPEN SPACE" AREAS SHALL BE INSTALLED WITH THE RING AND COVER AT AN ELEVATION THAT IS 6" ABOVE FINAL GRADE WITH A COLLAR OF CONCRETE. A MARKER POST SHALL BE INSTALLED NEAR BY. SEE MARKER POST DETAIL.
4. STEPS INSTALLED OVER DOWNSTREAM INVERT OF MANHOLE.
5. 60" OR LARGER DIAMETER MANHOLES REQUIRE A 30" OPENING.
6. SEE EITHER CAST-IN-PLACE OR PRECAST MANHOLE BASE DETAIL.
7. ALL COVERS TO BE CASTINGS, INC. J-1161 FOR 24" OPENING OR J-1361 FOR 30" OPENINGS.
8. RING AND COVER SHALL BE CASTINGS U-1161 FOR 24" AND J-1361 FOR 30".
9. AVOID 12" HIGH BARREL SECTIONS
NOTES:
1. MANHOLE SHALL HAVE EITHER CAST-IN-PLACE REINFORCED CONCRETE BASE OR PRECAST BASE.
2. SQUARE BASES ARE ACCEPTABLE (IF APPROVED BY AUTHORITY).
3. SEE STANDARD PLAN FOR SECTIONS A–A AND B–B.
*NOTE: 1) PREPOURED INVERTS ARE NOT ALLOWED
2) AVOID 12" BARREL SECTIONS.
NOTES:

1. SEE MANHOLE REINFORCEMENT DETAIL FOR BASE.
2. STEPS INSTALLED OVER DOWNSTREAM INVERT OF MANHOLE.
4" DIA. SCHEDULE 40 STEEL POST, PAINTED YELLOW AND FILLED WITH CONCRETE

SEWER MAIN SIZE

DISTANCE TO MANHOLE

NOTE:
2" CAPITAL LETTERS FACING MANHOLE

PAINTED SILVER BAND

PAINTED YELLOW

CONCRETE

UNDISTURBED SOIL

NOTE:
PROVIDE ONLY IF MANHOLE NOT IN TRAVELED WAY

STANDARDS & SPECIFICATIONS

REVISED:

MANHOLE MARKER POST

DATE:  DRAWING NO. 300-11
WHERE APPLICABLE
REPLACE EXISTING SEWER WITH DUCTILE IRON
PIPE CONFORMING TO ANSI A 15.1 OR PSM SDR
35 PVC PIPE CONFORMING TO ASTM D3034

UNDISTURBED
BEDDING

UNDISTURBED SOIL

2' MIN.
BOTH SIDES

WATER LINE

CLEAN, SELECT SAND OR SQUEEGEE

NOTE:
ANY SUBDrain UNDER THE SEWER
SHALL BE REPLACED SUCH THAT
NO FLOW SHALL ENTER THE
WATER LINE TRENCH.

SECTION A-A

TOP OF WATERLINE

EDGE OF TRENCH

EXISTING SEWER

WITH "D" LESS THAN 2'

NOTE:
ALL EXISTING SEWER DAMAGED DURING INSTALLATION
MUST BE REPLACED WITH PVC PIPE.

STORM SEWER AND
SANITARY SEWER
CROSSING

STANDARDS &
SPECIFICATIONS

REVISADO:

DATE:

DRAWING NO. 300-12
CENTER OF TEE BRANCH TO BE PLACED IN UPPER THIRD OF MAIN.

1/8 BEND CONNECTION TO TEE

CENTER OF TEE BRANCH TO BE PLACED IN UPPER THIRD OF MAIN.

1/8 BEND & SADDLE CONNECTION

NOTES:
1. BELLS SHALL NOT TOUCH THE SIDES OR BOTTOM OF THE BELL HOLE.
2. THE BARREL SECTION SHALL BE SUPPORTED THROUGHOUT ITS LENGTH.
3. SERVICE TAPS SHALL BE IN-LINE TEE OR MACHINE TAPPED. HAND TAPS SHALL NOT BE ALLOWED.
4. SERVICE LINES SHALL BE LOCATED 5' DOWNHILL FROM CENTERLINE OF THE LOT AND A MINIMUM OF 10' FROM THE WATER SERVICE LINE.
5. THE MIN. SERVICE LINE GRADE SHALL BE 1/4" PER FT.
6. JOINTS SHALL BE WATER TIGHT.
7. WHEN SERVICE STUB-INS ARE INSTALLED WITH THE SEWER MAIN, THEY SHALL BE EXTENDED AT LEAST TO PROPERTY LINE AND SHALL BE PLUGGED WITH A 2x4 MARKER FOR LOCATION OF END.
NOTES:
NOT A WMD STANDARD DETAIL
SIX INCH PRIVATE SEWERS ONLY
ACCEPTABLE PIPE TYPES - VCP, PVC, DIP

TERMINAL CLEANOUT
### Incremental Rainfall Depth/Return Period

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N.T.S.

STANDARDS & SPECIFICATIONS

REVISED: DESIGN STORMS

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**NOTE:**

1. DEPTH AT EACH DURATION = ONE HOUR RAINFALL DEPTH x RESPECTIVE DURATION

2. SEE FIGURE 400–6 FOR GRAPH OF THESE VALUES
THE DRAINAGE REPORT WITH PLAN DRAWINGS, AS NOTED BELOW HAS BEEN RECEIVED AND FOUND TO LACK THE INFORMATION NOTED. THIS INFORMATION MUST BE SUBMITTED BEFORE THE REPORT WILL BE ACCEPTED FOR REVIEW. PLEASE PROVIDE THE REQUIRED INFORMATION AND RETURN THIS CHECKLIST WITH YOUR SUBMITTAL.

SUBDIVISION: ____________________________
LOCATION: ____________________________
DATE SUBMITTED: ___________ TYPE OF REPORT: PRELIM _______ FINAL _______
SUBMITTED BY: FIRM: ____________________________
CONTACT: ____________________________ PHONE: ____________
SUBMITTED DATE: (1) ___________ (2) ___________ (3) ___________ (4) ___________
DATE APPROVED: ____________

CHECKLIST

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<td>GENERAL LOCATION AND DESCRIPTION</td>
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<td>4.</td>
<td>DRAINAGE BASINS AND SUB-BASINS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td>MAJOR BASIN DESCRIPTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>SUB-BASIN DESCRIPTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>DESIGN CRITERIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td>DEVELOPMENT MASTER PLAN DISCUSSION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>HYDROLOGIC CRITERIA DISCUSSION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.</td>
<td>HYDRAULIC CRITERIA DISCUSSION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>DRAINAGE FACILITY DESIGN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td>DISCUSSION OF PROPOSED FACILITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>DISCUSSION OF DRAINAGE PATTERNS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.</td>
<td>IMPACT ON OFFSITE FACILITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.</td>
<td>IMPACT ON MASTER PLAN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>DRAINAGE PLAN</td>
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</tr>
<tr>
<td>A.</td>
<td>TOPOGRAPHIC CONTOURS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>R.O.W. AND EASEMENTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.</td>
<td>DELINEATION OF BASIN AND SUB-BASINS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.</td>
<td>EXISTING DRAINAGE PATTERNS AND FACILITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.</td>
<td>PROPOSED DRAINAGE PATTERNS AND FACILITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F.</td>
<td>PROPOSED OUTFALL POINTS</td>
<td></td>
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<tr>
<td>G.</td>
<td>ROUTING OF OFFSITE DRAINAGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.</td>
<td>ROUTING FROM SITE TO MAJOR DRAINAGE WAY</td>
<td></td>
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</tr>
</tbody>
</table>

N.T.S.
## TIME OF CONCENTRATION

SUBDIVISION ___________________________ DATE __________________

<table>
<thead>
<tr>
<th>SUB-BASIN DATA</th>
<th>INITIAL/OVERLAND TIME (t₁)</th>
<th>TRAVEL TIME (t₄)</th>
<th>tₑ CHEK (URBANIZED BASINS)</th>
<th>FINAL tₑ</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGN (1)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AREA AC (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cₛ (3)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>LENGTH FT (4)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SLOPE % (5)</td>
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<td></td>
<td></td>
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<tr>
<td>t₁ MIN (6)</td>
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<td></td>
<td></td>
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<tr>
<td>LENGTH FT (7)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>SLOPE % (8)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>VEL FPS (9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t₄ MIN (10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMP tc (11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL LENGTH FT (12)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tₑ=(L/180)+10 MIN (13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIN (14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N.T.S.
**SUMMARY RUNOFF TABLE**
*(TO BE PLACED ON DRAINAGE PLAN)*

<table>
<thead>
<tr>
<th>DESIGN POINT</th>
<th>CONTRIBUTING AREA (ACRES)</th>
<th>RUNOFF 5YR (CFS)</th>
<th>PEAK 100YR (CFS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX</td>
<td>XX.XX</td>
<td>XX.X</td>
<td>XX.X</td>
</tr>
</tbody>
</table>

N.T.S.
$V_R$, PRODUCT OF VELOCITY AND HYDRAULIC RADIUS

NOTE:

1. MAIN CHANNEL: CAPACITY TO BE NO LESS THAN 20% OF 100-YEAR AT MAIN CHANNEL DEPTH. MAXIMUM 100-YEAR FLOW VELOCITY IS 7 FPS.

2. TRICKLE CHANNEL: MINIMUM CAPACITY TO BE 1% TO 3% OF 100-YEAR FLOW BUT NOT LESS THAN 1 CFS. CHANNEL TO BE CONSTRUCTED OF CONCRETE, GROUTED RIPRAP OR OTHER MATERIALS APPROVED BY THE CITY ENGINEER. SEE FIGURE 400-16 FOR REQUIREMENTS IN SANDY SOILS.

3. NORMAL DEPTH: FLOW DEPTH FOR 100-YEAR FLOW SHALL NOT EXCEED 5 FEET.

4. FREEBOARD: FREEBOARD TO BE A MINIMUM OF 1 FOOT.

5. MAINTENANCE ACCESS ROAD: MINIMUM WIDTH TO BE 12 FEET. CITY MAY REQUIRE ALL OR PART OF THE ROAD TO BE SURFACED.

6. EASEMENT/ROW WIDTH: MINIMUM WIDTH TO INCLUDE FREEBOARD AND MAINTENANCE ACCESS ROAD.

7. OVERBANK: FLOW IN EXCESS OF MAIN CHANNEL TO BE CARRIED IN THIS AREA. AREA MAY BE USED FOR RECREATION PURPOSES.
TYPE I

- 10' MINIMUM
- ALLOWABLE LONGITUDINAL SLOPE FROM 0.5% TO 3.0%
- *** SHOULDER WIDTH VARIES

TYPE II

- 10' MINIMUM
- ALLOWABLE LONGITUDINAL SLOPE FROM 0.5% TO 1.5%
- *** SHOULDER WIDTH VARIES

6" LAYER OF RIPRAP WITH D50=3", AND FILTER MATERIAL

TYPE III

- 10' MINIMUM
- ALLOWABLE LONGITUDINAL SLOPE LESS THAN 0.5%
- *** SHOULDER WIDTH VARIES

CONCRETE TRICKLE CHANNEL

NOTE:
1. SEE FIGURE 400— FOR CAPACITY OF ROADSIDE DITCH.
2. FOR STREET SLOPES GREATER THAN MAXIMUM ALLOWABLE, CHECK DROPS (2' MAXIMUM HEIGHT) WILL BE REQUIRED.

N.T.S.
<table>
<thead>
<tr>
<th>SLOPE (%)</th>
<th>DITCH TYPE I</th>
<th>DITCH TYPE II</th>
<th>DITCH TYPE III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VEL. (FPS)</td>
<td>Q (CFS)</td>
<td>VEL. (FPS)</td>
</tr>
<tr>
<td>0.5</td>
<td>1.4</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>1.0</td>
<td>2.5</td>
<td>11</td>
<td>3.3</td>
</tr>
<tr>
<td>1.5</td>
<td>3.4</td>
<td>20</td>
<td>NOT PERMITTED</td>
</tr>
<tr>
<td>2.0</td>
<td>4.3</td>
<td>26</td>
<td>NOT PERMITTED</td>
</tr>
<tr>
<td>2.5</td>
<td>5.0</td>
<td>32</td>
<td>NOT PERMITTED</td>
</tr>
<tr>
<td>3.0 (4)</td>
<td>5.7</td>
<td>37</td>
<td>NOT PERMITTED</td>
</tr>
</tbody>
</table>

**NOTES:**

1. SEE FIGURE 400–17 FOR GEOMETRY OF ROADSIDE DITCH.

2. VELOCITY IS BASED UPON THE SCS RETARDANCE CURVE "D". SEE FIGURE 400–13.


4. MAXIMUM PERMISSIBLE SLOPE FOR ROADSIDE DITCH IS 3.0%. SLOPE LIMITATION IS BASED ON A MAXIMUM FROUDE NUMBER OF 0.8 FOR TYPE I AND II AND 0.9 FOR TYPE III DITCH.

5. LINEARLY INTERPOLATE FOR INTERMEDIATE SLOPES.
RECTANGULAR CHANNEL SECTION

NOTE: CONCRETE TO BE REINFORCED WITH FIBERMESH PER MANUFACTURERS SPECIFICATIONS

COMBINATION CHANNEL SECTION

N.T.S.
MINIMUM 24" LAYER GROUTED TYPE L RIPRAP (TYP)

FLOW

PLAN

MINOR STORM FLOW DEPTH OR 24" MINIMUM

PROFILE

DEPRESS RUNDOWN ON CHANNEL BANK

SECTION A–A

N.T.S.

STANDARDS & SPECIFICATIONS

REVISED:

CHANNEL RUNDOWN

DATE: DRAWING NO. 400–12
EQUATION: \( Q = 0.56 \left( \frac{\tau}{n} \right)^{0.6} S^{2/3} \)

\( n \) is roughness coefficient in Manning formula, applicable to material in bottom of channel.

\( \tau \) is reciprocal of cross slope.

REFERENCE: H.R.B. PROCEEDINGS 1946, PAGE 150, EQUATION (14)

EXAMPLE (DETAILED LINES):
Given: \( S = 0.03 \)
\( \tau = 0.04 \)
\( T = 0.02 \)
\( Z/N = 1200 \)
\( d = 0.25 \)

Find: \( Q = 2.0 \) CFS

INSTRUCTIONS:
1. Connect \( Z/N \) Ratio with slope (\( S \)) and connect discharge (\( Q \)) with depth of flow. These two lines must intersect at turning line for complete solution.

2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH WITH \( Z = \frac{1}{n} \)

3. TO DETERMINE DISCHARGE ON IN PORTION OF CHANNEL HAVING WIDTH \( x \) DETERMINE DEPTH \( d \) FOR TOTAL DISCHARGE IN ENTIRE SECTION 3 THEN USE NOMOGRAPH TO DETERMINE \( Q \) IN SECTION 4 FOR DEPTH \( d = d - \frac{Z}{n} \)

4. TO DETERMINE DISCHARGE IN COMPOSITE SECTION FOLLOW INSTRUCTIONS 3.
TO DETERMINE DISCHARGE IN SECTION 4 AT ASSUMED DEPTH \( d \), OBTAIN \( Q \) FOR SLOPE \( Z/N \) AND DEPTH \( d \). THEN \( Q = Q_0 + Q_4 \)
REDUCTION FACTOR FOR ALLOWABLE GUTTER CAPACITY WHEN APPROACHING AN ARTERIAL STREET

REDUCTION FACTOR FOR ALLOWABLE GUTTER CAPACITY LOCAL AND COLLECTOR STREETS

APPLY REDUCTION FACTOR FOR APPLICABLE SLOPE TO THE THEORETICAL GUTTER CAPACITY TO OBTAIN ALLOWABLE GUTTER CAPACITY APPROACHING ARTERIAL STREET
MAJOR STORM

(A) SYMMETRICAL STREET SECTION

(B) NON-SYMMETRICAL STREET SECTION

NOTE: FOR NON-SYMMETRICAL STREET SECTION, ADJUST THE TOTAL GUTTER CAPACITY BY REDUCING THE ALLOWABLE GUTTER CAPACITY FOR THE GUTTER WITH THE HIGHER FLOWLINE.

N.T.S.
LEGEND:

QL = LOCAL RUNOFF FOR DESIGN STORM TRIBUTARY TO DESIGNATE INLET (CFS)
QI = RUNOFF INTERCEPTED BY INLET (CFS)
QCO = CARRY OVER RUNOFF PAST INLET (CFS)
QT = TOTAL RUNOFF AT INLET = QL + QCO
QP = RUNOFF IN PIPE

SUMMARY OF FLOWS FOR DESIGN EXAMPLE #4

<table>
<thead>
<tr>
<th>INLET</th>
<th>Q* ALLOW</th>
<th>QL</th>
<th>QCO</th>
<th>QT</th>
<th>QI</th>
<th>QCO</th>
<th>Q SEWER</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO. 1: 15’ TYPE R</td>
<td>__ 8.6</td>
<td>8</td>
<td>0</td>
<td>8</td>
<td>6.4</td>
<td>1.6</td>
<td>6.4</td>
<td>INLET ON Grade</td>
</tr>
<tr>
<td>NO. 2: 10’ TYPE R</td>
<td>7.2</td>
<td>4</td>
<td>1.6</td>
<td>5.6</td>
<td>3.7</td>
<td>1.9</td>
<td>10.1</td>
<td>INLET ON Grade</td>
</tr>
<tr>
<td>NO. 3: 10’ TYPE R</td>
<td>__10.4</td>
<td>8</td>
<td>1.9</td>
<td>9.9</td>
<td>9.9</td>
<td>0</td>
<td>20.0</td>
<td>INLET IN SUMP CONDITION</td>
</tr>
</tbody>
</table>

* MAXIMUM ALLOWABLE INLET CAPACITY AT MAXIMUM ALLOWABLE GUTTER CAPACITY, FROM FIGURE 400-28
### Vertical Dimension of Pipe (Inches)

| 15 to 36  | Maximum Allowable Distance Between Manholes and/or Cleanouts |
| 42 and Larger | 400 Feet |
|            | 500 Feet |

### Minimum Radius for Radius Pipe

<table>
<thead>
<tr>
<th>Diameter of Pipe</th>
<th>Radius of Curvature</th>
</tr>
</thead>
<tbody>
<tr>
<td>48” to 54”</td>
<td>28.50 Feet</td>
</tr>
<tr>
<td>57” to 72”</td>
<td>32.00 Feet</td>
</tr>
<tr>
<td>78” to 108”</td>
<td>38.00 Feet</td>
</tr>
</tbody>
</table>

Short radius bends shall not be used on sewers 42 inches or less in diameter.

### Minimum Pipe Diameter

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum Equivalent Pipe Diameter</th>
<th>Minimum Cross-Sectional Area</th>
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<tbody>
<tr>
<td>Main Trunk &amp; <em>Lateral from Inlet</em></td>
<td>18 Inches</td>
<td>1.77 Sq Ft</td>
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</tbody>
</table>

*Minimum size of lateral shall also be based upon a water surface inside the inlet with a minimum distance of 1 foot below the grate or throat.

### Manning's n-Value

<table>
<thead>
<tr>
<th>Sewer Type</th>
<th>Capacity Calculation</th>
<th>Velocity Calculation</th>
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</thead>
<tbody>
<tr>
<td>Concrete (Newer Pipe)</td>
<td>.013</td>
<td>.011</td>
</tr>
<tr>
<td>Concrete (Older Pipe)</td>
<td>.015</td>
<td>.012</td>
</tr>
<tr>
<td>Concrete (Preliminary Sizing)</td>
<td>.015</td>
<td>.012</td>
</tr>
<tr>
<td>Plastic</td>
<td>.011</td>
<td>.009</td>
</tr>
</tbody>
</table>

N.T.S.
(a) EXPANSION \((K_e)\)

<table>
<thead>
<tr>
<th>(\theta^+)</th>
<th>(\frac{D_2}{D_1} = 3)</th>
<th>(\frac{D_2}{D_1} = 1.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>20</td>
<td>0.40</td>
<td>0.40</td>
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<tr>
<td>45</td>
<td>0.86</td>
<td>1.06</td>
</tr>
<tr>
<td>60</td>
<td>1.02</td>
<td>1.21</td>
</tr>
<tr>
<td>90</td>
<td>1.06</td>
<td>1.14</td>
</tr>
<tr>
<td>120</td>
<td>1.04</td>
<td>1.07</td>
</tr>
<tr>
<td>180</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

* THE ANGLE \(\theta^+\) IS THE ANGLE IN DEGREES BETWEEN THE SIDES OF THE TAPERING SECTION

(b) PIPE ENTRANCE FROM RESERVOIR

BELL-MOUTH \(H_L = 0.04 \frac{V^2}{2g}\)

SQUARE EDGE \(H_L = 0.5 \frac{V^2}{2g}\)

GROOVE END U/S FOR CONCRETE \(H_L = 0.2 \frac{V^2}{2g}\)

(c) CONTRACTION \((K_c)\)

<table>
<thead>
<tr>
<th>(\frac{D_2}{D_1})</th>
<th>(K_c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>0.4</td>
<td>0.4</td>
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<tr>
<td>0.6</td>
<td>0.3</td>
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<tr>
<td>0.8</td>
<td>0.1</td>
</tr>
<tr>
<td>1.0</td>
<td>0</td>
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</table>
CASE I
CONDUIT ON 90° CURVES

NOTE: HEAD LOSS APPLIED AT PC FOR LENGTH

<table>
<thead>
<tr>
<th>RADIUS</th>
<th>K_b</th>
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<tbody>
<tr>
<td>1 X D</td>
<td>0.50</td>
</tr>
<tr>
<td>(2 TO 8) X D</td>
<td>0.25</td>
</tr>
<tr>
<td>(8 TO 20) X D</td>
<td>0.04</td>
</tr>
<tr>
<td>&gt;20 X D</td>
<td>0</td>
</tr>
</tbody>
</table>

*WHEN CURVES OTHER THAN 90° ARE USED, APPLY THE FOLLOWING FACTORS TO 90° CURVES
60° CURVE 85%
45° CURVE 70%
22–1/2" CURVE 40%

CASE II
BENDS WHERE RADIUS IS EQUAL TO DIAMETER OF PIPE

NOTE: HEAD LOSS APPLIED AT BEGINNING OF BEND

<table>
<thead>
<tr>
<th>9° BEND</th>
<th>K_b</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>0.50</td>
</tr>
<tr>
<td>60</td>
<td>0.43</td>
</tr>
<tr>
<td>45</td>
<td>0.35</td>
</tr>
<tr>
<td>22–1/2</td>
<td>0.20</td>
</tr>
</tbody>
</table>
BENDS AT MANHOLES

DEFLECTION ANGLE $\gamma$ DEGREES

NOTE: HEAD LOSS APPLIED AT OUTLET OF MANHOLE
CASE I
INLET OR STRAIGHT THROUGH MANHOLE ON MAIN LINE

USE EQUATION 400-4
Kj = 0.05

CASE II
INLET ON MAIN LINE WITH BRANCH LATERAL

USE EQUATION 400-4
Kj = 1.25

CASE III
MANHOLE ON MAIN LINE WITH 2° BRANCH LATERAL

CASE III

USE EQUATION 400-8

CASE IV
INLET OR MANHOLE AT BEGINNING OF LINE

N.T.S.
# CULVERT RATING

## Low Point Elevation

- $H_w$
- $D$
- $H$
- $h_o$
- $T_w$
- $S_o$
- $L$
- $S_o L$

## Culvert Data

- **Type**: 
- **Inlet**: 
- **Outlet**: $Q_{full}$, $V_{full}$

## Outlet Control Equations

1. $H_w = H + h_o - L S_o$
2. For $T_w < D$: $h_o = \frac{d_e + D}{2}$ or $T_w$ (whichever is greater)
   - $T_w > D$: $h_o = T_w$
3. For box culvert: $d_e = 0.315 \left( \frac{Q}{B} \right)^{2/3}$

## Table

<table>
<thead>
<tr>
<th>Q</th>
<th>$\frac{H_w}{D}$</th>
<th>$H_w$</th>
<th>$H$</th>
<th>$T_w$</th>
<th>$T_w &lt; D$</th>
<th>$T_w &gt; D$</th>
<th>$d_e$</th>
<th>$\frac{d_e + D}{2}$</th>
<th>$h_o$</th>
<th>$H_w$</th>
<th>$H_w$</th>
<th>ELEV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

## N.T.S.

### Standards & Specifications

- **Revised:**
- **Date:**
- **Drawing No.:** 400-24
SECTION—BASIN FLOOR

H = 3w/d
L = 4w/3
a = w/2
b = 3w/8
c = w/2
d = w/6
t = w/12

PROJECTED PIPE AREA
IMPACTS BAFFLE SURFACE

ALWAYS ALIGN CLEANOUT
NOTCHES IN BAFFLE AWAY
FROM THE PROJECTED
PIPE AREA

END VIEW—BAFFLE NOTCHES

FOR TWO PIPES OF EQUAL
SIZE AND SIMILAR FLOW
RATE
W₂ = 1.5 W₁
W₁ FROM DETAIL 400-52
BASED ON HIGHER FLOW
OF D₁ OR D₂

WIDTH ADJUSTMENT FOR
DOUBLE PIPE OUTLET

N.T.S.
<table>
<thead>
<tr>
<th>SHAPE</th>
<th>COEFFICIENT</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHARP CRESTED</td>
<td>-</td>
<td>H&lt;1.0</td>
</tr>
<tr>
<td>PROJECTION RATIO (H/P = 0.4)</td>
<td>3.4</td>
<td>H&gt;1.0</td>
</tr>
<tr>
<td>PROJECTION RATIO (H/P = 2.0)</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>BROAD CRESTED</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>W/SHARP U/S CORNER</td>
<td>2.6</td>
<td>CRITICAL DEPTH</td>
</tr>
<tr>
<td>W/ROUNDED U/S CORNER</td>
<td>3.1</td>
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N.T.S.

STANDARDS & SPECIFICATIONS

DATE:  DRAWING NO. 400-26

REvised:

WEIR FLOW COEFFICIENTS
**TYPE 1 OUTLET**

- Headwater for 5-year flow
- 100-year water surface
- 5-year water surface
- Grated inlet capacity greater than twice 5-year discharge
- Top of berm

**TYPE 2 OUTLET**

- Design head for weir flow
- 10-year minimum freeboard
- 100-year water surface
- 5-year water surface
- Pond invert (trickle channel)
- Headwater for 100-year flow
- Orifice opening trashrack required
- 100-year control at weir in front of box

**N.T.S.**
(A) ORIFICE PLATE DETAILS

NOTE: TRASHRACK CAPACITY TO BE 10 TIMES ORIFICE CAPACITY

(B) TRASHRACK AREA REQUIREMENTS

NOTE: FOR ORIFICE DIAMETER LESS THAN 3", USE A MINIMUM CLEAR OPENING OF 2 FT²
NOTE:

1. NUMBERS REFER TO SEQUENCE OF MORTAR INJECTION
2. LINERS MAY BE USED PROVIDED THE FROUDE NUMBER OF THE CHANNEL SECTION IS LESS THAN 0.8

N.T.S.
REINFORCED CONCRETE PIPE (RCP)

POLYVINYL CHLORIDE PIPE (PVC)

HIGH DENSITY POLYETHYLENE (HDPE) CORRUGATED METAL PIPE (CMP)

NATIVE SOIL: COARSE GRAINED SAND AND GRAVEL (50% OR MORE BY WEIGHT RETAINED ON # 40 SIEVE) CDOT CLASS A FILTER MATERIAL (SECTION 703.04)

FINE GRAINED SOIL (LESS THAN 50% RETAINED ON # 40 SIEVE) UDECO TYPE 1 FILTER MATERIAL ODOT FINE AGGREGATE FOR CONCRETE AASHTO M6 (SECTION 703.01)

* MINIMUM COVER SHALL NOT INCLUDE PAVEMENT.
** MAY BE REQUIRED IN AREAS WITH HIGH GROUNDWATER TABLE OR UNSUITABLE SUB-GRADE.

STORM DRAINAGE PIPE BEDDING DETAILS

STANDARDS & SPECIFICATIONS

DATE: DRAWING NO. 400–30

REVIEWED:
PLAN VIEW

DEFLECT 6" UNDERDRAIN AROUND MANHOLE BASE
UNDERDRAIN TO BE ENCASED IN FABRIC SOCK

COIL 2' OF TRACER WIRE IN TOP OF BOX

SEE DETAIL SHEET SS13
4" P.V.C. RISER
EXPANSION JOINT MATERIAL PLACED BETWEEN RISER & MANHOLE BARREL

RISER TO BE STRAPPED TO MANHOLE BARREL PRIOR TO BACKFILL

45° BEND

TRACER WIRE

6" SOLID WALL P.V.C. UNDERDRAIN

SIDE VIEW

N.T.S.

STANDARDS & SPECIFICATIONS

REvised:

UNDERDRAIN CLEANOUT DETAIL

DATE: DRAWING NO. 400-32
FLEXIBLE BUTYL RESIN SEALING COMPOUND

SECTION B-B

NOTES:

1. JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND GROUTED WITH MORTAR INSIDE AND OUTSIDE.

2. BASES SHALL BE REINFORCED WHEN THE DISTANCE FROM INVERT TO TOP OF COVER WILL EXCEED 15 FT. REINFORCING TO BE APPROVED BY CITY ENGINEER.

3. SQUARE BASES ARE ACCEPTABLE.

4. FOR PIPE 36” AND LARGER, OR WHERE CONDITIONS SUCH AS MULTIPLE PIPES WARRANT, A CONCRETE BOX BASE WILL BE REQUIRED.

(SEE CDOT STANDARD DRAWING M-604-20)

N.T.S.

SECTION A-A

FLEXIBLE BUTYL RESIN SEALING COMPOUND

4'-0" DIA. (PIPE 15" AND SMALLER)
5'-0" DIA. (PIPE 18" THROUGH 27")
6'-0" DIA. (PIPE 30" THROUGH 36")

6" MIN
SLOPE 2" PER FOOT
8" MIN.
1. ALL JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND PLASTERED WITH MORTAR 5/8" THICK AND EXTENDING 4" EACH SIDE OF JOINT INSIDE AND OUTSIDE.

2. MORTAR ON RISER RINGS IS ACCEPTABLE.

3. MANHOLES INSTALLED OUTSIDE OF STREET RIGHT-OF-WAY SHALL HAVE LOCKING COVERS.

4. "SEWER" TO BE IMPRINTED ON COVER.

5. FOR PIPE 36" AND LARGER, OR WHERE CONDITIONS SUCH AS MULTIPLE PIPES WARRANT, A CONCRETE BOX BASE WILL BE REQUIRED. (SEE CDOT STANDARD DRAWING M-604-20)

![Manhole Diagram]

**NOTES:**

- **ECCENTRIC CONE**
- **CEMENT MORTAR**
- **PRECAST MANHOLE RISERS**
- **DO NOT PLACE STEPS OVER PIPE**
- **ALUMINUM STEPS OR PLASTIC COVERED STEPS (M.A. INC. INC. PS-2-PF-S)**
  - CAST INTO SECTIONS AT 12"-16" VERTICAL SPACING AND ALIGNED

**TYPICAL MANHOLE SECTION WITH ECCENTRIC CONE**

- 4 WIRE HOOPS CAST INTO EACH SECTION AS SHOWN
- 18" MAX.
- 18" MAX.
- 4'-0" DIA. (PIPE 15" & SMALLER)
- 5'-0" DIA. (PIPE 18" THROUGH 27")
- 6'-0" DIA. (PIPE 30" THROUGH 36")

**ALTERNATE FLAT TOP**

- 4 WIRE HOOPS CAST INTO EACH SECTION AS SHOWN
- 4'-0" DIA.
- 5'-0" DIA. OR 6'-0" DIA. M.H.
- 5" FOR 6' DIA. FOR 6' DIA.
- 6"
ATTACH HINGE TO GRATING WITH (2) 3/8" DIA. BOLTS x 1" O.C. W/HEX NUTS. ATTACH HINGE TO PLATFORM WITH (2) 3/8 DIA. X 3" LG. RED HEADS OR EQUAL.

ALUMINUM GRATING, 3/16" x 1 1/4" BEARING BARS.

NOTE:
1. ALL JOINTS TO BE SET IN FLEXIBLE BUTYL RESIN SEALING COMPOUND AND PLASTERED WITH MORTAR 5/8" THICK AND EXTENDING 4" EACH SIDE OF JOINT INSIDE AND OUTSIDE.

TO BE USED WHEN THE DISTANCE FROM INVERT TO TOP OF COVER EXCEEDS 17 FT.

FOR MANHOLES OVER 17’ IN DEPTH

N.T.S.
TRANSITION CURB

MEET SHAPE OF NORMAL BARRIER

See Channel Layout on Sheet 2.

CURB FACE ASSEMBLY,
PLACE ENTIRE ASSEMBLY BEFORE POURING CONCRETE

SECTION B-B
TYPICAL END VIEW

NOTE: MANHOLE RING & COVER, STATION POINT AND OUTFLOW PIPE SHALL BE LOCATED AT THE SAME END OF THE INLET.

(DOTTED BARS ARE IN SECTION d-d)
SESSIONS c-c & d-d

N.T.S.
TABLE ONE ~ BAR LIST FOR CURB INLETS, TYPE "R"

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N.B. REFER TO TABLE TWO.

1) INCLUDE 18" NO. 4 BARS (SEE CHANNEL LAYOUT DETAIL).
2) SEE CURB FACE ASSEMBLY ON SHEET 2 AND
   CHANNEL LAYOUT DETAILS ON SHEET 4.

TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"

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NOTE: FOR L = 5', L = 10' AND L = 15'

REGULAR INLETS: TOTAL QUANTITIES NEEDED ARE INSIDE OF THE HEAVY BLACK LINE.
DROP BOX INLETS: TOTAL QUANTITIES NEEDED ARE OUTSIDE OF THE HEAVY BLACK LINE.

STEEL WEIGHTS DO NOT INCLUDE STRUCTURAL STEEL.

BAR BENDING DIAGRAMS ~ (Dimensions are Out-To-Out of bar)

N.T.S.

STANDARDS & SPECIFICATIONS

REVISED: CURB INLET TYPE R

SHEET 3 OF 4

DATE: DRAWING NO. 400-38
TOP OF COVER

1" (25mm) LETTERING
(RECESSED FLUSH)

1/2" [13mm] LETTERING
RECESSED

1" (25mm) LETTERING
RECESSED

ELBERT COUNTY
DRAINS TO RIVER

MADE IN USA

BOTTOM OF COVER

23 7/8" DIA.
[606mm]

3" [76mm]

5/8" [16mm]

7 1/4" [184mm]

7/8" [22mm]

20 11/16" DIA.
[526mm]

3/8" [10mm]

PICKSLOT DETAIL

COVER: GRAY IRON ASTM A48 CL35 B
LOAD RATING: H=20
COVER: 135 LBS 61kg
PRODUCT NUMBER 00240562
√ MACHINED SURFACE
EAST JORDAN IRON WORKS #2405A
PRODUCT #240562

N.T.S.
STORM OR SANITARY SEWER CROSSING UNDER WATER MAIN

IF $d_3 > 18''$, ENCASEMENT NOT REQUIRED

NOTES:

1. CONCRETE COLLAR AROUND STORM SEWER JOINTS MAY BE ACCEPTED WITH WRITTEN APPROVAL BY THE CITY ENGINEER AND ONLY FOR PIPE 30'' OR LARGER.

2. CONCRETE TO BE CAST AGAINST UNDISTURBED SOIL OR SHORING.

3. LENGTH OF ENCASEMENT SHALL EXTEND AT LEAST 10-FEET EACH SIDE OF WATER MAIN.

4. UNLESS OTHERWISE NOTED ON PLAN/PROFILE DRAWINGS, ENCASEMENTS NEED NOT BE REINFORCED.

5. FILLER MATERIAL BETWEEN CONDUITS TO BE:

   a) APPROVED COMPRESSIBLE MATERIAL SUCH AS STYROFOAM, ETC. IF $d_4 \leq 6''$.

   b) COMPACTED BACKFILL, IF $d_4 > 6''$.

6. SHORING OR SHEETING, IF USED, TO BE CUT OFF AT TOP OF ENCASEMENT.

STORM OR SANITARY SEWER CROSSING OVER TOP OF WATER MAIN

ENCASEMENT REQUIRED REGARDLESS OF DIMENSION $d_3$

(SEE NOTE 1 FOR SPECIAL CASES)

N.T.S.

STANDARDS & SPECIFICATIONS

REVISED:

ENCASEMENT FOR CONDUIT CROSSINGS

DATE: DRAWING NO. 400-40
10' UTILITY, ROW
SNOW STORAGE & SIGNAGE ESM'T

12' DRIVING LANE

12' DRIVING LANE

4' SHOULDER

6'

6'

3.1 MAX 4:1

2%

2%

18'' MIN.

4:1

4.1 MAX

MINIMUM CULVERT SIZE = 18''

NATURAL GROUND

ROW 10' UTILITY, SNOW STORAGE & SIGNAGE ESM'T
MINIMUM CULVERT SIZE = 18"

LOCAL TYPE II (ASPHALT)
W/GRAVEL SHOULDERS

LOCAL TYPE II (ASPHALT)

4' COMBINATION CURB,
GUTTER AND WALK (SF)
VERTICAL CURB
PERMISSIBLE.

5' COMBINATION CURB,
GUTTER AND WALK (MF)
VERTICAL CURB
PERMISSIBLE.

N.T.S.
NOTE:

1. DEVELOPER TO INSTALL INLAY & PAVEMENT MARKINGS SUCH AS ARROWS, STOP BARS & ONLY SYMBOLS PER CITY SPECIFICATIONS.

2. TRAFFIC CONTROL SIGNS TO BE INSTALLED PER CITY SPECIFICATIONS BY DEVELOPER.

THE CROOVED RECTANGULAR PORTION OF THE RAMP AND CUTTER SHALL BE INTEGRAL DAVIS COLOR TILE RED (3 POUNDS OF COLOR PIGMENT NO. 1117 PER SACK OF CEMENT) AND SHALL BE CURED WITH CLEAR CURING COMPOUND.
Corner clearance requirements for uncontrolled local street intersections to maintain adequate sight distance.

Design speed of thru roadway (mph) | Minimum sight distance for stopped vehicle (ft.) | Grade correction distance (ft.)
--- | --- | ---
25 | 250 | 3% 6% 3% 6%
30 | 300 | 25 0 -10 +10 +20
35 | 350 | 30 0 -10 +10 +20
40 | 400 | 35 -10 -15 +10 +25
45 | 450 | 40 -10 -20 +10 +30
45 | 450 | 45 -15 -25 +15 +40

N.T.S.
CUL-DE-SAC MAY HAVE A MAXIMUM LENGTH OF 500', MEASURED FROM INTERSECTION Q TO RADIUS POINT. (TYP.)

LOCAL—LOW VOLUME

CUL-DE-SAC MAY HAVE A MAXIMUM LENGTH OF 500', MEASURED FROM INTERSECTION Q TO RADIUS POINT. (TYP.)

LOCAL—STANDARD RESIDENTIAL

LOCAL—STANDARD COMMERCIAL/INDUSTRIAL

NOTE: THESE STANDARDS MAY BE APPLIED TO ASYMMETRICAL CUL-DE-SACS.
- DESIGN ENGINEER SHOW REFERENCE ELEVATIONS AT THESE POINTS.
0.5" EXPANSION JOINT MATERIAL AT EACH END OF ALL CURB RETURNS AND AT 150 FEET MAX. SPACING

10' MAX. SPACING BETWEEN CONTRACTION JOINTS

BACK OF CURB

FL

0.25" MAX. GROOVE JOINT

0.75" X 24" GREASED DOWEL BAR WITH EXPANSION CAP

0.5" PREMOLDED NON-EXTRUDING EXPANSION JOINT MATERIAL

LAYOUT

1/3 CONCRETE

DEPTH (1.5" MIN.)

EXPANSION JOINT

CONTRACTION JOINT

6" VERTICAL CURB & GUTTER

6" VERTICAL MEDIAN CURB & GUTTER

NOTES:

1. EXPANSION JOINT MATERIAL SHALL BE NON-EXTRUDING AND RESILIENT TYPE TO MEET AASHO SPEC. M-213.

2. ANY OVER-EXCAVATION SHALL BE REPLACED WITH GRANULAR BACKFILL COMPACTED TO 95% MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-698.

3. TYPE 2 SPILL CURB MAY BE REQUIRED FOR SPECIAL CONDITIONS.

4. GUTTER CROSS SLOPE SHALL BE 1/2"/FT. WHEN DRAINING AWAY FROM CURB AND 1"/FT. WHEN DRAINING TOWARD CURB.

5. TYPE 2 CURB & GUTTER IS FOR USE IN COMMERCIAL, ARTERIALS AND COLLECTOR STREETS.

N.T.S.

STANDARDS & SPECIFICATIONS

REVISED:

6" VERTICAL CURB AND GUTTER

DATE: DRAWING NO. 500-13
0.5" EXPANSION JOINT MATERIAL
AT EACH END OF ALL CURB RETURNS
AND AT 150 FEET MAX. SPACING

10' MAX.
SPACING BETWEEN
CONTRACTION
JOINTS

FL

BACK OF CURB

LAYOUT

0.75" X 24" GREASED
Dowel Bar with
Expansion Cap

0.5" PREMOLDED
NON-EXTRUDING
EXPANSION JOINT
MATERIAL

1/3 CONCRETE
DEPTH (1.5" MIN.)

EXPANSION JOINT

CONTRACTION JOINT

2'-0"

11"

3'-7"

2%

6"

2'-3"

6-1/2"

3' 8-1/2"

NOTES:

1. EXPANSION JOINT MATERIAL SHALL BE NON-EXTRUDING AND
RESILIENT TYPE TO MEET AASHTO SPEC. M-213.

2. ANY OVER-EXCAVATION SHALL BE REPLACED WITH GRANULAR
BACKFILL COMPACTED TO 95% MAXIMUM DRY DENSITY AS
DETERMINED BY ASTM D-698.

N.T.S.

STANDARDS &
SPECIFICATIONS

REVISED:

4" MOUNTABLE
CURB, GUTTER
AND WALK

DATE:

DRAWING NO. 500-14
VERTICAL CURB, GUTTER & SIDEWALK

SECTION A-A

N.T.S.

STANDARDS & SPECIFICATIONS

REVISED:

CROSS PAN
INDUSTRIAL/ARTERIAL/COLLECTOR STREET

DATE:

DRAWING NO. 500-15
COMBINATION CURB, GUTTER & SIDEWALK TYPE 1

SECTION A-A

FIBER MESH OR OTHER REINFORCEMENT APPROVED BY CITY ENGINEER

24" LONG DOWELS IF NOT POURED MONOLITHICALLY

TOOLED JOINTS 6" O.C.

RADIUS POINT

SIDEWALK RAMP, TYPE L-1

NO Lip

N.T.S.

STANDARDS & SPECIFICATIONS

DATE:

REVISED:

CROSS PAN LOCAL STREET

DRAWING NO. 500-16
2' x 2' Prestressed, Reinforced Concrete Truncated Dome Tiles with 0.9 in (23 mm) Nominal Diameter, a Height of Nominal 0.2 in (5 mm) and Spacing of 2.35 in (60 mm) Center to Center.

6.5' Combination Curb, Gutter and Sidewalk 25.0' Radius

3' Min. Sidewalk as shown on plans

SECTION A'-A

SECTION B-B

N.T.S.

STANDARDS & SPECIFICATIONS
REVISED: COMBINATION CURB, GUTTER AND SIDEWALK

DATE: DRAWING NO. 500-17
2' x 2' PRESTRESSED, REINFORCED CONCRETE TRUNCATED DOME TILES WITH 0.9 IN (23 MM) NOMINAL DIAMETER, A HEIGHT OF NOMINAL 0.2 IN (5 MM) AND SPACING OF 2.35 IN (60 MM) CENTER TO CENTER.

6' VERT. CURB, GUTTER ATTACHED 8' SIDEWALK 30.0' RADIUS

3' MIN. SIDEWALK AS SHOWN ON PLANS

6 1/2' MIN.

2' MIN.

SECTION A'-A

TOP OF PAVEMENT

GUTTER VARI E 6"-8"

SECTION B-B

N.T.S.

VERT. CURB, GUTTER, ATTACHED SIDEWALK
1. Horizontal geometry of the back of walk varies depending on the curb radius and pre-existing physical obstructions. The design shall adequately provide a minimum width route behind the ramp with an aesthetically pleasing appearance.

2. 1/2" wide x 1/2" deep grooves shall be spaced at 12".

3. The ramp and wings shall be textured with a coarse broomed finish.

N.T.S.
TYPE 1 OR 2 COMBINATION CURB, GUTTER & SIDEWALK

18'-0" (MIN. 2 CAR)
9'-0" (MIN. 1 CAR)
30'-0" (2 CAR)
21'-0" (1 CAR)

NO LIP

1'-0"

6'-0"

1'-0"

N.T.S.

STANDARDS & SPECIFICATIONS

REVISED:

DATE:

500-20

DRAWING NO.

DRIVEWAY APRON LOCAL STREET
SUBBASE MATERIAL CARRIED THROUGH SHOULDTER

SUBBASE MATERIAL NOT CARRIED THROUGH SHOULDER

CURB AND GUTTER SECTION

NOTE: WHERE THE BOTTOM OF SELECT MATERIAL IS GREATER THAN 4'-0" BELOW PAVEMENT, THE UNDERDRAIN PIPE IS TO BE COINCIDENT WITH THE BOTTOM OF SELECT MATERIAL, AND THE TRENCH DEPTH AND BACKFILL QUANTITY INCREASED ACCORDINGLY.

N.T.S.

STANDARDS & SPECIFICATIONS

REvised:

STANDARD PIPE
UNDERDRAINS

DATE: DRAWING NO. 500-23
ELEVATION OF BOTTOM OF SAND OR ROCK TO CONFORM TO BOTTOM OF CURB ELEVATION

FILTER FABRIC 1" MIN. OVERLAP

CLASS A 3/4" WASHED ROCK

4", 6" OR 8" PIPE

1'-6"

2"

1/2"/FT

WIDTH = W MINUS 1'-0"

W (RAISED MEDIAN)

WITH SUBSURFACE MATERIAL

SUBBASE MATERIAL (TYP.)

CLASS A OR 3/4" WASHED ROCK

4", 6" OR 8" PIPE

4"

1'-6"

N.T.S.

STANDARDS & SPECIFICATIONS

REVISED:

PIPE UNDERDRAIN FOR RAISED IRRIGATED MEDIANS

DATE:

DRAWING NO. 500-24
2" x 4" RAIL
1" x 4" PICKETS
4" x 4" POST
WITH 8' SPACING

4" x 4" POST
2" x 4" RAIL
1" x 4" PICKETS

PROVIDE A 1” MOUND AROUND EACH POST TO DRAIN AWAY FROM POST

NOTE: PICKETS SHOULD ABUT AGAINST EACH OTHER.

SUBGRADE

12” DIA. CONCRETE PIER

SUBGRADE

FRONT VIEW

SIDE VIEW

N.T.S.

STANDARDS & SPECIFICATIONS

Date: 

DRAWING NO. 500-25
NOTES:

1) A STRUCTURAL ENGINEERING DESIGN FOR THE WALL AND FOUNDATION SHALL BE SUBMITTED TO THE CITY FOR APPROVAL.

2) COLORS FOR SPLIT CONCRETE BLOCKS SHALL BE LIMITED TO:
   BROWN # 277, TAN # 276, RED # 265 AS MANUFACTURED BY THREE-COOPER OR APPROVED EQUAL.

---

**CONCRETE BLOCK SOUND WALL**

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STANDARDS & SPECIFICATIONS

REVISED: 

DATE: 

DRAWING NO. 500-26
NOTE:

SIDEWALK UNDERDRAIN IS TO BE USED WHEN THE SIDEWALK
LONGITUDINAL GRADIENT IS 3% OR MORE AND WHEN THE
UNDERLYING SOIL HAS 34% OR MORE PASSING THE NO.
200 SIEVE AND HAS A PI OF 30 OR MORE.

SIDEWALK UNDERDRAINS SHOULD BE TIED INTO THE STORM
SEWER SYSTEM AT POINTS ABOUT A CITY BLOCK APART.
UNDERDRAIN RUNS MUST NOT EXCEED 1,000 FEET IN LENGTH
WITHOUT DISCHARGING INTO THE STORM DRAIN SYSTEM OR
INTO AN OPEN DRAIN. THE LENGTH OF RUN MAY BE INCREASED
UP TO AN ADDITIONAL 1,000 FEET IF 8" DIAMETER PIPE IS USED
IN THE DOWNSTREAM 1,000 FEET SECTION OF THE RUN.

D = ALL PIPE TO BE 6" UNLESS OTHERWISE
NOTED. CORRUGATED PERFORATED
PLASTIC PIPE OR ALTERNATE TYPES
AS APPROVED BY CITY ENGINEER.

* THIS PORTION TO BE DELETED
WHEN SIDEWALK IS ADJACENT
TO CURB OR CURB AND GUTTER
WITH NO UTILITY STRIP

STANDARDS &
SPECIFICATIONS

REVISED:

STANDARD SIDEWALK
UNDERDRAIN

DATE: DRAWING NO. 500-27

N.T.S.
TYPE 1 AND TYPE 1A ALUMINUM AND STAINLESS STEEL DRIVEN MONUMENTS

MONUMENTS ARE INSTALLED BY ATTACHING THE PROPER SIZE CAP TO ONE END OF A SECTION OF ROD AND A 3" LONG x 3/4" STAINLESS STEEL DRIVER TO THE OTHER END. DRIVER IS THEN PLACED OVER THE STAINLESS STEEL DRIVER FOR THE HAMMER TO CONNECT. WHEN ADDITIONAL SECTIONS OF ROD ARE NEEDED, THEY ARE ATTACHED USING A SET OF REPLACEMENT WASHERS. TAPS ARE INSTALLED IN THE DRIVING END OF THE MONUMENT. THE ROOF SECTION IS DRIVEN BY USING THE PROPER HAMMER WITH A SOFT FACE OR BY USING A POWER ADAPTER WITH A GAS-COOLED HAMMER.

TYPE 1 MONUMENTS TYPICALLY USE A THREE-FOOT SECTION OF ROD. WHEN SUBSURFACE ROCK OR CONCRETE IS ENCOUNTERED LESS THAN THREE-FEET BELOW THE GROUND Surface, THE ROD SHALL BE EXPOSED IN THE ROD OR CONCRETE IS LEFT IF WITH A GROUT MATERIAL. THE ROD MAY BE SHOVED INTO THE CONCRETE TO ACCOMPLISH THE LOCATION.

TYPE 1A MONUMENTS SHALL BE DRIVEN TO REFERENCE BY THREHOLD ADDITIONAL SECTIONS UNTIL THE FIRST SECTION. ADDITIONAL SECTIONS REQUIRE A SET OF LOCK WASHERS. REFRACTION IS DEFINED AS ONE INCH OF MONUMENT WITH FOUR HEAVY BLOWS OF A 12 LB. HAMMER, A DRIVEN CAP IS RECOMMENDED FOR A DRIVEN CAP WHEN A CUT CAP IS USED. A SOFT-FACED HAMMER IS REQUIRED TO BE USED ON THE CAP ITSELF.

TYPE 2 AND TYPE 2A ALUMINUM FINNED ROD MONUMENTS

TYPE 2 MONUMENT IS USED FOR HORIZONTAL CONTROL MONUMENTS WHERE LOOSE MATERIAL IS ENCOUNTERED. THE GROUND CAP IS TO BE USED ON THE END OF THE TOP-FOOT ROD AND THE CAPS ON THE OPPOSITE END OF THE DRIVING END ARE TO BE USED TO ACCOMPLISH THE CAP. ALL METAL SEPARATION IS REQUIRED FOR USE AS A HORIZONTAL CONTROL MONUMENT. THE ADDED SECTIONS WHICH ARE NOT FINNED, SHOULD BE DRIVEN FIRST. THE NUMBER OF MONUMENTS TO BE ADDED WILL VARY WITH NEEDS AND TYPE OF SOIL. THE TYPE 2A MONUMENT NOTE ABOVE ALSO APPLIIES TO THE TYPE 2A MONUMENT.

TYPE 3 AND TYPE 3A ALUMINUM PIPE MONUMENTS

THIS MONUMENT IS USED TO MONUMENT AN ALUMINUM CAP. THE INSTALLATION OF THIS MONUMENT IS REQUIRED TO BE GOOD IN ACCORDANCE WITH THE LOCATIONAL PLACED STATURES. MINE 3G, ARTICLES 50 AND 5-1; ALSO REFER TO THE CONCRETE MONUMENT. THE MOUNT MONUMENT THE RAISED WALL SHALL BE PLACED ON THE CAP.

TYPE 4 BRASS CAP MONUMENT

THIS MONUMENT IS PLACED IN CONCRETE, SUCH AS BRIDGE SUPER STRUCTURE CONCRETE. IT IS PLACED ABOVE A POSTING SUPPORT OVER THE ADJACENT OR OVER A FERRO, AN ALTERNATE PLACEMENT IS VERTICALLY IN THE MOUNT MONUMENT OR IN AN ELEVATION REFERENCE IS DESIRED AND IT IS POSSIBLE TO LEAVE A CONCRETE FOR AN ELEVATION MONUMENT.

TYPE 5 BRASS CAP MONUMENT

THIS MONUMENT IS PLACED IN LOCATIONS WHERE A TYPE 1 OR TYPE 1A MONUMENT CANNOT BE PLACED. A COMMON APPLICATION IS IN A LARGE RIBBON WHERE A PROPERTY CORNER HAS BEEN PLACED, THIS MONUMENT COULD ALSO BE PLACED IN A SIDEWALK.

WITNESS POSTS

THE WITNESS POST, WHEN REQUIRED, WILL BE SUPPLIED BY THE DIVISION AND INSTALLATION SHALL BE IN RIBBON IN THE WORK. IT SHALL BE GIVEN KEEPS TO PREPARE FOR THE WORK, A WARNING WILL BE PLACED IN ADDITION TO THE WARNING. A REINS BASKET WILL BE USED IN PLACE OF THE WARNING. THIS POST SHALL BE PLACED IN A DJ 6.12.1.

SELF-LOCKING WASHERS

A SET OF THIS WASHERS SHALL BE USED AT THE JOINTS AND FINNED CAP JOINTS, BUT NOT AT TIP JOINTS.

TEMPORARY MONUMENTS

A TEMPORARY ALUMINUM CAP IS USED ON A NO. 5 REBAR.
BMP LEGEND

CD  CHECK DAM
CF  CONSTRUCTION FENCE
DD  DIVERSION DITCH
IP  INLET PROTECTION
SB  SEDIMENT BASIN
ST  SEDIMENT TRAP
SM  SEEDING AND MULCHING
SF  SILT FENCE
VTC  VEHICLE TRACKING CONTROL
STB  STRAW BALE BARRIER
LOC  LIMITS OF CONSTRUCTION
CHECK DAM

Definition
Small temporary dam constructed across a swale or drainage ditch.

Purposes
To reduce the velocity of stormwater flows and erosion of the swale or ditch.

ROCK CHECK DAM

Median 12 inch Rock
Flow

L=The distance such that points A and B are of equal elevation

SPACING BETWEEN CHECK DAMS
CONSTRUCTION FENCE

15 FT. (MAX)

2'-6" (MIN)

12" (MIN)

ORANGE PLASTIC FENCE
11 GA. WIRE CLAMP

TIES FOR "STUDDED TEE"

"STUDDED TEE" LINE POST
TEMPORARY DIVERSION DITCH

DEFINITION
A TEMPORARY RIDGE OF COMPACTED SOIL LOCATED AT THE TOP, MIDSLOPE, OR BASE OF A DISTURBED AREA.

PURPOSE
1. TO DIVERT STORM RUNOFF FROM HIGHER DRAINAGE AREAS AWAY FROM THE UNPROTECTED SLOPES TO A PERMANENT CHANNEL OR TEMPORARY CHANNEL DIVERSION.
2. TO DIVERT SEDIMENT-LADEN RUNOFF FROM THE MIDSLOPE OF A DISTURBED AREA TO A TEMPORARY SLOPE DRAIN.
3. TO DIVERT SEDIMENT-LADEN RUNOFF FROM THE BASE OF A DISTURBED AREA TO A SEDIMENT TRAPPING FACILITY.
INLET PROTECTION

**Definition**

A sediment filter or an excavated impounding area around a storm drain drop inlet or curb inlet.

**Purposes**

To reduce sediment from entering storm drainage systems prior to permanent stabilization of disturbed areas.

**Special Application**

This method of inlet protection is applicable where heavy concentrated flows are expected, but not where ponding around the structure might cause...
INLET PROTECTION

Definition

A sediment filter or an excavated impounding area around a storm drain or curb inlet.

Purposes

To reduce sediment from entering storm drainage systems prior to permanent stabilization of disturbed area.

STORM DRAIN INLET PROTECTION
TEMPORARY SEDIMENT TRAP

Definition
A small temporary ponding area, formed by constructing an earthen embankment with a rock-covered outlet across a drainage swale, or by excavation of a depression below original grade. Relative elevations should contain all runoff within the trap area.

Purposes
To detain sediment-laden runoff from disturbed areas long enough to allow the majority of the sediment to settle out.

EXCAVATED SEDIMENT TRAP

Rock-Lined Inlet

Diversion Dike

Original Grade

Rock-Lined Outlet

1’ Min.

EMBANKMENT SEDIMENT TRAP

1’ Min.

Maximum Sediment Storage Clean-out Level (1/2 total depth)

3:1

5’ Max.

4’ Min.

Rock-Lined Outlet

Rock Lining: 9” thick layer of 6” rock on 3” thick layer of 1/2”–3/4” filter
TEMPORARY SEDIMENT BASIN

DEFINITION

A TEMPORARY BASIN WITH A CONTROLLED STORM WATER RELEASE STRUCTURE, FORMED BY EXCAVATION OR CONSTRUCTION OF AN EMBANKMENT OF COMPACTED SOIL, REQUIRED FOR ALL DRAINAGE AREAS GREATER THAN 1 ACRE.

PURPOSE

TO DETAIN SEDIMENT-LADEN RUNOFF FROM DISTRIBUTED AREAS TO ALLOW THE MAJORITY OF THE SEDIMENT TO SETTLE OUT.

LIMITING GEOMETRY:
L/W GREATER THAN 2.0

REQUIRED VOLUME TO CREST OF EMERGENCY SPILLWAY = 1800 CUBIC FEET PER ACRE OF DRAINAGE AREA. SHOULD BE CLEANED OUT PRIOR TO BECOMING HALF FULL.

100-YEAR OR LARGER EMERGENCY SPILLWAY

EMERGENCY SPILLWAY SHOULD NOT BE CONSTRUCTED OVER FILL MATERIAL

INFLOW

OUTLET SEE DETAIL B
TEMPORARY SEDIMENT BASIN
OUTLET DETAIL B

SEE DETAIL OF RISER PIPE

SEDIMENT BASIN SURFACE

GRAVEL (1-1/2" ROCK) AROUND RISER

4" DIA. RISER PIPE W/END

1-1/2" DIA. AIR VENT IN THREADED CAP

WATER QUALITY OUTLET HOLES, 1/4" DIA.

SCHEDULE 40 PIPE

6 COLUMNS

RISER PIPE DETAIL

STANDARDS & SPECIFICATIONS

REVISED:

TEMPORARY SEDIMENT BASIN OUTLET

DATE: 485

DRAWING NO. 600-09
SEEDING AND MULCHING INSTALLATION NOTES

1. All brands furnished shall be free from such noxious seeds as Russian or Canadian thistle, course fescue, European bindweed, Johnson grass, Knap weed, and leafy spurge.

2. The seeder shall furnish to the Contractor a signed statement certifying that the seed furnished is from a lot that has been tested by a recognized laboratory. Seed that has become wet, moldy, or otherwise damaged in transit or in storage, will not be acceptable. Seed tickets shall be provided to the Engineer upon request.

3. Drill seeding mix shall conform to the seed mix table.

4. If the seed available on the market does not meet the minimum purity and germination percentages specified, the subcontractor must compensate for a lesser percentage of purity or germination by furnishing sufficient additional seed to equal the specified product. The tags from the seed mixes must be supplied to contractor and forwarded to the Engineer.

5. The formula used for determining the quantity of pure live seed (PLS) shall be (pounds of seed) X (purity) X (germination) = pounds of pure live seed (PLS).

6. Perminate seed mix shall be used unless otherwise approved by the Engineer.

7. All areas to be seeded and mulched shall have native topsoil or approved soil amendments spread to a depth of at least 6 inches (loose depth). Haul roads and other compacted areas shall be loosened to a depth of 6 inches prior to spreading topsoil.

8. Soil is to be thoroughly loosened (tilled) to a depth of at least 6 inches prior to seeding. The top 6 inches of the seed bed shall be free of rocks greater than 4 inches and soil clods greater than 2 inches. Seeding over any compacted areas that haven’t been thoroughly loosened shall be rejected.

9. Seed is to be applied using a mechanical drill to a depth of 1/4 inch. Row spacing shall be no more than 6 inches. Material used for mulch shall consist of long-stemmed straw. At least 50 percent of the mulch, by weight, shall be 10 inches or more in length. Mulch shall be applied and mechanically anchored to a depth of at least 2 inches. Mulch shall be applied at a rate of 4000 Lb. of straw per acre.

10. If the permittee demonstrates to the Engineer that it is not possible to drill seed, seed is to be uniformly broadcast at two times the drilled rate, then lightly harrowed to provide a deed depth of approximately 1/4 inch, then rolled to compact, then mulched as specified above.

11. Seeding and mulching shall be completed within 30 days of initial exposure or 7 days after grading is substantially complete in a given area (as defined by the Engineer). This may require multiple mobilizations for seeding and mulching.

12. Mulch shall be applied within 24-hours of seeding.

13. Tackifier should be utilized to help with straw displacement.
DRILL SEEDING MIX

1. Seed shall be drilled only (no hydroseed).

2. Seed type and amount of pure live seed (PLS) required per acre shall be:

### NATIVE AREA SEED MIX

<table>
<thead>
<tr>
<th>SEED NAME</th>
<th>BOTANIC NAME</th>
<th>% IN MIX</th>
<th>POUNDS OF PLS PER ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slender Wheatgrass</td>
<td>Agropyron Trachycaulum</td>
<td>0%</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Mountain Brome</td>
<td>Bromus Marginatus</td>
<td>0%</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Indian Ricegrass</td>
<td>Oryzopsis Hymenoides</td>
<td>0%</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Thickspike Wheatgrass</td>
<td>Agropyron Dasytachyum</td>
<td>0%</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Western Wheatgrass</td>
<td>Agropyron Smithii</td>
<td>0%</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Arizona Fescue</td>
<td>Festuca Arizonicana</td>
<td>0%</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Sandburg Bluegrass</td>
<td>Poa Sandbergii</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Rocky Mountain Penstemon</td>
<td>Penstemon Strictus</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Blue Flax</td>
<td>Linium Lewsi</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Mountain Lupine</td>
<td>Lupinus Alpestris</td>
<td>0%</td>
<td>1 lbs.</td>
</tr>
<tr>
<td>Lance-leaved Coreopsis</td>
<td>Coreopsis Lanceolata</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Rubber Rabbitbrush</td>
<td>Chysothanux Nauseosus</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Fringed Sagebrush</td>
<td>Artemisia Frigida</td>
<td>0%</td>
<td>0.3 lbs.</td>
</tr>
<tr>
<td>Prairie Sage</td>
<td>Artemesia Ludoviciana</td>
<td>0%</td>
<td>0.2 lbs.</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>22.5 lbs.</strong></td>
</tr>
</tbody>
</table>

### SWALES/DRAINAGE AREA SEED MIX

<table>
<thead>
<tr>
<th>SEED NAME</th>
<th>BOTANIC NAME</th>
<th>% IN MIX</th>
<th>POUNDS OF PLS PER ACRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streambank Wheatgrass</td>
<td>Agropyron Riparium</td>
<td>0%</td>
<td>4 lbs.</td>
</tr>
<tr>
<td>Thickspike Wheatgrass</td>
<td>Agropyron Dasytachyum</td>
<td>0%</td>
<td>7 lbs.</td>
</tr>
<tr>
<td>Mountain Brome</td>
<td>Bromus Marginatus</td>
<td>0%</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Western Wheatgrass</td>
<td>Agropyron Smithii</td>
<td>0%</td>
<td>3 lbs.</td>
</tr>
<tr>
<td>Tufted Hairgrass</td>
<td>Deschampsia Caesipitosa</td>
<td>0%</td>
<td>2 lbs.</td>
</tr>
<tr>
<td>Nuttall Alkaligrass</td>
<td>Puccinellia Airoides</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Western Yarrow</td>
<td>Achillea Lanulosa</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>New England Aster</td>
<td>Aster Novae-angliae</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td>Rocky Mountain Iris</td>
<td>Iris Missouriensiensis</td>
<td>0%</td>
<td>0.5 lbs.</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>21.0 lbs.</strong></td>
</tr>
</tbody>
</table>
SILT FENCE EROSION BARRIER

SILT FENCE INSTALLATION

STEEL T POST OR 2"x4" WOOD POST (ANCHORED TO FABRIC)

FABRIC MATERIAL (ANCHORED IN TRENCH)

4"x4" TRENCH COMPACTED BACKFILL

FLOW

NOTE: EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL LANDSCAPING IS COMPLETED.

SECTION

STANDARDS & SPECIFICATIONS

REVISED:

DATE: 488

DRAWING NO. 600-12

SILT FENCE EROSION BARRIER
VEHICLE TRACKING CONTROL

NOTE: EROSION CONTROL MEASURES SHALL BE MAINTAINED AT ALL TIMES AS DIRECTED BY THE CITY ENGINEER.

SECTION A-A

NOTES
1. ALL ROCK TO BE REMOVED UPON COMPLETION OF CONSTRUCTION.
2. PUBLIC ROADWAY TO BE KEPT CLEAN AND FREE OF MUD, DIRT AND DEBRIS AT ALL TIMES.
STRAW BALE EROSION BARRIER

TRENCH EXCAVATION

STRAW BALE INSTALLATION

SECTION

NOTE: EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL LANDSCAPING IS COMPLETED.