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1.1 TITLE
This document is called the “Engineering Criteria Manual” and shall be referred to throughout the text as the “ECM.”

1.2 AUTHORITY
The El Paso Board of County Commissioners (BOCC) has adopted the ECM by resolution pursuant to the authority given by the Colorado Constitution and the following sections of the Colorado Revised Statutes, as amended:

- Article 1 of Title 32 (Special District Act/Provisions),
- Article 1 of Title 34 (Preservation of Commercial Mineral Deposits),
- Article 2 of Title 43 (State, County and Municipal Highways),
- Article 4 of Title 41 (Airports),
- Article 6 of Title 28 (Division of Aviation),
- Article 11 of Title 30 (County Powers and Functions),
- Article 15 of Title 30 (County Regulations under Police Power),
- Article 20 of Title 29 (Local Government Land Use Control Act),
- Article 28 of Title 30 (County Planning and Building Code),
- Article 30.5 of Title 38 (Conservation Easements),
- Article 32 of Title 22 (Zoning, Planning and Building Code Duties of School District Boards),
- Article 65.1 of Title 24 (Areas and Activities of State Interest), and
- Article 68 of Title 24 (Vested Property Rights).

1.3 PURPOSE
The purpose of this ECM is to set standards for designing, constructing, locating, maintaining, choosing materials for, repairing, reconstructing and using public improvements and guiding design and construction of common development improvements in El Paso County (County). The ECM was developed to be consistent with the El Paso County Land Development Code (LDC). The standards are necessary to protect and promote public health, safety, and the general welfare of the public; ensure that public infrastructure meets commonly accepted engineering standards; and maintain consistency and fairness in development review.

The ECM governs the quality of workmanship must be adhered when constructing public and development-related improvements. The ECM also provides standards for County staff to adhere to in reviewing plans and inspecting construction.
1.4 APPLICABILITY

1.4.1 Activities

The provisions of ECM shall apply to the planning, design, construction, enlargement, alteration, relocation, removal, conversion, demolition, repair, excavation and use of any public improvements. The ECM shall also apply as guidance or as specific regulatory standards when required by the LDC to common development improvements. The ECM applies to public and private projects including:

- new construction and modification of transportation facilities, storm drainage facilities, utilities, and any facility located in County rights-of-way or easements, whether occurring under permit or franchise, and other transportation facilities, storm drainage facilities, utilities and any facilities mandated by the LDC;
- facilities outside County rights-of-way (such as private roads or drainage systems), which are regulated through the LDC and County’s police power authority to ensure public health, safety, and welfare, and Title 30, Article 15, Colorado Revised Statutes.
- every new placement and every planned, non-emergency replacement of existing utility poles and other utility structures within the County’s rights-of-way.
- reconstruction, resurfacing, restoration, and rehabilitation of existing transportation facilities, storm drainage facilities, utilities and any other facilities located in County rights-of-way or easements, as well as other transportation facilities, storm drainage facilities, utilities, and facilities mandated by the LDC, as far as practicable and feasible.

1.4.2 Jurisdiction

The ECM applies to all subdividers, developers, landowners, owners of facilities located in the County’s rights-of-way or easements and their employees, agents or contractors that design, construct, and maintain facilities or conduct activities subject to review and approval under the provisions of the ECM or where required by the LDC in El Paso County. The ECM further applies to the County and their employees, agents or contractors.

1.5 STANDARDS ADOPTED BY REFERENCE

The BOCC hereby adopts the following documents and standards by reference:

- Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction;
- Colorado Department of Transportation (CDOT) State Highway Access Code;
- Colorado Department of Transportation (CDOT) Field Materials Manual;
- American Association of State Highway & Transportation Officials (AASHTO) including Roadway Design Guide and Bicycle Design;
- Institute of Transportation Engineers (ITE) Trip Generation Manual;
- American Society for Testing Materials (ASTM);
- Manual on Uniform Traffic Control Devices (MUTCD);
Chapter 1 General Provisions
Adopted: 12/23/2004
Revised: 12/13/2016
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- Colorado Springs and El Paso County Drainage Criteria Manual Volume 1 (DCM1);
- The State of Colorado, Department of Transportation M&S Standards;
- El Paso County's Road Impact Fee Program; and
- ASCE Code of Ethics.

The referenced documents and standards are enforceable parts of the ECM and may be amended and revised at the discretion of the BOCC in accordance with requirements and processes prescribed by the Colorado Constitution and applicable provisions of the Colorado Revised Statute.

1.6 MINIMUM STANDARDS

The standards presented in this ECM are considered the minimum requirements and design values necessary to accomplish the purpose of the ECM. Where minimum values are stated, greater values should be used whenever practical and consistent with State law; where maximum values are stated, lesser values should be used where practical.

Situations might arise where the application of individual standards from the ECM will not ensure the protection of public health, safety, and welfare. Accordingly, the ECM Administrator may impose additional or more stringent standards than those contained in the ECM, or require the modification of plans, specifications or operations to achieve the necessary public health, safety, and welfare. Modifications may include, but are not limited to, scheduling, phasing or timing restrictions. The standards contained herein are not a substitute for sound professional engineering judgment.

1.7 NO STANDARDS SPECIFIC PROVIDED IN ECM

In the case of those improvements that are required by the County, but are not specifically addressed by the ECM, the County will require the owner, permit holder, developer, contractor, and their agents to follow applicable local, state, and federal guidelines or standards promulgated by professional organizations. The ECM Administrator shall be consulted for guidance on proper references.

1.8 MUNICIPAL STANDARDS MAY APPLY IN 3-MILE PLAN AREA

In areas subject to the requirements of C.R.S. § 31-12-105 (3-Mile Plan Areas), the design standards of the municipality may be applied if approved by the ECM Administrator. In cases where ECM standards are more restrictive, the ECM Administrator may require compliance with the ECM.

1.9 DEVIATIONS FROM STANDARDS

The ECM standards represent appropriate practice under most conditions, based on past experience in the County and in other jurisdictions. The Standards are intended to ensure that facilities are safe and appropriate for use in the County.

Engineering design is an endeavor that examines alternative solutions to real world situations. These standards are not intended to limit the introduction of new ideas. Situations will arise where alternatives to these standards may better accommodate existing conditions, overcome adverse
topography or allow for more cost-effective solutions without adversely affecting safety, operations, maintenance or aesthetics.

Accordingly, requests for deviations from these standards will be considered by the ECM Administrator. The request for a deviation may be considered if the request is not based exclusively on financial considerations. The deviation must not be detrimental to public safety or surrounding property. Requests must be submitted and reviewed in accordance with the process outlined in Chapter 5 and include supporting information demonstrating compliance with all of the following criteria:

- The deviation will achieve the intended result with a comparable or superior design and quality of improvement.
- The deviation will not adversely affect safety or operations.
- The deviation will not adversely affect maintenance and its associated cost.
- The deviation will not adversely affect aesthetic appearance.
- The deviation meets the design intent and purpose of these Standards.

It is recognized that the need for and timing of a deviation request may not be predictable. Requests should be submitted as soon as the need becomes known. No request will be considered until an application for a permit or other approval has been submitted. Known deviation requests that affect lot yield or scope of development must be decided before holding any public hearing or making an official decision on the application. This is important for public notice and participation in the decision process.

Deviations that affect engineering design, to the extent they are known, must be decided before submitting construction plans. This will minimize additional effort in the preparation of plans with non-standard features that cannot be approved.

The ECM Administrator is the final authority on all deviation requests. The ECM Administrator reserves the right to deny a deviation from these Standards, at any time, in the interest of public health, safety, and welfare.

1.9.1 PUD Zoning Districts

The ECM Administrator may establish, on a case-by-case basis, special standards (i.e., deviations) that apply to a project with a Planned Unit Development (PUD) zoning classification. The ECM Administrator, in establishing such standards, shall first find that there are mitigating elements in the design of the project that allow for such special standards and that the special standards are in conformance with the intent and purpose of these Standards.

1.9.2 Alternate Materials and Methods of Construction

The provisions of these Standards are not intended to prevent the use of any material or method of construction not specifically prescribed by these Standards, provided any alternate is approved in writing by the ECM Administrator as a deviation.

The ECM Administrator, as indicated above, shall require that sufficient evidence or proof be submitted to substantiate any request that may be made regarding the alternate method or material.
1.10 CONFLICTING PROVISIONS

The following standards shall apply in considering conflicts between provisions of the ECM:

- Whenever any provision of the ECM conflicts with a provision in any federal, state or local law, ordinance, resolution, rule, or regulation, the more restrictive or higher standard shall be used.
- Whenever any provision of the ECM conflicts with another provision of the ECM, the more restrictive or higher standard shall be used.
- Whenever any provision of the ECM conflicts with any provision of the documents and standards adopted by referenced, the provision of the ECM shall be used.

1.11 PERMITS REQUIRED

No owner, permit holder, developer, contractor, and their agents shall do or cause to be done any work governed by the ECM without first having obtained a permit to do the work in accordance with the provisions of Chapter 5. All work shall be done in accordance with the ECM, approved plans, and the conditions of the required permits. In many cases, a Notice to Proceed is also required before beginning work in accordance with the terms and conditions of a permit issued under the provisions of Chapter 5.

Other permits, approvals or agreements may be required by the County or others having jurisdiction before initiating any activities subject to the ECM. It is the responsibility of the owner, permit holder, developer, contractor and their agents to identify and secure all required permits, approvals, or agreements required to do the work.

1.12 PLAN REVIEW PROCEDURES, GENERAL

For County-constructed roads and drainage projects, plan review requirements are governed by the ECM and the policies and procedures of the ECM Administrator. For owner, permit holder, and developer-constructed public improvements and development or subdivision related improvements, all plans, reports, drawings, and specifications that support permit or land use applications are governed by the LDC, ECM and the policies and procedures of the ECM Administrator.

Construction plans are required for all proposed road and drainage-related improvements. Chapter 5 of the ECM outlines the submittal requirements. In some cases, additional engineering data may be required to be submitted. Construction documents will be valid for a period of 2 years from the date signed by the El Paso County Engineer. If construction has not started within 2 years of being signed by the El Paso County Engineer, the plans will need to be resubmitted for approval. Fees for the re-approval will be in accordance with the fee schedule current at the time of plan re-approval.

Engineering Record Drawings (also known as "as-built" plans) for roads and drainage facilities must be submitted before final acceptance of any public facility and release of the required surety.

1.13 PROFESSIONAL QUALIFICATIONS

Professionals in the fields of engineering, architecture, geology or surveying who prepare or are responsible for preparing plans, drawings, specifications, calculations, technical reports, etc., for the purpose of obtaining County permits or approvals, shall be registered or authorized to
practice in the state of Colorado. Registration or authorization to practice shall be in the specific technical area pertinent to the documents being prepared. In some cases, specific additional or special professional qualifications are required for preparing specific studies or plans. Any specific additional or special professional qualifications are identified in those sections of the ECM specifically governing preparation of the study or plan.

### 1.14 ERRORS AND OMISSIONS

At the discretion of the ECM Administrator, any significant errors or omissions in the approved plans or information used as a basis for such approvals may constitute grounds for withdrawal of the approvals and stoppage of any or all permitted work. It is the responsibility of the owner, permit holder, developer, contractor or their agents to demonstrate why work should continue and to make changes in plans that may be required by the ECM Administrator before the plans are re-approved.

### 1.15 OWNER, PERMIT HOLDER, DEVELOPER, CONTRACTOR AND AGENT RESPONSIBILITIES

#### 1.15.1 Permit and Construction

It is the responsibility of the owner, permit holder, developer, contractor, and their agents to:

- Have an approved set of plans, required permits and Notice to Proceed before commencement of any work governed by the ECM.
- Notify the ECM Administrator in advance of the commencement of any authorized work, in accordance with permit requirements. A pre-construction meeting and field review may be required by the ECM Administrator before the commencement of any work on significant projects.
- Perform all work in accordance with the terms and conditions of the permit, ECM, and all applicable local, state, and federal laws.
- Have an approved set of plans, permits, and a copy of the ECM on the job site wherever work is being accomplished.
- Provide tests to substantiate the adequacy and placement of construction materials if requested by the ECM Administrator.

#### 1.15.2 General Right-of-Way and Site Maintenance

The owner, permit holder, developer, contractor, and their agents shall:

- Schedule and control work so as to comply with all applicable provisions of El Paso County codes and applicable state and federal laws and to prevent any hazards to public safety, health, and welfare.
- Maintain two-way traffic on existing roads for vehicles, bicycles, and pedestrians at all times unless detour plans or lane closures have been approved in advance by the ECM Administrator.
- Keep roads, bridges, bikeways, and pedestrian facilities free of dirt, debris or any obstructions. Paved temporary detour(s) shall be provided when necessary and not detrimental to the abutting properties.
• Maintain pedestrian and vehicular access to occupied buildings, except where written approval from the building owner has been obtained.
• Complete on-site grading in a manner that minimizes off-site erosion and siltation in conformance with all statutory requirements, permits, and approved plans.

1.15.3 Work Conditions

A. Action by ECM Administrator to Protect Public or Private Interests

When the owner, permit holder, developer, contractor, or their agents have not taken sufficient precautions for the safety of the public or the protection of the work, adjacent structures or property, and when, as a result, the ECM Administrator determines a loss-of-life or damage could result, the ECM Administrator, with or without notice to the owner, permit holder, developer, contractor or their agents, may provide suitable protection by causing work to be done and materials to be furnished and placed as the ECM Administrator may consider necessary to protect the public or any private interest. The cost and expense of the ECM Administrator’s action including the cost of labor, equipment and material is the responsibility of the owner, permit holder, developer, contractor, or their agents. All costs shall be paid by the owner, permit holder, developer, contractor, or their agents within 30 calendar days upon receipt of the invoice from the ECM Administrator.

The action performed under the direction of the ECM Administrator shall in no way relieve the owner, permit holder, developer, contractor, or their agents of responsibility for damages that may occur during or after such precaution has been taken.

B. Action by Owner to Protect Public or Private Interests

When an emergency threatening loss of life or damage to the work or an adjoining structure or property is identified by the owner, permit holder, developer, contractor or their agents and the person who identified the emergency is unable to obtain special instructions or authorization from the ECM Administrator, the owner, permit holder, developer, contractor, or their agents are hereby permitted to act to prevent loss of life or damage. The ECM Administrator shall be notified of such emergency work within four hours of the action.

C. Final Cleanup

The owner, permit holder, developer, contractor or their agents shall be responsible for daily clean-up on the project area and shall remove and properly dispose of all surplus and discarded materials, rubbish, and temporary structures from the project area and adjacent areas. They shall, where appropriate, leave the project area swept and in a neat and clean condition. The owner, permit holder, developer, contractor or their agents shall restore all work areas that have been damaged by the operations to general conformity with the specifications for the item or items involved and to the original condition.
The owner, permit holder, developer, contractor or their agents will be responsible for keeping roads free of dirt, mud, and any debris during construction. The work shall conform to the requirements for erosion control, as described in the statutes, ordinances or regulations. The owner, permit holder, developer, contractor or their agents shall be responsible, at their own expense, for keeping on-site roads used as construction routes and rights-of-way clean of mud, rocks, and debris at all times during said construction.

The owner, permit holder, developer, contractor or their agents shall inspect and clean the interior of all manholes and catch basins within the construction limits or impacted by the construction.

The owner, permit holder, developer, contractor or their agents shall, within 24 hours of the ECM Administrator’s notification of noncompliance with this section, commence clean-up operations and shall diligently pursue completion of said clean up to the satisfaction of the ECM Administrator. The County may revoke any and all permit approvals until the owner, permit holder, developer, contractor or their agents remedy the problem if:

- the owner, permit holder, developer, contractor or their agents fail to respond within 24 hours, or
- the ECM Administrator is unable to contact the owner, permit holder, developer, contractor or their agents after reasonable effort, or
- the owner, permit holder, developer, contractor or their agents fail to diligently pursue clean-up operations to the satisfaction of the ECM Administrator.

The ECM Administrator may also choose to have the streets and rights-of-way cleaned by County crews or an outside contracted firm and invoice the owner, permit holder, developer, contractor or their agents for all costs. All cost shall be paid by the owner, permit holder, developer, contractor or their agents within thirty days of being invoiced.

D. Suspension of Work

In case of suspension of work for any cause whatsoever, the owner, permit holder, developer, contractor or their agents, before leaving the job site, shall take such precautions as may be necessary to prevent damage to the work; provide for proper drainage; and erect any necessary barricades, signs, or other facilities. The owner, permit holder, developer, contractor or their agents will take the above precautions at their own expense, as required by applicable standards.

1.15.4 Protection of Existing Facilities

The owner, permit holder, developer, contractor or their agents shall notify the electric and gas utility, telephone company, cable television, and all other interested parties before beginning work. They shall have their facilities staked and located in the field in order to ensure that there are no interruptions of these services during progress of the work.
Existing power lines, telephone lines, trees, shrubbery, fences, water mains and services, gas mains and services, sewer mains and services, cables, conduits, drainage and irrigation ditches and pipes, embankments, and other structures in the vicinity of the work not authorized to be removed, shall be supported and protected from damage by the owner, permit holder, developer, contractor or their agents during the construction and until completion of work.

The owner, permit holder, developer, contractor or their agents shall preserve intact any underground pipes or other utilities encountered during construction. The owner, permit holder, developer, contractor or their agents shall be liable for all damages done to such existing facilities and structures and shall hold the County harmless from any liability or expense for injuries, damages or repairs to such facilities. The type, size, approximate location and number of all known underground utilities shall be shown on all drawings. It shall be the responsibility of the owner, permit holder, developer, contractor or their agents to verify the existence and location of all underground utilities along the route of the work.

1.15.5 Traffic Control

The flow of traffic on public streets and roadways shall be maintained at all times during construction in accordance with the rules, regulations, and conditions as set forth in the Work in the Right-of-Way Permit issued by the ECM Administrator.

The owner, permit holder, developer, contractor or their agents shall be responsible for the provision of a safe travel-way on all roadways on and adjacent to the job site. The owner, permit holder, developer, contractor or their agents shall erect or cause erection of proper traffic control warning devices around all excavations, embankments, and obstructions. The owner, permit holder, developer, contractor or their agents shall be responsible for the proper maintenance of said erected devices, in accordance with their approved Work in the Right-of-Way permit.

The owner, permit holder, developer, contractor or their agents shall cause suitable warning lights or flares to be provided and kept lighted at night or other times when visibility is limited.

The owner, permit holder, developer, contractor or their agents shall provide flaggers or off-duty police protection, as may be determined by the ECM Administrator, for the protection of the public and workers on the job site.

The owner, permit holder, developer, contractor or their agents shall coordinate with the ECM Administrator so that arrangements may be made by the owner, permit holder, developer, contractor or their agents for detours, parking, and access to property adjacent to work, etc., 48 hours before they are needed.

The owner, permit holder, developer, contractor or their agents shall not work within any portion of a road right-of-way without receiving a Work in the Right-of-Way Permit from the ECM Administrator at least 48 hours before they begin work. Full roadway closures will be reviewed on a case-by-case basis; time of review will vary based on the extent of the closure.
The County reserves the right to refuse to allow full road closures. Requirements for such closures will be determined at the time of issuance of the permit. The owner, permit holder, developer, contractor or their agents will be responsible for all public notices, public meetings, and requirements as outlined in the Work in the Right-of-Way Permit. The owner, permit holder, developer, contractor or their agents shall notify the police and fire departments at least 48 hours before closure and immediately after opening of any street, alley, or fire lane.

The ECM Administrator shall close down work that is not controlled in accordance with approved barricading procedures or on projects that require a Work in the Right-of-Way Permit, but on which one has not been obtained by the owner, permit holder, developer, contractor or their agents.

No work shall be allowed at signalized intersections or on arterial roadways that impedes normal traffic flow from 6:00 a.m. to 8:30 a.m. and 3:30 p.m. to 7:00 p.m., except during emergencies or with prior approval of the ECM Administrator.

1.15.6 Safety

Machinery, equipment, materials, and all hazards shall be guarded or eliminated in accordance with the MAPC and all applicable federal regulations including Office of Safety and Health Administration (OSHA), state, County, and municipal laws and regulations. No blasting shall be done without the prior approval of the County. Safety equipment, devices, and clothing shall be utilized by personnel where required by federal, state, and local laws. The owner, permit holder, developer, contractor or their agents shall strictly comply with MUTCD for temporary and permanent traffic control.

1.15.7 Removal of Unacceptable Work

Work shall be considered unacceptable if it does not conform to the approved plans and specifications or if it results in an inferior or unsatisfactory product. Unacceptable work found to exist prior to the final acceptance of the work shall be immediately removed and replaced or corrected by, and at the expense of, the owner, permit holder, developer, contractor or their agents, whether the unacceptable work is the result of poor workmanship, poor design, use of defective materials, damage through carelessness or any other cause. This expense includes total and complete restoration of any disturbed surface to original or to better than the original condition that existed before the repairs or replacement, regardless of improvements on lands where the repairs or replacement are required.

1.15.8 Control of Materials

A. Samples and Tests

To ascertain whether materials comply with contract requirements, samples shall be taken at the source or at the job destination as often as the ECM Administrator deems necessary. Samples shall be collected in accordance with standard practices, except where methods and procedures for sampling materials are otherwise set forth in this ECM.
The owner, permit holder, developer, contractor or their agents shall furnish, when requested by the ECM Administrator, a written statement of the origin, composition, and sample manufacture process of a material. Any samples shall be collected and any tests performed shall be done so at the expense of the owner, permit holder, developer, contractor or their agents.

B. **Storage of Material**

Material shall be stored to ensure the preservation of its quality and suitability for the work. Stored material, even though inspected prior to storage, shall be subject to inspection prior to its use in the work and shall meet all requirements of these Standards at the time it is used. Stored material shall be located to facilitate inspection. With the ECM Administrator’s approval, the owner, permit holder, developer, contractor or their agents may use portions of the right-of-way for storage purposes. Any additional storage required shall be secured by, and at the expense of, the owner, permit holder, developer, contractor or their agents.

C. **Defective Materials**

Materials not in conformance with the requirements of these Standards shall be considered defective and shall be rejected. Rejected materials shall be removed from the job site at the expense of the owner, permit holder, developer, contractor or their agents.

1.15.9 **Protection of Public and Utility Interests**

A. **Public Convenience and Safety**

Fire hydrants shall be visible and accessible to the fire district from the road at all times. No permanent or temporary obstructions (including, but not limited to, fencing, street lighting, landscaping, and mailboxes) shall be placed within 6 feet of a fire hydrant.

Unless otherwise specified, the owner, permit holder, developer, contractor or their agents shall give written notice to the proper authorities in charge of streets, gas and water pipes, sanitary and storm sewer facilities, electric service, cable television and other conduits, railroads, poles, manholes, catch basins and all other property that may be affected by the operations, at least 48 hours before breaking ground. The owner, permit holder, developer, contractor or their agents shall not hinder or interfere with any person in the protection of such property or with the operation of utilities at any time. The owner, permit holder, developer, contractor or their agents must obtain all necessary information regarding existing utilities, protect such utilities from damage, and avoid unnecessary exposure so that they shall not cause harm to the public.

The owner, permit holder, developer, contractor or their agents shall obtain all necessary information regarding the planned installation of new utilities and cables, conduits and transformers; make proper provision; and give proper notification so that new utilities and electrical equipment can be installed at the proper time without delay or unnecessary inconvenience. All underground utilities
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Revised: 12/13/2016
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and electrical equipment shall be installed prior to the placement of the final lift of pavement.

When the work involves excavation adjacent to any properties or structures along the work site, the owner, permit holder, developer, contractor or their agents shall give such property owners sufficient written notice thereof, and shall furnish a copy to the ECM Administrator.

B. Protection and Restoration of Property and Monuments

The owner, permit holder, developer, contractor or their agents shall use every precaution to prevent the damage or destruction of public or private property adjacent to or interfering with the work (such as poles; trees; shrubbery; crops; fences; monuments; and all overhead structures, such as wires and cables) within or outside of the right-of-way.

The owner, permit holder, developer, contractor or their agents shall protect and support all water, gas, sanitary sewer, storm sewer, electrical pipes and conduits, railroad tracks, buildings, walls, fences, landscaping, significant wetlands, or other properties that might be damaged during the execution of work. All reasonable and proper precautions shall be taken to protect property, persons, animals, and vehicles from injury. Wherever necessary, fencing or railing shall be placed around any excavation and a sufficient number of amber lights shall be on from twilight until sunrise. One or more guards shall be employed as additional security wherever they are needed or required by the ECM Administrator.

The owner, permit holder, developer, contractor or their agents 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 in progress.

The owner, permit holder, developer, contractor or their agents shall protect and carefully preserve all land boundary and all survey control monuments until the surveyor for the owner, permit holder, developer, contractor or their agents have referenced their location for relocation. All monuments disturbed or removed by the owner, permit holder, developer, contractor or their agents shall be replaced by a licensed surveyor at the expense of the owner, permit holder, developer, contractor or their agents.

The owner, permit holder, developer, contractor or their agents shall be responsible for the damage or destruction of property resulting from neglect, misconduct, or omission in the manner or method of execution or nonexecution of the work, or caused by defective work or the use of unsatisfactory materials. They shall restore such property to a condition similar to or better than existed before such damage or injury was done by repairing, rebuilding, or replacing it as might be directed.

The owner, permit holder, developer, contractor or their agents shall bear the cost of repairing underground pipes, wires, or conduits damaged by the work.

The owner, permit holder, developer, contractor or their agents shall be liable for all damage caused by storms and fire. They shall, under no circumstances, start
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1.15.10 Warranty
The permit holder is required to warrant Improvements for 2 years, as described in Chapter 5 and the standard Development Agreement and Subdivision Improvement Agreement. The preliminary and final acceptance processes are also described in Chapter 5.

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. While burning brush, stumps, or rubbish, care shall be taken not to damage any standing trees, shrubs or other property.

The owner, permit holder, developer, contractor or their agents shall ensure the continued availability of public services including, but not limited to, postal, solid waste collection, emergency services, and public utilities.

C. Protection of Streams, Lakes, and Reservoirs
The owner, permit holder, developer, contractor or their agents shall take all necessary precautions to prevent pollution of streams, lakes, reservoirs, and irrigation ditches with fuels, oils, bitumen, sodium chloride, calcium chloride or other harmful materials. The operations shall be conducted and scheduled to avoid or minimize siltation of streams, lakes, and reservoirs. A plan for erosion protection shall be submitted to the ECM Administrator for approval before starting work and must conform to all local, state, and federal laws and regulations.

D. Barricades, Warning Signs, and Flagmen
Work shall be barricaded as necessary at all times. Between the hours of sunset and sunrise barricades shall be properly lighted to warn all persons. Signs, barricades, lights, and warning devices shall be constructed and used in accordance with the most current version of the MUTCD. These guidelines shall be strictly enforced by the ECM Administrator during the progress of the work.

The owner, permit holder, developer, contractor or their agents shall be responsible for obtaining a Work in the Right-of-Way Permit before beginning work. The owner, permit holder, developer, contractor or their agents shall apply for the permit and submit a traffic control plan for review and approval by the ECM Administrator.

The owner, permit holder, developer, contractor or their agents shall be responsible for all damages to the work due to failure to place barricades, signs, lights, and flaggers and other workers to protect it. Whenever evidence of such damage is found prior to acceptance, the ECM Administrator may order the damaged portion immediately removed and replaced by the owner, permit holder, developer, contractor or their agents.

The permit holder is required to warrant Improvements for 2 years, as described in Chapter 5 and the standard Development Agreement and Subdivision Improvement Agreement. The preliminary and final acceptance processes are also described in Chapter 5.
1.16 ADMINISTRATION

1.16.1 Discretionary Authority
The ECM Administrator may utilize discretionary authority as it relates to the provisions of the ECM. Judgments will take into consideration the individual situation, but in no instance will safety features or structural integrity prescribed by these Standards be sacrificed. Where the design standards, standard specifications or standard drawings do not cover improvements, the ECM Administrator shall establish appropriate standards.

1.16.2 Delegation and Review of Differences of Opinion
The ECM Administrator may appoint personnel as appropriate to administer these standards. The personnel appointed may only exercise the specific authority delegated to them by the ECM Administrator.

When a difference of opinion occurs between personnel appointed to exercise the authority of the ECM Administrator and an owner, permit holder, developer, contractor or their agents, the owner, permit holder, developer, contractor or their agents are required to obtain a review and decision from the ECM Administrator before appealing an issue to the BOCC. To obtain a review and decision, the owner, permit holder, developer, contractor or their agents shall submit a written request to the ECM Administrator identifying the conflict and describing the unresolved issue. After reviewing all pertinent information, the ECM Administrator will advise those interested parties of the decision relative to the conflict.

1.16.3 Interpretation
Interpretations of this ECM are made by the ECM Administrator. The ECM Administrator’s interpretations of provisions may be appealed to the BOCC. The meanings and construction of words and phrases established in this section apply throughout the ECM.

- Words and phrases must be read in context and construed according to the rules of grammar and common usage. Words and phrases that have acquired a technical or particular meaning, whether by definition under the definitions section of the ECM, by legislative declaration or otherwise, must be construed accordingly.
- The particular controls the general.
- Mandatory requirements use the words "shall," "must" or "will" and are sometimes labeled “Standards.” Recommendations use the words "may" or "should" and are sometimes labeled “Guidelines” or “Criteria”.
- Words used in the present tense include the future, unless the context clearly indicates otherwise.
- Words or provisions apply. The word "or" indicates connected words or that provisions may apply singly or in any combination.
- Words indicating a specific gender apply to all persons and things unless the context clearly indicates otherwise.
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- A reference to days is to calendar days unless otherwise specified in this code or state statute. If a deadline falls on a weekend or County holiday, the deadline extends to the next working day.
- When computing a period of days, the first day is excluded and the last day is included. If the last day falls on a weekend or County holiday, the last day is the next working day.

Section and subsection headings are for convenience only. They do not govern, limit or modify the scope, meaning or intent of the ECM.

1.16.4 Revisions to Approved Plans

Work performed within or outside the public right-of-way as mandated by the LDC, ECM or other County codes shall comply with the approved plans, the approved specifications, and these standards. The ECM Administrator must approve any revision to construction plans before the change is implemented.

1.16.5 Enforcement

The ECM Administrator has the authority to enforce the ECM as well as other referenced or pertinent standards and specifications. The ECM Administrator shall appoint personnel as appropriate to inspect work completed pursuant to the ECM standards. Personnel appointed may only exercise the specific authority delegated to them by the ECM Administrator.

Whenever any work is being done contrary to the provisions of these Standards, the ECM Administrator may order the work stopped by a written notice served on any persons engaged in doing the work or causing of the work to be done. Persons shall stop work until authorized by the ECM Administrator to proceed.

1.16.6 Inspection

The ECM Administrator is authorized to inspect all work completed and all material furnished. Inspections may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials to be used. The ECM Administrator shall notify the owner, permit holder, developer, contractor or their agents of any failure of the work or material conformity with these Standards. The ECM Administrator shall have the authority to reject materials until any questions at issue can be resolved by the ECM Administrator.

The ECM Administrator shall, in no case, act as foreman or perform other duties for, or interfere with the management of work done by, the owner, permit holder, developer, contractor or their agents. Any "advice" that the ECM Administrator might give the owner, permit holder, developer, contractor or their agents shall not be construed as binding upon the County in any way or release the owner, permit holder, developer, contractor or their agents from fulfilling all of the terms of these Standards.

The presence or absence of the ECM Administrator shall not relieve, in any degree, the responsibility or the obligation of the owner, permit holder, developer, contractor or their agents. The ECM Administrator, or an authorized designee, shall, at all times, be
provided reasonable and safe access to inspect the work whenever it is in preparation or progress.

### 1.16.7 Right to Require Additional Tests

Whenever there is insufficient evidence of compliance with any of the provisions of these Standards or evidence that any material or construction does not conform to the requirements herein, the ECM Administrator may require that the owner, permit holder, developer, contractor or their agents, at their expense, provide test results to establish compliance. Such tests shall be as specified by these Standards or by other recognized test standards approved by the ECM Administrator. If there are no recognized and accepted test methods, the ECM Administrator shall determine test procedures. Before testing begins, all tests shall be made by an agency approved by the ECM Administrator. Reports of such test results shall be retained by the County.

### 1.17 SURETY

Where authorized by the ECM, surety may be required by the ECM Administrator to guarantee the performance of, maintenance of or to correct permitted work. The type and amount of surety shall be per the applicable ECM Standard or, if not specified, at the discretion of the ECM Administrator.

Types of surety include, but are not limited to, cash deposits, assigned savings, and bonds. The ECM Administrator shall release surety upon satisfactory completion of the required work or any previously specified stipulations related to the required work in accordance with the surety release provisions of the ECM.

### 1.18 PENALTIES

Failure to comply with the ECM will be cause for withholding or withdrawing approval of plans or drawings; withholding of surety, final inspection approval or occupancy certificates; and other penalties as provided by County regulations or state law.

### 1.19 NO WAIVER OF LEGAL RIGHTS

The 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 owner, permit holder, developer, contractor or their agents, or
- 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 Standards.

### 1.20 AMENDMENT AND REVISIONS

The ECM may be amended or revised at the sole discretion of the BOCC in accordance with requirements and process prescribed by the Colorado Constitution and applicable provisions of Colorado Revised Statute.

Upon consultation with the County Attorney, the ECM Administrator may make the following changes or corrections to the provisions of the ECM when the changes or corrections do not alter the sense or meaning of its provisions:

- Misspellings. Misspelled words may be corrected.
Histories. Erroneous legislative histories may be corrected.

Cross-references. Cross-references may be changed to agree with new, amended, reenacted, renumbered, re-lettered, reallocated or corrected ordinances or resolutions.

Capitalization. Improper capitalization may be corrected.

Headings. Descriptive headings of titles, chapters, sections or subsections may be edited or added to briefly and clearly indicate the subject matter of the title, chapter, section or subsection.

Renumbering; re-lettering. The numbering or lettering of sections, including duplicative numbering or lettering created by conflicting enactments, may be corrected or properly arranged.

Changed job titles; agency names. References in design standards to specific job titles or agency names that are changed without substantial affect on job or agency responsibilities may be changed to refer to the new job title or agency name.

Punctuation. Punctuation, including hyphenization, may be corrected.

Clerical Errors. Typographical or grammatical errors may be corrected.

Gender. Gender-specific terms that occur may be changed to gender-neutral terms and necessary grammatical changes to properly use the gender neutral terms may be made.

Mandated Changes. Additions, deletions, or revisions to design standards may be made when required for compliance with mandatory regional, state or federal regulations.

Any change or correction made under the authority of this section may not affect the substantive meaning of any enactment of the County. Any erroneous or inadvertent substantive change must be construed as a clerical error and given no effect. If the ECM Administrator or County Attorney is in doubt whether a specific change or correction is authorized by this section, the ECM Administrator may not make the change or correction under authority of this section.

1.21 SEVERABILITY

Except as otherwise provided, a determination by a court that a provision of the ECM is unconstitutional or invalid does not make the remainder of the ECM unconstitutional or invalid. A determination by a court that the application of the ECM to a particular project or parcel of land is unconstitutional or invalid does not apply to any other project or parcel of land.

1.22 TERMS AND DEFINITIONS

Whenever, in these Standards, the words "as ordered", "as directed", "as required", "as permitted", "as allowed", or words or phrases of like meaning are used, it shall be understood that the order, direction, requirement, permission, or allowance of the ECM Administrator is intended. Unless otherwise specified herein, the words "approved", "reasonable", "suitable", "acceptable", "properly", "satisfactory", or words of like meaning shall mean approved, reasonable, suitable, acceptable, proper or satisfactory in the judgment of the ECM Administrator. The following terms, definitions, and acronyms used in the ECM shall be defined as follows (See the LDC for additional definitions of terms not defined in this section):
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<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials.</td>
</tr>
<tr>
<td>Acceleration Lane</td>
<td>A speed change lane, including tapered areas, to enable a vehicle entering a roadway to increase its speed to a rate at which it can safely merge with through traffic.</td>
</tr>
<tr>
<td>Access</td>
<td>The place, means or way by which vehicles shall have a safe, adequate and usable ingress and egress to a property, use or parking space from a road.</td>
</tr>
<tr>
<td>ADA</td>
<td>Americans with Disabilities Act of 1990.</td>
</tr>
<tr>
<td>ADT</td>
<td>Average daily traffic. The total two-directional volume of traffic during a given time period (in whole days), greater than one day and less than one year, divided by the number of days in that time period.</td>
</tr>
<tr>
<td>Applicant</td>
<td>The individual, firm, business entity, trust, association, syndicate, partnership, or corporation of record or any person designated by the property owner who has applied for or is requesting a permit.</td>
</tr>
<tr>
<td>Best Management Practices or BMP</td>
<td>A BMP is a practice or combination of practices that is determined to be the most practicable means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.</td>
</tr>
<tr>
<td>Board of County Commissioners or BOCC</td>
<td>The El Paso County legislative board.</td>
</tr>
<tr>
<td>CDOT</td>
<td>Colorado Department of Transportation.</td>
</tr>
</tbody>
</table>
Clear Zone: The total roadside border area, starting at the edge of the travel lane, available for safe use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a nonrecoverable slope or a clear runout area.

Construction Plans: Project drawings subject to County review and approval prior to construction that show the location, character, and dimensions of the proposed work, such as layouts, profiles, cross sections, details, methods, and general notes.

Construction Representative: The person who directly inspects or who directly supervises the inspection of the construction of a project, on behalf of the permit holder, to ensure compliance with the plans and standard specifications. The Construction Representative maintains the Engineering Record Drawings. The Construction Representative is not required to be a register Professional Engineer, but shall have adequate construction and design experience to perform the work required by these standards.

Contractor: A person, partnership, corporation, subcontractor or other legal entity that undertakes to construct, install, alter, move, demolish, repair, replace, excavate or add to any public improvements covered by these Standards.

County: El Paso County, Colorado.

County Attorney: El Paso County Attorney.

County Engineer: The County Road Engineer for El Paso County with authority and duties as designated in Colorado Revised Statutes or his/her authorized designee.

Deceleration Lane: A speed change lane including tapered areas, to enable a turning vehicle to slow to a safe turning speed after it has left the mainstream of faster moving traffic.

Defect Warranty Period: Shall be the time frame during which the permit holder is held liable for all work performed and materials utilized prior to final acceptance by El Paso County.
Design Engineer
The engineer who directly prepared plans and calculations or who
directly supervises the preparation of project plans and calculations.
The Design Engineer seals, signs, and dates the plans and calculations
certifying that they meet the required standards.

Design Speed
A selected speed used to determine the various geometric design
features of the roadway.

Developer
A property owner, or his/her agents or contractors, who are responsible
for applying for or receiving a permit or approval for development.

Development Agreement
An agreement with the County which clearly establishes the terms and
conditions of the approval, including the applicant's responsibility
regarding project phasing, the provision of public and private facilities
and improvements, and any other mutually agreed to terms and
requirements. The agreement may also serve to implement the site
specific development plan which establishes vested rights under Article
68 of Title 24, C.R.S.

Deviation
A technical adjustment from these Standards approved by the ECM
Administrator due to unusual circumstances.

Driveway
A physical access that connects a private property or properties to the
County road system. These accesses are typically privately owned and
privately maintained. El Paso County permits where driveways connect
to the public road system and how they connect to the road. All
driveway maintenance is the responsibility of the property owner(s).

DSD
El Paso County Development Services Department.

Easement
A right granted by a property owner to specifically named parties or to
the public for the use of certain land for specified purposes. Where
appropriate to the context, easement may also refer to the land covered
by the grant.

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ECM Administrator
The County Engineer or his/her authorized designee.

Encroachment
Occupancy of a County right-of-way by non-roadway structures or other objects.

Emergency Work
Construction work that responds to an unforeseen combination of circumstances or the resulting conditions that call for immediate action to restore utility service, pedestrian and traffic flow, or mitigate a safety hazard.

Encroachment
Occupancy of the County right-of-way by non-County-owned non-roadway structures or other objects.

Engineer
A Professional Engineer licensed by the State of Colorado.

EPC PSD
El Paso County Public Services Department.

FEMA
Federal Emergency Management Agency.

FHWA
Federal Highway Administration.

Final Acceptance
The acknowledgement by the County that the defect warranty period has expired and there are no outstanding items to be corrected under the provisions of the defect warranty.

Franchise
A document granted by the County authorizing the use of County right-of-ways by public or private entities, subject to specified conditions in accordance with State law.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Movement Intersection or Access</td>
<td>An intersection or access that allows a full range of turn movements between the two intersecting roads or access.</td>
</tr>
<tr>
<td>Inspector</td>
<td>The authorized representative of the County Engineer assigned to make detailed inspection of construction work to assure compliance with these Standards and the plans as approved by the County.</td>
</tr>
<tr>
<td>ITE</td>
<td>Institute of Transportation Engineers.</td>
</tr>
<tr>
<td>Intersection</td>
<td>The area embraced within the prolongation or connection of the lateral curb lines, or if none, the lateral boundary lines of the roadways of two roads that join one another at, or approximately at, right angles, or the area within which vehicles traveling on different roads that join at any other angle may come into conflict. The junction of an alley or driveway access with a roadway or highway shall not constitute an intersection.</td>
</tr>
<tr>
<td>Land Development Code or LDC</td>
<td>The zoning, subdivision, and other land development regulations adopted by the Board of County Commissioners.</td>
</tr>
<tr>
<td>Level of Service or LOS</td>
<td>A qualitative measure of traffic flow. Six levels are defined as A through F with A being the best operating conditions and F being the worst (See Highway Capacity Manual).</td>
</tr>
<tr>
<td>MPH</td>
<td>Miles per hour.</td>
</tr>
<tr>
<td>Neighborhood Path</td>
<td>A local pathway system that may or may not connect to a larger regional trail network.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Notice to Proceed</td>
<td>A document issued by the ECM Administrator authorizing a permit holder to begin construction of common development, subdivision or public improvements in accordance with an approved set of plans.</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollutant Discharge Elimination System.</td>
</tr>
<tr>
<td>Owner</td>
<td>Any individual, corporation, partnership or other legal entity holding controlling title on property that is the subject a permit or improvements covered by these Standards.</td>
</tr>
<tr>
<td>Permit Holder</td>
<td>Any individual, corporation, partnership or other legal entity holding a valid permit authorized pursuant to the ECM.</td>
</tr>
<tr>
<td>Posted Speed</td>
<td>Maximum vehicle speed signed along a roadway.</td>
</tr>
<tr>
<td>Preliminary Acceptance</td>
<td>An acknowledgement by the County that, to the best of the County's knowledge, all work has been completed in accordance with the plans and specifications and the defect warranty period should begin.</td>
</tr>
<tr>
<td>Public Improvements</td>
<td>Improvements under the ownership or control of the County and maintained by the County including, but not limited to, the components of the street system and storm drainage system covered by these Standards.</td>
</tr>
<tr>
<td>Public Utility</td>
<td>Public utility as defined by Section 401103, C.R.S., 1973.</td>
</tr>
<tr>
<td>Record Drawings</td>
<td>An approved final revision of a design drawing or plan updated to include information from field inspections showing the true condition or configuration of what has been built. The drawing or plan is designated Record Drawing by stamp or lettering on the drawing.</td>
</tr>
<tr>
<td>Regional Trail</td>
<td>A bike or pedestrian facility designated by the County as a regional trail.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Right-of-Way or ROW</td>
<td>All property in which the County has any form of ownership or title and which is held for public purposes, regardless of whether or not any public improvement exists thereon or whether or not it is used, improved, or maintained for public use.</td>
</tr>
<tr>
<td>Roads, Private</td>
<td>A road that is owned and maintained by a private individual, organization, or company, other than a government. All roads within private gated communities are considered private roads and shall be maintained by the residents of that gated community. In order to accept a road for maintenance in El Paso County, any road, existing or proposed, must first meet the standards found within the ECM for a public road.</td>
</tr>
<tr>
<td>Roads, Public</td>
<td>Any street, highway, or road under the jurisdiction of and maintained by a public authority and opened to public travel.</td>
</tr>
<tr>
<td>Subdivision Improvements Agreement</td>
<td>An enforceable agreement between an applicant and El Paso County that serves as the security arrangement to secure the cost of public improvements required by the ECM and LDC.</td>
</tr>
<tr>
<td>Surety</td>
<td>A financial guarantee, by the applicant or permit holder and naming El Paso County as beneficiary, that public infrastructure and other common development or subdivision improvements required by the ECM, LDC, or other County rules and regulations will be completed.</td>
</tr>
<tr>
<td>Surveyor</td>
<td>A Professional Land Surveyor licensed by the State of Colorado.</td>
</tr>
<tr>
<td>Transportation Impact Study or TIS</td>
<td>A report that documents a study of traffic conditions before and after construction of a proposed development. It addresses any deficiencies in the transportation system, either current or after development, and proposes recommended mitigation.</td>
</tr>
<tr>
<td>Warrant</td>
<td>A threshold condition that, if found to be satisfied as part of an engineering study, shall result in analysis of other traffic conditions or factors to determine whether a traffic control signal or other transportation system improvement is justified.</td>
</tr>
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</table>
CHAPTER 2  TRANSPORTATION FACILITIES

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2.1 OVERVIEW

This chapter addresses the standards and technical criteria to be used to plan, design, construct, choose materials, locate, repair, maintain, reconstruct, and use roadways and other transportation facilities and the associated extrinsic structures.

2.1.1 Purpose

The purpose of this chapter is to provide detailed design guidelines and criteria for the preparation of plans for all County-owned and maintained transportation facilities and access to those facilities. These facilities include roadways and their structures, as well as extrinsic structures that support the use of the transportation facility.

2.1.2 Chapter Content and References

Table 2-1 outlines the chapter content and references used as a basis for the standards established in Chapter 2.

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1. El Paso County Land Development Code
2. El Paso County Major Transportation Corridor Plan
3. AASHTO, A Policy on Geometric Design of Highways and Roadways
4. AASHTO, Standard Specifications for Highway Bridges
5. AASHTO, LRFD Bridge Design Specifications
6. AASHTO, LRFD Bridge Construction Specifications
7. AASHTO, Roadside Design Guide
8. AASHTO, Standard Specifications Material, Sampling and Testing
9. CDOT, Standard Specifications for Road and Bridge Construction
10. CDOT, Bridge Manual
11. CDOT, M&S Standards
2.1.3 Standard Drawings

Table 2-2 identifies the standard drawings that are included in Appendix F as an enforceable part of these Standards. The Standard Drawing shall be used when designing improvements for County-owned and maintained facilities. Any change to a Standard Drawing shall be approved by the ECM Administrator and noted in the construction plans.

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2.1.4 Relationship Between ECM and El Paso County Road Impact Fee Program

El Paso County approved a Road Impact Fee Program in 2012 pursuant to Resolution 12-382. The Fee Program establishes an impact fee applicable to subdivision and certain zoning actions, and it provides a method of establishing credit for the construction of certain transportation improvements identified in the EPC Major Transportation Corridors Plan.

2.2 PLANNING

2.2.1 Basis for Planning

Proper planning of traffic systems helps to provide a safe and effective transportation network to meet existing and future demands within the County. All transportation system components shall be designed to promote:

- Safety – for vehicular and other modes of travel
- Performance – efficiency of service for all users
- Livability – impacts mitigated by circulation system improvements and coordinates with adjoining land uses
- Economy – of construction and use of land

The goal of planning transportation facilities is to create a network of roadways that connect, enhance circulation, and provide a balanced relationship between all that uses the roadways through coordination with developed land use plans (strategic and small area).

Transportation system planning requires consideration of the following when planning, designing and laying out facilities:

- Adjoining land uses;
- Natural features (topography, creeks, and wooded areas);
- Circulation;
- Impact to traffic;
- Roadway functional classification standards;
- Roadway access criteria;
- Soils investigations; and
- Pavement design.
2.2.2  Circulation

Circulation is important in transportation system design for the following reasons:

- Operation of the arterial road system is improved by dispersing local traffic onto multiple roads and access points;
- Local roads are to be used only for accessing developed lots;
- Response time for emergency services is reduced;
- Time and mileage traveled by individuals and service providers, including school bus transportation, mail delivery, utilities, etc., are reduced; and
- Use of transit systems, and pedestrian and bicycle facilities, is promoted.

2.2.3  Transportation Impact Study (TIS)

A.  General

The goal of the TIS is to identify the traffic-related issues that result from development and to determine mitigation techniques required to maintain acceptable levels of service, meet the transportation planning goals, and implement the El Paso County Major Transportation Corridors Plan (MTCP).

B.  TIS Preparation Guidelines

A TIS shall be prepared in accordance with the general guidelines in Appendix B. A number of specific parameters shall be evaluated in the TIS based on the level of complexity of the development and location within the transportation network. Three levels of analysis are permitted. Prior to assuming a specific level of required analysis, the design engineer should consult with the ECM Administrator to determine what level of analysis is appropriate and desired in support of a specific project proposal.

C.  Qualifications to Prepare a TIS

A TIS shall be prepared under the supervision of, and sealed by, a licensed Professional Engineer in the State of Colorado with experience in traffic engineering and transportation planning.

2.2.4  Roadway Functional Classifications and Urban/Rural Designations

Roadway functional classification is one parameter used to determine appropriate road design. The function of a road is determined by the volume of traffic, length of vehicle trips, and whether the road provides service primarily for vehicular movement or access to abutting land uses. For example, arterial roadways generally carry significantly greater traffic volumes and variety of traffic types at higher speeds than collector roads. Similarly, collector roads will carry greater traffic volumes at higher speeds than local roads.

Roadway functional classifications for regional based facilities are established by the most recently adopted MTCP. Other roadways are classified by the BOCC based on whether the adjoining land uses are rural or urban in nature (i.e. developments with lots greater than or equal to 2.5 acres), along with the existing and projected objectives of the roadway.
The County recognizes six roadway functional classifications within the rural designation: expressways, principal arterials, minor arterials, major collectors, minor collectors, and locals. The County recognizes seven roadway functional classifications within the urban roadway designation: expressways, principal arterials, minor arterials, nonresidential collectors, residential major collectors, residential minor collectors, and locals.

These Standards have been developed in support of the County roadway functional classification system.

A. Rural Roadways

1. Expressway

Expressways serve high-speed and high-volume traffic over long distances. Access is highly controlled and may have both grade-separated interchanges and full movement signalized intersections. Adjacent, existing and future, land uses shall be served by other network roadways, no direct parcel access is permitted (See Figure 2-1 and Figure 2-2).

Figure 2-1. Typical Rural Expressway Partial Cross Section (6 Lane)
2. **Principal Arterial**

Principal arterials serve high-speed and high-volume traffic over long distances. Access is highly controlled with a limited number of full movement intersections and medians with infrequent openings, and no direct parcel access. Adjacent, existing and future, land uses shall be served by other network roadways, service roads, and inter parcel connections (See Figure 2-3 and Figure 2-4).

**Figure 2-3 Typical Rural Principal Arterial Partial Cross Section (6 Lane)**
3. **Minor Arterial**

Minor arterials serve high-speed and high-volume traffic over medium distances, or are anticipated to serve this kind of traffic within a twenty-year period. Access is restricted through prescribed distances between intersections, use of medians, and no full movement parcel access (See Figure 2-5). Minor arterial status is assigned to rural roadways where the probability of significant travel demand in the future is high. Rights-of-way, easements, setbacks, and access limitations shall be pursued through the land development process on properties adjacent to minor arterials.

![Figure 2-5. Typical Rural Minor Arterial Partial Cross Section](image)

4. **Major Collector**

Major collectors serve as links between local access and arterial facilities over medium-to-long distances. Major collectors are managed to
maximize the safe operation of through-movements at speed. No full movement access is permitted where the local roadways can be expected to provide access (See Figure 2-6). Where no local public roadway can provide access, temporary direct parcel or partial turn movement access may be permitted, provided the design meets requirements presented in these Standards.

**Figure 2-6. Typical Rural Major Collector Cross Section**

5. **Minor Collector**

Minor collectors link local roadways to major collectors or arterial roadways. No full movement access is permitted where local roadways can be expected to provide access (See Figure 2-7). Where no local public or private roadway can provide access or where lot size is five acres or more, temporary direct parcel or partial turn movement access may be permitted. Access location and design are to be reviewed by the ECM Administrator to ensure roadway objectives are being met.
6. **Local**

Local roadways provide direct lot access and deliver lot-generated trips to collector roadways. Although access needs are high, accesses shall not be allowed to compromise the safety, health or welfare of roadway users (See Figure 2-8).

---

**Figure 2-7. Typical Rural Minor Collector Cross Section**

**Figure 2-8. Typical Rural Local Cross Section**
Chapter 2 Transportation Facilities
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section 2.2.4-2.2.4

B. Urban Roadways

1. Expressway

Expressways serve high-speed and high-volume traffic over long distances. Access is highly controlled and may have both grade-separated interchanges and full movement signalized intersections. Adjacent, existing and future, land uses shall be served by other network roadways, no direct parcel access is permitted (See Figure 2-9 and Figure 2-10).

Figure 2-9. Typical Urban Expressway Cross Section (6 Lane)
2. Principal Arterial

Principal arterials serve high-speed and high-volume traffic over long distances. Access is highly controlled with a limited number of full movement intersections and medians with infrequent openings, and no direct parcel access. Adjacent, existing and future, land uses shall be served by other network roadways, service roads, and inter parcel connections (See Figure 2-11 and 2-12).
3. **Minor Arterial**

Minor arterials serve high-volume traffic over medium distances in developed or developing urban areas. Access is restricted and based on prescribed distances between intersections, use of medians, and no full movement parcel access is permitted where the local roadways can be expected to provide access (See Figure 2-13). Where no local public or private roadway can provide access, temporary lot or partial turn movement access may be permitted, provided the design meets these Standards.
4. Nonresidential Collector

Nonresidential collectors link local roadways and arterial roadways in locations characterized by nonresidential land uses or uncommitted future land uses. Urban nonresidential collectors are intended to accommodate multiple modes of transportation, high-volume turning movements or significant changes in roadway use over time (See Figure 2-14). Urban nonresidential collectors are managed to maximize the safe operation of through-movements. Intersection and parcel access locations and design are reviewed by the ECM Administrator to ensure roadway objectives are being met.
5. **Residential Collector**

Residential collectors link local and arterial roadways in exclusively residential areas where build-out conditions for land development and roadway use can be reasonably forecasted (See Figure 2-15). Residential major collectors are managed to maximize the safe operation of through-movements. No full movement parcel access is permitted where the local roadways can be expected to provide access. Where no local public or private roadways can provide access, partial turn movement access may be permitted. Intersection and access location and design are reviewed by the ECM Administrator to ensure roadway objectives are being met.
6. **Local**

Local roadways link to collector or arterial roadways. Direct parcel access is permitted provided they meet sight distance and other design requirements presented in these Standards (See Figure 2-16). Intersection and parcel access location and design are reviewed by the ECM Administrator to ensure safe operations.

7. **Local (low volume)**

Local (low volume) roadways provide direct lot access and deliver lot-generated trips to collector roadways. Although access needs are high, accesses shall not be allowed to compromise the safety, health or welfare of roadway users (See Figure 2-17).
2.2.5 Roadway Access Criteria

All new or modified accesses to the County roadways shall meet the requirements of the ECM. Standards and technical criteria not specifically addressed in the ECM shall follow the provisions of the AASHTO, A Policy on Geometric Design of Highways and Roadways ("Green Book") and the Colorado State Highway Access Code. In addition, should any access request fall within the preview of the Major Thoroughfare Task Force (MTTF), per their adopted bylaws, then the request shall be brought before the MTTF for a recommendation.

A. Rural and Urban Expressway Access Criteria

1. Intersection Spacing and General Access Standards

Full movement intersections and major access spacing shall meet the requirements of this section. Right-in/right-out and three quarter movement accesses may be permitted as a deviation only if they meet the criteria presented in this section for sight distances, turn lane requirements, grades and do not negatively impact traffic operations or safety.

2. No Alternative Access to Road System

Where reasonable access can be obtained from the local roadway system, a temporary direct lot or partial turn movement access may be permitted provided the access meets these Standards or as otherwise required by the ECM Administrator.

3. Access and Lot Division

No additional access right shall accrue and no additional access shall be provided when splitting or dividing of existing lots of land. When an alternative is reasonably available in the opinion of the ECM Administrator, all access to the newly created properties shall be
provided internally from the existing access or new access to a roadway of lower functional classification.

4. Relocation of Access when Alternative is Available

All access to an expressway not meeting the minimum one-mile spacing requirement shall be closed in favor of an alternative access when an alternative is reasonably available in the opinion of the ECM Administrator.

B. Rural and Urban Principal Arterial and Rural Minor Arterial Access Criteria

1. Spacing

Spacing of roads accessing a principal arterial or rural minor arterial that will result in a full movement intersection shall be planned at one-half mile (one-quarter mile for rural minor arterials). Should the one-half mile spacing not be “viable or practical” for providing access to the adjacent land, a deviation may be considered and approved by the ECM Administrator. If a deviation is granted, only one additional full movement intersection will be permitted by the ECM Administrator. The Applicant shall have the burden of proof that no other “viable or practical” access is available. A deviation request should be supported by a traffic study or memorandum that provides information to assist the ECM Administrator in determining the proposed deviation minimizes negative safety and other operational impacts. If the development is at the intersection of two major corridors, the full movement access should be located on the lower functional classification roadway. The intersection shall only be approved if the intersection and roadway are shown to operate safely and efficiently with buildout design hour/peak hour projected traffic volumes. The intersection must also show a public benefit. An arterial progression through bandwidth percentage of 35 percent or greater must be achieved or the inclusion of a signal at the access must not degrade the existing signal progression. The intersection must not create any queuing or blocking of lane entries or access points. The intersection must be in a location such that any necessary turn, acceleration and deceleration lanes can be accommodated to maintain safe operations and capacity. The analysis should consider all potential future additional requirements for left turn or other exclusive phasing at a signal for which the need is created by traffic generated by land uses on both sides of the roadway.

2. Topography and Other Limitations

Where topography or other existing conditions make the required spacing inappropriate or unfeasible, location of the access shall be determined with consideration given to topography, established property ownerships, unique physical limitations, pre-existing historical land use patterns, and physical design constraints, with every attempt to achieve an access spacing of one-half mile. The final location shall serve as
many properties as possible to reduce the need for additional direct access to the principal arterial or rural minor arterial. In selecting locations for full movement intersections, preference shall be given to roads that meet, or may be reasonably expected to meet, signal warrants in the future.

3. **Access and Lot Division**

   No additional access right shall accrue and no additional access shall be provided when splitting or dividing existing lots of land. When an alternative is reasonably available in the opinion of the ECM Administrator, all access to the newly created properties shall be provided internally from the existing access or new access to a roadway of lower functional classification.

C. **Urban Minor Arterial Access Criteria**

   Spacing of roads accessing an urban minor arterial that will result in a full movement intersection shall be planned at one-quarter mile. However, one parcel access shall be granted to each existing lot, if it does not create safety or operational problems. The parcel access will provide for right turns only. The access may allow for left turns in (three-quarters movement) if the addition of left turns will improve the operation at an adjacent full movement intersection and meet appropriate design standards.

D. **Collector Access Standards**

   Collector roadways shall intersect another roadway (centerline to centerline) in accordance with the standards in Section 2.3.7. On minor collector roadways, the closest local roadway intersection to an arterial roadway shall be 330 feet (right-of-way line of arterial to centerline of local roadway). On major collector roadways, the closest local roadway intersection to an arterial roadway shall be 660 feet (right-of-way line of arterial to centerline of local roadway). Single-family residence access to major collector roadways is not permitted (even though existing conditions show otherwise).

E. **Rural and Urban Local Roadways**

   Roads shall not intersect urban local roadways closer than 175 feet from each other (centerline to centerline) and shall not intersect a rural local roadway closer than 330 feet from each other. On an urban local roadway, the closest intersection to a collector roadway shall be at least 200 feet (centerline to centerline). To an arterial roadway, the closest intersection shall be 330 feet (arterial right-of-way line to local roadway centerline).

2.2.6 **Soils Investigations**

A. **General**

   Soil investigations are conducted to help in preparing designs of roadways and other public facilities. The soil investigation report provides detailed information
for use in designing facilities to maximize their performance and enhance the lifecycle costs of the asset.

**B. Reporting Requirements**

As appropriate for the project, the following soil investigation reports shall be developed: (1) Geological Hazards Report, (2) Geotechnical Report, (3) Pavement Design Report, and (4) Inspection and Testing Report. A Professional Geologist or Professional Engineer licensed in the State of Colorado must prepare all soil investigations, as defined by Colorado State Statutes.

**C. Purpose of Reports**

1. **Geologic Hazards Report**
   
   This report identifies geologic conditions that may pose hazards to a proposed project.

2. **Geotechnical Report**
   
   This report evaluates the characteristics of the soils and the general issues of groundwater, soil stability, dipping bedrock, and swell/collapse potential that may pose hazards to, or affect the design of, roadway and related improvements within the right-of-way, public easements or slope easements. If groundwater is found within certain parameters, a subsurface water investigation shall be conducted to determine potential impacts to a proposed project.

3. **Pavement Design Report**
   
   This report investigates and details the characteristics of the soil and subsurface conditions affecting the roadway pavement design. The soil investigation associated with this report occurs after the roadways are graded and utilities are installed. The soil investigation associated with this report occurs after the roadways are graded and the deepest utility is installed.

4. **Inspection and Testing Report**
   
   The inspection and testing report is prepared following construction. It is based on the construction inspections and tests performed under the direct supervision of a Professional Engineer licensed in the State of Colorado, who must sign the report as defined by Colorado State Statutes. Analysis results of all fill material shall be included in the report.

**D. Report Preparation Guidelines**

All reports shall be prepared in conformance with the guidelines in Appendix C.
2.2.7 Pavement Design

A. General

Pavement design is a critical component of roadway design. Proper pavement design helps to ensure roadway performance and reduce the lifecycle costs associated with maintaining the roadway system.

B. Road Paving Policy

Paved roads meet the paving requirements established by Roadway Functional Classifications in Section 2.2.4.

1. New Roads

New roadways shall be paved if it connects to an existing roadway that is paved at the time of final approval of the development or it connects to a roadway internal to the development that is required to be paved.

New roadways are not required to be paved where:

- The new roadway has a projected ADT of less the 200 ADT within the proposed 20-year design life and the new road connects to an existing gravel road or
- The new road is located in an area of gravel roads and, to reduce the cost of maintenance, the ECM Administrator has determined that a gravel road is the most appropriate application.

2. Existing Roads

Existing roadways shall be paved where:

- Any development causes an existing gravel road to exceed a projected ADT of 200 (Note: the extent of paving will be determined by the ECM Administrator based on the Transportation Impact Study [Section 2.2.3]).
- In accordance with the terms and conditions of BoCC Resolution 07-495 regarding the Resident Participation Program.

3. New Gravel Roads

New gravel roads may be permitted in accordance with the allowances in Section 2.2.7B.1 except where:

- The road is projected to have an ADT of 200 or more. All roads with a projected ADT of 200 or more shall be paved to facilitate compliance with Colorado Air Quality Control Commission Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulfur Oxides for the State of Colorado.
- The new gravel road would be an extension of an existing paved road.
C. Pavement Design Report

A Pavement Design Report is required to be submitted and approved before paving any County road. The final pavement design may be submitted after the ECM Administrator approval of the associated roadway, profile, drainage, and final construction plans. The Pavement Design Report shall conform to the requirements of Appendix D. The soil investigation associated with this report occurs after the roadways are graded and the deepest utility is installed.

2.3 ROADWAY DESIGN

2.3.1 Roadway Design Criteria

Table 2-3 outlines the general roadway design criteria that shall guide roadway design and layout. All proposed roadway designs and layouts shall conform to the general roadway design criteria; the MTCP; and all other applicable criteria, standards, and regulations.

<table>
<thead>
<tr>
<th>Table 2-3. Roadway Design Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>Ensure Vehicular and Pedestrian Access</td>
</tr>
<tr>
<td>Minimize Through Trips</td>
</tr>
<tr>
<td>Control Access to Arterials</td>
</tr>
<tr>
<td>Discourage Speeding</td>
</tr>
<tr>
<td>Minimize Modal Conflicts (bike, pedestrian, transit, low speed vehicles)</td>
</tr>
</tbody>
</table>
Table 2-3. Roadway Design Criteria Continued

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Concern</th>
<th>Guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimize Space Devoted to Road Use</td>
<td>It is desirable to minimize local road mileage, thereby reducing construction and maintenance costs, as well as permitting the most efficient use of land. Roads should also have an appearance commensurate with their function.</td>
<td>Roads should be designed to complement local character.</td>
</tr>
<tr>
<td>Relate Road to Topography</td>
<td>Local roads are more attractive and economical if constructed to closely adhere to topography (minimize cut and fill).</td>
<td>The important role that roads play in the overall storm drainage system can be enhanced by closely following existing topography.</td>
</tr>
<tr>
<td>Layout Road to Achieve Optimum Subdivision of Land</td>
<td>The arrangement of roads should allow for economical and practical patterns, shapes, and sizes of adjacent lots. Roads as a function of land use must not unduly hinder the development of land.</td>
<td>Distances between roads, number of roads, and related elements all have a bearing on efficient subdivision of an area. Access to adjoining properties should also be encouraged.</td>
</tr>
</tbody>
</table>

2.3.2 Design Standards by Functional Classification

Section 2.2.4 of these standards identifies the Roadway Functional Classifications recognized and used by the County. Table 2-4 through Table 2-7 summarize many of the minimum roadway design standards by category and functional classification. Detailed road Standard Drawings are provided in Appendix F.

Table 2-4. Roadway Design Standards for Rural Expressways and Arterials

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Expressways</th>
<th>Arterials</th>
<th>Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 Lane</td>
<td>4 Lane</td>
<td>6 Lane Principal</td>
</tr>
<tr>
<td>Design Speed / Posted Speed (MPH)</td>
<td>70 / 65</td>
<td>70 / 65</td>
<td>70 / 65</td>
</tr>
<tr>
<td>Clear Zone</td>
<td>34’</td>
<td>34’</td>
<td>34’</td>
</tr>
<tr>
<td>Minimum Centerline Curve Radius</td>
<td>2,050’</td>
<td>2,050’</td>
<td>2,050’</td>
</tr>
<tr>
<td>Number of Through Lanes</td>
<td>6</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Lane Width</td>
<td>12’</td>
<td>12’</td>
<td>12’</td>
</tr>
<tr>
<td>Right-of-Way</td>
<td>210’</td>
<td>180’</td>
<td>210’</td>
</tr>
<tr>
<td>Paved Width</td>
<td>56’</td>
<td>38’</td>
<td>56’</td>
</tr>
<tr>
<td>Median Width</td>
<td>24’</td>
<td>24’</td>
<td>24’</td>
</tr>
<tr>
<td>Outside Shoulder Width (paved/gravel)</td>
<td>12’(10'2’)</td>
<td>12’(10'2’)</td>
<td>12’(10'2’)</td>
</tr>
<tr>
<td>Inside Shoulder Width (paved/gravel)</td>
<td>12’(10'2’)</td>
<td>6’(4'2’)</td>
<td>12’(10'2’)</td>
</tr>
<tr>
<td>Design ADT</td>
<td>48,000</td>
<td></td>
<td>40,000</td>
</tr>
<tr>
<td>Access Permitted</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Access Spacing</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Intersection Spacing</td>
<td>1 mile</td>
<td>1 mile</td>
<td>½ mile</td>
</tr>
<tr>
<td>Parking Permitted</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Minimum Flowline Grade</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>
### Centerline Grade (Min.-Max.)
- 1-5%
- 1-5%
- 1-5%
- 1-6%

### Intersection Grades (Min.-Max.)
- 1-2%
- 1-2%
- 1-3%
- 1-3%
- 1-4%

1. Assumes 4% superelevation, 6% for 70 MPH design speeds
2. Pavement width in each direction for divided roadways

---

**Table 2-5. Roadway Design Standards for Rural Collectors and Locals**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Collectors</th>
<th>Local</th>
<th>Gravel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collectors</strong></td>
<td><strong>Major</strong></td>
<td><strong>Minor</strong></td>
<td><strong>Local</strong></td>
</tr>
<tr>
<td><strong>Design Speed / Posted Speed (MPH)</strong></td>
<td>50 / 45</td>
<td>40 / 35</td>
<td>30 / 30</td>
</tr>
<tr>
<td><strong>Clear Zone</strong></td>
<td>20’</td>
<td>14’</td>
<td>7’</td>
</tr>
<tr>
<td><strong>Minimum Centerline Curve Radius</strong></td>
<td>930²</td>
<td>565’</td>
<td>300’</td>
</tr>
<tr>
<td><strong>Number of Through Lanes</strong></td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Lane Width</strong></td>
<td>12’</td>
<td>12’</td>
<td>12’</td>
</tr>
<tr>
<td><strong>Right of Way</strong></td>
<td>90’</td>
<td>80’</td>
<td>70³</td>
</tr>
<tr>
<td><strong>Paved Width</strong></td>
<td>32’</td>
<td>32’</td>
<td>28’</td>
</tr>
<tr>
<td><strong>Median Width</strong></td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Outside Shoulder Width (paved/gravel)</strong></td>
<td>8'(4'/4')</td>
<td>6'(4'/2')</td>
<td>4'(2'/2')</td>
</tr>
<tr>
<td><strong>Inside Shoulder Width (paved/gravel)</strong></td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Design ADT</strong></td>
<td>3,000</td>
<td>1,500</td>
<td>750</td>
</tr>
<tr>
<td><strong>Design Vehicle</strong></td>
<td>WB-67</td>
<td>WB-67</td>
<td>WB-50</td>
</tr>
<tr>
<td><strong>Access Permitted</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Access Spacing</strong></td>
<td>n/a</td>
<td>Frontage</td>
<td>Frontage</td>
</tr>
<tr>
<td><strong>Intersection Spacing</strong></td>
<td>¼ mile</td>
<td>660’</td>
<td>330’</td>
</tr>
<tr>
<td><strong>Parking Permitted</strong></td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Minimum Flowline Grade</strong></td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Centerline Grade (Min.-Max.)</strong></td>
<td>1-8%¹</td>
<td>1-8%¹</td>
<td>1-8%¹</td>
</tr>
<tr>
<td><strong>Intersection Grades (Min.-Max.)</strong></td>
<td>1-4%</td>
<td>1-4%</td>
<td>1-4%</td>
</tr>
</tbody>
</table>

1. 10% maximum grade permitted at the discretion of the ECM Administrator
2. Assumes 4% superelevation, 6% for 70 MPH design speeds
3. 60-foot right-of-way plus two 5-foot Public Improvements Easements granted to El Paso County
### Table 2-6. Roadway Design Standards for Urban Expressways and Arterials

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Expressways</th>
<th>Arterials</th>
<th>Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 Lane</td>
<td>4 Lane</td>
<td>6 Lane Principal</td>
</tr>
<tr>
<td>Design Speed / Posted Speed (MPH)</td>
<td>60 / 55</td>
<td>60 / 55</td>
<td>50 / 45</td>
</tr>
<tr>
<td>Clear Zone</td>
<td>30’</td>
<td>30’</td>
<td>20’</td>
</tr>
<tr>
<td>Minimum Centerline Curve Radius</td>
<td>1,505’</td>
<td>1,505’</td>
<td>930’</td>
</tr>
<tr>
<td>Number of Through Lanes</td>
<td>6</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Lane Width</td>
<td>12’</td>
<td>12’</td>
<td>12’</td>
</tr>
<tr>
<td>Right-of-Way</td>
<td>160’</td>
<td>140’</td>
<td>160’</td>
</tr>
<tr>
<td>Paved Width (Excluding Gutter Pan)</td>
<td>48’</td>
<td>36’</td>
<td>48’</td>
</tr>
<tr>
<td>Median Width (Including Curb &amp; Gutter)</td>
<td>31’</td>
<td>23’</td>
<td>31’</td>
</tr>
<tr>
<td>Shoulder Width (Ext., Excluding Gutter)</td>
<td>8’</td>
<td>8’</td>
<td>8’</td>
</tr>
<tr>
<td>Shoulder Width (Int., Excluding Gutter)</td>
<td>4’</td>
<td>4’</td>
<td>4’</td>
</tr>
<tr>
<td>Required Curb/ Gutter Type</td>
<td>6’ ramp</td>
<td>6’ ramp</td>
<td>6’ vertical</td>
</tr>
<tr>
<td>Sidewalk Width (@ FL)</td>
<td>6’ detached</td>
<td>6’ detached</td>
<td>6’ detached</td>
</tr>
<tr>
<td>Design ADT</td>
<td>48,000</td>
<td></td>
<td>40,000</td>
</tr>
<tr>
<td>Bike Lanes Permitted</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Access Permitted</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Access Spacing</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Intersection Spacing</td>
<td>1 mile</td>
<td>1 mile</td>
<td>½ mile</td>
</tr>
<tr>
<td>Parking</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Minimum Flowline Grade of Curb</td>
<td>.50%</td>
<td>.50%</td>
<td>.50%</td>
</tr>
<tr>
<td>Centerline Grade (Min.-Max.)</td>
<td>0.5-5%</td>
<td>0.5-5%</td>
<td>0.5-6%</td>
</tr>
<tr>
<td>Intersection Grades (Min.-Max.)</td>
<td>0.5-2%</td>
<td>0.5-2%</td>
<td>0.5-3%</td>
</tr>
</tbody>
</table>

1 Assumes 4% superelevation, 6% for 70 MPH design speeds
2 Pavement width in each direction for divided roadways
3 Where no local public or private roadway can provide access, temporary or partial turn movement parcel access may be permitted
Table 2-7. Roadway Design Standards for Urban Collectors and Locals

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Collectors</th>
<th>Local</th>
<th>Local&lt;sup&gt;4&lt;/sup&gt; (low volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Speed / Posted Speed (MPH)</td>
<td>40 / 35</td>
<td>25 / 25</td>
<td>20 / 20</td>
</tr>
<tr>
<td>Clear Zone</td>
<td>14'</td>
<td>12'</td>
<td>7'</td>
</tr>
<tr>
<td>Minimum Centerline Curve Radius</td>
<td>565'</td>
<td>200'</td>
<td>100'</td>
</tr>
<tr>
<td>Number of Through Lanes</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Lane Width</td>
<td>12'</td>
<td>12'</td>
<td>12'</td>
</tr>
<tr>
<td>Right-of-Way</td>
<td>60'</td>
<td>60&lt;sup&gt;3&lt;/sup&gt;</td>
<td>60&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Paved Width (Excluding Gutter Pan)</td>
<td>36'</td>
<td>30'</td>
<td>24'</td>
</tr>
<tr>
<td>Median Width (Including Curb &amp; Gutter)</td>
<td>12'</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Shoulder Width (Ext., Excluding Gutter)</td>
<td>6'</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Shoulder Width (Int., Excluding Gutter)</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Required Curb/ Gutter Type (Vertical)</td>
<td>6'</td>
<td>6'</td>
<td>6' (or ramp)</td>
</tr>
<tr>
<td>Sidewalk Width (@ FL)</td>
<td>5' detached</td>
<td>5' attached</td>
<td>5' attached</td>
</tr>
<tr>
<td>Design ADT</td>
<td>20,000</td>
<td>3,000</td>
<td>300</td>
</tr>
<tr>
<td>Design Vehicle</td>
<td>WB-50</td>
<td>WB-50</td>
<td>SU-30</td>
</tr>
<tr>
<td>Bike Lanes Permitted</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Access Permitted</td>
<td>No&lt;sup&gt;5&lt;/sup&gt;</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Access Spacing</td>
<td>See Table 2-35</td>
<td>See Table 2-35</td>
<td>Frontage</td>
</tr>
<tr>
<td>Intersection Spacing</td>
<td>660&lt;sup&gt;2&lt;/sup&gt;</td>
<td>660&lt;sup&gt;2&lt;/sup&gt;</td>
<td>175'</td>
</tr>
<tr>
<td>Parking Permitted</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Minimum Flowline Grade of Curb</td>
<td>.50%</td>
<td>.50%</td>
<td>.50%</td>
</tr>
<tr>
<td>Centerline Grade (Min.-Max.,)</td>
<td>0.5-6%&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.5-8%&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.5-8%&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Intersection Grades (Min.-Max.)</td>
<td>0.5-4%</td>
<td>0.5-4%</td>
<td>0.5-4%</td>
</tr>
</tbody>
</table>

<sup>1</sup> 10% maximum grade permitted at the discretion of the ECM Administrator
<sup>2</sup> 330 feet when intersecting local roadways
<sup>3</sup> 50-foot right-of-way plus two 5-foot Public Improvements Easements granted to El Paso County
<sup>4</sup> Section can be used for cul-de-sacs, or roads with two ways out having a maximum of 300 ADT and a maximum length of 1,200 feet
<sup>5</sup> Where no local public or private roadway can provide access, temporary or partial turn movement parcel access may be permitted

2.3.3 Horizontal Alignment

A. General Criteria

Proper roadway alignment provides for safe and continuous operation at a uniform design speed. Proposed road layouts shall have a logical relationship to existing or platted roads and fit within the overall transportation plan.
Chapter 2 Transportation Facilities
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section 2.3.3-2.3.3

B. Intersections

All new roadways must intersect at or nearly at right angles. Modified roadways shall intersect at or nearly at right angles or otherwise allow for safe operation as determined by the ECM Administrator.

C. Design Speed

Design speed is a speed selected to determine the various geometric design features of a roadway. Design speed shall be used to determine stopping sight distance and intersection sight distance requirements for new road facilities. The design speeds by functional classification are provided in Table 2-4 through Table 2-7.

D. Superelevation

1. General

The maximum rate of superelevation is controlled by factors including climate conditions, terrain conditions, land use characteristics (rural or urban), and frequency of slow-moving vehicles. For a given design speed, the superelevation rate applied shall have a logical relationship to the side friction factor.

2. Establishing the Rate

Superelevation shall be consistent with Table 2-8, the AASHTO Green Book, and CDOT M & S Standards. However, the maximum rate used for expressways shall be 0.060 and arterial roadways shall be 0.040. Superelevation is not permitted on roadways with design speeds less than 50 MPH.

3. Adjustments to the Rate

Standard rates of superelevation must be maintained throughout the curve when possible. In general, roadway intersections, established roadway grades, curb, and adverse drainage conditions may require a reduction in the rate of superelevation or the application of different rates for each half of the roadway to create a safe condition in an urban environment. In areas where pavement warping is required for adverse drainage, superelevations should be avoided.
Table 2-8. Design Values for Rate of Superelevation (e) and Minimum Length of Runoff

<table>
<thead>
<tr>
<th>R (feet)</th>
<th>V_d=50 MPH</th>
<th>V_d=60 MPH</th>
<th>V_d=70 MPH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L (feet)</td>
<td>L (feet)</td>
<td>L (feet)</td>
</tr>
<tr>
<td></td>
<td>e (%) 2 Ls</td>
<td>e (%) 2 Ls</td>
<td>e (%) 2 Ls</td>
</tr>
<tr>
<td></td>
<td>Ls</td>
<td>Ls</td>
<td>Ls</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>23,000</td>
<td>NC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20,000</td>
<td>NC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17,000</td>
<td>NC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14,000</td>
<td>NC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12,000</td>
<td>NC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10,000</td>
<td>NC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8,000</td>
<td>RC</td>
<td>48</td>
<td>72</td>
</tr>
<tr>
<td>6,000</td>
<td>RC</td>
<td>48</td>
<td>72</td>
</tr>
<tr>
<td>5,000</td>
<td>RC</td>
<td>48</td>
<td>72</td>
</tr>
<tr>
<td>4,000</td>
<td>2.3</td>
<td>55</td>
<td>83</td>
</tr>
<tr>
<td>3,500</td>
<td>2.5</td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td>3,000</td>
<td>2.7</td>
<td>65</td>
<td>97</td>
</tr>
<tr>
<td>2,500</td>
<td>2.9</td>
<td>70</td>
<td>104</td>
</tr>
<tr>
<td>2,000</td>
<td>3.2</td>
<td>77</td>
<td>115</td>
</tr>
<tr>
<td>1,800</td>
<td>3.3</td>
<td>79</td>
<td>119</td>
</tr>
<tr>
<td>1,600</td>
<td>3.5</td>
<td>84</td>
<td>126</td>
</tr>
<tr>
<td>1,400</td>
<td>3.7</td>
<td>89</td>
<td>133</td>
</tr>
<tr>
<td>1,200</td>
<td>3.9</td>
<td>94</td>
<td>140</td>
</tr>
<tr>
<td>1,000</td>
<td>4.0</td>
<td>96</td>
<td>144</td>
</tr>
</tbody>
</table>

where:

- e_max = 4% (Recommended by the ECM Administrator, must obtain approval for differences)
- R = radius of curve, feet
- V_d = design speed
- e = rate of superelevation
- L = minimum length of runoff (does not include tangent runout)
- NC = normal crown section
- RC = remove adverse crown, superelevate at normal slope

1 e_max = 6% for V=70MPH

E. Horizontal Curve Radii

Horizontal alignment design speed must be consistent with the requirement for vertical alignment design speed. The minimum acceptable design radii are shown in Tables 2-4 through 2-7. Reverse and compound curves should be used only when a single radius curve will not work. For driver safety, compound curves shall have a ratio no greater than 1.5 where the value of the larger radius is divided by the smaller radius.
F. Minimum Tangent Length

1. Intersection

Whenever a roadway intersects a roadway of higher classification, a tangent length (measured from the nearest gutter flowline of the intersected roadway to the point of curvature in the intersecting roadway) shall be provided for a safe sight distance and traffic operation. The minimum required tangent lengths indicated in Table 2-9 only apply to the roadways with lower functional classifications. The angle of departure shall not exceed 10 degrees for the length of tangent.

Table 2-9. Minimum Tangent Lengths at Intersection

<table>
<thead>
<tr>
<th>Higher Classification Roadway (below)</th>
<th>Lower Classification Intersecting Roadway</th>
<th>Expressway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Collector 200</td>
<td>250</td>
</tr>
<tr>
<td>Collector 200</td>
<td>Arterial</td>
<td>250(^1)</td>
</tr>
<tr>
<td>Collector 200(^1)</td>
<td>Arterial 200(^1)</td>
<td>n/a</td>
</tr>
<tr>
<td>Collector 200(^1)</td>
<td>Collector 200(^1)</td>
<td>n/a</td>
</tr>
<tr>
<td>Collector 200(^1)</td>
<td>Collector 200(^1)</td>
<td>n/a</td>
</tr>
</tbody>
</table>

1 In the case of where each intersecting roadway is of the same classification, the ECM Administrator will designate which roadway takes precedence.

2 Use AASHTO, A Policy on Geometric Design of Highways and Roadways for design requirements.

2. Reverse Curves

The tangent between reverse curves shall be no less than the length shown in Table 2-10.

3. Broken Back Curves

Two curves in the same direction (broken back curves) shall be separated by a tangent with a length of at least two times the minimum length shown in Table 2-10. For local roadways, a minimum tangent of 200 feet shall be used to separate all broken back curves.

Table 2-10. Minimum Tangent Lengths between Curves

<table>
<thead>
<tr>
<th>Roadway Classification</th>
<th>Minimum Tangent Length (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressway</td>
<td>250</td>
</tr>
<tr>
<td>Arterial</td>
<td>200</td>
</tr>
<tr>
<td>Collector</td>
<td>150</td>
</tr>
</tbody>
</table>
G. **Consistent Radii**

All curves along a roadway shall be designed with radii that are approximately equal to provide consistency and minimize unexpected maneuvers for the driver.

H. **Curves with Small Deflection Angles (10° or less)**

High volume roadways using minimum length curves shall be designed with the minimum centerline arc lengths shown in Table 2-11. All other roadways shall be designed for safe travel and to create a smooth appearance.

<table>
<thead>
<tr>
<th>Functional Classification</th>
<th>Minimum Centerline Arc Length (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressway</td>
<td>500</td>
</tr>
<tr>
<td>Arterial</td>
<td>400</td>
</tr>
</tbody>
</table>

I. **Horizontal Curves on Vertical Curves**

Horizontal curves shall not begin near the crest of a vertical curve nor near the bottom of a sag vertical curve.

J. **Lane Shifts or Drops**

Transitions for roadways are useful in maintaining the safety, traffic flow, and operations of the roadway and access. When the County requires a lane shift or drop based on information obtained in a TIS, the design, installation, and purchase of the right-of-way to accommodate the required lanes is the responsibility of the owner, applicant or developer.

K. **Joining Existing Improvements**

Connection with existing roadways shall be made to match the alignment grade of the existing improvements, in accordance with the horizontal alignment criteria.

L. **Effect of Grade**

Grade affects the operating speeds of vehicles and should be recognized as a critical issue in the design of roadways. Where practical, the roadway should be designed for a higher design speed on the downgrade portions and a lower design speed on the upgrade. This variation in design speed will depend on the rate and length of grade and the degrees of curvature, as compared with other curves on the roadway section.

M. **Sight Distance on Horizontal Curves**

The proposed horizontal alignment must provide for the minimum stopping distance for the design speed at all points along the roadway. In addition, the design must take into account the visibility at intersections, around curves, and roadside encroachments.
N. Future Extension Confirmation

When a roadway is designated within the MTCP for future extension, additional survey and preliminary design beyond the current project boundaries may be requested by the ECM Administrator to confirm coordination.

2.3.4 Vertical Alignment

A. Vertical Curves

Vertical curves may either be a crest or sag-type curve (See Figure 2-18).

1. Crest Vertical Curves

Figure 2-19 and Table 2-12 show the required lengths of vertical curves for different algebraic differences in grade to provide required stopping sight distances for each design speed.

Design values of crest vertical curves for passing sight distance differ from those for stopping sight distance because of the different height criterion (4.25 feet instead of 0.5 feet). K-values for crest vertical curves based on passing sight distance are shown in Table 2-13.

![Figure 2-18. Types of Vertical Curves](image)
**Figure 2-19. Design Controls for Stopping Sight Distances on Crest Vertical Curves**

![Diagram showing design controls for stopping sight distances on crest vertical curves.](image_url)

**Table 2-12. Design Controls for Stopping Sight Distances on Crest Vertical Curves**

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Stopping Sight Distance (feet)</th>
<th>Rate of Vertical Curvature, K&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Calculated</td>
</tr>
<tr>
<td>25</td>
<td>155</td>
<td>11.1</td>
</tr>
<tr>
<td>30</td>
<td>200</td>
<td>18.5</td>
</tr>
<tr>
<td>40</td>
<td>305</td>
<td>43.1</td>
</tr>
<tr>
<td>50</td>
<td>425</td>
<td>83.7</td>
</tr>
<tr>
<td>60</td>
<td>570</td>
<td>150.6</td>
</tr>
<tr>
<td>70</td>
<td>730</td>
<td>246.9</td>
</tr>
</tbody>
</table>

<sup>1</sup> Assumes an eye height of 3.5 feet and an object height of 0.5 feet under open road conditions.

**where:**

- \( K = \text{rate of vertical curvature} = \frac{L}{A}, \) the length of curve per percent algebraic difference in intersecting grades.
- \( L = \text{length of vertical curve, feet} \)
- \( A = \text{algebraic differences in intersecting grades} \)
- \( S = \text{estimated sight distance, feet} \)
2. Sag Vertical Curves

Table 2-14 and Figure 2-20 show the required lengths of sag vertical curves for different algebraic differences in grade to provide required stopping sight distances for each design speed.

Table 2-13. Design Controls for Passing Sight Distance on Crest Vertical Curves

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Minimum Passing Sight Distance (feet)</th>
<th>Rate of Vertical Curvature, K&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>900</td>
<td>289</td>
</tr>
<tr>
<td>30</td>
<td>1090</td>
<td>424</td>
</tr>
<tr>
<td>40</td>
<td>1470</td>
<td>772</td>
</tr>
<tr>
<td>50</td>
<td>1835</td>
<td>1203</td>
</tr>
<tr>
<td>60</td>
<td>2135</td>
<td>1628</td>
</tr>
<tr>
<td>70</td>
<td>2480</td>
<td>2197</td>
</tr>
</tbody>
</table>

<sup>1</sup> Assumes an eye height of 3.5 feet and an object height of 0.5 feet under open road conditions.

where:

- \( K = \text{rate of vertical curvature} \) \((K = \frac{L}{A}, \text{the length of curve per percent algebraic difference in intersecting grades})\)
- \( L = \text{length of vertical curve, feet} \)
- \( A = \text{algebraic differences in intersecting grades} \)
- \( S = \text{estimated sight distance, feet} \)

**Figure 2-20. Design Controls for Stopping Distances on Sag Vertical Curves**
Table 2-14. Design Controls for Stopping Distance on Sag Vertical Curves

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Stopping Sight Distance (feet)</th>
<th>Rate of Vertical Curvature, K&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Calculated</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>155</td>
<td>25.5</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>30</td>
<td>200</td>
<td>36.4</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td>40</td>
<td>305</td>
<td>63.4</td>
<td></td>
<td>64</td>
</tr>
<tr>
<td>50</td>
<td>425</td>
<td>95.7</td>
<td></td>
<td>96</td>
</tr>
<tr>
<td>60</td>
<td>570</td>
<td>135.7</td>
<td></td>
<td>136</td>
</tr>
<tr>
<td>70</td>
<td>730</td>
<td>180.3</td>
<td></td>
<td>181</td>
</tr>
</tbody>
</table>

<sup>1</sup> Assumes an eye height of 3.5 feet and an object height of 0.5 feet under open road conditions.

**Where:**

\[ K = \text{rate of vertical curvature} (K = \frac{L}{A}, \text{the length of curve per percent algebraic difference in intersecting grades}) \]

\[ L = \text{length of vertical curve, feet} \]

\[ A = \text{algebraic differences in intersecting grades} \]

\[ S = \text{estimated sight distance, feet} \]

**B. Maximum and Minimum Grades for Roadways**

The maximum and minimum grades for specific roadway classifications are shown in Table 2-15. The centerline grade in the bulb of a cul-de-sac shall not exceed 3 percent.

Table 2-15. Minimum and Maximum Roadway Grades

<table>
<thead>
<tr>
<th>Functional Classification or Facility Type</th>
<th>Maximum Centerline Grade (%)</th>
<th>Minimum Centerline Grade (%)</th>
<th>Minimum Gutter Flowline Grade (%)</th>
<th>Minimum Roadside Ditch Flowline Grade (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressway (Urban/Rural)</td>
<td>5/5</td>
<td>0.5/1</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Arterial (Urban/Rural)</td>
<td>6/5 or 6 (for minor)</td>
<td>0.5/1</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Collector (Urban/Rural)</td>
<td>8&lt;sup&gt;1/2&lt;/sup&gt;/8&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.5/1</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Local (Urban/Rural)</td>
<td>8&lt;sup&gt;1/8&lt;/sup&gt;</td>
<td>0.5/1</td>
<td>0.5</td>
<td>1</td>
</tr>
<tr>
<td>Cul-De-Sac</td>
<td>3</td>
<td>1</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

<sup>1</sup> 10% maximum grade permitted at the discretion of the ECM Administrator

<sup>2</sup> 6% maximum grade permitted for Non-residential Collector

**C. Joining Existing Improvements**

Connection with existing roadways shall be made to match the grade of the existing improvements, in accordance with vertical alignment criteria.

**D. Intersection Approach Grades**

Intersection approach grades can be found in Section 2.3.7C.4.

**E. Grade Breaks and Vertical Curves**

Vertical curves are required when the algebraic difference in grades is equal to or greater than 1.0%. In addition, the maximum grade break allowed at the point of
tangency at a curb return for local and collector roads shall be 2%. Grade breaks of less than 1.0% are permitted.

F. Cross Fall
Except at intersections or where a superelevation is required, roadways must be designed to maintain a level cross slope from top of curb to top of curb (or flowline to flowline). The distance from an intersection where cross-fall will be permitted shall be determined by the ECM Administrator.

G. Spiral Curves
Major and minor arterial roadways may be designed with spiral curves with approval of the ECM Administrator.

H. Future Extension Confirmation
When a roadway is designated within the MTCP for future extension, additional survey and preliminary design beyond the current project boundaries may be requested by the ECM Administrator to confirm coordination.

2.3.5 Clear Zones
Clear zones and recovery areas shall conform to CDOT Highway Access Code, AASHTO Green Book, and AASHTO Roadside Design Guide, as modified by Table 2-16. Where a site-specific investigation indicates a high probability of continuing crashes, or such occurrence are indicated by crash history, the greater clear-zone distances may be required by the ECM Administrator. Clear zones may be limited to 30 feet, when approved by the ECM Administrator, to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance. In addition, in no case shall a permanent structure, including light poles, fire hydrants or trees be placed within these clear zones or in any other location that would obstruct sight distances without prior approval from the ECM Administrator.
Table 2-16. Clear Zone Distances

<table>
<thead>
<tr>
<th>Design Speed</th>
<th>Design ADT</th>
<th>1V:6H or flatter</th>
<th>1V:5H to 1V:4H</th>
<th>1V:3H</th>
<th>1V:3H</th>
<th>Backslopes</th>
</tr>
</thead>
</table>

1 Distances are provided in feet from the edge of the through lane.
2 Since recovery is less likely on the unshielded, traversable 1V:3H slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of the slope. Determination of the width of the recovery area at the toe of slope should take into consideration right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through-traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope.

2.3.6 Sight Distance

Sight distance is the length of roadway that is clearly visible to the driver and is dependent upon the height of the driver's eye above the road surface, the specified object height above the road surface, and the height of sight obstructions within the line of sight. The minimum sight distance available on a roadway should be sufficient to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object. In evaluating the overall performance of a roadway, both the horizontal and vertical sight distances should be considered.

A. Sight Distance Calculations

For general sight distance calculations, the height of the driver's eye is considered to be 3.5 feet above the road surface and the object is considered to be 0.5 feet above the road surface. However, for passing sight distance calculations, the height of the object is considered to be 4.25 feet above the road surface.
The sight distance design shall assume that a 6-foot-high fence (as measured from actual finish grade) exists at all property lines except where a sight distance easement has been established.

**B. Stopping Sight Distance on Straight Roadways**

The minimum stopping sight distance is the distance required by the driver of a vehicle traveling at the design speed to bring the vehicle to a stop after an object on the road becomes visible. Stopping sight distance is the sum of the braking distance and the brake reaction time (the interval between the instant that the driver recognizes the existence of an object on the roadway and the instant the driver applies the brakes). The braking distance is related to the initial speed and the coefficient of friction between the tires and the roadway. The wet condition governs the stopping distances for purposes of design. Table 2-17 provides the required minimum stopping sight distances on straight roadways with grades of less than 3%. In no case shall the stopping sight distance be less than as specified in Table 2-17. For grades in excess of 3%, refer to Table 2-18.

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Brake Reaction Distance (feet)¹</th>
<th>Braking Distance on Level (feet)</th>
<th>Stopping Sight Distance Calculated (feet)</th>
<th>Stopping Sight Distance Design (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>91.9</td>
<td>60.0</td>
<td>151.9</td>
<td>155</td>
</tr>
<tr>
<td>30</td>
<td>110.3</td>
<td>86.4</td>
<td>196.7</td>
<td>200</td>
</tr>
<tr>
<td>40</td>
<td>147.0</td>
<td>153.6</td>
<td>300.6</td>
<td>305</td>
</tr>
<tr>
<td>50</td>
<td>183.8</td>
<td>240.0</td>
<td>423.8</td>
<td>425</td>
</tr>
<tr>
<td>60</td>
<td>220.5</td>
<td>345.5</td>
<td>566.0</td>
<td>570</td>
</tr>
<tr>
<td>70</td>
<td>257.3</td>
<td>470.3</td>
<td>727.6</td>
<td>730</td>
</tr>
</tbody>
</table>

¹Brake reaction distance predicted on a time of 2.5 seconds; deceleration rate of 11.2 feet/second used to determine calculated sight distance.

**C. Stopping Sight Distance on Horizontal Curve**

Stopping sight distance on horizontal curves is based upon lateral clearance from the inner edge of pavement to sight obstruction, for various radii of inner edge of pavement and design speeds. The position of the driver’s eye and the object sighted shall be assumed to be 6 feet from the inner edge of pavement, with the sight distance being measured along this arc. Figure 2-21 is a design chart showing the required middle ordinates for clear sight areas to satisfy stopping sight distances required for curves of various degrees. Figure 2-21 utilizes the stopping sight distance values in Table 2-17. A value at or approaching the upper limit should be used as a minimum wherever conditions permit.
**Figure 2-21. Design Controls for Stopping Distance on Horizontal Curve**

![Graph showing design controls for stopping distance on horizontal curves.](image)

Middle Ordinate, M, centerline of inside lane to obstruction (ft)

**where:**

- **V** = design speed, MPH
- **M** = middle ordinate, centerline of inside lane to obstruction, feet
- **R** = radius of inside lane, feet
- **S** = estimated sight distance, feet (See Table 2-17)

**D. Stopping Sight Distances at Grade**

When a roadway is constructed on a grade steeper than 3 percent, the braking distance should not only include to the initial speed and coefficient of friction, but also the percent grade (both up and down). Table 2-18 provides the required stopping sight distances at grade in wet conditions.
Table 2-18. Stopping Distance at Grade

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Downgrades</th>
<th>Upgrades</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3%</td>
<td>6%</td>
</tr>
<tr>
<td>25</td>
<td>158</td>
<td>165</td>
</tr>
<tr>
<td>30</td>
<td>205</td>
<td>215</td>
</tr>
<tr>
<td>40</td>
<td>315</td>
<td>333</td>
</tr>
<tr>
<td>50</td>
<td>446</td>
<td>474</td>
</tr>
<tr>
<td>60</td>
<td>598</td>
<td>638</td>
</tr>
<tr>
<td>70</td>
<td>771</td>
<td>825</td>
</tr>
</tbody>
</table>

E. Decision Sight Distance in Areas of Visual Noise

Decision sight distance is defined as the distance it takes for a driver to detect an unexpected or difficult-to-perceive hazard along the roadway that may be visually cluttered, recognize this hazard, select an appropriate speed and path, and complete the required safety maneuver. Based on this definition, these values tend to be greater than stopping sight distances. Interchanges and intersections, locations where unusual or unexpected maneuvers are required, changes in cross section, and areas of “visual noise” are examples of locations where decision sight distances may be needed. Table 2-19 provides the required decision sight distances.

Table 2-19. Decision Sight Distance

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Decision Sight Distance for Avoidance Maneuver (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>30 or less</td>
<td>220</td>
</tr>
<tr>
<td>40</td>
<td>330</td>
</tr>
<tr>
<td>50</td>
<td>465</td>
</tr>
<tr>
<td>60</td>
<td>610</td>
</tr>
<tr>
<td>70</td>
<td>780</td>
</tr>
</tbody>
</table>

where:
- Avoidance Maneuver A = stop on rural road (t = 3.0 seconds)
- Avoidance Maneuver B = stop on urban road (t = 9.1 seconds)
- Avoidance Maneuver C = speed/path/direction change on rural road (t = 10.2 - 11.2 seconds)
- Avoidance Maneuver D = speed/path/direction change on suburban road (t = 12.1 - 12.9 seconds)
- Avoidance Maneuver E = speed/path/direction change on urban road (t = 14.0 - 14.5 seconds)

F. Passing Sight Distance for Two-Lane Roads

Passing sight distance is the minimum distance (traveling at the design speed) that must be available to enable the driver of one vehicle to pass another safely and comfortably without interfering with oncoming traffic. Required passing sight distances are provided in Table 2-20.
Table 2-20. Minimum Passing Sight Distance for Two-Lane Roads

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Passed Vehicle (MPH)</th>
<th>Passing Vehicle (MPH)</th>
<th>Passing Sight Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>22</td>
<td>32</td>
<td>897</td>
</tr>
<tr>
<td>30</td>
<td>26</td>
<td>36</td>
<td>1,088</td>
</tr>
<tr>
<td>40</td>
<td>34</td>
<td>44</td>
<td>1,470</td>
</tr>
<tr>
<td>50</td>
<td>41</td>
<td>51</td>
<td>1,832</td>
</tr>
<tr>
<td>60</td>
<td>47</td>
<td>57</td>
<td>2,133</td>
</tr>
<tr>
<td>70</td>
<td>54</td>
<td>64</td>
<td>2,479</td>
</tr>
</tbody>
</table>

Figure 2-22. Total Passing Sight Distance for Two-Lane Roads

G. Intersection sight distance

This section applies to intersections where one public road meets a second public road. The intersection sight distance provides for vehicles to enter traffic and accelerate to the average running speed. Intersection sight distances shall be measured as shown on Figure 2-23. The intersection sight distance shall be as shown in Table 2-21.
**Figure 2-23. Sight Distance Triangle (Stop Controlled)**

![Diagram of a sight distance triangle for stop-controlled intersections with labels for Major Street, Edge of Pavement, Property Line, Minor Street or Access, Corner Intersection Sight Distance, and Line of Sight.]

**Table 2-21. Intersection sight distance**

<table>
<thead>
<tr>
<th>Higher Functional Classification Roadway Design Speed (MPH)</th>
<th>Intersection sight distance (feet)(^1, 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>555</td>
</tr>
<tr>
<td>40</td>
<td>445</td>
</tr>
<tr>
<td>30</td>
<td>335(^2)</td>
</tr>
<tr>
<td>25</td>
<td>280(^2)</td>
</tr>
</tbody>
</table>

\(^1\) Intersection sight distance measured from a point on the minor road at 13 feet back from the edge of the major road pavement ("D") and measured from a height of eye at 3.5 feet on the minor road to a height of object at 3.5 feet on the major road.

\(^2\) At local/local road intersections only, "D" shall be 10 feet and the sight distance shall be measured to the centerline of the road.

\(^3\) These values only apply to two-lane roads with stop control, all other situations require special design considerations.
1. **Sight Distance Triangles within Easements**

   There shall be an unobstructed sight distance along both approaches and both sides at an intersection (within the right-of-way) for distances sufficient to allow the operators of vehicles, approaching simultaneously, to see each other in time to prevent collisions at the intersection.

   All sight distance triangles must be within the public right-of-way or a sight distance easement (See Figure 2-23). If the line of sight crosses onto private property, a “Sight Distance Easement” shall be dedicated to provide the required sight distance. The easement or right-of-way shall be dedicated to the County. Maintenance of a sight distance easement shall be the responsibility of the property owner or the homeowners’ association unless otherwise approved by the County.

2. **Encroachment into Sight Distance Triangles or Easements**

   Any object within the sight distance triangle or easement more than 30 inches above the flowline elevation of the adjacent roadway shall constitute a sight obstruction, and shall be removed or lowered. The objects may include but are not limited to berms, buildings, parked vehicles on private property, cut slopes, hedges, trees, bushes, utility cabinets or tall crops. Trees may be permitted at the discretion of the ECM Administrator if pruned to at least 8 feet above the flowline elevation of the adjacent roadway.

3. **On-Roadway Parking within Sight Distance Triangles**

   The ECM Administrator may limit on-street parking to protect visibility and enhance roadway capacity.

### 2.3.7 Intersections

**A. Intersection Design Guidelines**

Intersections shall be designed to provide safe movement for all those using roadways within the County (motorists, pedestrians, and bicyclists). By their nature, intersections are conflict locations. Vehicles, pedestrians, and bicycles all cross paths. Each crossing is a conflict point. The basic design of intersections includes the following objectives:

- Minimize points of conflict
- Simplify areas of conflict
- Limit conflict frequency
- Limit conflict severity

**B. Intersection Spacing and General Access Standards**

Full movement intersections and major accesses spacing shall meet the requirements in Section 2.2.5. While access to a major roadway should be avoided, right-in/right-out and three quarter movement accesses may be permitted as a deviation if they meet the criteria for sight distances, turn lane
requirements, grades and do not negatively impact traffic operations or safety. The applicant shall have the burden of proof that no other "viable or practical" property access is available. A deviation request should be supported by a traffic study or memorandum that provides information to assist the ECM Administrator in determining the proposed deviation minimizes negative safety and other operational impacts along upstream and downstream roadway segments. The addition of such an access shall minimize impacts to queuing or blocking of lane entries or access points and minimize impacts to progression. The access must be in a location such that any necessary turn lanes and acceleration/deceleration lanes can be accommodated to maintain safe operations and capacity. The analysis should consider all potential future additional requirements for to accommodate traffic generated by adjacent land uses. Buildout design hour/peak hour projected traffic volumes should be used.

C. Intersection Alignment

1. Offset
   All lanes traversing an intersection shall be in alignment. A maximum 2-foot lane offset may be approved by the ECM Administrator if no other alternative exists.

2. Angle
   Crossing roadways shall intersect at 90 degrees whenever possible. In no case shall roadways be permitted to intersect at less than 80 degrees or more than 100 degrees.

3. Horizontal Alignment
   The horizontal alignment of roadways through an intersection shall be designed in conformance with this chapter depending on the classification of the roadways intersecting. Intersections may be placed on horizontal curves, provided the minimum tangent lengths shown in Table 2-11 are provided on the lower functional classification roadway and the required sight distance is met.

4. Vertical Alignment
   The roadway profile grade shall not exceed the value presented in Table 2-22 on the approach to the intersection, as measured along the centerline of the roadway for a minimum distance equal to the grade lengths presented in Table 2-23 for each of the roadway functional classifications.

   The grade of the roadway with the higher functional classification shall prevail at intersections. Grading of lower functional classifications, adjacent property, private access shall adapt to the higher functional classification roadway grade.
In cases where the natural grade for which a roadway is to be constructed is steeper than 4 percent (hillside areas). A deviation from the presented standards may be requested for to accommodate these conditions up to a maximum of 8 percent.

5. **Intersection Sight Distance**

The sight distance at intersections shall be shown geographically on the construction plans. A note shall be added to each leg of the intersection stating that intersection sight distance exceeds the minimum sight distance for ___ mph design speed.

### Table 2-22. Intersection Grades by Roadway Functional Classification

<table>
<thead>
<tr>
<th>Functional Classification</th>
<th>Maximum Intersection Grade (%)</th>
<th>Minimum Intersection Grade (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressway (Urban/Rural)</td>
<td>2/2</td>
<td>0.5/1</td>
</tr>
<tr>
<td>Arterial (Urban/Rural)</td>
<td>3/3</td>
<td>0.5/1</td>
</tr>
<tr>
<td>Collector (Urban/Rural)</td>
<td>4/4</td>
<td>0.5/1</td>
</tr>
<tr>
<td>Local (Urban/Rural)</td>
<td>4/4</td>
<td>0.5/1</td>
</tr>
</tbody>
</table>

### Table 2-23. Intersection Profile Grade Lengths

<table>
<thead>
<tr>
<th>Higher Classification Roadway (below)</th>
<th>Local</th>
<th>Collector</th>
<th>Arterial</th>
<th>Expressway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressway</td>
<td>n/a</td>
<td>n/a</td>
<td>200</td>
<td>250(^1)</td>
</tr>
<tr>
<td>Arterial</td>
<td>n/a</td>
<td>120</td>
<td>200(^1)</td>
<td>n/a</td>
</tr>
<tr>
<td>Collector</td>
<td>100(^1)</td>
<td>120(^1)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Local</td>
<td>100(^1)</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

\(^1\) In the case of where each intersecting roadway is of the same classification, the ECM Administrator will designate which roadway takes precedence and the distance required.

### D. Turn Lanes Required

1. **Exclusive Left Turn Lane Required**

Exclusive left turn lanes shall be provided wherever left turn lanes are specified as being needed by an approved TIS, identified in the MTCP, required by the ECM, or determined to be warranted by the ECM Administrator. Information in the TIS shall be used to determine whether an exclusive left turn lane is warranted. Warrant determinations shall also be based on this chapter, which include:

- **Expressways Left Turn Lane (State Highway Access Code Designation - EX):** A left turn lane is required for any access that allows left turn ingress movement, except for field approaches. A
left turn acceleration lane may be required if the design would be a benefit to safety and operation of the roadway.

- Principal Arterials Left Turn Lane (State Highway Access Code Designation - RA for Rural and NR-A for Urban): A left turn lane is required for an access with a projected peak hour left ingress turning volume of 10 VPH or greater. A left turn acceleration lane may be required if it would be a benefit to the safety and operation of the roadway.

- Minor Arterials (State Highway Access Code Designation - RB for Rural and NR-B for Urban) and Lower Classifications Left Turn Lane: A left turn lane is required for any access with a projected peak hour ingress turning volume of 25 VPH or greater.

2. **Exclusive Right Turn Lanes Required**

Exclusive right turn lanes shall be provided wherever right turn lanes are specified as being needed by an approved TIS, identified in the MTCP, required by the ECM or determined to be warranted by the ECM Administrator. Information in the TIS shall be used to determine whether an exclusive right turn lane is warranted. Warrant determinations shall also be based on this chapter, which include:

- Expressway Right Turn Lane (State Highway Access Code Designation - EX): A right turn lane is required for any access with a projected peak hour right turn ingress turning volume of 10 VPH or greater. A right turn acceleration lane is required for any access with a projected peak hour right turn egress turning volume of 10 VPH or greater.

- Principal Arterials Right Turn Lane (State Highway Access Code Designation - RA for Rural and NR-A for Urban): A right turn lane is required for any access with a projected peak hour right ingress turning volume of 25 VPH or greater. A right turn acceleration lane is required for any access with a projected peak hour right turning volume of 50 VPH or greater when the posted speed on the roadway is greater than 40 MPH. A right turn acceleration lane may also be required at a signalized intersection if a free right-turn is needed to maintain an appropriate level of service in the intersection.

- Minor Arterials (State Highway Access Code Designation - RB for Rural and NR-B for Urban) and Lower Classifications Right Turn Lane: A right turn lane is required for any access with a projected peak hour right turning volume of 50 VPH or greater. An acceleration lane is generally not required.
3. **Acceleration Lanes Required**

Where acceleration lanes are required, deviations may be considered at stop controlled intersections under certain circumstances. As stated in the AASHTO “Green Book” (PGDHS), acceleration lanes are not always desirable. Please refer to the “Green Book” for additional information concerning instances where acceleration lanes may not be desirable. Deviations may also be considered at intersections with traffic signals.

4. **Lane Shifts or Drops Required**

Lane shifts or drops shall be provided wherever redirection of traffic are specified as being needed by an approved traffic control plan, required by the ECM or determined to be warranted by the ECM Administrator.

5. **Conflicts between Exclusive Turn Lanes**

Where two intersections have exclusive turn lanes that overlap, or the ending points of the exclusive turn lanes have less than 300 feet or one-half their length of separation (whichever is shorter) and a significant structure or topographical feature does not preclude widening, a continuous exclusive turn lane shall be established between the intersections to improve roadway consistency, safety, and to maintain edge of pavement continuity.

If restrictive topography allows only one exclusive turn lane, normally a left turn deceleration lane is given first priority. Where a left turn is installed and the travel lanes must be redirected, an overlay of pavement is required.

E. **Turn Lane Design**

Turn lanes typically consist of a combination of several components (i.e. tapers, lane length, and storage). The use and design of these components varies based on the type of access, roadway classification, and site-specific conditions. Figure 2-24 presents a graphical guide to basic exclusive turn lane elements.
Figure 2-24. Guide to Basic Exclusive Turn Lane Elements

1. Turn Lane Design Elements
   - Left Turn Lane. The design elements for a left turn lane are the bay taper, lane length, storage length, which in combination makes up the left turn lane. The elements are shown in Figure 2-25. The specific designs for these lanes shall be in accordance with this chapter. For each high volume access and major intersection, both acceleration and deceleration lanes shall be considered in designing an exclusive left turn lane.
• Right Turn Lane. The design elements for a right turn and deceleration lanes are the approach taper, lane length, storage length, which in combination makes up the right turn lane. The elements are as shown in Figure 2-26. For each high volume access and major intersection, both acceleration and deceleration lanes shall be considered in designing an exclusive right turn lane. The specific designs for these lanes shall be in accordance with this chapter. Specific lane shift and lane drop design criteria can be found in Section 2.3.8J.3.

• Acceleration Lane. The design elements for an acceleration lane are the transition taper and acceleration length. For each high volume access and major intersection, both acceleration and deceleration lanes shall be considered in designing an exclusive right or left turn lane. The specific designs for these lanes shall be in accordance with this chapter.

• Shift or Drop Lane. The design elements for a transition or drop lane are the redirect taper, full width auxiliary lane, and storage length. The use and design of these elements varies based on the roadway classification and site-specific conditions.
2. Tapers

- Approach Tapers. The basis for designing a deceleration lane and taper is to provide sufficient length for a vehicle to decelerate and brake primarily outside the through traffic lanes. Table 2-24 provides the required deceleration lane and taper design lengths by design speed. Deceleration lane lengths shall be adjusted for a grade of 3% or more using the factors in Table 2-25. The required length allows a motorist to decelerate in gear for at least 3 seconds followed by safe braking to a complete stop.
### Table 2-24. Required Deceleration Lane and Taper Lengths

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Lane Length (feet)</th>
<th>Approach Taper (feet)</th>
<th>Total Length (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>115</td>
<td>120</td>
<td>235</td>
</tr>
<tr>
<td>30</td>
<td>115</td>
<td>120</td>
<td>235</td>
</tr>
<tr>
<td>40</td>
<td>155</td>
<td>160</td>
<td>315</td>
</tr>
<tr>
<td>50</td>
<td>235</td>
<td>200</td>
<td>435</td>
</tr>
<tr>
<td>60</td>
<td>290</td>
<td>240</td>
<td>530</td>
</tr>
<tr>
<td>70</td>
<td>Special Design</td>
<td>Special Design</td>
<td>Special Design</td>
</tr>
</tbody>
</table>

### Table 2-25. Deceleration Lane Grade Adjustment Factors

<table>
<thead>
<tr>
<th>Roadway Grade</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrade</td>
<td></td>
</tr>
<tr>
<td>3% to 4.9%</td>
<td>0.90</td>
</tr>
<tr>
<td>5% to 7%</td>
<td>0.80</td>
</tr>
<tr>
<td>Downgrade</td>
<td></td>
</tr>
<tr>
<td>3% to 4.9%</td>
<td>1.20</td>
</tr>
<tr>
<td>5% to 7%</td>
<td>1.35</td>
</tr>
</tbody>
</table>

- Bay Tapers. Table 2-26 provides the required bay taper length by lane width. A bay taper is designed to direct left-turning vehicles into the turn lane. A minimum taper ratio of 8:1 may be used for tangent bay tapers in constrained locations. Bay tapers should be used (asymmetrical reverse curves) for deceleration transition tapers. Straight transition tapers should be avoided at design speeds above 40, and where a vertical crest or horizontal curve is present. Under these conditions, an immediate bay taper and lane striping should be substituted for a straight transition taper to reduce drifting of the through vehicles into the deceleration lane. Where horizontal or crest vertical curves exist, the ECM Administrator may require the deceleration transition taper to begin with an immediate asymmetrical reverse curve bay taper of 1/3L then 2/3L with the remaining required transition taper length at full lane width. Partial tangent transition tapers, symmetrical reverse curve tapers or asymmetrical reverse curve tapers may be used for transition taper design provided a radius of at least 150 feet is used in curve calculations.
Table 2-26. Required Bay Taper Lengths for 12-foot Lanes (for use with design of left turn deceleration lanes)

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Lane Length (feet)</th>
<th>Bay Taper (feet)</th>
<th>Total Length (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>115</td>
<td>80</td>
<td>195</td>
</tr>
<tr>
<td>30</td>
<td>115</td>
<td>120</td>
<td>235</td>
</tr>
<tr>
<td>40</td>
<td>155</td>
<td>160</td>
<td>315</td>
</tr>
<tr>
<td>50</td>
<td>235</td>
<td>200</td>
<td>435</td>
</tr>
<tr>
<td>60</td>
<td>290</td>
<td>Special Design</td>
<td>Special Design</td>
</tr>
<tr>
<td>70</td>
<td>Special Design</td>
<td>Special Design</td>
<td>Special Design</td>
</tr>
</tbody>
</table>

Taper = WV/3
where: W = lane width, feet, V = design speed, MPH

- Transition Tapers. The basis for designing an acceleration lane and transition taper is to provide sufficient length for a vehicle to accelerate to the appropriate speed and merge into the through traffic lanes without disrupting traffic flow. Table 2-27 provides the required acceleration lane and transition taper design lengths by design speed. Acceleration lane lengths in Table 2-27 shall be adjusted for a grade of 3% or more using the factors in Table 2-28. The total length of the acceleration lane includes the values of both the lane and transition taper. The length of a transition taper is calculated by multiplying the width of the lane by a standard ratio. The beginning and ending point of all tapers shall be rounded.

Table 2-27. Design Criteria for Acceleration Lanes

<table>
<thead>
<tr>
<th>Posted Speed Limit (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>Acceleration Length (feet)</td>
<td>N/A</td>
<td>190</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>

Table 2-28. Grade Adjustment Factors for Acceleration Lanes

<table>
<thead>
<tr>
<th></th>
<th>40 to 50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 to 4.9%</td>
<td>1.3</td>
<td>1.5</td>
<td>1.7</td>
</tr>
<tr>
<td>5 to 7.5%</td>
<td>1.5</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Downgrade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 to 4.9%</td>
<td>0.7</td>
<td>0.65</td>
<td>0.6</td>
</tr>
<tr>
<td>5 to 7.5%</td>
<td>0.6</td>
<td>0.55</td>
<td>0.5</td>
</tr>
</tbody>
</table>

- Redirect Tapers. Redirect tapers shall be used where an exclusive turn lane, median or other redirection of vehicles is necessary and where redirection of the flow of traffic is
necessary to accommodate the exclusive turn lane or median due to constraints. Redirect tapers required for redirecting through travel lanes shall be installed in conformance with Table 2-29. If the redirect taper would result in a horizontal curve design deficiency for the through movement, the horizontal curve shall be corrected. Redirect taper should be designed as straight tapers with the beginning and ending points rounded.

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>30 or less</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight Taper Ratio</td>
<td>15:1</td>
<td>20:1</td>
<td>45:1</td>
<td>55:1</td>
<td>65:1</td>
</tr>
</tbody>
</table>

### 3. Storage Lengths

The basis for designing the length of required storage is to provide sufficient length for vehicles to queue within the lane without affecting other movements. Table 2-30 provides the required storage lengths for stop-controlled intersections. Figure 2-27 provides the required calculated storage lengths for signal-controlled intersections. Where the ECM Administrator determines that meeting the required storage length is impractical or results in an unsafe condition, the minimum storage length shall be based on the mean arrival rate, but in no case shall the minimum storage length be less than 50 feet.

<table>
<thead>
<tr>
<th>DHV (VPH)</th>
<th>&lt; 60</th>
<th>61-120</th>
<th>121-180</th>
<th>181-250</th>
<th>&gt;250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Length (feet)</td>
<td>50-75</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>250 or more</td>
</tr>
</tbody>
</table>
Figure 2-27. Required Storage Lengths for Signal-Controlled Intersections

F. Curb Returns

1. Radii

Table 2-31 and Table 2-32 present minimum curb return radii at intersections for each roadway type, rural and urban. A paved shoulder adjacent to an exclusive turn or acceleration lane is required where no curb and gutter exist or are proposed. Shoulders adjacent to an exclusive turn or acceleration lane shall be at least 4 feet wide and paved.
Table 2-31. Minimum Curb Return Radius at Intersection (Urban Roads)

<table>
<thead>
<tr>
<th></th>
<th>Local</th>
<th>Collector</th>
<th>Minor Arterial</th>
<th>Principal Arterial</th>
<th>Expressway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>20'</td>
<td>25'</td>
<td>30'</td>
<td>30'</td>
<td>Special</td>
</tr>
<tr>
<td>Collector</td>
<td>25'</td>
<td>25'</td>
<td>30'</td>
<td>40'</td>
<td>Special</td>
</tr>
<tr>
<td>Minor Arterial</td>
<td>30'</td>
<td>30'</td>
<td>50'</td>
<td>Special</td>
<td>Special</td>
</tr>
<tr>
<td>Principal Arterial</td>
<td>30'</td>
<td>40'</td>
<td>Special</td>
<td>Special</td>
<td>Special</td>
</tr>
<tr>
<td>Expressway</td>
<td>Special Design</td>
<td>Special Design</td>
<td>Special Design</td>
<td>Special Design</td>
<td>Special Design</td>
</tr>
</tbody>
</table>

Table 2-32. Minimum Curb Return Radius at Intersections (Rural Roads)

<table>
<thead>
<tr>
<th></th>
<th>Local</th>
<th>Collector</th>
<th>Minor Arterial</th>
<th>Principal Arterial</th>
<th>Expressway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>20'</td>
<td>30'</td>
<td>40'</td>
<td>40'</td>
<td>Special</td>
</tr>
<tr>
<td>Collector</td>
<td>30'</td>
<td>30'</td>
<td>40'</td>
<td>40'</td>
<td>Special</td>
</tr>
<tr>
<td>Minor Arterial</td>
<td>40'</td>
<td>40'</td>
<td>50'</td>
<td>Special</td>
<td>Special</td>
</tr>
<tr>
<td>Principal Arterial</td>
<td>40'</td>
<td>40'</td>
<td>Special</td>
<td>Special</td>
<td>Special</td>
</tr>
<tr>
<td>Expressway</td>
<td>Special Design</td>
<td>Special Design</td>
<td>Special Design</td>
<td>Special Design</td>
<td>Special Design</td>
</tr>
</tbody>
</table>

2. **Grades**

The minimum grade for flowlines around the curb return shall be 1%. In some instances, the minimum grade for flowlines around curb returns may be reduced to 0.5% with approval from the ECM Administrator.

G. **Design Vehicles**

Intersections shall be designed to accommodate the AASHTO design vehicles. The following minimum allowable design vehicle criteria shall apply. For special circumstances, other design vehicles and criteria may be required by the ECM Administrator or proposed by the design engineer where trucking volumes and typical truck sizes suggest an alternative design vehicle would be more appropriate.

1. **SU-30 (Single Unit Truck)**

   At all intersections, SU-30 vehicles shall be able to turn easily from one roadway to the next and remain in the correct lane for each roadway.

2. **B-40 (Bus)**

   At all intersections, B-40 vehicles may use one or more traffic lanes to complete a turn when turning from the correct lane without crossing into opposing traffic lanes and without tracking onto the curb at corners.

3. **WB-50 (Large Semi Trailer)**

   WB-50 vehicles may use one or more traffic lanes to complete a turn without tracking onto the curb at corners. In addition, the vehicle must make the turn in one forward maneuver encroaching into opposing traffic lanes. These requirements shall apply to all arterial/arterial, arterial/collector, arterial/local, and collector/collector intersections.
all other intersections, the vehicles may use the entire paved surface of the road to negotiate the turn.

4. **WB-67 (Large Semi Trailer)**

WB-67 vehicles may use one or more traffic lanes to complete a turn without tracking onto the curb at corners. In addition, the vehicle must make the turn in one forward maneuver encroaching into opposing traffic lanes. These requirements shall apply to all arterial/arterial, and arterial/collector intersections. For all other intersections, the vehicles may use the entire paved surface of the road to negotiate the turn.

**H. Intersection Channelization**

Channelization is intended to separate or regulate conflicting traffic movements into definite paths of travel by the use of pavement markings, raised islands or other suitable means to facilitate the safe and orderly movement of all modes of travel using a particular corridor. See Figure 2-28 for a channelization example associated with a portion of an intersection exclusive right turn lane.

*Figure 2-28. Channelization Example*

**I. Roundabouts**

Roundabouts are considered a form of traffic control. Roundabouts shall be considered as two types: (1) modern roundabouts and (2) mini roundabouts.
1. **Modern Roundabouts Design Guidelines**

Modern roundabouts shall be designed based on site-specific needs for high volume roadways. The use of modern roundabouts may be considered for many reasons; some may include, but not be limited to:

- Traffic volumes on both roadways are approximately equal (i.e. within 10% of each other), or
- Where significant percentages (20% or greater) of traffic on the major roadway is conducting left turns, or
- Where the intersection is expected to warrant signalization within twenty years.

Specific guidelines for designing the main elements of a modern roundabout shown in Figure 2-29 include:

- Modern roundabouts shall be designed to accommodate the largest design vehicle of the intersecting streets.

*Figure 2-29. Typical Design Elements of a Modern Roundabout*

- The design of the center island will be in accordance with the Roundabout Design Guide and approved by the ECM Administrator. Should a truck apron be warranted based on site-specific design parameters, the width shall be selected based on
what is appropriate to accommodate the free circulation of the design vehicle.

- The circulatory roadway width shall be a minimum of 1.2 times the width of the widest entering roadway or 20 feet, whichever is greater. The width may include the apron when approved by the ECM Administrator.
- The roundabout design shall be completed with the aid of computer software. The ECM Administrator is authorized to require the use of a specific software package when warranted by the needs of a specific intersection. (The design shall conform with the FHWA Roundabout Design Guide or other design criteria approved by the ECM Administrator).
- Raised splitter islands are required on all approaches.
- Signage shall conform with the requirements of the MUTCD.

2. Mini Roundabouts Design Guidelines

Mini roundabouts may be allowed in a neighborhood setting for traffic calming. Mini roundabouts may be used on urban local roadways. Mini roundabouts are prohibited in areas without curb and gutter.

Specific guidelines for designing the main elements of a mini roundabout shown in Figure 2-30 include:

- The design shall conform with the Roundabout Design Guide, FHWA Standards or other design criteria approved by the ECM Administrator.
- The circular roadway shall be a minimum of 20 feet wide flowline to flowline, and the approach legs shall be a minimum of 16 feet wide.
- Mini roundabouts shall be designed to accommodate WB-50 vehicles.
- To enhance truck movement through smaller-diameter roundabouts, a concrete truck apron may be used to assist with tracking.
2.3.8 Roadway Terminations

A. Cul-de-Sacs

Cul-de-sacs shall be used only where absolutely necessary. Cul-de-sacs shall have a minimum radius of 45 feet and a maximum length of 750 feet for urban conditions and a minimum radius of 50 feet and a maximum length of 1,600 feet for rural conditions, be designed in conformance with Figure 2-31. The maximum length of cul-de-sac shall be measured from the right-of-way of the intersecting street to the center of the cul-de-sac bulb. Hammerhead turnarounds are not permitted as permanent roadway terminations. The cul-de-sac right-of-way width shall be consistent with the right-of-way associated with the roadway functional classification and provide for the turnaround, sidewalks, utilities, and necessary drainage facilities. A request for a deviation from the maximum length criteria will not be considered without an express written endorsement from the Fire District in which the proposed cul-de-sac is located.

In special cases where a divided 4 lane roadway that terminates adjacent to a subdivision or development, the length of the collector or local roads that intersect the divide 4 lane roadway shall be measured from the point of...
intersection with the divided 4 lane roadway regardless of the length of the
terminated divided 4 lane roadway. In all other cases, the length of the cul-de-sac
or terminated road shall be measured from the point at which the road providing
access to a site begins.

**Figure 2-31. Typical Cul-de-Sac Requirements (Urban and Rural)**

**B. Eyebrows**

Eyebrows shall be permitted only on local roadways in conformance with Figure
2-32. The location of the eyebrow shall be in conformance with spacing
requirements presented in Table 2-4 through Table 2-26.
C. Temporary Cul-de-Sacs (or Hammerheads)

Where a roadway will be temporarily terminated, a temporary cul-de-sac or hammerhead turnaround shall be constructed in accordance with Figure 2-33 or Figure 2-34. No curb and gutter is required on temporary cul-de-sac or hammerhead turnaround. Temporary turnarounds shall not exceed 600 feet in length except as otherwise approved by the BOCC in association with a phased development plan. The minimum dimensions for the temporary cul-de-sacs shall follow those of Figure 2-31 in all other respects.

The following criteria language will be required for all easements.

The non-revocable public improvement easement shown at the end of _____ Street cul-de-sac is intended for turn around and emergency response purposes. At such a time that _____ Street is extended by the adjacent property owner/developer and accepted by the County, the non-revocable public improvement easement for the cul-de-sac will be vacated, leaving a standard street ROW and the cul-de-sac improvements will be removed and replaced with a standard street section. The easement vacation, cul-de-sac removal and standard street section construction and site restoration is the responsibility of the owner/developer extending _____ Street.
Section 2.3.8-2.3.8

1. **Cul-de-Sac Terminates Within the Plat**

If the cul-de-sac terminates within the proposed plat, the cul-de-sac shall be dedicated as public right-of-way or non-exclusive public improvement easement. If the road right-of-way is stubbed to an adjacent property for future extension, the right-of-way width at the boundary shall match the proposed street right-of-way width. The cul-de-sac at the end of street is intended as a turn around and also is for emergency response purposes until the road is extended. The cul-de-sac shall meet all current standards. If the street is extended by the adjacent property owner/developer, the cul-de-sac right-of-way or public improvement easement may be vacated, leaving a standard street right-of-way. The cul-de-sac improvements within the right-of-way or public improvement easement will be for public use and publicly maintained.

The lot(s) adjacent to cul-de-sacs may be granted an administrative variance (minor variation during platting) and platted at less than the required minimum acreage. However, the lots will be sized such that if and when the street is extended and the cul-de-sac right-of-way is vacated and the standard street right-of-way is defined, the lots adjacent to the vacated cul-de-sac will meet the minimum zoned acreage requirements that were in place when the plat was approved. No direct access shall be allowed off the anticipated cul-de-sac unless the cul-de-sac is designed to be permanent. The administrative variance would be according to the Land Development Code and is permissive, not mandatory.

When the road is extended at some future time, the responsibility for conversion of the cul-de-sac to the typical road cross section and site restoration shall be the owner/developer requiring the street extension. The same owner/developer will at that time also be responsible for vacation and replat of the lots.

2. **Cul-de-Sac Terminates Outside the Plat of a Phased Development**

If the owner is platting in phases and the cul-de-sac will terminate within the phased development but outside the current subdivision plat, the entire cul-de-sac shall be dedicated as a non-revocable public improvement easement. Where the cul-de-sac will terminate outside the proposed plat, the applicant must provide a copy of the recorded easement for the entire public improvement cul-de-sac easement. The cul-de-sac design shall meet all current standards. Until further land use actions, the non-revocable public improvement easement shall remain in public use and publicly maintained until further resolution or disposition of extension.

When the road is extended at some future time, the developer of the extension at that time shall be responsible for conversion of the cul-de-
3. **Cul-de-Sac Terminates on Property not Owned by the Current Developer**

If the cul-de-sac will terminate on property not owned by the current developer, the developer shall acquire a public improvement easement from the adjacent property owner for the cul-de-sac. The entire cul-de-sac shall be dedicated as a non-revocable public improvement easement by separate instrument. No direct lot access to the proposed development will be provided off the cul-de-sac turnaround. Where the cul-de-sac will terminate outside the proposed plat, the applicant must provide proof of ownership for the entire cul-de-sac turnaround. The cul-de-sac shall meet all current standards. Until further land use actions, the non-revocable public improvement easement shall remain in public use and publicly maintained until further resolution or disposition of extension.

When the road is extended at some future time, the developer at that time shall be responsible for conversion of the cul-de-sac to the typical road cross section and site restoration shall be the responsibility of the owner/developer extending the street. The developer at that time shall also be responsible for vacation of any public right-of-way.
Figure 2-33. Typical Temporary Cul-de-Sac Requirements
2.4 ROADWAY ACCESS DESIGN

2.4.1 Access Design Criteria

A. Access Design Guidelines

Access points shall be designed to provide safe movement for both those entering and traveling on roadways within the County. Like intersections, access points are conflict locations. The basic design of access points includes the following objectives:

- Adequate spacing
- Proper alignments
- Clear sight distances
- Coordinated widths with its intended use
- Clearances from intersections

B. Access Spacing

Accesses shall be separated by a distance equal to the entering sight distance values in Table 2-35. When turn lanes are present or will be needed in the future, the accesses shall be separated by a sufficient distance so that exclusive turn lanes including tapers will not overlap. Access shall not be permitted within a turn lane. Warrant criteria, design, and construction of turn lanes shall be governed by the requirements contained in Section 2.3.7D.
C. Access Alignment

1. Horizontal Alignment
   Access points shall be aligned at 90 degrees to the adjacent road centerline or along a radial line in a cul-de-sac.

2. Vertical Alignment
   Maximum access grades are 4% for commercial and industrial properties with a required 30-foot landing length and a 4% for rural residential properties with a required 15-foot landing length. Access point approach grades and configuration shall be designed and constructed to accommodate the ultimate road standard of the intersecting roadway to prevent major access point reconstruction. Where an access approach will cross an existing sidewalk, the access shall be designed and constructed to match the elevation of the sidewalk where the two intersect. Reverse slope private accesses may be allowed as long as sight distance requirements are met.

D. Access Sight Distances

Accesses and specific turn movements shall not be permitted where the sight distance is not adequate to allow the safe movement of a motorist using or passing the access. Any potentially obstructing objects, such as but not limited to advertising signs, structures, trees, and bushes, shall be designed, placed, and maintained at a height not to interfere with the sight distance needed by any vehicle using the access. Reconstruction of the horizontal and vertical curvature along the roadway or side slopes adjacent to the roadway may be necessary to increase sight distances.

1. Sight Distance Along Roadways
   Horizontal and vertical sight distances shall conform to Table 2-33 for the vehicle traveling on the roadway toward the access. The lengths shown in Table 2-33 shall be adjusted for any grade of 3% or greater using the figures set forth in Table 2-34.

<table>
<thead>
<tr>
<th>Posted Speed (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>Design Sight distance (feet)</td>
<td>150</td>
<td>200</td>
<td>250</td>
<td>325</td>
<td>400</td>
<td>475</td>
<td>550</td>
<td>650</td>
<td>725</td>
<td>850</td>
</tr>
<tr>
<td>Minimum Sight distance (feet)</td>
<td>150</td>
<td>200</td>
<td>225</td>
<td>275</td>
<td>325</td>
<td>400</td>
<td>450</td>
<td>525</td>
<td>550</td>
<td>625</td>
</tr>
</tbody>
</table>

1 To calculate sight distance at the proposed access location, a height of 3.5 feet shall be used for the driver’s eyes of a vehicle on the highway approaching the access location. The driver’s eyes shall be assumed to be at the centerline of the inside lane (inside with respect to the curve) for measurement purposes. A height of 3.5 feet shall be used for a vehicle assumed to be on the centerline of the access 5 feet back from the edge of the roadway.

2 If an auxiliary lane is present, the entering posted speed for the deceleration lane and the posted speed at the end of the acceleration lane shall be used.
Table 2-34. Sight distance Adjustment Factors for Roadway Grade

<table>
<thead>
<tr>
<th>Roadway Grade</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgrade</td>
<td></td>
</tr>
<tr>
<td>3% to 4.9%</td>
<td>0.90</td>
</tr>
<tr>
<td>5% to 7.5%</td>
<td>0.80</td>
</tr>
<tr>
<td>Downgrade</td>
<td></td>
</tr>
<tr>
<td>3% to 4.9%</td>
<td>1.20</td>
</tr>
<tr>
<td>5% to 7.5%</td>
<td>1.35</td>
</tr>
</tbody>
</table>

2. **Entering Sight Distance**

This section applies to entering sight distance where a non-public road or driveway meets a public road. The entering sight distance necessary for the entering vehicle shall conform to Table 2-35. These lengths shall be adjusted for any grade of 3% or greater using Table 2-34. The design vehicle used to determine the entering sight distance shall be selected from Table 2-36.

If the median provides at least 20 feet of storage for a crossing or turning vehicle and can safely store the design vehicle, then the sight distance may be calculated assuming a two-stop condition.

Table 2-35. Entering Sight Distance for Driveways (Access Design)

<table>
<thead>
<tr>
<th>Design Vehicle</th>
<th>25</th>
<th>35</th>
<th>45</th>
<th>55</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Lane Roadway</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger Cars, Pickup Trucks</td>
<td>250</td>
<td>350</td>
<td>450</td>
<td>550</td>
<td>n/a</td>
</tr>
<tr>
<td>Single Unit Trucks</td>
<td>325</td>
<td>455</td>
<td>585</td>
<td>715</td>
<td>n/a</td>
</tr>
<tr>
<td>Multi-Unit Trucks</td>
<td>425</td>
<td>595</td>
<td>765</td>
<td>935</td>
<td>n/a</td>
</tr>
<tr>
<td>Four Lane Roadway</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger Cars, Pickup Trucks</td>
<td>n/a</td>
<td>420</td>
<td>540</td>
<td>660</td>
<td>780</td>
</tr>
<tr>
<td>Single Unit Trucks</td>
<td>n/a</td>
<td>525</td>
<td>675</td>
<td>825</td>
<td>975</td>
</tr>
<tr>
<td>Multi-Unit Trucks</td>
<td>n/a</td>
<td>700</td>
<td>900</td>
<td>1,100</td>
<td>1,300</td>
</tr>
<tr>
<td>Six Lane Roadway</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passenger Cars, Pickup Trucks</td>
<td>n/a</td>
<td>n/a</td>
<td>585</td>
<td>715</td>
<td>845</td>
</tr>
<tr>
<td>Single Unit Trucks</td>
<td>n/a</td>
<td>n/a</td>
<td>765</td>
<td>935</td>
<td>1,105</td>
</tr>
<tr>
<td>Multi-Unit Trucks</td>
<td>n/a</td>
<td>n/a</td>
<td>945</td>
<td>1,155</td>
<td>1,365</td>
</tr>
</tbody>
</table>

1 For calculating sight distance, a height of 3.5 feet shall be used for the driver’s eyes at the access location and a height of 3.5 feet for the oncoming vehicle. The entering driver’s eyes shall be 10 feet behind the edge of the roadway.
2 If an auxiliary lane is present, the entering posted speed for the deceleration lane and the posted speed at the end of the acceleration lane shall be used.
3 From Table 2-36.
4 This table is for use for determining entering sight distance for driveways.
Table 2-36. Design Vehicle Selection

<table>
<thead>
<tr>
<th>Land Use(s) Served by Access</th>
<th>Design Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential, Non-School Bus Route</td>
<td>Passenger Cars, Pickup Trucks</td>
</tr>
<tr>
<td>Residential, School Bus Route</td>
<td>Single Unit Trucks</td>
</tr>
<tr>
<td>Office</td>
<td>Single Unit Trucks</td>
</tr>
<tr>
<td>Recreational</td>
<td>Single Unit Trucks</td>
</tr>
<tr>
<td>Commercial/Retail</td>
<td>Multi-Unit Trucks</td>
</tr>
<tr>
<td>Industrial</td>
<td>Multi-Unit Trucks</td>
</tr>
<tr>
<td>Agricultural Field Approaches (&lt; 1 VPD)</td>
<td>Single Unit Trucks</td>
</tr>
</tbody>
</table>

\(^1 \text{If less than 2 multi-unit truck trips per day (average), use single-unit truck}\)

E. Access Width

1. Residential Access Points
   Two-way residential access points shall have a 10-foot minimum and a 24-foot maximum width.

2. One-Way Commercial or Industrial Access Points
   One-way commercial or industrial access points shall have a minimum 15-foot and a maximum 30-foot inbound access, and a minimum 20-foot and maximum 35-foot outbound access width.

3. Two-Way Commercial or Industrial Access Points
   Two-way commercial or industrial parcel access points shall have:
   - For Nonresidential Collector Roadways: A minimum 25-foot and maximum 40-foot access width.
   - For Minor Arterial Roadways (when approved by the ECM Administrator): A minimum 35-foot and maximum 40-foot access width.

4. Deviations to Commercial or Industrial Access Point Widths
   Wider commercial or industrial access point widths, where necessary to accommodate buses, trucks or other oversized vehicles, may be approved through deviation. Such parcel access points shall be designed to meet the additional loading and turning radius requirements.

F. Access Clearance from Intersections

1. Residential
   Access to residential corner lots shall be located a minimum of 10 feet from the point of curvature or point of tangency of the curb line at the intersection. If no curb exists, access points shall be located not less than 35 feet from where the projected right of way lines intersect. No portion of an access will be permitted within curb returns or curb ramps.
2. Commercial

Access to commercial or industrial properties fronting collector or local roads shall be located a minimum of 50 feet from the point of curvature or point of tangency of the curb line at the intersection. Access to commercial or industrial parcels fronting Nonresidential Collector roadways shall be located a minimum of 115 – 480 feet from the point of curvature or point of tangency of the curb line at the intersection depending on the sight distance and location with respect to the intersection, intersection control, and posted speed.

In all cases, a minimum corner clearance of 50 feet shall be provided. If the minimum corner clearance cannot be attained, the ECM Administrator may require investigation to determine if left turns should be prohibited into or out of the access point. For proposed access points near stop or signalized intersections, the ECM Administrator will require studies to determine if stopping queues will block the access point and if left turns should be prohibited into or out of the access point.

G. Construction of Access Points

Prior to constructing, reconstructing, paving, altering, enlarging, or changing the use of any access point entering a County roadway, an approved Driveway Permit must be obtained. In the case of more complex access projects (i.e. commercial, industrial, or multi-family residential complexes), a Construction Permit may also be required if determined as being warranted through an Engineering Site Plan review.

2.5 EXTRINSIC STRUCTURES

2.5.1 Curbs and Gutters

A. Curbs and Gutters

Curbs and gutters shall be designed and installed where required by the functional classification (See Table 2-6 and Table 2-7), the County rules and regulations including the LDC or when required by the ECM Administrator. The curb and gutter will be part of an overall surface water conveyance system. The intent of the system will be to adequately and efficiently control surface water flows during typical storm events (less than 5-year events) while still allowing proper traffic circulation.

B. Curb Cuts and Accesses

Curb cuts and accesses shall be constructed in accordance with the Standard Drawings. Radius returns are required when the number of parking spaces served by the access exceeds 10.
2.5.2 Pedestrian Facilities

A. General

All pedestrian facilities shall be designed in accordance with American Disabilities Act (ADA) requirements, AASHTO Green Book and the requirements of these Standards. The standard that results in the greatest overall safety of pedestrians shall prevail when designing and constructing pedestrian facilities.

B. Sidewalks

All sidewalks within a development will be designed and constructed by the developer. The design of such sidewalks shall continue to be included within the construction drawings associated with the respective final plat or site development plan, as applicable, and shall comply with the following standards:

1. Sidewalk Widths

   Minimum-required sidewalk widths by roadway classifications are specified in Table 2-4 through Table 2-7 and Appendix F. The ECM Administrator may require additional width in activity areas and routes leading to and from these areas. This additional width shall be determined through additional study in higher pedestrian traffic areas.

2. Sidewalk Crossings of Accesses

   Access crossings shall be designed in accordance with the sidewalk crossing Standard Drawing in Appendix F.

3. Sidewalks on Both Sides of the Roadway

   Sidewalks shall be installed on both sides of the roadway.

4. In-Fill Sidewalk, Curb, and Gutter

   In developed areas, sidewalks, curbs, and gutters may be required to be upgraded to current standards at the ECM Administrator’s discretion.

5. Sidewalk Widening

   Existing sidewalks shall only be permitted to be widened if the increase in width is 4 feet or more. If an existing sidewalk is required to be widened by less than 4 feet to meet the requirements of the ECM, the existing walk shall be entirely replaced with a sidewalk meeting the minimum width requirements.

6. Concrete Thickness

   All developments within the RS-5000 (Residential Suburban) or RS-6000 (Residential Suburban) zoning districts shall be required to construct sidewalks at a thickness of five inches (5") for all sidewalks along the entire length of any roadway from which temporary or permanent access will be provided. All other sidewalks within either the RS-5000 or RS-6000 zoning districts (e.g., sidewalks in common areas, sidewalks along identified school parcels, sidewalks in open space, etc.) may be
designed and constructed to a thickness of five inches (5") but may, at the developer’s discretion, be reduced to a thickness no less than four inches (4").

Developments within a Planned Unit Development (PUD) zoning district shall be required to design and construct sidewalks to a thickness of five inches (5") for all sidewalks along the entire length of any roadway from which temporary or permanent access will be provided unless an alternative thickness is approved by the Board of County Commissioners as an element of the associated PUD development standards. Under no circumstances shall any sidewalk be designed and constructed to a thickness of less than four inches (4"). All other sidewalks within a PUD zoning district (e.g., sidewalks in common areas, sidewalks along identified school parcels, sidewalks in open space, etc.) may be designed and constructed to a thickness of five inches (5") but may, at the developer’s discretion, be reduced to a thickness no less than four inches (4").

Sidewalks within all other developments not located within the RS-5000 or RS-6000 zoning districts or within a PUD may be designed and constructed to a thickness of five inches (5") but may, at the developer’s discretion, be reduced to a thickness no less than four inches (4").

At high volume access or alley crossings, the thickness shall be a minimum of six inches (6"). Sidewalks located at an access for commercial or industrial traffic will be terminated at the edges of the access allowing the access design to set precedence for thickness of pavement.

7. Sidewalk Slope
   - Cross Slope: Maximum cross slope for sidewalks shall be 2%.
   - Longitudinal Slope of Attached Sidewalks: Longitudinal slope of attached sidewalks shall be consistent with the roadway slopes.
   - Detached Sidewalks and ADA Requirements: Detached sidewalks with greater than 5% longitudinal slope shall be constructed to meet ADA requirements.

8. Sidewalk Clearances
   Horizontal and vertical sidewalk clearances shall meet the requirements of Figure 2-35.

9. Driveway Option
   Where five inch (5") sidewalks with mountable curb have been installed, the thickness at driveways can remain five inches (5"). As an alternative, the mountable curb and sidewalk at driveways can be poured at six inches (6"). The desired thickness must be identified on the approved construction drawings for the project. Where five inch (5")
sidewalks are installed, the Cut Back Swale Standard Drawing (SD_3-88) can be used as an acceptable stormwater BMP along the constructed five inch (5") sidewalk. The proposed stormwater BMPs will need to be provided in detail in the approved erosion control plan for the project.

Where four inch (4") sidewalks are installed, the sidewalks shall be a minimum of 4-inches thick except at driveways, high volume access, or alley crossings where the thickness shall increase to a minimum of six inches (6"). Sidewalks located at an access for commercial or industrial traffic will be terminated at the edges of the access allowing the access design to set precedence for thickness of pavement. The Cut Back Swale Standard Drawing (SD_3-88) is not an acceptable stormwater BMP for any sidewalk that is less than five inches (5") thick.

C. Handicap and Access Ramps

1. Ramp Requirements
   Access ramps shall be installed at all intersections and at certain mid-block locations for all new construction or reconstruction of curb or sidewalks in accordance with the most recent ADA requirements.

2. 4-Way Intersections
   Access ramps shall be installed at all intersection corners. Access ramps shall be constructed in accordance with Standard Drawings in Appendix F.

3. “T” Intersections
   All “T” intersections shall have a minimum of three access ramps as shown in Figure 2-36. A private access may be used as an access ramp provided it is designed to meet ramp requirements and it is within the intersection and directly across from other ramps.
Figure 2-35. Sidewalk Clearances

Attached Sidewalk Section

Detached Sidewalk Section

Figure 2-36. Access Ramp Locations at "T" Intersections
4. **Mid-Block Ramps on Local Roadways**
   Access ramps on local roadways shall be spaced no greater than 600 feet apart. Where spacing is greater than 600 feet, mid-block access ramps shall be provided at spacings that minimize travel distances between access ramps. Private accesses may be used for these access points where the access is designed to meet access ramp requirements. The pavement markings and signing required by the ECM and MUTCD shall be provided for mid-block access ramps.

5. **Cul-de-Sacs**
   Either an access ramp or a private access that meets access ramp requirements shall be provided in all cul-de-sacs.

6. **Underwalk Drains (Chases)**
   Underwalk drains shall not interfere with the pedestrian use. The chase plate shall be flush with the sidewalk surface and be securely fastened, as specified in the Standard Drawing in Appendix F. Underwalk drains shall not be located within an access ramp, curb cut, or private access.

7. **Inlets**
   Inlets located in a sidewalk shall be integrated with sidewalks. The inlet access shall be flush with the sidewalk surface. No manholes, inlets, or other storm sewer facilities are allowed within access ramps. Inlets shall be located at or behind the tangent points of a curb return.

D. **Grade-Separated Roadway Crossings**
   The construction of a grade-separated pedestrian crossing may be requested by the ECM Administrator when a regional trail intersects with either an Expressway or Principal Arterial. If available, existing structures should be used to accommodate the proposed grade separation.

E. **Rural Roads and Pedestrians**
   Rural road sections shall provide sufficient shoulder width for pedestrian travel. Table 2-4 and Table 2-5 outline the requirements for rural roadways.

F. **Pedestrian Crossings**
   All crosswalks shall be properly marked to ensure safe pedestrian movement. Crosswalks will be required at all signalized intersections, school areas, and high pedestrian areas, as determined by the ECM Administrator.

1. **Crosspans**
   Crosswalks shall not be located in crosspans.

2. **Maximum Crosswalk Length and Pedestrian Refuge Areas**
   The maximum length for any crosswalk shall be 48 feet. Any roadway crossing longer than 48 feet shall be provided with pedestrian refuge...
areas. Pedestrian refuge areas shall be created in medians or splitter islands to increase pedestrian safety. Vehicle turning radii shall be considered in the design of pedestrian refuge areas.

3. Traffic Signals
   All pedestrian traffic signals shall be designed and installed in accordance with MUTCD and an approved TIS.

G. Multi-Use Path Width
   Where a multi-use path is proposed, the minimum path width shall be 10 feet wide.

H. Clear Path Pedestrian Minimum
   The minimum horizontal clearance around utility structures, furniture, and other encroachments shall be greater or equal to 4 feet (see Figure 2-35). A Work in the Right-of-Way Permit is required for any private improvements within the right-of-way.

2.5.3 Noise Analysis and Mitigation
   A noise study shall be prepared where a new expressway or principal arterial is planned or where roadway construction is planned which will result in changing an existing road classification from a lower classification road to an expressway or principal arterial. Noise mitigation may be required where noise levels exceed or are predicted to exceed 67 dBA Leq or exceed the current Federal Standards.

2.5.4 Bus Shelters
   A. Location
      The location of a bus shelter shall be determined by the transit provider with the concurrence of the ECM Administrator.

   B. Visibility
      Bus shelters shall have maximum transparency, and be highly visible from the surrounding area to assure the users’ safety. The shelter may not be located within required sight distance triangles.

   C. Minimum Size and Capacity
      1. Opening Size
         Openings shall be at least 36 inches wide and shall meet the requirements of ADA.

      2. Capacity and Size
         Capacity shall be based on maximum passenger accumulation at the stop. The shelter size shall be based on approximately 5 square feet per person.
3. Placement
Shelters shall not obstruct pedestrian flow or motorist’s sight distance. Minimum pedestrian clear path widths shall be maintained.

4. Pad Requirements
A 6-inch thick concrete pad is required under all bus shelters. The pad shall extend at least 6 inches beyond each edge of the shelter.

5. Passenger Loading Area Width and Detached Sidewalks
Shelters located adjacent to detached sidewalks shall include a fifteen foot wide concrete area between the sidewalk and the curb for passenger loading and unloading.

6. Relocation of Shelters
The ECM Administrator may require a shelter to be relocated or removed in the future to accommodate other needs within the roadway right-of-way at the sole expense of the transit provider.

7. Bicycle Racks and Trash Containers
All shelters are required to provide one trash container and one bicycle rack.

8. Sidewalk Connections
A sidewalk connection shall be provided between the bus shelter and the existing sidewalk or nearby pedestrian destinations. The minimum width shall be as required in Section 2.5.2B.1.

2.5.5 Crosspans

A. Basic Requirements
Crosspans for passing storm drainage flow across roadways shall be constructed in accordance with the Standard Drawing in Appendix F.

B. Dimensions and Depth
Crosspans adjacent to local roadways shall be a minimum of 6 feet wide with a typical depth of 7/8-inch. Crosspans adjacent to collector roadways shall be a minimum of 8 feet wide with a typical depth of 1-1/8 inches. Crosspans adjacent to arterial roadways shall be 10 feet wide with a typical depth of 1-1/2 inches.

C. Prohibited on Arterial and Collector Roadways
No crosspans shall cross roadways classified as urban residential collectors and higher.

D. Minimum Grade
The flowline of the crosspan shall have a minimum grade of 0.5%.
E. Crosspan Transitions

1. Design Speeds
   Pavement transition from standard crown to crossspan shall be designed using the appropriate design speeds for urban roadways in Table 2-6 and Table 2-7.

2. Intersections
   Transitions from standard crown to crossspan at intersections shall be designed in accordance with Figure 2-37.

Figure 2-37. Standard Intersection Crowns

F. Pavement Material
   Approaches to crossspans shall be constructed with full depth asphalt wedges on asphalt roadways per the Standard Drawing in Appendix F. If pavement is concrete, crossspans may be poured monolithically with the main line paving process.
2.5.6 Medians and Traffic Islands

A. General Requirements
The design and construction details for medians shall be in accordance with roadway cross sections presented in Appendix F. The minimum width of any raised median shall be 4 feet.

B. Drainage
Landscaped medians shall be provided with drainage facilities to handle sprinkler runoff and nuisance flows. Sprinklers shall be designed to prevent spray onto the pavement surface. A properly designed drain system shall be required. When low maintenance landscaping is used in conjunction with trickle irrigation, drainage requirements may be waived.

C. Curb and Gutter
If gutters are not needed to handle drainage referenced above, medians may be constructed with outfall curb and gutter. Due to its fragility, glue-down curbs are prohibited.

D. Nose
The position of the median nose shall be placed so that vehicles do not track onto the median. The minimum radius for nose curbs shall be 2 feet to flowline.

E. Paving
All non-landscaped areas of medians shall be paved with stamped concrete, colored concrete or exposed aggregate concrete, as determined by the ECM Administrator.

F. Transitions
The ends of medians shall transition into turn lanes with a minimum radius of 100 feet. A change of direction must be accomplished with the use of radii. Angle points shall not be allowed.

G. Corner Islands Separating Right Turns
Standard corner islands shall be used in all high capacity intersections to channelize traffic, provide pedestrian refuge or where required by the ECM Administrator.

H. Median Design for Left Turn Lanes
Where a single left turn lane is necessary, a median area of 16 feet shall be provided. The median area shall consist of a 12-foot turn lane and a 4-foot painted separator. If a barrier median is necessary, the median area should consist of a 12-foot lane exclusive of gutter, and a minimum 6-foot raised median divider.
Median Islands Separating Opposing Traffic

Median islands are required at all high capacity intersections. If raised medians are not required by these standards, the median islands may be raised or painted. The design shall be in accordance with these Standards and as follows:

1. **No Obstruction**
   Medians must not obstruct the minimum left turn radius for the design vehicle(s).

2. **Drainage**
   Landscaped medians shall include drainage facilities to handle sprinkler run-off and nuisance flows. When low maintenance landscaping is used in conjunction with trickle irrigation, drainage requirements may be waived and outfall curb and gutter should be used.

Median Islands on Minor Arterials, Collectors or Local Roadways

Raised medians may be placed in minor arterial, collector, and all local roadways. If medians are included, they shall be placed in the public right-of-way, and they must meet the following standards for design:

1. **No Obstruction**
   The medians may not obstruct the design vehicle turns.

2. **Visibility**
   The medians must be placed such that the required visibility in the intersection is not obstructed.

3. **Undiminished Use**
   Medians must be placed so they do not diminish the intersection use.

4. **Alignment**
   Lanes on one side of the intersection must align with the correct lanes on the opposite side of the intersection.

5. **Median Maintenance**
   Maintenance of median landscape will be limited at the discretion of the ECM Administrator.

6. **Public Use**
   The ECM Administrator may use these islands for roadway signing and may choose to remove the median if it is deemed necessary by the ECM Administrator.

7. **Additional Right-of-Way**
   Any additional right-of-way necessary to accommodate the medians shall be provided.
2.5.7 Bicycle Facilities

A. General

1. Permitted Bicycle Travel Areas
   Bicyclists may share vehicular travel lanes in cases where no designated bike lanes are provided, except in certain cases where bicycle travel may be prohibited or is unsafe.

2. ADA Requirements
   All designs for off-roadway bicycle paths are considered multi-use paths and shall conform to ADA requirements.

3. Use of Drainage System and Open Space
   The bike path and pathway system may use the drainage and open space system.

4. Access Easements
   Where bike paths cross private land or coincide with private access facilities, a public access easement shall be provided.

5. Maintenance Responsibility
   Maintenance and operation responsibility for new bike paths will be determined by the ECM Administrator.

B. On-Roadway Bike Lanes Design Requirements

1. On-Roadway Bike Routes
   Specific roadways may be designated as on-roadway bicycle routes. These routes are on roadways with lower traffic volumes and speeds, wide outside lanes, and minimal stop signs, stop lights, curb cuts, private access, and interference with turning traffic. Roadways designated as on-roadway bicycle routes shall be designed with additional width for bike lanes. Some roadways within new developments or re-developments must also contain additional roadway width for bike lanes.

2. One-Way Road Cross Sections
   Bicycle lanes on one-way roadways shall be on the right side of the roadway.

3. Signage and Striping
   All designated bike lanes shall be signed and striped in accordance with MUTCD.
4. **Actuation Loop**

Separate actuation loops are required in bike lanes at signalized intersections.

5. **Bike Lanes at Intersections**

Where a separate right turn lane exists, the bicycle lane shall transition and be placed between the through lane and the right turn lane. The bike lane width shall remain the same as the approaching bike lane.

C. **Off-Roadway Bicycle Paths Design Requirements**

1. **General Design Requirements**

The general design of bicycle paths in the County shall meet these Standards. The bicycle path shall be designed to ensure safe, secure, and connected travel for bicyclists and other users of the off-roadway system/facilities.

2. **Bike Path Location and Easements**

Bike path locations shall be based on safety, circulation, and access considerations. Where needed, a 20-foot minimum easement shall be procured for a 10-foot-wide bike path in accordance with Figure 2-38.

3. **Preserving Trees**

Where possible, bike paths shall be routed to minimize the loss of trees and disruption of natural environmental conditions.

4. **Distance from Obstacles**

A minimum of 2 feet is required between the bike path edge and any vertical obstructions such as trees, utility poles, signs, fences, or other obstacles. The ECM Administrator may require greater separation where grades exceed 4%.

5. **Clearing of Vegetation**

During construction, minimal vegetation will be removed to assist with path installation.

6. **Overhead Clearance**

All bike paths shall have a minimum of 10 feet clear vertical clearance above the path.

7. **Cross Section**

The typical cross section shown in Figure 2-38 shall be maintained along the entire length of the bike path.

8. **Grade**

Minimum bicycle path grade shall be 0.60% except in sag curves where proper drainage shall be provided by the cross slope. The minimum
grade shall be waived if cross slope is 2% and good drainage is provided and unobstructed. A maximum grade of 8% is permitted.

9. Design Speed
For paved surfaces, a minimum design speed of 20 MPH shall be used. Where grades exceed 4%, a design speed of 30 MPH shall be used. For unpaved surfaces, a minimum design speed of 10 MPH shall be used. Where grades exceed 4%, a design speed of 20 MPH shall be used.

Figure 2-38. Typical Bicycle Path Cross Section

10. Radius of Curvature
Based upon a superelevation rate (e) of 2%, the minimum radius of curvature to be used is 95 feet at 20 MPH.

The minimum radius is a limiting value of curvature for a given design speed. At a proposed design speed both the superelevation rate and the assumed value for side friction factor determine the minimum safe radius. The minimum radius of curvature is determined from the following equation:

\[ R = \frac{V^2}{5(0.01e + f)} \]

where:
- \( R \) = radius of curve, feet
- \( V \) = vehicle design speed, MPH
e = rate of superelevation, percent (The bicycle path superelevation rate shall be a minimum of 2% and a maximum of 3%.)

f = side friction factor (Friction factors used for design should be selected based upon the point at which centrifugal force causes the bicyclist to recognize a feeling of discomfort and instinctively act to avoid higher speed. Extrapolating values used in highway design, design friction factors for paved bicycle paths can be assumed to vary from 0.27 at 20 MPH to 0.22 at 30 MPH. Unpaved surface friction factors are to be reduced by 50% to allow a sufficient margin of safety.)

11. Substandard Radius Curves

When substandard radius curves must be used on bicycle paths because of right-of-way, topographical or other considerations, standard curve warning signs and supplemental pavement markings shall be installed in accordance with the MUTCD. The negative effects of substandard curves can also be partially offset by widening the pavement through curves.

12. Sight Distance

Sight distance requirements shall be in conformance with AASHTO requirements. Figure 2-39, Figure 2-40, Figure 2-41, and Section 2.3.7 provide the required sight distance requirements. Obstructions to the visibility of motorists or bike path users shall be removed or the bike path aligned around the obstruction to maximize visibility. Lateral clearances on horizontal curves should be calculated based on the sum of the stopping sight distance for bicyclists traveling in opposite directions around the curve.

Figure 2-39. Minimum Stopping Sight Distance (Bicycle Paths)
13. **Cross Slope**

The required cross slope for all bike paths shall be 2%.

14. **Drainage**

All bicycle paths shall drain freely. Where a bike path is cut into a hillside, a ditch shall be placed along the high side of the bike path to prevent sheet flow across it.

15. **Safety Considerations**

The safety of pedestrians, and others who may use or travel on a bike path, shall be a prime consideration in the bike path design.

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*Figure 2-40. Minimum Length of Vertical Curves (Bicycle Paths)*
16. **Barriers and Other Safety Devices**

For bike paths adjacent to roadways with speed limits over 25 MPH, and with slopes greater than 6%, the ECM Administrator may require special safety measures. Examples include barriers or other safety devices between the roadway and bike path, or an increase in the distance between the bike path and highway.

17. **Signs for Hazards and Regulatory Messages**

Standard signage and pavement markings in the MUTCD are required to alert bike path users to hazards and to convey regulatory messages.

18. **Intersection Grade**

Maximum grade of the bike path at intersections is 3% extending for 30 feet in each direction from the centerline of the intersection.

19. **Access Ramps**

Standard sidewalk access ramps will be provided at all bike path curb crossings to allow continuity of bike path use by bicyclists and pedestrians. Curb depressions equaling the bike path width shall be used, with the bike path surface sloping to the pavement at 1:12 maximum slope.
20. Water Crossings  
All bike paths require either a bridge or a fair weather crossing. All bridges shall be designed in accordance with the requirements of Section 2.6.

21. Grade-Separated Roadway Crossings  
Grade-separated bicycle crossings shall be provided for regional/neighborhood paths and trails that intersect with major roadways as determined by the ECM Administrator.

22. Railings, Fences, or Barriers  
Railings, fences, or barriers on both sides of a bicycle path structure shall be a minimum of 4.5 feet high. Smooth, snag-free rub rails should be attached to the barriers at handlebar height of 3.5 feet. Barriers should not impede storm water runoff from the path.

23. Bicycle Path Underpasses  
A minimum of 10 feet of vertical clearance from trail surface to underside of bridge shall be provided. Twelve feet of clearance shall be provided if equestrian accommodations are required.

24. Trail Surface Elevation and Flooding  
The trail surface elevation shall be at or above the high water mark for the 10-year storm.

25. Signage and Pavement Marking  
All signs, except locally adopted bike route signs, shall conform to MUTCD. All curves with restricted sight distances are required to be painted with a centerline to separate traffic. The centerline shall be 4 inches wide and painted yellow.

26. Turning Radius at Bike Path Intersections  
The minimum turning radius at bike path intersections shall be 20 feet.

2.5.8 Other Features in the Right-of-Way

A. Landscaping  
Landscaping within the County’s right-of-way shall provide adequate erosion control for roadside areas; a natural streetscape environment; and safe conditions for motorists, pedestrians, and bicyclists. The landscaping must be appropriate for the conditions and easily maintained by the use of power-mowing equipment.

If plantings are proposed within the County’s right-of-way, written approval from the ECM Administrator must be obtained prior to placement and proper maintenance must be performed to ensure that a safety hazard is not created.
B. Side Slopes and Grading in Right-of-Way

1. Cut and Fill Slopes
   Cut and fill slopes should be flattened and rounded to fit with the topography.

2. Slope Benches (outside EPC Right-of-Way, inside Easement)
   Benches shall be on a slope of no more than 20:1 towards the roadway to prevent ponding of moisture behind the bench, thus creating additional slope blend with geological stratum rather than conforming to any set grade. For ease of maintenance, a 20-foot wide bench is considered satisfactory.

3. Slopes
   The maximum slopes for all areas within or outside of the right-of-way that can affect public improvements shall be a maximum of 3:1. In general, retaining walls are discouraged and not allowed within the right-of-way. Maximum slopes maybe further restricted by clear zones.

4. Off-Site Fill Material
   Any material from an off-site location to be used in right-of-way or areas within the influence area of the right-of-way must be tested to ensure these Standards are being met.

C. Roadside Ditches
   Roadside ditches shall be designed to the following criteria.
   - Ditches shall have a minimum depth of 24 inches to accommodate driveway culverts.
   - If 100-year flows require ditches to be greater than 24 inches deep, additional rights-of-way must be provided to accommodate the ditch.
   - Ditches shall be stabilized with vegetation, stone or concrete paving where velocities will erode natural soils. Asphalt paving of ditches is prohibited.
   - Ditches with steep flow lines shall be interrupted with dikes (ditch checks) at such intervals to maintain a velocity not to exceed what is appropriate for the ditch material.
   - Type C Grate Inlets are not permitted in roadside ditch applications.
   - Ditches shall have a minimum grade of 1.0% or as dictated by the roadway grade and surrounding slopes.
   - Side slopes of ditches shall be designed to minimize drifting snow onto the roadway.

D. Design Features to Prevent Snow Drifting
   Many areas of El Paso County have problems with drifting snow. Snow drifting on El Paso County roads is a dangerous problem for the traveling public and...
snow removal crews. Snow drifting has left motorists stranded, has created the need for rescue efforts for stuck motorists, impedes emergency vehicles, and has even caused deaths in El Paso County. Snow drifting increases the snow removal costs to allow motorists and emergency vehicles access to subdivisions. Therefore, subdivision applicants shall address the issue of drifting snow on El Paso County roads early in the subdivision planning and design process.

A map has been developed by snow removal crews for roads that have recurring snow drifting problems. The map is shown in Figure 2-42. Snow drifting along applicable arterial roads must be addressed when the subdivision:

- Is in a rural area.
- Consist of lot sizes 2.5 acres or larger, and
- Occurs along a road with snow drifting problems according to Figure 2-42

When all previous conditions are met, the subdivision applicant shall:

- Provide written documentation of measures taken to minimize snow drifting on identified El Paso County roads adjacent to the subdivision.
- Provide a 150 foot building setback to accommodate snow fencing / storage along the applicable arterial road.
- Provide plat notes that discuss setbacks, necessary easements, and maintenance responsibilities. El Paso County will maintain the snow fence if there is an easement and the plat notes identify that El Paso County is responsible for maintenance.
- Identify the type of snow fence to be used. The preferred snow fence is an earthen berm. Other acceptable snow fence types include a living snow fence, vertical slat fence, Wyoming snow fence (with horizontal slats) and other approved snow fence types.
- Identify the primary direction of wind and snow drifting. Typically, a snow fence will be required on the windward side of the arterial and a snow storage area will be required on the leeward side of the arterial.
2.6 STRUCTURE DESIGN

2.6.1 Structures That Must Conform to the Standards
All culvert pipe, box culverts, guardrails, and bridges that will be owned and maintained by the County shall conform to these standards.

2.6.2 Drainage Capacity and Erosion Control
Bridges and major drainage structures shall be designed to conform to the hydraulic requirements presented in Chapter 3. The design of all structures shall include measures to control bank erosion and bridge scour.

2.6.3 Design Criteria
Designs of structures shall conform to these Standards and the criteria contained in the following documents.

Structural Standards:
- AASHTO, Standard Specifications for Highway Bridges
Chapter 2 Transportation Facilities
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section 2.6.4-2.6.6

- AASHTO, LRFD Bridge Design Specifications
- AASHTO, LRFD Bridge Construction Specifications
- AASHTO, A Policy on Geometric Design of Highways and Roadways
- AASHTO, Roadside Design Guide
- CDOT, Bridge Manual, Volumes I and II
- CDOT, Standard Specifications for Road and Bridge Construction
- CDOT, M&S Standards

Borings and Soils Tests:
- Borings and soils tests shall conform to the requirements for Soils Investigations in Appendix C

2.6.4 Design Approach
Load and Resistance Factor Design (LRFD) is the recognized design approach for structures.

2.6.5 Deflection Control
Designs of three-sided concrete drainage structures shall include deflection control.

2.6.6 Bridges (Major Structures)

A. Design Life
All bridges shall have a minimum design life of 50 years.

B. Sufficiency Rating
All major structures shall be rated for structural sufficiency prior to approval of the plans by the County. The design shall conform to Federal Bridge Rating Guidelines for new bridges.

C. Basic Construction Parameters
Bridges shall be constructed of reinforced concrete or steel. Bridges constructed of timber are prohibited.

D. Span Construction Types
Typical span types and approximate acceptable span limitations are shown in Table 2-37.

Table 2-37. Bridge Span Types

<table>
<thead>
<tr>
<th>Span Type</th>
<th>Approximate Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforced Concrete Slab</td>
<td>&lt;40 feet</td>
</tr>
<tr>
<td>Prestressed Concrete Slab</td>
<td>&lt;50 feet</td>
</tr>
<tr>
<td>Prestressed Concrete Double Tee Girders</td>
<td>&lt;120 feet</td>
</tr>
<tr>
<td>Prestressed Concrete Box Girders</td>
<td>&lt;140 feet</td>
</tr>
<tr>
<td>Prestressed Concrete B-T Girders (Bulb Tee)</td>
<td>&lt;160 feet</td>
</tr>
<tr>
<td>Rolled Beams</td>
<td>&lt;100 feet; with cover plate up to 120 feet</td>
</tr>
<tr>
<td>Plate Girders</td>
<td>&lt;70 feet</td>
</tr>
<tr>
<td>Trusses</td>
<td>&gt;140 feet</td>
</tr>
</tbody>
</table>
E. Vehicular Bridges

Vehicular bridges shall be designed to carry vehicles, pedestrians, and bicycles.

1. Design Loads

All vehicular bridges shall be designed for vehicle loadings of HS-15 or higher. A pedestrian load of 85 psf shall be applied to all sidewalks wider than 2 feet, in combination with vehicular design live load. Sidewalks in this case include wide curbs or other structures that may be used by pedestrians.

2. Deflection

Maximum deflection on a vehicular bridge shall be:

\[ D_{\text{max}} = \frac{S}{1000} \]

where:

- \( D_{\text{max}} \) = deflection, feet
- \( S \) = span, feet

3. Clear Width

The clear width for bridges on roadways with curbed approaches shall meet or exceed the curb-to-curb width of the roadway approaches. For roadways with shoulders and no curbs, the clear width should be the same as the approach roadway width.

4. Sidewalks

Sidewalks conforming to the roadway cross sections shall be provided on both sides of a bridge. Sidewalk and bike path widths will match those of the approaching roadway segments. If no sidewalks or bike paths currently exist, sidewalks conforming to the roadway functional classification shall be provided (See Table 2-4 through Table 2-7).

F. Pedestrian, Equestrian, and Bicycle Bridges (PEB bridges)

1. Design Approach

PEB bridges shall be designed with the LFD method, as provided by AASHTO Standard Specifications for Highway Bridges.

2. Vehicle Design Loads

The minimum design vehicle loading for a PEB bridge follows the H-truck configuration loading. Table 2-38 presents specific H-truck loading based upon clear deck width for PEB bridges.
### Table 2-38. H-Truck Loading for PEB Bridges

<table>
<thead>
<tr>
<th>PEB Bridge Width (feet)</th>
<th>H-Truck Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–10</td>
<td>H-5 Truck Configuration (10,000 lb)</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>H-10 truck configuration (20,000 lb)</td>
</tr>
<tr>
<td>&gt;6</td>
<td>Not wide enough for any vehicles</td>
</tr>
</tbody>
</table>

3. **Pedestrians and Bicycle Design Loads**
   The pedestrian live load for the main member shall be 85 psf. When the deck influence area, A1, is greater than 400 square feet, a reduction may be made per the following equation:
   \[
   \text{Pedestrian live load} = \frac{85}{0.25 + \left(\frac{15}{A1^{1/2}}\right)}
   \]
   At no time shall the pedestrian live load of the main member be less than 65 psf.
   The design live load for the secondary member shall be 85 psf.

4. **Equestrian Design Loads**
   A concentrated load of \( P = 1,000 \) lb shall be used when horse traffic is present.

5. **Wind**
   Wind load is a horizontal load. There is no required combination of wind on live loads (pedestrian or vehicular). For wind overturning force, see AASHTO Standard Specifications for Highway Bridges. Table 2-39 presents a listing of design wind loads applicable to the vertical area of PEB bridge members.

### Table 2-39. Design Wind Load for PEB Bridges

<table>
<thead>
<tr>
<th>Member Type</th>
<th>Design Wind Load (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truss and Arches</td>
<td>75</td>
</tr>
<tr>
<td>Girders and Beams</td>
<td>50</td>
</tr>
<tr>
<td>Open Truss</td>
<td>35</td>
</tr>
</tbody>
</table>

6. **Deflection**
   Maximum deflection on a PEB bridge shall be as follows:
   \[
   D_{max} = \frac{S}{1000}
   \]
   where:
   \( D_{max} = \text{deflection, feet} \)
   \( S = \text{span, feet} \)

7. **Vibrations for PEB Bridge without Live Load**
   When the PEB bridge has no vehicular or pedestrian traffic, the frequency shall be greater than 3 Hz to avoid the first harmonic.
8. **Vibrations for PEB Bridge with Live Load**

When the PEB bridge has a live load (e.g., running and jumping), the frequency shall be greater than 5 Hz to avoid the second harmonic.

9. **Allowable Fatigue Stress**

Fatigue provisions are not required for pedestrian live load stresses where heavy pedestrian loads are infrequent. Fatigue provisions shall be included for wind loads.

10. **Half-through Truss Spans**

Half-through truss spans shall be designed per AASHTO Guide Specifications for Design of Pedestrian Bridges.

### 2.6.7 Railings

**A. Using Rigid Railings**

Railing systems can be rigid or they can allow deflection to reduce penetration. Highway structures normally warrant the use of a rigid railing.

**B. Criteria**

Railings used on any bridge structure in the County shall comply with AASHTO and CDOT Criteria.

**C. Traffic Railing**

1. **Accepted Bridge Railing Types**

Bridge railings must handle vehicles on the bridge under impact conditions. Vehicles and impact conditions are specified in the design. Table 2-40 presents the acceptable bridge railings for bridges in the County.

<table>
<thead>
<tr>
<th>Type of Railing</th>
<th>Reference(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDOT Railing Types 3, 7, 8 and 10</td>
<td>CDOT Standards</td>
</tr>
<tr>
<td>Oklahoma Modified TR-1</td>
<td>AASHTO and Appendix F</td>
</tr>
<tr>
<td>BR1 Type C Aluminum Bridge Railing</td>
<td>AASHTO and Appendix F</td>
</tr>
<tr>
<td>Safety-Shaped Concrete Bridge Railing</td>
<td>AASHTO and Appendix F</td>
</tr>
<tr>
<td>Nevada Concrete Safety Shape (w/ Steel Rails)</td>
<td>AASHTO and Appendix F</td>
</tr>
<tr>
<td>Texas Type HT (Heavy Truck)</td>
<td>AASHTO and Appendix F</td>
</tr>
<tr>
<td>Texas Type TT (Tank Truck)</td>
<td>AASHTO and Appendix F</td>
</tr>
</tbody>
</table>

2. **Using Other Types of Railing**

Other railings may be proposed for review and approval by the ECM Administrator. Structural calculations or crash test results shall be submitted with such proposals.
3. Transitions
Transitions shall be provided when a semi-rigid roadside guardrail meets a rigid bridge railing.

4. Gradual Stiffening
The transition shall provide a gradual stiffening of the approach by adjusting the post spacing or rail strength or by transitioning to a different, stiffer barrier.

5. Flexible Bridge Railings
Transitions may not be necessary when bridge railings have some flexibility. Any design without a transition shall satisfy AASHTO criteria.

6. Alternatives in Congested Areas
In urban areas or where roadways and sidewalks prevent installation of approach guardrail transitions, one or more of the following alternatives shall be followed:

- Extend the guardrail or bridge rail in a manner that prevents encroachment of vehicle onto any roadway system below the bridge. A tapered end section parallel to the roadway may be an option.
- Provide a barrier curb.
- Restrict speed. The ECM Administrator approval is required for this option.
- Provide a recovery area.

7. Placement and Lateral Clearance
The rail system shall be placed 2 feet beyond the useable shoulder.

D. Roadside Barrier Railing

1. Required Barriers
Barriers are required only when the warrants in the AASHTO Roadside Design Guide are met.

2. Acceptable Roadside Barriers
Roadside barriers are flexible, semi-rigid or rigid. Table 2-41 presents the acceptable roadside barriers in the County.

<table>
<thead>
<tr>
<th>Category</th>
<th>Type of Barrier</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-Rigid Systems</td>
<td>Blocked-Out W-Beam (Strong Post)</td>
<td>Refer to M &amp; S Standards</td>
</tr>
<tr>
<td></td>
<td>Blocked-Out Three-Beam (Strong Post)</td>
<td>Refer to M &amp; S Standards</td>
</tr>
<tr>
<td></td>
<td>Modified Three-Beam</td>
<td>Refer to M &amp; S Standards</td>
</tr>
<tr>
<td>Rigid Systems</td>
<td>Concrete Safety Shape</td>
<td>Refer to M &amp; S Standards</td>
</tr>
<tr>
<td></td>
<td>Stone Masonry Wall</td>
<td>Refer to M &amp; S Standards</td>
</tr>
</tbody>
</table>
3. **Transitions**

In the case of roadside barriers, the gradual stiffening shall decrease from structure to roadway.

4. **Lateral Offset from the Edge-of-Traveled Way**

Roadside barriers shall be placed as far from the through lane as conditions allow. A roadside barrier shall not be placed beyond the shy line offset given in Table 2-42.

**Table 2-42. Shy Line Offset Values**

<table>
<thead>
<tr>
<th>Design Speed (MPH)</th>
<th>Shy Line Offset Ls (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>9.2</td>
</tr>
<tr>
<td>60</td>
<td>7.9</td>
</tr>
<tr>
<td>50</td>
<td>6.6</td>
</tr>
<tr>
<td>40</td>
<td>4.6</td>
</tr>
<tr>
<td>30</td>
<td>3.6</td>
</tr>
<tr>
<td>25</td>
<td>3.0</td>
</tr>
</tbody>
</table>

5. **Deflection Distance**

If a rail is installed along the face of an exposed pier, abutment or wall, sufficient clearance shall be provided to allow dynamic lateral deflection. This will enable the rail to cushion and deflect an errant vehicle. Figure 2-43 provides the barrier-to-obstruction distance.
6. **Terrain Effect**

Most roadside barriers are designed and tested on level terrain. Caution must be taken when slopes are 1:6 or more. Figure 2-44 shows recommended barrier location on a 1:6 slope.

**Figure 2-44. Terrain Effects Barrier Location on a 1:6 Slope**

7. **Length of Need**

AASHTO Roadside Design Guide shall be used to determine the length of need requirements.
E. Pedestrian Railing

1. Pedestrian Railing Required
   A pedestrian railing shall be used at all locations where pedestrians are adjacent to a 2:1 or steeper drop-off equal to or greater than 30 inches high.

2. Placement
   The railing shall be placed on the outer edge of the sidewalk when pedestrian traffic is separated from vehicular traffic by a traffic railing.

3. Height and Openings
   Pedestrian railing height shall be a minimum of 42 inches, measured from the walkway surface (See Figure 2-45). Railings shall not have openings large enough to pass a 4-inch sphere.

Figure 2-45. Typical Pedestrian Railing

4. Construction Material
   A pedestrian railing shall be constructed of metal fabric, chain link (vinyl clad only), metal rails only or metal rails placed above a concrete parapet.

5. Metal Rail Design Loads
   The design live loading shall be 0.050 kips per linear foot, both transversely and vertically, acting simultaneously on each longitudinal element. A concentrated load of 0.20 kips, acting on the top rail and simultaneous with the design live loading can be considered at any point and in any direction.
6. **Chain Link/Metal Fabric Design Loads**
   The design live load shall be 0.015 Kips per Square Foot acting normal to the entire surface.

F. **Bicycle Railing**

1. **Bicycle Railing Required**
   A bicycle railing shall be used wherever bicycle lanes are adjacent to the edge of a bridge or hazard. The railing shall be warranted when the roadway has designated bike lanes.

2. **Placement**
   The bicycle railing shall be placed on the outer edge of the bike lane.

3. **Height and Rub Rail**
   Bicycle railing height shall be a minimum of 54 inches, measured from the riding surface. Smooth, snag-free rub rail shall be attached to the railings at the handlebar height of 3.5 feet (See Figure 2-46).

![Figure 2-46. Typical Bicycle Railing](image)

4. **Construction Materials**
   A bicycle railing shall be constructed of metal rails only, metal rails above a concrete parapet, chain link or metal fabric.

5. **Design loads**
   Design loads shall conform to pedestrian railing design loads in Section 2.6.7E.
G. Combination Pedestrian, Vehicle or Bicycle Traffic Barrier

1. Conditions for Use
   The combination barrier shall be provided for structures whenever a raised curb and an attached sidewalk exist.

2. Placement
   The combination barrier shall be installed adjacent to the roadway with either a pedestrian or bicycle railing, as appropriate. The combination barrier shall be placed on the outboard side as shown in Figure 2-47.

![Figure 2-47. Typical Combination Barrier](image)

3. Height
   If the sidewalk width is 6 feet or greater, the railing height shall be between 42 and 54 inches, measured from the sidewalk surface.

2.6.8 Retaining Walls and Abutments

A. General requirements

1. Accepted Retaining Walls
   Four types of retaining wall systems are accepted by the County: conventional retaining walls and abutments, anchored walls, mechanically stabilized earth walls, and prefabricated modular walls.

2. Backfill Materials
   The backfill materials used shall be granular and free-draining.
3. **Drainage**

Drainage shall be provided to reduce hydrostatic pressure behind the wall.

4. **Design Life**

All retaining walls shall have a minimum design life of 50 years.

**B. Conventional Retaining Walls and Abutments**

1. **Design Basis**

Conventional retaining walls and abutments are proportioned to provide stability against bearing capacity failure, overturning, and sliding.

2. **Avoid Placement in Right-of-Way**

Retaining walls are discouraged within the public right-of-way. They will be allowed only when necessary to support public improvements and when approved by the ECM Administrator.

3. **Requirements When Beyond Right-of-Way**

Retaining walls needed to support private improvements shall not be located in the public right-of-way. However, if the failure of a related retaining wall could threaten any improvements or safety within the right-of-way, the retaining wall shall be designed to ECM standards.

4. **Loading**

Design of conventional retaining walls and abutments shall satisfy the following loading factors:

- Lateral earth and water pressures including any live and dead load surcharges,
- The weight of the wall,
- Temperature and shrinkage effects, and
- Seismic loads.

**C. Anchored Walls**

1. **Design Basis**

Anchored walls provide additional lateral resistance with the use of anchors. Their design is based on the suitability of the subsurface soil and rock conditions.

2. **Loading**

Design of conventional retaining walls and abutments shall satisfy the following loading factors:

- Lateral earth and water pressures including any live and dead load surcharges,
- The weight of the wall, and
D. Mechanically Stabilized Earth Walls

1. Design Basis

Mechanically Stabilized Earth Walls (MSEW) are flexible composites of granular soil and tensile inclusions that behave as earth embankments with vertical or nearly vertical faces. MSEW are proportioned to provide stability against overturning and sliding. Bearing pressure generally governs design.

2. Loading

Design of conventional retaining walls and abutments shall satisfy the following loading factors:

- Lateral earth and water pressures including any live and dead load surcharges,
- The weight of the wall, and
- Seismic loads.

3. Application for MSEW

An MSEW should be used where substantial total and differential settlement is expected. This type of wall may also be used where conventional gravity, cantilever or counterforted concrete retaining walls are considered.

4. Unacceptable Uses of MSEW

An MSEW shall not be used in any of the following conditions:

- Where utilities other than highway drainage are to be constructed within the reinforced zone,
- Where floodplain erosion or scour may undermine the reinforced fill zone or any supporting footing, and
- Where surface or groundwater contaminated by acid mine drainage or other industrial pollutants is present.

E. Prefabricated Modular Walls

1. Design Basis

Prefabricated modular walls employ soil-filled interlocking modules to resist earth pressures. Stability of modular walls depends upon the weight and strength of the fill soil. Each module level shall be investigated for sliding and overturning.

2. Loading

Design of conventional retaining walls and abutments shall satisfy the following loading factors:
Lateral earth and water pressures including any live and dead load surcharges,
• The weight of the wall, and
• Seismic loads.

3. Earth Pressure and Lateral Thrust Calculations
Earth pressure shall be computed on a plane surface where modules form an irregular, stepped surface. Ka, used to compute lateral thrust, shall be computed based on the friction angle of the backfill behind the modules.

4. Application for Prefabricated Modular Wall
A prefabricated modular wall may be used where conventional gravity, cantilever or counterforted concrete retaining walls are considered.

5. Unacceptable Uses of Prefabricated Modular Wall
A prefabricated modular wall shall not be used in any of the following conditions:
• On curves with radii less than 800 feet, unless the chord can be substituted with a series of chords and
• Where groundwater or surface runoff is contaminated with acid.

F. Placement of Walls

1. Clear Zone Placement
Walls shall not be placed within the clear zone. Walls located in the clear zone shall be snag-proof and crash resistant or include an AASHTO barrier.

2. Relationship to Shoulder
Full or partial height walls shall not be located closer than the outer edge of the shoulder.

3. Retaining Wall at Roadway Level
When the top of the retaining wall is at the level of a roadway, the face of the parapet wall or rail shall be at least 4 feet from the edge of the traveled way.

2.6.9 Buried Structures

A. Materials
Buried structures may be constructed of precast or cast-in-place concrete, aluminum, or steel materials.

B. Design Life
The design life for buried structures shall be a minimum of 100 years.
C. Non-Vehicular Loads

1. Load Factors
   Buried structures shall be designed for force effects resulting from horizontal and vertical earth pressure, pavement load, live load, and vehicular dynamic load.

2. Other Load Factors
   When relevant for site or construction conditions, earth and live load surcharges and downdrag loads shall also be evaluated.

3. Water Buoyancy Loads
   Water buoyancy loads shall be analyzed for buried structures with inverts below the water table.

D. Vehicular Loads

1. Wheel Loads
   Where depth of fill is greater than 2 feet, wheel loads may be considered uniformly distributed over a rectangular area equal to the dimensions of the tire contact area.
   For depth of fill 2 feet or less, wheel loads shall be increased by 1.15 times the depth of fill in select granular backfill.

2. Recreational Trails
   The minimum design vehicular loading for buried structures supporting recreational trails shall accommodate maintenance traffic. The minimum design loading shall be H-15.

3. All Other Traffic
   Buried structures below traffic other than recreational traffic shall be designed for vehicular loadings of HS-20 or higher.

4. Sidewalks
   A pedestrian load of 85 psf shall be applied to all sidewalks, where warranted for location above buried structures, wider than 2 feet, and considered simultaneously with vehicular design live load.

E. Embankment Installation
   The soil envelope shall be wide enough to ensure lateral restraint for the buried structure. In no cases shall the width of the soil envelope on each side of the buried structure be less than the values specified in Table 2-43.
Table 2-43. Minimum Width of Soil Envelope around Buried Structures

<table>
<thead>
<tr>
<th>Diameter, S (inches)</th>
<th>Minimum Envelope Width (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;24</td>
<td>S/12</td>
</tr>
<tr>
<td>24 - 144</td>
<td>2.0</td>
</tr>
<tr>
<td>&gt;144</td>
<td>5.0</td>
</tr>
</tbody>
</table>

F. Minimum Soil Cover

The depth of cover of a well compacted granular sub-base, taken from the top of rigid pavement or the bottom of flexible pavement, shall be no less than the values specified in Table 2-44 and Table 2-45.

Table 2-44. Minimum Soil Cover for Buried Structures

<table>
<thead>
<tr>
<th>Type</th>
<th>Condition</th>
<th>Minimum Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Plate Pipe Structures</td>
<td></td>
<td>S/8 ≥ 12.0 inches</td>
</tr>
<tr>
<td>Long Span Structural Plate Pipe Structures</td>
<td></td>
<td>Table 2-45</td>
</tr>
<tr>
<td>Structural Plate Box Structures</td>
<td></td>
<td>1.4 to 5.0 feet</td>
</tr>
<tr>
<td>Reinforced Concrete Pipe</td>
<td>Unpaved areas and under flexible pavement</td>
<td>B/8 or B/8 ≥ 12.0 inches (whichever is greater)</td>
</tr>
<tr>
<td></td>
<td>Compacted granular fill under rigid pavement</td>
<td>9.0 inches</td>
</tr>
</tbody>
</table>

where:

S = diameter of pipe, inches
B = outside diameter or width of the structure, feet
B' = out-to-out vertical rise to pipe, feet
ID = inside diameter, inches

Table 2-45. Minimum Soil Cover for Buried Long Span Plate Pipe Structures

<table>
<thead>
<tr>
<th>Steel Thickness Without ribs (inches)</th>
<th>≥15.0</th>
<th>15 – 17</th>
<th>17 – 20</th>
<th>20 – 23</th>
<th>23 – 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.111</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0.140</td>
<td>2.5</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0.170</td>
<td>2.5</td>
<td>3.0</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0.188</td>
<td>2.5</td>
<td>3.0</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>0.218</td>
<td>2.0</td>
<td>2.5</td>
<td>2.5</td>
<td>3.0</td>
<td>-</td>
</tr>
<tr>
<td>0.249</td>
<td>2.0</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>0.280</td>
<td>2.0</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

G. Multiple pipe crossings

Due to maintenance issues, parallel culverts (a.k.a. culvert batteries) are not permitted except in areas where low headwater is unavoidable, areas where approach velocity is supercritical, or in the vicinity of a bend immediately.
upstream. Refer to Chapter 9 of the CDOT Drainage Design Manual for additional information.

H. Structural Plate Box Structures

1. Design

The shallow covers and extreme shapes of box culverts require special design procedures. Flexural requirements of metal box culverts govern the choice of section in all cases.

2. Geometric Requirements

Table 2-46 and Figure 2-48 provide the geometric requirements for structural plate box structures.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Required Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Span, S</td>
<td>8'-9&quot; to 25'-5&quot;</td>
</tr>
<tr>
<td>Rise, R</td>
<td>2'-6&quot; to 10'-6&quot;</td>
</tr>
<tr>
<td>Radius of crown, r(c)</td>
<td>&lt;24'-9 1/2&quot;</td>
</tr>
<tr>
<td>Radius of haunch, r(h)</td>
<td>&gt;2'-6&quot;</td>
</tr>
<tr>
<td>Haunch radius included angle, (\Delta)</td>
<td>50 to 70 degrees</td>
</tr>
<tr>
<td>Length of leg, D</td>
<td>4-3/4&quot; to 71&quot;</td>
</tr>
<tr>
<td>Minimum length of rib of leg, L</td>
<td>19&quot;; D – 3&quot;; or within 3&quot; of top of footing (whichever is lowest)</td>
</tr>
</tbody>
</table>

Figure 2-48. Typical Structural Plate Box

3. Embankment Installation

The combined width of the soil envelope and embankment beyond shall be adequate to support all the loads on the culvert.

4. Live Loads

Live load distribution for culvert tops may be based on provisions for deck slabs spanning parallel to traffic.
5. **Maximum Soil Cover**

Maximum soil cover for structural plate box structures shall be limited to a depth of cover of 5 feet.

6. **Concrete Relieving Slabs**

Concrete relieving slabs may be used to reduce flexural moments in box culverts. The length of the concrete relieving slab shall project at least 1 foot beyond the haunch on each side of the culvert.

I. **Reinforced Concrete Pipe**

1. **Design**

Buried reinforced concrete pipes shall be designed to resist structural failure due to flexure, thrust, shear, and radial tension. The dimensions of the pipe sections shall be determined with either the direct or indirect design method as outlined in the AASHTO standards referenced.

2. **Trench and Embankment Installations**

Both trench and embankment installations shall be designed for embankment loads and pressure distribution. The earth pressure distribution shall be the Hedger pressure distribution as shown in Figure 2-49 and Table 2-47.

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Installation Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAF</td>
<td>1.35</td>
</tr>
<tr>
<td>HAF</td>
<td>0.45</td>
</tr>
<tr>
<td>A1</td>
<td>0.62</td>
</tr>
<tr>
<td>A2</td>
<td>0.73</td>
</tr>
<tr>
<td>A3</td>
<td>1.35</td>
</tr>
<tr>
<td>A4</td>
<td>0.19</td>
</tr>
<tr>
<td>A5</td>
<td>0.08</td>
</tr>
<tr>
<td>A6</td>
<td>0.18</td>
</tr>
<tr>
<td>A</td>
<td>1.4</td>
</tr>
<tr>
<td>B</td>
<td>0.4</td>
</tr>
<tr>
<td>C</td>
<td>0.18</td>
</tr>
<tr>
<td>E</td>
<td>0.08</td>
</tr>
<tr>
<td>F</td>
<td>0.05</td>
</tr>
<tr>
<td>U</td>
<td>0.8</td>
</tr>
<tr>
<td>V</td>
<td>0.8</td>
</tr>
</tbody>
</table>
3. **Live Loads**
   For standard installations, the live load on the pipe shall be assumed to have a uniform vertical distribution across the top of the pipe and the same distribution across the bottom of the pipe.

J. **Reinforced Concrete Cast-in-Place and Precast Arches and Box Culverts**

1. **Trench and Embankment Installations**
   Trenches or embankments shall be constructed according to these Standards.

2. **Other Installations**
   Other installation methods (such as partial positive projection, 0.0 projection, negative projection, induced trench, and jacked installations) may be used to reduce the loads on a culvert.

3. **Vehicular Live Loads**
   All vehicular box culverts shall be designed for vehicular loadings of HS-20 or higher. For single-span culverts, the effects of live load may be neglected where the depth of fill is more than 8 feet and exceeds the span length. For multiple span culverts, the effects of live load may be neglected when depth of fill exceeds the distance between faces of end walls.
4. **Less Than Two Feet of Soil Cover**
   Distribution of wheel loads and concentrated loads for culverts with less than 2 feet of cover shall be as specified for slab-type superstructures.

5. **No Soil Cover**
   If soil cover is not provided, the top of reinforced concrete box structures shall be designed for direct application of vehicular and pedestrian loads.

6. **Crack Width Control**
   Steel reinforcement shall be well distributed over the zone of maximum concrete tension to control flexural cracking.

K. **Thermoplastic Pipe**
   Thermoplastic pipe shall not be used in El Paso County right-of-way or in any publically maintained easements.

L. **Precast Reinforced Concrete Three-Sided Structures**
   1. **Design**
      Design of three-sided structures shall be based on a pinned connection at the footing and shall take into account anticipated footing movement. Each precast, three-sided structure shall be analyzed independently with no shear or stress transfer assumed between sections.

   2. **Geometric Requirements**
      Wall thickness shall be a minimum of 8.0 inches for spans under 24 feet and 10 inches for spaces 24 feet and longer.

   3. **Shear Key**
      Flat top structures with shallow cover shall be provided with shear keys in the top surface.

   4. **Minimum Reinforcement**
      The flexural reinforcement in the direction of span shall provide a ratio of reinforcement/gross concrete area ≥ 0.002. This minimum reinforcement shall be provided at all cross sections subject to flexural tension, at the inside face of walls, and in each direction at the top of slabs of three-sided sections with less than 2.0 feet of fill.

   5. **Deflection Control**
      Deflection criteria shall be addressed in the design of all precast reinforced concrete, three-sided structures.

2.6.10 **Subdrains**
   A. **Controlling Groundwater**
      Subdrains used for the purpose of controlling groundwater on private property may be constructed within the County’s right-of-way if certain criteria are met.
The system shall be private and must be maintained by viable private parties and approved with a Work in the Right-of-Way Permit.

B. Protecting Right-of-Way Improvements
Subdrains constructed for the purpose of protecting public improvements may be installed only if other means are not possible. Subdrains installed for the protection of public improvements shall be maintained by the County.

C. Design Criteria
1. Positive Outfall
   A subdrain shall have a positive outfall for gravity drainage.

2. Adequate Engineering
   The subdrain shall be designed in consideration of site-specific groundwater conditions, soil properties, topography, and layout of proposed development.

3. Sanitary Sewer Kept Dry
   The subdrain system shall maintain adequate flow capacity under peak hydraulic loading rates to keep groundwater below the invert of the sanitary sewer.

4. No Offsite Transport
   The subdrain shall neither receive groundwater inflow from additional upstream developments, nor transfer collected groundwater to downstream developments without first recording legally binding documents of the agreements established between multiple owners.

5. Water Rights
   The subdrain shall not injure existing water rights.

6. Monitoring after Construction
   The subdrain shall incorporate provisions to allow monitoring of groundwater levels to confirm that it is functioning as designed.

7. Design for Seasonal High Water
   The subdrain shall be designed in consideration of seasonal high groundwater levels.

8. Groundwater Barriers
   The subdrain shall be designed with clay cutoff walls to preclude hydraulic communication with offsite utility trenches either upstream or downstream.

9. Filter Fabric
   The subdrain trench shall be lined with a filter fabric specifically selected to minimize the invasion of fine soil particles into the bedding gravel.
10. **Pipe Diameter**
   The minimum subdrain pipe diameter is 4 inches for mains and 3 inches for laterals or as determined by a completed geotechnical analysis.

11. **Subdrain Placement and Cleanouts**
    The Standard Drawings in Appendix F show general requirements for subdrain placement, location of cleanouts, and service.
CHAPTER 3 DRAINAGE

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3.1 OVERVIEW

This chapter provides policies and procedures to attain reasonable standardization of drainage design throughout the County.

3.1.1 Purpose

The purpose of this chapter is to discuss specific drainage and grading related criteria for projects that disturb surface soils within the unincorporated areas of the County. In addition, with the issuance of a County-wide National Pollutant Discharge Elimination System (NPDES) permit, this chapter and adopted Addendum presented in Appendix I provide specific criteria and standards for the management and protection of surface water quality.

The most current version of the Drainage Criteria Manual Volume 1 (DCM1) can be found here:
http://adm.elpasoco.com/publicservices/transportation/Documents/DCM%20VOLUME%20%201%20UPDATE.pdf

The most current version of the drainage fees and bridge fees can be found at the following website under Fees:
http://adm.elpasoco.com/Development%20Services/Pages/default.aspx

3.1.2 Chapter Content and References

Table 3-1 outlines the chapter content and references used as a basis for the standards established in Chapter 3.

<table>
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References

1. El Paso County Land Development Code
2. City of Colorado Springs Drainage Criteria Manual Volume 1 (DCM 1)
3. City of Colorado Springs Drainage Criteria Manual Volume 2 (DCM 2)

3.1.3 Standard Drawings

Table 3-2 identifies the standard drawings that are included in Appendix F as an enforceable part of these Standards. The standard drawings shall be used in all applications for which a public improvement is to be designed. Any change to a standard drawing shall be approved by the ECM Administrator and noted on the construction plans.
### Table 3-2. Standard Drawings

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<td>Storm Sewer Manhole Detail Type II</td>
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<td>SD_3-3</td>
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<td>SD_3-25</td>
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3.2 PLANNING

3.2.1 Developing a Plan for Drainage

All drainage systems being designed in the County shall take into account both minor intensity and major intensity storms. The objective of drainage system planning for minor intensity storms reoccurrence interval is to allow for the proper design of minor drainage systems (i.e., curb and gutters, storm sewers, culverts, open channels, and detention ponds) while minimizing minor damage and maintenance costs. The objective of drainage planning for major intensity storms (100-year reoccurrence interval) is to allow for proper design of major drainage systems (i.e., bridges, storm sewers, open channels, and detention ponds) while minimizing the possibility of major damage and/or loss of life.

It is the design engineer’s responsibility to develop, justify, and submit values and calculations used in the preparation of drainage for county review and approval.

3.2.2 Natural and Artificial Systems

Conveyance systems include drainage facilities, both natural and artificial, that collect, contain, and convey stormwater runoff. Natural conveyance systems include, but are not limited to, swales, wetlands, drainage courses, streams, and rivers. Artificial conveyance systems include, but are not limited to, gutters, ditches, pipes, catch basins, manholes, constructed wetlands, open channels, and swales. Requirements for artificial conveyance systems, where natural systems already exist, shall not be interpreted to supersede County requirements for protection of natural systems.

3.2.3 Requirements of Adequate Drainage Systems Required

Adequate drainage designs shall provide for removal of runoff from the roadway or the upstream end of any development, and for carrying runoff water from the upstream side to the downstream side. These functions shall be accomplished without causing objectionable backwater, causing excessive or increased velocities, creating damages to downstream ownerships, unduly affecting the safe operation of traffic on the roadway, damaging the roadway or damaging water quality.

3.2.4 Suitable Outfall Location Definition

A suitable outfall location refers to a stream which is a hydraulically adequate historic natural stream or channel segment which developed conveyance systems (i.e., storm drain systems, channels, and detention basin outlets) shall utilize for ultimate discharge of stormwater runoff from development. A suitable outfall stream may be a perennial or ephemeral stream in its previously undeveloped, natural condition. The other choice for a new stormwater outfall is a connection to an existing hydraulically adequate man-made system.

Any and all proposed man-made systems for stormwater conveyance shall outfall to a location as identified above, which is capable of receiving developed flows without negative impacts to streambed stability and/or natural sediment transport functions. Man-made conveyance systems are not limited to storm drain systems, detention basin outlets, and lined channels, but also include any change in the land configuration by
grading which results in a new runoff pattern in terms of flow direction and quantity of runoff.

All suitable outfall streams as defined above shall be defined on a map of the basin and included in the applicable drainage basin planning study. In the event an older planning study does not define a suitable discharge point for a new stormwater discharge in the basin, the above criteria shall still apply.

3.2.5 Basic Objectives

The purpose of the drainage system is to collect, transmit, and discharge drainage consistent with the following objectives:

A. Space Planning

Adequate space shall be provided and properly allocated for drainage facilities to ensure that downstream water damage has been eliminated and that the functionality of urban systems has been maintained. At no time shall concentrated flows be allowed in developed lots.

B. Multi-Use Resource

Stormwater runoff shall be treated as a multi-use resource and the design of storm drainage management facilities shall be planned to ensure that the multi-use aspects of drainage facilities are maintained.

C. Jurisdictional Boundaries and Master Planning

Drainage boundaries are non-jurisdictional and regional cooperation is required to receive approval of facilities that have potential multi-jurisdictional and regional impacts through the preparation of a new or use of an existing Drainage Basin Planning Study.

D. Floodplain Management

The design of drainage facilities shall consider the general purpose of the County’s Floodplain Regulations and reduce the hazard of floods to life and property, protect and preserve hydraulic characteristics of water courses used for conveyance of floodwaters, protect the public from the extraordinary financial expenditures for flood control and relief, and promote the multi-use resource concept with the intent to provide and preserve quality open space, trails, and tree lines.

E. Stormwater Quantity and Quality

Land disturbance activities shall properly manage and mitigate both stormwater quantity and quality related impacts. Quantity related impacts shall be mitigated in a manner that controls possible damage caused by the amount of surface water being transported to any one design point. Quality related impacts shall be mitigated using approved BMPs discussed in the adopted Addendum presented in Appendix I.
F. **Water Rights**

When proposed drainage systems interfere with existing water rights, the value and use of the water are affected; therefore, the design of any proposed stormwater drainage system incorporating retention shall identify the impact to water rights, and shall be approved by the State Engineer as appropriate.

**3.2.6 County Policy on Drainage Diversion**

Colorado drainage law recognizes the inequity in transferring the burden of managing storm drainage from one location or property to another. Liability questions may also arise when the historic drainage continuum is altered. Therefore, diversion of stormwater runoff from one basin to another is discouraged unless specific and prudent reasons justify such a transfer without impacting the historical drainage paths within the basin and the appropriate legal agreements have been recorded.

**3.2.7 County Roadside Ditches**

Consistent with Section 3.2.5, the County’s existing roadside ditch and ditch systems shall not be used as an outfall conveyance for developed runoff. The main purpose of these ditch systems is to collect and properly convey stormwater from adjacent public roadways. Roadside ditches should not be considered as a suitable outfall for conveyance of developed runoff. Should a roadside ditch be the only true option, downstream capture and storage of sediment shall be planned for and provided for in the construction plans.

**3.2.8 Hydrology**

**A. Design Storm Criteria**

Design storm flows shall be calculated based on appropriate criteria and guidelines presented in the DCM 1 to assure minimum design standards and that a regional drainage solution is developed. Information presented in these Standards do not replace information presented in the other referenced standards, but instead should be considered as additional criteria and shall be used in determining design storm runoff for both on-site and off-site flows.

**B. Peak Volumes and Times of Concentration**

Peak volumes and times of concentrations shall consider fully developed land use scenarios to determine runoff coefficients and changes in flow patterns (from the undeveloped site conditions). Estimated times of concentration shall be based on proposed grading. The proposed project or developed land use shall not change historical runoff values, cause downstream damage or adversely impact adjacent properties.

**C. Entire Project Area**

Phased or partial development analysis will not be accepted. The entire project area shall be analyzed based on full build-out to properly site and size storage areas and conveyance systems.
D. Off-Site Runoff

The analysis of off-site runoff is dependent on regional drainage characteristics, the existing/proposed land use, and topographic features. If an existing storm drainage master plan is available for the area, the storm drainage master plan shall be used as a baseline document and updated with proposed information. Should no off-site information be available for fully developed flows, the design engineer must perform a regional analysis to ensure that the project does not change historic runoff values, cause downstream damage or adversely impact adjacent properties.

E. Design Runoff

Design runoff shall be based on the following information:

- The 5-year minor design storm may be used in accordance with City of Colorado Springs adopted revisions to DCM 1.
- Within floodplain and floodplain fringe areas, as defined by the FEMA, the runoff criteria shall be based on a 100-year frequency storm.
- For all drainage channels and storm drain systems, which will convey drainage from a tributary area equal to and greater than one square mile, the runoff criteria shall be based on a 100-year frequency storm.
- For tributary areas under one square mile, (1) the storm drain system shall be designed so that the combination of storm drain system capacity and overflow will be able to carry the 100-year frequency storm without damage to or flooding of adjacent existing buildings or potential building sites, and (2) the runoff criteria for the minor storm and underground storm drain systems shall be based upon a frequency storm consistent with DCM 1 and 2.

F. Design Runoff Methods

Storm discharge flows shall be based on the adopted storm drainage master plan. If no established storm discharge flows are available, the storm drainage flows shall be based on the following:

- Design flows for watersheds less than 100 acres shall be developed using the Rational Method. Methods other than Rational Method shall not be accepted for watersheds less than 100 acres in size.
- Design flows for watersheds greater than 100 acres shall be developed using Soil Conservation Service (SCS) Methods, tabular or computer modeling or U.S. Army Corps of Engineers HEC I or HEC HMS computational methods.
- When determining design flows for floodplain management and flood proofing, design runoff shall be based upon existing conditions in accordance with the Regional Building Development's Floodplain Management Requirements and FEMA Regulations.
G. Design Points

Basin delineation within a development or specific design area is problematic with relation to the design of proper drainage systems and the long-range management of discharge quantities. Therefore, specific design points shall be analyzed in the design process. Discharge volumes for minor and major storm events shall be calculated at all design points. Examples of typical design points include:

- Curb inlets/catch basin;
- Area drains;
- Discharge points: pipes, swales, channels, detention basins, and sedimentation basins to a suitable outfall (existing or natural system);
- Transition points: pipe to channel or swale, crossspans, at any location where developed runoff exits the project boundary and at any point where off-site runoff enters the project boundary;
- Ditchout locations;
- Intersections; and
- Inflow and outflow from sedimentation basins and detention basins.

3.2.9 Site Grading

A. Basic Objectives

The goal of site grading is to develop features that direct and store surface water in a manner consistent with the following objectives:

- Assist in directing surface away from existing and proposed structures and towards well-developed conveyance/storage systems to minimize property damage;
- Minimize the amount of surface erosion and sediment transport by limiting steep grades in excess of 4:1 through terracing and using applicable permanent BMPs;
- Site grading shall be designed in a manner that minimizes the use of retaining walls and limits severe transitions at property boundaries;
- Storing surface runoff on site to minimize downstream impacts and control discharge flows; and
- Enhance surface water quality through the use of BMPs designed to remove constituents of concern collected during smaller storm events.

Site grading should imitate natural landforms and work effectively with the developed drainage plan to minimize erosion. The overall area being graded should be kept to a minimum per provisions presented in an approved ESQCP. Once construction is complete, all disturbed areas must be revegetated or other permanent BMPs must be installed.
B. County Policy on Site Grading

Site grading shall be designed to the level of detail necessary to ensure that the developed drainage plan is followed for each parcel or lot. In most cases, this will require lot templates to be developed showing the direction of overall lot drainage, key drainage features/structures, slopes exceeding 10 percent, and approved discharge points. Lot templates are recommended for all commercial development and proposed residential development densities of one unit per acre or more. Where drainage conditions across individual lots are critical to the function of the overall drainage systems or where otherwise required by the ECM Administrator, lot templates shall be developed.

3.2.10 Major Drainageways/Floodplain Management

A. Permitting and Regulations

All construction within the 100-year floodplain must comply with applicable local, state, and federal regulations. The Floodplain Administrator and ECM Administrator shall be consulted prior to submitting any formal proposal that requires or will potentially cause a change in base flood elevations in designated floodplains. Proposed modifications to the 100-year floodplain must be approved through the FEMA map revision process.

The preservation and enhancement of natural floodplains is encouraged whenever feasible. Filling floodplain fringes is generally discouraged because discharge and flood storage capacity will be impacted, affecting water surface elevations, velocity of flow, and downstream peak flows. All construction in the floodplain should be undertaken with caution and in accordance with applicable regulations.

Wetland regulations and permitting issues are also relevant to the major drainage system. A permit under Section 404 of the federal Clean Water Act (CWA) is required for any activities impacting waters of the U.S. and jurisdictional wetlands.

B. Embankments and Levees

Permanent earth embankments, roadway embankments, walls or other structures along a water course for the purpose of flood control are not allowed as provisions for new development or redevelopment. Any existing or proposed roadway embankment that could be considered a levee or "non-levee embankment" providing flood control shall meet County, State, and FEMA requirements prior to development or redevelopment of an area potentially impacted by the subject floodplain.
3.3 STORMWATER DESIGN

3.3.1 Storm Sewers

A. Design Basis

The installation of storm sewer systems is required when the other parts of the minor system (i.e., curb, gutter, and roadside ditches) no longer have capacity for additional runoff and required spread widths are exceeded.

The design of storm sewers shall be done in accordance with these Standards, the DCM1 and 2, and other references cited for additional discussion and basic design concepts. Hydraulics, debris and detritus, maintenance, inlet conditions, outlet conditions, safety, the effects on traffic, property, economics, and aesthetics shall be considered in the design of all underground storm drainage conduits.

B. Service Life

1. Minimum Service Life

The minimum design service life for storm sewer systems shall be 50 years.

2. Extended Service Life Required

The service life for storm sewer systems shall be increased to 100 years when:

- The depth of cover exceeds 15 feet,
- A portion of the system is or may be located under a structure or the overhang of a structure,
- The system is located within the traveled way of 4-lane or major and minor arterial roadways (rural and urban),
- The centerline of a storm sewer pipe is located 15 feet or less horizontally from a structure, or
- A storm sewer pipe is under a pressure head (typically caused by an installation on a steep slope).

C. Minimum Pipe Size

Storm sewers shall be designed and sized to convey the minor storm runoff peaks without surcharging the sewer. To ensure that this objective is achieved, the hydraulic and energy grade lines shall be estimated by calculating both the major and minor losses (i.e., friction, expansion, contraction, bend, and junction losses). The final energy grade line shall be at or below the proposed ground surface.

The minimum allowable pipe size for storm sewers is dependent upon the estimated flows and a practical diameter from a maintenance standpoint. The
minimum pipe size shall have a cross sectional area equivalent to an 18" circular pipe.

D. **Minimum Gradient**

The minimum gradient shall be 0.5% or a minimum velocity of 4 feet per second (fps) with the pipe flowing one quarter full. Storm sewer pipes shall be designed to flow full and free of pressure heads except for short runs where the grade changes and a small pressure head cannot be avoided. Where it is necessary to design for a pressure head, it shall be approved by the ECM Administrator and shall use pressure pipe with watertight joints with a 100-year service life.

E. **Vertical Alignment**

The storm sewer grade shall withstand AASHTO HS-20 or higher loading on the pipe. The minimum cover depends upon the pipe size, type and class, and soil bedding condition.

The minimum clearances between the proposed storm sewer, water main, and sanitary sewer (either above or below) shall be in accordance with the applicable district standards and Chapter 4.

F. **Horizontal Alignment**

In most cases, the curvilinear storm sewer shall be avoided. Where a demonstrated need exists and where the pipe will have a diameter of 48-inches or less, a curvilinear alignment may be approved. The limitations on the radius for pulled-joint pipe are dependent on the pipe length and diameter, and the amount of opening permitted in the joint per the pipe manufacturer’s recommendations.

G. **Manholes**

Maximum spacing and locations of manholes and cleanouts are to be installed per requirements described in DCM 1, except as modified by Section 3.3.1.J.2. Manholes shall be installed 1/8” below the surface of the pavement on the lowest side of the manhole.

H. **Inlets**

The capacities of standard inlets under various flow conditions shall be calculated or obtained from the DCM Volumes I and II.

I. **Angle of Confluence**

In no case shall a component of lateral velocity oppose the mainline velocity by an angle of confluence. The angle of confluence shall be 90° or less, except where lateral measures 36 inches in diameter or more, in which case the angle of confluence shall be 60° or less. The change in energy gradient in the cleanout or junction shall not exceed 3 feet. In no case shall the energy gradient exceed the elevation of 6 inches below the gutter grade on inlets, grate for grated inlets, or 6 inches below the bottom of the roof slab on cleanouts.
J. Design Criteria Summary

1. Minimum Class of Pipe
   All storm sewers within the County’s right-of-way (right-of-way) are required to be RCP (minimum Class 3, Wall B). Other materials for storm pipe may be allowed, assuming a comparable service life can be achieved and the design criteria presented in this section are met. Pipe must maintain its original manufactured dimensions after installation.

2. Changes in Conduit Size
   Where the conduit size increases, the inside top slopes of the conduits shall be continuous in elevation. Change in conduit sizes shall be accomplished in a reinforced concrete manhole or cleanout structure only.

3. Consistent with Plans
   All pipes in the storm sewer system shall have size and slope indicated in the profiles on the plans.

4. Stationing
   Storm sewer stationing shall run upgrade from the lower end of the drain. When a storm sewer runs longitudinally in a roadway, the stationing may be the roadway stationing.

5. Minimum and Maximum Cover
   Minimum and maximum cover for storm pipes shall be determined based on loading, type and class of pipe, manufacturer’s recommendations, and soil bedding conditions. Should a design warrant a cover depth of greater than 15 feet, an extended service life shall be accommodated (see Section 3.3.1 B2).

6. Alignment Priority
   Drainage alignment priority shall be given to the larger of any two connecting storm drain systems. Pipes larger than 36 inches shall not run into and out of storm drain inlets in lieu of manholes without a specially designed inlet structure.

7. Changes in Flow from Supercritical to Subcritical
   Hydraulic calculations shall be provided when the flow changes from supercritical to subcritical flow.

8. Maximum Velocity
   The maximum storm sewer velocity shall be 18 fps.
9. **No Diversions of Drainage**
   Diversion of drainage to other than an approved storm system is not permitted.

10. **Concrete Cutoff Walls and Anchoring**
    Reinforced cast-in-place concrete cutoff walls shall be installed at intervals of no greater than 30 feet (horizontally) for all pipes placed in slopes where there is the possibility of erosion of the pipe trench on the slope. In addition, anchoring shall be installed at intervals of no greater than 30 feet for all culvert pipe placed on or within slopes 3:1 or steeper.

11. **Special Bedding Requirements**
    When other pipe materials are proposed, the bedding of the pipe will be performed in a manner that is consistent with the material manufacturer's recommendations to achieve the required service life and meet the design criteria presented within these Standards.

K. **Storm Sewer Easements**

1. **Minimum Widths**
   Table 3-3 is a general guide for establishing minimum easement widths, although special conditions, such as deep locations, may require additional widths. The minimum easement width should be as shown in the table or twice the pipe depth plus the pipe diameter (rounded to the nearest 5 feet), whichever is larger. In general, storm sewer pipes should be centered in the easement.

<table>
<thead>
<tr>
<th>Pipe Diameter or Equivalent (inches)</th>
<th>Minimum Width (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18–35</td>
<td>15</td>
</tr>
<tr>
<td>36–60</td>
<td>15</td>
</tr>
<tr>
<td>Over 61</td>
<td>30</td>
</tr>
</tbody>
</table>

2. **Location**
   Storm sewers and easements are to be placed on one side of the lot ownership lines in a new development and in existing developments where conditions will permit.

3. **Joint Easements Permitted and Separations**
   In general, storm sewer easements are to be established exclusively for drainage facilities. Joint use easements will be permitted, such as sewer, water, non-motorized public access, where necessary. Each underground line shall be separated by a minimum of 10 feet horizontally.
4. **Access to Storm Sewer**

Physical access shall be provided to all storm sewer easements. Should special access to storm sewer easements be required because of grade differential, a minimum access easement of 15 feet shall be established. A 15-foot wide access road shall be provided within the access easement. The access road shall have a maximum grade of 15 percent. Maintenance vehicle access is required every 1,500 feet or more often if site conditions demand. Joint use for non-motorized public use access may be permitted.

5. **Surface Use**

In areas to be improved over a storm sewer easement, only at-grade parking lots or fences may be constructed. Permanent structures are not permitted over or within storm sewer easements.

### 3.3.2 Culverts

**A. Selection of Culvert**

The selection of a culvert for installation shall be based on information outlined in the DCM1. The required pipe strength shall be determined from the actual depth of cover, true load, and proposed field conditions. See also section 2.6.9.G for restrictions on the number of culverts.

**B. Service Life**

The minimum design service life for all culverts shall follow the design service life for storm sewer systems outlined in Section 3.3.1B.

**C. Minimum Pipe Size**

The minimum allowable culvert size shall follow the minimum size criteria for storm sewer systems in Section 3.3.1C. The minimum culvert size shall have a cross-sectional area equivalent to an 18-inch circular pipe.

**D. Minimum Gradient**

In designing culverts, both the minimum and maximum velocities must be considered. A flow velocity greater than approximately 3 fps during the initial storm is required to ensure that self-cleaning conditions exist. A velocity less than approximately 7 to 12 fps (subcritical flow regime) minimizes possible culvert damage due to scouring and downstream channel erosion.

**E. Culvert Entrances**

1. **Entrances**

   Entrances shall be rounded, beveled or expanded, whichever is appropriate, to increase the capacity of the culvert, whether the outlet is free or submerged and whether the slope is above or below critical.
2. **Flared End Sections Required**
   Flared end sections are required for outlets and inlets of culverts that do not have headwalls (except for private driveway culverts).

3. **Inlet Aprons**
   Inlet aprons shall be used as transitions between the culvert and an improved approach channel, and may be used between the culvert and a natural approach channel. These shall be designed to prevent grade cutting of natural channels and to provide for a more efficient entrance condition.

F. **Outlet Dissipater**
   A suitable energy dissipater shall be installed to reduce discharge velocities to non-erodible levels at each culvert outlet.

G. **Slope Drains**
   1. **Defined**
      A slope drain is a culvert placed on a grade of 5:1 (20%) or greater that does not fall within a road right-of-way. Slope drains may be permanent installations or temporary drains for a future extension of a permanent installation, above or below ground.
   2. **Concealed**
      Any slope drain that would be conspicuous or placed in landscaped areas shall be concealed.
   3. **Concrete Encasement**
      For installations on steep slopes or difficult topography, 6-inch concrete shall completely encase the pipe.
   4. **Watertight Joints**
      All slope drains shall have positive watertight joint connections in conformance with manufacturer's recommendations.

H. **Debris and Silt Control Facilities**
   1. **Flows Transporting Debris**
      When determined or observed by the ECM Administrator that flows are likely to carry floating debris, sediment or other abrasive materials in sufficient size to block or obstruct the conduit, a trash fence, rack or deflector is required. Vehicular access shall be provided to accommodate maintenance activities. These facilities shall be constructed upstream of the inlet so they will not obstruct the entrance.
2. Flows Transporting Silt

Where temporary drainage flows will be transporting silt, a temporary desilting basin shall be required to prevent silting of the culvert.

I. Design Criteria Summary

1. Minimum Class of Pipe

All culverts within the County’s right-of-way are required to be RCP (minimum Class 3). Other materials for storm pipe may be allowed, assuming a comparable service life can be achieved and the design criteria presented in this section are met. Pipe must maintain its manufactured dimensions after installation.

2. Consistent with Plans

Culverts in the storm drain system shall have classification indicated in the profiles on the plans.

3. Stationing

Culvert stationing shall run upgrade from the lower end of the drain. When a culvert runs longitudinally in a roadway, the stationing may be the roadway stationing.

4. Discharge Areas

Culvert outfalls shall extend to the nearest well-defined natural drainage channel that can adequately convey the discharge. Downstream conditions shall be investigated to verify the appropriateness of the point of discharge. This may require off-site storm drains or channel stabilization measures.

5. Abrasive Load

When the culvert is expected to carry a large amount of abrasive material, such as rocks and boulders, a special design to protect the full length of invert area (the lower 90°) and walls within curves to the spring line is required.

6. Superelevation Sections

Drainage must be picked up prior to reversing superelevation sections to prevent cross flows from one side of the roadway to the other side or median.

7. Minimum and Maximum Cover

Minimum and maximum cover for culverts shall be determined based on loading, type and class of pipe, manufacturer's recommendation, and soil bedding conditions. Should a design warrant a cover depth of greater than 15 feet, an extended service life shall be accommodated (see Section 3.3.1.B.2).
8. Changes in Flow from Supercritical to Subcritical
Hydraulic calculations shall be provided when the flow changes from supercritical to subcritical.

9. Special Bedding Requirements
When other culvert materials are proposed, the bedding of the culvert will be performed in a manner that is consistent with the material manufacturer’s recommendations to achieve the required service life and meet the design criteria presented within these Standards.

3.3.3 Open Channels

A. Design Options
Due to the complexities of open channels, there are a wide range of design options available. Therefore, this section only covers those issues that are particularly useful in the design of a channel and have the greatest effect on the performance and costs. The exact method of analysis and design shall be clearly documented.

B. Conformance with Standards
All open channels shall conform to these Standards and the DCM1 and 2.

C. Channel Types
1. Soft-Lined Channels
Soft-lined channels may be used where the following conditions exist:

   - A fully improved channel section is determined to be economically unfeasible.
   - Adequate bank protection, where necessary, is to be installed for alignment control and for safeguarding adjacent property.
   - Channel work will not significantly alter the watercourse or cause detrimental effects on adjacent property.
   - Planted wetlands are not allowed within the lowest portion of a newly constructed channel.
   - The channel conforms to the permissible velocities contained in the DCM1 and 2.
   - A low-flow channel is required because the main channel grade has been determined to result in ponding during low flows.
   - Drop structures will be used to accommodate changes in channel grades.

2. Hard-Lined Channels
Hard-lined channels shall be used where the conditions required for soft-lined channels do not exist. Concrete or other lining materials used in hard-lined channels shall be designed to withstand all loads including...
hydrostatic uplift, lateral earth pressures, velocities and debris loads, truck subcharge, and possible wheel loads.

D. Minimum Channel Gradient

The minimum gradient shall be dictated by the calculated hydraulics for the estimated channel low flows (2 to 5 year storm events). In addition, soft-lined channels will be designed to accommodate low flow events by armoring the lowest portion of the channel. This armoring will allow these low flow events to be accommodated within the channel without causing excessive erosion or sediment transport.

E. Channel Alignment

1. Bends
   A bend in channel alignment should be located where the velocity is lowest. The degree of bend shall be as minimal as practicable.

2. Radius of Curvature
   The minimum radius of curvature of the centerline of a channel shall be at least 3 times the width of a rectangular channel or 2 times the top width of a trapezoidal channel to minimize development of spiral flow.

F. Channel Transitions

1. Change in Channel Shape
   Transitions between two different shaped channels shall be designed to produce a smooth, low-head-loss transfer of flow. The water surface level of the downstream channel must be set below the water surface level of the upstream channel by at least the sum of the increase in velocity head, plus transition and friction losses.

2. Downstream of a Conduit
   The channel downstream of a conduit shall have a water surface far enough below the conduit to prevent a submerged outlet for a design storm.

3. Maximum Angle of Deviation
   The maximum angle of deviation in any transition shall be 12.5°.

G. Angle of Confluence

1. Determined by Downstream Flow
   The angle of confluence shall be determined by the downstream flow characteristics. The angle shall be designed to produce a smooth, low-head-loss transfer of flow and shall consider flow-rate changes, roughness, shape, and slope.
2. Lateral and Main Velocity
In no case shall a component of lateral velocity oppose the mainline velocity by an angle of confluence.

3. Conduit Connection to Channel
A conduit connection to a channel shall be made at an elevation at the top of the channel water surface and the angle of confluence shall produce a smooth low-head-loss transfer of flow.

H. Cutoff Walls
1. Lined Channels
Lined channels shall have a cutoff wall constructed at each end of the lining along the full width of section. Intermediate cutoff walls shall be provided at 250-foot intervals.

2. Unlined Channels
Graded, unlined channels, or channels with rock slope protection, shall have a rock or other type of suitable cutoff wall at each end along the full width or section.

I. Debris and Silt Control Facilities
1. Flows Transporting Debris
When determined or observed by the ECM Administrator that flows into a channel are likely to carry floating debris or rocks in any quantity, a trash fence, rack or deflector is required upstream of the channel. This facility shall be designed and located to prevent an obstruction or blockage of the channel entrance. Maintenance access to debris/rock racks is required. The channel entrance and upstream area shall be designed to provide for overtopping of the rack without overtopping the channel or damaging adjacent property.

2. Flows Transporting Silt
Where flows will be transporting significant quantities of silt, a temporary or permanent desilting basin shall be required to prevent silting in the channel or downstream from the channel.

J. Outlet Dissipater
A suitable energy dissipater for all open channel flow shall be installed to reduce velocities to pre-improved conditions where:

- Channels discharge into an unimproved or natural channel and the velocities exceed those permissible for the material involved and
- Roadway gutters discharge onto natural ground with velocities exceeding those permissible for the material involved.
K. Open Channel Easements and Access

1. Minimum Width and Access Road
   All easements shall be wide enough to provide for the channel structure and adequate maintenance access.
   - For channels 30 feet or more in top width, a minimum access road width of 15 feet shall be provided on each side of the channel.
   - For channels with a top width of less than 30 feet, a minimum access road width of 15 feet shall be provided on one side of the channel and 4 feet on the opposite side.
   - The minimum width of any channel easement shall be the top width of channel plus 4 feet on each side of the channel.
   - For channels with a depth greater than 10 feet and a length longer than 1,000 feet, access to the bottom of the channel in the form of a vehicular ramp shall be provided at an interval of 500 feet.
   - Easement and maintenance access provisions shall be made for public road discharge (i.e., ditch outs) and for cross-lot drainage in subdivisions.

2. Exclusion of Access Road
   When the lack of an access road is not considered detrimental to the maintenance and integrity of the channel, the access road can be omitted under the following conditions:
   - Where suitable exit-entry ramps are provided to intermediate channels with a minimum bottom width of 8 feet at roadway crossings and at other approved, needed locations to facilitate travel or maintenance of emergency vehicles in the channel bottom. At a minimum, one access ramp must be provided at each end of a channel.
   - Where vehicular access to the channel on a maximum spacing of 1,000 feet and at other approved, needed locations is provided to small channels with a bottom width of less than 8 feet.

3. Easement Location
   - Easements shall be placed on one side of a lot or parcel lines in new developments and where conditions permit in existing developments.
   - Easements for public road discharge and capture of created sediment shall be located where appropriate based on topography and available property.
4. **Fencing**

Fencing is required for all channels abutting residential developments, schools, parks, and pedestrian walkways based on the following criteria:

- All concrete-lined or rip-rapped channels where the design frequency storm provides a velocity that exceeds 5 feet per second and 2 feet in depth, or a combination thereof, for a factor of ten. Fencing is not required for right-of-way ditches.
- All constructed channels steeper than 4:1 where the design frequency storm provides a velocity that exceeds 5 feet per second and 2 feet in depth, or a combination thereof.
- Fencing shall be installed on both sides of the channel easement, with gate openings at all access points.
- Fencing shall be located at a minimum of 6 inches inside the easement boundary lines.
- All new fences shall be chain link, a minimum of 6 feet in height with a top rail and vinyl-coated for natural color compatibility (green or brown).

### 3.3.4 Drainage Ditches

**A. Application of Standards**

A ditch located within a development, not including roadside ditches, that conveys less than 15 cubic feet per second of public drainage is considered a drainage ditch. The requirements for open channels shall apply to drainage ditches.

In rural subdivisions where no overlot site grading will be performed, and "natural" drainageways will be conveying developed runoff, the easement width for increased capacity of these drainage channels will be determined by the engineer. Typical lot line easements designated as drainage and utility easements are generally not adequate for the purpose of runoff control. The size of the drainage channel easement shall be large enough to accommodate the developed design runoff without impact to adjacent lots or public improvements. The engineer must determine the easement width for these drainage channels early in the subdivision planning and design process. The easement size must also meet the requirements in the Land Development Code.

**B. Right-of-way and Terrace Ditches**

A right-of-way or terrace ditch is one that is located along the top of a slope and is designed to convey surface water towards designated downdrain locations. The following standards shall apply to right-of-way and terrace ditches.
1. **Minimum Grade**
   Minimum grade shall be 2 percent or a grade that will produce a minimum velocity of 6 fps when flowing full and 4 fps when a quarter full.

2. **Minimum Freeboard**
   Minimum freeboard shall be 0.5 foot. Where energy gradients necessitate, more freeboard is required.

3. **Angle of Confluence**
   The maximum angle of confluence on any ditch connection shall be 60°. Connections at any angle of confluence may require some means to contain the drainage flow within the ditches (splash aprons, splash walls, etc.)

4. **Downdrains**
   Downdrains may be either ditch or pipe. All drainage flow in an open ditch downdrain shall be totally contained within the ditch.

5. **Outfall**
   Right-of-way ditch drainage must outfall either into a constructed channel within the development or a well-defined natural channel. An energy dissipater will be required upstream of the outfall in a natural channel.

6. **Single Lot Right-of-way Ditches**
   Single lot right-of-way ditches may terminate at the toe of the slope within the lot, with an adequate energy dissipater.

C. **Toe Ditches**
   Toe ditches shall be required at the toe of fill slopes where any drainage is directed toward or along the slope. Right-of-way or terrace ditch sections may be used as toe ditches if they have adequate capacity for the drainage flow.

3.3.5 **Roadways**
   When the drainage in the roadway exceeds allowable limits, a storm sewer or an open channel system is required to convey the excess flows. The primary function of roadways is for traffic movement. Therefore, the drainage function is subservient to the traffic objective. Design criteria for the collection, conveyance, and protection of surface water runoff on public roadways shall meet the requirements of these Standards and the DCM1 and 2.

3.3.6 **Subsurface Drainage**
   When localized groundwater impacts the design of public improvements, a subsurface drainage system may be constructed, provided an acceptable subsurface drain system from the drainage system to the point of connection within the County's right-of-way is provided.
A. **Subsurface Drainage Required**

Subsurface drainage systems shall be provided in the following situations:

- Where necessary for stability and protection of adjacent properties from the influence of groundwater on cut and fill slopes.

- Where natural or artificially introduced groundwater (i.e., derived from meteoric or landscape irrigation and similar sources, respectively) affects or is likely to affect the project in a potentially unstable, hazardous or otherwise deleterious manner.

B. **Design Requirements**

1. **Minimum Pipe Size**

   The minimum size of a collector line within the County’s right-of-way shall be 6 inches.

2. **Materials**

   Polyvinyl chloride (PVC) pipe shall be allowable conduit for seepage collector lines within the County’s right-of-way.

3. **Cleanout**

   A suitable cleanout or manhole shall be located in the seepage collector line on 350-foot spacing for straight runs of pipe, and at each break in alignment or grade.

4. **Outlets**

   All discharge outlets for new construction on existing lots or newly developed lots shall be taken to the nearest existing underground public storm drain system. Discharge from a sump pump shall not be directly onto a County road. Prior to connecting to the County's system, an approved Encroachment Permit must be obtained from the ECM Administrator.

5. **Minimum Grade**

   The minimum allowable grade of seepage collector pipes shall be 0.5%.

6. **Depth and Spacing**

   Depth and spacing of the collection system will depend upon the permeability of the soil, the elevation of the water table, and the quantity of water encountered.

3.4 **GRADING AND EROSION CONTROL PLANS**

(Replaces City of Colorado Springs/El Paso County Drainage Criteria Manual Section 4.8.2 Information to be included in the Erosion Control Plan)

The Board of Commissioners of El Paso County passed Resolution 07-279 on June 28, 2007 "Authorizing a Joint Policy Statement on Clarifications to Previously Approved Regulations..."
Concerning Grading, Erosion Control, and Dust." The clarifications include definitions and checklists of required components of Grading and Erosion Control Plans (GEC) and Stormwater Management Plans (SWMP) and Standard Notes for the GEC, SWMP and the construction plans.

The checklists and standard notes can be found in Appendix E of the El Paso County Engineering Criteria Manual. These checklists and standard notes replace the requirements in City of Colorado Springs/El Paso County Drainage Criteria Manual for GEC and the City of Colorado Springs Drainage Criteria Manual, Volume 2: Stormwater Quality Policies, Procedures, and Best Management Practices (BMPs) (DCM2) for SWMP.

Grading and Erosion Control (GEC) Plan: The intent of the GEC Plan is to provide for overall subdivision or development grading design as part of the engineering required for review and approval by the County. This plan is done at the time subdivision or development construction drawings are prepared by the Professional Engineer working for the developer. This is complex work whereby cuts and fills are analyzed for balance, slopes and contours are proposed as an integral part of the engineering design. A second important use of the GEC Plan is to estimate the cost of the overall grading, erosion control measures known as Best Management Practices (BMPs), and ultimate site stabilization. The County subdivision regulations require that collateral for these activities be posted prior to any land disturbing activity. The GEC Plan is therefore important to be completed and approved at the time of subdivision construction drawing approval so that these costs can be accurately estimated and included with the required subdivision collateral.

At the time of GEC Plan approval, the exact timing and phasing of the work is not always known. The exact starting date is sometimes delayed, and often the contractor that will do the earthwork is not yet under contract. The earthwork contractor has expertise in planning and phasing the earth disturbing activity to maintain compliance that is not yet a part of the project at the time of GEC Plan approval. Although overall phasing and general timing may be known and presented, the exact dates, phasing and progression of the earthwork and stabilization work is not known at plan approval. Detailed phasing of the work and the proposed construction schedule shall be deferred to the required SWMP.
CHAPTER 4 UTILITIES AND OTHER RIGHT-OF-WAY USES

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4.1 OVERVIEW

All activities using the County's rights-of-way for other than transportation are subject to the Standards in this chapter, which regulates these activities through the Work in the Right-of-Way Permit processes. Detailed permit requirements are contained in Chapter 5 Permits and Inspections.

4.1.1 Purpose

The purpose of this chapter is to provide guidelines for those proposing to perform work or place a privately owned structure within the County’s right-of-way. The main focus of the criteria within this chapter is on utilities, however, it also discusses the importance of coordination and the expectation of those performing any and all work within the County’s right-of-way.

4.1.2 Chapter Content and References

Table 4-1 outlines the chapter content and references used as a basis for the standards established in Chapter 4.

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References

1. El Paso County Land Development Code
2. Utility District (location dependent) Installation Standards/Specifications
3. US Department of Transportation, Manual on Uniform Traffic Control Devices

4.1.3 Standard Drawings

Table 4-2 identifies the standard drawings that are included in Appendix F as an enforceable part of these Standards. The Standard Drawing shall be used in all applications for which a public improvement is to be designed. Any deviations from a Standard Drawing shall be approved by the ECM Administrator and noted in the construction plans.
4.2 PLANNING

4.2.1 Rights of Utilities

Section 38-5-101, Colorado Revised Statutes, authorizes the placement of utilities within the County's right-of-way. While the County is obligated to allow the public right-of-way to be used to provide development with sanitary and storm sewers, water mains and service lines, gas mains and service lines, electrical main lines and service lines, telephone cable lines and service lines, etc., the County must establish and enforce these Standards for design, installation, and maintenance of utilities and other facilities within the right-of-way. The County must enforce these Standards to protect the value and use of the right-of-way and roadways for transportation.

4.2.2 Use of Right-of-Way Policy

A. Coordination with Roadway Improvements

Every attempt shall be made to coordinate proposed utility and facility installations with existing conditions and other proposed construction activities, such as utility main lines and service lines to all lots, tracts or parcels of land shall be placed prior to completion of roadways.
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Adopted: 12/23/2004
Revised: 12/13/2016
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B. No Disturbance of Roadway Surface
When roadway construction is completed, utility and facility placement shall not disturb the roadway surfaces, except for an emergency repair. Jacking or boring under the surface will be required for new utility placement in hard surfaced roadways. The size of disturbed area necessary to install a utility or facility shall be kept to a minimum.

C. Coordination with Other Utilities
Each utility company or district must coordinate with the other utility companies in the location of its utility; that is, the companies shall mutually ascertain the most satisfactory location of their utility.

D. Impact Traffic Operations and Safety
Accommodation of utilities and other facilities within the County's right-of-way shall not materially degrade or adversely affect traffic operations, safety, maintenance or the structural integrity of the roadway.

4.3 UTILITY DESIGN

4.3.1 Permit Required
A Work in the Right-of-Way Permit shall be obtained from the ECM Administrator for the placement of utilities within the County's right-of-way. The installation of utilities in dedicated right-of-way in new subdivisions will be exempt from requiring a Work in the Right-of-Way Permit, but such installations shall obtain approval of a layout plan showing proposed utility locations prior to beginning construction. The approved layout plan(s) shall be submitted as part of the Construction Permit.

A Work in the Right-of-Way Permit shall be obtained from the ECM Administrator for the maintenance of utilities within the County's right-of-way.

4.3.2 Damages Caused by Utility Installations
Any damage to existing installations caused by the installation of utilities shall be repaired or replaced at the expense of the permit holder, contractor or utility company making the installation. Examples of existing installations include culverts damaged or cut, sidewalks cut or undermined, curbs or gutters cut or undermined, fencing cut or damaged, vegetation destroyed, hard surface cut or undermined.

4.3.3 Adjustment or Relocation Cost Obligations
Utilities are deemed acceptable to the ECM Administrator if they are installed per plans showing horizontal and elevation control, within the County's right-of-way, and approved by the ECM Administrator. In the case where utilities are installed prior to or without plan approval, the utility company will cover expenses for relocation and adjustments due to road improvements or reconstruction.
4.3.4 General Standards

A. Existing Utility Districts
   Where a utility district exists and has adopted installation standards, the utility
district’s requirements shall be followed and used in preparing the utility design.

B. Area Not Currently in a Utility District
   In areas not covered by a utility district, the standards contained in this section
shall be used in preparing the utility design. These standards generally follow
industry codes that are used by the utility companies for design and installation of
their facilities.

4.3.5 Utility Location

A. Minimize Relocation and Disruption of Traffic
   Utility facilities shall be located to minimize the need for future relocation, to
accommodate roadway improvements, and to provide service access to such
facilities with minimum disruption to roadway traffic.

B. Minimize Disruption of Other Utilities
   Utility equipment or facilities to be installed in the County's right-of-way shall not
disrupt the operation of existing utilities. Other utilities, including but not limited to
electrical, telephone, cable TV, and fiber optic lines, are preferred for
underground installation at locations compatible with other utilities, storm drains,
and future roadway construction.

C. Precedence of Gravity Systems
   Gravity systems, whether sanitary sewer or storm drainage, shall have
precedence over other systems in design and construction.

D. Aboveground Utilities
   1. Compatibility
      The location of poles, vaults, boxes or other aboveground utility objects
shall be compatible with driveways, intersections, and other roadway
features. They shall not interfere with sight distance, signage, traffic
signals, drainage facilities, etc. Where possible, utilities shall share
facilities to minimize the number of obstructions in the County's right-of-
way.

   2. Clear Zone
      The placement of aboveground utility facilities or equipment within the
County's right-of-way shall conform to the “clear zone” guidelines in
Chapter 2. Utility poles and other aboveground utility equipment shall be
placed outside of clear zone areas unless a deviation is approved by the
ECM Administrator and provisions for vehicular safety are installed.
3. **Roadway Vertical Clearances**

A 19-foot minimum vertical clearance for overhead lines shall be maintained over all County roadways. The minimum vertical clearance for overhead power and communication lines above the roadway and the minimum lateral and vertical clearance from bridges shall comply with state and federal standards.

4. **Pedestrian and Bike Path Clearances**

Utility poles and equipment shall not be placed in pedestrian or bicycle facilities, or protrude into the vertical space over sidewalks, walkways or bikeways. As specified in Chapter 2, there shall be an unobstructed vertical clearance of at least 7 feet above the surface of any sidewalk and 10 feet above any bike path. A 2-foot horizontal clearance shall be maintained between the edge of any bike path and any vertical utility obstruction.

E. **Underground Utilities**

1. **Scoping Meeting**

A Scoping Meeting is required with the ECM Administrator for all proposals to install underground utilities in the right-of-way of any arterial or expressway roadway or in more than 2,000 feet of right-of-way of non-arterial roadway. Final approval of all utility installations within the road right-of-way rests with the ECM Administrator even if the utility ownership falls within an existing utility district.

2. **Longitudinal Placement**

Longitudinal placement of underground utilities in the County's right-of-way shall comply with the typical utility locations shown in the utility Standard Drawing in Appendix F. When determining the planned longitudinal placements of utilities, the design engineer shall consider the roadway functional classification in the Major Transportation Corridors Plan to try to anticipate future roadway alterations and limit the need for relocation of utilities in the future.

3. **Lateral Placement**

Lateral placement of underground utilities across a County right-of-way shall be as near a right angle to the road centerline as practicable. Utility crossings should avoid deep cuts, bridge footings and retaining walls, or locations where roadway drainage would be affected. Utility crossings may be designated by the ECM Administrator.
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4.3.6 Underground Utilities Standards

A. Cover and Separation

Cover over underground utilities and the separation between underground utilities shall conform to applicable federal and state regulations, these Standards, and the Standard Drawings in Appendix F.

1. Water Lines
   - Water Mains: At no time shall a water main be placed less than 5 feet in depth measured perpendicularly to the ground line at any point of the road cross section.
   - Water Service Lines: At no time shall water service lines be placed less than 5 feet in depth measured perpendicularly to the ground line, at any point of the road cross section, to the right-of-way line.
   - Meter and Stop Boxes: Meter and stop boxes shall be set at the inside edge of the right-of-way line, but not within curb ramps. Where a utility easement exists adjacent and parallel to the right-of-way, meter and stop boxes shall be placed in the utility easement.
   - Fire Hydrants: Fire Districts must be contacted to determine location, spacing, and equipment standards.

2. Sanitary Sewer Lines
   - Sewer Mains: At no time shall a sewer main be placed less than 5 feet in depth measured perpendicularly to the ground line at any point of the road cross section.
   - Sanitary Sewer Service Lines: At no time shall sewer service lines be placed at a depth of less than 5 feet measured perpendicularly to the ground line at any point of the road cross section, to the right-of-way line.

3. Storm Sewer Lines
   - Storm Sewer Lines: At no time shall storm sewer lines be placed less than 2 feet in depth measured perpendicularly to the finished road surface. When placed outside the road, at no time shall the storm sewer lines be placed less than 1 foot in depth from the ground surface.
   - Storm Sewer Lines: Include pipe culverts, box culverts, and manholes, excluding the risers.
4. **Gas**
   - Gas Mains: At no time shall the depth of gas mains be less than 3 feet as measured perpendicularly to the ground line at any point of the road cross section.
   - Gas Service Lines: At no time shall the depth of gas service lines be less than 2.5 feet, as measured perpendicularly to the ground line at any point of the road cross section, to the right-of-way line.

5. **Electrical Lines**
   - Main Lines: At no time shall the depth of electrical main lines be less than 4 feet as measured perpendicularly to the ground line at any point of the road cross section.
   - Service Lines: At no time shall the depth of electrical service lines be less than 2.5 feet, as measured perpendicularly to the ground line at any point of the road cross section, to the right-of-way line.

6. **Telephone and Cable TV**
   - Telephone Cable TV Main Lines: At no time shall the depth of telephone main cables be less than 2.5 feet, as measured perpendicularly to the ground line at any point of the road cross section.
   - Telephone and Cable TV Service Lines: At no time shall the depth of telephone service lines be less than 2.5 feet, as measured perpendicularly to the ground line at any point of the road cross section, to the right-of-way line.

B. **Casings**

1. **When Required**
   Casings shall be installed for roadway crossings when required by appropriate industry codes or by the ECM Administrator. Casings may be required in the following situations:
   - To facilitate the insertion, removal, replacement or maintenance of a carrier line crossing or other circumstances where it is necessary to avoid open trench construction.
   - To protect carrier lines from external loads or shock during or after construction of a road.
   - To protect jacked or bored installation of coated carrier lines unless assurance is provided that no damage will result.

2. **Type and Sizing**
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The type of casing used shall meet industry and applicable state and federal standards and shall be designed to withstand road loading. The casing shall be sized to accommodate other compatible utilities and future needs.

3. Extension
Within the County's right-of-way, casing pipes shall extend to the outside of curbs or ditches or beyond the toe of fill slopes.
4. **Ends Sealed**  
Casing pipes shall be sealed at both ends, except for necessary vents or drains.

C. **Carrier Pipes**  
Carrier pipes, i.e., pipes that directly enclose a transmitted fluid or gas, shall conform to the material and design requirements of the appropriate utility industry and state and federal codes and specifications.  
Carrier pipes shall be designed to withstand road loading plus all loads imposed under all ranges of operating pressure from zero to maximum internal pressure.

D. **Marking**  
Location markers and emergency information shall be provided by the utility when required by applicable state and federal standards.

E. **Appurtenances**  
To avoid damage to appurtenances by snowplows and other maintenance activities, all appurtenances shall be installed below the roadway surface.  
Damage to appurtenances that occurs during maintenance activities will be the responsibility of the utility owner.

The depth of the appurtenance will depend on the surface type. Appurtenances installed within a paved roadway shall be installed a minimum of 1/8” below the pavement surface.

Appurtenances installed within a gravel roadway shall be installed a minimum of 8” below the gravel surface and shall be covered with gravel. A concrete collar shall be installed around the appurtenance for protection. A strip of tape shall be placed above the appurtenance to help identify the location of the appurtenance.

1. **Vents**  
Vents may be required for casings, tunnels, and galleries enclosing carriers of fluids or gases in accordance with state and federal standards. Vent standpipes shall be located as close to the right-of-way line as possible to minimize interference with road operation and maintenance, and shall not be concealed by vegetation.

2. **Drains**  
Drains may be required for casings, tunnels or galleries enclosing carriers of fluids or gases in accordance with state and federal standards. Drains for carriers of hazardous materials shall be directed to artificial holding areas to prevent possible surface or groundwater contamination. Drains for which only water or other non-hazardous liquids may discharge may be directed into roadway drainage systems at locations approved by the ECM Administrator. The drainage outfall shall
not be used as a waste way for routine purging of the carrier pipe unless specifically authorized by the ECM Administrator.

3. Manholes
Manholes shall be designed and located in a manner that will cause the least interference to other utilities or future road expansion.

4.3.7 Underground Utility Installation Standards

A. General
All utility installation, maintenance, and repair shall conform to these Standards and Appendices F and K.

B. Logistical Planning
Logistical planning shall be coordinated with and approved by the ECM Administrator as part of an approved Work in the Right-of-Way Permit. Logistics plans shall include requirements for advance warning signs, directional signs, flagmen, lighting, and all such standard traffic control devices deemed necessary. Upon approval of the logistics and construction plans, implementation of logistics plans shall be complied with by the utility company performing the work to best guarantee the safety of the motorist, pedestrian, workers, and equipment.

C. Maintenance during Peak Traffic Periods
Utility construction maintenance activities on heavily traveled roadways are prohibited during the peak traffic volume periods. The ECM Administrator shall establish appropriate work hours for all projects. The closing of any lane to traffic shall have written approval from the ECM Administrator.

D. Alternative Installation Methods

1. Plowing
Plowing of communication and electrical lines on or adjacent to existing roads by means of a vibratory plow may be allowed by the ECM Administrator provided the structural integrity of the roadway will not be impaired. Plowing may be no closer than 4 feet from the pavement. Use of a "static" type plow is not allowed.

2. Boring
Boring may be required for pipelines or conduits to cross roads, instead of trenching, as directed by the ECM Administrator. If sufficient right-of-way exists, the length of the bore shall extend a minimum of 4 feet from the edge of the pavement. Unused holes or abandoned casings shall be backfilled. Water boring under roadways shall not be permitted. Existing carriers and conduit installed under a roadway shall be physically located prior to boring.
4.3.8 Utility Installation on Roadway Structures

A. General
Attachment of utility lines to a roadway structure, including bridges, may be allowed where such attachment conforms to sound engineering practice for preserving the roadway structure and ensuring its safe operation, maintenance, and appearance. Attachment of any utility to any bridge within the County's right-of-way requires the approval of the ECM Administrator.

Attachment of a utility shall not be considered unless the structure is designed to support the additional load and can accommodate the utility facility without limiting features such as ease of maintenance.

B. Placement of Utility Features
Utility features, such as manholes or access panels, shall not be placed within the roadway portion of the structure.

C. Hazardous Substance
A pipeline carrying a hazardous substance shall not be attached to a roadway structure unless specifically approved by the ECM Administrator.

D. Clearance Requirements
The utility attachment shall not reduce any clearance requirement of the structure. Attachment to the outside of a structure shall be avoided unless there are no reasonable alternatives.

E. Vibration and Noise
Utility mountings shall be of a type that does not create noise from vibration.

F. Sleeves Required
Any hole created in a structure abutment shall be sleeved, be of a minimum size necessary to accommodate the utility line, and be sealed to prevent any leakage of water or backfill material.

G. Alignment
A utility line behind an abutment shall curve or angle out to align outside the roadbed area in as short a distance as is operationally practicable.

H. Communication and Electric Lines
Communication and electrical power line attachments shall be suitably insulated, grounded, and preferably carried in protective conduit or pipe from point of exit from the ground to re-entry. Carrier pipe and casing pipe shall be properly isolated from electric power line attachments.
4.4 MAILBOXES

4.4.1 United States Postal Service (USPS) Coordination
Mailbox type and location require approval of the USPS. Discussions with the local postmaster early in the project design process are important to ensure proper coordination.

4.4.2 Mail Box Types
To assist in clarifying the differences between the types of mailboxes typically installed within the County's right-of-ways, the following three descriptions were developed:

- Type 1 is a typical post mounted individual mail box
- Type 2 is an individual mail box that has been modified by the owner through the addition of a larger/permanent supportive structure
- Type 3 relates to cluster boxes

These descriptions are only applicable to this section and were primarily developed to assist in determining the different levels of actions required for locating and installing these types of mailboxes within the County's right-of-way.

4.4.3 Work in the Right-of-Way Permit Required
A Work in the Right-of-Way Permit shall be obtained from the ECM Administrator to locate either Type 2 or 3 mailboxes within the County's right-of-way.

4.4.4 Mailbox Construction Plans
Construction plans shall clearly show the proposed location or relocation of either Type 2 or 3 mailboxes. Construction plans shall include a statement that the postmaster has approved the proposed mailbox type(s) and location(s). The statement shall be signed and dated by the local postmaster or authorized representative prior to obtaining approval of a Work in the Right-of-Way Permit.

The relocation of Type I mail boxes will be done so through direct coordination between the owner and local postal carrier.

4.4.5 Location and Installation

A. Lower Functional Classification Roadway
Where a choice of roadway locations exists, mailboxes shall be located on the lower functional classification roadway.

B. Not Impede Access or Sight Distance
Mailboxes shall be located so as not to impede access or sight distance visibility.

C. Clear Zone Placement
Type 2 or 3 mailboxes located within a roadway clear zone shall have breakaway features.
D. **Temporary Relocation**

If it becomes necessary to remove or otherwise disturb existing mailboxes, the mailboxes shall be temporarily placed so their function will not be impaired. The boxes shall be reinstalled in accordance with the local postal carrier’s requirements.

E. **Type 3 Mailbox Placement**

Type 3 mailboxes and the pullout for the mailbox shall be located within the right-of-way dedication but outside the roadway clear zone. A license agreement with provisions for the structure to remain within the right-of-way is required. The Type 3 mailbox and associated structures shall be maintained by a private entity in accordance with the license agreement. Figures 4-1 and 4-2 show the required right-of-way and clear zone. The following conditions also apply:

- The Type 3 mailbox must be within the right-of-way so additional right-of-way dedication is required
- Provisions shall include the ability to park vehicles temporarily outside the clear zone
- Discussions with Growth Management or the local Postmaster are required for mailbox location, concrete specifications, and mailbox type.

If contact with Growth Management or the local Postmaster is bypassed, you may be required to relocate the concrete pad at your own expense and mail delivery may be delayed.

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**Figure 4-1. Mailbox Pad Pull-Off Area Detail, Urban Application**

**Figure 4-2. Mailbox Pad Pull-Off Area Detail, Rural Application**
4.4.6 Road Improvements

Turnouts for mail delivery vehicles shall be installed to serve cluster mailbox units located along arterial or collector roads, or any road with a posted speed of 35 MPH or above.

4.4.7 Snowplow Activities

If a mailbox of any type is destroyed during snowplow activities, a standard wooden post and standard mailbox will be provided to the property owner, if the budget allows.
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5.1 OVERVIEW

This chapter addresses the review, permitting and inspection process for projects involving the use, construction, enlargement, alteration, relocation, removal, conversion, demolition, repair, maintenance and excavation of any public improvements; work within a County right-of-way (right-of-way) or easement, transport of over dimensional loads on County roads; removal of trees or plants from the County's right-of-way or easements; the discharge of stormwater from a construction site or land development activity to water bodies located within El Paso County, and requests for deviations from these standards. The chapter also establishes the acceptance process for public infrastructure.

5.1.1 Purpose

The purpose of this chapter is to identify permit and inspection requirements and standards for activities associated with the construction, enlargement, alteration, relocation, removal, conversion, demolition, repair, maintenance and excavation of public infrastructure or common development improvements, the use of or work within a County right-of-way or easement, the discharge of stormwater to County drainage facilities or water bodies located within El Paso County, and requests for deviations from these standards. The chapter also establishes the acceptance process for public infrastructure.

5.1.2 Chapter Content and References

Table 5-1 outlines the chapter content and references used as a basis for the standards established in Chapter 5.
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References
1. El Paso County Land Development Code

5.2 PERMITS

5.2.1 Permit Required
It shall be unlawful for any person, owner, firm or corporation or other legal entity to construct, enlarge, alter, repair, move, improve, remove, excavate, convert or demolish any public improvements, work or locate any facility in a County right-of-way or easement, transport over dimensional loads on a County road, remove or place trees or vegetation in a County right-of-way or easement, or to construct, enlarge, alter, repair, move, improve, remove, excavate, convert or demolish any common development improvements regulated by the ECM or the LDC without first obtaining the required permits for the activity.

5.2.2 Permit Administration
The ECM Administrator is hereby authorized to administer, approve, and enforce the permit requirements of these Standards; develop procedures for the administration, approval and enforcement of the permit requirements of these Standards; and delegate the authority for the administration, approval and enforcement of the permit requirements of these Standards.

The ECM Administrator shall administer, approve and enforce all permits in a manner consistent with the general purpose and intent of the ECM.

The ECM Administrator shall have the authority to review and approve the following permit types:
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- Construction Permits
- Driveway Permits (Access Permits)
- Work in Right-of-Way Permits including (1) Excavation Permits, (2) Temporary Obstruction Permits, and (3) Encroachment Permits
- Erosion and Stormwater Quality Control Permits including (1) Erosion and Stormwater Quality Control Permits (ESQCP), and (2) Building Erosion and Stormwater Quality Control Permits (BESQCP)
- Special Transport Permits
- Annual Maintenance Permits

5.2.3 Conditions of Approval

The ECM Administrator is authorized to impose any reasonable conditions upon a permit necessary to carry out the general purpose and intent of the ECM. Conditions shall be directly related to the impacts of the proposed action and shall be roughly proportional in both extent and amount to the anticipated impacts of the action.

5.2.4 Simultaneous Processing of Applications

Where possible and without creating an undue administrative burden on the County's decision-making bodies and staff, the ECM intends to accommodate the simultaneous processing of applications for different County permits and approvals that may be required for the same project or activity in order to expedite the overall review process. Review and decision-making bodies and staff considering applications submitted simultaneously shall render separate reports, recommendations, and decisions on each application based on the specific standards applicable to each permit or approval.

Some permits depend on the applicant having previously received another permit or approval, or require the applicant to take particular action within some time period following the issuance of a permit or approval in order to avoid having the permit or approval lapse. Therefore, even though this ECM intends to accommodate simultaneous processing of County required permits or approvals, applicants should note that each of the permits or approvals set forth in the ECM, LDC and other County regulations has its own timing and review process.

5.2.5 Pre-Application Conferences

The purpose of a pre-application conference is to familiarize the applicant and the staff with the applicable provisions of the ECM that are required to permit the proposed project or activity. This conference is not required, but is recommended particularly for complex projects. The conference should be held prior to developing a detailed plan for the project or activity to ensure that the plan will address all applicable requirements of the ECM.

Any potential applicant may request a pre-application conference. Prior to the pre-application conference, the applicant shall provide to the ECM Administrator a description of the character, location, and magnitude of the proposed project or activity and any other supporting documents such as maps, drawings, models, and a description of the project or activity for which a permit or approval is sought.
The ECM Administrator shall schedule a pre-application conference after receipt of a request. At the conference, the applicant, the ECM Administrator, and any other persons the ECM Administrator deems appropriate to attend shall discuss the proposed activity. As a result of the pre-application conference, the ECM Administrator may eliminate or expand the list of required application submittals by providing the applicant with an amended application checklist.

5.2.6 Responsibility for Damage
The County and its officers and employees, including but not limited to the ECM Administrator, shall not be answerable or accountable in any manner, for injury to or death of any person, including but not limited to a permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder, or for damage to property resulting from any activities undertaken by a permit holder or under the direction of a permit holder. The permit holder shall be responsible for any liability imposed by law and for injuries to or death of any person, including but not limited to the permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder, or damage to property arising out of work or other activity permitted and done by the permit holder under a permit, or arising out of the failure on the permit holder’s part to perform the obligations under any permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity, or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit.
To the extent allowed by law, the permit holder shall indemnify, save, and hold harmless the County and its officers and employees, including but not limited to the BOCC and ECM Administrator, from all claims, suits or actions of every name, kind and description brought for or on account of injuries to or death of any person, including but not limited to the permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder and the public, or damage to property resulting from the performance of work or other activity under the permit, or arising out of the failure on the permit holder’s part to perform his obligations under any permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit, except as otherwise provided by state law. The permit holder waives any and all rights to any type of expressed or implied indemnity against the County, its officers or employees.

5.2.7 Contractor Certification
A. General Requirements
Any contractor performing work in a County right-of-way or easement must be certified by the County to be knowledgeable of the specifications, testing, inspection, and other procedures required by the ECM. To become certified, a person must take, and pass, a written test given by the ECM Administrator.
B. Testing

A written test will be conducted by the ECM Administrator to ensure that every contractor responsible for work performed within a County right-of-way or easement is knowledgeable of the requirements of the County for that work. The person being certified may pick one or all of the 3 following areas of testing: (1) earthwork, (2) concrete work, and (3) asphalt work. The ECM Administrator shall develop a standardized written test and shall determine the minimum grade that will be required before a contractor is certified to perform work.

C. Work Performed Under a Contractor Certification

Each contractor who is issued a contractor certification may designate other persons who are authorized to perform work on behalf of the certified contractor. The certified contractor holder is still responsible for the work even though the work is performed by an authorized representative. The certified contractor or authorized representative must be on the site of the work at all times during construction. If a certified contractor or an authorized representative is not present at the construction site during construction activity, a stop work order for all work on the site may be issued until a certified contractor or an authorized representative arrives on site.

D. Expiration

Contractor Certification is good for a period of 2 years. At the end of 2 years, the certified contractor must pay a renewal fee to renew the certification. The ECM Administrator may require the contractor to retest before issuing the renewal when significant changes in the specifications, testing, inspection, and other procedures required by the ECM have occurred during the certification period or where the certified contractor has had a history of substandard performance or violations during the certification period.

E. Revocation of Certification

If it is found that work performed by a certified contractor is repeatedly substandard according to the requirements and specifications of the ECM, the ECM Administrator may revoke the contractor’s certification. A contractor’s certification cannot be revoked unless the ECM Administrator determines that allowing the certified contractor to continue to perform work on public property would be detrimental to the health, safety and welfare of the general public. If revoked, the contractor shall not be granted a new certification for one-year. Prior to revoking the certification, the ECM Administrator shall provide 7 days written notice to the certified contractor and allow the certified contractor to provide materials documenting the certified contractor’s performance and the reasons that certification should not be revoked. The ECM Administrator shall consider the materials presented by the certified contractor prior to rendering a decision concerning revocation of the contractor’s certification. The certified contractor may appeal the decision of the ECM Administrator to the BOCC.
F. Obligation of Contractors Performing Work in the County Right-of-Way

Before any certified contractor shall perform work within a County right-of-way or easement that requires a permit under the ECM, the certified contractor shall have on file with the ECM Administrator general permit bond in the minimum amount of $20,000.00. Such bond shall be for the benefit of the BOCC of El Paso County by and through the ECM Administrator and shall assure recovery by the County of any expense incurred by the County in completing work begun, but not finished, by the certified contractor in accordance with these Standards. Such bond shall remain in place for at least 2 years after completion of the work.

Before any certified contractor shall perform work within a County right-of-way or easement, the certified contractor shall show evidence of a valid and enforceable bodily injury and property damage liability insurance policy, with minimum limits of $1,000,000.00 combined single limit coverage. Such policy shall be for the protection of the County from all suits, actions or claims of any type for injuries or damages allegedly sustained by any person or property as a result of the operations or completed operations of the work. Such policy shall specifically cover the acts and operations of any subcontractors or independent contractors of the certified contractor.

G. Special Districts, Utilities and Municipalities

Special districts, utilities governed by the State Public Utilities Commission, and municipalities are not be required to be certified contractors, but when using a contractor to perform work within a County right-of-way or easement shall be required to use only certified contractors. Special districts, utilities governed by the State Public Utilities Commission, and municipalities, by obtaining a permit, do agree to accept liabilities for their work in within a County right-of-way or easement.

5.2.8 Surety from Public Agency, Public Utilities and Quasi-Governmental Agencies

Appropriate surety or collateral is required for all new construction associated with development.

When obtaining a work in the right-of-way permit, municipalities, quasigovernmental agencies, special districts, mutual companies, electric, gas and communication utilities, may provide a Letter of Responsibility in lieu of posting the required surety in a form acceptable to the ECM Administrator. This Letter of Responsibility in lieu of posting the required surety does not apply to any new development. The Letter of Responsibility used in obtaining a work in the right-of-way permit does not relieve the Public Agency, Public Utility, or Quasi-Governmental Agency from their responsibility to complete the project as planned. Every entity is required to assure that they have the financial ability to fund the entire project. Acceptable documentation verifying assets adequate to assure construction should be included in District documentation and may be verified. They must also show that they have the ability to obtain required surety for the project, even if a Letter of Responsibility is used in lieu of the surety. Special districts, metro districts, or
other districts specifically created for construction or financing of improvements cannot provide a Letter of Responsibility in lieu of posting the required financial assurance.

5.2.9 Nonexclusive Remedy
The remedies provided in the ECM are not exclusive or in lieu of other rights and remedies that the County may have at law or in equity. The County is hereby authorized to seek legal and equitable relief for actual or threatened injury to the public rights-of-way or County-owned infrastructure, including, but not limited to, damages to the right-of-way, roads, sidewalks, bridges, or drainageways whether or not caused by a violation of any of the provisions of the ECM.

5.3 CONSTRUCTION PERMIT

5.3.1 General
Construction Permits are a tool to:

• provide for the administration of the orderly construction, alteration or reconstruction of public improvements within a County right-of-way or easement; and

• protect the public interest and safety in the development of private property by providing general review and oversight of the construction, alteration and reconstruction of common development and subdivision improvements regulated by the ECM and LDC.

5.3.2 Construction Permit Required
Construction Permits are required for:

• construction, alteration or reconstruction of public improvements within any County right-of-way or easement; and

• construction, alteration or reconstruction of common development improvements covered by the ECM, LDC, development agreement, or subdivision improvement agreement.

• site preparation activities including grading, stripping of soil or vegetation, depositing fill material, and trenching or excavating.

5.3.3 Notice to Proceed Required
No work shall begin under an approved Construction Permit until the ECM Administrator has also issued a Notice to Proceed.

5.3.4 Construction Permit Not Required
Construction Permits are not required for the following activities:

• Grading in an area of one acre or less which is isolated and self-contained. When a negative impact is identified by the ECM Administrator, a permit shall be required.
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• An excavation below finished grade for basements and footing of a building, retaining wall or other structure authorized by a valid building permit including any fill using material from such excavation.
• Routine agricultural uses of agricultural land.
• Exploratory excavations of less than 500 square feet (excluding mining activity) being performed at the direction of a professional soils engineer or engineering geologist or utility locates.
• A fill less than one foot in depth and placed on natural terrain with a slope flatter than 5 horizontal feet to 1 vertical foot, or less than 3 feet in depth, not intended to support structures, which does not exceed 50 cubic yards on any one lot and does not obstruct a drainage course.

Even if a Construction Permit is not required, any clearing, grading, or land disturbance activities shall be in accordance with these Standards and may require an ESQCP, BESQCP or other County permits.

5.3.5 Relationship to Other ECM Permits
In most cases, construction of public facilities within any County right-of-way or easement or the construction of common development improvements covered by a development agreement or subdivision improvement agreement will often require that the applicant obtain other County permits or approvals including an ESQCP or BESQCP. A Construction Permit will not be issued by the ECM Administrator until all other required County permits and approvals have been obtained.

5.3.6 Relationship to LDC Approvals
A Construction Permit is generally required in connection with subdivision approvals and complex development approvals including some site development plan approvals, planned unit development approvals, and commercial and multifamily residential development approvals governed by the LDC. In most cases, construction plans are required as part of the development review process which are reviewed and approved by the ECM Administrator. Therefore, the necessary construction plans to obtain a Construction Permit have often already been prepared by the applicant, and reviewed and approved by the ECM Administrator. If a complete set of construction drawings have been approved by the ECM Administrator in connection with a subdivision or development review application reviewed and approved by the BOCC, no additional plan review is necessary to obtain a construction permit.

5.3.7 Application for Permit
A. Complete Application Required
   1. General
      Applicants shall file a complete application for a Construction Permit.
      Each application shall:
• Identify and describe the work to be covered by the permit for which the application is made.
• Describe the land on which the proposed work is to be done, by legal description, street address, or similar description that readily identifies and definitively locates the proposed work location.
• Be accompanied by plans, diagrams, computations and specifications, and other data as required in these Standards.
• State the valuation of the work to be performed.
• Identify all other required County permits or approvals including permit or approval type, permit number (if permit has been approved by the ECM Administrator) or case number, date of approval (or date of application if approval has not been received), and description of work for which the permit or approval was sought.
• Include all other materials requested by the ECM Administrator including those identified in the ECM Administrator approved checklist.

2. Traffic Control
Construction activities shall not interfere with traffic on the adjacent roadways. If interference with traffic is required, a traffic control plan shall be submitted and approved by the ECM Administrator as part of the Construction Permit application. All traffic control shall conform to MUTCD standards.

3. Signed by Applicant
All applications for Construction Permit shall be signed by the applicant, or an authorized agent, who may be required to submit evidence to indicate their authority.

4. Determination of Application Completeness
An application will be considered complete if it is submitted in the required form, including all mandatory information and supporting materials specified by the ECM Administrator, and is accompanied by the applicable fee. If an application is determined to be incomplete, the ECM Administrator shall provide notice to the applicant along with an explanation of the application’s deficiencies. No further processing of the application shall occur until the deficiencies are corrected in the resubmittal. An application which is determined to be incomplete may or may not retain its same processing cycle.
B. Construction Plan Submittal Requirements

1. General
Submittal requirements consist of application, design plans, grading plans (where required), erosion control plans (where required), drainage calculations, and other information as required by the ECM Administrator. An application for Construction Permit and checklist provided by the ECM Administrator shall accompany all submittals. The application form and checklist are subject to change at the discretion of the ECM Administrator. Therefore, the applicant is advised to contact the ECM Administrator to ensure that the most current form and checklist are used.

2. Signed and Sealed by PE
The seal of the design engineer shall appear on each plan sheet. The design engineer shall be a registered Colorado Registered Professional Engineer.

5.3.8 Construction Permit Review and Issuance

A. Review Process
The application, checklist, plans, specifications, and other data filed by an applicant for a Construction Permit shall be reviewed by the ECM Administrator. The plans may also be reviewed by other departments or agencies to verify compliance with any applicable laws.
As discussed in 5.3.6, construction plan review is often conducted as part of the subdivision and development approvals. Upon completion of the detailed review by the ECM Administrator and any other departments or agencies, the ECM Administrator will return written comments and may provide one set of plans with “Red Line” comments. More than one review and “Red Line” comments may be required. All applicable “Red Line” plans shall be returned to the ECM Administrator with the revised plan set. After the design engineer has completed all revisions, final revised plans shall be submitted to the ECM Administrator for signoff and the latest set of “Red Line” plans shall be returned to the ECM Administrator. Current review procedures are provided in the Land Development Code Procedures Manual.

B. Criteria for Approval
If the ECM Administrator finds that the work described in an application for a Construction Permit and the plans and other data conform to the requirements of these Standards and other pertinent laws regulations or ordinances and that all required fees have been paid, a Construction Permit may be issued to the applicant.
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A Construction Permit may only be approved if it meets the criteria set forth below:

- The construction plan complies with all applicable requirements of the ECM;
- The applicant has obtained an ESQCP and all other required County permits and approvals for the project;
- All approvals required by the LDC have been obtained, the construction plans are consistent with the approvals obtained, and all conditions associated with any LDC approvals have been met;
- All required review and permit fees have been paid; and
- The required surety has been provided in a form acceptable to the ECM Administrator.

Any Construction Permit application that in the opinion of the ECM Administrator fails to meet the criteria for approval listed above may be denied a Construction Permit by the ECM Administrator. In denying a Construction Permit, the ECM Administrator shall provide a statement outlining the reasons for denial of the permit.

C. Authority to Deny Permit to Applicant in Violation of ECM

The ECM Administrator may deny a Construction Permit to any applicant where the applicant, or any parent or subsidiary corporation (if the applicant is a corporation) has:

- Failed to substantially comply with local regulations adopted in support of the El Paso County’s Colorado Discharge Permit System General Permit (See Appendix I);
- Conducted or is conducting land-disturbing activity without an approved Construction Permit, ESQCP, or any other permit required by the ECM;
- Failed to pay a civil penalty assessed pursuant to the ECM for failure to comply with the applicable sedimentation and erosion control requirements, where the payment is due and no appeal regarding the penalty is pending.

D. Approved Plans

When issuing a Construction Permit, the ECM Administrator shall approve the plans by signing the appropriate approval block. The approved plans shall be attached to and become an enforceable part of the Construction Permit.

E. Valid Permit and Notice to Proceed

A Construction Permit is valid once issued, but work may not proceed until a Notice to Proceed is issued by the ECM Administrator. Generally, a Notice to Proceed will be provided to the permit holder following the preconstruction meeting. A Notice to Proceed may be issued concurrently with the Construction
Permit where the ECM Administrator has determined that a preconstruction meeting is not required.

F. Preconstruction Meeting
The ECM Administrator may require a preconstruction meeting prior to issuing a Notice to Proceed. The ECM Administrator shall specify in the approved permit whether or not a preconstruction meeting is required and who is required to attend. The applicant is responsible for scheduling the meeting with the ECM Administrator.

G. Onsite Quality Control
The permit holder shall provide onsite quality control by an experienced construction representative during all phases of construction. All quality control and inspections shall meet the requirements presented in Section 5.11. Field changes made during the construction process that modifies the overall design intent as permitted or do not meet minimum County standards shall be considered a change to the permit and shall be approved by the design engineer and ECM Administrator. No adjustment to the surety is warranted unless extensive redesign is required.

H. Change in Approved Plan
The approved plans and specifications shall not be changed, modified, or altered without written authorization from the ECM Administrator. All work shall be done in conformance with the approved permit, plans, specifications, and these Standards.

I. Approved Plans and Copy of ECM at Work Site
One set of approved plans, a copy of the Construction Permit and any conditions of approval, and a copy of the ECM shall be maintained at the work site at all times during construction activities.

J. No Violation of Standards
The issuing and granting of a Construction Permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of these Standards or of any regulations of the County. No permit presuming to give authority to violate or cancel the provisions of these Standards shall be valid unless a deviation has been expressly and specifically approved by the ECM Administrator.

K. Limit of Plan Review and Permit Approval
Construction Permit approval means that the plans have been reviewed for reasonableness and compliance with minimum ECM Standards. Construction Permit approval does not relieve the design engineer from responsibility for errors, omissions, or deficiencies in the plans.
L. **Correction of Errors**

The issuance of a Construction Permit based on plans, specifications or other data shall not prevent the ECM Administrator from requiring the correction of errors in the plans, specifications and other data, or from stopping construction operations being conducted in violation of these Standards or any other regulations of the County.

**5.3.9 Construction Permit Suspension or Revocation**

The ECM Administrator may suspend or revoke any Construction Permit, in writing, issued under the provisions of these Standards whenever the Construction Permit is issued in error or on the basis of incorrect information supplied by the applicant or whenever the permit may have been issued in violation of any provision of these Standards. In the event a permit is suspended or revoked, no refund of permit fees shall be made unless the permit was issued by the ECM Administrator in error.

**5.3.10 Violations**

Construction Permits may be enforced by injunction, including both the enjoining of actions or inactions in violation of the ECM, and a mandatory injunction to require the action accomplished without, or in violation of the terms of, a Construction Permit. In any such injunctive action the County shall be entitled to an award of its costs of suit and any costs incurred in the correcting any action undertaken in violation of the provisions of the information presented herein.

The County shall be entitled to recover its attorney's fees incurred in bringing action to compel compliance with the provisions of these regulations or to compel compliance with any plan approved hereunder.

**5.3.11 Construction Permit Fees**

Construction Permit fees shall be paid in full prior to any pre-construction conference or notice to proceed. The fee for Construction Permits shall be determined by resolution of the Board of County Commissioners.

**5.3.12 County Inspections**

A. **General Requirements**

All work performed under a Construction Permit shall be subject to inspection by the ECM Administrator. The permit holder shall notify the ECM Administrator when work is ready for inspection. The ECM Administrator shall require that every request for inspection be filed at least 48 hours before the inspection is desired. The request may be in writing, email or by telephone. It is understood that in some cases it may not be possible to give 48 hours notice. However, every attempt shall be made to provide the ECM Administrator with at least 48 hours notice. Where the ECM Administrator determines that a permit holder consistently fails to provide adequate notice, the ECM Administrator may issue a stop work order or suspend the permit.
Chapter 5 Permits and Inspections
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section 5.3.13-5.3.15

It shall be the responsibility of the permit holder to provide access to and means for proper inspection of all regulated construction activities.

5.3.13 Permit Holder Inspections

In accordance with the provisions of Section 5.11, the permit holder shall provide inspection services of all public improvements and common development improvements. All improvements shall be inspected by a construction representative or a qualified individual under the supervision of a construction representative. All inspection costs, including the services of the construction representative and required testing, shall be paid by the permit holder. Copies of all inspections and required testing shall be provided to the ECM Administrator.

5.3.14 Insurance

Before any permit holder shall perform work under a Construction Permit, the permit holder shall show evidence of a valid and enforceable bodily injury and property damage liability insurance policy, with minimum limits of $1,000,000.00 combined single limit coverage. Such policy shall be for the protection of the County from all suits, actions or claims of any type for injuries or damages allegedly sustained by any person or property as a result of the operations or completed operations of the work. Such policy shall specifically cover the acts and operations of any subcontractors or independent contractors of the permit holder, in addition to the permit holder's employees or agents.

In addition to the insurance described above, the permit holder personally, by obtaining an approved Construction Permit, agrees to be liable to the County for any expenses incurred by the County because of the permit holder's acts of omissions relating to the work, and the permit holder shall hold the County harmless from any claims of anyone else arising from or relating to the work.

5.3.15 Construction Surety, Warranties, and Acceptance of Public Improvements

A. General

The purpose for this section is to provide the policies and procedural guidelines for providing an acceptable guarantee of performance and compliance with County and State codes; and acceptance of public improvements.

B. Requirements of Applicant

The applicant shall be required to submit construction surety in a form acceptable to the ECM Administrator prior to the issuance of a Construction Permit. The construction surety shall be released in accordance with the provisions of Section 5.3.16E or as otherwise allowed by any approved development agreement or subdivision improvements agreement. A 2-year defect warranty shall be posted by the permit holder for public improvements prior to preliminary acceptance and release of any portion of the construction surety.
C. **Construction Surety Default**

The ECM Administrator may demand payment on construction surety if the applicant fails to:

- renew the construction surety at least 30 days in advance of the expiration; or
- comply with a written notice of violation or correction within the time specified in the notice.

D. **Construction Surety Requirements**

1. **Types of Surety**

   The applicant is required to ensure the construction of all public improvements and utilities in accordance with the Construction Permit, approved plans, these Standards, and any development or subdivision improvements agreement. The construction surety must be posted prior to issuance of a Construction Permit for the proposed work or recording of the final plat in the case of a subdivision.

2. **Surety Estimates**

   All surety estimates will be prepared based on unit prices for new public or private sector construction in the County.

   The applicant shall complete and submit a Construction Surety Estimate to the ECM Administrator. The ECM Administrator will review the surety estimate for public improvements and will coordinate with the appropriate utility providers to review the surety estimate for water, sewer, and other utilities.

3. **Forms of Acceptable Construction Surety**

   The acceptable forms of surety guarantee for construction surety are: Surety with a Bonding Company; Collateral Assignment of a Certificate of Deposit; Letter of Credit, Certified or Cashier’s Check. Other forms of construction surety such as plat restrictions, loan commitments, property liens, or other similar surety agreements may be approved by the BOCC.

4. **Posting Construction Surety**

   The applicant shall provide all construction surety in a form acceptable to the ECM Administrator. Surety forms shall be completed, executed and then submitted, along with any other required supporting documentation, to the ECM Administrator for approval prior to the issuance of a Construction Permit or recording a final plat in the case of a subdivision.

   - Surety with a Bonding Company: The applicable “Performance Bond with Surety” form is completed by the applicant and the surety company. An original power of attorney for the individual signing for the surety company shall be attached to the bond.
The bond shall be signed or countersigned by a Colorado Resident Agent of the surety. Once the bond is completed and executed, the original is submitted for approval.

- **Collateral Assignment of Certificate of Deposit:** The applicable “Performance Bond with Certificate of Deposit” form shall be completed and executed by the applicant. Both the applicant and the financial institution must complete the “collateral assignment” form. The original of the completed and executed bond and collateral assignment, along with the certificate of deposit or an original receipt for the certificate of deposit, are submitted for approval.

- **Certified or Cashier’s Check:** The applicable “Performance Bond with Cash Escrow” form and the “Request for Taxpayer Identification Number (Form W-9)” shall be completed and executed by the applicant. The check shall be made payable to the El Paso County. The cashier’s check and the original of the completed and executed bond and Form W-9 are submitted for approval. Checks are cashed and the funds placed in an interest bearing performance bond account maintained by the County.

- **Letter of Credit from an Insured Lending Institution:** The applicable "Irrevocable Letter of Credit" form shall be completed by the lending institution and be in favor of the BOCC, and shall guarantee construction of the improvements according to the approved plans and specifications. This Letter of Credit shall be automatically extended for additional periods of one year from the present or future expiration date, unless the bank notifies the ECM Administrator and the "Customer" via courier or certified mail at least 120 calendar days prior to the then expiration date that the bank has elected not to renew the Letter of Credit. 30 days after receipt of such notice, the County may draw on the Letter of Credit by presentation of the Letter of Credit, and a demand in writing signed by a person who has been duly authorized to sign on the County's behalf.

Under no circumstances shall the required performance bond, collateral assignment of certificate of deposit, certified or cashier’s check or irrevocable letter of credit be tied to or be considered a portion of the developer’s financing for the development.

5. **Construction Surety Term**

The construction surety shall have minimum term of one year.
E. Preliminary Acceptance, Surety Reductions and Inspection

1. General
The permit holder seeking preliminary acceptance shall notify the ECM Administrator that the public improvements are complete and ready to be accepted by the County. The permit holder shall schedule a preliminary acceptance walk-through. The ECM Administrator shall develop a punch-list of items to be corrected prior to preliminary acceptance, and non-critical items which must only be completed prior to final acceptance. The walk through shall involve at a minimum the ECM Administrator and the construction representative.

Upon satisfactory completion of punch list items required for preliminary acceptance and a determination by the ECM Administrator that the installed improvements meet all applicable Standards, a preliminary acceptance recommendation shall be forwarded by the ECM Administrator to the BOCC for action. If the BOCC approve preliminary acceptance of an improvement, then construction surety shall be released in accordance with Section 5.3.16E.3 and 5.3.16E.4 upon receipt of a defect warranty bond (See Section 5.3.16F).

Upon preliminary acceptance by the BOCC and release of the construction surety by the ECM Administrator, the facilities to be publicly maintained will be included in the County system for maintenance. A roads system maintenance acceptance form and drainage facility maintenance form shall be prepared by the BOCC identifying the systems to be added into the maintenance system.

A determination concerning final acceptance will not be made for 2 years from the date of preliminary acceptance.

2. Preliminary Acceptance Limitation
The preliminary acceptance of an improvement shall in no way constitute an assumption by the County of liability for defects in the improvement due to workmanship or materials. By accepting the improvement, the County does not warrant or guarantee that the improvement has been properly designed or constructed. Any errors or omission of the permit holder, design engineer, or construction engineer shall not be the responsibility of the County.

The permit holder shall be responsible for making any repair of facility failures that occur during the 2-year defect warranty period.

3. Surety Reductions and Inspections
Once the initial surety estimate is prepared, to request any reduction in surety the permit holder shall submit an approved "Surety Inspection Request Form" to the ECM Administrator.
Requests for construction surety reduction will be subject to the following conditions based upon the percentage of work completed and approved by the County, or other authority or agency having jurisdiction over the improvement. The following conditions apply to surety reductions and inspection fees.

- No more than 3 inspections for surety reductions will be scheduled during any twelve-month period. Additional inspections for surety reductions can be requested and will be scheduled and conducted based on staff availability but shall be scheduled only after regular inspections are completed.
- A surety reduction inspection fee must accompany each request for reduction.
- Inspections will be scheduled within 30 days of receipt of the surety reduction inspection request form and applicable fee.
- Reductions will not occur until completion and approval of at least 30% of the public improvements.

Twenty percent (20%) of the original construction surety amount will be retained until final completion and preliminary acceptance of all public improvements. Preliminary acceptance will not begin until the applicable defect warranty surety is posted.

4. **Release of Construction Surety**

Construction surety shall be released upon completion and preliminary acceptance of all public and common development improvements. A county public improvement is deemed to be complete when it is preliminarily accepted and taken over for maintenance by the County. Other public improvements are deemed to be complete when approved by the authority or state agency responsible for maintaining and operating the improvement. A common development improvement is deemed to be approved once the ECM Administrator determines that the improvements are complete.

Engineering Record Drawings are required at the time of preliminary acceptance in accordance with 5.11.6. However, any field modifications made to the site contrary to the accepted drawings during the warranty period will be documented during inspections, and an addendum must be submitted to revise the Engineering Record Drawings prior to receiving Final Acceptance.

F. **Warranty Requirements**

1. **General**

   The permit holder is required to warranty all improvements against defects in materials or workmanship. This warranty must be posted prior
to preliminary acceptance by the County or the release of any portion of the construction surety except as otherwise provided. The amount of the defect warranty shall be equal to 20% of those items as identified in the approved surety estimate.

2. **Form of Defect Warranty Surety**

The permit holder shall provide a defect warranty in a form acceptable to the ECM Administrator. The approved Defect Warranty Form shall be completed, executed and then submitted, along with any required supporting documentation, to the ECM Administrator for approval prior to the preliminary acceptance.

3. **Defect Warranty Period**

The permit holder is required to warrant improvements for 2 years.

4. **Permit Holder Responsibilities During Defect Warranty Period**

The permit holder shall repair or correct any deficiencies or defects in workmanship or materials that may occur before final acceptance is granted. Any repairs or correction shall be noted and a copy of the repair description and action shall be provided to the ECM Administrator.

G. **Final Acceptance, Inspection and Release of Defect Warranty**

1. **General**

The permit holder seeking final acceptance shall notify the ECM Administrator to schedule a final walk-through inspection at least 30 days and no more than 90 days before the end of the defect warranty period. The final walk-through inspection shall include the permit holder (or representative), the construction representative (if different than the permit holder representative), and the ECM Administrator. The ECM Administrator may invite additional County or outside agency representatives. The ECM Administrator will generate a punch list of items for repair or correction.

Once all items identified on the punch list have been repaired or corrected to the satisfaction of the ECM Administrator and the ECM Administrator determines that the installed improvements meet all applicable Standards, the ECM Administrator shall prepare and schedule final acceptance documents for public improvements for Board of County Commissioner hearing and approval. The defect warranty may be released by the ECM Administrator upon action of the BOCC to accept the public improvements.

2. **Final Acceptance Certification**

Prior to scheduling final acceptance for BOCC approval, the final punch list certification shall be signed by the ECM Administrator, construction
representative, and permit holder stating that all items identified in the punch list have been repaired, corrected or completed.

3. **Final Acceptance and Release of Defect Warranty**
   Upon final acceptance of the improvements by the BOCC, the ECM Administrator shall release the defect warranty.

4. **Failure to Make Repairs or Corrections**
   If the permit holder fails to make the required repairs or corrections identified during the final walk-through inspection within six months, the ECM Administrator may draw on the defect warranty in order to perform the required repairs or corrections.

### 5.4 DRIVEWAY PERMIT

#### 5.4.1 General
For the safety of the general public, the County has determined the minimum requirements and technical standards for driveways, and associated culverts and drainage structures constructed within the County right-of-way. The Driveway Permit is a tool to help the County regulate the location and construction of driveways that will intersect any County road, determine compliance with general access standards, and determine whether or not an access will intersect a county road. This section provides an orderly procedure for obtaining a Driveway Permit.

#### 5.4.2 Driveway Permit Required
Driveway Permits are required to construct, reconstruct, pave, alter, enlarge or change the use of any driveway intersecting a County road; install, re-install, replace, or move a culvert associated with a driveway intersecting a County road; or verify a driveway location is on a private road before issuing a building permit. Where a new driveway is to be constructed in conjunction with the construction of a new principal structure, the Driveway Permit shall be issued as a condition for obtaining a building permit. Where the use of a principal structure or property is proposed to change, a new Driveway Permit may be required prior to the use conversion.

No person shall commence work on any driveway or culvert within a County right-of-way before the Driveway Permit has been issued.

#### 5.4.3 Restrictions on Locations
All driveways shall meet the criteria for access outlined in Chapter 2 of the ECM. In addition, accesses shall be subject to any subdivision plat restrictions.

#### 5.4.4 Application

A. **Complete Application Required**
Applicants shall file a complete application for a Driveway Permit on forms provided by the ECM Administrator. Based on the proposal, additional
submissions may be required to provide the ECM Administrator with sufficient information to provide for review of the application.

The ECM Administrator may allow Driveway Permits to be processed in groups within a common development or subdivision to reduce the administrative burden on applicants requesting permits concurrently for multiple lots.

B. **Additional Requirements for Commercial or Multifamily Driveways**

All commercial and multifamily driveways are subject to site development plan review. Due to the higher complexity and possible impacts, a transportation impact study may be required to support review and approval of a Driveway Permit application for a driveway serving commercial and multifamily development. Where the transportation impact study determines or these Standards require public improvements such as acceleration and deceleration lanes, exclusive left or right hand turn lanes, or a traffic signal, the applicant shall also be required to obtain a Construction Permit to construct, reconstruct, alter, or enlarge the necessary public improvements.

C. **Signed by Applicant**

All applications for Driveway Permit shall be signed by the applicant, or an authorized agent, who may be required to submit evidence to indicate their authority.

D. **Proposed Driveway Location to be Marked**

For access onto a County public road with open ditch drainage (not curb and gutter), the applicant may be required by the ECM Administrator to stake the proposed location of the driveway at the point of intersection with County road. If staking is required, the driveway location shall be staked with 2 stakes marked “driveway” placed along the edge of the County right-of-way, and shall be clearly visible from the road. In evaluating the Driveway Permit application, the ECM Administrator may conduct a field inspection of the location of the proposed driveway. If the location has not been staked in accordance with this section, the Driveway Permit may be denied by the ECM Administrator or a reinspection fee may be assessed prior to reinspecting the location and issuing the Driveway Permit.

E. **Determination of Application Completeness**

An application will be considered complete if it is submitted in the required form, includes all mandatory information, including all supporting materials specified by the ECM Administrator, and is accompanied by the applicable fee. If an application is determined to be incomplete, the ECM Administrator shall provide notice to the applicant along with an explanation of the application’s deficiencies. No further processing of the application shall occur until the deficiencies are corrected in a future resubmittal. An application which is determined to be incomplete may or may not retain its same processing cycle.
F. **Application for Second Driveway Access**

In some situations, El Paso County will consider a second driveway access for a lot, if requested. If a second driveway access is requested, all driveway criteria must be met for both driveways.

**5.4.5 Driveway Permit Review and Issuance**

A. **Review Process**

The application and other data filed by an applicant for a Driveway Permit shall be reviewed by the ECM Administrator. The application may also be reviewed by other departments or agencies to verify compliance with any applicable laws. If the ECM Administrator finds that the work described in an application for a Driveway Permit conform to the requirements of these Standards and other pertinent laws regulations or ordinances and that all required fees have been paid, a Driveway Permit shall be issued to the applicant.

B. **Criteria for Approval**

A Driveway Permit may only be approved if it meets the criteria set forth below:

- The submitted application complies with all applicable requirements of the ECM;
- The ECM Administrator determines that the access will not create an unsafe condition for the traveling public;
- All required review and permit fees have been paid and any required construction surety has been posted in a form acceptable to the ECM Administrator.

Any Driveway Permit application that in the opinion of the ECM Administrator fails to meet the criteria for approval listed above may be denied a Driveway Permit by the ECM Administrator. In denying a Driveway Permit, the ECM Administrator shall provide a statement outlining the reasons for denial of the permit.

C. **Change in Approved Permit**

The approved permit shall not be changed, modified, or altered without written authorization from the ECM Administrator. All work shall be done in conformance with the approved permit and these Standards.

D. **Violation of Standards**

The issuing and granting of a Driveway Permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of these Standards or of any regulations of the County. No permit presuming to give authority to violate or cancel the provisions of these Standards shall be valid, unless expressly and specifically varied by the ECM Administrator.
E. **Limit of Permit Approval**

Driveway Permit approval means that the permit has been reviewed for reasonableness and compliance with minimum ECM Standards. The Driveway Permit does guarantee that if the permit specifications are met and construction complies with the standards outlined in the ECM and on the Driveway Permit, the permit holder will not be liable for damages to the County road after construction is completed.

F. **County Authority Preserved**

The County, notwithstanding the issuance of any permit or construction of any driveway, reserves the right to make any changes, additions, repairs or relocation of any part of a driveway within the dedicated right-of-way at any time, including but not limited to, in connection with the relocation, reconstruction, widening and maintaining the road or right-of-way, without compensating the owner of the driveway for the damages to or destruction of the driveway.

5.4.6 **Driveway Permit Holder Responsibilities**

A. **Maintenance Responsibility**

The property owner is responsible for maintaining the driveway approaches, culvert and ditch to permit free and unobstructed flow of water. The County does not assume any responsibility for repair or replacement of concrete or decorative pavement, decorative endwalls/headwalls, the removal or clearance of snow or ice, or the opening of windrows of such material, upon any portion of the driveway within the County right-of-way.

B. **Utility Locates**

The permit holder shall be responsible for contacting the Utility Notification Center of Colorado for utility locates at least 48 hours in advance of the driveway construction if excavation is required.

C. **Traffic Control**

Driveway construction activities shall not interfere with traffic on the adjacent roadway. If interference with traffic is required, a traffic control plan shall be submitted and approved by the ECM Administrator as part of the permit application. All traffic control shall conform to MUTCD standards.

D. **Drainage Interference**

A permit holder shall not obstruct the natural free and clear passage of water along the gutters or other waterways. If surface drainage is to be affected, the permit holder is responsible for the proper disposition of the runoff.

E. **Responsibility for Clean Up and Restoration**

The permit holder shall assume all responsibility for removing all debris and slash from the County’s right-of-way associated with the driveway construction.
activities. If, upon inspection, the ECM Administrator determines that debris and slash have not been removed from the County right-of-way, the ECM Administrator shall notify the permit holder of the violation of the permit conditions. The permit holder, upon notification from the ECM Administrator shall correct all work to the extent necessary, using the method required by the ECM Administrator. The work shall be completed within the time period specified in the notice from the ECM Administrator.

If the permit holder fails to restore the right-of-way in the manner and to the condition required by the ECM Administrator, the ECM Administrator may have the County perform the restorations. In that event, the permit holder shall pay to the County, within 30 days of billing, the cost of restoring the right-of-way.

5.4.7 Driveway Permit Expiration
Every Driveway Permit issued by the ECM Administrator shall expire if a building permit is not obtained within 90-days, the work authorized by the permit is not substantially begun within one year from the date of the permit or if the construction of work authorized by the permit is suspended or abandoned for a period of one year at any time after the work is begun. Before work can begin or be resumed, the Driveway Permit shall be reissued by the ECM Administrator.

5.4.8 Driveway Permit Suspension or Revocation
The ECM Administrator may suspend or revoke any Driveway Permit, in writing, issued under the provisions of these Standards whenever the Driveway Permit is issued in error or on the basis of incorrect information supplied by the applicant or whenever the Driveway Permit may have been issued in violation of any provisions of these Standards. In the event a Driveway Permit is suspended or revoked, no refund of permit fees shall be made unless issued in error by the ECM Administrator.

5.4.9 Driveway Permit Fees
Driveway Permit fees shall be paid in full at the time of the driveway permit application. The fee for Driveway Permits shall be as determined by resolution of the BOCC.

5.4.10 Inspections
The ECM Administrator may conduct an inspection of the driveway to ensure full compliance with all provisions of the ECM and terms of the permit.

5.4.11 Driveway Construction Surety
When determined necessary by the ECM Administrator, the applicant shall be required to submit driveway construction surety in a form and amount acceptable to the ECM Administrator prior to the issuance of a Driveway Permit. Surety shall be released upon final completion and approval of the ECM Administrator.
5.5 WORK IN THE RIGHT-OF-WAY PERMIT

5.5.1 General

The County holds public right-of-way and easement as an asset in trust for its citizens and manages the use of the right-of-way and other uses for public purposes, including use by public utilities pursuant to Section 38-5-101 of the Colorado Revised Statutes. To provide for the health, safety and welfare of its citizens and to ensure the structural integrity of its roads and the appropriate use of right-of-way, the County strives to keep its right-of-way in a state of good repair and free from unnecessary encumbrances.

The Work in the Right-of-Way Permit is a tool to help regulate obstructions of, excavations in, and the use of the County’s right-of-way and easements by, among other things, granting a permit holder authority to obstruct, excavate, or install facilities within the right-of-way or easement, and provide for the subsequent restoration of the County's right-of-way, easement, and public improvements located therein.

5.5.2 Work in the Right-of-Way Permit and Notice to Proceed Required

A. General Requirements

A Work in the Right-of-Way Permit is required to excavate that part of the right-of-way described in the permit to the extent and for the duration specified in the permit including, but not limited to:

- Grade, trench, cut, or change the elevation of the surface of a County right-of-way or easement including any road, drainageway, ditch, drainage facility, and reservoir/catch basin or drainage structure located within a County right-of-way or easement.

B. Work in the Right-of-Way Permit Types

1. Excavation in the Right-of-Way

A Work in the Right-of-Way Permit is required to excavate that part of the right-of-way described in the permit to the extent and for the duration specified in the permit including, but not limited to:

- Grade, trench, cut, or change the elevation of the surface of a County right-of-way or easement including any road, drainageway, ditch, drainage facility, and reservoir/catch basin or drainage structure located within a County right-of-way or easement.

2. Temporary Obstruction of the Right-of-Way

A Work in the Right-of-Way Permit is required to hinder free and open passage over a specified portion of right-of-way by placing equipment or
materials in the right-of-way or conducting an approved activity within the right-of-way for the duration specified therein including, but not limited to:

- Place within a County right-of-way or easement any rubbish, brush, earth, or other material of any nature whatsoever;
- Place any equipment, barrier, sign, detour, post or bollard so as to change the flow of vehicular or pedestrian traffic in a County right-of-way or easement.

3. **Encroachment in the Right-of-Way**

A Work in the Right-of-Way Permit is required to locate, erect or maintain any structure, including but not limited to driveway monuments, flag, banner, post, sign, pole, fence, guardrail, wall, loading platform, gang mailbox, pipe, drainage ditch or facility, conduit, irrigation facility, utility, or wire on, over, or under a County right-of-way or easement.

All Work in the Right-of-Way Permits for encroachments shall require the owner of the encroachment to fulfill the registrant requirements of Section 5.5.8 and file an Encroachment Removal Agreement.

4. **Annual Maintenance Permit**

This permit is approved by the El Paso County Board of County Commissioners. The following conditions apply:

- The Annual Maintenance Permit is for maintenance of existing utilities requiring only access to vaults, cabinets, manholes, etc.
- No excavation is permitted

C. **Working Without a Permit - Registrants**

1. **Registrant Identified Emergencies**

When a condition arises where emergency work must be performed on a facility located within the County right-of-way (i.e., existing approved encroachment), the registrant shall immediately notify the ECM Administrator of the event regarding its facilities which it considers to be an emergency. The registrant may proceed to take whatever actions are necessary in order to respond to the emergency in accordance with approved Standards. Within 2 business days after the occurrence of the emergency, the registrant shall apply for the necessary permits, pay the associated fees and fulfill the rest of the requirements necessary to comply with the ECM for the actions the registrant took in response to the emergency.

2. **ECM Administrator Identified Emergencies**

In the event that the ECM Administrator becomes aware of an emergency regarding a registrant's equipment or facilities located in the County right-of-way or easement, the ECM Administrator shall attempt to
contact the local representative of each registrant affected, or potentially affected, by the emergency. The ECM Administrator may take whatever action deemed necessary in order to respond to the emergency, the cost of which shall be borne by the registrant whose equipment or facilities occasioned the emergency.

D. Working Without a Permit - Non-Registrants

1. General

Non-registrants shall not work in the County right-of-way without a valid Work in the Right-of-Way Permit except as otherwise permitted.

2. Emergency Repair of Service Lines

When a condition arises where emergency work must be performed on a service line located within the County right-of-way, the property owner shall immediately notify the ECM Administrator of the event regarding the emergency. The property owner may proceed to take whatever actions are necessary in order to respond to the emergency provided a contractor certified and bonded with the ECM Administrator or registrant performs all work within the County right-of-way. Within 2 business days after the occurrence of the emergency, the property owner shall apply for the necessary permits, pay the associated fees and fulfill the rest of the requirements necessary to bring the action into compliance with the ECM.

3. Mailboxes and Other Exceptions

A property owner may erect a single mailbox in accordance with USPS standards, maintain and mow areas of vegetation within the County right-of-way, maintain roadside ditches, and maintain that portion of the driveway located within the County right-of-way without obtaining a Work in the Right-of-Way Permit. Caution should be used when working in the County right-of-way. Although a permit is not required, all activities shall conform to these Standards.

5.5.3 Application for Permit

A. Complete Application Required

1. General

Applicants shall file a complete application for a Work in the Right-of-Way Permit. Each application shall:

- Identify and describe the work to be covered by the permit for which the application is made.
- 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 definitively locate the proposed work location.
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Revised: 12/13/2016

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- Be accompanied by plans, diagrams, computations and specifications, and other data as required by these Standards and the approved application and permit checklists.
- Be accompanied by a traffic management plan that clearly describes the traffic management to be implemented and maintained during excavation, obstruction or placement of the encroachment.
- Identify in detail the activities including proposed dates and times of operation, schedule for start and completion.
- Include all other materials requested by the ECM Administrator.

2. Signed by Applicant
All applications for Work in the Right-of-Way Permit shall be signed by the applicant, or an authorized agent, who may be required to submit evidence to indicate their authority.

3. Joint Applications
Applicants may jointly make application for permits to excavate, obstruct or encroach on the County right-of-way at the same place and time. The ECM Administrator may reduce the disruption and degradation portions of the permit fee for applicants who join in during a scheduled obstruction, excavation, or encroachment action whether or not it is a joint application by 2 or more applicants or a single application.

4. Encroachment Removal Agreement
An approved executed Encroachment Removal Agreement is required for any planned encroachment into the County right-of-way or easement. A metes and bounds easement for the encroachment shall be provided to the ECM Administrator with a statement of justification as to why the appurtenance must remain in the County right-of-way or easement.
In the event the County performs work in this area which requires removal of the encroachment, the registrant shall at their own cost remove and relocate the appurtenance, or the ECM Administrator may have the encroachment removed at the County’s expense and invoice the registrant.

5. Supplemental Applications
A Work in the Right-of-Way Permit is valid only for the area of the right-of-way or easement specified in the permit. No permit holder may perform any work outside the area specified in the permit, except as provided. Any permit holder that determines an area greater than that specified in the permit must be obstructed, excavated or encroached upon must, before working in that greater area: (1) make application for a
permit modification and pay any additional fees, and (2) be granted a new permit or permit modification.

A Work in the Right-of-Way Permit is valid only for the dates specified in the permit. No permit holder may begin its work before the permit start date or, except as provided herein, continue working after the end date. If a permit holder does not finish the work by the permit end date, the permit holder must: (1) make application for a permit extension for the additional time needed before the permit expires, and (2) receive the extension before working after the end date of the previous permit.

6. Determination of Application Completeness
An application will be considered complete if it is submitted in the required form and includes all mandatory information, including all supporting materials specified by the ECM Administrator. If an application is determined to be incomplete, the ECM Administrator shall provide notice to the applicant along with an explanation of the application’s deficiencies. No further processing of the application shall occur until the deficiencies are corrected in a resubmittal. An application which is determined to be incomplete may or may not retain its same processing cycle.

B. Plan Submittal Requirements

1. General
Plans for any work or activity within the County right-of-way or easement shall be submitted to the ECM Administrator for approval. For minor installations such as service lines, drops, etc., simple sketch plans with pertinent information as to location and depth may suffice as the plans. For complex applications and if requested on the application, the following shall be provided:

- Engineering scale drawings showing the location of all facilities and improvements proposed.
- Location and approximate depth of the subject and related facilities and any other facilities in the immediate vicinity.
- A description of the methods that will be used in the work.
- The County road and associated right-of-way affected by the work.
- Offset distances from the roadway centerline to the back of curb or edge of pavement surface and the associated right-of-way line.
- A legend explaining symbols, characters, abbreviations, scale, north arrow, and other data.
2. **Traffic Control**

Work within the County right-of-way shall not interfere with traffic. If interference with traffic is required, a traffic control plan shall be submitted and approved by the ECM Administrator as part of the permit application. All traffic control shall conform to MUTCD standards.

3. **Signed and Sealed by PE**

The seal of the design engineer shall appear on each sheet. The design engineer shall be a registered Colorado Registered Professional Engineer.

5.5.4 **Work in the Right-of-Way Permit Review and Issuance**

**A. Review Process**

The application, plans, specifications, and other data filed by an applicant for a Work in the Right-of-Way Permit shall be reviewed by the ECM Administrator. The plans may also be reviewed by other departments or agencies to verify compliance with any applicable laws.

Upon completion of the detailed review by the ECM Administrator and any other departments or agencies, the ECM Administrator will return one set of plans with “Red Line” comments. More than one review may be required. All successive sets of “Red Line” plans shall be returned to the ECM Administrator with the corresponding revised set of plans. After the design engineer has completed all revisions, final revised plans shall be submitted to the ECM Administrator for signoff and the most recent set of “Red Line” plans shall be returned to the ECM Administrator. Plan review priority will be given to plans submitted for final review over plans submitted for initial or intermediate review.

If the ECM Administrator finds that the work described in an application for a Work in the Right-of-Way Permit and the plans and other data conform to the requirements of these Standards and other pertinent laws, regulations, or ordinances and that all required fees have been paid, a Work in the Right-of-Way Permit may be issued to the applicant at the discretion of the ECM Administrator. A Work in the Right-of-Way Permit is valid once issued, but the ECM Administrator might require a preconstruction meeting.

**B. Authority of ECM Administrator**

The ECM Administrator shall have the discretionary authority to issue or deny a permit. A Work in the Right-of-Way Permit is considered a privilege. The ECM
Administrator will decide all questions that may arise as to the quality and acceptability of materials furnished and work performed. The ECM Administrator shall have the authority to suspend work, wholly or in part, because of the failure of the permit holder to properly execute the work in accordance with these Standards. The ECM Administrator may undertake the inspection of the material at the source and shall have full entry at all times to those areas where the manufacture or production of the materials is taking place. The ECM Administrator shall also have the authority to waive, wholly or in part, the requirements presented in these Standards, dealing with individual projects, for reasons deemed to be in the public’s interest.

C. Permit Conditions

The ECM Administrator may impose reasonable conditions upon the issuance of the permit and the performance of the permit holder in order to protect the public health, safety and welfare, to insure the structural integrity of the right-of-way, to protect the property and safety of other users of the right-of-way, and to minimize the disruption and inconvenience to the traveling public. In addition, the ECM Administrator may develop permit conditions that provide reasonable assurance that utilities and their contractors working in the right-of-way are competent and qualified. These permit conditions may include, but not be limited to, instruction in state and local laws, including one-call, construction zone traffic safety, and construction standards, including restoration standards.

D. Criteria for Approval

A Work in the Right-of-Way Permit may only be approved if it meets the criteria set forth below:

- The proposal complies with all applicable requirements of the ECM or a deviation has been granted;
- All required review and permit fees have been paid; and
- The required insurance and surety has been provided in a form acceptable to the ECM Administrator.

Any Work in the Right-of-Way Permit application that in the opinion of the ECM Administrator fails to meet the criteria for approval listed above may be denied a Work in the Right-of-Way Permit by the ECM Administrator. In denying a Work in the Right-of-Way Permit, the ECM Administrator shall provide a statement outlining the reasons for denial of the permit.

E. Authority to Deny Permit

1. Mandatory Denial

Except in the case of an emergency, the ECM Administrator shall deny a Work in the Right-of-Way Permit to any applicant, or any parent or subsidiary corporation (if the applicant is a corporation) where the applicant:
2. Permissive Denial

The ECM Administrator may deny a permit in order to protect the public health, safety and welfare, to prevent interference with the safety and convenience of ordinary travel over the County right-of-way, would cause a conflict or interfere with an exhibition, celebration, festival, or any other event, or when necessary to protect the County right-of-way and its users. The ECM Administrator may consider one of more of the following factors: the extent to which right-of-way space where the permit is sought is available; the competing demands for the particular space in the County right-of-way; the availability of other locations in the County right-of-way or in other right-of-way for the facilities of the permit applicant; the applicability of standards or other regulations of the County right-of-way that affect location of facilities in the County right-of-way; the degree of compliance of the applicant with the terms and conditions of its franchise, if any; the degree of disruption to surrounding communities and businesses that will result from the use of that part of the County right-of-way; the condition and age of the right-of-way, and whether and when it is scheduled for total or partial reconstruction; and the balancing of the costs of disruption to the public and damage to the County right-of-way, against the benefits to that part of the public served by the expansion into additional parts of the County right-of-way.

To protect health, safety, and welfare or when necessary to protect the County right-of-way and its current use, the ECM Administrator shall have the power to prohibit or limit the placement and location of new or additional facilities within the County’s right-of-way.

F. Approved Plans

When issuing a Work in the Right-of-Way Permit, the ECM Administrator shall endorse the plans in writing or by stamping the plans and specifications "Approved, El Paso County ECM Administrator". The approved plans shall be attached to and become an enforceable part of the Work in the Right-of-Way Permit.

G. Preconstruction Meeting

The ECM Administrator may require a preconstruction meeting prior to issuing a Notice to Proceed. The ECM Administrator shall specify in the approved permit whether or not a preconstruction meeting is required and who is required to
attend. The applicant is responsible for scheduling the meeting with the ECM Administrator.

H. Change in Approved Plan
The approved plans and specifications shall not be changed, modified, or altered without written authorization from the ECM Administrator. All work shall be done in conformance with the approved permit, plans, specifications, and these Standards.

I. Approved Plans at Work Site
One set of approved plans, a copy of the Work in the Right-of-Way Permit and any conditions of approval shall be maintained at the work site at all times during the progress of the work or activity.

J. Maintenance of Drainage Within Right-of-Way
A permit holder shall not obstruct the natural free and clear passage of water along the gutters or other waterways. If surface drainage is to be affected, the permit holder is responsible for the proper disposition of the runoff.

K. Utility Locates
The permit holder shall be responsible for contacting the Utility Notification Center of Colorado for utility locates at least 48 hours in advance of the work that requires the ground to be disturbed.

L. Violation of Standards
The issuing and granting of a Work in the Right-of-Way Permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of these Standards or of any regulations of the County. No permit presuming to give authority to violate or cancel the provisions of these Standards shall be valid unless a deviation has been expressly and specifically approved by the ECM Administrator.

M. Limit of Plan Review and Permit Approval
Work in the Right-of-Way Permit approval means that the plans have been reviewed for reasonableness and compliance with minimum ECM Standards. Work in the Right-of-Way Permit approval does not relieve the design engineer from responsibility for errors, omissions, or deficiencies in the plans.
Permits issued by the ECM Administrator pertain only to work within the County-owned right-of-way and in no way allow a permit holder to enter onto private property adjacent to County-owned right-of-way nor to alter or disturb any facilities or installations that exist within the County-owned right-of-way that are owned by others unless expressly and specifically approved.
N. Correction of Errors

The issuance of a Work in the Right-of-Way Permit based on plans, specifications or other data shall not prevent the ECM Administrator from requiring the correction of errors in the plans, specifications and other data, or from stopping construction operations being conducted in violation of these Standards or any other regulations of the County.

O. Right-of-Way Patching and Restoration

1. General

The work to be done under the Work in the Right-of-Way Permit, and the required patching and restoration of the County’s right-of-way must be completed within the dates specified in the permit, increased by as many days as work could not be done because of circumstances constituting force majeure or when work was prohibited as unseasonal or unreasonable. In addition to patching their work, the permit holder must restore the general area of the work, and the surrounding areas, including the paving and its foundations, to the same condition that existed before the commencement of the work.

2. Patching and Restoration Methods

The permit holder shall perform excavation, backfilling, patching and restoration according to the Standards and with the materials specified by the ECM Administrator. The ECM Administrator shall have the authority to prescribe the manner and extent of the restoration in written procedures of general application or on a case-by-case basis. Methods of restoration may include, but are not limited to, patching, replacement of the base, and milling and overlay of the affected area of the County roadway. The permit holder shall at the time of application of permit post construction surety when required by the ECM Administrator.

3. Defects and Repair

The permit holder shall correct defects in patching, or restoration performed by the permit holder or its agents for up to 2 years following restoration. The permit holder, upon notification from the ECM Administrator shall correct all restoration work to the extent necessary, using the method required by the ECM Administrator. The work shall be completed within the timeframe specified by the ECM Administrator.

4. County Action to Restore or Correct

If the permit holder fails to restore the County’s right-of-way in the manner and to the condition required by the ECM Administrator, or fails to satisfactorily and timely complete all restorations required by the ECM Administrator, the ECM Administrator may have the County perform the restorations. In that event, the permit holder shall pay to the County,
within 30 days of billing, the cost of restoring the right-of-way plus an additional degradation fee established by the ECM Administrator

5.5.5 Work in the Right-of-Way Permit Expiration and Extension

A. Expiration

Every Work in the Right-of-Way Permit issued by the ECM Administrator shall expire if the work authorized by the permit is not substantially begun within one year from the date of the permit or if the construction of work authorized by the permit is suspended or abandoned for a period of one year at any time after the work is begun. The permit will also expire if it is not picked up within 90 days of the permit being issued. Before such work can be resumed, the Work in the Right-of-Way Permit shall be reissued by the ECM Administrator. The fee for a reissued Work in the Right-of-Way Permit shall be one-fourth of the amount required for a new Work in the Right-of-Way Permit for the work, provided no changes have been made or are required by the ECM Administrator in the originally approved plans and specifications. A copy of the permit must be available at the site for review at all times.

B. Extension

Any permit holder with an unexpired Work in the Right-of-Way Permit may apply for an extension of the time within which work may begin under that permit if the permit holder is unable to begin work within the time required for good cause, and that the cause is acceptable to the ECM Administrator. There shall be an extension fee assessed to cover administrative costs.

5.5.6 Work in the Right-of-Way Permit Suspension or Revocation

A. Permit Issued in Error or Violation of ECM

The ECM Administrator may suspend or revoke any Work in the Right-of-Way Permit, in writing, whenever the Work in the Right-of-Way Permit is issued in error or on the basis of incorrect information supplied by the applicant or whenever the permit may have been issued in violation of any provisions of these Standards. In the event a permit is suspended or revoked, no refund of permit fees shall be made unless the permit was issued by the ECM Administrator in error.

B. Breach of Permit Terms and Conditions

Permit holders hold Work in the Right-of-Way Permits as a privilege. The County reserves its right to revoke any Work in the Right-of-Way Permit, without fee refund, in the event of a substantial breach of the terms and conditions of any statute, ordinance, standard, rule or regulation, or any condition of the permit. A substantial breach by the permit holder shall include, but shall not be limited to, the following:
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Revised: 12/13/2016

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- The violation of any material provision of the Work in the Right-of-Way Permit;
- An evasion or attempt to evade any material provision of the Work in the Right-of-Way Permit, or the perpetration or attempt to perpetrate any fraud or deceit upon the County or its citizens;
- Any material misrepresentation of fact in the application for a Work in the Right-of-Way Permit;
- The failure to maintain the required bonds or insurance;
- The failure to complete the work in a timely manner;
- The failure to correct a condition indicated on an order of the ECM Administrator;
- Hiring illegal aliens;
- Failing to report damage to other utilities; or
- Failing to report injuries.

If the ECM Administrator determines that the permit holder has committed a substantial breach of a term or condition of any statute, ordinance, rule, regulation or any condition of the permit, the ECM Administrator shall make a written demand upon the permit holder to remedy the violation. The demand shall state that continued violations may be cause for revocation of the permit. Further, a substantial breach will allow the ECM Administrator to place additional or revised conditions on the permit.

Within 48 hours of receiving notification of the breach, the permit holder shall contact the ECM Administrator with a plan, acceptable to the ECM Administrator, for correction. The permit holder's failure to contact the ECM Administrator, or the failure to submit an acceptable plan, or failure to reasonably implement the approved plan, shall be cause for immediate revocation of the permit. Further, the permit holder's failure to contact the ECM Administrator, or failure to submit an acceptable plan, or failure to implement the approved plan, shall automatically place the permit holder on probation for one full year. Permit fees may increase while an applicant is on probation.

C. Violation of Permit Conditions

From time to time, the ECM Administrator may establish a list of permit conditions which, if breached, will automatically place the permit holder on probation for one full year, such as, but not limited to, working out of the allotted time period, working on right-of-way grossly outside of the permit, failing to report utility hits, failing to report injuries or hiring illegal aliens.

D. Breach of Permit While on Probation

If a permit holder, while on probation, commits a breach as outlined above, the permit holder's permit will automatically be revoked and permit holder will not be allowed further permits for one full year, except for emergency repairs.
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E. Reimbursement of County Costs for Revoked Permit

If a permit is revoked, the permit holder shall reimburse the County for the County's reasonable costs, including restoration costs and the costs of collection and reasonable attorneys' fees incurred in connection with revocation.

5.5.7 Fees

A. General

1. Excavation

The excavation fee shall be in an amount sufficient to recover the following costs if applicable:
   - The County management and administrative cost;
   - The traffic management fee;
   - The degradation cost;
   - The trench fee for trenches over 1,320 linear feet; and
   - The incentive/disincentive.

2. Temporary Obstruction Fee

The obstruction fee shall be in an amount sufficient to recover the following costs if applicable:
   - The County management and administrative cost; and
   - The traffic management fee.

3. Encroachment

The encroachment fee shall be in an amount sufficient to recover the following costs if applicable:
   - The County management and administrative cost;
   - The traffic management fee;
   - The registration and monitoring costs;
   - The degradation cost;
   - The incentive/disincentive; and
   - The trench fee for trenches over 1,320 linear feet.

4. Annual Maintenance Permit ($600.00 currently)

   - The County management and administration cost.

B. Work in the Right-of-Way Permit Review Fees

The Work in the Right-of-Way Permit review fee shall be paid in full at the time the Work in the Right-of-Way Permit application is submitted for approval to the ECM Administrator. The permit review fees shall be determined by resolution of the BOCC. Applications for which no Work in the Right-of-Way Permit is issued within one year following the date of the original application shall expire; and plans and other data submitted for review may be returned to the applicant or
destroyed by the ECM Administrator. The ECM Administrator may extend the time for action by the applicant for a period not exceeding one year upon request by the applicant showing that circumstances beyond the control of the applicant have prevented action from being taken. No application shall be extended more than once. In order to renew action on an application after expiration, the applicant shall resubmit plans and pay a new plan review fee.

All resubmittals or incomplete applications are subject to re-review fees. Re-review fees shall be established by resolution the BOCC. A re-review fee may be assessed at the discretion of the ECM Administrator for each plan review when the redlines are not corrected or when resubmittal materials are not complete. The purpose of the re-review fee shall not to be interpreted as requiring re-review fees the first time a submittal is rejected for failure to comply with the requirements of these Standards, but rather as controlling the practice of not making required plan corrections or submitting complete materials.

C. **Work in the Right-of-Way Permit Fees**

The fee for Work in the Right-of-Way Permit shall be as determined by resolution of the BOCC plus any mapping, registration and monitoring, degradation or traffic management costs assessed by the ECM Administrator. Work in the Right-of-Way Permit fees shall be paid in full at the time the plans and specifications have been approved by the ECM Administrator and the Work in the Right-of-Way Permit is issued. The ECM Administrator may allow the registrants to pay permit fees within 30 days of billing.

1. **Computation of Traffic Management Fee**

The ECM Administrator shall determine the traffic management fee component of the fees for excavation, obstruction or encroachments, and in doing so shall have the purpose of providing a financial incentive to permit holders to minimize their obstruction and use of the right-of-way and to get in and get out of the right-of-way as quickly as possible. In aid of that purpose, the ECM Administrator shall use in the computation of the traffic management fee, to the extent practicable, economic and accounting principles relating to the quantification of the social costs resulting from road obstructions, including (1) losses to businesses and merchants which would not have occurred but for the obstructions, and (2) social costs to the users of the County's right-of-way resulting from traffic delays, diversions, disruption in services, missed or delayed appointments, and decline in quality of life. Fees may vary from one location to another based on the size of the area to be obstructed; the duration that the County right-of-way or parts of it will be unavailable for public use and travel; the proximity of businesses and enterprises which rely in whole or in part on access by members of the public or the delivery of supplies or raw materials; the importance of the particular right-of-way as to the traveling public; the use of the particular right-of-
way for emergency vehicles and the availability of alternate routes; the traffic volumes carried by the particular right-of-way; and the amount of vehicular, bicycle, and pedestrian traffic that is reasonably likely to be disrupted. The methodology used to establish the fee shall be approved by the BOCC.

2. **Computation of Degradation Fees**

The ECM Administrator shall determine the degradation fee component of the fees for excavation, obstruction or encroachments. The degradation fee shall have the purpose of providing a financial incentive for permit holders to minimize their damage to public improvements and to coordinate their new construction, repair and replacement programs with County maintenance and capital improvement programs. The ECM Administrator shall use in the computation of the degradation fee, to the extent practicable, economic and accounting principles relating to the decrease in the useful life of the County's right-of-way and impact public improvements caused by excavation in or disturbance of the County right-of-way or those improvements, resulting in the need to reconstruct improvements earlier than would be required if the excavation or disturbance did not occur. The degradation fee shall consider:

- The number, size, depth and duration of the excavations, disruptions or damage to the County's right-of-way;
- The traffic volume carried within the County's right-of-way and the character of the neighborhood surrounding the County right-of-way;
- The pre-existing condition of the County's right-of-way and the remaining useful life of the County's right-of-way affected by the excavation;
- Whether the relative cost of the method of restoration to the permit holder is in reasonable balance with the prevention of an accelerated depreciation of the County's right-of-way that would otherwise result from the work, disturbance or damage to the County's right-of-way; and
- The likelihood that the particular method of restoration would be effective in slowing the depreciation of the County's right-of-way that would otherwise take place.

The methodology used to establish the fee shall be approved by the BOCC.

3. **Incentive/Disincentive**

- Earn 1 point for each item successfully completed per permit
- Track running average* of points earned for each permit holder
Post averages on Transportation website

Five Rating Categories

- 24-hours minimum notification of start and completion of project
- Proper setup and continual maintenance of work zone per approved traffic control plan
- Submit all required compaction test per ECM at time of project completion
- Perform all patch work and restoration per ECM
- Completed project within time period specified on the permit (weather allowance is considered)

Permit costs using the incentive/disincentive points earned:

<table>
<thead>
<tr>
<th>POINTS EARNED</th>
<th>PERMIT COST</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>200%</td>
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<td>90%</td>
</tr>
<tr>
<td>5</td>
<td>75%</td>
</tr>
</tbody>
</table>

* Running averages will be rounded up or down to the nearest whole number

4. Computation of Registration and Monitoring Fees

The ECM Administrator may assess a registration and monitoring fee to all encroachment and registration renewal applications to cover the cost of maintaining the registry and monitoring County right-of-way information. The methodology used to establish the fee shall be approved by the BOCC.

D. Investigation Fees (Working without a Permit/Notice to Proceed)

Whenever any work for which a Work in the Right-of-Way Permit is required by these Standards is begun without the required Work in the Right-of-Way Permit or Notice to Proceed, a special investigation shall be made before a Work in the Right-of-Way Permit or the Notice to Proceed may be issued for the work. All work shall cease immediately upon written notice by the ECM Administrator.

An investigation fee shall be collected whether or not a permit is then or subsequently issued. The investigation fee shall be as determined by resolution of the BOCC. The payment of investigation fees shall not exempt any person from compliance with all other provisions of these Standards nor from any penalty prescribed by law.
E. Delay Penalty
The ECM Administrator may impose a delay penalty for unreasonable delays in right-of-way excavation, obstruction, patching, or restoration by the permit holder. The delay penalty shall be proposed by the ECM Administrator and established by resolution of the BOCC. The delay penalty may also include a traffic management fee at the discretion of the ECM Administrator calculated in accordance with Section 5.5.7C.1.

F. Fee Refunds
The ECM Administrator may authorize the refunding of any fee which was erroneously paid or collected. In addition, upon written request from the permit holder, the ECM Administrator may authorize the refunding of not more than eighty percent of the Work in the Right-of-Way Permit fee when no work has been done under a Work in the Right-of-Way Permit issued in accordance with these procedures. The ECM Administrator shall not refund any fee except upon written request filed by the original permit holder. The written request must be filed not later than one year after the date of the fee payment.

5.5.8 Registration and Right-of-Way Occupancy

A. Registration
Any person, agency, corporation, or other entity who occupies or seeks to occupy the right-of-way or place any equipment or facilities in or on the right-of-way, including those with installation and maintenance responsibilities by lease, sublease or assignment, must register with the ECM Administrator.

Registration is not intended to apply to or require the following persons to register with the ECM Administrator: (1) property owners maintaining service lines solely for the purpose of connecting to utility service facilities located in the County's right-of-way or those facilities not subject to an Work in the Right-of-Way Permit; and (2) agents, contractors or subcontractors of a right-of-way user who has registered with the ECM Administrator.

B. Registration Prior to Work
No person, agency, corporation, or other entity may construct, install, repair, remove, relocate, or perform any other work on, or use any non-county-owned facilities installed in any County right-of-way without first being registered with the ECM Administrator.

C. Annual Registration Renewal
Registration is required on an annual basis to maintain facilities within the County right-of-way. If a registrant fails to renew their registration, the ECM Administrator shall assume that the registrant's facilities are abandoned and any facilities of the registrant's found in a County right-of-way shall be deemed to be a nuisance. The ECM Administrator may exercise any remedies or rights it has at law or in equity,
to abate or correct the nuisance, including, but not limited to, abating the
nuisance or taking possession of the facilities and restoring the County's right-of-
way to a useable condition, and the registrant shall reimburse the County for all
costs incurred.

D. Failure to Register

One year after the passage of this section, any facilities of a person, agency,
corporation, or other entity found in a County right-of-way that have not been
registered shall be deemed to be a nuisance. The ECM Administrator may
exercise any remedies or rights it has at law or in equity, to abate or correct such
nuisance, including, but not limited to, abating the nuisance or taking possession
of the facilities and restoring the County's right-of-way to a useable condition, and
the person, agency, corporation, or other entity who owns said facilities shall
reimburse the County for all costs incurred.

E. Registration Information.

1. Information Required

The information provided to the ECM Administrator at the time of
registration shall include, but not be limited to:

- Each registrant's name, Utility Notification Center of Colorado
  registration number, address and e-mail address if applicable,
  and telephone and facsimile numbers.

- The name, address and e-mail address, if applicable, and
  telephone and facsimile numbers of a local representative. The
  local representative or designee shall be available at all times.
  Current information regarding how to contact the local
  representative in an emergency shall be provided at the time of
  registration.

- A certificate of insurance or self insurance: (1) Verifying that an
  insurance policy has been issued to the registrant by an
  insurance company licensed to do business in the State of
  Colorado, or a form of self insurance acceptable to the ECM
  Administrator; (2) Verifying that the registrant is insured against
  claims for personal injury, including death, as well as claims for
  property damage arising out of the: (i) use and occupancy of the
  County's right-of-way by the registrant, its officers, agents, and
  employees, and (ii) placement and use of facilities and
  equipment in the County's right-of-way by the registrant, its
  officers, agents, and employees, including, but not limited to,
  protection against liability arising from completed operations,
  damage of underground facilities and collapse of property;
  Naming the County as an additional insured as to whom the
  coverages required herein are in force and applicable and for
whom defense will be provided as to all such coverages; Requiring that the County be notified 30 days in advance of cancellation of the policy or material modification of a coverage term; Indicating comprehensive liability coverage, automobile liability coverage, workers compensation and umbrella coverage established by the County in amounts sufficient to protect the County and the public and to carry out the purposes and policies of this section. The ECM Administrator may require a copy of the actual insurance policies.

- An acknowledgment by the registrant of the indemnification of the County
- A copy of the registrant's order granting a certificate of authority from the Colorado Public Utilities Commission or other applicable state or federal agency, where the person, agency, corporation, or other entity is lawfully required to have such certificate from the commission or other state or federal agency.

2. Notice of Changes

The registrant shall keep all of the information listed above current at all times by providing the ECM Administrator information as to changes within fifteen days following the date on which the registrant has knowledge of any change.

F. Reporting Obligations

1. Mapping Data for New and Replaced Facilities

Registrants shall provide mapping information for all new or replaced facilities in a format approved by the ECM Administrator. Registrants shall provide the mapping information required by the ECM Administrator including:

- Location and approximate depth of registrant's mains, cables, conduits, switches, and related equipment and facilities, with the location based on: (1) Offsets from property lines, distances from the centerline of the County's right-of-way, and curb lines as determined by the County; (2) Coordinates derived from the coordinate system being used by the County; or (3) Any other system agreed upon by the registrant and the ECM Administrator.
- The type and size of the facility;
- A description showing above ground appurtenances;
- A legend explaining symbols, characters, abbreviations, scale, and other data shown on the map; and
- Any facilities to be abandoned, if applicable.
2. **Data on Existing Facilities**

At the request of the ECM Administrator, a registrant shall provide existing data on its existing facilities within the County's right-of-way in the form maintained by the registrant at the time the request is made, if available.

3. **Construction and Maintenance Plans**

Each registrant shall, at the time of registration and by December 1 of each year, file a construction and major maintenance plan for underground facilities with the ECM Administrator (in this paragraph, a "plan"). The plan shall be submitted using a format designated by the ECM Administrator and shall contain the information determined by the ECM Administrator to be necessary to facilitate the coordination and reduction in the frequency of excavations and obstructions of the County right-of-way.

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

- The locations and the estimated beginning and ending dates of all projects for facilities to be constructed in the County's right-of-way to be commenced during the next calendar year (in this paragraph, a "next year project"); and

- To the extent known, the tentative locations and estimated beginning and ending dates for all projects for facilities to be constructed in the County's right-of-way contemplated for the 5 years following the next calendar year (in this paragraph, a "5-year project"). The term "project" in this paragraph shall include both next year projects and 5-year projects.

4. **Availability of Plans**

The ECM Administrator will have available for inspection in the ECM Administrator's office a list of all plans submitted by registrants. All registrants are responsible for keeping themselves informed of the current status of this list and the plans filed with the ECM Administrator.

5. **Changes in Next Year Projects and Coordination**

Thereafter, by February 1, each registrant may change any project in its list of next year projects, and must notify the ECM Administrator and all other registrants of all changes. A registrant may at any time join in a next year project of another registrant listed by the other registrant, subject to the prior consent of such other registrant. Where registrants join in a next year project to reduce disruption and degradation of the County's right-of-ways and infrastructure, the ECM Administrator may reduce the disruption and degradation fees. In cases where registrants join in a County next year road construction, reconstruction or
resurfacing project, disruption and degradation fees may be waived by
the ECM Administrator.

6. **Additional Next Year Projects**

Failure by a registrant to include a project in a plan submitted to the ECM
Administrator shall not, in and of itself, constitute grounds for denial of a
permit if the registrant has used commercially reasonable efforts to
anticipate and plan for the project.

7. **Utility Coordination Committee**

The ECM Administrator may create an advisory utility coordination
committee. Participation on the committee is voluntary. It will be
composed of any registrants that wish to assist the County in obtaining
information and by making recommendations regarding the use of the
County's right-of-way, and to improve the process of performing
construction work therein. The ECM Administrator may determine the
size of such committee and shall appoint members from a list of
registrants that have expressed a desire to assist the County.

G. **Relocation of Facilities**

1. **Responsibility of the Registrant**

The registrant must promptly and at its own expense, with due regard for
seasonal working conditions, permanently remove and relocate its
facilities in the right-of-way whenever it is necessary to prevent
interference, and not merely for the convenience of the County, in
connection with: (1) A present or future use of the County's right-of-way
for a public project; (2) The public health or safety; or (3) The safety and
convenience of ordinary travel over the County's right-of-way.

2. **Relocation Notification Procedure**

The ECM Administrator shall notify the registrant at least six months in
advance of the need to relocate existing facilities so the registrant can
plan the relocation. The ECM Administrator shall provide a second
notification to the registrant one month before the registrant needs to
begin the relocation. The registrant shall begin relocation of the facilities
within one week of the second notification. All facilities shall be relocated
within one month. The ECM Administrator may allow a different schedule
if it does not interfere with the County's project. The registrant shall
diligently work to relocate the facilities within the above schedule.

3. **Delay to County Project**

The ECM Administrator shall notify the registrant if the registrant's
progress will not meet the relocation schedule.
H. **Interference By Other Facilities**

When the County does work in the right-of-way as part of its governmental right-of-way management function and finds it necessary to maintain, support, or move a registrant's facilities to carry out the work without damaging the registrant's facilities, the ECM Administrator shall notify theregistrant's local representative as early as is reasonably possible. The County costs associated will be billed to the registrant and must be paid within 30 days from the date of billing.

Each registrant shall be responsible for the cost of repairing any facilities in the County right-of-way which it or its facilities damage.

I. **Right-of-Way Vacation**

If the County vacates a right-of-way that contains the facilities of a registrant, the registrant's rights in the vacated County right-of-way are governed by state law.

J. **Abandoned Facilities**

A registrant shall notify the County when facilities are to be abandoned in County right-of-way. A registrant that has abandoned facilities in a County right-of-way shall remove them from that right-of-way if required in conjunction with other County right-of-way repair, excavation or construction, unless this requirement is waived by the ECM Administrator.

K. **Indemnification and Liability**

By registering with the County, a registrant agrees to defend and indemnify the County in accordance with Section 5.2.6.

5.5.9 **Insurance, Bonding, Construction Surety and Warranty Requirements**

A. **Permit Holder Insurance**

Before any permit holder shall perform work within the County's right-of-way under a Work in the Right-of-Way Permit, the permit holder shall show evidence of a valid and enforceable bodily injury and property damage liability insurance policy, with minimum limits of $1,000,000.00 combined single limit coverage.

Such policy shall be for the protection of the County from all suits, actions or claims of any type for injuries or damages allegedly sustained by any person or property as a result of the encroachments. Such policy shall specifically cover the acts and operations of any subcontractors or independent contractors of the permit holder, in addition to the permit holder's employees or agents. Special districts, utilities governed by State Public Utilities Commission, and municipalities, by obtaining a permit, do agree to accept liabilities for their work in the County’s right-of-way.

In addition to the insurance described above, the permit holder personally, by working under an approved Work in the Right-of-Way Permit, agrees to be liable to the County for any expenses incurred by the County because of the permit
holder's acts of omissions relating to the work, and the permit holder shall hold the County harmless from any claims of anyone else arising from or relating to the work.

B. **Indemnification and Liability**

By accepting a Work in the Right-of-Way Permit, a permit holder agrees to defend and indemnify the County in accordance with Section 5.2.6.

C. **Defect Warranty**

The permit holder shall warrantee all restoration work and its maintenance for 2 years following its completion and approval by the ECM Administrator. The permit holder shall post a defect warranty prior to the release of any portion of the construction surety. The amount of the defect warranty shall be based on an estimate of the percentage cost of roads construction, drainage facilities construction, utilities, and erosion control and revegetation damaged by the action. During the 2 year warrantee period the permit holder shall, upon notification from the ECM Administrator, correct all defective restoration to the extent necessary within the time period specified in the notice, using the method required by the ECM Administrator. If the defective work is not corrected by the permit holder, and the County does the work and sends a bill to the permit holder, who fails to pay for such work, the County may exercise its rights under the defect warranty. The following are exempt from having to file a defect warranty: special districts, utilities governed by the State Public Utilities Commission, and municipalities.

5.5.10 **Inspections, Corrections and Project Closeout**

A. **Progress Inspections and Orders**

Inspections during the construction period will be made by the ECM Administrator to ensure that work is progressing in compliance with the permit and ECM. The permit holder shall make the work-site available to the ECM Administrator and to all others as authorized by law for inspection at all reasonable times during the execution and upon completion of the work. At the time of inspection the ECM Administrator may order the immediate cessation of any work which poses a serious threat to the life, health, safety or well-being of the public.

The ECM Administrator may issue an order to the permit holder for any work which does not conform to the applicable standards, approved plans and specifications, or permit conditions. The order shall state that failure to correct the violation will be cause for revocation of the permit. Within 10 days after issuance of the order, the permit holder shall present proof to the ECM Administrator that the violation has been corrected. If such proof has not been presented within the required time, the ECM Administrator may revoke the permit.
B. **Inspection Before Pavement Placement**

Before a pavement section is replaced (patched) the contractor shall notify the ECM Administrator as to the date such work is proposed. Failure to notify the ECM Administrator may result in a request to have work re-done in order to pass a final inspection.

C. **Completion Certificate and Project Closeout**

When the work under a Work in the Right-of-Way Permit is completed, the permit holder shall submit a completion certificate to the ECM Administrator within 5 days following completion. The completion statement, signed by the permit holder, shall show the completion date for the work performed, identify the installer and design engineer, and certify that the work was completed according to the requirements of the ECM Administrator. If the work involved the placement of any permanent facilities, record drawings meeting the requirements of Section 5.11.6 shall be submitted.

### 5.6 EROSION AND STORMWATER QUALITY CONTROL

#### 5.6.1 General

The Erosion and Stormwater Quality Control Permit (ESQCP) and Builder’s Erosion and Stormwater Quality Control Permit (BESQCP) are established as a tool to help protect water quality in the County, provide for the enforcement of detailed and specific Best Management Practices (BMPs) during construction through final stabilization, and implement measures associated with the County’s Colorado Discharge Permit System General Permit. The permits and associated standards are designed to minimize soil erosion and sedimentation during and after construction; and to control non-point source pollution by requiring the implementation of soil erosion, sedimentation control, and runoff control practices for protection of water quality.

#### 5.6.2 ESQCP Permit and Notice to Proceed Required

An ESQCP is required for construction activities that result in a land disturbance of greater than or equal to one acre. An ESQCP may be required for construction activity of less than one acre if the activity is part of a larger common plan of development or sale that will disturb at least one acre. For builders who are constructing a small number of residences in a single area, a BESQCP may be obtained following a simplified procedure.

No work shall begin under an approved ESQCP or BESQCP until the ECM Administrator has issued a Notice to Proceed under an approved Construction Permit or issuance of a Building Permit.

#### 5.6.3 Relationship to Other ECM Permits

In most cases, construction of public facilities within any County right-of-way or easement or the construction of common development improvements including grading will require that the applicant obtain an ESQCP or BESQCP.
5.6.4 **Application, Review, Approval, Inspections, and Enforcement**

Application, review, approval, inspections, and enforcement for ESQCP or BESQCP shall conform to the requirements of Appendix I.

5.7 **SPECIAL TRANSPORT PERMIT**

5.7.1 **General**

The ECM Administrator is responsible for ensuring the long-term structural stability of roads and bridges in the County has established a Special Transport Permit as a tool to allow over dimensional loads and vehicles to be routed along County routes with adequate capacity to accommodate the proposed load or vehicle dimensions, ensure adequate safety provisions are provided to protect the traveling public, reduce damage to County facilities, track over dimensional loads, and obtain reasonable fees to provide for the administration of permits and impacts to County facilities. This section provides an orderly procedure for obtaining a Special Transport Permit.

There are two types of Special Transport Permits:

1. **Annual**
   - For vehicles and fleets moving multiple oversize/overweight loads during the year
   - Maximum width of 17’, pilot cars required per section 5.8.6
   - Maximum length of 110’, pilot cars requirements per section 5.8.6
   - Maximum height of 16’, pilot cars requirements per section 5.8.6
   - Maximum weight of 200,000lbs; pilot cars requirements per section 5.8.6

2. **Oversize/Overweight (Special)**
   - Single oversize/overweight loads exceeding Annual Permit maximum dimensions or weights
   - Requires 1 or more pilot cars

5.7.2 **Special Transport Permit Required**

Pursuant to the laws of the State of Colorado, the County requires that a Special Transport Permit be obtained from the ECM Administrator, when transporting a load or vehicle on a County road where overall dimensions or weight of the load or vehicle exceed one or more of the following limits:

- Overall height (Total distance from ground to top part of load): 13 feet.
- Overall width: 8.5 feet.
- Overall length for single vehicles: 45 feet.
- Overall length for combination vehicles: 75 feet.
- Overhang: 4 feet front and 10 feet rear.
- Overall weight for combination vehicles: 85,000 lbs.
- Overall weight for single vehicles (3 or more axles): 54,000 lbs.
- Overall weight for single vehicles (2 axles): 36,000 lbs.
Chapter 5 Permits and Inspections

Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section 5.7.3-5.7.5

- Weight on Any Single Axle (with low-pressure tires): 20,000 lbs per single axle, 36,000 lbs for tandem axle and 54,000 lbs for tridem axles.

5.7.3 Prohibited Loads or Vehicles

The following over dimensional loads and vehicles are prohibited on the County roads:

- Front overhangs exceeding 32 feet.
- Rear overhangs exceeding 35 feet.
- Five and Six-axle vehicles carry more than 74.5 tons.

5.7.4 Application

A. Complete Application Required

Applicants shall file a complete application for a Special Transport Permit on forms provided by the ECM Administrator. Application for permits shall be made not less than 5 days in advance of the time transport is to be done. The application shall fully describe the load dimensions and proposed route including when the transport will occur.

B. Signed by Applicant

All applications for Special Transport Permit shall be signed by the applicant, or an authorized agent, who may be required to submit evidence to indicate their authority.

C. Determination of Application Completeness

An application will be considered complete if it is submitted in the required form, includes all mandatory information, including all supporting materials specified by the ECM Administrator, and is accompanied by the applicable fee. If an application is determined to be incomplete, the ECM Administrator shall provide notice to the applicant along with an explanation of the application’s deficiencies. No further processing of the application shall occur until the deficiencies are corrected in a future resubmittal. An application which is determined to be incomplete may or may not retain its same processing cycle.

5.7.5 Special Transport Permit Review and Issuance

A. Review Process

The application and other data filed by an applicant for a Special Transport Permit shall be reviewed by the ECM Administrator.

If the ECM Administrator finds that the transport described in an application for a Special Transport Permit and other data conform to the requirements of these Standards and other pertinent laws regulations or ordinances and that all required fees have been paid, a Special Transport Permit may be issued to the applicant. A Special Transport Permit is valid once issued and transport may proceed in accordance with the dates prescribed in the permit.
B. Criteria for Approval
The ECM Administrator may issue a Special Transport Permit if the proposed transport meets these Standards, no alternative routes are available that would limit transport of the over dimensional load over County roads, and the proposed method is satisfactory.

C. Conditions of Approval
The ECM Administrator shall have the authority to affix reasonable conditions to the granting of a Special Transport Permit.

5.7.6 Special Transport Permit Standards and Permit Holder Responsibilities

A. Pilot Car Required
One pilot car is required when the overall dimensions/weight of load/vehicle fall within one or more of the following limits:

- Overall height equals or exceeds 16 feet.
- Overall width equals or exceeds 11 feet but less than 14 feet.
- Overall length exceeds 45 feet for single vehicles or exceeds 75 feet for combination vehicles, but less than 100 feet.
- Front overhang equals or exceeds 25 feet in length.
- Rear overhang equals or exceeds 20 feet in length.
- Overall weight equals or exceeds 75 tons.

2 pilot cars, fore and aft, are required when the overall dimensions/weight of load/vehicle fall within one or more of the following limits:

- Overall width equals or exceeds 14 feet.
- Overall length equals or exceeds 100 feet.

A pilot car shall be a single vehicle with a minimum width of 60 inches, and may operate with a nondestructive vertical clearance-measuring device suitable for measuring heights in excess of 14 feet.

A pilot car shall be equipped with one stop/slow paddle, one orange vest, one (18” x 18” minimum) red hand-flag, 2-way radio to communicate with transporting vehicle, top-mount flashing amber warning-light and the proper load signs.

A single pilot car shall precede the load/vehicle on 2 or 3-lane roads and follow on 4 or more lane highways and divided highways. When 2 pilot cars are required, one shall precede and one shall follow.

Pilot cars and transporting vehicle shall remain to the right of the roadway centerline, and along the most right lane, at all times, unless it is absolutely necessary to stay left.

- A pilot car shall not:
- Preempt opposing traffic.
- Tow another vehicle.
Display the stop/slow sign paddle out of its window when moving.

- Stop opposing traffic, except in extreme emergencies.
- Convoy more than one load/vehicle at the same time.

Pilot cars shall accompany the extralegal load/vehicle at all times during the transportation operation. Pilot cars shall maintain proper intervals from the vehicle, to allow passing by other traffic.

**B. Signs**

All signs shall:

- Be neat, clean, legible and securely mounted.
- Have black letters on a bright yellow background.
- Be illuminated for night moves, or be constructed of reflectorized material that is clearly visible to traffic.
- Read “oversize load” or “overweight load”, as appropriate.
- Have lettering a minimum of 10 inches in height with a 2 inch minimum brushstroke and a minimum 1 inch margin all around.
- Be posted on the front and rear of the vehicle.
- Mounted at least 18 inches for vehicles and 48 inches for pilot cars, above road surface, and shall be visible from straight-ahead or behind and to 45 degrees either side thereof.
- Be posted on the front of the pilot car, when leading, and on rear, when following.
- Have a minimum sign area of 440 square inches for a pilot car.

**C. Flagmen**

A flagman is required whenever 2 pilot cars are in use. Flagging shall be done in accordance with CDOT requirements.

**D. Manufactured Housing**

Axle weight for manufactured housing unit shall not exceed 6,000 pounds per axle. Tractor units towing manufactured housing unit that exceeds legal width, up to 12 feet, shall be equipped with dual rear wheels and shall have an unladen weight of not less than 6,500 pounds. Tractor units towing manufactured housing unit exceeding 12 feet in width, shall be equipped with dual rear wheels and shall have an unladen weight, as of not less than 9,500 pounds.

Manufactured housing units open on one side shall be covered with plywood or other approved rigid material. Approved flexible material billowing or flapping less than six inches, may be substituted for rigid material. Manufactured housing units, open on both sides, need not be covered if transported empty.
E. Transport During Inclement Weather Prohibited

The permit holder shall ensure that the transportation of an over dimensional load/vehicle does not occur during inclement weather conditions, including snow, rain, fog and wind. The permit holder shall ensure that the transportation of an over dimensional load/vehicle does not occur when the pavement surface is hazardous due to inclement weather conditions. The permit holder shall ensure that no transportation of an over dimensional load/vehicle occurs when the visibility is less than 1000 feet. Any accident caused by the transportation of an over dimensional load/vehicle during inclement weather conditions, shall be considered a violation and shall constitute grounds for revoking the permit.

F. Vehicle Requirements

The permit holder shall check the load/vehicle to ensure compliance with all applicable requirements and shall ensure that actual axle weights do not exceed those shown on the permit. The permit holder shall further ensure that permitted axle or axle group weights do not exceed the rated capacity of the vehicle tires. A permit holder shall use neither booster axles nor joe dog axles in transporting overweight loads.

G. Check Clearance

The permit holder shall check all underpasses, bridges, mast arms of lighting and traffic signals, overhead wires and all other structures, for impaired vertical clearance. The permit holder shall arrange for either a bypass or a clearance at such locations.

H. Repair Damage

The permit holder shall repair, at permit holder’s sole cost, any damage to any public or private property, and pertinent improvements, resulting from transporting the permit holder’s load/vehicle, to the satisfaction of the ECM Administrator. Any damage shall be reported to the ECM Administrator, in writing, within 72 hours. Failure to file a report will result in the cancellation of all future permit privileges, pending a satisfactory arrangement with the ECM Administrator to repair the damage.

I. Hours for Transport

The transportation of an over dimensional load/vehicle shall strictly occur between the hours 11:00 p.m. and 5:00 a.m. and shall not occur from 5:00 a.m. on Saturday until 11:00 p.m. on Sunday, when the overall dimensions of the load/vehicle fall within one or more of the following limits:

- Overall height equals or exceeds 18 feet.
- Overall width equals or exceeds 15 feet.
- Overall length equals or exceeds 110 feet.
Unless specifically authorized by the permit, no transportation of any over dimensional load/vehicle shall occur during the following times or holidays:

- 7:00 a.m. to 9:00 a.m. Monday through Friday.
- 4:00 p.m. to 6:00 p.m. Monday through Friday.
- Christmas Evening and Day.
- New Years Evening and Day.
- Memorial Day.
- Independence Day.
- Labor Day.
- Thanksgiving Day.
- Any other national/state holiday.

J. Permit Available for Surrender

The Special Transport Permit is the property of the County, and must be surrendered upon demand, to any law enforcement officer or the County employee charged with the care and protection of the County's right-of-way.

K. Insurance, Subrogation and Indemnity

The permit holder shall maintain on file with the ECM Administrator, throughout the term of the permit, a County-approved general liability insurance policy and endorsement naming the County additional insured on primary basis. Insurers must be admitted to do business in the State of Colorado.

Signing the Special Transport Permit is prima facie evidence that the permit holder waives permit holder's right of subrogation against the County, its officers, elected and appointed officials, employees and volunteers for any loss, liability, damage, or cost sustained by any person or property, arising out of work or operations performed by or on behalf of the permit holder, including materials, parts, or equipment furnished in connection with such work or operations.

Signing the Special Transport Permit is prima facie evidence that the permit holder agrees to indemnify, defend and hold harmless the County, its officers, elected and appointed officials, employees and volunteers against any loss, liability, damage, or cost sustained by any person or property, arising out of work or operations performed by or on behalf of the permit holder, including materials, parts, or equipment furnished in connection with such work or operations.

5.7.7 Special Transport Permit Expiration and Extension

A. Expiration

The date of expiration shall be identified in the Special Transport Permit. Transport shall be completed in the time allowed on the permit and in the manner as therein described.
B. **Extension**

Any permit holder with an unexpired Special Transport Permit may apply for an extension of the time within which complete transport under that permit if the permit holder is unable to transport the load within the time required for good cause, and that the cause is acceptable to the ECM Administrator.

5.7.8 **Fees**

A. **Special Transport Permit**

Special Transport Permit fees shall be paid in full at the time of permit issuance. The fee for Special Transport Permit shall be as determined by resolution of the BOCC.

1. **Annual permit (fleet) costs:**
   - 5 times oversize/overweight permit plus 5% of Annual permit cost per vehicle to be permitted
   - No security deposit
   - If any of the maximum limits in Section 5.7.1 are exceeded, each vehicle exceeding the limit must have its own annual permit and cannot be included in the fleet annual permit.

2. **Oversize**
   - Fee to be set by resolution of the BOCC
   - Security deposit based on load dimensions. The security deposit will be determined for both width and height. The security deposit required will be determined based on the greater deposit of width and height.

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<th>Height of Load</th>
<th>Deposit</th>
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<tr>
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<td>&gt;22’</td>
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</tr>
</tbody>
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B. **Investigation Fees (Working without a Permit/Notice to Proceed)**

Whenever any transport for which a Special Transport Permit is required by these Standards is begun without the required Special Transport Permit, a special investigation shall be made before a Special Transport Permit may be issued. Transport shall cease immediately upon notice by the ECM Administrator of failure to obtain a permit.

An investigation fee shall be collected whether or not a Special Transport Permit is then or subsequently issued. The investigation fees shall be determined by resolution of the BOCC. The payment of investigation fees shall not exempt any
person from compliance with all other provisions of these Standards nor from any penalty prescribed by law.

5.7.9 Special Transport Permit Suspension or Revocation

The ECM Administrator may suspend or revoke any Special Transport Permit, in writing, issued under the provisions of these Standards whenever the Special Transport Permit is issued in error or on the basis of incorrect information supplied by the applicant or whenever the Special Transport Permit may have been issued in violation of any provisions of these Standards. In the event a Special Transport Permit is suspended or revoked, no refund of permit fees shall be made.

5.7.10 Voidance of Special Transport Permit

The Special Transport Permit is void if one of the following occurs:

- permit is not carried on the permitted vehicle.
- any part of the permit is not legible, or has been altered.
- permit is not signed by an authorized representative of the County
- permit is presented without pertinent attachments.
- permit is used on state or city highways.
- route includes roads and bridges that have posted weight limits.
- permitted dimensions/weight of an extralegal load/vehicle can be reduced to legal limits by repositioning and/or practical removal of a part, portion or unit.
- permit is used to represent proper authority for transporting a load/vehicle that is not specifically described on the permit.
- permit is used to represent proper authority for transporting a load/vehicle by an entity not specifically named on the permit, or organizationally related to the permit holder.
- permit is used to represent proper authority for transporting a load/vehicle before or after the times and dates authorized by the permit.

5.8 DEVIATIONS FROM STANDARDS

5.8.1 General

The ECM establishes uniform standards for the design and construction of public improvements and common development improvements. These standards were established to promote consistent construction practices, and safeguard the interests of the County, its citizens, and the general public by ensuring that all improvements are designed and constructed in conformance with sound engineering principles and accepted standards. It is recognized that site conditions or a specific design or construction problem may require a design engineer to deviate from the adopted Standards. In cases where the design engineer can demonstrate, in writing, with engineering rationale and data that a provision of these Standards, if strictly adhered to, would cause unnecessary hardship or unsafe design because of topographical or other conditions particular to the site, and that a departure may be made without destroying the
intent of such provision, the ECM Administrator may approve a deviation of the required Standard.

5.8.2 Deviation for Specific Projects
The ECM Administrator may make project-specific revisions to standard drawings and other BOCC promulgated technical engineering standards for use in any project, whether privately or publicly funded, in accordance with the procedures outlined in this section.

5.8.3 Submittal for Requested Deviation
A design engineer may request that the ECM Administrator deviate from a Standard relating to, and only for, a specific project by submitting a written request for such deviation to the ECM Administrator. The written request shall state the desired deviation, the reason for the requested deviation, the condition authorizing consideration of the request from Section 5.9.6 that apply to the desired deviation, a comparison between the County’s existing standard and the proposed deviation; and a detailed statement addressing each of the Criteria for Approval in Section 5.9.7.

Any request for deviation of a Standard for a specific project shall be supported with reference to pertinent nationally accepted specifications or standards. Refer to the Deviation Form for more information.

5.8.4 Review of Requested Deviation
After completing a review of the information submitted, the ECM Administrator shall:

• Approve the request as proposed,
• Approve the request with conditions, or
• Deny the request.

The ECM Administrator’s decision shall be documented in writing. A denial of a request shall be accompanied with a brief explanation of the reason for the denial.

The ECM Administrator may consult with others to assist in determination of whether to approve, approve with conditions, or deny a request to modify a Standard for a specific project.

5.8.5 Affect of Request on Development Review and Permits
A request for deviation constitutes permission to delay processing the all associated development applications for up to 21 calendar days to allow analysis and decision by the ECM Administrator. The ECM Administrator may advise the Development Services Department to add the time between receiving this request and the decision being made to the project timeline.

5.8.6 Limits of Consideration
The ECM Administrator may only consider a project-specific deviation to an existing Standard when one of the following conditions is met:

• The ECM standard is inapplicable to a particular situation.
• Topography, right-of-way, or other geographical conditions or impediments impose an undue economic hardship on the applicant, and an equivalent alternative that can accomplish the same design objective is available and does not compromise public safety or accessibility.

• A change to a standard is required to address a specific design or construction problem, and if not modified, the standard will impose an undue hardship on the applicant with little or no material benefit to the public.

5.8.7 Criteria for Approval

In approving a request for deviation, the deviation must not be detrimental to public safety or injurious to surrounding property. No deviation shall be approved unless it is demonstrated that:

• The request for a deviation is not based exclusively on financial considerations;

• The deviation will achieve the intended result with a comparable or superior design and quality of improvement;

• The deviation will not adversely affect safety or operations;

• The deviation will not adversely affect maintenance and its associated cost; and

• The deviation will not adversely affect aesthetic appearance.

5.8.8 Limits of Approval

Whether a request for deviation is approved as proposed or with conditions, the approval is for project-specific use and shall not constitute a precedent or general deviation from these Standards.

5.8.9 Review Fees

A Deviation Review Fee shall be paid in full at the time of submission of a request for deviation. The fee for Deviation Review shall be as determined by resolution of the BOCC.

5.8.10 Tracking Approved Deviations

The ECM Administrator shall track all approved deviations to review in coordination with the annual evaluation of potential amendments to the ECM.

5.9 SITE DEVELOPMENT PLAN REVIEW

5.9.1 Overview

Submission of a Site Development Plan (SDP) for review by the ECM Administrator is required for all multifamily, commercial and industrial development within unincorporated the County in accordance with the requirements of the ECM. Obtaining approval of the SDP is required as part of El Paso County’s Site Development Plan Review process and must occur prior to issuance of a building permit from the Regional Building Department. The SDP is to be reviewed by the ECM Administrator for compliance with applicable ECM Standards and ensure coordination between proposed and existing improvements.
5.9.2 Review Process

In most cases where site development is occurring within El Paso County, an applicant must submit applicable information for review and acceptance by the ECM Administrator through the Site Development Plan review process outlined in the LDC. In many cases, the review process may require the submission of certain engineered plans and documents to allow complete review and approval of the proposed development. Submissions will vary with the level of complexity and impact of the project but may include:

- Grading and Erosion Control Plan
- Drainage Report
- Traffic Impact Study
- Site Utility Plan
- Specific Plans for Proposed Public Improvements
- Traffic Control Devices Plans (i.e. signalization, signing and pavement marking, traffic control plans)
- Other submissions typically required by the ECM.

Guidance concerning submission requirements is provided by the LDC and will be clarified during the Early Assistance meeting outlined in the LDC.

5.9.3 Standards

Proposed public improvements shall meet the requirements of these Standards. The ECM standards will be used as guidance in the review of the SDP and accompanying reports and plans for private improvements should use the ECM to provide guidance.
testing shall be at a frequency and magnitude determined by the ECM Administrator. All costs incurred for sampling and testing shall be the responsibility of the permit holder.

5.10.2 Inspection

A. Permit Holder Inspection Services

The permit holder is fully responsible for providing onsite inspection of all public improvements by a construction representative. The ECM Administrator will not authorize work to begin without designation of the permit holder's construction representative at the preconstruction meeting.

B. Construction Inspection Services and Conflict of Interest

Individuals or firms serving as the construction representative for a project, and all employees of such firms, must be financially independent of the permit holder. It is the sole responsibility of the permit holder to ensure the requirements of this paragraph are met.

C. County Policies Concerning Inspection Services

The County's policies on inspection services for privately-funded site improvements and privately-funded public infrastructure improvements are as follows:

- Permit holder Inspection Services: Permit holder inspection services required by the County are the primary inspection services on a project, are more comprehensive and intensive than County inspection services, and are the responsibility of the permit holder and designated construction representative.

- County Inspection Services: It is the policy of El Paso County to provide only “spot check” (oversight) inspection services. The County's inspection services are only secondary inspection services and do not relieve the permit holder or construction representative of responsibility for proper construction and compliance with the requirements of these Standards, nor do County inspection services constitute approval of any modification to the approved construction plans.

D. County Inspection Activities

Inspecting services provided by the County shall include:

- Acting as a liaison between the designated construction representative, and the County.

- Monitoring both work progress and performance testing results.

- The performance of administrative and coordination activities as required to support the processing and completion of the project.

- Maintaining a completion file containing the following: (1) The original of the project completion certification; (2) A copy of any portions of the log
book determined to be important to the County initialed by the construction representative; (3) The results of material tests, compaction tests, and soil analysis as detailed in the log book.

- Inform the Development Services Department of all proposed plan changes, material changes, stop work orders, or errors or omissions in the approved plans or specifications as soon as practical.

E. Construction Engineer’s Activities

The following represents the standard onsite construction representative’s activities the County believes are necessary to provide quality onsite control. This list is not all inclusive and the permit holder will ensure the activities match the site conditions and the activities being performed:

- Maintain a project log book of daily inspection reports which contain the following information: (1) job number and name of design engineer and designees; (2) permit number; (3) date and time (arrival and departure) of site visits; (4) weather conditions, including temperature; (5) a description of construction activities; (6) statements of directions to change plans, specifications, stop work, reject materials, or other work quality actions; (7) public agency contacts which result in plan changes or other significant actions; (8) perceived problems and action taken; (9) final and staged inspections; (10) record all material and soil types and conditions; (11) test results; (12) record all pavement grade and depth measurements by stationing; (13) general remarks including citizen contact or complaints.

- All active site development projects will be required to make inspection reports available to the ECM Administrator during construction.

- Obtain and use a copy of County-approved construction plans, specifications, and a copy of this manual. The construction representative shall document any changes to the plans which may arise during construction in accordance with Section 5.11.6.

- Inspect and approve all materials such as pipe, aggregate, portland cement concrete, asphaltic concrete, and other products used onsite to ensure their compliance with the approved plans and specifications.

- Approve all plan or specification changes in writing and obtain ECM Administrator approval of changes for which a change in design intent is to be made prior to the commencement of work affected by the revision.

- Monitor construction activities to ensure end products meet approved plans and specifications.

- Perform (or have performed) material, composition, and other tests required to ensure compliance with approved specifications.

- For pavement construction, perform the following stage inspections and record date of each: (1) curbs are built to line and grade; (2) subgrade
meets grade and compaction specifications; (3) base course meets depth/thickness, grade, and compaction specifications; (4) leveling course meets depth/thickness, grade, and compaction specifications; and (5) wearing course meets depth/thickness, grade, and compaction specifications.

- Provide the ECM Administrator with 48-hour notice of impending stage inspections.

5.10.3 Haul Route Agreements

Haul route agreements may be required for new or expanded hauling within the right-of-way for activities such as development construction that are anticipated to cause extraordinary damage or accelerated deterioration to County roads.

If required by the ECM Administrator, the permit applicant shall submit a proposed haul route for review by the ECM Administrator prior to the start of hauling activities. Based on review of the proposed haul route, the ECM Administrator may require a haul route agreement.

5.10.4 Subdivision and Commercial Development Inspection

A. General

The County shall inspect all public improvements relating to subdivision and commercial development. Construction events that require notification of the ECM Administrator by the permit holder include those general items listed below. Adequate notice is required to ensure the ECM Administrator as reasonable opportunity to inspect.

1. Preconstruction Meeting

A preconstruction meeting shall precede the start of construction and the issuance of a notice to proceed if required by the ECM Administrator. The meeting shall include the contractor, design or construction engineer, utilities, and other parties affected. Approved plans, including the traffic control plan, and all permits are required to be obtained prior to the meeting.

2. Temporary Erosion Control Inspection (Initial ESQCP Inspection)

48 hours notice is required prior to land disturbance to allow inspection of initial site work involving drainage and initial BMPs required by the Stormwater Management Plan.

3. Grading, Subgrade and Stormwater Management Inspection

48 hours notice is required prior to trenching and placing of utilities or placement of road base to allow inspection of final grading and stormwater facilities.
4. **Road Base Approval**
   
   48 hours notice is required prior to placement of asphalt or curb to allow for inspection of underground utilities and placement of road base. Inspection shall include review and approval of any density tests and certifications submitted in accordance with Appendix J.

5. **Asphalt and Curb Placement**
   
   48 hours notice is required following placement of road surface treatment and curb to allow for inspection of road and curb.

B. **Failure to Notify For Inspection**
   
   Notification of the ECM Administrator by the permit holder of the construction events described above is essential for verification of compliance with these Standards. Failure to notify in a timely manner may require the County to arrange appropriate sampling and testing after-the-fact, with certification by a qualified private testing laboratory or by the ECM Administrator. The cost of such testing and certification shall be borne by the permit holder. The ECM Administrator may prohibit or limit further work on development construction until all required tests have been completed and corrections made to the satisfaction of the ECM Administrator. If necessary, the County may take further action as permitted by law.

5.10.5 **Monumentation of Roadways**

A. **Not Offset**
   
   Monuments within and adjacent to the County's right-of-way shall not be offset unless prior approval from the ECM Administrator is received in writing.

B. **Centerline Monumentation**
   
   Center line monumentation shall be installed. If the monument is located within a hard surfaced road, the monument shall be located in a valve box with cover at grade. If the monument is located within a gravel surfaced road, the monument shall be placed in a valve box 3 to 6 inches below road grade.

C. **Monument Caps and Data**
   
   All monuments shall be metallic caps stamped with the registered business name or the letters "L.S." followed by the registration number of the surveyor in charge. All monuments shall include state plane coordinate and elevation information meeting County GIS Standards along with any information required by State law.

D. **Replacement of Disturbed Monuments**
   
   The permit holder is responsible for replacement of any disturbed monumentation previously present. All disturbed monumentation including property corners shall be reset per state statute.
5.10.6 Engineering Record Drawings

A. Record Drawing Required

Engineering Record drawings (also known as "as-built" plans) are required for all projects that include public improvements or common development improvements. Engineering Record Drawings are necessary as a basis to plan and design future projects in the same location and to make repairs to damaged structural components or other non-working facilities. Engineering Record Drawings shall be suitable quality for producing legible prints through scanning, microfilming or other standard copying procedure.

B. Reflect Changes to Construction Plans

Engineering Record Drawings are a record of any variations or changes to the original intended physical product of the approved construction plans. The revisions shall be shown on a copy of the original approved construction plans that are filed with the County. Engineering Record Drawings submitted for County review shall reflect the same degree of detail as the original plan drawings. Engineering Record Drawings shall be accompanied by a completion letter from the permit holder. The completion letter shall include a statement that the site and adjacent properties (as affected by work performed under the County permit) are stable with respect to settlement and subsidence, sloughing of cut and fill slopes, and the as-built improvements (public improvements, site grading and paving) meet or exceed the minimum design requirements.

Engineering Record Drawings submitted for review and approval shall include, but not be limited to, the following details:

- roadway widths.
- curb ramps.
- stormwater system catchbasins and manholes, inverts of inlet and outlet, rim elevations.
- detention pond elements including elevations of any overflow structures, bottom of pond elevations at each corner and center, intake and outlet pipes, and volume calculations.
- control stormwater structure elements including size and elevation of all orifices, standpipe notches, bottom of structure, and bottom of lid.
- elevations on stormwater trenches at all pipe inlets and outlets.
- channel cross sections, grade, velocity and required stabilization.
- stormwater laterals with descriptions of their lengths, location, sizes, materials, and depths.

C. Record Drawings Approval Process:

To facilitate the approval process of record drawings, the following procedure shall be followed when record drawings are required.
• The permit holder shall submit a paper copy of the Engineering Record Drawings for ECM Administrator review. The Record Drawings shall be done on a copy of the original approved construction plans.

• The ECM Administrator will review the drawings and redline any necessary changes. The construction engineer shall then resubmit a paper copy of the revised record drawings to the ECM Administrator for approval.

• Upon ECM Administrator approval of the paper copy of the Engineering Record Drawings, the permit holder shall submit a final copy of the drawings. The hardcopy remains as the legal record drawing and shall not be removed from the County’s files. The Engineering Record Drawing shall clearly indicate the "as-built" state of the project. Each sheet of the record drawings shall be designated as "Engineering Record Drawings", and signed and dated by the construction engineer.
APPENDIX A  REFERENCES


American Association of State Highway and Transportation Officials: "A Policy on Geometric Design of Rural Highways"

American Association of State Highway and Transportation Officials: "Guide Specifications for Design of Pedestrian Bridges"

American Association of State Highway and Transportation Officials: "Standard Specifications for Highway Bridges"

American Association of State Highway and Transportation Officials: "LRFD Bridge Design Specifications"

American Association of State Highway and Transportation Officials: "LRFD Bridge Construction Specifications"

American Association of State Highway and Transportation Officials: "Roadside Design Guide"

American Association of State Highway and Transportation Officials: "Standard Specifications for Transportation Material and Method of Sampling and Testing, Parts I and II"

City of Colorado Springs, Colorado: "Drainage Criteria Manual, Volumes 1 and 2"


City of Colorado Springs, Colorado: "Subdivision Policy Manual"


Colorado Department of Transportation: "Standard Specifications for Road and Bridge Construction"

Colorado Department of Transportation: "Bridge Manual, Volumes I and II"

Colorado Department of Transportation: "M&S Standards"


El Paso County, Colorado: "Major Transportation Corridor Plan", August 3, 2004

Federal Highway Administration: "Roundabouts: An Informational Guide", 2010


Larimer County, Colorado: "Road Manual", January 2000

U.S. Department of Transportation: "Manual on Uniform Traffic Control Devises (MUTCD)"

Soil Conservation Service (SCS): "Procedure for Determining Peak Flows in Colorado"

APPENDIX B  TRANSPORTATION IMPACT STUDY GUIDELINES

B.1  GENERAL

These Transportation Impact Study (TIS) guidelines are established to help ensure a standard process, set of assumptions, set of analytic techniques, and presentation format to be used in the preparation of the TIS. All TISs prepared for the County shall be prepared in conformance with these guidelines.

B.1.1  Types of Study

A.  Master TIS

Where large, complex projects (big box retail or residential developments over 100 acres) are planned or a project is phased over a multi-year build-out, it may be appropriate to prepare a Master TIS for the initial action followed by periodic updates for specific phases. The Master TIS must include overall phasing of improvements to coincide with project phasing.

B.  Individual Site TIS

An individual site TIS is prepared for a project that stands alone or is a phase of a master development. It can be for a new use in an existing or remodeled building, the construction of a new building (either single occupant or multi-user), construction of multiple buildings, or the construction of new residential development.

B.1.2  Levels of Analysis

For an Individual Site TIS, the following levels of analysis apply:

A.  Full TIS

A full TIS is required if one or more of the following conditions occur:

- Vehicular Traffic: The site-generated traffic exceeds 1,000 trips/day or 100 peak-hour trips, or new high-volume access to an arterial roadway or State Highway is proposed.
- Pedestrian Traffic: Paved pedestrian facilities exist or will be constructed on or adjacent to the site, or the proposed use will generate an increase in new pedestrian traffic.
- Bicycle Traffic: Paved bicycle lanes or paths exist or will be constructed on or adjacent to the site, or the proposed use will generate an increase in new bicycle traffic.
- When the site plan does not significantly comply with the Comprehensive Plan or the MTCP.

B.  Intermediate TIS

An Intermediate TIS may be considered instead of a Full TIS if all the following requirements are met:

- Vehicular Traffic: Daily vehicle trip-end generation is between 501 and 1,000 inclusive, the peak hour trip generation is between 51 and 100, no
high volume access to arterials or State Highways are proposed, and the Level of Service (LOS) of the adjacent facility when the development is completed equals or exceeds the minimum allowable LOS standard established for that facility.

- **Pedestrian Traffic:** No paved pedestrian facilities exist or will be constructed on or adjacent to the site, or the proposed use will not generate any new pedestrian traffic.
- **Bicycle Traffic:** No paved bicycle lanes or paths exist or will be constructed on or adjacent to the site, or the proposed use will not generate any new bicycle traffic.

### C. Transportation Memorandum

A Traffic Memorandum may be considered if all the following requirements are met:

- **Vehicular Traffic:** Daily vehicle trip-end generation is less than or equal to 500, or the peak hour trip generation is between 21 and 50, and the proposed access is for local roadways or minor collector roadways only.
- **Pedestrian Traffic:** Paved pedestrian facilities exist or will be constructed on, or adjacent to, the site; or, the proposed use will not generate an increase in new pedestrian traffic.
- **Bicycle Traffic:** Paved bicycle lanes or paths exist or will be constructed on, or adjacent to, the site; or, the proposed use will not generate an increase in new bicycle traffic.

### D. No TIS Required

No TIS is required if all of the criteria below are satisfied:

- **Vehicular Traffic:** (1) Daily vehicle trip-end generation is less than 100 or the peak hour trip generation is less than 10; (2) there are no additional proposed minor or major roadway intersections on major collectors, arterials, or State Highways; (3) the increase in the number of vehicular trips does not exceed the existing trip generation by more than 10 peak hour trips or 100 daily trip ends; (4) the change in the type of traffic to be generated (i.e., the addition of truck traffic) does not adversely affect the traffic currently planned for and accommodated within, and adjacent to, the property; (5) acceptable LOS on the adjacent public roadways, accesses, and intersections will be maintained; (6) no roadway or intersection in the immediate vicinity has a history of safety or accident problems; and (7) there is no change of land use with access to a State Highway.
- **Pedestrian Traffic:** Paved pedestrian facilities exist or will be constructed on, or adjacent to, the site; or, the proposed use will not generate any new pedestrian traffic.
Bicycle Traffic: Paved bicycle lanes or paths exist or will be constructed on, or adjacent to, the site; or, the proposed use will not generate any new bicycle traffic.

**B.1.3 Revisions and Updates**

An approved TIS that has been prepared in the last three years may be revised or updated where a proposed access is changed or a change in the proposed action may result in new trip generation that exceeds the original trip generation estimates. An amendment letter addressing the changes may be accepted provided the letter adequately addresses: (1) an estimate of site trip generation, (2) existing site trip generations, (3) the differences between anticipated estimates and existing trip generation, and (4) changes to the bicycle or pedestrian facilities. If the original TIS is older than three years, an entirely new TIS shall be prepared.

**B.2 TIS PARAMETERS**

A TIS shall include the following information.

**B.2.1 Project Description**

A description of the proposed project shall be prepared and include the type of land use and size of the proposed project (e.g., number of dwelling units of building square footage, etc.). Any proposed phasing shall be discussed and the anticipated completion date established. A figure depicting the proposed site plan shall also be included and the proposed vehicular access location shall be described. This section of the TIS shall also include a description of how pedestrians and bicycle travel will be accommodated within the proposed site plan. This shall include a discussion of types of sidewalks (attached/detached), pathways, and connections to local and perimeter destinations.

**B.2.2 Analysis Horizons**

Three study horizons are required for a Master TIS analysis: the existing (current), the short-range (short-range) and the long-range build-out (20-25 years). An Individual TIS analysis shall be based on build-out.

**A. Existing Horizon**

The intent of completing an analysis of the existing (current) study horizon is to establish a baseline of traffic conditions.

**B. Short-Range Horizon**

The intent of the short-range planning horizon is to investigate the immediate impacts of the completed, proposed project on the existing and committed roadway network. The short-range planning horizon year is defined as one year after the full occupancy of the project. If the project is proposed to occur over multiple phases, each phase shall be evaluated for impacts one year after the occupancy of the phase for the short-range analysis.
C. **Long-Range Horizon**

The third planning horizon is the long-range planning horizon. It shall be based on the current MTCP planning horizon and related modeling. The model shall be updated based on existing counts where necessary. In such situations, the current counts shall be increased by application of a growth rate established by the ECM Administrator. The intent of the long-range planning horizon is to evaluate the implications of the fully developed project on the long-range traffic condition. This study horizon is for the ECM Administrator’s use as an indicator of traffic for planning purposes and the determination of the necessary right-of-way.

B.2.3 **Study Area**

The limits of the transportation network to be studied shall be based on the size and extent of the proposed development, the existing and future land uses, and traffic conditions on and near the site.

The limits of the study area shall be agreed to by the ECM Administrator before preparing the TIS. The Master TIS shall generally establish the study area for all subsequent Individual TISs.

A. **Study Area Basis for Master TIS**

- All adjacent and internal collector and arterial roadways;
- Offsite collector and arterial links within the study area that are impacted by 10 percent or more by the project;
- Continuity and adequacy of pedestrian and bicycle facilities to the nearest attraction (existing or planned);
- Access to the most direct public transportation services facility or public transportation services route where public transportation services are available; or
- Any pedestrian routes within 2 miles of a school.

B. **Study Area Basis for Individual Full TIS**

- All adjacent roadways, intersections, and high-volume accesses;
- Nearest offsite major intersection(s);
- Offsite collector and arterial links within the study area that have impacted intersections as defined below or provide the primary connections between the project and urban services;
- Internal public roads, including establishing the road classification;
- Additional offsite major intersections where: the project contributes a 10 percent impact (during either the A.M. or P.M. peak hour) to any approach leg of the intersection where the intersection is operating at a LOS of C or better in the Short-Range Horizon, or the project contributes a 5 percent impact (during either the A.M. or P.M. peak hour) to any approach leg of the intersection where the intersection is operating at a LOS of D or worse in the Short-Range Horizon;
Additional offsite minor intersection where the project contributes a 30 percent increase in volume (during either the A.M. or P.M. peak hour) to any approach leg of the intersection where any existing leg of the intersection is currently operating at a LOS of E or worse;

Pedestrian and bicyclist destinations (existing or planned) to the nearest attraction;

Access to the most direct public transportation services facility or public transportation services route (existing or planned) within 1,320 feet of the site where public transportation services are available; or

Any pedestrian routes within 2 miles of a school (residential land uses only).

C. Study Area Basis for Individual Intermediate TIS

- All adjacent roadways, intersections, and high-volume accesses;
- The nearest offsite major intersection(s) only if: the project contributes a 10 percent impact (during either the A.M. or P.M. peak hour) to any approach leg of the intersection where the intersection is operating at a LOS of C or better in the Short-Range Horizon, or the project contributes a 5 percent impact (during either the A.M. or P.M. peak hour) to any approach leg of the intersection where the intersection is operating at a LOS of D or worse in the Short-Range Horizon,
- Offsite collector and arterial links within the study area that have impacted intersections;
- Internal public roads, including establishing the road classification;
- Pedestrian and bicyclist destinations (existing or planned) to the nearest attraction;
- Access to public transportation services where available; or
- Any pedestrian routes within 2 miles of a school (residential land uses only).

D. Traffic Memorandum

- All adjacent roadways, intersections, and high-volume accesses;
- Internal public roads, including establishing the road classifications;
- Continuity and adequacy of pedestrian and bicycle facilities adjacent to the site; or
- Access to the most direct public transportation services facility or public transportation services route adjacent to the site.

B.2.4 Evaluation Elements

A. Evaluation Elements for a Master TIS

The purpose of the Master TIS is to provide a general sense of the overall impacts to the transportation system and to identify the larger scale improvement needs necessitated by the proposed zoning (i.e., widening of arterials,
connecting key gaps in the roadway system, etc.). For example, for a large development plan with a multi-phase build-out, the Master TIS would not only address the overall project, but also identify key measurable criteria that would trigger the construction of some incremental portion of the overall infrastructure improvement plan. Typically, with each phase of the project a new individual site TIS specific to that phase would be prepared. This new study would verify the accuracy of the original traffic projections, both on site and background, and check the criteria identified for infrastructure improvements and other pertinent information.

The key elements of the project impact assessment for a Master TIS shall include the following minimum evaluations:

- Conformity with the adopted MTCP and ECM;
- Peak hour link volume and LOS;
- Appropriateness of access locations;
- Multi-modal and Transportation Demand Management (TDM) opportunities;
- Pedestrian/bicycle requirements and improvements;
- Safety and accident analysis. Other items requested by the ECM Administrator in the Scoping Meeting; and
- Neighborhood and public input issues.

In cases where a developer seeks vesting with a Site Specific Development Plan, the Master TIS is required to present all the detailed information required in an Individual Site Transportation Impact Study.

B. Evaluation Elements for a Full TIS

The key elements of the project impact assessment shall be specified by the ECM Administrator from the following list:

- Conformity with the adopted MTCP and ECM;
- Peak hour link volume and LOS;
- Peak hour intersection and access LOS;
- Appropriateness of access locations;
- Location and requirements for turn lanes or acceleration/deceleration lanes at accesses or intersections, including recommendations for taper lengths, storage length, acceleration/deceleration lengths, and other geometric design requirements;
- Sight distance evaluations and recommendations (intersection, stopping, passing);
- Multi-modal and TDM opportunities;
- Continuity and adequacy of pedestrian and bicycle facilities to the nearest attraction (existing or planned) within the study area;
Recommended traffic control devices for intersections which may include two-way stop control, four-way stop control or yield signs, school flashers, school crossing guards, crosswalks, traffic signals, or roundabouts;

- Traffic Signal and stop sign warrants;
- Progression analysis for signalized intersections;
- Appropriateness of the existing roadway signing and striping;
- Safety and accident analysis;
- Other items as requested by the ECM Administrator in the Scoping Meeting; and
- Neighborhood and public input issues.

C. Evaluation Elements for an Intermediate TIS

- The key elements of the project impact assessment shall be specified by the ECM Administrator from the following list:
  - Conformity with the adopted MTCP and ECM;
  - Peak hour link volume and LOS;
  - Peak hour intersection and access LOS;
  - Appropriateness of access locations;
  - Location and requirements for turn lanes or acceleration/deceleration lanes at accesses or intersections, including recommendations for taper lengths, storage length, acceleration/deceleration lengths, and other geometric design requirements;
  - Sight distance evaluations and recommendations (intersection, stopping, passing);
  - Continuity and adequacy of pedestrian and bicycle facilities to the nearest attraction (existing or planned) within the study area;
  - Recommended traffic control devices for intersections, which may include two-way stop control, four-way stop control or yield signs, school flashers, school crossing guards, crosswalks, traffic signals, or roundabouts;
  - Traffic signal and stop sign warrants;
  - Progression analysis for signalized intersections;
  - Appropriateness of the existing roadway signing and striping;
  - Safety and accident analysis;
  - Other items as requested by the ECM Administrator in the Scoping Meeting; and
  - Neighborhood and public input issues.

D. Traffic Memorandum

The key elements of the project impact assessment shall be specified by the ECM Administrator from the following list:

- Peak hour link volume and LOS;
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Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section B.3.1-B.3.1

- Peak hour access LOS;
- Appropriateness of access locations;
- Location and requirements for turn lanes or acceleration/deceleration lanes at the access, including recommendations for taper lengths, storage length, acceleration/deceleration lengths, and other geometric design requirements;
- Sight distance evaluations and recommendations (intersection, stopping, passing);
- Continuity and adequacy of pedestrian and bicycle facilities within the study area;
- Appropriateness of the existing roadway signing and striping;
- Other items as requested by the ECM Administrator in consultation with the applicant’s traffic engineer; and
- Neighborhood and public input issues.

E. Board of County Commissioners Rights Reserved
The BOCC reserves the right and ability to review the cumulative impacts created by the proposed development and to require improvements to mitigate the impacts.

B.3 ASSESS TRAFFIC VOLUMES

B.3.1 Existing Traffic

A. Roadway Traffic Volumes/Traffic Counts
Current A.M. and P.M. peak hour traffic counts as specified by the ECM Administrator shall be obtained for the roadways within the study area for one, non-holiday Tuesday, Wednesday, or Thursday. Each peak hour count shall be conducted over a two-hour period and shall include fifteen (15)-minute count data to clearly identify the peak hours.

Weekend counts and average daily counts on local roadways may also be required where appropriate when requested by the ECM Administrator. The DOT or CDOT average weekday traffic (AWT) counts may be used when available. Pedestrian counts and bicycle usage should be obtained. Vehicle classification counts may be required.

In any case, these volumes shall be no more than one year old (from the date of application submittal). The source(s) of each of the existing traffic volumes shall be explicitly stated. Summaries of current traffic counts shall be provided. The ECM Administrator may require the use of seasonal adjustment factors depending on when data was collected and if the project is considered to be in an area of higher risk for lower levels of services (i.e., Tourism).

B. Intersection LOS
A.M. and P.M. peak hour intersection LOS shall be determined for the existing collector and arterial signalized and unsignalized intersections within the
transportation network to be studied. The analysis shall use procedures described in the Highway Capacity Manual. Factors for intersections will be by approach and those used for roadways will be by facility unless otherwise directed by the ECM Administrator.

1. **Existing and Short-Range Horizon**
   Use calculated peak hour factors or 0.85, whichever is higher, and

2. **Long-Range Horizon**
   A peak hour factor of 0.95 may be used for the Long-Range Horizon. Greater values may be used if approved by the ECM Administrator.

**C. Roadway Links**
Roadway links shall be analyzed. Acceptable maximum traffic volumes allowed for the specific class of roadway are shown in Table B-1.

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<th>Facility Type</th>
<th>Lanes</th>
<th>ADT Threshold Capacity (Urban/Rural)</th>
</tr>
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<tr>
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<td>Collector-Non-Residential</td>
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<td>20,000</td>
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<td>10,000/3,000</td>
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<td>20,000/10,000</td>
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</tr>
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</tr>
<tr>
<td>Expressway (4-lane)</td>
<td>4</td>
<td>48,000/48,000</td>
</tr>
<tr>
<td>Expressway (6-lane)</td>
<td>6</td>
<td>48,000/48,000</td>
</tr>
</tbody>
</table>

**B.3.2 Background Traffic**

**A. Short-Range Volume Projections**

The traffic forecast for the short-range planning horizon shall be the sum of existing traffic volumes plus cumulative development traffic from approved land use actions (projects with reserved intersection capacity established through a certified Full TIS), plus background growth (as adjusted to avoid duplicative consideration of the identified development traffic from the approved land use already considered). The cumulative development traffic shall be based, in part, on the A.M. and P.M. peak hour and (ADT) data established and accepted from planned and approved land use actions within and near the study area. The assumed baseline surface transportation network shall reflect existing facilities (without the proposed project improvements) plus any committed improvements within the study area.

The short-range planning horizon background traffic growth rate shall be based:
B.3.3 Project Traffic

A. Trip Generation Rate

Trip generation shall be calculated from the latest data contained within the Institute of Transportation Engineers’ Trip Generation Manual. Other industry publications (such as the ITE Journal or other sources) may be approved by the ECM Administrator. Data limitations, data age, choice of peak hours (for the land use or adjacent roadway traffic), choice of independent variables, and choice of average rate versus statistically significant modification shall be discussed in the study when appropriate. When data is not available for a proposed land use or a modification is proposed, the Applicant must conduct a local trip generation study following procedures prescribed in the ITE Trip Generation Manual and provide sufficient justification for the proposed generation rate. This rate must be approved by the ECM Administrator prior to its use in the written study.

B. Preliminary Land Use Assumptions

The trip generation values contained in studies submitted prior to the establishment of a site-specific development plan shall be based on the maximum number of dwelling units permitted for the approved land uses or the maximum trip generation rates for the non-residential development proposed land use action. When a TIS is being developed for a project with an established site-specific development plan, trip generation shall be based on actual dwelling unit counts and square footage(s) proposed on the final plan.

C. Trip Generation Table

A Trip Generation Table, listing each type of land use within the site at build-out, the size and unit of measure for each land use, trip generation rates (total daily
traffic, A.M. and P.M. peaks), directional splits for each in/out access, and the resultant total trips generated shall be provided. The data source shall include ITE land use code. Build-out land uses and trip generations shall be used for both the short-range and long-range planning horizons.

D. Committed Trips/Capacity

The trip generation stated in the TIS will establish the maximum number of trips permitted entering and exiting the development. If the number of committed trips is reached prior to full occupancy, the ECM Administrator reserves the right to require from the sponsor, at the sponsor’s expense, supplemental traffic analyses prior to the issuance of additional building permits. This information shall demonstrate that uncommitted capacity is available on the transportation network to serve the excessive trips, or that additional transportation mitigation improvements can be reasonably installed to maintain compliant operation with the excessive trips. If no additional capacity is available, or no reasonable mitigation conforming to the requirements of these roadway standards can be implemented, the owner shall obtain an exception from the ECM Administrator for the non-conformity or scale back the intensity of the proposed land uses as needed to achieve compliance. If the project is fully occupied and it is determined that the approved land use action’s traffic exceeds that which was included in the approved TIS, the ECM Administrator is authorized to require the property to conduct additional traffic analysis and provide additional mitigation measures.

E. Adjustments to Trip Generation

Trip-making reduction factors may be used after first generating trips at full ITE rates. These factors fall into two categories: those that reassign some portion of generated trips to the background stream of traffic, and those that remove or move generated trips. In all cases, the underlying assumptions of the ITE trip generation rates must be recognized and considered before any reductions are used in the TIS. Two specific situations will be closely reviewed. The first is when the traffic study assumes rates where the collection of mixed uses, such as at a shopping center, result in lower peak hour trips than when applying individual rates to each land use. The second is when reductions in the trip generation rates are assumed based on reductions due to travel demand management.

1. Pass-by Trips

This first category may be considered when trips to the proposed development currently exist as part of the background traffic stream, referred to as a pass-by trip. Pass-by percentages identified in the ITE Trip Generation Manual will be considered with appropriate explanation and documentation. Pass-by traffic must remain assigned to driveways and access points, but should not be added to the background traffic stream. A technical appendix, table, or map that illustrates the re-diversion of pass-by trips is required.
2. Internal Site Trips/ Transportation Demand Management (TDM)

Analytic support documentation of internal site trips, public transportation services use, and TDM actions shall be provided to show how trip adjustments are derived. Optimistic assumptions regarding public transportation use and TDM actions will not be accepted unless accompanied by specific implementation proposals that will become a condition of approval. Such implementation proposals must have a high expectation of realization within a 5-year period after projection initiation.

F. Trip Distribution

Trip Distribution must be documented in the TIS. It may be based on the professional engineer’s judgment applied to one or more of the following: MTCP traffic volume projections, gravity model, market analysis, existing traffic flows, or applied census data. Regardless of the basis of the estimates, the procedures and rationale used in determining the trip distributions must be fully explained, documented, and approved by the ECM Administrator.

G. Trip Assignment

The project traffic will be assigned to the roadway system according to the trip distribution. The resulting project site-generated traffic and total site traffic will be depicted on figures for each analysis horizon. These figures will include peak hour traffic volume information, plus daily traffic volume information. Separate maps or values are required when the trip distribution differs by more than 10 percent between the short-and long-range analysis horizons.

B.3.4 Total Traffic

The total traffic projections will be determined for each of the analysis horizons identified in the base assumptions. The total traffic projections will include the existing traffic, plus the future background traffic, plus the project generated traffic. The future total traffic projections will be depicted on figures for each study year. Based upon the total traffic projections, roadway standards, and MTCP, the applicant shall provide roadway functional classification recommendations.

B.4 ASSESS PROJECT IMPACTS

B.4.1 Project Impact Assessment

The key elements of the project impact assessment include evaluations of issues outlined for a specific Analysis Level.

A. Project Impacts

The key elements of the project impact analysis include:

- Generalized Daily Traffic Volume Level of Service
- Using the daily traffic volumes forecast and general daily level of service thresholds, a general evaluation should be made of the arterial roadway system for the short term and long-term horizon years. Incremental
differences attributable to the land use action should be identified. A map showing generalized levels of service should be presented for each design year.

- For unsignalized intersections of 2 lane (and rarely on 4-lane) roads, where traffic on the main road is not stop controlled, an evaluation for the need for auxiliary speed change lanes is to be provided (reference Section 2.3.7.D).

- Peak Hour Intersection Level of Service
- An a.m. and p.m. peak hour intersection level of service analysis shall be conducted for each intersection, based on procedures specified in the Highway Capacity Manual. All level of service analysis worksheets shall be included in the Appendix.

- The principal objective of the intersection level of service traffic impact analysis is to identify whether the traffic from the proposed project when added to the existing plus short and long term planning horizon traffic will result in a significant impact and an unacceptable LOS. For definitional purposes, the threshold for acceptable LOS is not less than LOS D for peak hours.

- Significance for signalized intersections is defined as when the added project traffic causes an intersection to fail the minimum acceptable LOS standard; or when the background traffic conditions (without project traffic) causes an intersection to fail the minimum acceptable LOS standards; and when the project traffic causes more than a 2 percent increase in the intersection delay. Significance for unsignalized intersections is defined when backstacking to adjacent intersections would create impeded traffic flows and/or excessive congestion; when added project traffic is determined to create potential safety problems.

B. Traffic Signals and Access Locations

Traffic signals warranted by the land use action a signal warrant analysis (based on the MUTCD) shall be identified. The acceptability of the signal locations must be demonstrated through a signal progression (time-space) analysis. The analysis shall consider any existing access or intersection or a possible future signal location along the arterial for a distance of at least one mile in each direction of the proposed signal. A cycle length of between 80 and 120 seconds should be selected and agreed to by the ECM Administrator. A travel speed of 45 mph on majors and 35 mph on minors, unless the existing posted speed limit is less, must be used. A major arterial bandwidth of 50 percent and a minor arterial bandwidth of 40 percent are considered desirable, and must be used where existing conditions allow. Where intersections or other accesses have no signals presently, but are expected to have signals, a 60 percent mainline, 40 percent cross roadway, and cycle split should be assumed. Where more detailed information is available from turning movement projections, other split assumptions may be made.
Any access where a signal would reduce the desirable bandwidth shall be identified. In general terms, that access should remain unsignalized and have turning movements limited by access design or median islands, unless the impacts to traffic operation and safety are made worse. The implications of the land use action upon the adequacy of the signal locations for each design year shall be provided. Distances between signalized intersections (centerline) shall be indicated. Signal progression worksheets (time-space diagrams) shall be included in the TIS Appendix.

The following signalization and access parameters shall also be addressed:

- Turn lane storage needs shall be identified for the “necessary” situation, based on projected turning volumes and AASHTO analytic techniques. Appropriate documentation of the calculations must be provided;
- The identification of project sight distance at the project entrances and all internal roadways shall be conducted. Line of sight triangles for determining sight distances and landscape restrictions shall be prepared and submitted;
- Appropriateness of acceleration or deceleration lanes;
- All proposed project entrances on arterials shall be evaluated as to whether they require acceleration lanes or deceleration lanes per the requirements presented in these Standards.

C. Pedestrian and Bicycle Impact Evaluations

Pedestrian and bicycle facility demand shall be identified and related items for discussion shall include:

- School routing plans shall be developed per the MUTCD between the project and all schools within 2 miles of the project boundary.
- The demand for pedestrian and bicycle facilities to serve high pedestrian activity areas with the land use shall be evaluated and properly accommodated for the planning of the project.
- The need for links of bicycle or pedestrian facilities to neighboring land uses or attractions (trails, etc.) within 1,320 feet or greater if applicable to unique pedestrian-oriented destinations) of the project site.
- Existing and proposed sidewalk width, separation from traffic, and space available for trees, public transportation services stops (if any), or other related elements (if any).
- Geometric improvements and recommended traffic control devices to accommodate pedestrians and bicyclists.

D. Pedestrian and Bicycle Level of Service

Existing and proposed pedestrian and bicycle facilities shall be evaluated for compliance with the following elements:
1. Directness
Walking distance to destinations like public transportation services stops, schools, parks, and commercial or activity areas shall be direct. Measurement of directness is the ratio of the actual distance to a destination via a sidewalk or pathway divided by the minimum distance characterized by a grid roadway system.

2. Continuity
The sidewalk/walkway system shall be complete, without gaps. The pedestrian corridor shall be integrated with the activities along the corridor and shall provide continuous access to destinations.

3. Roadway Crossings
Safety and comfort is essential while crossing roadways, intersections, and mid-block crossings. Factors that affect safety include number of lanes to cross, crossing delay for pedestrians, signal indication, crosswalks, lighting, raised medians, visibility, curb ramps, pedestrian buttons, convenience, comfort, and security.

4. Visual Interest and Amenity
Pedestrians enjoy visually appealing environments that are compatible with local architecture and include roadway lighting, fountains, and benches.

5. Security
Pedestrians shall be visible to motorists, separated from motor vehicles and bicycles, and under adequate roadway lighting.

6. Surface Condition
Pedestrian facilities shall be free from obstructions, cracks, and interruptions.

E. Special Studies
This section provides the ECM Administrator with opportunities to require specific focused traffic analyses that may be unique to the proposed land use action. The ECM Administrator will determine if special studies are required in a Scoping Meeting. These may include, but are not limited to, the following:

1. Access Management
   - If a development is proposing a new access location on an arterial and an Access Management Plan does not exist, the ECM Administrator may require an Access Management Plan. Proposals to access roads classified as arterials and above shall require review through the Major Thoroughfares Task Force Process;
   - Access spacing;
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Adopted: 12/23/2004
Revised: 12/13/2016
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Section B.4.1-B.4.1

- Accident/safety concerns (accident statistics);
- Truck routing;
- Emergency and snow routes; and
- Hazardous materials routes.

2. Neighborhood Transportation Impact Evaluation
The TIS may be required to include a focused analysis of the potential project-related impacts on adjacent residential neighborhood quality of life issues, such as potential cut-through traffic and speeding/volume concerns. If it is determined that a neighborhood transportation impact evaluation is required, the following procedure shall be followed:

- Examine existing transportation conditions within the neighborhood following the procedure as set forth for the transportation impact analysis. Daily and peak hour traffic volumes shall be collected for the local roadways to be included in the analysis;
- Determine project-generated traffic for all modes within the neighborhood and show on a figure;

3. Determine total traffic projections for the local roadways
This shall follow the same procedures as described earlier, including other projects and area-wide growth, if applicable:

- Determine if the proposed project would create significant impacts to the residential roadways;
- If necessary, develop measures including, but not limited to, traffic calming techniques, to mitigate any significant impacts; and
- The neighborhood TIS shall also discuss how pedestrians and bicyclists would access the proposed project from the adjacent neighborhood(s), and the need for special facilities to enhance direct pedestrian and bicycle connectivity.

4. Sight Distance
Sight distance concerns that are anticipated or observed which may impact access, intersection, or roadway operation and safety need to be discussed in the TIS. Recommendations regarding stopping sight distance, intersection sight distance, and passing sight distance needs shall be provided for detailing on the final development, site plan, or final construction plans.

B.5 DEVELOP MITIGATION MEASURES
When a project’s vehicular impacts do not meet the minimum acceptable LOS standard, the TIS shall include feasible measures, which would mitigate the project’s impacts. The mitigation measures are intended to be in addition to the minimum required improvements necessary to
meet these standards. One goal of the mitigation measure(s) should be to minimize the demand for trips by single occupant vehicles and to increase the use of the alternative modes.

The intersection LOS shall be recalculated to reflect the effectiveness of the proposed mitigation measures and show that the project-related impacts have been reduced to an acceptable LOS. The LOS findings shall be shown in tabular form. The following mitigation categories are not listed in order of priority.

B.5.1 Transportation Demand Management Measures

Transportation Demand Management measures are designed to facilitate the use of alternate transportation modes in an effort to decrease demand on the roadway system by single occupant vehicles. A detailed description of the proposed TDM measures and implementation plan must be included in the TIS for any project seeking TDM-related trip reductions. If the TDM program is acceptable to The ECM Administrator, the total project vehicle trips may be reduced by an amount commensurate with applicable trip reduction policies.

A. Examples of TDM Measures

- Vehicle trip reduction incentives and services offered by employers to encourage employees to utilize alternative modes of travel, such as carpooling, vanpooling, riding public transportation services, bicycling, walking, telecommuting, etc.;
- Vehicle trip reduction incentives and services affecting visitors to the project, such as shoppers, clients, patrons, etc.;
- Financial support for the capital or operating costs of enhanced public transportation services or vanpool service to the project;
- Provision of a mix of land uses in close proximity, facilitating trip making by walking, bicycling, or local shuttles;
- Provision of on-site facilities that encourage the use of alternate forms of transportation, such as bicycle lanes and amenities, enhanced pedestrian connections, telecommuting facilities, etc.; and
- Site trip cap and/or parking cap including trip-monitoring agreements.

B.5.2 Public Transportation Service

Suggested elements of a public transportation services program include:

- Contributions of equipment or funds to increase the capacity of existing public transportation systems,
- Public transportation shuttles provided by Applicant (e.g., bus, taxicab, van, etc.), and
- Contributions toward park and ride lots, public transportation services stations or centers.
B.5.3 Traffic Control

There are many ways to control traffic and enhance safety and mobility for motorists, pedestrians and bicyclists. Each component of a traffic control system must be viewed as a single unit in an overall network.

A. Medians

Medians are grouped into three general types (i.e., raised, depressed, and flush) and are designed for both through traffic and access control.

B. Signals

Design of all traffic signals shall be in accordance with the MUTCD and the CDOT Standards and Specifications. Traffic signal plans shall be submitted to and approved by the ECM Administrator prior to initiating installation.

C. Signing and Striping

Signing and Striping plans are required for signing/striping of new roadways and re-signing/striping of existing roadways. All plans shall be prepared in accordance with the MUTCD and included with the final construction plans for review and approval.

D. Traffic Control Plans

Traffic control during construction shall be planned and performed in accordance with the MUTCD and be included with the final construction plans for review and approval.

B.5.4 Roadway Widening and Other Physical Improvements

Mitigation measures, which include roadway widening, and other physical improvements must be demonstrated to be physically feasible and must meet minimum ECM standards.

B.5.5 Roadway Restriping and Parking Regulations

The ECM Administrator must approve proposed striping and parking regulation mitigation(s). Generally, roadway restriping is not a preferred mitigation due to resulting parking impact. Therefore, any parking impacts should be clearly identified and proposed for mitigation to the extent feasible.

B.5.6 Geometric Improvements

Turn lanes and other auxiliary lane needs shall be identified for each access.

B.5.7 Traffic Calming

This section presents acceptable methods of neighborhood traffic calming for urban collector or rural minor collectors and local roads. This section also provides for specific design criteria for a number of traffic calming methods.

A. Intended Use

The necessity or desire for traffic safety and calming stems from the perception that local and minor collector roadways are not always functioning as intended. These roadways should be low traffic volume roadways used for direct access to
property. They are also intended as a system that is shared by vehicular, bicycle, and pedestrian traffic, in a manner that minimally impacts residents in these areas.

Traffic calming measures are intended to minimize these issues and return the quality of life to the neighborhood. Care must be taken by the designer so that the installation of traffic calming devices does not create unintended hazards that delay emergency response or jeopardize the safety of bicyclists, pedestrians, or motorists.

B. Traffic Calming for New Roadway Design

New local and minor collectors roadways are to be designed to minimize cut-through traffic, high volumes, and high-speed operation and to maximize the efficiency of the roadway to provide vehicular access and bicycle and pedestrian traffic.

C. Roundabouts and Mini Roundabouts

Roundabouts and Mini roundabouts are considered traffic control measures. These traffic control measures may be used in new or existing roadway design if the appropriate criteria are met.

D. Traffic Calming Design Criteria

Table B-2 presents a brief list of traffic calming solutions and their intended uses. Traffic calming devices may only be used on local and minor collector roadways.

<table>
<thead>
<tr>
<th>Table B-2. Traffic Calming Solutions</th>
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</thead>
<tbody>
<tr>
<td><strong>Device</strong></td>
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<tr>
<td>Signals, Signs, and Striping</td>
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<tr>
<td>Mini Roundabouts</td>
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<tr>
<td>Neckdowns</td>
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<tr>
<td>Drop Off Zone for Schools</td>
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<tr>
<td>Realigned Intersections</td>
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</table>
B.6 RECOMMENDATIONS AND REPORT CONCLUSIONS

B.6.1 Recommended Improvements

The findings of the TIS shall be provided in summary format, including the identification of any areas of significant impacts and recommended improvements/mitigation measures to achieve LOS standards.

A. Geometric Improvements

The TIS shall include recommendations for all geometric improvements, such as pavement markings, signs, adding through or turn lanes, adding project access and assorted turn lanes, acceleration lanes, and changes in medians. Sufficient dimensions/data shall be identified to facilitate review. Anticipated right-of-way needs shall be identified.

B. Responsibility

The location, nature, and extent of all transportation improvements recommended to achieve the required LOS for each analysis horizon shall be identified. In addition, the sponsor responsible to complete the improvements shall be identified.

C. Proposed Transportation Demand Management

If TDM measures are recommended to mitigate the traffic impact of the proposed land use action, a specific TDM Implementation Proposal shall be developed and presented to the ECM Administrator. If accepted, this Implementation Proposal will become a condition of approval of the land use action requested. Each TDM Implementation Proposal shall be developed in conformance with the ECM Administrator’s and the PPACG’s Transportation Demand Management Program.

D. Summary Presentation

A Recommended Improvements Summary Table shall be prepared. The recommended improvements identified on the Recommended Improvement Table shall be categorized as Master Planned, Background Committed, or Project Committed. Each project shall include a description of its location, the type of project, right-of-way needs (for roadways), and signal or turn lane improvements (for intersections). Commitment to funding and constructing each of the improvements shall be identified.

B.7 SIGNATURE AND APPROVAL BLOCK

El Paso County: County report review is provided only for general conformance with County standards and design criteria. The County is not responsible for the accuracy and adequacy of the data, analysis, or conclusions. The County through the approval of this document assumes not responsibility for completeness and/or accuracy of this document.
B.8 TRAFFIC REPORT STANDARDS

Traffic reports shall include the following unless the review engineer specifically waives them:

- Proposed classifications of all proposed internal roadways (e.g. "rural local road", "rural local low volume road", "urban minor arterial", etc.)
- Classification of all adjacent or impacted roadways per the MTCP. (e.g. "rural local road", "rural local low volume road", "urban minor arterial", etc.)
- Trigger points for the construction of all required future improvements including but not limited to turn lanes, signals, widenings, and openings or closings of accesses. ("Trigger points" are the conditions that, when met, will call for the construction of said improvements.) Cost estimates and escrow amounts can be determined at the final plat stage.
- For final plats, state definitively what improvements the developer will be constructing with the project.
- Clearly state in text and in supporting documents what the ADT and peak hour traffic levels are at all accesses currently, at full development, and long term (twenty years out.) Include intermediate stages for phased development.
- State whether or not any improvements affected by the project are reimbursable under the current Major Transportation Corridors Plan (MTCP).
- State whether the MTCP or other approved corridor study calls for the construction of improvements in the immediate area.
- List ECM criteria for stacking, storage, and taper for every affected auxiliary lane and access and state whether this access can be met. If it cannot be met, state the required modifications so that it can be met.
- State what the sight distance is for every affected access and whether it can be met. If it cannot be met, state the required modifications so that it can be met.
- State what the current applicable Transportation Impact Fees are and what option the developer will be selecting for payment. If the site is in a special district, so state and summarize the applicable fees.
- List other traffic studies by the consultant in the area of study within the past five years, in addition to any reports identified by County staff or that the applicant is aware of. State whether the current study is consistent with those studies and explain any discrepancies.
- List all deviations from the County Engineering Criteria that the applicant will be making. Include supporting information, together with a signed and stamped deviation request form.
- Include LOS for all affected intersections.
- Show total traffic generated by the proposed development using ITE trip generation figures.
- If an intersection does not meet LOS D or better, discuss what steps can be taken to bring the intersection to a satisfactory level.
- Include an engineer’s certification page with the engineer’s stamp, signature, and date. The statement must read as follows:
“The attached traffic report and supporting information were prepared under my responsible charge and they comport with the standard of care. So far as is consistent with the standard of care, said report was prepared in general conformance with the criteria established by the County for traffic reports.”

Include a developer’s statement on the certification page. The statement must read as follows:

“I, the Developer, have read and will comply with all commitments made on my behalf within this report.” Include a printed or typed developer name and address as well as a signature block.
APPENDIX C  SOILS INVESTIGATION REPORTS AND MITIGATION

C.1 PURPOSE
This appendix provides the minimum requirements for soils investigations associated with new and improved County infrastructure. In addition, it provides guidelines for the documentation to be developed for summarizing the results of these investigations.

C.2 GEOLOGIC HAZARDS REPORT

C.2.1 General Requirements
These guidelines outline the minimum information that shall be presented and evaluated in a Geologic Hazard Report. These guidelines are not intended to be a rigid framework of requirements, nor a specific format for each report submitted for County review. The level of detail and emphasis may vary due to unique or particular geologic conditions or due to the type of project.

C.2.2 Report Guidelines

A. Overall Project Information
A general project description shall be included with each report and in a clear manner present at a minimum the following list of items:

- Size and location of the project;
- Existing site land uses;
- Proposed site land uses; and,
- Identification of the person who prepared the study and his/her qualifications for conducting the study.

B. Study Overview
A general overview of the report objectives, contents, methods, level of investigation, and findings should be provided:

- State the objective(s) and level of investigation for the study;
- Cite the previous publicly available geologic reports which were reviewed or referenced in the course of preparing the geologic hazard study and indicate the author(s), firm, and date of each report;
- List the methods of investigation as well as professional firm(s) who participated;
- If the level of investigation varies within the subject area, describe in the text and show on the maps areas of concentration or exclusion;
- Describe the general physiographic setting of the project and its relationship to local topographic features;
- Describe the general geologic setting of the project and indicate any lithologic, tectonic, geomorphic, or soils problems specific to the area; and,
- Describe the general surface and groundwater conditions.
C. Site Evaluation Techniques

The most appropriate site evaluation techniques shall be determined by the geologist/geotechnical engineer based on site conditions and the activities being proposed for the site. However, the list below presents typical methodologies and techniques used to evaluate the potential geological hazards of a site. Based on their applicability to the site being investigated, the information listed under each technique shall be included with the submitted report unless otherwise indicated to not be required. A detailed explanation is necessary for exclusion of minimum requirements listed.

1. Extent
   State the extent and method of surface and subsurface geologic studies.

2. Geologic Mapping
   The geologic mapping shall:
   - Show important details corresponding to the size, extent and degree of the investigation on the project topographic map;
   - Show the abundance of distributions of earth materials and structural elements exposed or inferred in the subject area. Observed and inferred features or relationships should be so designated on the geologic map;
   - Portray all geologic information at a scale that is appropriate for readability and interpretation. When different sources are used, “tie-points” between the sources shall be presented, and,
   - Indicate the geologic base map use, date, and significant additions and modifications to previous work.

3. Aerial Photographs and Remote-Sensing Imagery
   When aerial photographs or imagery are used, the report shall:
   - Present the source(s) of photographs or images, if available;
   - Indicate data and scale of photographs or imagery; and,
   - Highlight critical points and their relationship to the project.

4. Geophysical Investigations
   Geophysical investigation information shall:
   - Indicate the type and objectives of the geophysical investigation(s) (if any), quality of the data, and limitations of geophysical techniques;
   - Describe the information used to correlate the geophysical data and geologic conditions; and,
   - Display the geophysical data on the topographic/geologic maps and cross section.
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5. Drill-Hole Data
Drill-hole data information shall:
- Describe the specific investigative methods, tests conducted, drilling, and date of investigation;
- Show the location of all borings on the topographic or geologic map; and,
- Show boring logs, geophysical logs, or profiles obtained in the investigation.

6. Test Pits and Trenches
The test pit and trench information shall:
- Describe the location and dimensions of all pits and trenches and date of investigation;
- Indicate the location of all excavations on the topographic/geologic map and profiles;
- Provide a large scale descriptive log with sufficient detail; and,
- Show sample location if supplemental laboratory tests were conducted.

7. Field and Laboratory Tests
The field and laboratory tests information shall:
- Describe the type of any tests conducted in the field or laboratory;
- Describe the sample method and test procedures; and,
- Show the test results on the data work sheets or on summary tables.

8. Monitoring Programs
The monitoring program information shall:
- Describe the type, objectives, and location of all monitoring programs in the subject area; and,
- State the monitoring period, the firm(s) or individuals responsible for the care and disposal of the installations.

D. Geologic Descriptions
As appropriate for site conditions, the report should provide the following general geologic description information.

1. Bedrock Units
- Rock type and bedding attitude or foliation;
- Age of and correlation with recognized formations;
- Dimensional characteristics such as thickness and extent;
- Distribution and extent of the weathered zone;
2. **Surficial Deposits**
   - Distribution, occurrence, and age;
   - Identification of material types and sources;
   - Dimensional characteristics such as thickness and extent;
   - Surface expression and relationships with present topography;
   - Physical and chemical characteristics; and,
   - Distributions and extent of altered zones.

3. **Geomorphic Features**
   Geomorphic features resulting from landslides, earthflows, debris flows, mudflows, rockfalls, debris avalanches, fault scarps, soil creep, erosion scarps, avalanched paths, and subsidence phenomenon.
   - Locations and distribution;
   - Dimensional characteristics;
   - Age of feature and history of activity;
   - Recurrence interval for geomorphic process; and,
   - Physical characteristics.

4. **Structural Features**
   Structural features include joints, faults, shear zones, folds, schistocity, and foliation.
   - Occurrence, distribution, and proximity to site;
   - Dimensional and displacement characteristics of faults;
   - Orientation and changes in orientation;
   - Physical characteristics such as brecciation, slickensides, gouge zones, sand boils, sag ponds, springs alignment;
   - Disrupted drainages, or ground-water barriers;
   - Nature of offset(s) and timing of movement(s); and,
   - Absolute or relative age of latest movement.

5. **Surface Drainage**
   - Distributions;
   - Relation to topography (drainage patterns);
   - Relation to areas of vegetations;
   - Relation to geologic features;
   - Source permanence, and variation in amount of surface water;
   - Evidence of earlier occurrence of water localities now dry;
   - Estimated peak flows an physiographic flood plain of drainages;
6. **Ground Water**
   - Distributions and occurrence;
   - Hydraulic gradients;
   - Relation to topography;
   - Relations to geologic features; and,
   - Seasonal variations.

E. **Geologic Interpretation**

The report shall include interpretations and detailed descriptions of the following:

1. **Geologic Hazards**
   Geologic hazards include landslides, avalanche, rockfall, mudflows, debris flows, radioactivity, etc.
   - Geomorphic and structural features/processes present in the area;
   - Man-induced features/processes;
   - Age and activity of the features/processes;
   - Natural contentions affecting the features/processes;
   - Susceptibility to man-induced changes;
   - Potential impact of hazard(s) and risk to project;
   - Amenability of adverse conditions for adequate mitigation;
   - Long-term lateral and vertical stability of earth materials; and,
   - Impact of project on materials stability.

2. **Geologic Constraints**
   Geologic constraints include expansive soil or rock, potentially unstable slopes, high groundwater levels, soil creep, hydrocompaction, shallow bedrock, erosion, etc.
   - Soil, surface and ground water, and geomorphic conditions;
   - Man-induced conditions;
   - Activity of conditions
   - Effect of natural or man-induced changes;
   - Potential impact of conditions and risk to project;
   - Amenability of adverse conditions for adequate mitigation; and,
   - Impact of project on long-term project stability.

F. **Relationship of Geologic Factors on the Proposed Action**

This topic normally constitutes the principal contribution of the report. It involves both the affects of geologic features upon the proposed grading, construction,
and land use; and the effects of these proposed modifications upon future geological processes in the area. The following checklist includes the topics that ordinarily should be considered as part of the findings, conclusions, and recommendations of the geologic reports:

1. **Compatibility**
   General compatibility of natural features with proposed action that should be discussed includes:
   - Topography;
   - Lateral stability of earth materials;
   - Problems of flood inundation, erosion, and deposition;
   - Problems caused by features or conditions in adjacent properties; and,
   - Other general problems.

2. **Proposed Cuts**
   A description of proposed cuts and the relationship to the activities being proposed including:
   - Prediction of what materials and structural features will be encountered;
   - Prediction of stability based on geologic factors;
   - Problems of excavation (e.g. unusually hard or massive rock, excessive flow of groundwater); and,
   - Recommendations for reorientation or repositioning of cuts, reductions of cut slopes, development of compound cut slopes, special stripping above daylight lines, buttressing, protections against erosion, handling of seepage water, setbacks for structures above cuts, etc.

3. **Proposed Fill**
   A description of proposed fill and the relationship to the action including:
   - General evaluation of planning with respect of canyon-filling and sidehill masses of fill; and
   - Comment on suitability of existing natural materials for fill.

4. **Recommendations for Fill**
   Recommendations concerning the positioning of fill masses, provision for underdrainage, buttressing, special protection against erosion including:
   - Recommendations for subsurface testing and exploration; and
   - Cuts and test holed needed for additional geologic information.

5. **Special Recommendations:**
   Details concerning any unique or unusual recommendations concerning the action including recommendations about:
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Revised: 12/13/2016
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- Areas to be left as natural ground;
- Removal or buttressing of existing slide masses;
- Flood protection;
- Problem of groundwater level fluctuation;
- Position of structures, with respect to active faults;
- Problems associated with radon gas and soil radioactivity; and,
- Problems caused by natural gases, such as methane and hydrogen sulfide, radon, and,
- Protection of existing and proposed utility facilities.

G. Conclusions
The report shall provide detailed conclusions of the analysis including:

1. Land Compatibility
State generally whether the intended use of the land is compatible with the investigated site conditions; and if mitigation measures are necessary. In addition, depict those areas where "no building" is recommended.

2. Construction Planning
Discuss critical construction planning aspects that may need further consideration by the contractor including the stability of earth materials, grading plans and the need for selective location of project facilities.

3. Geologic Basis
The report shall clearly state the geologic basis for all conclusions.

H. Recommendations
The report shall provide recommendations to be used in later stages of the project based on this preliminary analysis of the project site including:

1. Mitigation Procedures
Discuss the development of mitigation procedures or design changed necessary to minimize or abate any hazardous condition requires a recommendation.

2. Long-term Project Objectives
Recommendations should focus upon the long-term stability and safety of the proposed project.

C.3 GEOTECHNICAL REPORT

C.3.1 General Requirements
These guidelines outline the minimum information that shall be presented and evaluated in a Geotechnical Report. These guidelines are not intended to be a rigid framework of requirements, nor a specific format for all reports. The level of detail and emphasis may
vary due to unique or particular conditions or due to the type of project. The Geotechnical Report shall generally show results from the applicable testing. The report shall also include a description of site characteristics, e.g., topography, drainage features, etc.

**C.3.2 Detailed Report Requirements**

**A. Required Items**

The following items are required to be included in all Geotechnical Reports:

- Site location and description
- Boring location diagram
- Laboratory test reports with evaluations (classification tests) (See Table C-1)

<table>
<thead>
<tr>
<th>Table C-1. Applicable Geotechnical Laboratory Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applicable Laboratory Tests</strong></td>
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<tr>
<td>Visual classification</td>
</tr>
<tr>
<td>Liquid limit - AASHTO T89 or ASTM D4318</td>
</tr>
<tr>
<td>Plastic limit - AASHTO T90 or ASTM D4318</td>
</tr>
<tr>
<td>Plasticity Index</td>
</tr>
<tr>
<td>In-situ moisture content</td>
</tr>
<tr>
<td>Percent passing No. 200 sieve - AASHTO T11 or ASTM C117-90</td>
</tr>
<tr>
<td>Gradation of granular (sand &amp; gravel) materials - AASHTO T27, ASTM D422 or ASTM C136</td>
</tr>
<tr>
<td>AASHTO classification and group index - AASHTO M145</td>
</tr>
<tr>
<td>Standard Penetrations Test</td>
</tr>
<tr>
<td>Swell Potential Evaluation - ASTM D4546-96</td>
</tr>
</tbody>
</table>

- Boring logs, to include but not limited to the following: (1) Date, Strata Elevation, Depth of Boring; (2) Natural moisture content, blow count and dry density of each undisturbed sample; and (3) Water table elevation
- Seasonal variations in soil and groundwater conditions to include the expected seasonal groundwater elevation variation shall be summarized.
- Shallow bedrock depth and description including mitigation requirements if bedrock is within 3 feet of subgrade.
- Percentage of soluble sulfates.
- Backfill and fill evaluation including any additional tests required for trench backfill evaluation, fill evaluation, etc.
- Groundwater evaluation including the elevation of groundwater encountered in each boring at time of drilling and at 24 to 48 hours after drilling. If deemed necessary, the boring may remain open for up to 7 days if required for further assessment.

**B. Recommendations and Mitigation Plans**

The report shall include recommendations and mitigation concerning but not limited to the following:
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Revised: 12/13/2016
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- Allowable soil pressure
- Foundation types
- Groundwater
- Maximum stable slopes (cut, fill, and natural)
- Retaining wall information (if applicable)
- Detention pond design and construction (if applicable)
- Cut and fill criteria (such as compaction, moisture content, benching)

C. Engineer Seal

All Geotechnical Reports shall be signed and sealed by a professional engineer registered or authorized to practice in the State of Colorado.

C.3.3 Boring Standards

The following represent the minimum boring standards and guidelines for conducting borings for Geotechnical Reports.

A. Timing of Soil Borings

1. Initial Borings

   The information from the initial soil borings shall be summarized in the Geotechnical Report. The entire site shall be sampled for initial testing. This is required to evaluate soil and groundwater conditions and for evaluating roadway locations that may not yet be determined or may change.

2. Structures

   Soil borings for design of transportation structures shall be taken prior to the design of the structure.

3. Fill for Right-of-Way Grading

   Testing shall be provided for all proposed fill material. All proposed fill material shall be approved by The ECM Administrator prior to placement. The material shall meet minimum requirements and be equal to or better than existing conditions. No fill material with a liquid limit greater than 40 and plasticity index greater than 20 shall be used in the upper 2-feet of the pavement subbase without implementing proper mitigation techniques.

B. Frequency of Borings

The following represent the minimum number of borings that are required based on a typical improvements project. The number of borings may be increased based on the geotechnical engineer’s recommendations or at the request of the ECM Administrator.

- A minimum of 2 borings for each project with public improvements shall be performed.
A minimum 1 boring for each SCS (NRCS) soil type within a development shall be performed.

A minimum of 1 boring shall be performed for each 10 acres of development up to 100 acres. One additional boring shall be performed for every 25 acres of development above the 100 acres.

C. Borings for Structures
The boring frequency for transportation structures shall satisfy AASHTO Bridge Design requirements and CDOT Materials Testing requirements.

D. Depth of Borings
Borings shall be performed to a minimum depth of 20 feet. In areas where the cut depths are expected to exceed 8 feet, borings shall be extended to a minimum of 15 feet below proposed finished grade. Borings shall extend deeper if needed to determine if bedrock or high groundwater levels are design concerns. Samples for structures shall be taken to a minimum depth of 10 feet below the footing elevation. Additional depth may be required for piers or piles.

It should be noted that boring depths will ultimately be determined by the geotechnical engineer based on site conditions. However, when depths different than those presented is performed, documentation as to the difference must be presented in the submitted report.

C.3.4 Testing
The following represent a listing of the minimum testing requirements and procedures for Geotechnical Reports. The actual numbers and types of tests will be based on the site and the activities being proposed.

A. Applicable Tests
- Visual Classification
- Liquid Limit
- Plastic Limit
- Plasticity Index
- Moisture Content
- Percent Passing 200
- Gradation (Granular Soils)
- AASHTO Classification
- Swell Potential Evaluation
- Percentage of Soluble Sulfates
- Standard Penetration/California Test
- Corrosion Potential Resistivity
B. Classification Testing

Soils shall be classified visually and representative samples tested to determine the soil properties. Sands and gravel samples shall be analyzed for gradation where needed to comply with classification requirements.

C.3.5 Soil Mitigation

Mitigation measures for soil problems revealed by the soils investigation shall be included in the Geotechnical Report. The following specific factors shall be addressed:

A. Mitigation Measures and Approval

All special problems found in soils investigation (e.g., expansion, frost, soluble sulfates, shallow bedrock, heave, groundwater, soil instability, utility backfill, etc.) shall be addressed in the mitigation plans. All proposed mitigation shall be approved by the ECM Administrator.

B. Swell Criteria

If the average swell is 2.0 percent or greater, the pavement design report must provide mitigation measures. The mitigation measures shall reduce destructive swell potential under the public improvements, including landscaping, to an acceptable level of less than 2.0 percent. The swell test report shall specify sample conditions, surcharge pressures, and other key testing factors.

C. Swell Mitigation Measures

Some commonly accepted mitigation measures for swell include: (1) over excavation; (2) chemical treatment; and (3) moisture treatments. Other procedures may be proposed for approval by the ECM Administrator. The selected method must work for the full life expectancy of the improvements.

D. Mitigation of Unstable Subgrade

Some commonly accepted mitigation measures for unstable subgrade include: (1) over-excavation; and (2) chemical treatment. Other procedures may be proposed for approval by The ECM Administrator. The selected method of mitigation must work for the full life expectancy of the improvements.

E. Mitigation Recommendations

1. Extent of Mitigation

   Soil treatment shall extend to the back of curb, or to the back of walk for attached or monolithic walk. For detached walk, separate mitigation procedures may be required. A combination of mitigation methods may be required to sufficiently mitigate a soil problem.

2. Approval of Chemical Treatment

   Mitigation procedures that alter existing soil conditions (such as lime, fly ash, or cement treatment) shall follow an approved mix design process.
Additional testing is required to verify that no swell is introduced in the chemical treatment.

C.4 PAVEMENT DESIGN REPORT
The Pavement Design Report must be submitted and approved prior to any nonstructural concrete or paving installation. See Appendix D for specific requirements for the Pavement Design Report information.

C.5 INSPECTION AND TESTING REPORTS
All tests and inspection results performed by the sponsor's testing firm shall be submitted directly from the testing agency to the ECM Administrator at the time of field tests, and within ten (10) working days after the testing or retesting date of laboratory test (See Chapter 5 and Appendix J, Roadway and Ancillary Facility Inspections and Testing, for more detailed information).

C.6 SUBSURFACE WATER INVESTIGATION REPORT
C.6.1 When Required
If groundwater is encountered within 5 feet of the original ground surface, a Subsurface Water Investigation Report shall be submitted for approval by the ECM Administrator. This report is required to ensure mitigation of high groundwater effects upon public improvements within the right-of-way. This information may be a separate report or may be included in the Geotechnical Report. This report is not required for temporary dewatering activity needed to facilitate construction of buried utilities. However, all applicable state and federal requirements shall be followed.

C.6.2 Report Requirements
The subsurface water investigation report shall include the following information.

A. Site Location
Site location and description including locations of any irrigation ditches and wetlands.

B. Groundwater
Elevation of water table and seasonal high water level shall be presented within the report and critical issues pertaining to groundwater highlighted.

C. Additional Subsurface Information
Other relevant subsurface information such as water ownership (water rights), groundwater quality (contamination or other undesirable characteristics).

D. Subsurface Drainage
Subsurface drainage recommendations, including its effects on all conditions, including sensitive habitat.
E. Control Measures and Designs

1. Subsurface Drains
   Should subsurface drains be recommended, the drains must have a gravity discharge without any possibility of backflow or blockage of the outlet. Any subsurface drain system shall be owned and maintained by the Applicant or the Applicant’s assigned successor(s). These drains may discharge into the ECM Administrator’s storm drainage system, including inlets or detention ponds, upon appropriate submitted design and approval by the ECM Administrator. Anticipated impacts to the groundwater table on adjacent properties must be quantified.

2. Drain Lines
   Drain lines may be installed in the sanitary sewer trench, at an elevation of one sewer diameter lower than the sanitary sewer line.

3. Drain Line Separation from Sewer
   Drain line separation from sewer shall be marked to specifically distinguish the drain from the sanitary sewer line.

4. Pipe Materials
   Pipe Materials shall be an approved material pipe, for long-term 100 years minimum design life, with appropriate cleanouts.

5. Drain Outlet
   Drain Outlet into an inlet structure or detention pond shall be designed to prevent any possibility of backflow and blockage of the drain line.

F. Engineer Seal
   All Subsurface Water Investigation Reports shall be signed and seal by a professional engineer registered or authorized to practice in the State of Colorado.
APPENDIX D  PAVEMENT DESIGN CRITERIA AND REPORT

D.1 PURPOSE
This appendix provides the basic criteria, design procedures, and report guidelines for roadway pavements. Asphalt and Portland Cement Concrete (PCC) methodologies generally follow the CDOT methodology.

D.2 SUBGRADE INVESTIGATION

D.2.1 Field Investigation
The field investigation shall consist of borings or other suitable methods of sampling subgrade soils for visual classification to a depth of at least 5 feet below proposed subgrade elevation, at spacings of not more than 500 feet. A minimum of one boring shall be obtained for any roadway segment. Every fifth hole shall be 10 feet deep. The ECM Administrator may require more frequent testing or additional borings that extend deeper should bedrock or high groundwater be a design concern. All borings shall be field logged and visually classified. Samples shall be obtained from each soil type in the upper 24 inches of subgrade for testing and evaluation. The soil investigation associated with this report occurs after the roadways are graded and the deepest utility is installed. Multiple samples shall be taken alternating among lanes and shall be evenly spaced.

D.2.2 Classification Testing
Each boring location shall be tested to determine Liquid Limit, Plastic Limit, Plasticity Index, and the percentage passing the U.S. Standard No. 200 sieve. Samples of sands and gravels will require gradation analysis for classification determination. These data shall be determined using the following methods:

- Liquid Limit - AASHTO T 89 (ASTM D 4318)
- Plastic Limit - AASHTO T 90 (ASTM D 4318)
- % Passing No. 200 - AASHTO T 11 (ASTM C 117)
- Gradation - AASHTO T 27 (ASTM D 422)

The results of these tests shall be used to calculate the AASHTO Classification and Group Index using AASHTO M 145.

Additional testing that shall be performed include:

- Moisture Content – AASHTO T 265
- Water Soluble Sulfates (for rigid pavements only) - AASHTO T 290

D.2.3 Soil Grouping
Soil samples collected in the field investigation can be combined to form soil groups. These groups determined by laboratory testing shall be based upon the AASHTO Classification, Group Index and location within the area investigated. Groupings shall not consist of samples with different AASHTO Classifications. Composite samples can be manufactured by combining small portions of each subgrade sample contained within the group and mixing to provide a uniform composite sample of the soil group. Soils are to be grouped based on the AASHTO classification of the bulk materials. When significant
disparities in Group Index (greater than 7) are noted, the subgrade soil groups shall be subdivided into two or more groups.

**D.2.4 Subgrade Support Testing**

Individual subgrade or composite samples shall be tested to determine the subgrade support value using either California Bearing Ratio (CBR) or Hveem Stabilometer (R-value) testing. In addition, a swell potential evaluation shall be performed when the plasticity index (PI) is greater than 10 or as deemed appropriate. These values shall be used in the design of pavement sections. Tests shall be conducted in accordance with the procedures listed below.

**A. CBR Tests**

California Bearing Ratio tests shall be conducted in accord with AASHTO T 193 with the following modifications:

- Note 4 of AASHTO T 193 shall not apply. A 3-point CBR evaluation is required.
- Surcharge shall be calculated using a unit weight of 140 pcf for Mix Asphalt and 135 pcf for untreated aggregate base course.
- The design CBR value shall be determined from the CBR - Dry Density Curve and shall be the CBR value at 95 percent compaction.
- In addition to the values requested in AASHTO T 193, Stress - Penetration curves for each sample, a CBR - Dry Density curve and Proctor Compaction test results shall be reported.

**B. R-Value Tests**

Hveem Stabilometer tests shall be conducted in accordance with AASHTO T 190. The design R-value shall be at 300 psi exudation pressure. The reported data shall consist of:

- Dry density and moisture content for each sample.
- Expansion pressure for each sample.
- Exudation Pressure - corrected R-value curve showing the 300-psi design R-value.

**C. Swell Test**

The results of a swell potential evaluation (ASTM D4546-96) shall be presented in the Pavement Design Reports where the PI of the existing material is greater than 10.

If the swell (at an overburden pressure of 100-150 psf, at specified compaction per CDOT and at optimum moisture content) is 2.0% or greater, the Pavement Design Report must provide mitigative measures to minimize the destructive swell potential. Since the pavement is not placed on the soils until after the soil has been scarified, moisture treated, and compacted to optimum, the "% swell" shall be measured from the point after the overburden pressure is applied, to the point after water is added.
D.3 PAVEMENT DESIGN CRITERIA

This section provides the input data used for the design of pavements for El Paso County roads.

D.3.1 ESAL

Equivalent Single Axle Loads (ESAL) are considered equivalent units based on 20-year design criteria and an 18-kip axle loading. All data and design nomographs use ESAL units for pavement loading repetitions. ESAL criteria shall conform to Table D-2.

D.3.2 Design Serviceability

Design values in Table D-1 shall be used for all County roadways.

Table D-1. Pavement Design Values

<table>
<thead>
<tr>
<th>Roadway Functional Classification</th>
<th>Serviceability Index, SI</th>
<th>Lanes</th>
<th>Directional Distribution Factor, DD</th>
<th>Lane Distribution Factor, DL</th>
<th>Truck (%)</th>
<th>Reliability (%)</th>
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<td>4.0</td>
<td>80</td>
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<td>5.0</td>
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</tr>
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<td>0.9</td>
<td>8.0</td>
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<td>9.0</td>
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<td>10.0</td>
<td>90</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local (low volume)</td>
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<td>3.0</td>
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<td>6.0</td>
<td>85</td>
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<tr>
<td>Principal Arterial, 4-lane</td>
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<td>0.9</td>
<td>8.0</td>
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<td>0.7</td>
<td>8.0</td>
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</tbody>
</table>

D.3.3 Minimum Pavement Section

Table D-2 provides the minimum acceptable pavement sections for County roadways. Final pavement designs must be based on actual subgrade support test results and the Transportation Impact Study (TIS).
Table D-2. Minimum Pavement Sections

<table>
<thead>
<tr>
<th>Roadway Functional Classification</th>
<th>ESAL</th>
<th>Composite Sections</th>
<th>Portland Cement Concrete (in)</th>
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</thead>
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<td></td>
<td></td>
<td>Asphalt (in)</td>
<td>Base (in)</td>
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<tr>
<td>Expressway, 6-lane</td>
<td>9,811,000</td>
<td>6.5</td>
<td>10.0</td>
</tr>
</tbody>
</table>

D.3.4 Flexible Pavement Strength Coefficients

The standard design coefficients for pavement materials are provided in Table D-3. Design values shall be verified by predesign mix test data and supported by daily construction tests.

D.3.5 Portland Cement Concrete Working Stress ($f_l$)

The working stress ($f_l$) shall be 75% of that provided by third-point beam loading which shall have minimum laboratory 28-day strength of 650 psi based on actual tests of materials to be used.

D.3.6 Gravel Roads

A minimum thickness of 6-inches shall be used on all newly constructed gravel roads meeting material specifications presented in Table D-7.

D.4 PAVEMENT DESIGN PROCEDURE

D.4.1 Flexible Pavements

The following procedure shall be used in determining the Structural Number (SN) and thickness of the pavement being designed.
A. Define ESAL
Determine ESAL from Table D-2. The ESAL calculated from the traffic volumes in the Traffic Impact Study shall be used whenever they exceed the minimum ESAL values given in Table D-2.

B. Define Serviceability Index (SI)
Determine the SI of the roadway classification from Table D-1 and use it in Figure D-1 or use AASHTO pavement design software.

C. Resilient Modulus Usage (MR) and CBR
Using the resilient modulus and ESAL, determine the SN from the appropriate design nomograph. The appropriate reliability value from Table D-1 and an overall deviation of 0.45 shall be used for flexible pavements. Resilient modulus shall be calculated using the following equations:

\[
S_1 = \left[\frac{(R - 5)}{11.29}\right] + 3
\]

\[
M_R = 10^{\frac{S_1 + 18.72}{6.24}}
\]

\[
M_R = 1,500 \times CBR
\]

Where:
- \(M_R\) = resilient modulus (psi)
- \(S_1\) = the soil support value
- \(R\) = R-value obtained from the Hveem stabilometer
- \(CBR\) = California Bearing Ratio

D. Pavement Design Thickness
The design thickness for the pavement structure can be determined by the general equation:

\[
SN = a_1D_1 + a_2D_2 + a_3D_3 + \ldots
\]

Where:
- \(a_1\) = Hot Mix Asphalt (HMA) strength coefficients
- \(a_2, a_3, a_n\) = strength coefficients of additional pavement components
- \(D_1\) = thickness of Hot Mix Asphalt (HMA) (inches)
- \(D_2, D_3, D_n\) = thickness of additional pavement component sections

The strength coefficients for various components of the pavement structures are given in Table D-3. The component thickness selected must meet two conditions. Pavement layer thickness shall be rounded up to the nearest 1/4 inch.
Table D-3. Strength Coefficients

<table>
<thead>
<tr>
<th>Pavement Structure Component</th>
<th>Strength Coefficients</th>
<th>Limiting Test Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Mix Asphalt</td>
<td>0.44</td>
<td>See Section D.5.4</td>
</tr>
<tr>
<td>Existing Bituminous Pavement</td>
<td>0.20-0.40(^1)</td>
<td>N/A</td>
</tr>
<tr>
<td>Aggregate Base Course/Recycled Concrete(^2)</td>
<td>0.11</td>
<td>(CBR 80+ or R 78+)</td>
</tr>
<tr>
<td>Existing Aggregate Base Course/Existing Recycled Concrete(^2)</td>
<td>0.09</td>
<td>(CBR 50+ or R 69+)</td>
</tr>
<tr>
<td>Granular Subbase Course</td>
<td>0.07</td>
<td>(CBR 15 or R 50+)</td>
</tr>
<tr>
<td>Treated Materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement Treated Aggregate Base</td>
<td>0.23</td>
<td>(7 day, 640-1000 psi)</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>0.10</td>
<td>(7 day, 150 psi @ 70°±)</td>
</tr>
<tr>
<td>Lime Treated Subgrade</td>
<td>0.14</td>
<td>(7 day, 160 psi, PI &lt; 6)</td>
</tr>
<tr>
<td>Klin Dust</td>
<td>0.10</td>
<td>(7 day, 150 psi, PI &lt; 6)</td>
</tr>
<tr>
<td>Cement Stabilized Subgrade(^3)</td>
<td>0.11</td>
<td>(7 day, 125 psi)</td>
</tr>
<tr>
<td>Cement Stabilized Subgrade(^3)</td>
<td>0.12</td>
<td>(7 day, 200 psi)</td>
</tr>
</tbody>
</table>

\(^1\) An average value of 0.30 can be used, unless analysis of existing pavement dictates a more representative coefficient.

\(^2\) Materials must meet the requirements in Section D.5.5.I.

\(^3\) If testing during construction shows the Cement Stabilized Subgrade strength is greater than 275 psi, the subgrade shall be micro fractured prior to paving.

\(^4\) Crushed concrete shall not be used as a driving surface, even as a temporary driving surface during construction.

E. **Total HMA Thickness**

Total HMA thickness selected cannot be less than the minimum specified in Table D-2 for the roadway classification.

F. **Base Course Thickness**

The base course thickness selected cannot exceed 2.5 times the HMA thickness selected. A composite section of asphalt over aggregate base must be used.

G. **Swelling Soils**

The design must reference any mitigation measures required when the subgrade contains swelling soils. Pavement Design Reports recommending permeable layers such as untreated aggregate base course in the pavement system, must present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of the layers from the swelling soils.

D.4.2 **Rigid Pavement**

The design of rigid pavements is a function of structural quality of the subgrade soil (R-value or CBR), traffic (ESAL), and the strength of the concrete (working stress). In comparison to the strength of the concrete slab, the structural contributions of underlying...
layers to the capacity of the pavement are relatively insignificant. Therefore, the use of thick bases or subbases under concrete pavement to achieve greater structural capacity is considered to be uneconomical and is not recommended. The following procedure should be used in determining the thickness of rigid pavement.

**A. Define ESAL**
Determine roadway classification and corresponding ESAL from Table D-2. The ESAL calculated from the traffic volumes in the traffic impact study shall be used whenever they exceed the minimum ESAL values given in Table D-2.

**B. Define Serviceability Index (SI) and Other Variables**
Determine design Serviceability Index (SI) of the roadway from Table D-1. For the purposes of design, the Concrete Elastic Modulus (Ec) shall be 3.4, the Mean Concrete Modulus of Rupture (\(S'_{c}\)) shall be 650 psi, the Load Transfer Coefficient (J) shall depend on the whether the shoulders are tied or non-tied and doweled or non-doweled (The J's shall be used. 2.8 for tied shoulders and doweled pavement, 4.2 for non-tied shoulders and non-doweled pavement. All other combinations shall be 3.6), and the Drainage Coefficient (Cd) shall be assumed to be 1.0 unless there is justification for a different number.

**C. Effective Modulus of Subgrade Reaction (k) Determination**
The Effective Modulus of Subgrade Reaction (k) shall be calculated using AASHTO. In most cases where there is no subbase, k can be calculated using the following equations:

\[
\begin{align*}
S_1 &= \frac{[(R \cdot 5) / 11.29] + 3}{10^{[\frac{\ln (S_1 + 18.72)}{6.24}]}} \\
M_R &= 1,500 \cdot CBR \\
k &= \frac{M_R}{19.4}
\end{align*}
\]

Where:
- \(M_R\) = resilient modulus (psi)
- \(S_1\) = the soil support value
- \(R\) = R-value obtained from the Hveem stabilometer
- CBR = California Bearing Ratio

**D. Software or Nomograph Used**
Determine the structural numbers using AASHTO pavement design software. Nomographs of the AASHTO parameters may be used instead (Figures D-2 and D-3). If the nomographs are used, copies of the nomograph determinations must be included with the design submittal. The appropriate reliability from Table D-1 and an overall deviation of 0.35 shall be used for rigid pavements.

**E. Slab Thickness**
Use the slab thickness or the minimum thickness from Table D-2, whichever is greater.
F. Swelling Soils

The design must reference any mitigation measures required when the subgrade contains swelling soils. Pavement Design Reports recommending permeable layers such as untreated aggregate base course in the pavement system must present the measures to be used to ensure adequate drainage of such layers, and to maintain segregation of the layers from the swelling soils.
Figure D-1. Flexible Pavement Nomograph

\[ W_{10} = 9.36 \log_{10}(SN) - 0.20 + 2.32 \log_{10}(\frac{U}{R}) - 8.07 \]

Example:
- \( W_{10} = 5 \times 10^6 \)
- \( R = 90\% \)
- \( s_0 = 0.25 \)
- \( W_R = 5000 \text{ psi} \)
- \( \Delta \text{PSI} = 19 \)
- Solution: \( SN = 5.0 \)
Figure D-2. Rigid Pavement Nomograph
Figure D-3. Rigid Pavement Nomograph Cont.

Legend:
- **Design Slab Thickness, \( D \) (inches)**
- **Match Line**
- **Design Serviceability Loss, \( \Delta PSI \)**
- **Estimated Total 18-kip Equivalent Single Axle Load (ESAL) Applications, \( W_{eq} \) (millions)**
- **Overall Standard Deviation, \( \sigma \)**
- **Reliability, \( R \) (%)**

**NOTE:** Application of reliability in this chart requires the use of mean values for all the input variables.
D.5 MATERIAL SPECIFICATIONS

D.5.1 General
The material specifications presented are performance oriented. All sources of mined or manufactured materials used in public improvement construction must be annually approved by the ECM Administrator as having met the appropriate materials performance specifications.

D.5.2 Procedure for Material Source Approval
On or before April 1st of each year, or a minimum of 14 calendar days before construction, a material supplier for any public improvements may supply written documentation and material test results from a competent materials testing laboratory that describes:

- Material(s) being tested to meet the ECM Administrator specifications.
- The test procedures employed.
- The supplier’s manufacturing, mining or treating process by which the tested materials were created.
- The material test results.

A signed statement shall be provided by the material supplier certifying the materials tested are representative of the materials to be provided for public improvements during the coming 365-day period.

D.5.3 Violations of Approval Conditions
Any and all material used to construct public improvements that is not from a certified source, or that is from a certified source and fails random material tests ordered by the ECM Administrator, may be subject to complete removal as a condition of the ECM Administrator acceptance of that public improvement. Additional tests will be required to confirm the existence and extent of the sub-standard material prior to the initiation of remedial action. The extent of the material to be removed will be at the discretion of the ECM Administrator.

D.5.4 Hot Mix Asphalt (HMA)
Hot mix asphalt (HMA) materials shall meet the requirements of and be placed according to the latest edition of the Pikes Peak Region Asphalt Specification. The Pikes Peak Region Asphalt Specification can be obtained online at:

D.5.5 Portland Cement Concrete Pavement
This material shall consist of a mixture of coarse and fine aggregates, Portland Cement, water and other materials or admixtures as required. Colorado Department of Transportation Class “P” mix may be used. The only alternatives to "P" shall be according to Section 412.03 of CDOT Standard Specifications. Other high-early strength concretes may be used where special conditions warrant, subject to written approval by the ECM Administrator.
A. **Cement Requirements**

Portland cement shall comply with the CDOT requirements and the type of cement shall be Type II, unless sulfate conditions dictate otherwise. Table 2.2.3 in Chapter 2.2 of ACI 201, indicates recommendations for sulfate resistance.

B. **Fine Aggregates**

Fine aggregates shall meet CDOT Section 703.01 requirements and gradation as shown in Table D-4.

### Table D-4. Fine Aggregates for Portland Cement Concrete

<table>
<thead>
<tr>
<th>Sieve Size Or Test Procedure</th>
<th>Percent Passing By Weight Or Test Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8”</td>
<td>100</td>
</tr>
<tr>
<td>#4</td>
<td>95 – 100</td>
</tr>
<tr>
<td>#16</td>
<td>45 – 80</td>
</tr>
<tr>
<td>#50</td>
<td>10 – 30</td>
</tr>
<tr>
<td>#100</td>
<td>2 – 10</td>
</tr>
<tr>
<td>#200</td>
<td>3, Maximum</td>
</tr>
</tbody>
</table>

Friable Particles, % 1.0, Maximum

Coal & Lignite, % 1.0, Maximum

Deleterious Material (AASHTO T-11), % 3.0, Maximum

Sand Equivalent (AASHTO T-176), % 80.0, Minimum

Fineness Modulus 2.50 – 3.50

Sodium Sulfate Soundness, % 20.0, Maximum

C. **Coarse Aggregate**

Coarse aggregates shall meet CDOT Section 703.02 requirements and gradation as shown in Table D-5.

### Table D-5. Coarse Aggregates for Portland Cement Concrete

<table>
<thead>
<tr>
<th>Sieve Size Or Test Procedure</th>
<th>Percent Passing By Weight Or Test Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>100</td>
</tr>
<tr>
<td>1- ½”</td>
<td>95 – 100</td>
</tr>
<tr>
<td>¾”</td>
<td>35 – 70</td>
</tr>
<tr>
<td>3/8”</td>
<td>10 – 30</td>
</tr>
<tr>
<td>#4</td>
<td>0 – 5</td>
</tr>
<tr>
<td>#200</td>
<td>1, Maximum (1.5% if crushed fines)</td>
</tr>
</tbody>
</table>

% Wear 45.0, Maximum

Clay Lumps & Friable Particles, % 2.0, Maximum

Coal & Lignite, % 0.5, Maximum

Sodium Sulfate Soundness, % 12.0, Maximum
Appendix D Pavement Design Criteria and Report
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section D.5.6-D.5.6

D. **Fly Ash**
Fly Ash shall comply with CDOT Section 701.02.

E. **Water**
Water shall meet the requirements of CDOT Section 712.01.

F. **Air Entraining and Chemical Admixtures**
Air entraining and chemical admixtures shall meet the requirements of CDOT Sections 711.02 and 711.03. No additive manufactured with the purposeful addition of chloride shall be permitted. Water-reducing admixtures are used when concrete temperatures are as follows: Type A is used with ambient temperature range of 50 to 90 degrees inclusive; Type D is used when ambient temperature is over 90 degrees.

G. **Reinforcement**
Reinforcing steel shall meet the requirements of CDOT Section 709.01, grade 40 minimum.

H. **Laboratory Design Strength**
Minimum compressive laboratory design strength shall be 3,750 psi; minimum modulus of rupture or flexural strength shall be 650 psi.

I. **Aggregate Base Course Material**
This material shall consist of hard, durable particles or fragments of stone or gravel, crushed to required sizes, containing an appropriate quantity of sand or other finely-divided mineral matter which conform to the requirements of AASHTO M 147, and CDOT Section 703.03. In addition, the material must have an R-value of 72 or greater, or a CBR of 80+, and must be moisture stable.

The materials to be used in construction shall be tested and a mix design submitted to The ECM Administrator for approval. Only aggregate from approved sources shall be used. As a minimum, the mix design report shall contain documented gradation, Atterberg limits, and CBR/R-value testing.

Two types of crushed aggregate base course are acceptable. The gradation specifications for these two types of base course are listed in Table D-6.

D.5.6 **Gravel for Gravel Roads**
Gravel described in this section shall be used for gravel shoulders, repairing gravel surfaces, or in cases where gravel roads are allowed. The gradation specification for this material is listed in Table D-7.
### Table D-6. Aggregate Base Course Materials

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent Passing By Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 5</td>
<td>Class 6</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1&quot;</td>
<td>95 – 100</td>
</tr>
<tr>
<td>¾&quot;</td>
<td>100</td>
</tr>
<tr>
<td>#4</td>
<td>30 – 70</td>
</tr>
<tr>
<td>#8</td>
<td>25 – 55</td>
</tr>
<tr>
<td>#200</td>
<td>3 - 15(^1)</td>
</tr>
<tr>
<td>Liquid Limit (LL)</td>
<td>30, Maximum</td>
</tr>
</tbody>
</table>

\(^1\) ASTM C-117

### Table D-7. Gravel for Gravel Roads

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾&quot;</td>
<td>100</td>
</tr>
<tr>
<td>#4</td>
<td>50 – 78</td>
</tr>
<tr>
<td>#8</td>
<td>37 – 67</td>
</tr>
<tr>
<td>#40</td>
<td>13 – 35</td>
</tr>
<tr>
<td>#200</td>
<td>4 – 15</td>
</tr>
<tr>
<td>Plastic Index (PI)</td>
<td>4 – 12</td>
</tr>
</tbody>
</table>

### D.5.7 Cement Treated Aggregate Base Course

This material shall consist of a mixture of aggregate materials, Portland cement and water as outlined in CDOT Section 308. Acceptable aggregates include CDOT Classes 4, 5, and 6.

The materials to be used in construction shall be tested and a mix design submitted to the ECM Administrator for approval. As a minimum, the mix design report shall contain a description of material sources, gradations, and Atterberg limits of aggregates, cement type, Proctor compaction curves and unconfined compressive strength results for each mix, strength versus cement content curves, a design mix, and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO specifications.

The mix shall have a 7-day compressive strength of at least 650 psi, and no more than 1000 psi. The minimum acceptable cement content shall be 5 percent by weight. Only approved mix designs shall be used. Approvals are required on a project basis or an annual basis for suppliers. Mixes shall be approved, prior to issuance of a Construction Permit.

### D.5.8 Class C Fly Ash Treated Subgrade

This material consists of a mixture of native or imported soils, Class C fly ash, and water, as outlined by ASTM C 618 or AASHTO M-295. Minimum in-place thickness for this material shall be eight (8) inches.
The materials to be used in construction shall be tested and a mix design submitted to the ECM Administrator for approval. As a minimum, the mix design report shall contain a description of material sources, gradations, and Atterberg limits of the native soils, fly ash type, Proctor compaction curves and unconfined compressive strength results for each mix, strength versus fly ash content curves, a design mix, and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO specifications.

To be approved, the mix shall have a minimum 7-day compressive strength of 150 psi. Only approved mix designs shall be used. Approvals are required on a project basis prior to issuance of a Construction Permit.

**D.5.9 Lime Treated Subgrade**

This material consists of a mixture of native or imported soils, hydrated or quick lime and water, as outlined by ASTM Specification C 977 or AASHTO M216. Minimum in-place thickness for this material shall be eight (8) inches.

The materials to be used in construction shall be tested and a mix design submitted to the ECM Administrator for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits and 7-day unconfined compressive test results for each mix, strength versus lime content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

The mix shall have a minimum 7-day compressive strength of 160 psi. In addition, the Plasticity Index of the treated soil shall not exceed 6. The minimum acceptable hydrated lime content shall be 4 percent by weight.

Only approved mix designs shall be used. Approvals are required on a project basis prior to issuance of a Construction Permit.

**D.5.10 Kiln Dust Treated Subgrade**

This material consists of a mixture of native or imported soils, kiln dust and water, as outlined by ASTM and AASHTO Specifications. Minimum in-place thickness for this material shall be eight (8) inches.

The materials to be used in construction shall be tested and a mix design submitted to the ECM Administrator for approval. As a minimum, the mix design report shall contain a description of material sources, gradation and Atterberg limits of native soils, Atterberg limits and 7-day unconfined compressive test results for each mix, strength versus kiln dust content curves, a design mix and special construction procedures recommended. Testing shall be in accordance with appropriate AASHTO methods.

The mix shall have a minimum 7-day compressive strength of 150 psi. In addition, the Plasticity Index of the treated soil shall not exceed 6.

Only approved mix designs shall be used. Approvals are required on a project basis prior to issuance of a Construction Permit.
D.6 PAVEMENT DESIGN REPORT

The Pavement Design Report shall be prepared by or under the supervision of and signed and seal by a professional engineer registered or authorized to practice in the State of Colorado. The Pavement Design Report shall include the following information:

- Vicinity map to locate the investigated area.
- Scaled drawings showing the location of borings.
- Scaled drawings showing the estimated extent of subgrade soil types and ESAL for each roadway.
- Pavement design alternatives for each roadway on a scaled drawing.
- Tabular listing of sample designation, sample depth, Group Number, Liquid Limit, Plasticity Index, percent passing the No. 200 sieve, AASHTO Classification, Group Index, soil description, and moisture content. Percent soluble sulfate will also be necessary for rigid pavements.
- Identification of any samples that were consolidated to create composite samples for testing purposes.
- CBR or R-value test results of each soil type used in the design.
- Pavement design nomographs properly drawn to show Soil Support - ESAL – SN and/or output from an approved AASHTO pavement design program.
- Design calculations including all design assumptions.
- A discussion regarding potential subgrade soil problems including, but not limited to: soils with swelling potential, frost susceptible soils, ground water, drainage considerations (surface and subsurface), cold weather construction (if appropriate), soluble sulfates in the subgrade, and other factors or properties that could affect the design or performance of the pavement system.
- Recommendations to alleviate or mitigate the impact of problems discussed in Item I.
- Pavement Mix Types to be used for the project.
APPENDIX E  CHECKLISTS AND PERMITS

As described in Appendix I, an Erosion and Stormwater Quality Control Permit is required for any project disturbing 1 acre or more of land, as well as any disturbance associated with a non-residential land use application. During the vertical building phase, builders of single-family residences and duplexes may obtain a Builders Erosion and Stormwater Quality Control Permit for each lot with a separate address instead.

Projects that go through any part of the development review process (land use applications include subdivision, site development plan, location approval, etc), shall obtain their ESQC permit from Department of Community Services, Development Services Division. Projects that are not associated with a land use application, but propose to disturb more than one acre of land (e.g. roadwork, installation of minor utility lines, maintenance/minor upgrades within existing utility corridors), shall obtain their ESQC Permits through Department of Public Services, Transportation Division (Stormwater Program).

To assist in preparing the plan sets required for the ESQCP approval, a land use committee comprised of DSD and the Housing and Building Association prepared a joint policy statement on grading, erosion control, and dust. The group sought to clarify the requirements of each plan to meet the current regulations. The effort resulted in checklists for Stormwater Management Plans and Grading and Erosion Control Plan Submittals plus Standard Notes for Grading and Erosion Control Plans.

Permits – Applications

Erosion and Stormwater Quality Control Permit – Issued by Department of Public Services, Transportation Division

 Builders Erosion and Stormwater Quality Control Permit – Issued by Department of Department of Community Services, Development Services Division

Checklists and Standard Notes

El Paso County Stormwater Management Plan Checklist

El Paso County Grading and Erosion Control Plan Submittal Checklist

Standard Notes for El Paso County Grading and Erosion Control Plans
EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP)
EL PASO COUNTY PUBLIC SERVICES DEPARTMENT
APPLICATION AND PERMIT

PERMIT NUMBER ________________

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<td>Owner</td>
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</tr>
<tr>
<td>Name (person of responsibility)</td>
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<tr>
<td>Company/Agency</td>
<td></td>
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<tr>
<td>Position of Applicant</td>
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<td>Address (physical address, not PO Box)</td>
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<tr>
<td>City</td>
<td></td>
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<tr>
<td>State</td>
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<td>Zip Code</td>
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<td>Company</td>
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<td>Address (physical address, not PO Box)</td>
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<tr>
<td>City</td>
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<tr>
<td>State</td>
<td></td>
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<td>Zip Code</td>
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<td>Mailing address, if different from above</td>
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<td>Telephone</td>
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<td>FAX number</td>
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<td>Email Address</td>
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<tr>
<td>Cellular Phone number</td>
<td></td>
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<tr>
<td>Erosion Control Supervisor (ECS)*</td>
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<tr>
<td>ECS Phone number*</td>
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<tr>
<td>ECS Cellular Phone number*</td>
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*Required for all applicants. May be provided at later date pending securing a contract when applicable.
### Project Specifications

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<td>Legal Description</td>
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<td>Address (or nearest major cross streets)</td>
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</tbody>
</table>
| Acreage (total and disturbed) | Total: acres  
Disturbed: acres |
| Schedule | Start of Construction:  
Completion of Construction:  
Final Stabilization: |
| Project Purpose |  |
| Description of Project |  |
| Tax Schedule Number |  |

**FOR OFFICE USE ONLY**

The following signature from the ECM Administrator signifies the approval of this ESQCP. All work shall be performed in accordance with the permit, the El Paso County Engineering Criteria Manual (ECM) Standards, City of Colorado Springs Drainage Criteria Manual, Volume 2 (DCM2) as adopted by El Paso County Addendum, approved plans, and any attached conditions. The approved plans are an enforceable part of the ESQCP. Construction activity, except for the installation of initial construction BMPs is not permitted until issuance of a Construction permit and Notice to Proceed.

Signature of ECM Administrator: ___________________________  Date ____________
1.1 REQUIRED SUBMISSIONS
In addition to this completed and signed application, the following items must be submitted to obtain an ESQCP:
- Permit fees;
- Stormwater Management Plan (SWMP) meeting the requirements of DCM2 and ECM either as part of the plan set or as a separate document;
- Cost estimates of construction and maintenance of construction and permanent stormwater control measures (Cost estimates shall be provided on a unit cost basis for all stormwater BMPs);
- Financial surety in an amount agreeable to the ECM Administrator based on the cost estimates of the stormwater quality protection measures provided. The financial surety shall be provided in the form of a Letter of Credit, Surety with a Bonding Company, or other forms acceptable to El Paso County;
- Operation and Maintenance Plan for any proposed permanent BMPs; and
- Signed Private Detention Basin/Stormwater Quality Best Management Practice Maintenance Agreement and Easement, if any Permanent Best Management Practices are to be located on site.

1.2 RESPONSIBILITY FOR DAMAGE
The County and its officers and employees, including but not limited to the ECM Administrator, shall not be answerable or accountable in any manner, for injury to or death of any person, including but not limited to a permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder, or for damage to property resulting from any activities undertaken by a permit holder or under the direction of a permit holder. The permit holder shall be responsible for any liability imposed by law and for injuries to or death of any person, including but not limited to the permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder, or damage to property arising out of work or other activity permitted and done by the permit holder under a permit, or arising out of the failure on the permit holder’s part to perform the obligations under any permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity, or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit.

To the extent allowed by law, the permit holder shall indemnify, save, and hold harmless the County and its officers and employees, including but not limited to the BOCC and ECM Administrator, from all claims, suits or actions of every name, kind and description brought for or on account of injuries to or death of any person, including but not limited to the permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder and the public, or damage to property resulting from the performance of work or other activity under the permit, or arising out of the failure on the permit holder’s part to perform his obligations under any permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit, except as otherwise provided by state law. The permit holder waives any and all rights to any type of expressed or implied indemnity against the County, its officers or employees.
1.3 APPLICATION CERTIFICATION

I, as the Applicant or the representative of the Applicant, hereby certify that this application is correct and complete as per the requirements presented in this application and the El Paso County Engineering Criteria Manual and Drainage Criteria Manual, Volume 2 and El Paso County Addendum.

I, as the Applicant or the representative of the Applicant, have read and will comply with all of the requirements of the specified Stormwater Management Plan and any other documents specifying stormwater best management practices to be used on the site including permit conditions that may be required by the ECM Administrator. I understand that the Best Management Practices are to be maintained on the site and revised as necessary to protect stormwater quality as the project progresses. I further understand that a Construction Permit must be obtained and all necessary stormwater quality control BMPs are to be installed in accordance with the SWMP and the El Paso County Engineering Criteria Manual and Drainage Criteria Manual, Volume 2 and El Paso County Addendum before land disturbance begins and that failure to comply will result in a Stop Work Order and may result in other penalties as allowed by law. I further understand and agree to indemnify, save, and hold harmless the County and its officers and employees, including but not limited to the BOCC and ECM Administrator, from all claims, suits or actions of every name, kind and description as outlined in Section 1.2 Responsibility for Damage.

________________________________________________________________________
Signature of Applicant or Representative
Date: __________

________________________________________________________________________
Print Name and Title of Applicant or Representative

Permit Fee $_________
Surcharge $_________
Financial Surety $_________ Type of Surety _________________

Total $_________
### APPLICATION AND PERMIT
BUILDERS EROSION AND STORMWATER QUALITY CONTROL
PERMIT (BESQCP)

**PERMIT NUMBER ______________**

#### APPLICANT INFORMATION

<table>
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<tr>
<th>Applicant Contact Information</th>
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#### CONTRACTOR INFORMATION

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#### PROJECT INFORMATION

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<td>Name of Subdivision Filing</td>
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<td>Address (or nearest major cross streets)</td>
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<td>Acreage (total and disturbed)</td>
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<td>Schedule (start and finish and date of final stabilization)</td>
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<tr>
<td>Description of Project</td>
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<td>Tax Schedule Number</td>
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</table>

FOR OFFICE USE ONLY
The following signature from the ECM Administrator signifies the approval of this BESQCP. All work shall be performed in accordance with the permit and the El Paso County ECM Standards.

Signature of ECM Administrator: _________________________________ Date ____________

1.1 REQUIRED SUBMISSIONS

In addition to this completed and signed application, all permit fees must be submitted to obtain a BESQCP. Submission and review of a Stormwater Management Plan or posting of financial sureties are not required for a BESQCP.

1.2 RESPONSIBILITY FOR DAMAGE

The County and its officers and employees, including but not limited to the ECM Administrator, shall not be answerable or accountable in any manner, for injury to or death of any person, including but not limited to a permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder, or for damage to property from any cause. The permit holder shall be responsible for any liability imposed by law and for injuries to or death of any person, including but not limited to the permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder, or damage to property arising out of work or other activity permitted and done by the permit holder under a permit, or arising out of the failure on the permit holder’s part to perform the obligations under any permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity, or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit.

The permit holder shall indemnify, save, and hold harmless the County and its officers and employees, including but not limited to the ECM Administrator, from all claims, suits or actions of every name, kind and description brought for or on account of injuries to or death of any person, including but not limited to the permit holder, persons employed by the permit holder, persons acting in behalf of the permit holder and the public, or damage to property resulting from the performance of work or other activity under the permit, or arising out of the failure on the permit holder’s part to perform his obligations under any permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit, except as otherwise provided by state law. The permit holder waives any and all rights to any type of expressed or implied indemnity against the County, its officers or employees. It is the intent of the parties that the permit holder will indemnify, save, and hold harmless the County, its officers and employees from any and all claims, suits or actions as set forth above regardless of the existence or degree of fault or negligence, whether active or passive, primary or secondary, on the part of the County, the permit holder, persons employed by the permit holder, or persons acting in behalf of the permit holder.

1.3 APPLICATION CERTIFICATION

I, as the Applicant or the representative of the Applicant, hereby certify that this application is correct and complete as per the requirements presented in this application and the El Paso County Engineering Criteria Manual and Drainage Criteria Manual, Volume 2 and El Paso County Addendum. I own and will build on ten (10) or fewer lots in the referenced subdivision filing.
I understand that the Best Management Practices are to be maintained on the site and revised as necessary to protect stormwater quality as the project progresses. The site and adjacent areas will be self-inspected as often as necessary to be sure that Best Management Practices are installed correctly and functioning for each stage of construction and following each rain event.

Installation and maintenance of Best Management Practices include, but are not limited to:

- Source control and physical barriers that prevent pollutants, including sediment, from leaving the site, especially into waterways or storm drain systems. Pollutants are also to be kept off of roadways, including roadside ditches, and adjacent properties.
- Protection of downstream storm drains, channels, ponds, or waterways.
- Immediate cleanup of sediment and other pollutants that are tracked or otherwise leave the permitted site.

Examples of pollutants that must be contained and cleaned up are:

- Sediment (mud or dirt)
- Excavated or imported soil, aggregate, or rock
- Landscaping materials, including topsoil
- Concrete washout water
- Stucco
- Paints
- Solvents
- Fuels and lubricants
- Pesticides and fertilizers
- Cleaning products
- Other chemicals
- Trash, litter, garbage
- Sanitary waste (e.g. portable toilets), other animal waste

Note: El Paso County does not require that a Stormwater Management Plan (SWMP) be reviewed for a BESQCP. However, it is recommended that a SWMP be prepared and site personnel be trained in the procedures necessary to protect stormwater quality. The measures in the City of Colorado Springs' Drainage Criteria Manual, Volume 2, Chapter 3, and the El Paso County approved Addendum provide guidance on BMPs for construction sites. Sites covered by BESQCPs are still subject to any other relevant regulations such as the Colorado Discharge Permit System regulations. The permit holder is responsible for subcontractors onsite complying with the terms of the permit holder's BESQCP.

________________________________________________  Date:__________
Signature of Applicant or Representative
1) Applicant (owner/ designated operator), Prepared By, SWMP Administrator, and Contractor Information.

2) Table of Contents.

3) Site description and location to include vicinity map (not just Section, Township, Range)

4) Narrative description of construction activities proposed (e.g., may include clearing and grubbing, temporary stabilization, road grading, utility / storm installation, final grading, final stabilization, and removal of temporary control measures).

5) Phasing plan – may require separate drawings indicating initial, interim, and final site phases for larger projects. Provide “living maps” that can be revised in the field as conditions dictate.

6) Proposed sequence for major activities: Provide a construction schedule of anticipated starting and completion dates for each stage of land-disturbing activity depicting conservation measures anticipated, including the expected date on which the final stabilization will be completed.

7) Estimates of the total site area and area to undergo disturbance.

8) An estimate of runoff coefficients before and after project construction (may not be required with next State update).

9) Soil erosion potential and potential impacts upon discharge.

10) A description of existing vegetation at the site and percent ground cover.

11) The location and description of any other potential pollution sources such as fueling (mobile or stationary), chemical storage, etc.
12) Material handling to include spill prevention and response procedures.

13) Spill prevention and pollution controls for dedicated batch plants.

14) Other SW pollutant control measures to include waste disposal and off site soil tracking.

15) The location and description of any anticipated non-stormwater components of discharge (springs, irrigation, etc.).

16) The name of ultimate receiving waters; size, type and location of stormwater outfall or storm sewer system discharge.

17) SWMP Map to include:
   a) construction boundaries
   b) all areas of disturbance
   c) areas of cut and fill
   d) areas used for storage of building materials, soils or wastes (stockpiles)
   e) location of any dedicated asphalt / concrete batch plants
   f) major erosion control facilities or structures (sedimentation ponds, etc.)
   g) springs, streams, wetlands and other surface waters
   h) boundaries of FEMA mapped 100 year flood plain

18) Narrative description of structural BMPs to be used, including silt fence, straw bales, check dams, sediment basins, drainage swales, etc. Ensure method is ECM / DCM approved.

19) Description of non-structural BMPs to be used including seeding, mulching, protection of existing vegetation, site watering, sod placement, etc.
20) Technical drawing details for BMP installation and maintenance.

21) Procedure for how the SWMP will be revised.

22) Description of Final Stabilization and Long-term Stormwater Quality (describe measures to control SW pollutants after construction operations have been completed.

23) Provide for vegetative cover density to be 70% of pre-disturbed levels.

24) Outline of permit holder inspection procedures to install, maintain, and effectively operate BMPs, to manage erosion and sediment.

25) Record keeping procedures identified to include signature on inspection logs and location of SWMP records on-site.

Please note: all items need to be addressed. If not applicable, explain; simply identifying “not applicable” will not satisfy CDPHE requirement of explanation.
1. Summary:
Earthwork and grading operations at construction sites have long been a concern because of the potential for soil erosion carried by storm runoff and related dust generated during dry seasons. Dust first, then runoff sediment were both significant problems in El Paso County in 2006 and came to the attention of the County Commissioners, the County Health Department, and the Colorado Department of Public Health and the Environment (CDPHE). In meetings that followed, County Administration asked County Development Services Department (DSD) to work with the construction industry through the Housing and Building Association (HBA) to improve compliance with the current regulations. A working group was formed between DSD and the HBA to make improvements to processes, and make clarifications of requirements so that the result would be improved compliance (less erosion and related dust) at construction sites. The working group has met six times to date, and held “work” meetings where the current requirements were discussed and clarified in detail. The industry acknowledged that it can do a better job of compliance through required self-inspection and maintaining compliance at construction sites. The working group used the meetings to prepare submittal checklists for two of the main required documents: Grading and Erosion Control (GEC) Plans, and Storm Water Management Plans. A set of standard notes for GEC Plans was also prepared. These checklists and notes are attached. The meetings allowed for much improved understanding of specific regulations, requirements, and enforcement along with some of the challenges industry faces in maintaining compliance.

County staff believes that we are already seeing the benefit of this work in construction site compliance. No additional regulations have been proposed at this time. More thought about these issues and planning is being brought to pre-construction conferences. More attention is being paid in the field.

After endorsement from both El Paso County and the Industry, the working group proposes follow up actions. These clarifications and policies would be shared with the wider development and construction community through public workshops. A trial period of a year is proposed to allow for improvement and then evaluation of effectiveness. After that time, the working group could be convened again to make necessary changes to policies and procedures, and if necessary to propose changes to the regulations.

The sections that follow provide detailed discussion of these policies and procedures in an effort to lessen the impact of construction and to improve construction site compliance.

2. Background:
Soil erosion along with blowing dust has long been a concern in the region. Dry weather early in 2006 and blowing dust that resulted made this a significant concern on construction sites that were undergoing earthwork and grading operations. Later in 2006, the other concern over
construction site stabilization was illustrated as severe rain events threatened to send sediment laden runoff to downstream properties from many construction sites in the County.

The County development-related regulations concerning grading and erosion control requirements emphasize storm water management, water quality concerns, and prevention of soil erosion from rainfall events. It is clear that wind erosion is also a significant concern, both from the standpoint of soil transfer to surrounding properties, and the impact to public health. From ongoing experience on various construction sites it is also evident that the amount of disturbed land area actively being graded is directly related to dust production.

3. Current Regulations and Enforcement:

Dust is regulated in El Paso County by the County Health Department. Grading, Erosion Control and storm water quality is regulated in El Paso County by the County Development Services Department, the County Public Services Department under the County MS4 (Municipal Separate Storm Sewer System) storm water quality permit, and by the Colorado Department of Public Health and Environment under a Colorado Discharge Permit for each construction site.

The overlapping requirements from different jurisdictions is confusing and has added to the problem. When County DSD or DOT staff receive dust complaints, those specific complaints are turned over to the County Health Department. If a construction site in the County is implicated by the complaint, DSD inspections staff does follow up with a site visit in order to determine if non-compliance with GEC or water quality best management practices are contributing to the dust complaint. The responsibility for dust enforcement is with the Health Department, but there are times when DSD or DOT get involved with enforcement of related GEC requirements.

The County Health Department issues Construction Activity Permits for projects that disturb more than one acre of ground under the County Air Quality Regulations. The permit regulates visual dust emissions (opacity), and often sets a maximum wind speed under which earthwork activities can be performed. The regulations list control measures such as compacting, minimizing disturbed areas, phasing, watering among others that may be required in order to minimize dust. Projects larger than 25 acres, or that will exceed six months in duration are also regulated by the CDPHE Air Quality Control Commission. County Health Department enforcement includes possible revocation of the permit, and civil penalties up to $10,000.

Regulations concerning grading, erosion control and storm water quality management are primarily in the El Paso County Engineering Criteria Manual (ECM), and the City / County Drainage Criteria Manual (DCM) Volumes 1 and 2 that are administered by County DSD and DOT. Builder’s Erosion and Storm Water Quality Control Permits (BESQCP), and Erosion and Storm Water Quality Control Permits (ESQCP) for development and larger projects are issued for construction projects under the County’s MS4 permit.

The County regulations currently require that:

- “All earth disturbances shall be designed, constructed, and completed in such a manner so that the exposed area of any disturbed land shall be limited to the shortest practical period of time.” (DCM, vol. 2)
- “All disturbed areas and stockpiles shall be mulched within 21 days after final grade is reached.” (DCM, vol. 2)
- “The overall area being graded should be kept to a minimum per provisions presented in an approved Erosion and Stormwater Quality Control Permit (ESQCP).” (ECM)
- Areas that will be dormant for more than 30 days be stabilized by mulching. (DCM vol. 2)
• Areas that are at final grade or will be dormant for more than 60 days be stabilized by seeding and mulching (DCM vol. 2)

Enforcement provisions are carried out by DSD and DOT under the procedure provided in the ECM Appendix I and include: Letter of Non-Compliance, Stop Work Order, permit revocation, and ultimately court summons.

The Colorado Department of Public Health and Environment administers the NPDES water quality program for the EPA. CDPHE requires separate Colorado Discharge Permits for construction sites. State enforcement can include stop work orders and significant daily fines for violations.

4. County and Industry Committee Meetings:

To address the concerns over erosion, sediment and the related dust from construction sites, County DSD staff met with the County Health Department and the Housing and Building Association (HBA) land use committee. Initially, County staff discussed the possibility of specific disturbed area limits, similar to Douglas and Arapahoe County where a limit is placed on the amount of land (e.g., 40 acres, 50 acres, etc.) that could be undergoing active earth disturbance, at any given time.

In August, 2006, the HBA provided a letter to County Administration requesting that disturbed area limits not be applied. The letter requested that the County work to better enforce the existing regulations, and acknowledged that the construction industry can do a better job of compliance with the regulations. The HBA requested that a committee be set up to work on these improvements. Upon direction from County Administration, County DSD and the HBA formed a grading and erosion control working group to provide clarification of the requirements and enforcement as called for in current regulations. To date, this group has met six times.

5. Resulting Clarification of County Engineering Criteria, Grading / Erosion Control Plans and Storm Water Management Plans:

As described earlier, there are overlapping regulations in the County and at the State level concerning grading and erosion control. The County’s water quality permit required by the State (MS4 permit) is fairly recent. It began in 2004 with a 5-year implementation period. The County Engineering Criteria Manual (ECM) was initially adopted in December 2004, also with an implementation period. The ECM in place now sets forth construction site requirements for grading and erosion control in Chapter 5 and in Appendix I. These current County regulations are those that implement the County’s obligation under the State MS4 permit.

Two critical requirements of the ECM are Grading and Erosion Control (GEC) Plans, and Storm Water Management Plans (SWMP). Because of the overlapping regulations and permit requirements, clarifying the scope and timing of these two plans has been the main focus of the County / HBA working group. Early on, the working group determined that clarifying these plan requirements would allow for more efficient preparation and County review, and much improved construction related compliance.

Because the GEC Plan and SWMP are so inter-related, the working group sought clarification on what each plan includes, when each of the plans is actually prepared, approved and carried out.

It is clear from the ECM that GEC Plans are required to be prepared by the Professional Engineer, reviewed and approved by County DSD as part of the development related Construction Drawings. It was less clear as to when the SWMP would be required in the
development review process. Further, many of the State mandated requirements for the SWMP overlap with the GEC Plan.

Through much discussion, the working group sought to sort out the requirements and timing for each plan to meet all the current regulations. As a work product the group developed simplified checklists for both the GEC Plan and SWMP. As there has been inconsistency in the standard notes on GEC Plans that are intended to help the project stay in compliance with applicable regulations (many have evolved from other jurisdictions or old regulations, etc.), another work product was to develop together standard County notes to be placed on the GEC Plan. These checklists and standard notes are attached. The following are the resulting scope and timing policies that have resulted from the work of the working group:

**Grading and Erosion Control (GEC) Plan:** The intent of the GEC Plan is to provide for overall subdivision or development grading design as part of the engineering required for review and approval by the County. This plan is done at the time subdivision or development construction drawings are prepared by the Professional Engineer working for the developer. This is complex work whereby cuts and fills are analyzed for balance, slopes and contours are proposed as an integral part of the engineering design. A second important use of the GEC Plan is to estimate the cost of the overall grading, erosion control measures known as Best Management Practices (BMPs), and ultimate site stabilization. The County subdivision regulations require that collateral for these activities be posted prior to any land disturbing activity. The GEC Plan is therefore important to be completed and approved at the time of subdivision construction drawing approval so that these costs can be accurately estimated and included with the required subdivision collateral.

It was also determined that at the time of GEC Plan approval, the exact timing and phasing of the work is not always known. The exact starting date is sometimes delayed, and often the contractor that will do the earthwork is not yet under contract. The earthwork contractor has expertise in planning and phasing the earth disturbing activity to maintain compliance that is not yet a part of the project at the time of GEC Plan approval. Although overall phasing and general timing may be known and presented, the exact dates, phasing and progression of the earthwork and stabilization work is not known at plan approval. It is therefore the working group’s recommendation that detailed phasing of the work and the proposed construction schedule be deferred to the required SWMP. The GEC Plan checklist and Standard Notes prepared by the working group are attached.

**Storm Water Management Plan (SWMP):** The SWMP is required before any ground disturbing activities. It describes in detail exactly what BMPs will be used prior to construction, during the construction period and at project closeout. It is the plan that is required to show how the project will maintain compliance throughout construction to final stabilization. The consulting engineer, the owner and contractors should collaborate on the preparation to provide the best information possible.

The SWMP does not have to be prepared by a registered Professional Engineer. The SWMP is required to be kept up to date on site by the designated permit Site Manager. On larger projects it will include “Living Maps” that are marked to show current status of disturbance, and stabilized areas. This plan is required before a notice to proceed is issued by the County and should be provided to the DSD Inspections group at least 2 weeks prior to ground disturbance. The SWMP checklist prepared by the working group is attached.
6. **Enforcement of Regulations:**

Concerning enforcement, the working group determined that the current County enforcement tools (i.e., Letter of Non-Compliance, Stop Work, Court injunction, etc.) are adequate. Letter of Non-Compliance and Stop Work orders have been used since the time of ECM adoption, and have been effective. During this intervening time, the CDPHE has also been active in enforcing its Colorado Discharge Permit regulations through inspection of construction projects in the unincorporated County. The State enforcement actions have also been effective. The working group is not recommending any changes to enforcement regulations at this time. The industry acknowledges that it can do a better job of self inspection and compliance with the regulations. It is the working group’s belief that renewed focus on the regulations, and the beneficial clarifications in this policy will result in better compliance and a significant decrease in the concern of the public over construction related soil erosion and related dust.

**Acknowledgements:**

The Development Services Department and the Housing and Building Association wishes to thank the following individuals for participating in the working group meetings:

- Kirk Ager, Rice and Rice, Inc.
- Mike Mallon, Mallon Development Co.
- Charlie Williams, Infinity Land Corp.
- Brenda Quinones, Housing and Building Assoc.
- Kim Cooper, Lennar
- Bobby Ingels, Ingels Company
- Matthew Merritt, Classic Consulting
- Marc Whorton, Classic Consulting
- Darin Moffatt, Classic Consulting
- Jeff Dwire, Dwire Earthmoving
- Chad Ellington, Oakwood Homes
- Dean Blazik, Construction Site Management
- Margie DeLaurell, JR Engineering
- Larry Lee, Raw Land Detailing, Inc.
- Mike Lee, Raw Land Detailing, Inc.
- Mike DeGrant, Lowell Development
- Rudy Cross, Cross Company
- Ken Bailey, LaPlata
- Jennifer Davis, Kiowa Engineering
- Stewart Wills, Classic Homes
- John LeSage, Matrix Design Group
- Tom Kerby, PBS&J
- Jim Luthi, Century Communities
- Roger DeKloe, New Generation Homes
- Mel Keys, Banning Lewis Ranch
- Tara McGowan, El Paso County DSD
- Larry Syslo, El Paso County DSD
- Paul Danley, El Paso County DSD
- Robert Wolf, El Paso County DSD
- Todd Sturtevant, City Stormwater Enterprise
EL PASO COUNTY GRADING AND EROSION CONTROL PLAN SUBMITTAL CHECKLIST

Revised 5/21/07

1) Vicinity map.
2) North arrow and acceptable scale (1"=20' to 1"=100').
3) Existing and proposed Contours 2 feet or less (except for hillside).
4) Standard EPC Grading and Erosion Control Notes included.
5) Delineate mapped FEMA 100-yr floodplain.
6) Construction site boundaries clearly delineated.
7) Areas of soil disturbance shown.
8) All proposed construction BMPs and Construction BMP details shown.
9) Show existing vegetation.
10) Existing and proposed water courses including springs, streams, wetlands, Detention ponds, roadside ditches, irrigation ditches and other water surfaces.
11) Show any existing structures.
12) Show all existing utilities.
13) Submit geotechnical investigation from soils engineer.
14) Conclusions from soils report and geologic hazards report incorporated in grading design.
15) Show existing and proposed property lines and subdivision boundary.
16) All existing and proposed easements (permanent and construction) including required off site easements.
17) Any offsite grading clearly shown and called out.
18) Existing and proposed storm drainage facilities as necessary to show all BMPs.
19) Temporary sediment ponds provided for disturbed drainage areas greater than 1 acre.
20) Proposed slopes steeper than 3:1 with top and toe of slope delineated.
21) Erosion control blanketing shown on slopes steeper than 3:1.
22) Retaining walls greater than or equal to 4ft in height require design by P.E. and building permit from Regional Building Department. Locations to be shown on the plan (not located in County ROW).
23) Vehicle tracking shown at all construction entrances.
24) The erosion control plan is to be certified by a Colorado Registered P.E. with appropriate signature blocks for EPC and the Engineer and the statement “The Owner will comply with the requirements of the Erosion Control Plan” signed by the owner.
25) Required Signature blocks:
Engineer’s Statement:

This Grading and Erosion Control Plan was prepared under my direction and supervision and is correct to the best of my knowledge and belief. Said Plan has been prepared according to the criteria established by the County for Grading and Erosion Control Plans. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

_______________________________________                      _______________
Name                                                                                           Date

El Paso County Grading and Erosion Control Plan

Submittal Checklist

Page 2 of 2

Owner’s Statement:

The Owner will comply with the requirements of the Grading and Erosion Control Plan.

_________________________________________                     _______________
Name                                                                                              Date

El Paso County:

County plan review is provided only for general conformance with County Design Criteria. The County is not responsible for the accuracy and adequacy of the design, dimensions, and/ or elevations which shall be confirmed at the job site. The County through the approval of this document assumes no responsibility for completeness and/ or accuracy of this document.

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria, and Engineering Criteria Manual as amended.

_________________________________________                          ____________
Standard Notes for El Paso County Grading and Erosion Control Plans

Revised 5/21/07

1. Stormwater discharges from construction sites shall not cause or threaten to cause pollution, contamination, or degradation of State Waters. All work and earth disturbance shall be done in a manner that minimizes pollution of any on-site or off-site waters, including wetlands.

2. Notwithstanding anything depicted in these plans in words or graphic representation, all design and construction related to roads, storm drainage and erosion control shall conform to the standards and requirements of the most recent version of the relevant adopted El Paso County standards, including the Land Development Code, the Engineering Criteria Manual, the Drainage Criteria Manual, and the Drainage Criteria Manual Volume 2. Any deviations to regulations and standards must be requested, and approved, in writing.

3. A separate Stormwater Management Plan (SMWP) for this project shall be completed and an Erosion and Stormwater Quality Control Permit (ESQCP) issued prior to commencing construction. During construction the SWMP is the responsibility of the designated Stormwater Manager, shall be located on site at all times and shall be kept up to date with work progress and changes in the field.

4. Once the ESQCP has been issued, the contractor may install the initial stage erosion and sediment control BMPs as indicated on the GEC. A preconstruction meeting between the contractor, engineer, and El Paso County will be held prior to any construction. It is the responsibility of the applicant to coordinate the meeting time and place with County DSD inspections staff.

5. Soil erosion control measures for all slopes, channels, ditches, or any disturbed land area shall be completed within 21 calendar days after final grading, or final earth disturbance, has been completed. Disturbed areas and stockpiles which are not at final grade but will remain dormant for longer than 30 days shall also be mulched within 21 days after interim grading. An area that is going to remain in an interim state for more than 60 days shall also be seeded. All temporary soil erosion control measures and BMPs shall be maintained until permanent soil erosion control measures are implemented and established.

6. Temporary soil erosion control facilities shall be removed and earth disturbance areas graded and stabilized with permanent soil erosion control measures pursuant to standards and specification prescribed in the DCM Volume II and the Engineering Criteria Manual (ECM) appendix I.

7. All persons engaged in earth disturbance shall implement and maintain acceptable soil erosion and sediment control measures including BMPs in conformance with the erosion control technical standards of the Drainage Criteria Manual (DCM) Volume II and in accordance with the Stormwater Management Plan (SWMP).
8. All temporary erosion control facilities including BMPs and all permanent facilities intended to control erosion of any earth disturbance operations, shall be installed as defined in the approved plans, the SWMP and the DCM Volume II and maintained throughout the duration of the earth disturbance operation.

9. Any earth disturbance shall be conducted in such a manner so as to effectively reduce accelerated soil erosion and resulting sedimentation. All disturbances shall be designed, constructed, and completed so that the exposed area of any disturbed land shall be limited to the shortest practical period of time.

10. Any temporary or permanent facility designed and constructed for the conveyance of stormwater around, through, or from the earth disturbance area shall be designed to limit the discharge to a non-erosive velocity.

11. Concrete wash water shall be contained and disposed of in accordance with the SWMP. No wash water shall be discharged to or allowed to runoff to State Waters, including any surface or subsurface storm drainage system or facilities.

12. Erosion control blanketing is to be used on slopes steeper than 3:1.

13. Building, construction, excavation, or other waste materials shall not be temporarily placed or stored in the street, alley, or other public way, unless in accordance with an approved Traffic Control Plan. BMP’s may be required by El Paso County Engineering if deemed necessary, based on specific conditions and circumstances.

14. Vehicle tracking of soils and construction debris off-site shall be minimized. Materials tracked offsite shall be cleaned up and properly disposed of immediately.

15. Contractor shall be responsible for the removal of all wastes from the construction site for disposal in accordance with local and State regulatory requirements. No construction debris, tree slash, building material wastes or unused building materials shall be buried, dumped, or discharged at the site.

16. The owner, site developer, contractor, and/or their authorized agents shall be responsible for the removal of all construction debris, dirt, trash, rock, sediment, and sand that may accumulate in the storm sewer or other drainage conveyance system and stormwater appurtenances as a result of site development.

17. The quantity of materials stored on the project site shall be limited, as much as practical, to that quantity required to perform the work in an orderly sequence. All materials stored on-site shall be stored in a neat, orderly manner, in their original containers, with original manufacturer’s labels.

18. No chemicals are to be used by the contractor, which have the potential to be released in stormwater unless permission for the use of a specific chemical is granted in writing by the ECM Administrator. In granting the use of such chemicals, special conditions and monitoring may be required.

19. Bulk storage structures for petroleum products and other chemicals shall have adequate protection so as to contain all spills and prevent any spilled material from entering State Waters, including any surface or subsurface storm drainage system or facilities.

20. No person shall cause the impediment of stormwater flow in the flow line of the curb and gutter or in the ditchline.
21. Individuals shall comply with the “Colorado Water Quality Control Act” (Title 25, Article 8, CRS), and the “Clean Water Act” (33 USC 1344), in addition to the requirements included in the DCM Volume II and the ECM Appendix I. All appropriate permits must be obtained by the contractor prior to construction (NPDES, Floodplain, 404, fugitive dust, etc.). In the event of conflicts between these requirements and laws, rules, or regulations of other Federal, State, or County agencies, the more restrictive laws, rules, or regulations shall apply.

22. All construction traffic must enter/exit the site at approved construction access points.

23. Prior to actual construction the permittee shall verify the location of existing utilities.

24. A water source shall be available on site during earthwork operations and utilized as required to minimize dust from earthwork equipment and wind.

25. The soils report for this site has been prepared by __________ and shall be considered a part of these plans.

26. At least ten days prior to the anticipated start of construction, for projects that will disturb 1 acre or more, the owner or operator of construction activity shall submit a permit application for stormwater discharge to the Colorado Department of Public Health and Environment, Water Quality Division. The application contains certification of completion of a stormwater management plan (SWMP), of which this grading and erosion control plan may be a part. For information or application materials contact:

Colorado Department of Public Health and Environment
Water Quality Control Division
WQCD – Permits
4300 Cherry Creek Drive South
Denver, CO 80246-1530
Attn: Permits Unit
APPENDIX F   STANDARD DRAWINGS

Note: Drawings are listed by chapter and then sequential (intentional gaps in the numbering have been placed to allow for future additions). These Standard Drawings remain products in progress and will continue to be updated as necessary through an administrative process. Only those with listed Approval Dates shall be considered a standard and all others are presented for "reference" purposes only until such date that they are fully accepted by the ECM Administrator.
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<thead>
<tr>
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<th>Detail/Description</th>
<th>Approval Date</th>
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<td>Lug Connection Detail (cast in place concrete pipe)</td>
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<td>Plan and Section of an Extended Detention Basin Sedimentation Facility</td>
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<td>Typical WQCV Outlet Structure Profiles Including 100-Year Detention</td>
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SCALE: NOT TO SCALE

Design Vehicle: WB-60
Max ADT: 20,000
Paved: 55 mph
Design Speed: 40 mph

Roadway Design Parameters

Point of Slope

Selction (Typ)
Scale: Not to Scale

Design Vehicle: WB-67
Maximum ADT: 20,000
Pedestrian Speed: 35 mph
Design Speed: 40 mph

Roadway Design Parameters

Symmetrical About Centerline
Scale: Not to Scale

Design Vehicle: WB-67
Maximum ADT: 4,000
Project Speed: 45 mph
Design Speed: 60 mph

Roadway Design Parameters

Symmetrical About Centerline
Urban Expressway
Standard Cross Section
4-Lane Roadway

Roadway Design Parameters
- Design Speed: 60 mph
- Posted Speed: 55 mph
- Maximum ADT: 48,000
- Design Vehicle: WB-67

Symmetrical About Centerline
Roadway Design Parameters

- Design Speed: 60 mph
- Posted Speed: 55 mph
- Maximum ADT: By Design

Design Vehicle: WB-67

Point of Slope (Typ)
Roadway Design Parameters:
- Design Speed: 50 mph
- Posted Speed: 45 mph
- Maximum ADT: 199
- Design Vehicle: WB-50

Rural Gravel Local Roadway

P.O.C. Selection (Typ)
SCALE: NOT TO SCALE

Design Vehicle: WB-67
Maximum ADT: 3,000
Posted Speed: 45 mph
Design Speed: 50 mph

Roadway Design Parameters

Point of Slope (Typ)

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Standard Cross Section
Arterial Roadway
Rural Principal 6-Lane

Design Vehicle: WB-67
Maximum ADT: 40,000
Design Speed: 65 mph

Roadway Design Parameters

Symmetrical About Centerline

Scale: Not to Scale
Scale: Not to Scale

Design Vehicle: WB-6T
Max Adt: 8000
Post Speed: 65 mph
Design Speed: 40 mph
Roadway Design Parameters

Symmetrical About Centerline
EPC TYPE A
(REVERSE SLOPE OF PAN FOR SPILL CURB)

EPC TYPE B

EPC TYPE C
(REVERSE SLOPE OF PAN FOR SPILL CURB)

EPC OPTIONAL TYPE C

EPC TYPE D
(6" RAMP CURB)

EPC TYPE E
(6" RAMP CURB)

Legend for radii:
A 1/8" to 1/4"
B 1-1/2"
C 1-1/2" to 2"

Note:
—at gutter cross slopes shall be 1/2 in./ft. when draining away from curb and 1 in./ft. when draining toward curb.

Scale: Not to scale
NOTES:

A) The median paving shall be constructed with 4 inch thick, integrally colored concrete, embossed with a running bond 4” x 8” brick pattern as shown.

B) Install 1/2” x 4” expansion material at median noses, fixed objects, and at transverse joints at 50 ft. intervals (maximum) along the median.

C) The color additive shall be an approved commercially pure or synthetic mineral pigment, factory formulated and packaged in cubic yard dosage increments. The mixture shall be "Chromix" as manufactured by L.M. Scofield Company, "Davis Colors" as manufactured by Davis Color Company, Pigment No. 678, 5 lbs/sack, or an approved equal.

D) Patterned concrete to be colored L.M. Scofield Company "Santa Barbara Brown, C-35", Davis Color Company, Pigment No. 678, 5 lbs/sack, or an approved equal.

E) The Matching curing compound shall be a blend of waxes and pigments in a solvent emulsion base and conform to the requirements of ASTM C-309. The curing compound shall be "Lithocrome Colorwax" as manufactured by L.M. Scofield Company, Davis Color- Seal, as manufactured by Davis Color Company, or approved equal.

F) The concrete mix design shall conform to the requirements of the color admixture manufacturer and shall meet CDOT Class B concrete requirements, unless otherwise approved.

G) For weed control prior to median paving, apply a pre- emergent herbicide to median subgrade area per manufacturer's specifications for paving under Barrier 50 label (pbi Gordon). Trifluralin is labeled for use under asphalt under the Treflan 4EC label (Elanco).

SCALE: NOT TO SCALE
PLOWABLE END SECTION DETAIL

SECTION A–A

SECTION B–B

NOTES:
1. MEDIAN NOSE CONCRETE AND CURB & GUTTER SHALL BE PLACED MONOLITHIC WITH NON-COLORED CONCRETE REINFORCED #4 REBAR AT 18" E.W.
2. MEDIANS GREATER THAN 10' WIDE (BOC TO BOC) DO NOT REQUIRE MEDIAN NOSE.

SCALE: NOT TO SCALE

1/12/16
André P. Brackin
DEPARTMENT OF TRANSPORTATION

PLOWABLE Median Nose Detail
Standard Drawing

REVISION DATE: 1/12/16
FILE NAME: SD_2-22
6" RESIDENTIAL
8" MULTI-FAMILY
AND COMMERCIAL

EXPANSION JOINT MATERIAL
REQUIRED. IF CONCRETE DRIVE
IS USE BEHIND CURB CUT.

CROSS SECTION

CURB CUT WIDTH

FRONT VIEW

SCALE: NOT TO SCALE

8/11/11

Driveway Cut Detail
Standard Drawing

André P. Brackin
DEPARTMENT OF TRANSPORTATION

DATE APPROVED:

FILE NAME:
SD_2-23
NOTES

1. W – WIDTH SHALL BE 6’ FOR LOCAL, 8’ FOR COLLECTORS, AND 10’ FOR ARTERIAL ROADS.

2. T – SQUARED-OFF RETURN TO BE POURED MONOLITHICALLY, 8” PCC FOR LOCAL ROADS, 9” FOR COLLECTORS WITH 6x6 – 4.4 W.W.F. OR #4 REINFORCING BAR @ 18” EACH WAY.

3. = 3” MINIMUM ASPHALT DEPTH (2 LIFTS).

4. DESIGN TO SPECIFY ELEVATIONS AT PI AND PCR.

SCALE: NOT TO SCALE
W = SAME WIDTH AS THE APPROACHING SIDEWALK, BUT NOT LESS THAN 4.0 FEET

PEDESTRIAN RAMP NOTES

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE CURRENT ENGINEERING CRITERIA MANUAL AND ADA REQUIREMENTS.

2. CONTRACTOR TO NOTIFY ENGINEERING DIVISION INSPECTION STAFF 48 HOURS PRIOR TO CONCRETE PLACEMENT.

3. PEDESTRIAN RAMP CONSTRUCTION SHALL BE A MINIMUM 4,500 PSI CONCRETE, MINIMUM 4" THICK, NON-COLORED, NON-SCORED, COARSE BROOM FINISH.

4. RAMP LOCATION AND LENGTH MAY REQUIRE MODIFICATION TO MAINTAIN THE 12:1 MAXIMUM RUNNING RAMP SLOPE AND 20:1 DETECTABLE WARNING AREA DUE TO STREET INTERSECTION GRADES AND/OR ALIGNMENTS.

5. DETECTABLE WARNING AREA SHALL START A MINIMUM OF 6" BUT NOT MORE THAN 8" FROM THE FLOWLINE OF THE CURB AT ANY POINT.

6. DETECTABLE WARNING AREA SHALL BE PREFABRICATED, REDDISH INTEGRALLY COLORED, TRUNCATED—DOME, PAVERS. THERMOPLASTIC TRUNCATED DOMES WILL NOT BE ACCEPTED.

7. THE DETECTABLE WARNING AREA SHALL BE 24" IN LENGTH AND THE FULL WIDTH OF THE RAMP.

8. RAMP WIDTH REQUIRED IS SAME AS APPROACHING SIDEWALK; 4" MINIMUM.

9. ALL RAMPS WILL BE PERPENDICULAR TO TRAFFIC WITH THE EXCEPTION OF MID-BLOCK OR TERMINAL RAMPS WHICH MAY BE PARALLEL SUBJECT TO APPROVAL.

10. AVOID PLACING DRAINAGE STRUCTURES, TRAFFIC SIGNAL/SIGNAGE, UTILITIES/JUNCTION BOXES, OR OTHER OBSTRUCTIONS WITHIN PROPOSED RAMP AREAS.

GENERAL NOTES

1. WHERE THE 1"-6" FLARED SIDE(S) OF A PERPENDICULAR CURB RAMP IS (ARE) CONTIGUOUS WITH A PEDESTRIAN OR HARD SURFACE AREA, THE MAXIMUM FLARE SLOPE SHALL NOT EXCEED 10:1.

2. PEDESTRIAN WALKWAY AND/OR LOCATION OF EXISTING OR FUTURE PEDESTRIAN RAMPS ON OPPOSITE CORNERS SHALL BE REVIEWED BEFORE CONSTRUCTING NEW RAMPS.


7/9/09
DATE APPROVED:
André P. Brackin
DEPARTMENT OF TRANSPORTATION

Pedestrian Intersection Ramp
Standard Drawing
TRUNCATED DOME DETAILS

DOME SPACING

THE TOP DIAMETER OF THE TRUNCATED DOMES SHALL BE 50%–60% OF THE BASE DIAMETER

1.6” MIN – 2.5” MAX (EQUAL BOTH DIRECTIONS)

0.2"

0.9”–1.4”

ELEVATION VIEW

DETECTABLE WARNING WELL AND CURB AREA

GUTTER

3’–1” FOR 12:1 RAMP

4’–6” FOR 12:1 RAMP

CURB TRANSITION

WING

12:1

SIDEWALK WING TRANSITION

20:1

DOMES

1” SAND FOUNDATION (TYP.)

PAVERS

DETECTABLE WARNING WELL

PAID FOR AS CURB AND GUTTER

PAID FOR AS CONCRETE CURB RAMP TO BE Poured MONOLITHICALLY

SIDE CROSS SECTION VIEW OF DETECTABLE WARNING, WELL, CURB AND GUTTER

P.J. = PERMISSIBLE JOINT WITH EPOXY-COATED DEFORMED NO. 4 BARS CONFORMING TO AASHTO M 284 AT 18 IN. SPACING

1/1/08

Truncated Dome Details

Standard Drawing

DATE APPROVED:
John A. McCarty
DEPARTMENT OF TRANSPORTATION

REVISION DATE: 11/25/15
FILE NAME: SD_2–42
RAIL HEIGHT (IN.) | 32"
TEST VEHICLE (LB.) | 1900–CAR  | 4660 – CAR  | 20,000–BUS
IMPACT SPEED (MPH) | 60        | 60          | 57
IMPACT ANGLE (DEGREES) | 18.8      | 25.0        | 14.8

FROM AASHTO ROADWAY GUIDELINE

SCALE: NOT TO SCALE
### Elevation of Traffic Rail

#### Section

<table>
<thead>
<tr>
<th>RAIL HEIGHT (IN.)</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST VEHICLE (LB.)</td>
<td>1980# CAR</td>
</tr>
<tr>
<td>IMPACT SPEED (MPH)</td>
<td>59</td>
</tr>
<tr>
<td>IMPACT ANGLE (DEGREES)</td>
<td>18.9</td>
</tr>
</tbody>
</table>

**FROM AASHTO ROADWAY GUIDELINE**

**SCALE: NOT TO SCALE**

---

**DATE APPROVED:** 8/11/11

**André P. Brackin**

**DEPARTMENT OF TRANSPORTATION**

**Oklahoma TR-1**

**Bridge Railing**

**Standard Drawing**

**REVISION DATE:** 11/10/04

**FILE NAME:** SD_2-71
<table>
<thead>
<tr>
<th>RAIL HEIGHT (IN.)</th>
<th>39</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST VEHICLE (LB.)</td>
<td>1900–CAR</td>
</tr>
<tr>
<td>IMPACT SPEED (MPH)</td>
<td>61</td>
</tr>
<tr>
<td>IMPACT ANGLE (DEGREES)</td>
<td>19.3</td>
</tr>
</tbody>
</table>

FROM AASHTO ROADWAY GUIDELINE

SCALE: NOT TO SCALE
RAIL HEIGHT (IN.) | 50
TEST VEHICLE (LB.) | 80,150 – TRUCK
IMPACT SPEED (MPH) | 48
IMPACT ANGLE (DEGREES) | 14.5

FROM AASHTO ROADWAY GUIDELINE

SCALE: NOT TO SCALE
<table>
<thead>
<tr>
<th><strong>RAIL HEIGHT (IN.)</strong></th>
<th><strong>90</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEST VEHICLE (LB.)</strong></td>
<td><strong>80,190 – TANK TYPE TRACTOR–TRAILER</strong></td>
</tr>
<tr>
<td><strong>IMPACT SPEED (MPH)</strong></td>
<td><strong>52</strong></td>
</tr>
<tr>
<td><strong>IMPACT ANGLE (DEGREES)</strong></td>
<td><strong>15.0</strong></td>
</tr>
</tbody>
</table>

FROM AASHTO ROADWAY GUIDELINE

SCALE: NOT TO SCALE

8/11/11
DATE APPROVED:

André P. Brackin
DEPARTMENT OF TRANSPORTATION

Texas Type TT
Bridge Railing
Standard Drawing

REVISION DATE: 11/10/04
FILE NAME: SD_2–74
NOTE:
FOR RURAL INSTALLATIONS WHERE THERE IS A SIGNIFICANT DITCH REQUIRED AROUND THE OUTSIDE OF THE CUL-DE-SAC, AN ADDITIONAL EASEMENT IS REQUIRED ON THE PLAT TO ACCOMODATE THE DITCH AND SLOPES FOR MAINTANENCE.

SCALE: 1"=50'

1/1/08

DATE APPROVED:

John A. McCarty
DEPARTMENT OF TRANSPORTATION

Rural Cul-De-Sac Details
Standard Drawing

12/8/15
FILE NAME: SD_2-76
URBAN LOCAL KNUCKLE DETAILS

<table>
<thead>
<tr>
<th>R/W</th>
<th>50'</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>30' (EOA)</td>
</tr>
<tr>
<td>R_1</td>
<td>27'</td>
</tr>
<tr>
<td>R_2</td>
<td>37'</td>
</tr>
<tr>
<td>R_3</td>
<td>50'</td>
</tr>
<tr>
<td>R_4</td>
<td>60'</td>
</tr>
<tr>
<td>SDT</td>
<td>40'</td>
</tr>
</tbody>
</table>

SDT = SIGHT DISTANCE TRIANGLE
DESIGN SPEED = 25 MPH
URBAN LOCAL LOW–VOLUME KNUCKLE DETAILS

R/W | 50'
---|---
W  | 24' (EOA)
R₁ | 27'
R₂ | 40'
R₃ | 47'
R₄ | 60'
SDT| 40'

SIGHT DISTANCE TRIANGLE
DESIGN SPEED = 20 MPH
Scale: Not to Scale

Channel details:
- Channel depth: SD 2 to 3 for typical
- Floor shall be shaped and leveled towards the outlet
- Adjacent slope shall be

Floor:
- Max. 1.5 above
- Less than 0.5 below
- Lowest step shall be

Particulars:
- As shown
- Details shown are

Notes:
- 60 and larger
- 4-10
- 6-9
- 6-4
- Pipe ID
1. TYPE II MANHOLES SHALL BE USED WHEN APPROPRIATE AND TYPICALLY WHEN THE PIPE SIZES ARE 30" OR LESS INSIDE DIAMETER.

2. VIEW AND DETAILS ARE TYPICAL. DESIGN ENGINEER SHALL DETERMINE MANHOLE BASE CONFIGURATION AND DIMENSIONS FOR PARTICULAR PIPE SIZES AND ALIGNMENT.

3. EITHER LADDER OF STEPS SHALL BE INSTALLED WHEN MANHOLE DEPTH EXCEEDS 30". STEPS IN BASE SHALL BE INSTALLED IN "TOE POCKETS" (SEE DETAIL THIS SHEET). LOWEST STEP SHALL BE A MAXIMUM OF 16" ABOVE THE FLOOR.

4. PIPES SHALL BE TRIMMED TO FINAL SHAPE AND SET BEFORE MANHOLE IS POURED.

5. BENCH SHALL BE SLOPED TOWARD CENTER OF MANHOLE BASE (4:1 MAX., ⅜" PER FOOT. MIN.).

6. FLOOR OF MANHOLE SHALL BE TROWELLED TO A SMOOTH, HARD SURFACE AND SHALL SLOPE TOWARDS THE OUTLET (8:1., ⅛" PER FT. MIN.) . FLOOR SHALL BE SHAPE AND CHANNELED; SEE DETAILS THIS SHEET.

Scale: Not to Scale
Scale: Not to Scale

NOTE

Pipe 1d

Welded

Pipe 1d

For Details

Plan View

See Sheet 4

For Details

Section View

Shop Welded

1. Slope is Flat and Continuous
2. No Change in Pipe Material
3. No Change in Pipe Size
4. Pipe is 48" or Larger Inside Diameter

Following Conditions are Met:

1. Type III Manholes shall be used when

Applicable and Intended When The

Appropriate Type III Manholes shall be fabricated and

Delivered to the Site as a Single Unit. By The Manufacturer/Supplier.

2. Type III Manholes shall be fabricated and

Delivered Above the Inlet of the

Installation. Lowest Step shall be a

3" either Ladder or Steps shall be

Maximum of 30" above the Inlet of the

Installation. Lowest Step shall be a

4.0" Cast Riser

FOR DETAILS

See Sheet 4

Special Lid for Use

SLIP COLLAR

FABRICATED FACTORY

12"

4.0"

3"

9"
Storm Sewer Manhole
Details
Standard Drawing

Scale: Not to Scale

DATE APPROVED:
André P. Brackin
DEPARTMENT OF TRANSPORTATION

REVISION DATE: 9/16/10
FILE NAME: SD_3-5
NOTES

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE STANDARD AND SUPPLEMENTAL SPECIFICATIONS APPLICABLE TO THE PROJECT.
2. PRECAST RISERS SHALL CONFORM TO ASTM C478.
3. STEPS SHALL BE INSTALLED WHEN MANHOLE DEPTH EXCEEDS 30". STEPS SHALL BE CAST IRON OR EXTRUDED ALUMINUM, 1000 LB CAPACITY, 12" WIDE WITH NON-SKID GROOVES AND DROP FRONT ON SAFETY NOSES, IN ACCORDANCE WITH APPROVED OSHA REQUIREMENTS.
GRADE TO DRAIN AS SHOWN ON PLAN
1% MIN. OR 2% MIN. FOR HARD SURFACES

BROOK 12"X12" CATCH BASIN WITH STEEL TRAFFIC GATE OR EQUIVALENT

PVC PIPE SIZE PER PLAN 8" MIN.

0'-6" MIN.

FLOWLINE AS SHOWN ON PLAN PRIVATE CONNECTION TO PUBLIC SYSTEM REQUIRES ENCROACHMENT PERMIT

GROUT

1'-0"

3'-0" MIN.

0'-6"

0'-8" MIN.

CONCRETE SUPPORT BLOCK

SCALE: NOT TO SCALE

8/11/11
DATE APPROVED:

André P. Brackin
DEPARTMENT OF TRANSPORTATION

Grate Inlet for Common Areas (guidance)
Standard Drawing

11/10/04
REVISION DATE:

SD_3-8
FILE NAME:
NOTES
1. SURFACE TREATMENT OF DRIVEWAY TO MATCH SURFACE TREATMENT OF ROAD WITHIN THE ROW.

2. DRAIN PIPE TO BE 18” DIAMETER CMP MINIMUM.

3. PIPE SLOPE TO BE CONSISTENT WITH FLOWLINE OF DITCH, MINIMUM OF 1% PREFERRED.

4. ALL DRIVEWAYS SHALL HAVE A 4 PERCENT CROWN.

5. WHEN SLOPING TOWARDS ROAD, DRIVEWAYS SHALL HAVE A MAXIMUM GRADE OF 4 PERCENT FOR A MINIMUM OF 20 FEET WHERE THE SITE ALLOWS.

SCALE: NOT TO SCALE
MATCH FINISHED GRADE

SLOPE APRON 2% MIN

FINISH GRADE

6" 2" 3" 2'

30° BEVEL

B

GUTTER

SECTION

PROVIDE POSITIVE DRAINAGE TO CONCRETE INLET APRON (TYP.)

520-C-2500 CONCRETE

LEVEL E PER PLAN

NOTE: MAINTAIN FLOW TO UNDERGROUND PIPES

4" THICK CONCRETE INLET APRON W/ 6" DEEP 4" WIDE CUTOFF WALL AROUND PERIMETER. APRON & CUTOFF WALL REINFORCED W/ 1 1/2"x1 1/2" 17 GAGE STUCCO NETTING

(4) 4" SCH-80 PVC PIPES (CONTINUOUS LENGTHS)

FLOW

C

GUTTER

STANDARD SIDEWALK

PLAN

SECTION B-B

520-C-2500 CONCRETE

SECTION C-C

PIPE TO BE FINISHED FLUSH W/ CURB FACE

TYPE G CURB & GUTTER

SCALE: NOT TO SCALE

8/11/11

DATE APPROVED:

André P. Brackin
DEPARTMENT OF TRANSPORTATION

Sidewalk Underdrain With Curb Outlet Detail
Standard Drawing

REVISED DATE:

FILE NAME:

11/10/04

SD_3–24
EXTEND UPPER BAR 18" INTO CURB HEAD. EXTEND LOWER BARS 18" INTO GUTTER SECTION.

SIDEWALK

VARIES

18"

8"

1"

RADIUS

FACE OF CURB

PLAN VIEW

OUTLET TREATMENT SUBJECT TO DETAIL DESIGN.

L

2.0%

1"

VERT. C&G

6"

2' MIN

GALVANIZED, NON-SLIP, RAISED PATTERN, 3/8" STEEL

SECTION A-A FLOW FROM GUTTER

GALVANIZED, NON-SLIP, RAISED PATTERN, 3/8" STEEL

SLOPE VARIES

CUT-OFF WALL MAY BE DELETED IF UPSTREAM OR DOWNSTREAM AREA IS HARD SURFACED

CUT-OFF WALL CAST AGAINST UNDISTURBED EARTH.

SECTION A-A FLOW TO GUTTER

SCALE: NOT TO SCALE

8/11/11

DATE APPROVED:

André P. Brackin

DEPARTMENT OF TRANSPORTATION

Curb Opening with Drainage Chase Detail 1 of 2

Standard Drawing

12/8/15

FILE NAME:

SD_3-25
1" X 3/4" STEEL SUPPORT BARS WELDED TO BOTTOM OF 3/8" STEEL FLOOR PLATE. (1" DIMENSION TO BE VERTICAL)

W
BY DESIGN

8"
(VARIES IF FLOW FROM GUTTER)

2-NO 3 REBAR (BOTH SIDES)

3" CLEAR (TYP)

6" TYP

½" EXP JOINT

SUBRADE COMPACTED TO MIN 95% ASTM
D-698 = 2% OR 90% ASTM
D-1557 = 2%

SECTION B-B

3' MIN

EXTEND CHASE REBAR 18" INTO CUT-OFF WALL AS SHOWN

SECTION C-C

SCALE: NOT TO SCALE

8/11/11
DATE APPROVED:

André P. Brackin
DEPARTMENT OF TRANSPORTATION

Curb Opening with Drainage Chase Detail 2 of 2
Standard Drawing

REVISION DATE: 11/10/04
FILE NAME: SD_3-25A
CONCRETE ANCHOR BLOCK REINFORCE W/ 6"x6" (10 GA) WIRE MESH.

3/4" GRAVEL MOUND AROUND PIPE (1.5' HIGH)

CMP RISER (12 GA.), DIA PER PLANS. CUT 4 (24" DIA RISER) OR 5 (30" DIA RISER) 1/4x 10" HORIZONTAL SLOTS EQUALLY SPACED AROUND CIRCUMFERENCE. FIRST ROW TO BE 4" BELOW UNIVERSAL BAND COUPLER. SECOND ROW TO BE STAGGERED AT 5 1/3" BELOW FIRST ROW. CONTINUED STAGGERED ROWS UNTIL 12" ABOVE SOFFET OF PVC PIPE

SCALE: NOT TO SCALE
PLAN

NOTE: ALL BAGS TO BE SAND FILLED, EXCEPT THOSE AT WEIR LOCATION TO BE GRAVEL FILLED

WEIR ELEVATION

SCALE: NOT TO SCALE

8/11/11

Temporary Desilting Basin At Inlet
Standard Drawing

André P. Brackin
DEPARTMENT OF TRANSPORTATION

11/10/04
SD_3–31
NOTE: FOR SUMP INLET @ A CUL-DE-SAC, PROVIDE A SANDBAG STREET DESILTING BASIN (DETAIL SD_3-31) AT THE ENTRANCE TO THE CUL-DE-SAC

SANDBAG PER STREET DESILTING BASIN (DETAIL SD_3-31) ROWS TO BE IMMEDIATELY UPSTREAM OF INLETS

TEMP. DESILTING BASIN @ SUMP
NO SCALE

LEGEND:
GRAVEL FILLED BAG.. ○
SAND FILLED BAG..... ○

SCALE: NOT TO SCALE

8/11/11
DATE APPROVED:

André P. Brackin
DEPARTMENT OF TRANSPORTATION

Temporary Desilting Basin At Sump
Standard Drawing

11/10/04
FILE NAME: SD_3-32
TEMP. STREET DESILTING BASIN ON GRADE
NO SCALE

STREET
GRADE %

INTERVAL
(FT)

0–2
500
2–4
200
4–6
120
6–8
90
8–10
70
10–12
50
12–15
35

LEGEND:
GRAVEL FILLED BAG.  
SAND FILLED BAG....

SCALE: NOT TO SCALE

On Street Temporary Desilting Basin Detail
Standard Drawing

DATE APPROVED:
André P. Brackin
DEPARTMENT OF TRANSPORTATION

REVISION DATE:
11/10/04

FILE NAME:
SD_3−33
4 TOP BARS SAME AS POSTS
SPOT WELD TO END POSTS
BOTH SIDES

SPOTWELD EACH POST
4 PLACES

10 POSTS ~2" PIPE OR
\( \frac{1}{2}" \times 2" \times 3/16" \)
(GALVANIZED)

8" OF 36" CMP

8" BAND COUPLER

SPOTWELD EACH POST
4 PLACES

SCALE: NOT TO SCALE
PLACE DEBRIS CAGE OVER PERFORATIONS
SEE SD_3–35

6 – 2” dia HOLES EQUALLY SPACED
STAGGERED EACH ROW

3/4” AGGREGATE FILTER CONE
1 CUBIC FOOT, 1 FOOT PERIMETER

SLOPE PER PLAN

SCALE: NOT TO SCALE
SLOPE VARIES

CONCRETE DITCH

SEE DETAIL THIS SHEET

SLOPE VARIES

4" THICK P.C.C.
CUTOFF WALL
AT BEGINNING
OF ALL DITCHES

NOTE:
P.C.C. CUTOFF WALL SHALL BE CONSTRUCTED AT THE
BEGINNING OF LINED DITCHES.

ELEVATION AND LOCATION
SHOWN ON PLANS

CONCRETE DITCH
PER DETAIL THIS SHEET.

T.W.

ELEVATION SHOWN
ON PLANS

RETAINING
WALL

F.G.

FINISHED PAD

SCALE: NOT TO SCALE

8/11/11
DATE APPROVED:

André P. Brackin
DEPARTMENT OF TRANSPORTATION

Lined Ditch Behind Retaining
Wall Detail
Standard Drawing

11/10/04
FILE NAME: SD_3-44
FORM CONCRETE BASIN AROUND GRATE. TRANSITION LINED DITCH TO MATCH

ELEV. PER PLAN (T.G.)

SLOPE PER PLAN

3" (TYP.)

12" ROUND BEEHIVE GRATE AND FRAME. NEENAH FOUNDRY CO.

MASONRY RETAINING WALL

CONTINUOS NO. 3 REBAR OVERLAPPED 12" MIN.

6" MIN. (TYP.)

6" MIN. (TYP.)

CONCRETE

TOP OF FOOTING

BACKFILL & TAMP PER SOILS ENGINEERS RECOMMENDATIONS

2–3" PVC PIPES (SIDE BY SIDE) 5" ON CENTER (SCHEDULE 80)

90' ELBOW

CONTINUE 3" PIPES @ 2% ALONG RADIAL LINE TO OUTLET. CONNECTION TO PUBLIC SYSTEM Requires ENCROACHMENT PERMIT.

SCALE: NOT TO SCALE

Beehive Grate Detail (guidance)
Standard Drawings

DATE APPROVED:
8/11/11

André P. Brackin
DEPARTMENT OF TRANSPORTATION

REVISION DATE:
11/10/04

FILE NAME:
SD_3–48
TYPICAL STREET SANDBAGGING DETAIL  
NO SCALE

SECTION A–A  
NO SCALE

TYPICAL SANDBAG DETAIL  
NO SCALE

SECTIONS: NOT TO SCALE

Temporary Street Sandbag Detail and Section Standard Drawing

8/11/11
DATE APPROVED:  Andrés P. Brackin
DEPARTMENT OF TRANSPORTATION

11/10/04
FILE NAME:  SD_3–60
Typical Check Dam Detail

SAND IN BURLAP BAGS ONLY

GRANITE IN BURLAP BAGS

3'~ LEAVE OUT TWO BAGS TO FORM WEIR

SCALE: NOT TO SCALE

8/11/11

DATE APPROVED:

André P. Brackin
DEPARTMENT OF TRANSPORTATION

Typical Check Dam Detail

Standard Drawing

REVISED DATE:

11/10/04

FILE NAME:

SD_3-62
Subdrain Installation - Subdrain installation shall conform to requirements presented in the ECM.

1. Subdrain Type - Subdrain type shall conform to requirements presented in the ECM.

NOTES

SCALE: NOT TO SCALE
NOTE:

1. THE COMPRESSIVE STRENGTH OF CONCRETE MUST BE 4,000 PSI AT 28 DAYS OR BETTER.

2. MAXIMUM SLUMP SHALL BE 2".

3. TRENCH SIDES MUST STAND VERTICAL FROM THE BOTTOM OF THE TRENCH TO TWO FEET ABOVE THE TOP OF PIPE.

4. FULL TIME INSPECTION MUST BE PROVIDED TO ASSURE FULL COMPLIANCE.

5. 95% RELATIVE COMPACTION SHALL BE ACHIEVED AND VERIFIED IN THE PIPE CONTACT SUPPORT AREA OF THE TRENCH.
**BASIN PLAN**

- **PRESEDIMENTATION FOREBAY**
- **SIDE SLOPES 3:1**
- **PIPE**
- **TOP STAGE w/ 2% SLOPE FLOOR DRAINAGE**
- **LOW FLOW CHANNEL**
- **MAINTENANCE ACCESS**
- **BOTTOM STAGE**
- **OUTLET w/ TRASH RACK**
- **EMBANKMENT**
- **ACCESS TO OUTLET**
- **EMBANKMENT SIDE SLOPE NO STEEPER THAN 3:1**
- **SPILLWAY**

**WATER QUALITY CAPTURE VOLUME LEVEL (INCLUDING 20% ADDITIONAL VOLUME FOR SEDIMENT STORAGE)**

- **FREQUENT RUNOFF POOL 10% to 20% of WQCV**
- **PRESEDIMENTATION FOREBAY**
- **SECONDARY BERM**
- **TOP OF LOW FLOW CHANNEL**
- **INVERT OF LOW FLOW CHANNEL**
- **SIZE OUTLET & DRAIN FOREBAY VOLUME IN 1 HR.**

**EMERGENCY SPILLWAY FLOOD LEVEL @ SPILLWAY CREST** (E.G. 100-YR, SPF, PMF, ETC.)

- **SPILLWAY CREST**
- **EMBANKMENT**
- **OUTFLOW**
- **CUTOFF COLLAR OUTLET WORKS (SEE STANDARD DRAWING SD_3-83)**

---

**BASIN SECTION**

*COULD BE IMPACT BASIN, GSB DROP, CONCRETE RUNDOWN, OTHER HARDENED RUNDOWN*

---

1/1/08

**Plan & Section of an Extended Detention Basin Sedimentation Facility**

**Standard Drawing**

**DATE APPROVED:**

John A. McCarty

**DEPARTMENT OF TRANSPORTATION**

**REVISION DATE:** 7/16/07

**FILE NAME:** SD_3-82
NOTE: SIZE 5-YR. THROUGH 100-YR. OVERFLOW TRASH RACKS WITH THE AID OF FIGURE 7*

100-YR OR LARGER WATER SURFACE

WQCV WATER SURFACE

ORIFICE PLATE (SEE FIGURE 4*)

3 or 4
1

PERMANENT WATER SURFACE

TRASH RACK (SEE FIGURE 6*)

100-YR ORIFICE CONTROL OUTLET

OUTLET PIPE = 120% of 100-YR CAPACITY

UNDERDRAIN AROUND MICRO-POOL (OPTIONAL)

DROP BOX OUTLET OPTION

OVERFLOW AND EMERGENCY SPILLWAY

OVERTOPPING PROTECTION

100-YR OR LARGER WATER SURFACE

WQCV WATER SURFACE

ORIFICE PLATE (SEE FIGURE 4*)

3 or 4
1

PERMANENT WATER SURFACE

TRASH RACK (SEE FIGURE 6*)

10-YR ORIFICE CONTROL OUTLET

OUTLET PIPE = 120% of 10-YR CAPACITY

UNDERDRAIN AROUND MICRO-POOL (OPTIONAL)

OVERTOPPING SPILLWAY OPTION

*FIGURES 4, 6 and 7 ARE IN THE CITY OF COLORADO SPRINGS ENGINEERING DIVISION'S DRAINAGE CRITERIA MANUAL, VOLUME 2.

1/1/08  Typical WQCV Outlet Structure Profiles Including 100-Year Detention
John A. McCarty  Standard Drawing
DEPARTMENT OF TRANSPORTATION

DATE APPROVED:  REVISION DATE:  FILE NAME:
7/16/07  SD_3-83
NOTES:
1. SIGN MATERIAL, EXCAVATION, AND RESTORATION ARE INCLUDED IN THE COST OF THE CONCRETE WASHOUT STRUCTURE.
2. EROSION BAILS MAY BE USED AS AN ALTERNATIVE FOR THE BERM.
REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE HALF OF EXPOSED LOG HEIGHT. INSPECTIONS SHALL BE PERFORMED FREQUENTLY FOR PROPER FUNCTION.

EROSION LOGS SHOULD BE KEYED IN TO PREVENT UNDER-CUTTING.

PLAN VIEW

POINTS A SHALL BE HIGHER THAN POINT B

ELEVATION

EROSION LOG DETAIL DITCH INSTALLATION

NOTE: EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS.
NOTE:
Ø REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE HALF OF EXPOSED LOG HEIGHT. INSPECTIONS SHALL BE PERFORMED FREQUENTLY FOR PROPER FUNCTION.

SECTION A—A

EROSION LOGS SHOULD BE KEYED INTO PREVENT UNDER-CUTTING

EROSION PROTECTION ABOVE CULVERT OUTLETS IS SIMILAR

STAKES APPROXIMATELY 90° FROM EACH OTHER

Ø

EROSION LOG BURY IN SOIL
¼ to ñ LOG DIA

FLOW

PLAN VIEW

POINT TO TIE IN ADDITIONAL INLET PROTECTION

FLOW

EROSION LOG STAKED INTO FILL SLOPE

POINT TO TIE IN ADDITIONAL INLET PROTECTION
SECTION A—A
EROSION LOG APPLICATION

EROSION LOG

STAKES APPROXIMATELY 90° FROM EACH OTHER

WETLANDS OR FEATURES REQUIRING PROTECTION

NOTES:
Ø REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE HALF OF EXPOSED LOG HEIGHT. INSPECTIONS SHALL BE PERFORMED FREQUENTLY FOR PROPER FUNCTION.

EROSION LOGS SHOULD BE KEYED IN TO PREVENT UNDER-CUTTING

WHEN MORE THAN ONE EROSION LOG IS NEEDED, ENDS MUST BE TIGHTLY ABUTTED.

USE TWO WOOD STAKES 1½” x 1½” (NOMINAL) x SUFFICIENT LENGTH TO BE EMBEDDED AT LEAST 4” INTO THE SOIL AT ALL EROSION LOG ENDS OR JOINTS

USE A STAKE EVERY 24” AND CONTINUE ALTERNATE ORIENTATION THROUGHOUT THE LENGTH OF THE EROSION LOG

EROSION LOG

TYPICAL STAKE INSTALLATION

EROSION LOGS CAN ALSO BE USED ACROSS LONG SLOPES TO REDUCE EROSION AND SEDIMENT MOVEMENT

1/1/08
Erosion Log Barrier
Standard Drawing

John A. McCarty
DEPARTMENT OF TRANSPORTATION

REVISION DATE: 7/17/07
FILE NAME: SD_3-87
CROSS SECTION CUT BACK SWALE

SLOPE SHOULD NOT EXCEED 3H:1V SLOPE

LOT SLOPE - S (%)  SHEET FLOW

SLOPE SHOULD NOT EXCEED 3H:1V SLOPE

SWALE FLOWLINE

SURFACE ROUGHEN SLOPE

SEDIMENT ACCUMULATION

~H*

5" S

SWALE FLOWLINE

CURB & GUTTER SD-2-20

ATTACHED OR DETACHED SIDEWALK

COMPACTED 'CUT BACK SWALE'

LOT SLOPE = S (%)  DEPTH OF SWALE = H (IN.)

<table>
<thead>
<tr>
<th>Lot Slope - S (%)</th>
<th>Depth of Swale - H (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>5</td>
</tr>
<tr>
<td>5-10</td>
<td>10</td>
</tr>
<tr>
<td>10-20</td>
<td>20</td>
</tr>
<tr>
<td>20-33</td>
<td>33</td>
</tr>
</tbody>
</table>

CHECK DAM SPACING DETAIL

A = B IN ELEVATION
SPACING IS DEPENDENT ON SWALE SLOPE

- CHECK DAM CONSISTING OF CURB SOCK OR WATTLE
- INSTALL CHECKS DAMS AT DOWNSLOPE LOT LINE(S) AND AS THE SPACING DETAIL DICTATES.
- ADDITIONAL CHECK DAMS MAY BE REQUIRED TO PREVENT CONCENTRATED FLOWS LEAVING SITE.

DESCRIPTION AND PURPOSE
- A TEMPORARY SEDIMENT BARRIER BEHIND CURB OR SIDEWALK
  DESIGNED TO RETAIN SEDIMENT ON LOT DURING SITE DEVELOPMENT.

SUITABLE APPLICATIONS
- DURING LAND DEVELOPMENT AFTER PAVING OR VERTICAL CONSTRUCTION.
- USE SURFACE ROUGHENING ON UPGRADE SLOPES.
- USE IN CONJUNCTION WITH DOWNSLOPE CURB INLET PROTECTION AS BACK-UP BMP.

LIMITATIONS
- NOT FOR USE WITH DISTURBED AREAS OF ONE (1) ACRE OR GREATER.
- NOT FOR USE EXCEEDING 3H:1V SLOPES.
- NOT FOR USE FOR CONCENTRATED FLOW AREAS.
- IF THESE LIMITATIONS ARE NOT MET, A SITE SPECIFIC DESIGN IS NECESSARY.

INSPECTION AND MAINTENANCE
- INSPECT IN ACCORDANCE WITH SITE SWMP.
- REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES 1/3 SWALE DEPTH (H/3).
- DO NOT ALLOW SEDIMENT TO OVERFLOW ONTO CURB OR SIDEWALK.
- IMPLEMENT ADDITIONAL BMP CONTROLS SUCH AS DOWNSLOPE SEDIMENT CONTROL WATTLEs, CURB CHECKS, OR OTHER BARRIERS AS ON-SITE CONDITIONS REQUIRE.
- PROLONGED STANDING WATER IN PROXIMITY TO PAVEMENT MAY AFFECT SUB-BASE OF PAVING AND COULD CAUSE SOIL TO SETTLE AND POTENTIALLY DAMAGE CONCRETE.

SCALE: NOT TO SCALE

4/13/16
DATE APPROVED:

El Paso County Engineer
DEPARTMENT OF TRANSPORTATION

Cut Back Swale (TYP.)
Standard Drawing

7/20/16
FILE NAME: SD_3-88
Scale: Not to Scale

- **Sanitary Sewer** (SS)
- **Water** (W)
- **Gas** (G)
- **Storm sewer** (ST)
- **Cable Television** (Tel)
- **Underground Power** (UP)

**Legend**

NOTES:

1. Minimum cover and separation for fireceptors, storm sanitary sewer, water, gas power and non-fiberoptics.

2. See plans for utility cover requirements.

3. May be placed either side of centerline in residential areas. Power, telephone and cable TV may share the same trench.

4. Typical horizontal separation shall be at 5 ft. from other utilities.
Utility Placement Cross Section
Collector Roadway
Urban NonResidential

Scale: Not to Scale

1. Minimum cover and separation for fiberoptics, storm, sanitary sewer, water, gas, power and non-fiberoptics.
2. See plans for utility cover requirements.
3. May be placed either side of centerline in residential plans. Power, telephone and cable TV may share the same trench.
4. Typical horizontal separation shall be at 5 ft. from other utilities and minimum 4 ft. from the median.

Notes:

Legend:

- W: Water
- S: Sanitary Sewer
- G: Gas
- ST: Storm Sewer
- Tel: Telephone
- UP: Underground Power

Scale:

- 10 ft
- 5 ft
- 3 ft
- 0.5 ft

West and South
East and North
SCALE: NOT TO SCALE

1. MOTION OF TRANSITATION SEPARATION SHALL BE AT 0 FT. FROM OTHER UTILITIES.

2. TELEPHONE AND CABLE TELEVISION SHALL BE IN COMPLIANCE WITH FEDERAL AND STATE REGULATIONS.

3. MAY BE PLACED EITHER SIDE OF CENTERLINE IN RESIDENTIAL PLANTS. POWER, TELEPHONE, AND CABLE TV MAY SHARE THE SAME TRENCH.

4. TYPICAL HORIZONTAL SEPARATION SHALL BE AT 5 FT. FROM OTHER UTILITIES.

NOTES:

1. MINIMUM COVER AND SEPARATION REQUIREMENTS FOR FIBEROPTICS, TELEPHONE, STORM, SANITARY SEWER, WATER, GAS, POWER, AND NON-FIBEROPTICS.

2. SEE PLANS FOR UTILITY COVER REQUIREMENTS.

3. UNDERGROUND POWER

4. TELEPHONE

STORM SEWER

SANITARY SEWER

WATER

GAS

W

ST

SS

ST

CAY

CAY

TEL

UP

UP

W}

LEGEND

WEST AND SOUTH

EAST AND NORTH

20' ROW

20' ROW
Scale: Not to Scale

1. Minimum cover and separation for fiber optics, storm, sanitary sewer, water, gas, power, and non-fiberoptics.
2. See plans for utility cover requirements.
3. Power, telephone, and cable TV may share the same trench.
4. Typical horizontal separation shall be at 5 ft. from other utilities.

NOTE:
- Storm sewer
- Sanitary sewer
- Water
- Gas
- Cable television
- Telephone
- Underground power

Legend:
- SS
- ST
- T
- Tel
- up
SCALE: NOT TO SCALE

LEGEND

SANITARY SEWER
WATER
GAS
STORM SEWER
CABLE TELEVISION
UNDERGROUND POWER

NOTES:
1. Minimum cover and separation for fiberoptics, storm, sanitary sewer, water, gas, power and non-fiberoptics.
2. See plans for utility cover requirements.
3. Power, telephone, and cable to may share the same trench.
4. Typical horizontal separation shall be at 5 ft. from other utilities.
5. 20 ft. utility Placement Cross Section

West/South Bound Lanes
Urban Minor Arterial Roadway

Department of Transportation

Cal Poly Pomona

9/16/10

Prelim

Revised

Andre P. Brochak

8/11/11

Date Approved
NOTES:

1. MINIMUM COVER AND SEPARATION FOR FIBEROPTICS, STORM, SANITARY SEWER, WATER, GAS, POWER AND NON–FIBEROPTICS TELEPHONE AND CABLE TELEVISION SHALL BE IN COMPLIANCE WITH FEDERAL AND STATE REGULATIONS.
2. SEE PLANS FOR UTILITY COVER REQUIREMENTS.
3. POWER, TELEPHONE, AND CABLE TV MAY SHARE THE SAME TRENCH.
4. TYPICAL HORIZONTAL SEPARATION SHALL BE AT LEAST 5 FT. FROM OTHER UTILITIES.
Urbandale Principal 6–Lane Arterial

Roadway East/North Bound Lanes

Utility Placement Cross Section

SCALE: NOT TO SCALE

NOTES:

1. Minimum cover and separation for fiber optics, storm, sanitary sewer, water, gas, power and non-fiber optics.

2. See plans for utility cover requirements.

3. Power, telephone and cable TV may share the same trench.

4. Principal horizontal separation shall be at 3 ft. from other utilities.

Sanitary Sewer
Water
Gas
ST
Storm Sewer
Cable Television
Telephone
Underground Power

LEGEND
Scale: Not to Scale

Sanitary Sewer
Water
Gas
Storm Sewer
Cable Television
Telephone
Underground Power

Legend

NOTES:

1. Minimum cover and separation for fiberoptics, storm, sanitary sewer, water, gas, power and non-power utilities.
2. See plans for utility cover requirements.
3. Power, telephone, and cable TV may share the same trench.
4. Typical horizontal separation shall be at 5 ft. from other utilities.

Roadway Symmetrical About Centerline
SCALE: NOT TO SCALE

NOTES:
1. MINIMUM COVER AND SEPARATION FOR FIBEROPTICS, STORM SANITARY SEWER, WATER, GAS, POWER AND NON-FIBEROPTICS TELEPHONE AND CABLE TELEVISION SHALL BE IN COMPLIANCE WITH FEDERAL AND STATE REGULATIONS.
2. SEE PLANS FOR UTILITY COVER REQUIREMENTS.
3. POWER, TELEPHONE, AND CABLE TV MAY SHARE THE SAME TRENCH.
4. TYPICAL HORIZONTAL SEPARATION SHALL BE AT LEAST 5 FT. FROM OTHER UTILITIES.

LEGEND
\[\text{SS} \quad \text{ST} \quad \text{G} \quad \text{UP} \quad \text{TEL} \quad \text{CITY} \quad \text{CABLE TELEVISION} \quad \text{U.N. POWER} \quad \text{SANITARY SEWER} \quad \text{WATER} \quad \text{GAS} \]
SCALE: NOT TO SCALE

1. Minimum cover and separation for water, sanitary sewer, storm sewer, gas, power and non-fiberoptics.
2. See plans for utility cover requirements.
3. Power, telephone, and cable TV may share the same trench.
4. Principal horizontal separation shall be 4 ft. from other utilities.

NOTES:

LEGEND

Roadway Symmetrical About Centerline

Legend:

- SS: Sanitary Sewer
- W: Water
- G: Gas
- ST: Storm Sewer
- TEL: Telephone
- CABLE TELEVISION: CATV
- UNDERGROUND POWER: UP

Utility Placement Cross Section
Roadway East/North Bound Lanes
Urban Expressway 6-Lane

9/16/10

City of El Paso County
Department of Transportation
P.O. Box 8009
El Paso, TX 79999
5-1-9

Andre R. Bresciani
Manager of Transportation

Date Approved: 8/11/11
SCALE: NOT TO SCALE

LEGEND

1. Minimum cover and separation for fireplpots, storm sanitary sewer, water, cable, telephone and non-fiberoptics.
2. See plans for utility cover requirements.
3. May be placed either side of centrel ine in residential pl arts, power, telephone, and cable Iv lay share the same trench.
4. Typical horizontal separation shall be at least 5 ft. from other utilities.

NOTES:
Scale: Not to Scale

1. Top-of-Separation shall be at least 5 ft. from other utilities.
2. See plan for utility cover requirements.
3. May be placed either side of centerline in residential plant, power, telephone, and cable TV may share the same trench.
4. Typical separation shall be at least 5 ft. from other utilities.

Notes:

Legends:
- SS: Sanitary Sewer
- W: Water
- G: Gas
- C: Cable Television
- TEL: Telephone
- U: Underground Power
Rural Major Collector Roadway

Scale: Not to Scale

Legend

1. Minimum cover and separation for telephones, storm, sanitary sewer, water, gas, power and non-fiberoptics.
2. See plans for utility cover requirements.
3. Power, telephone, and cable TV may share the same trench.
4. Typical horizontal separation shall be at least 5 ft. from other utilities.

SCALE

SANITARY SEWER

WATER

GAS

CABLE TELEVISION

TELEPHONE

UNDERGROUND POWER

NOTES:

WEST AND SOUTH

EAST AND NORTH
Scale: Not to Scale

**Legend**

- Roadway Symmetrical About Centerline
- Underground Power
- Cable Television
- Telephone
- Gas
- Water
- Sanitary Sewer

**Notes:**
1. Minimum cover and separation for fiberoptics, storm, sanitary sewer, water, gas, power and non-fiberoptics.
2. See plans for utility minimum depth requirements.
3. Power, Telephone, and Cable TV may share the same trench.
4. Typical horizontal separation shall be at least 5 ft. from other utilities.
Scale: Not to Scale

Legend:
- SS: Sanitary Sewer
- W: Water
- G: Gas
- CATV: CATV Television
- Tel: Telephone
- ULP: Underground Power

Notes:
1. Minimum cover and separation for fiberoptics, storm, sanitary sewer, water, gas. Power and non-fiberoptics.
2. See plans for utility cover requirements.
3. Power, telephone, and cable TV may share the same trench.
4. Typical horizontal separation shall be at least 5 ft. from other utilities.

Rural Minor Arterial Roadway
Utility Placement Cross Section
West/South Bound Lanes
9/16/10
8/11/11
Scale: Not to scale

Legend:
- SS: Sanitary Sewer
- W: Water
- G: Gas
- CT: Cable Television
- T: Telephone
- UG: Underground Power

Notes:
1. Minimum cover and separation for utilities, storm, sanitary sewer, water, gas, power and non-fiberoptics.
2. See plans for utility cover requirements.
3. Power, telephone, and cable to may share the same trench.
4. Typical horizontal separation shall be at least 3 ft. from other utilities.

Roadway Symmetrical About Centerline

East and West

Scale:
Sanitary Sewer
Water
Gas
Cable Television
Telephone
Underground Power
Scale: Not To Scale

1. Minimum cover and separation for fireplopts, storm sanitary sewer, water, gas, power and non-fiberoptics telephone and cable television shall be in compliance with Federal and State Regulations.

2. See plans for utility cover requirements.

3. Power, telephone, and cable TV may share the same trench.

4. Typical separation shall be at least 5 ft. from other utilities.

Notes:

Legend:

- Roadway Symmetrical About Centerline
- 210 ROW
- East and North
- SS: Sanitary Sewer
- W: Water
- G: Gas
- Cable Television
- Telephone
Utility Placement Cross Section
Roadway: West/South Bound Lanes
Rural Principal 6-Lane Arterial

SCALE: NOT TO SCALE

SANITARY SEWER
WATER
GAS
CABLE TELEVISION
UNDERGROUND POWER

SCALE: 1" = 20' 6-16A

NOTES:
1. Minimum cover and separation for pipelines, storm, sanitary sewer, water, gas, power and non-fiberoptics.
2. See plans for utility cover requirements.
3. Power, telephone, and cable TV may share the same trench.
4. Typical horizontal separation shall be at least 5 ft. from other utilities.

LEGEND:
Roadway Symmetrical about Centerline

W
G
SS

9/16/10
8/11/11
DEPARTMENT OF TRANSPORTATION

Andre B. Brocklin

PREPARED: REVISION DATE

DATE APPROVED:
SCALE: NOT TO SCALE

SANITARY SEWER
WATER
GAS
CABLE TELEVISION
UNDERGROUND POWER

NOTES:
1. MINIMUM COVER AND SEPARATION FOR REROUTING, STORM, SANITARY SEWER, WATER, GAS, POWER AND NON-FIBROPTICS.
2. SEE PLANS FOR UTILITY COVER REQUIREMENTS.
3. POWER, TELEPHONE, AND CABLE TV MAY SHARE THE SAME TRENCH.
4. TYPICAL HORIZONTAL SEPARATION SHALL BE AT LEAST 5 FT. FROM OTHER UTILITIES.

LEGEND
Roadway Symmetrical About Centerline

9/16/10
DECLARATION OF TRANSPORTATION
UTILITY PLACEMENT CROSS SECTION
ROADWAY EAST/NORTH BOUND LANE
RURAL EXPRESSIONWAY 4-LANE

Andre P. Brockin
DATE APPROVED: 8/11/11
Roadway Symmetrical About Centerline

NOTES:
1. Minimum cover and separation for fiber optics, storm, sanitary sewer, water, gas, power and non-fiber optics telephone and cable television shall be in compliance with federal and state regulations.
2. See plans for utility cover requirements.
3. Power, telephone, and cable may share the same trench.
4. Typical horizontal separation shall be at least 5 ft. from other utilities.

Rural Expressway 6-Lane Utility Placement Cross Section

SCALE: NOT TO SCALE

LEGEND
- UNDERGROUND POWER
- TELEPHONE
- CABLE TELEVISION
- SANITARY SEWER
- WATER
- GAS

Date Approved: 8/11/11

André P. Brackin
A SQUARE VERTICAL CUT SHALL BE MADE
NEW A.C. PAVEMENT REPLACEMENT
NEW BASE COURSE (T - THICKNESS)

FIRM EXCAVATION LINE

NATIVE MATERIAL COMPACTED IN 6” LIFTS IN ACCORDANCE WITH APPLICABLE SPECIFICATIONS

UTILITY TO BE INSTALLED IN ACCORDANCE WITH APPLICABLE SPECIFICATIONS

NOTES:

1. THIS DETAIL MAY BE USED FOR PAVEMENT CUTS LESS THAN 200 SQ. FT.

2. EXISTING PAVEMENT MAY BE ROUGH CUT INITIALLY IN CONJUNCTION WITH TRENCHING.

3. A SQUARE VERTICAL CUT SHALL BE MADE IN THE EXISTING A.C. PAVEMENT AFTER PLACEMENT OF BACKFILL PRIOR TO PAVEMENT REPLACEMENT.

4. THICKNESS OF NEW A.C. PAVEMENT REPLACEMENT SHALL MATCH EXISTING (4” MIN.)

5. THICKNESS OF NEW BASE COURSE SHALL BE MINIMUM OF 6” OR EQUAL TO EXISTING, WHICHEVER IS GREATER.
A SQUARE VERTICAL CUT SHALL BE MADE
NEW A.C. PAVEMENT REPLACEMENT
NEW PORTLAND CEMENT CONCRETE

EXIST
6" MIN.

EXIST
6" MIN.

FIRM EXCAVATION LINE

NEW BASE COURSE COMPACTED IN ACCORDANCE WITH APPLICABLE SPECIFICATIONS

NATIVE MATERIAL COMPACTED IN 6" LIFTS IN ACCORDANCE WITH APPLICABLE SPECIFICATIONS

UTILITY TO BE INSTALLED IN ACCORDANCE WITH APPLICABLE SPECIFICATIONS.

NOTES

1. THIS DETAIL MAY BE USED FOR PAVEMENT CUT LESS THAN 200 SQ. FT.

2. EXISTING PAVEMENT MAY BE ROUGH CUT INITIALLY IN CONJUNCTION WITH TRENCHING.

3. A SQUARE, VERTICAL CUT SHALL BE MADE IN THE EXISTING A.C. PAVEMENT AFTER PLACEMENT OF BACKFILL AND PRIOR TO PAVEMENT REPLACEMENT.

4. THICKNESS OF NEW A.C. PAVEMENT REPLACEMENT SHALL MATCH EXISTING.

5. THICKNESS OF PORTLAND CEMENT CONCRETE SHALL BE A MINIMUM OF 6" WITH A 4000 PSI COMPRESSIVE STRENGTH AT 28 DAYS.

6. THICKNESS OF NEW BASE COURSE SHALL BE A MINIMUM OF 6" WHEN THE EXISTING BASE COURSE EXCEEDS 12" IN DEPTH. STREETS WITH LESS THAN 12" OF EXISTING BASE COURSE REQUIRE NO NEW BASE COURSE.

SCALE: NOT TO SCALE
A SQUARE VERTICAL CUT SHALL BE MADE
NEW A.C. PAVEMENT REPLACEMENT
6" MIN THICKNESS CONCRETE (MADE WITH PORTLAND
CEMENT MIN. 4500 PSI COMP. STRENGTH @ 28 DAYS).

30" LONG REBAR AT
18" OR 30" ON CENTER
(SEE DETAIL D–25B)

FIRM EXCAVATION LINE

6" MIN.

TOP 12" OF SELECT
GRAVEL COMPACTED IN
ACCORDANCE WITH
APPLICABLE
SPECIFICATIONS

NATIVE MATERIAL
COMPACTED IN
6" LIFTS IN
ACCORDANCE
WITH APPLICABLE
SPECIFICATIONS

UTILITY TO BE INSTALLED
IN ACCORDANCE WITH
APPLICABLE
SPECIFICATIONS.

NOTES

1. EXISTING PAVEMENT MAY BE ROUGH CUT INITIALLY IN CONJUNCTION WITH
   TRENCHING.

2. A SQUARE, VERTICAL CUT SHALL BE MADE IN THE EXISTING A.C. PAVEMENT AFTER
   PLACEMENT OF BACKFILL AND PRIOR TO PAVEMENT REPLACEMENT.

3. THICKNESS OF CONCRETE AND A.C. SHALL BE EQUAL TO EXISTING CONCRETE AND
   A.C. THICKNESS WITH MINIMUM AS SHOWN.

4. DRILL AND EPOXY 30" LONG REBARS 15" DEEP INTO EXISTING CONCRETE
   PAVEMENT IN ACCORDANCE WITH DETAIL D–25B FOR TRANSVERSE AND LONGITUDINAL
   JOINTS.

SCALE: NOT TO SCALE
NOTES

1. EXISTING PAVEMENT MAY BE ROUGH CUT INITIALLY IN CONJUNCTION WITH TRENCHING.

2. A SQUARE, VERTICAL CUT SHALL BE MADE IN THE EXISTING A.C. PAVEMENT AFTER PLACEMENT OF BACKFILL AND PRIOR TO PAVEMENT REPLACEMENT.

3. THICKNESS OF NEW A.C. PAVEMENT REPLACEMENT SHALL MATCH EXISTING OR 4” MINIMUM, WHICHEVER IS GREATER.

SCALE: NOT TO SCALE
APPENDIX G  STORMWATER BMP MAINTENANCE AGREEMENTS

To ensure good operation and maintenance of Post-Construction Best Management Practices (PBMPs), a responsible entity must inspect and provide appropriate services for the PBMPs. A maintenance agreement is required for this purpose. Maintenance agreements for three types of responsible entities are included in this appendix.

The maintenance agreement must cover any PBMP that is submitted as part of the water quality system, such as Extended Detention Basins and Porous Landscape Detention included in DCM2, plus any additional PBMPs such as Grassy Swales & Buffers that are used as part of "Minimizing Directly Connected Impervious Areas" (MDCIA), if they are used to decrease the size of WQCV as shown in Figure ND-1 of Drainage Criteria Manual, Volume 2.

Contents:

Private Detention Basin / Stormwater Quality Best Management Practice Maintenance Agreement and Easement
  
  Developer and Homeowners Association
  
  Developer-Owner
  
  Metropolitan District
PRIVATE STORMWATER QUALITY STRUCTURAL BEST MANAGEMENT PRACTICE AGREEMENT AND EASEMENT

This PRIVATE STORMWATER QUALITY STRUCTURAL BEST MANAGEMENT PRACTICE AGREEMENT (Agreement) is made by and between THE BOARD OF COUNTY COMMISSIONERS OF EL PASO COUNTY, COLORADO (Board or County) and ________________________, a Colorado Corporation (“Developer”) and __________________________ HOMEOWNERS ASSOCIATION (“Homeowners Association” or “Association”), A Colorado nonprofit corporation. The above may occasionally be referred to herein singularly as “Party” and collectively as “Parties.”

Recitals

1. WHEREAS, Developer is the owner of certain real estate (the Property or Subdivision) in El Paso County, Colorado, which Property is legally described as:

More particularly described as follows:

2. WHEREAS, Developer desires to plat and develop on the Property a subdivision to be known as _______________________________; and

3. WHEREAS, the development of this Subdivision will decrease the quality of the stormwater runoff from the Property, and, therefore, it is in the interest of public health, safety and welfare for the County to condition approval of this subdivision on Developer’s promise to construct adequate drainage and stormwater quality structural Best Management Practices (BMPs) in the subdivision described as

4. WHEREAS, [insert legal citations] as periodically amended, promulgated pursuant to [insert legal citations], as amended, requires the County to condition approval of all subdivisions on a developer’s promise to so construct adequate drainage and BMPs in subdivisions; and

5. WHEREAS, [insert legal citations] provides for a developer’s promise to maintain a subdivision’s BMPs; and
6. WHEREAS, Developer and the Association desire to construct the described BMPs as the means for providing adequate stormwater quality control in the Subdivision; and,

7. WHEREAS, the Association shall be charged in the Subdivision’s Covenants with the duty of maintaining all common areas and common structures within the Subdivision, including the BMPs; and

8. WHEREAS, these BMPs when not properly cleaned, maintained, and repaired, threaten the public health, safety and welfare; and

9. WHEREAS, the County in order to so protect the public health, safety and welfare, may be required to expend valuable and limited public resources to so properly clean, maintain, and repair these BMPs when developer and homeowner’s association have failed in their responsibilities, and therefore, the County desires the means to recover its costs incurred in the event the burden falls on the County to so clean, maintain and repair the BMPs in this Subdivision; and

10. WHEREAS, the County conditions approval of this Subdivision on the Developer’s and the Association’s promise to so construct this BMP, and conditions approval on the Association’s promise to reimburse the County in the event the burden falls upon the County to so clean, maintain and/or repair the BMP in this Subdivision; and

11. WHEREAS, the County in order to secure performance of the promises contained herein, conditions approval of this Subdivision upon the Developer’s grant herein of a perpetual Easement over a portion of the Subdivision for the purpose of allowing the County to periodically access, inspect, and, when so necessary, to clean, maintain and/or repair the BMPs; and

12. WHEREAS, given that the Association could potentially avoid liability hereunder by dissolving and reforming as a different entity, and given the difficulties inherent in collecting an unsecured promise, the County, in order to secure performance of the promises contained herein, conditions approval of this Subdivision upon the Developer’s creation, by and through this Agreement, of a covenant running with the land upon each and every lot in the Subdivision.

Agreement

NOW, THEREFORE, in consideration of the mutual Promises contained herein, the sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Incorporation of Recitals: The Parties incorporated the Recitals above into this Agreement.

2. Covenants Running with the Land and Pro Rata Liability upon Individual Lot Owners: Developer and the Homeowners’ Association agree that this entire Agreement and the
performance thereof shall become a covenant running with the land, which land is legally described in Paragraph One (1) of the Recitals set forth above, and that this entire Agreement and the performance thereof shall be binding upon themselves, their respective successors and assigns, including individual lot owners within the Subdivision.

However, any liability imposed under this Agreement against an individual lot owner shall not be joint and several with the Developer and the Association, but shall be prorated on a per-lot basis as determined by the following formula and illustration: each individual lot owner(s) shall be liable for no more than the total monetary amount of liability multiplied by a fraction in which the numerator is the number of lots in the Subdivision owned by a particular lot owner, and the denominator is the total number of lots in the Subdivision. As to any lot(s) owned by more than one person or entity, the liability among co-owners shall be joint and several for the pro rata obligation of that lot. The application of this Paragraph is best illustrated by the following example. Assume the following parameters: total liability is $10,000; total number of lots in the Subdivision is 100; Lot 1 is owned by persons A and B; person B also owns Lot 2. Liability is as follows: The Developer, $10,000; the Association, $10,000; Lot 1 is $100.00, joint and several as to A and B, Lot 2 is $100.00 owed solely by B. Thus person A’s total liability is $100.00 and Person B’s is $200.00. Applying the principle that the County cannot collect more than it is owed, and assuming that the County cannot collect anything from the Developer and the Association, if the County collected the whole $200.00 from B, then it could not collect the $100.00 from A. Likewise, if the County collected the $100.00 from A, then it could only collect $100.00 from B.

3. **Construction:** Developer and the Homeowners’ Association agree that they shall construct on [Tract ______ or Lot __________] as indicated on the final plat of the subdivision and as described below a private stormwater quality control BMP ______[specify BMP] [for multiple BMPs, insert the following here: consisting of ___________( ) [specify BMP] on Tract or Lot __________ for each type of BMP used in the Subdivision. The Developer and the Homeowners’ Association shall not commence construction of the BMPs until the Planning Department and the ECM Administrator have approved in writing the plans and specifications for the BMPs. Failure to obtain such approval shall be a material breach of this Agreement, and shall entitle the County to pursue any remedies available to it at law or in equity to enforce the same. Construction of the BMP must be complete prior to occupation of the site.

In the event construction is not so substantially completed within the occupation, then the County may exercise its discretion to complete the project, and shall have the right to seek reimbursement from the Developer and the Homeowners’ Association and their respective successors and assigns, including individual lot owners in the Subdivision, for its actual costs and expenses incurred in the process of completing construction. The term actual costs and expenses shall be liberally construed in favor of the County, and shall include, but shall not be limited to, labor costs, tool and equipment costs, supply costs, and engineering and design costs, regardless of whether the County uses its own personnel, tools, equipment and supplies, etc. to correct the matter. In the event the County initiates any litigation or engages the services of legal
counsel in order to enforce the Provisions arising herein, the County shall be entitled to its damages and costs, including reasonable attorney fees, regardless of whether the County contracts with outside legal counsel or utilizes in-house legal counsel for the same. The scope of liability therefore of the Developer, the Association, and the individual lot owners shall be as set forth in paragraph Two (2) above.

The structural BMP shall be located on the following parcel(s) within the Subdivision:
BMP: _____________ Tract: _____________________________ [or Lot: _________]

4. **Maintenance**: The Developer and the Association agree for themselves, their respective successors and assigns, including individual lot owners within the Subdivision, that they will regularly and routinely inspect, clean and maintain the BMP, and otherwise keep the same in good repair, all at their own cost and expense. No trees or shrubs that will impair the structural integrity of the BMP shall be planted or allowed to grow on the BMP.

5. **Creation of Easement**: Developer and the Association hereby grant the County a non-exclusive perpetual easement upon the entire Tract(s) [or Lot(s)] describe above. The purpose of the easement is to allow the County to access, inspect, clean, repair and maintain the BMP; however, the creation of the easement does not expressly or implicitly impose on the County a duty to so inspect, clean, repair or maintain the BMP.

6. **County’s Rights and Obligations**: Any time the County determines, in the sole exercise of its discretion, that the BMP is not properly cleaned, maintained and/or otherwise kept in good repair, the County shall give reasonable notice to the Developer, the Association and their respective successors and assigns, including the individual lot owners within the Subdivision, that the BMP needs to be cleaned, maintained and/or otherwise repaired. The notice shall provide a reasonable time to correct the problem(s). Should the responsible parties fail to correct the specified problem(s), the County may enter upon the Property to so correct the specified problem(s). Notice shall be effective to the above by the County’s deposit of the same into the regular United States mail, postage pre-paid. However, this Agreement does not expressly impose on the County a duty to so inspect, clean, repair or maintain the BMP.

7. **Reimbursement of County’s Costs/Covenant Running With the Land**: The Developer and the Association agree and covenant, for themselves, their respective successors and assigns, including individual lot owners within the Subdivision, that they will reimburse the County for its costs and expenses incurred in the process of cleaning, maintaining, and/or repairing the BMP. However, the obligation and liability of the Developer hereunder shall only continue until such time as the Developer transfers the entire management and operation of the Association to the individual lot owners within the Subdivision. Notwithstanding the previous
sentence, the Association and the individual lot owners within the Subdivision shall always remain obligated and liable hereunder, and as per the provision of Paragraph Two (2) above.

The terms actual costs and expenses shall be liberally constructed in favor of the County, and shall include, but shall not be limited to, labor costs, tools and equipment costs, supply costs, and engineering and design costs, regardless of whether the County uses its own personnel, tools, equipment and supplies, etc. to correct the matter. In the event the County initiates any litigation or engages the services of legal counsel in order to enforce the Provision arising herein, the County shall be entitled to its damages and costs, including reasonable attorney’s fees, regardless of whether the County contracts with outside legal counsel or utilizes in-house legal counsel for the same. The scope of liability therefor of the Developer, the Association, and the individual lot owners shall be as set forth in Paragraph Two (2) above.

8. Contingencies of Subdivision Approval: Developer’s and the Association’s execution of the Agreement is a condition of subdivision approval. Additional conditions of this Agreement include, but are not limited to the following:

a. Conveyance of Tract(s) ___________ from Developer to the Association (which will include a reservation of easement in favor of the County for purposes of accessing, inspecting, cleaning, maintaining, and repairing the BMP), and recording of the Deed for the same; and

[If not a conveyance of a fee interest but merely creating and conveying an easement on the affected lot(s), then substitute the following alternative Paragraph a:]

a. Conveyance of easements on Lot(s) ___________ from the Developer to the Association and to the County for purposes of accessing, inspecting, cleaning, maintaining, and repairing the BMP, and recording of appropriate conveyance documents for the same; and

b. The County’s receipt of a copy of the Articles of Incorporation for the Association, as filed with the Colorado Secretary of State; receipt of the Certificate of Incorporation or other comparable proof for the same from the Colorado Secretary of State; a copy of the Bylaws of the Association; a copy of the organization minutes or other appropriate document of the Association, properly executed and attested, establishing that the Association has adopted this Agreement as an obligation of the Association; and

c. A copy of the Covenants of the Subdivision establishing that the Association is obligated to inspect, clean, maintain, and repair the BMP; that the Association has adopted this Agreement as an obligation of the Association; and that a funding mechanism is in place whereby individual
lot owners within the Subdivision pay a regular fee to the Association for, among other matters, the inspection, cleaning, maintenance, and repair of the BMP.

d. A copy of the Covenants of the Subdivision establishing that this Agreement is incorporated into the Covenants, and that such Agreement touches and concerns each every lot within the Subdivision.

The County shall have the right, in the sole exercise of its discretion, to approve or disapprove any documentation submitted to it under the conditions of this Paragraph. The County’s rejection of any documentation submitted hereunder shall mean that the appropriate condition of this Agreement has not been fulfilled.

9. **Distribution to Lot Purchasers:** Upon the initial sale of any lot within the Subdivision, prior to closing on such sale, the Developer shall give a copy of this Agreement to the potential Buyer.

10. **Agreement Monitored by Engineering Criteria Manual Administrator:** Any and all actions and decisions to be made hereunder by the County shall be made by the Engineering Criteria Manual (ECM) Administrator. Accordingly, any and all documents, submissions, plan approval, inspections, etc. shall be submitted to and shall be made by the ECM Administrator.

11. **Indemnification and Hold Harmless:** To the extent authorized by law, Developer and the Association agree, for themselves, their respective successors and assigns, including the individual lot owners in the Subdivision, that they will indemnify, defend, and hold the County harmless from any and all loss, costs, damage, injury, liability, claim, lien, demand, action and causes of action whatsoever, whether at law or in equity, arising from or related to their respective intentional or negligent acts, errors, or omissions or that of its agents, officers, servants, employees, invitees and licensees in the construction, operation, inspection, cleaning (including analyzing and disposing of any solid or hazardous wastes as defined by State and/or Federal environmental laws and regulations), maintenance and repair of the BMP, and such obligation arising under this Paragraph shall be joint and several. Nothing in the Paragraph shall be deemed to waive or otherwise limit the defense available to the County pursuant to the Colorado Governmental Immunity Act, Sections 24-10-101, et seq. C.R.S. 2001, as amended, or as otherwise provided by law. However, the obligation and liability of the Developer hereunder shall only continue until such time as the Developer transfers the entire management and operation of the Association to the individual lot owners within the Subdivision.

12. **Severability:** In the event any Court of competent jurisdiction declares any part of this Agreement to be unenforceable, such declaration shall not affect the enforceability of the remaining parts of this agreement.

13. **Third Parties:** This Agreement does not and shall not be deemed to confer upon or grant to any third party any right to claim damages or to bring any lawsuit, action or other
proceeding against either the County, the Developer or the Association, their respective successors and assigns, including any individual lot owners in the Subdivision, because of any breach hereof or because of any terms, covenants, agreements or conditions contained herein.

14. **Solid or Hazardous Wastes**: Should any refuse from the BMP be suspected or identified as solid waste and/or hazardous waste, the Developer and the Association shall take all necessary and proper steps to characterize the waste and properly dispose of it in accordance with applicable State and/or Federal environmental laws and regulations, including, but not limited to, the following: Solid Wastes Disposal Sites and Facilities Acts, §§ 30-20-100.5 – 30-20-119, C.R.S. (2001) as amended, Colorado Regulations Pertaining to Solid Waste Disposal Sites and Facilities, 6 C.C.R. 1007-2, et seq., as amended, Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6992k (2001) as amended, and Federal Solid Waste Regulations 40 CFR Ch. I. (2001) as amended. The County shall not be responsible or liable for identifying, characterizing, cleaning up, or disposing of such solid and/or hazardous waste. Notwithstanding the previous sentence, should any refuse cleaned up and disposed of by the County be determined to be solid and/or hazardous waste, the Developer and the Association, but not the County, shall be responsible and liable as the owner, generator, and/or transporter of said solid and/or hazardous waste.

15. **Applicable Law and Venue**: The laws, rules, and regulations of the State of Colorado and El Paso County shall be applicable in the enforcement, interpretation, and execution of this Agreement, except that Federal law may be applicable regarding solid or hazardous wastes. Venue shall be the El Paso County District Court.

IN WITNESS WHEREOF, the Parties affix their signatures below.

Executed this ________ day of ____________________, ________, by:

[DEVELOPER’S NAME]:

By: _____________________________________________

(Insert name)___________________________________, President

The foregoing instrument was acknowledged before me this ________ day of __________, ________, by ________________________, President, ______________________.

Witness my hand and official seal.
My commission expires: ______________________
Appendix G Stormwater BMP Maintenance Agreements
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6

Notary Public

Executed this ________ day of ____________________, ________, by:
________________________________ HOMEOWNERS ASSOCIATION, a Colorado nonprofit corporation.

By:
_________________________, President

(insert name) ________________, President

The foregoing instrument was acknowledged before me this ________ day of
_________________________, ________, by ______________________, President, ______________________
Homeowners Association, a Colorado nonprofit corporation.

Witness my hand and official seal.

My commission expires: __________________________

Notary Public

Executed this ________ day of ____________________, ________, by:

BOARD OF COUNTY COMMISSIONERS
OF EL PASO COUNTY, COLORADO

By: ____________________________, Chairperson

Attest:
________________________________
Deputy Clerk
The foregoing instrument was acknowledged before me this ________ day of ________, by __________________, Chairperson of the Board of County Commissioners of El Paso County, Colorado, as Attested to by __________________, Deputy Clerk to the Board of County Commissioners of El Paso County, Colorado.

Witness my hand and official seal.

My commission expires: __________________________

________________________________
Notary Public

Approved as to Content and Form:

________________________________
Assistant County Attorney
PRIVATE DETENTION BASIN / STORMWATER QUALITY BEST MANAGEMENT PRACTICE MAINTENANCE AGREEMENT AND EASEMENT

This PRIVATE DETENTION BASIN / STORMWATER QUALITY BEST MANAGEMENT PRACTICE MAINTENANCE AGREEMENT AND EASEMENT (Agreement) is made by and between EL PASO COUNTY by and through THE BOARD OF COUNTY COMMISSIONERS OF EL PASO COUNTY, COLORADO (Board or County) and [Insert Lot Owner/Developer’s name] (Owner or Developer). The above may occasionally be referred to herein singularly as “Party” and collectively as “Parties.”

Recitals

A. WHEREAS, Developer is the owner of certain real estate (the Property or Subdivision) in El Paso County, Colorado, which Property is legally described in Exhibit A attached hereto and incorporated herein by this reference; and

B. WHEREAS, Developer desires to plat and develop on the Property a subdivision/land use to be known as [Insert proposed subdivision/land use name]; and

C. WHEREAS, the development of this Property will substantially increase the volume of water runoff and will decrease the quality of the stormwater runoff from the Property, and, therefore, it is in the best interest of public health, safety and welfare for the County to condition approval of this subdivision/land use on Developer’s promise to construct adequate drainage, water runoff control facilities, and stormwater quality structural Best Management Practices (“BMPs”) for the subdivision/land use; and

D. WHEREAS, Chapter 8, Section 8.4.5 of the El Paso County Land Development Code, as periodically amended, promulgated pursuant to Section 30-28-133(1), Colorado Revised Statutes (C.R.S.), requires the County to condition approval of all subdivisions on a developer’s promise to so construct adequate drainage, water runoff control facilities, and BMPs in subdivisions; and

E. WHEREAS, the Drainage Criteria Manual, Volume 2, as amended by Appendix I of the El Paso County Engineering Criteria Manual (ECM), as each may be periodically amended, promulgated pursuant to the County’s Colorado Discharge Permit System General Permit (MS4 Permit) as required by Phase II of the National Pollutant Discharge Elimination System (NPDES), which MS4 Permit requires that the County take measures to protect the quality of stormwater from sediment and other contaminants, requires subdividers, developers, landowners, and owners of facilities located in the County’s rights-of-way or easements to
provide adequate permanent stormwater quality BMPs with new development or significant redevelopment; and

F. WHEREAS, Section 2.9 of the El Paso County Drainage Criteria Manual provides for a developer’s promise to maintain a subdivision’s drainage facilities in the event the County does not assume such responsibility; and

G. WHEREAS, developers in El Paso County have historically chosen water runoff detention basins as a means to provide adequate drainage and water runoff control in subdivisions, which basins, while effective, are less expensive for developers to construct than other methods of providing drainage and water runoff control; and

H. WHEREAS, Developer desires to construct for the subdivision/land use [insert number of basins/BMPs] detention basin/stormwater quality BMP(s) (“detention basin/BMP(s)”) as the means for providing adequate drainage and stormwater runoff control and to meet requirements of the County’s MS4 Permit, and to operate, clean, maintain and repair such detention basin/BMP(s); and

I. WHEREAS, Developer desires to construct the detention basin/BMP(s) on property that is or will be platted as [Insert Lot or Tract identifier(s)], as indicated on the final plat of the subdivision, and as set forth on Exhibit B attached hereto; and

J. WHEREAS, Developer shall be charged with the duties of constructing, operating, maintaining and repairing the detention basin/BMP(s) on the Property described in Exhibit B; and

K. WHEREAS, it is the County’s experience that subdivision developers and property owners historically have not properly cleaned and otherwise not properly maintained and repaired these detention basins/BMPs, and that these detention basins/BMPs, when not so properly cleaned, maintained, and repaired, threaten the public health, safety and welfare; and

L. WHEREAS, the County, in order to protect the public health, safety and welfare, has historically expended valuable and limited public resources to so properly clean, maintain, and repair these detention basins/BMPs when developers and property owners have failed in their responsibilities, and therefore, the County desires the means to recover its costs incurred in the event the burden falls on the County to so clean, maintain and repair the detention basin/BMP(s) serving this subdivision/land use due to the Developer/Owner’s failure to meet its obligations to do the same; and

M. WHEREAS, the County conditions approval of this subdivision/land use on the Developer’s promise to so construct the detention basin/BMP(s), and conditions approval on the Owner’s promise to reimburse the County in the event the burden falls upon the County to so clean, maintain and/or repair the detention basin/BMP(s) serving this Subdivision; and
N. WHEREAS, the County could condition subdivision/land use approval on the Developer’s promise to construct a different and more expensive drainage, water runoff control system and BMPs than those proposed herein, which more expensive system would not create the possibility of the burden of cleaning, maintenance and repair expenses falling on the County; however, the County is willing to forego such right upon the performance of Developer/Owner’s promises contained herein; and

O. WHEREAS, the County, in order to secure performance of the promises contained herein, conditions approval of this subdivision/land use upon the Developer’s grant herein of a perpetual Easement over a portion of the Property for the purpose of allowing the County to periodically access, inspect, and, when so necessary, to clean, maintain and/or repair the detention basin/BMP(s); and

Agreement

NOW, THEREFORE, in consideration of the mutual Promises contained herein, the sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Incorporation of Recitals: The Parties incorporate the Recitals above into this Agreement.

2. Covenants Running with the Land: Developer/Owner agrees that this entire Agreement and the performance thereof shall become a covenant running with the land, which land is legally described in Exhibit A attached hereto, and that this entire Agreement and the performance thereof shall be binding upon itself, its successors and assigns.

3. Construction: Developer shall construct on that portion of the Property described in Exhibit B attached hereto and incorporated herein by this reference, [insert number of basins/BMPs] detention basin/BMP(s). Developer shall not commence construction of the detention basin/BMP(s) until the El Paso County Development Services Department (DSD) has approved in writing the plans and specifications for the detention basin/BMP(s) and this Agreement has been signed by all Parties and returned to the DSD. Developer shall complete construction of the detention basin/BMP(s) in substantial compliance with the County-approved plans and specifications for the detention basin/BMP(s). Failure to meet these requirements shall be a material breach of this Agreement, and shall entitle the County to pursue any remedies available to it at law or in equity to enforce the same. Construction of the detention basin/BMP(s) shall be substantially completed within one (1) year (defined as 365 days), which one year period will commence to run on the date the approved plat of this Subdivision is recorded in the records of the El Paso County Clerk and Recorder. In cases where a subdivision is not required, the one year period will commence to run on the date the Erosion and Stormwater Quality Control Permit (ESQCP) is issued. Rough grading of the detention
basin/BMP(s) must be completed and inspected by the El Paso County Development Services Department prior to commencing road construction.

In the event construction is not substantially completed within the one (1) year period, then the County may exercise its discretion to complete the project, and shall have the right to seek reimbursement from the Developer/Owner and its successors and assigns, for its actual costs and expenses incurred in the process of completing construction. The term actual costs and expenses shall be liberally construed in favor of the County, and shall include, but shall not be limited to, labor costs, tool and equipment costs, supply costs, and engineering and design costs, regardless of whether the County uses its own personnel, tools, equipment and supplies, etc. to correct the matter. In the event the County initiates any litigation or engages the services of legal counsel in order to enforce the Provisions arising herein, the County shall be entitled to its damages and costs, including reasonable attorney fees, regardless of whether the County contracts with outside legal counsel or utilizes in-house legal counsel for the same.

4. Maintenance: The Developer/Owner agrees for itself and its successors and assigns, that it will regularly and routinely inspect, clean and maintain the detention basin/BMP(s), and otherwise keep the same in good repair, all at its own cost and expense. No trees or shrubs that will impair the structural integrity of the detention basin/BMP(s) shall be planted or allowed to grow on the detention basin/BMP(s).

5. Creation of Easement: Developer/Owner hereby grants the County a non-exclusive perpetual easement upon and across that portion of the Property described in Exhibit B. The purpose of the easement is to allow the County to access, inspect, clean, repair and maintain the detention basin/BMP(s); however, the creation of the easement does not expressly or implicitly impose on the County a duty to so inspect, clean, repair or maintain the detention basin/BMP(s).

6. County’s Rights and Obligations: Any time the County determines, in the sole exercise of its discretion, that the detention basin/BMP(s) is not properly cleaned, maintained and/or otherwise kept in good repair, the County shall give reasonable notice to the Developer/Owner and its successors and assigns, that the detention basin/BMP(s) needs to be cleaned, maintained and/or otherwise repaired. The notice shall provide a reasonable time to correct the problem(s). Should the responsible parties fail to correct the specified problem(s), the County may enter upon the Property to so correct the specified problem(s). Notice shall be effective to the above by the County’s deposit of the same into the regular United States mail, postage pre-paid. Notwithstanding the foregoing, this Agreement does not expressly or implicitly impose on the County a duty to so inspect, clean, repair or maintain the detention basin/BMP(s).

7. Reimbursement of County’s Costs / Covenant Running With the Land: The Developer/Owner agrees and covenants, for itself, its successors and assigns, that it will reimburse the County for its costs and expenses incurred in the process of completing construction of, cleaning, maintaining, and/or repairing the detention basin/BMP(s) pursuant to the provisions of this Agreement.
The term “actual costs and expenses” shall be liberally construed in favor of the County, and shall include, but shall not be limited to, labor costs, tools and equipment costs, supply costs, and engineering and design costs, regardless of whether the County uses its own personnel, tools, equipment and supplies, etc. to correct the matter. In the event the County initiates any litigation or engages the services of legal counsel in order to enforce the provisions arising herein, the County shall be entitled to its damages and costs, including reasonable attorney’s fees, regardless of whether the County contracts with outside legal counsel or utilizes in-house legal counsel for the same.

8. **Contingencies of Land Use/Land Disturbance Approval:** Developer/Owner’s execution of this Agreement is a condition of land use/land disturbance approval.

The County shall have the right, in the sole exercise of its discretion, to approve or disapprove any documentation submitted to it under the conditions of this Paragraph, including but not limited to, any separate agreement or amendment, if applicable, identifying any specific maintenance responsibilities not addressed herein. The County’s rejection of any documentation submitted hereunder shall mean that the appropriate condition of this Agreement has not been fulfilled.

9. **Agreement Monitored by El Paso County Development Services Department and/or El Paso County Public Services Department:** Any and all actions and decisions to be made hereunder by the County shall be made by the Director of the El Paso County Development Services Department and/or the Director of the El Paso County Public Services Department. Accordingly, any and all documents, submissions, plan approvals, inspections, etc. shall be submitted to and shall be made by the Director of the Development Services Department and/or the Director of the El Paso County Public Services Department.

10. **Indemnification and Hold Harmless:** To the extent authorized by law, Developer/Owner agrees, for itself, its successors and assigns, that it will indemnify, defend, and hold the County harmless from any and all loss, costs, damage, injury, liability, claim, lien, demand, action and causes of action whatsoever, whether at law or in equity, arising from or related to its intentional or negligent acts, errors or omissions or that of its agents, officers, servants, employees, invitees and licensees in the construction, operation, inspection, cleaning (including analyzing and disposing of any solid or hazardous wastes as defined by State and/or Federal environmental laws and regulations), maintenance, and repair of the detention basin/BMP(s), and such obligation arising under this Paragraph shall be joint and several. Nothing in this Paragraph shall be deemed to waive or otherwise limit the defense available to the County pursuant to the Colorado Governmental Immunity Act, Sections 24-10-101, et seq. C.R.S., or as otherwise provided by law.

11. **Severability:** In the event any Court of competent jurisdiction declares any part of this Agreement to be unenforceable, such declaration shall not affect the enforceability of the remaining parts of this Agreement.
12. **Third Parties:** This Agreement does not and shall not be deemed to confer upon or grant to any third party any right to claim damages or to bring any lawsuit, action or other proceeding against either the County, the Developer/Owner, or their respective successors and assigns, because of any breach hereof or because of any terms, covenants, agreements or conditions contained herein.

13. **Solid Waste or Hazardous Materials:** Should any refuse from the detention basin/BMP(s) be suspected or identified as solid waste or petroleum products, hazardous substances or hazardous materials (collectively referred to herein as “hazardous materials”), the Developer/Owner shall take all necessary and proper steps to characterize the solid waste or hazardous materials and properly dispose of it in accordance with applicable State and/or Federal environmental laws and regulations, including, but not limited to, the following: Solid Wastes Disposal Sites and Facilities Acts, §§ 30-20-100.5 – 30-20-119, C.R.S., Colorado Regulations Pertaining to Solid Waste Disposal Sites and Facilities, 6 C.C.R. 1007-2, et seq., Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6992k, and Federal Solid Waste Regulations 40 CFR Ch. I. The County shall not be responsible or liable for identifying, characterizing, cleaning up, or disposing of such solid waste or hazardous materials. Notwithstanding the previous sentence, should any refuse cleaned up and disposed of by the County be determined to be solid waste or hazardous materials, the Developer/Owner, but not the County, shall be responsible and liable as the owner, generator, and/or transporter of said solid waste or hazardous materials.

14. **Applicable Law and Venue:** The laws, rules, and regulations of the State of Colorado and El Paso County shall be applicable in the enforcement, interpretation, and execution of this Agreement, except that Federal law may be applicable regarding solid waste or hazardous materials. Venue shall be in the El Paso County District Court.

IN WITNESS WHEREOF, the Parties affix their signatures below.

Executed this _________ day of _________________, 20___, by:

[Insert Developer’s company name]

By:  __________________________________________

[Insert name], [Insert title(President/Manager)]

The foregoing instrument was acknowledged before me this ______ day of

______________________, 20__, by [Insert name], [Insert title(President/Manager)], [Insert Developer’s company name].
Witness my hand and official seal.
My commission expires: ________________________________

__________________________, Chair

Attest:
____________________________________
County Clerk and Recorder

The foregoing instrument was acknowledged before me this ______ day of ______, 20__, by ____________________, Chair of the Board of County Commissioners of El Paso County, Colorado, as Attested to by ____________________, County Clerk and Recorder.

Witness my hand and official seal.
My commission expires: ________________________________

__________________________, Chair

Attest:
____________________________________
County Clerk and Recorder

Approved as to Content and Form:

____________________________________
Assistant County Attorney
PRIVATE DETENTION BASIN /
STORMWATER QUALITY BEST MANAGEMENT PRACTICE
MAINTENANCE AGREEMENT AND EASEMENT

This PRIVATE DETENTION BASIN / STORMWATER QUALITY BEST MANAGEMENT PRACTICE MAINTENANCE AGREEMENT AND EASEMENT (Agreement) is made by and between EL PASO COUNTY by and through THE BOARD OF COUNTY COMMISSIONERS OF EL PASO COUNTY, COLORADO (Board or County) and [Insert Developer’s company name] (Developer) and [Insert first part of Metro District name] METROPOLITAN DISTRICT (Metro District), a quasi-municipal corporation and political subdivision of the State of Colorado. The above may occasionally be referred to herein singularly as “Party” and collectively as “Parties.”

Recitals

A. WHEREAS, the District provides various municipal services to certain real property in El Paso County, Colorado referred to as [Insert development name]; and

B. WHEREAS, Developer is the owner of certain real estate (the Property or Subdivision) in El Paso County, Colorado, which Property is legally described in Exhibit A attached hereto and incorporated herein by this reference; and

C. WHEREAS, Developer desires to plat and develop on the Property a subdivision to be known as [Insert proposed subdivision name]; and

D. WHEREAS, the development of this Property will substantially increase the volume of water runoff and will decrease the quality of the stormwater runoff from the Property, and, therefore, it is in the best interest of public health, safety and welfare for the County to condition approval of this subdivision on Developer’s promise to construct adequate drainage, water runoff control facilities, and stormwater quality structural Best Management Practices (“BMPs”) for the subdivision; and

E. WHEREAS, Chapter 8, Section 8.4.5 of the El Paso County Land Development Code, as periodically amended, promulgated pursuant to Section 30-28-133(1), Colorado Revised Statutes (C.R.S.), requires the County to condition approval of all subdivisions on a developer’s promise to so construct adequate drainage, water runoff control facilities, and BMPs in subdivisions; and

F. WHEREAS, the Drainage Criteria Manual, Volume 2, as amended by Appendix I of the El Paso County Engineering Criteria Manual (ECM), as each may be periodically amended, promulgated pursuant to the County’s Colorado Discharge Permit System General
Appendix G Stormwater BMP Maintenance Agreements
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6

El Paso County Engineering Criteria Manual
G - 19

Permit (MS4 Permit) as required by Phase II of the National Pollutant Discharge Elimination System (NPDES), which MS4 Permit requires that the County take measures to protect the quality of stormwater from sediment and other contaminants, requires subdivider, developers, landowners, and owners of facilities located in the County’s rights-of-way or easements to provide adequate permanent stormwater quality BMPs with new development or significant redevelopment; and

G. WHEREAS, Section 2.9 of the El Paso County Drainage Criteria Manual provides for a developer’s promise to maintain a subdivision’s drainage facilities in the event the County does not assume such responsibility; and

H. WHEREAS, developers in El Paso County have historically chosen water runoff detention basins as a means to provide adequate drainage and water runoff control in subdivisions, which basins, while effective, are less expensive for developers to construct than other methods of providing drainage and water runoff control; and

I. WHEREAS, Developer desires to construct for the subdivision [insert number of basins/BMPs] detention basin/stormwater quality BMP(s) (“detention basin/BMP(s)”) as the means for providing adequate drainage and stormwater runoff control and to meet requirements of the County’s MS4 Permit, and to provide for operating, cleaning, maintaining and repairing such detention basin/BMP(s); and

J. WHEREAS, Developer desires to construct the detention basin/BMP(s) on property that is or will be platted as [Insert Lot or Tract identifier(s)], as indicated on the final plat of the subdivision, and as set forth on Exhibit B attached hereto; and

K. WHEREAS, Developer shall be charged with the duty of constructing the detention basin/BMP(s) and the Metro District shall be charged with the duties of operating, maintaining and repairing the detention basin/BMP(s) on the Property described in Exhibit B; and

L. WHEREAS, it is the County’s experience that subdivision developers and property owners historically have not properly cleaned and otherwise not properly maintained and repaired these detention basins/BMPs, and that these detention basins/BMPs, when not so properly cleaned, maintained, and repaired, threaten the public health, safety and welfare; and

M. WHEREAS, the County, in order to protect the public health, safety and welfare, has historically expended valuable and limited public resources to so properly clean, maintain, and repair these detention basins/BMPs when developers and property owners have failed in their responsibilities, and therefore, the County desires the means to recover its costs incurred in the event the burden falls on the County to so clean, maintain and repair the detention basin/BMP(s) serving this Subdivision due to the Developer’s or the Metro District’s failure to meet its obligations to do the same; and
N. WHEREAS, the County conditions approval of this Subdivision on the Developer’s promise to so construct the detention basin/BMP(s), and further conditions approval on the Metro District’s promise to reimburse the County in the event the burden falls upon the County to so clean, maintain and/or repair the detention basin/BMP(s) serving this Subdivision; and

O. WHEREAS, the County could condition subdivision approval on the Developer’s promise to construct a different and more expensive drainage, water runoff control system and BMPs than those proposed herein, which more expensive system would not create the possibility of the burden of cleaning, maintenance and repair expenses falling on the County; however, the County is willing to forego such right upon the performance of Developer’s and the Metro District’s promises contained herein; and

P. WHEREAS, the County, in order to secure performance of the promises contained herein, conditions approval of this Subdivision upon the Developer’s grant herein of a perpetual Easement over a portion of the Property for the purpose of allowing the County to periodically access, inspect, and, when so necessary, to clean, maintain and/or repair the detention basin/BMP(s); and

Q. WHEREAS, Pursuant to Colorado Constitution, Article XIV, Section 18(2) and Section 29-1-203, Colorado Revised Statutes, governmental entities may cooperate and contract with each other to provide any function, services, or facilities lawfully authorized to each.

Agreement

NOW, THEREFORE, in consideration of the mutual Promises contained herein, the sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Incorporation of Recitals: The Parties incorporate the Recitals above into this Agreement.

2. Covenants Running with the Land: Developer and the Metro District agree that this entire Agreement and the performance thereof shall become a covenant running with the land, which land is legally described in Exhibit A attached hereto, and that this entire Agreement and the performance thereof shall be binding upon themselves, their respective successors and assigns.

3. Construction: Developer shall construct on that portion of the Property described in Exhibit B attached hereto and incorporated herein by this reference, [insert number of basins/BMPs] detention basin/BMP(s). Developer shall not commence construction of the
detention basin/BMP(s) until the El Paso County Development Services Department (DSD) has approved in writing the plans and specifications for the detention basin/BMP(s) and this Agreement has been signed by all Parties and returned to the DSD. Developer shall complete construction of the detention basin/BMP(s) in substantial compliance with the County-approved plans and specifications for the detention basin/BMP(s). Failure to meet these requirements shall be a material breach of this Agreement, and shall entitle the County to pursue any remedies available to it at law or in equity to enforce the same. Construction of the detention basin/BMP(s) shall be substantially completed within one (1) year (defined as 365 days), which one year period will commence to run on the date the approved plat of this Subdivision is recorded in the records of the El Paso County Clerk and Recorder. Rough grading of the detention basin/BMP(s) must be completed and inspected by the El Paso County Development Services Department prior to commencing road construction.

In the event construction is not substantially completed within the one (1) year period, then the County may exercise its discretion to complete the project, and shall have the right to seek reimbursement from the Developer and its respective successors and assigns, for its actual costs and expenses incurred in the process of completing construction. The term actual costs and expenses shall be liberally construed in favor of the County, and shall include, but shall not be limited to, labor costs, tool and equipment costs, supply costs, and engineering and design costs, regardless of whether the County uses its own personnel, tools, equipment and supplies, etc. to correct the matter. In the event the County initiates any litigation or engages the services of legal counsel in order to enforce the Provisions arising herein, the County shall be entitled to its damages and costs, including reasonable attorney fees, regardless of whether the County contracts with outside legal counsel or utilizes in-house legal counsel for the same.

4. Maintenance: The Metro District agrees for itself and its successors and assigns, that it will regularly and routinely inspect, clean and maintain the detention basin/BMP(s), and otherwise keep the same in good repair, all at its own cost and expense. No trees or shrubs that will impair the structural integrity of the detention basin/BMP(s) shall be planted or allowed to grow on the detention basin/BMP(s).

5. Creation of Easement: Developer hereby grants the County and the Metro District a non-exclusive perpetual easement upon and across that portion of the Property described in Exhibit B. The purpose of the easement is to allow the County and the Metro District to access, inspect, clean, repair and maintain the detention basin/BMP(s); however, the creation of the easement does not expressly or implicitly impose on the County a duty to so inspect, clean, repair or maintain the detention basin/BMP(s).

6. County’s Rights and Obligations: Any time the County determines, in the sole exercise of its discretion, that the detention basin/BMP(s) is not properly cleaned, maintained and/or otherwise kept in good repair, the County shall give reasonable notice to the Developer, the Metro District and their respective successors and assigns, that the detention basin/BMP(s) needs to be cleaned, maintained and/or otherwise repaired. The notice shall provide a reasonable time to correct the problem(s). Should the responsible parties fail to correct the specified
problem(s), the County may enter upon the Property to so correct the specified problem(s). Notice shall be effective to the above by the County’s deposit of the same into the regular United States mail, postage pre-paid. Notwithstanding the foregoing, this Agreement does not expressly or implicitly impose on the County a duty to so inspect, clean, repair or maintain the detention basin/BMP(s).

7. Reimbursement of County’s Costs / Covenant Running With the Land: The Developer and the Metro District agree and covenant, for themselves, their respective successors and assigns, that they will reimburse the County for its costs and expenses incurred in the process of completing construction of, cleaning, maintaining, and/or repairing the detention basin/BMP(s) pursuant to the provisions of this Agreement.

The term “actual costs and expenses” shall be liberally construed in favor of the County, and shall include, but shall not be limited to, labor costs, tools and equipment costs, supply costs, and engineering and design costs, regardless of whether the County uses its own personnel, tools, equipment and supplies, etc. to correct the matter. In the event the County initiates any litigation or engages the services of legal counsel in order to enforce the provisions arising herein, the County shall be entitled to its damages and costs, including reasonable attorney’s fees, regardless of whether the County contracts with outside legal counsel or utilizes in-house legal counsel for the same.

8. Contingencies of Subdivision Approval: Developer’s and the Metro District’s execution of this Agreement is a condition of subdivision approval. Additional conditions of this Agreement include, but are not limited to, the following:

   a. Conveyance of [Insert Lot, Tract or easement identifier(s)], as indicated on the final plat of the subdivision, from Developer to the Metro District (which will include a reservation of easement in favor of the County for purposes of accessing, inspecting, cleaning, maintaining, and repairing the detention basin/BMP(s)), and recording of the Deed for the same; and

   b. A copy of the Covenants of the Subdivision, if applicable, establishing that the Metro District is obligated to inspect, clean, maintain, and repair the detention basin/BMP(s).

The County shall have the right, in the sole exercise of its discretion, to approve or disapprove any documentation submitted to it under the conditions of this Paragraph, including but not limited to, any separate agreement or amendment, if applicable, identifying any specific maintenance responsibilities not addressed herein. The County’s rejection of any documentation submitted hereunder shall mean that the appropriate condition of this Agreement has not been fulfilled.
9. Agreement Monitored by El Paso County Development Services Department and/or El Paso County Public Services Department: Any and all actions and decisions to be made hereunder by the County shall be made by the Director of the El Paso County Development Services Department and/or the Director of the El Paso County Public Services Department. Accordingly, any and all documents, submissions, plan approvals, inspections, etc. shall be submitted to and shall be made by the Director of the Development Services Department and/or the Director of the El Paso County Public Services Department.

10. Indemnification and Hold Harmless: To the extent authorized by law, Developer and the Metro District agree, for themselves, their respective successors and assigns, that they will indemnify, defend, and hold the County harmless from any and all loss, costs, damage, injury, liability, claim, lien, demand, action and causes of action whatsoever, whether at law or in equity, arising from or related to their respective intentional or negligent acts, errors or omissions or that of their agents, officers, servants, employees, invitees and licensees in the construction, operation, inspection, cleaning (including analyzing and disposing of any solid or hazardous wastes as defined by State and/or Federal environmental laws and regulations), maintenance, and repair of the detention basin/BMP(s), and such obligation arising under this Paragraph shall be joint and several. Nothing in this Paragraph shall be deemed to waive or otherwise limit the defense available to the County pursuant to the Colorado Governmental Immunity Act, Sections 24-10-101, et seq. C.R.S., or as otherwise provided by law.

11. Severability: In the event any Court of competent jurisdiction declares any part of this Agreement to be unenforceable, such declaration shall not affect the enforceability of the remaining parts of this Agreement.

12. Third Parties: This Agreement does not and shall not be deemed to confer upon or grant to any third party any right to claim damages or to bring any lawsuit, action or other proceeding against either the County, the Developer, the Metro District, or their respective successors and assigns, because of any breach hereof or because of any terms, covenants, agreements or conditions contained herein.

13. Solid Waste or Hazardous Materials: Should any refuse from the detention basin/BMP(s) be suspected or identified as solid waste or petroleum products, hazardous substances or hazardous materials (collectively referred to herein as “hazardous materials”), the Developer and the Metro District shall take all necessary and proper steps to characterize the solid waste or hazardous materials and properly dispose of it in accordance with applicable State and/or Federal environmental laws and regulations, including, but not limited to, the following: Solid Wastes Disposal Sites and Facilities Acts, §§ 30-20-100.5 – 30-20-119, C.R.S., Colorado Regulations Pertaining to Solid Waste Disposal Sites and Facilities, 6 C.C.R. 1007- 2, et seq., Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6992k, and Federal Solid Waste Regulations 40 CFR Ch. I. The County shall not be responsible or liable for identifying, characterizing, cleaning up, or disposing of such solid waste or hazardous materials. Notwithstanding the previous sentence, should any refuse cleaned up and disposed of by the County be determined to be solid waste or hazardous materials, the Developer and the Metro District, but not the County, shall be
responsible and liable as the owner, generator, and/or transporter of said solid waste or hazardous materials.

14. **Applicable Law and Venue:** The laws, rules, and regulations of the State of Colorado and El Paso County shall be applicable in the enforcement, interpretation, and execution of this Agreement, except that Federal law may be applicable regarding solid waste or hazardous materials. Venue shall be in the El Paso County District Court.

15. **Limitation on Developer’s Obligation and Liability:** The obligation and liability of the Developer hereunder shall only continue until such time as the Final Plat as described in Paragraph Three (3) of the Recitals set forth above is recorded and the Developer completes the construction of the detention basin/BMP(s) and transfers all applicable maintenance and operation responsibilities to the Metro District. By execution of this agreement, the Metro District agrees to accept all responsibilities and to perform all duties assigned to it, including those of the Developer, as specified herein, upon transfer of [Insert Lot, Tract or easement identifier(s)] from Developer to the Metro District.

IN WITNESS WHEREOF, the Parties affix their signatures below.

Executed this _________ day of _________________, 20___, by:

[Insert Developer’s company name]

By:  __________________________________________
[Insert name], [Insert title(President/Manager)]

The foregoing instrument was acknowledged before me this ______ day of
____________, 20___, by [Insert name], [Insert title(President/Manager)], [Insert Developer’s company name].

Witness my hand and official seal.

My commission expires: __________________________________________

________________________________________
Notary Public
Appendix G Stormwater BMP Maintenance Agreements
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6

Executed this _________ day of _________________, 20___, by:
[Insert first part of Metro District name] METROPOLITAN DISTRICT

By: __________________________________________

[Insert name], President

Attest:
By: __________________________________________

[Insert name], [Insert title]

The foregoing instrument was acknowledged before me this _______ day of
_____________,
20___, by [Insert name], President, and [Insert name], [Insert title], [Insert first part of Metro
District name] METROPOLITAN DISTRICT

Witness my hand and official seal.
My commission expires: ________________________________

_____________________________________________
Notary Public

Executed this ______ day of _______________________, 20___, by:

BOARD OF COUNTY COMMISSIONERS
OF EL PASO COUNTY, COLORADO

By: __________________________________________

________________________, Chair

Attest:
_________________________________________________
County Clerk and Recorder
The foregoing instrument was acknowledged before me this _____ day of ______________, 20___, by __________________, Chair of the Board of County Commissioners of El Paso County, Colorado, as Attested to by ____________________, County Clerk and Recorder.

Witness my hand and official seal.

My commission expires: ________________________________

_________________________________________
Notary Public

Approved as to Content and Form:

_________________________________________
Assistant County Attorney
SURETY ESTIMATE FORM

This Surety Estimate Form is located on the El Paso County website at http://adm.elpasoco.com/Development%20Services/Pages/CollateralSuretyForms.aspx

The following pages contain typical wording for:

- Defect Surety
- Performance Surety
- Punchlist Inspection Form
- Schedule for Completion of Improvements
- Surety Release Inspection Request
DEFECT SURETY (TYPICAL WORDING)

KNOW ALL MEN BY THESE PRESENTS: That (Owner or Contractor and Address) as Principal and the (Insurance Company) as a (Name of State) corporation authorized to execute an approved form of surety in the State of Colorado, and duly authorized to transact a general surety business in the State of Colorado, as Surety, are held and firmly bound unto County of El Paso, State of Colorado, in the sum of (20% of Contract Price) lawful money of the United States, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT: WHEREAS (The Principal) has _________________________________________________________________________, and WHEREAS, the said (Principal) is required to give a form of surety in the amount of (20% Contract Price) to protect the said COUNTY OF EL PASO against the result of faulty materials or workmanship for a period of TWO YEARS from and after the date of completion and preliminary acceptance of said work;

NOW, THEREFORE, if the said (Principal) shall for a period of TWO YEARS from and after the date of completion and acceptance of said work, replace any and all defects arising in said work whether resulting from defective materials or defective workmanship, then the above obligation to be void; otherwise, to remain in full force and effect.

Signed and sealed this __________________________ day of ____________________, 20__.
PERFORMANCE SURETY (TYPICAL WORDING)

WHEREAS, the County of El Paso, State of Colorado, and ______________________________ (hereinafter designated as “Principal”) have entered into an agreement whereby Principal agrees to install and complete certain designated public and development or subdivision improvements, which said agreement, dated ______________, and identified as Project ________________ is hereby referred to and made a part hereof; and

WHEREAS, Principal is required under the terms of said agreement to furnish surety for the faithful performance of said agreement;

NOW, THEREFORE, we, the Principal and ______________________________, as Surety, are held firmly bound unto the County of El Paso (hereinafter called “County”) in the penal sum of _____________________ Dollars ($______________) of lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The condition of this obligation is such that if the above Principal, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and provisions in said agreement and any alteration thereof made as therein provided, on his or their part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless the County, its elected officials, officers, employees, agents, and volunteers, as therein stipulated, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect.

As a part of the obligation secured hereby and in addition to the face amount specified therefore, there shall be included costs and reasonable expenses and fees, including reasonable attorney’s fees, incurred by County in successfully enforcing such obligation, all to be taxed as costs and included in any judgment rendered. The surety hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the agreement or to the work to be performed thereunder or the specifications accompanying the same shall in manner affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the agreement or to the work or to the specifications.

IN WITNESS WHEREOF, this instrument has been duly executed by the Principal and Surety above named on ________________________________________:
Appendix H Performance Surety Form
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6

APPROVED AS TO FORM:
________________________________
COUNTY ATTORNEY

ATTEST:
________________________________
County Clerk (Seal)

Name of Principal
________________________________
By: ________________________________
(Seal)

Name of Surety
________________________________
By: ________________________________
(Seal)    Attorney-in-Fact
PUNCHLIST INSPECTION FORM

1.1 PURPOSE
The purpose of this form is to ensure the completion a preliminary or final acceptance punchlist inspection and provide a comprehensive list of needed corrections.

1.2 INSPECTION CODES
The following codes shall be used:
NA - not applicable, NI – not installed, WU – work underway

1.3 DRAINAGE CONDITIONS CONFORM TO PLANS AND ARE ACCEPTABLE:
- Permanent BMPs
- Culverts
- Storm Sewers
- Manholes (including risers, steps, and inverts)
- Inlets (including risers, steps, and inverts)
- Drainage Contained Within the Right-of-Way
- Platted Drainage Easement
- Construction BMPs Removed

1.4 ROADWAY CONDITIONS CONFORM TO PLANS AND ARE ACCEPTABLE:
- Paved Surface in Acceptable Condition (i.e. free of cracking and potholes)
- Pavement Crown & Super Elevation Acceptable
- Shoulders to Grade and Stabilized
- Roadside Ditches Acceptable
- Cut Slopes to Grade and Stabilized
- Fill Slopes to Grade and Stabilized
- Paved Surface Cleared of Loose Stone

1.5 RIGHT-OF-WAY:
- Clear of Vegetation
- Clear of Debris
- Curbing Acceptable
- Sidewalk Acceptable
- Driveway Entrances Properly Installed According to Road Plan or Site Plan
- Driveway Entrances and/or Commercial Entrances Located as shown on Plans
- Guardrail Installed in Correct Location(s)
- Guardrail Installed at Correct Distance from Edge of Pavement
- Proper Guardrail End Sections Installed in Approved Manner
_____ Grass on Shoulders & Ditches Has Been Mowed
_____ Dead Trees Removed That Might Fall in Right-Of-Way
_____ Shoulders and Ditches Free of Loose Stone
_____ Driveway Pipes Clean and Functioning Properly

1.6 INSPECTION RESULTS

An Inspection Report shall be completed with all items failing to adhere to the approved plans and ECM Standards and specifications. This handwritten punchlist is to be typed, proofed, and then given to the engineer. In addition, the completed Inspection Form shall be put in the project file.
SCHEDULE FOR COMPLETION OF IMPROVEMENTS

1.1 PURPOSE
This form is intended to facilitate the completion of approved improvements in a timely manner by assuring the applicant has a schedule in place for the completion of the improvements, and by providing the County a means to assess the applicant’s ability to meet the completion date stated in the approved agreement. The permit holder must provide an estimated completion date for each milestone listed below.

1.2 GENERAL INFORMATION
Date: ______________________________________________________________________
Applicant: ___________________________________________________________________
Phone: _______________________________________________________________________
Tax Map Parcel No.: __________________________________________________________
Project Name (Include phase, section, and other relevant information to clearly identify the project): ______________________________________________________________________

<table>
<thead>
<tr>
<th>Date</th>
<th>Milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of construction.</td>
</tr>
<tr>
<td></td>
<td>Temporary erosion control systems installed (Initial BMPs).</td>
</tr>
<tr>
<td></td>
<td>Grading, subgrade, and stormwater management activities completed.</td>
</tr>
<tr>
<td></td>
<td>Road base constructed to required grade.</td>
</tr>
<tr>
<td></td>
<td>Asphalt, curb and gutter installation completed.</td>
</tr>
<tr>
<td></td>
<td>End of construction.</td>
</tr>
</tbody>
</table>

Office Use

|               | Road Improvements “Preliminary Acceptance Inspection”                     |
|               | Road Improvements “Final Inspection” (private roads accepted at this point) |
|               | Public Road “Preliminary Acceptance” notification received from BOCC.      |
1.3 AUTHORIZATION OF REQUEST

________________________________________
Signature of Applicant

________________________________________
Print Applicant Name       Title (if appropriate)
SURETY RELEASE INSPECTION REQUEST

1.1 PURPOSE

This form is used to request that an inspection be scheduled to determine if the following performance sureties can be reduced or released (check below all that apply). Requests are required for either partial or full release of any construction surety. Requests for construction surety reduction will be subject to the following conditions based upon the percentage of work completed and approved by the County, or other authority or agency having jurisdiction over the improvement. The following conditions apply to surety reductions and inspection fees.

- No more than three inspections for surety reductions will be scheduled during any twelve-month period.
- A surety reduction inspection fee must accompany each request for reduction.
- Inspections will be scheduled within 30 days of receipt of the surety reduction inspection request form and applicable fee.
- Reductions will not occur until completion and approval of at least 30% of the proposed improvements.
- 20% of the original construction surety amount will be retained until final completion and preliminary acceptance of all improvements.

Inspections will be scheduled within thirty days of receipt of this request and the required fee. Inspections must be requested by the permit holder.

1.2 GENERAL INFORMATION

Date: ____________________________________________
Applicant: ____________________________________________
Phone: ____________________________________________
Tax Map Parcel No.: ____________________________________________
Project Name (Include phase, section, and other relevant information to clearly identify the project): ____________________________________________

1.3 SURETY RELEASE INFORMATION

☐ Water Protection Performance Surety
  ☐ Erosion & Sediment Control
  ☐ Stormwater Management & Water Quality

Identification No.:
________________________________________
Description of Release Requested: ____________________________________________
________________________________________
Appendix H Surety Release Request Form

Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6

_______________________________________________________________________
_______________________________________________________________________
Amount of Requested Release: _____________________________________________

☐ Subdivision/Public Improvement Performance Surety

☐ Roads & Drainage (at least 30% of the work must be satisfactorily completed before requesting an inspection for reduction)

☐ Water & Sewer (at least 30% of the work must be satisfactorily completed before requesting an inspection for reduction)

☐ Other – list below (i.e. landscaping, pedestrian paths)
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Identification No.: _______________________________________________________

Description of Release Requested: ___________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Amount of Requested Release: _____________________________________________

☐ Work in the Right-of-Way Performance Surety

Identification No.: _______________________________________________________

Description of Release Requested: ___________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Amount of Requested Release: _____________________________________________

☐ Site Development Performance Surety

Identification No.: _______________________________________________________

Description of Release Requested: ___________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Amount of Requested Release: _____________________________________________
1.4 **FEE**
SUBMIT REQUIRED SURETY INSPECTION FEE - make check payable to the El Paso County and submit with request.

1.5 **AUTHORIZATION OF REQUEST**

______________________________
Signature of Permit Holder

______________________________
Print Permit Holder Name               Title (if appropriate)
APPENDIX I  STORMWATER QUALITY POLICY & PROCEDURES

I.1 TITLE

This appendix is called the “El Paso County Addendum to the Colorado Springs Drainage Criteria Manual, Volume 2: Stormwater Quality Policies, Procedures and Best Management Practices (BMPs)” (DCM2) and shall be referred to throughout the text as the Addendum.

I.2 OVERVIEW

As part of the National Pollutant Discharge Elimination System (NPDES)-Phase II program administered by the Colorado Department of Public Health and the Environment, El Paso County has a Colorado General Discharge Permit for Stormwater Discharges Associated with Municipal Separate Storm Sewer Systems (MS4 Permit). This Permit, made effective March 10, 2003, authorizes El Paso County to discharge stormwater associated with municipal separate storm sewers in its permitted area into waters of the State. As part of this permit, the County is required to take measures to protect the quality of stormwater from contaminants, including sediment.

The El Paso County Policy Plan, adopted January 20, 1998, includes several policies directly related to protecting the quality of surface water in the County, especially as it relates to stormwater runoff. Policy 2.1.1 commits the County to meeting the requirements of the Clean Water Act.

Directly related to the NPDES programs are:

- Policy 3.3.4 – Implement appropriate measures to protect and/or mitigate effects of point and non-point sources of pollution to surface water,
- Policy 3.3.5 – Regulate or restrict uses that are proven to contribute to contamination of water supplies,
- Policy 3.3.6 – Evaluate the consequences to surface water from new development including run off of natural soils, as well as chemical compounds that may result from the proposed uses,
- Policy 11.1.4 – Require development plans to effectively address both quantitative and qualitative impacts of drainage within the project site,
- Policy 11.3.3 – Fully evaluate the relative impact of proposed drainage improvements on the maintenance of water quality,
- Policy 11.3.4 – Promote the effective use of innovative short and long term strategies including sediment ponds, buffer strips, and constructed wetlands as a means of reducing peak flows and improving stormwater quality, and
- Policy 11.3.6 – Encourage the effective use of control measures to mitigate the short and long term erosion impacts of development.

Nothing contained herein relieves any person, corporation, firm or entity from the obligation to comply with any applicable state or federal laws or regulations relating to water quality or water quality standards or any other standards related to land disturbance activities.

I.3 ADOPTION OF DRAINAGE CRITERIA MANUAL VOLUME 2 BY EL PASO COUNTY

In November of 2002, the City of Colorado Springs adopted Drainage Criteria Manual Volume 2: Stormwater Quality Policies, Procedures and Best Management Practices (BMPs). The goal of this document is to provide guidance and engineering criteria for water quality protection measures during construction and for permanent installations.

DCM2 is adopted as the County’s stormwater quality design criteria with this Addendum that provides additions and revisions as applicable to the County in order to expand its scope to cover rural areas and other situations specific to the County. The goal has been to maintain consistency between criteria used in the County and the City of Colorado Springs.

To clarify applicability, “El Paso County” will be substituted for “City of Colorado Springs” or a County department or position analogous to one in the City will be used where appropriate unless otherwise specified in this Addendum. Table I-1 summarizes the most common or typical substitutions that shall be used in applying and interpreting DCM2. An example of a section where substitution would not be appropriate is the discussion of Colorado Springs’ stormwater discharge permit in Section 2.3 which is different in history and requirements from that of the County.

Table I-1. General Substitutions

<table>
<thead>
<tr>
<th>Text in DCM2</th>
<th>Substitution in DCM2 as Applied in El Paso County</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Colorado Springs</td>
<td>El Paso County</td>
</tr>
<tr>
<td>City</td>
<td>County</td>
</tr>
<tr>
<td>City Engineer</td>
<td>County Engineer</td>
</tr>
<tr>
<td>City Engineering Inspector</td>
<td>County Inspector</td>
</tr>
<tr>
<td>City Inspections</td>
<td>County Inspections</td>
</tr>
<tr>
<td>Erosion and Stormwater Quality Control Plan</td>
<td>Stormwater Management Plan</td>
</tr>
<tr>
<td><strong>Other Changes</strong></td>
<td></td>
</tr>
<tr>
<td>Hillside Overlay</td>
<td>Remove references to “Hillside Overlay”</td>
</tr>
</tbody>
</table>

I.4 EL PASO COUNTY EROSION AND STORMWATER QUALITY CONTROL PERMITS

An overview of the two types of erosion and stormwater quality permits issued by El Paso County is provided in section 5.6 of the ECM. The following section provides specific stormwater permit application requirements and permit holder responsibilities for construction activities that occur within the unincorporated areas of El Paso County.

I.4.1 Erosion and Stormwater Quality Control Permit

An Erosion and Stormwater Quality Control Permit (ESQCP) is required for construction activities that result in land disturbance of greater than or equal to (≥) one acre. An ESQCP is required for construction of less than (<) one acre if the activity is part of a larger common plan of development or sale that would disturb one acre or more of ground surface. Refer to Table I-2 for additional criteria to determine applicability of an
ESQCP. Ground surface disturbing activities include, but are not limited to, clearing, grading, excavating, demolition, installation of new or improved haul roads, staging areas, stockpile and borrow areas. Measures to protect water quality are to be implemented when needed as determined by an El Paso County Inspector, even if a permit is not required. The ESQCP is the key part of protecting water quality in the County and provides for detailed and specific Best Management Practices (BMPs) during construction through final stabilization.

Storm Sewer Connections:
An ESQCP may be used as a storm sewer connection permit to allow for a connection to the El Paso County separate storm sewer system. Those cases are limited to entities that possess their own Colorado Discharge Permit System permit for stormwater discharges, the land disturbances is less than one acre and not part of a larger common plan of development or sale.

A. Application
Applications for ESQCPs generally are submitted to the El Paso County Development Services Department as part of a Land Use application. For projects not involved in the Land Use application process, an ESQCP application must be submitted to the Public Services Department at least ten (10) days prior to the anticipated start of construction. The owner or operator of the construction activity must submit an ESQCP application with all required material listed below to allow for review and approval of the permit.

No work shall begin until the ECM administrator, or his designee, issues a Notice to Proceed under an approved Land Use application. Typically the Notice to Proceed is issued as part of the preconstruction conference held by Development Services Department staff. For ESQCP issued by the Public Services Department, a separate written Notice to Proceed is provided with the approved ESQCP.

Applications for an ESQCP shall include a completed permit application form and any required attachments reasonably necessary to review and evaluate the application or complete the permit. Generally, an application for an ESQCP shall be accompanied by the following:

1. **Stormwater Management Plan (SWMP)**
   The goal of a SWMP is to identify possible pollutant sources that may contribute to stormwater pollution, and identify Best Management Practices (BMPs) that, when implemented, will reduce or eliminate any possible water quality impacts. The SWMP must be completed and implemented prior to the time construction starts. The SWMP shall be submitted as a separate, stand-alone document from the engineering plan set submitted for review and approval.

   El Paso County uses a checklist to perform a completeness review of the initially submitted SWMP. The SWMP is intended to be a dynamic
document and must be revised as construction proceeds to accurately reflect the current conditions and Best Management Practices in use at the site. A copy of the checklist can be found in Appendix E.

2. **Permit Fee**

   Permit fees must be paid at the time of application for a permit. If the ESQCP and associated documents are reviewed as part of the Land Use application process, the ESQCP permit fee is included in the fee for plan review. If the ESQCP and associated documents are reviewed by the Public Services Department, a separate permit fee payment must be made. The permit fee shall be in a form acceptable to the ECM Administrator. Permit fees are non-refundable.

3. **Financial Surety**

   Financial surety equal to the estimated cost of all construction Best Management Practices and permanent Best Management Practices as described in the SWMP shall be required with each ESQCP application. The El Paso County Surety Estimate form found in Appendix H of the Engineering Criteria Manual must be used to calculate the surety amount. The financial surety shall be in a form acceptable to the ECM Administrator. The following are exempt from ESQCP Financial Surety requirements: special districts, utilities governed by the State Public Utilities Commission and municipalities.

4. **Statement of Certification**

   Signed statement from owner (applicant) certifying that the SWMP and other terms of the permit will be met.

5. **Operation and Maintenance Plan**

   Submitted and approved Operation and Maintenance Manual for Permanent BMPs, if any to be located on site.

6. **Maintenance Agreement**

   Submitted and signed Private Detention Basin / Stormwater Quality Best Management Practice Maintenance Agreement and Easement, if any Permanent Best Management Practices are to be located on site.

7. **Application Information**

   - Property location and legal description
   - Owner Name and Contact Information
   - Contractor Name and Contact Information
   - Project-related information such as: total acres, disturbed acres, brief description of project, and project schedule
El Paso County Surety Estimate form that contains cost estimates of Construction and Maintenance of Control Measures for determination of Financial Surety

Because each permit and site is different with respect to the scope of work and location, additional requirements may be added to address specific concerns relative to the proposed work. Attached to each approved permit will be a list of Special Provisions, if any, which shall govern the work and set forth minimum requirements for disturbing land in the County.

B. Permit Holder Responsibilities

The permit holder shall be responsible for the work authorized under the permit. Should there be any defects or failures in the work that result in erosion or sediment releases, following preliminary acceptance, corrective work shall be performed immediately upon notification from the County Stormwater Staff or County Subdivision Inspector. Failure to respond in a reasonable time frame, as determined by the County Stormwater Staff, shall be just cause for the County Stormwater Staff to take the necessary action to have the defect corrected and to bill the permit holder or draw on the financial assurance for the cost to correct the defect.

The permit holder is responsible for subcontractors and others at the site meeting the provisions of the SWMP. The permit holder is responsible for determining the need for and obtaining other required permits. A State General Permit for Stormwater Discharges from Construction Activities may be required if criteria for an ESQCP is met.

Upon completion of the permitted project, the permit holder is responsible for contacting the County, in writing to request closure of the permit. Permit Closure will be granted when all of the following conditions are met:

- Construction is complete and final stabilization has been achieved. Final stabilization will be achieved when re-vegetation efforts result in at least 70% of pre-disturbance vegetative cover at the site or equivalent permanent structural erosion and sediment control methods have been employed;
- All temporary BMPs have been removed from the site;
- A copy of the Construction Stormwater Inactivation Notice submitted to the Colorado Department of Public Health and Environment is provided to the County.

C. Transfer of Property and Permit Holder Responsibilities

Each successive owner of a property through the land development and building process will obtain its own ESQCP and submit its own permit fees and financial surety until final stabilization is achieved. The new owner of a property that is under an open ESQCP must immediately obtain its own ESQCP. The SWMP
from the previous owner may be used, if the previous owner agrees, it covers the phases of work planned by the new owner and it remains relevant to the work to be done. If the new owner will be building single-family residences or duplexes, it may qualify for a BESQCP. The BESQCP is to be obtained immediately following purchase.

When a property is covered by an ESQCP, construction is complete, final stabilization has not occurred, and more than one lot of the covered property is sold to another party (e.g., a home builder or private investor) the previous owner (i.e., current permit holder) is responsible for installing all necessary temporary erosion and sediment control BMP’s and informing the new property owner in writing of their responsibility to maintain the temporary BMP’s until final stabilization (e.g., landscaping) has been installed. Upon closing of the sale, the previous owner will then be allowed to modify the ESQCP by notifying a county stormwater inspector in writing by providing them with a copy of the “Notice of Reassignment of Permit Coverage and General Permit Application Stormwater Discharges Associated with Construction Activities,” which should be provided to the State of Colorado, when applicable. The Stormwater Management Plan must also be revised to account for the change in permit area coverage. Following the transfer and issuance of an ESQCP (or BESQCP as described below), the original owner may receive a partial release of the financial assurance proportional to the BMPs on the part of the property that was sold.

In situations where a BMP that provides protection for property that has been sold is located on the property that belongs to the original or other owner, the responsibility for the BMP rests with the owner of the property where it is located.

I.4.2 Builder’s Erosion and Stormwater Quality Control Permit

Builders of single family residences or duplexes may follow a simplified procedure by obtaining a Builder’s Erosion and Stormwater Quality Control Permit (BESQCP) for each lot and structure with a separate address. A BESQCP is used to protect stormwater on individual building lots with < 1 acre of total disturbed area. A property must be covered by either an ESQCP or BESQCP in order to obtain a building permit.

If the lot has been disturbed previously by construction work but has been completely stabilized and any ESQCP on the property has been closed, the lot may be considered undisturbed. A builder that has acquired a single residential lot that is covered by an ESQCP and the property has not been stabilized nor the ESQCP closed, the builder must obtain a new BESQCP to cover the future construction activity of single residential lots or duplexes.

A. Application

Applications for a BESQCP shall include a completed permit application form and any required attachments reasonably necessary to review and evaluate the application or complete the permit, a signed statement from the owner (applicant) certifying the terms of the permit will be met, and a permit fee. Financial surety or
a SWMP are not required for a BESQCP. However, a site covered by a BESQCP is required to meet stormwater quality protection criteria of preventing pollutants, including sediment, from leaving the site. If a BESQCP is revoked, the applicant will obtain an ESQCP, including the submission of a SWMP and payment of permit fee and financial surety.

Table I-2 provides guidance on which permit is to be obtained for various situations.
Table I-2. ESQCP and BESQCP Permit Guidance

<table>
<thead>
<tr>
<th>ESQCP</th>
<th>BESQCP</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td>Disturbs &gt;= 1 acre</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Disturbs &lt; 1 acre, but part of larger project that disturbs &gt;= 1 acre</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>New ESQCP required when developer acquires disturbed land previously or currently covered by an ESQCP unless meets criteria for BESQCP.</td>
</tr>
</tbody>
</table>

For Builders

<table>
<thead>
<tr>
<th>No</th>
<th>No</th>
<th>Single family residence or duplex building site disturbs &lt; 1 acre that is not part of larger project and is not in a sensitive area¹.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td>Single family residence or duplex site that has &lt; 1 acre of disturbed areas and the site is not currently covered by an ESQCP and site is not in sensitive area.</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Single family residence or duplex site that has &lt; 1 acre of disturbed areas and the site is currently covered by an ESQCP and site is not in sensitive area.</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Single family residence or duplex building site that has &lt;1 acre of disturbed area and the site has been covered by ESQCP in the past and is in sensitive area.</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Single family residence or duplex building site that disturbs ≥ 1 acre that has not previously been covered by an ESQCP.</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Commercial or multi-family building sites other than duplexes that disturbs ≥ 1 acre of land.</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td>Commercial building sites that disturbs &lt; 1 acre of land that are located within a sensitive area, or have potential stormwater discharges of concern² to the ECM Administrator.</td>
</tr>
</tbody>
</table>

NOTES:
1. Sensitive Areas are defined as those waters identified in Table I-5 of the ECM; and any other areas of concern identified by the ECM Administrator, such as endangered species habitat area, jurisdictional wetlands, flood plains or direct discharges to waters of the state.
2. “Potential stormwater discharges of concern,” include possible discharges from commercial sources with ability to cause water quality violations or acutely toxic conditions in receiving waters. Examples of sources include, but are not limited to, auto salvage yards, auto repair facilities, industrial sources, restaurants.

B. Permit Holder Responsibilities

The builder permit holder (owner) is responsible for subcontractors and others at the site to meet the provisions requirements of the BESQCP. The permit owner is responsible for determining the need for and obtaining other required permits. A State General Permit for Stormwater Discharges Associated with Construction Activities may be required.
The BESQCP owner is responsible for closure of the BESQCP upon completion of the project. To close a BESQCP all the following requirements must be met:

- Notify a County Inspector in writing that all work under the Building Permit is complete and request closure of the BESQCP;
- The site is stabilized to prevent sediment transport off the lot;
- All temporary BMPs have been removed.

C. Transfer of Property and Permit Holder Responsibilities

If a single residential lot covered by a ESQCP is sold prior to completion of construction and final stabilization of the lot has not been achieved, the new owner must obtain a BESQCP and will become responsible for achieving final stabilization of the lot. Only when a new BESQCP is obtained by the new owner will the ESQCP holder be allowed to modify the ESQCP to remove the sold lot from permit coverage.

D. Reassignment of Permit Coverage

When a property is covered by a ESQCP, construction is complete, final stabilization has not occurred, and the property is sold to a private home owner the current permit holder is responsible for installing all necessary temporary erosion and sediment control BMP’s and informing the new property owner, in writing, of their responsibility to maintain the temporary BMP’s until final landscaping has been installed. Upon closing of the sale, the previous owner will then be allowed to remove the sold property from the ESQCP coverage by notifying a county stormwater inspector in writing.

I.5 EL PASO COUNTY CONSTRUCTION SITE INSPECTIONS

[Replaces DCM2 Section 3.4]

Inspections of construction sites are conducted by the County Inspectors (Stormwater and Subdivision) to ensure compliance with the SWMP and associated county permits.

The focus of construction sites inspections is to ensure construction is in compliance with the approved plans and that BMPs are installed and maintained consistent with the onsite SWMP to prevent erosion, sediment transfer, spillage and leakage, improper sludge or waste disposal, and drainage from raw material storage from leaving the site creating negative public safety, property or stormwater quality impacts.

Inspections also serve as a means of educating owners/owner’s representatives, developers, and contractors of the need to minimize negative stormwater quality impacts from the site operations and to assist in complying with the requirements of the County’s Stormwater Program. As such County Inspectors will take a compliance assistance approach and will work with and assist the owner/owner’s representative and contractor to maintain compliance with its approved plans and erosion and stormwater quality control requirements.
I.5.1 County Engineering and Subdivision Inspections

County Engineering Inspections shall be accomplished by County Inspectors (Stormwater and Subdivision) for the purpose of assuring compliance with the County’s General Permit for Stormwater Discharges Associated with Municipal Separate Storm Sewer Systems (MS4). Projects located in the unincorporated areas of El Paso County with an active ESQCP issued by the Public Services Department shall be inspected by County Stormwater Inspectors. Projects located within the unincorporated areas of El Paso County with an ESQCP associated with Land Use Permits or Construction Permits issued by Development Services Department will be inspected by County Subdivision Inspectors. County Stormwater Inspectors typically will perform Reconnaissance, Compliance, Complaint Response, and Follow up inspections.

County Subdivision Inspectors and County Stormwater Inspectors may share duties. Inspections are not limited to new development and may be performed on any other land-disturbing activities except agriculture and mineral extraction that occur in unincorporated areas of the County.

County Subdivision Inspections of installed BMPs shall be accomplished by County Subdivision Inspectors. The types of inspections that County Subdivision Inspectors will perform are the Initial, Compliance, Follow-up, and Acceptance Inspections.

I.5.2 Types of Inspections

The following are inspections that may be performed at the construction sites within the unincorporated areas of El Paso County. Not all inspection types will be performed at all sites.

A. Self-Monitoring Inspections

The permit holder or authorized agent shall conduct Self-Monitoring Inspections. The purpose of these Self-Monitoring inspections is to ensure that all BMPs are installed according to approved plans, the BMPs are being properly maintained and the SWMP is updated to reflect current conditions. The person performing the inspections must be a registered Professional Engineer in Colorado, a certified erosion control specialist, or certified in a regionally recognized inspection training program. The person performing inspections should be a person with authority to expend project dollars on erosion and stormwater quality control.

The self monitoring inspections are to be performed and documented at least once every 14 calendar days. In addition to the bi-weekly inspections the owner or representative shall perform inspections of all BMPs after any precipitation or snowmelt event that causes surface erosion to insure that the BMPs have operated as designed, to determine if maintenance is needed, and to locate and clean up any areas where materials have run off site. The owner or his representative will record the results of all inspections by completing a copy of the Field Inspection Report or similar inspection checklist included in the SWMP.
Completed inspection reports shall be kept on site and available to County Inspectors (Stormwater and Subdivision). The County may require the submission of these inspection reports on a site-specific basis. Self-monitoring inspections are required on all construction sites, even if an ESQCP or BESQCP is not required.

The owner or representative may request an alternative to the 14 day self monitoring inspection cycle discussed above. Self Monitoring Inspections of stormwater best management practices may be requested for at least once every month (i.e., 30 days) for permitted construction sites where all construction activity is completed except final stabilization because planted vegetative cover has not yet become established. Self Monitoring Inspections after precipitation events are not required during an approved 30 day inspection cycle.

B. Initial Inspections for Sites Covered by ESQCPs

Initial inspections are to confirm that the SWMP is being implemented prior to the start of construction. The Initial Inspection must be scheduled at least 48 hours in advance. At the time of the Initial Inspection, the Initial BMPs must have been implemented according to the SWMP. No other land disturbing activity shall occur prior to the Initial Inspection. This inspection also serves to establish contact between Inspectors and the site personnel responsible for implementing the approved plans. This is especially important for those sites that have a long construction period or the potential to have a significant impact. These inspections are documented on the Field Inspection Report.

For projects permitted through the Development Services Department, during the Preconstruction Conference a County Inspector will provide the permit owner with an overview of initial BMPs expected to be installed prior to construction as outlined in the grading, erosion, and sediment control plans and/or SWMP and a timeline for completion of installation will be determined. Typically, a Notice to Proceed with initial temporary BMP installation will be given to the permit holder during the Preconstruction meeting. Upon installation of initial BMPs the permit holder (owner) or representative shall request an Initial Inspection by a County Inspector. Following a satisfactory Initial Inspection and verification that all required permits have been obtained by the permit holder (owner), a written Notice to Proceed will be provided for construction within two county working days after completion of an acceptable Initial Inspection.

For projects permitted through the Public Services Division, upon approval of the ESQCP and after an Initial Inspection a written Notice to Proceed will be provided to the permit owner or owner’s representative.

Failure to install initial BMPs, pass an Initial Inspection, or obtain a Notice to Proceed prior to beginning land disturbing activities may result in an immediate Stop Work Order.

Initial Inspections and Notices to Proceed are not required for sites with BESQCPs.
C. Compliance Inspections

Compliance Inspections are routine inspections conducted by County Inspectors (Stormwater and Subdivision) to ensure that the SWMP is being implemented. Compliance Inspections may occur during or immediately after a precipitation event.

During Compliance Inspections the County Inspectors (Stormwater and Subdivision) verify that the BMPs are installed and functioning according to design; only allowable discharges are occurring; the required Self Monitoring Inspections and associated documentation of activities are occurring; and the SWMP map is revised to reflect current site conditions. The County Inspectors will examine the SWMP, and Self Monitoring inspection reports and will evaluate installed BMPs to identify any installation, maintenance or effectiveness issues to determine compliance with the ESQCP.

Compliance Inspections are typically conducted for sites that require an ESQCP and are located within the urbanized areas of unincorporated El Paso County. The County uses the Field Inspection Report to document Compliance Inspections. A copy of the completed report will be provided to the permit holder (owner) typically within two County work days following the inspection.

D. Reconnaissance Inspections

Reconnaissance Inspections occur on a routine basis and are conducted for the general purpose of determining obvious compliance issues at the site. Particular attention is paid to determine if the site has contributed to offsite transfer of sediment or other pollutants to roads, drainage facilities, or surface water bodies and if any obvious BMP maintenance is needed.

Reconnaissance Inspections are generally performed from off-site on adjacent streets or property, and may occur during or immediately after a significant precipitation event. The Reconnaissance Inspection will be documented using the Field Inspection Report and a copy of the completed report will be provided to the permit owner.

A Reconnaissance inspection with cause could result in requiring a site that previously was not permitted, to submit a permit application and obtain an ESQCP or BESQCP.

E. Complaint Response Inspections

These Compliant Response Inspections will occur in response to either a citizen complaint or a complaint from another County agency. The County Inspectors (Stormwater and Subdivision) will inform the permit holder or authorized agent of the complaint, determine the validity of the complaint, and if necessary, advise on the necessary repair, maintenance or cleanup. The County Inspectors (Stormwater and Subdivision) may also require the implementation of specific measures or additional BMPs to prevent the recurrence of the problems that
gave rise to the complaint. All construction sites are subject to complaint response inspections. The Complaint Response Inspection will be documented using the Field Inspection Report.

F. Follow-up Inspections

Follow-up Inspections are conducted to ensure that measures or requirements from a previous inspection have been performed or complied with. These requirements may involve the cleanup of a discharge, implementing additional or revised BMPs, repairing, re-installing, or maintaining damaged or non-functioning BMPs. All construction sites are subject to Follow-up Inspections. The Follow-up Inspection will be documented using the Field Inspection Report.

Reconnaissance, Complaint and Follow-up Inspections will be used for construction sites with BESQCPs.

G. Final Inspection

At the completion of a project, when the ESQCP permit holder (owner) believes conditions in section I.4.3 are met and a request to close the ESQCP is received by the County, a County Inspector will perform a final inspection to verify the conditions required to close the permit are met. If so confirmed during the ESQCP Final Inspection, the County will provide the permit holder (owner) a written notice of permit closure using the Field Inspection Form.

During ESQCP Final Inspection, the following items will be evaluated in addition to the requirements listed in section I.4.3.

- The site has final stabilization equal to a uniform vegetative cover with a density of at least 70 percent compared to the pre-disturbance levels and such cover is capable of adequately controlling soil erosion, as determined by the County Inspectors (Stormwater and Subdivision), or equivalent permanent, structural erosion and sediment control methods have been employed.
- Any sediment or other pollutant that may have been transferred off-site has been removed.
- The site shall be free of noxious weeds or treated according to an approved Noxious Weed Control Plan.
- All approved permanent (post construction) BMPs have been maintained and are functioning in accordance with the design and with the Operation and Maintenance Manual.
- Streets, parking lots and other paved surfaces (on-site and off-site) are free of sediment and debris.
- Drainage structures such as pipes, inlets and channels are clean and in good service.
- The site is in compliance with required corrective action identified during previous Inspections.
Upon a satisfactory Final ESQCP Inspection the County will initiate the Surety Release process.

I.5.3 Frequency and Types of Inspections of Construction Sites

The frequency and type of inspections conducted by County Inspectors (Stormwater and Subdivision) will depend on the characteristics of the site, the type or phase of construction and the potential for the site to impact stormwater quality and other areas of environmental concern. The level of construction activity throughout the County and availability of staff resources will also factor into the decision. Key factors involved in the decision that relate to construction and the site are:

- The size of the disturbed area.
- The length of time that the site will be left disturbed.
- The proximity of the construction site to areas of environmental concern.
- Past experiences with the permit holder.
- The phase of construction.
- Season of land disturbing activity.

I.6 CONSTRUCTION STORMWATER ENFORCEMENT

[Replaces DCM2 Section 3.5]

As part of the effective stormwater protection and erosion control, a series of enforcement measures will be followed to ensure compliance with the County’s stormwater program.

The County considers the owner of the land the ultimate responsible party for all construction activities. It is the responsibility of the owner to take all necessary measures to ensure that the site is in compliance with County resolutions and Construction Permit, Stormwater Management Plan and the Erosion and Stormwater Quality Control Permit or Builder’s Erosion and Stormwater Quality Control Permit.

In addition to County requirements, the owner must meet State and Federal regulatory requirements for permits and BMPs. The County has tried to make its requirements consistent with State requirements for construction activities (CDPS General Permit – Stormwater Discharges Associated with Construction Activities). Should requirements conflict, it will be the responsibility of the owner to bring these conflicts to the County’s attention and propose how to address them.

Whenever a Stop Work Order is issued, it will be the County’s policy to stop any or all related work activities or further approvals relative to the site until the necessary measures are taken to address the concerns, as stipulated in the Stop Work Order.

In cases where the ECM Administrator deems it necessary to address a construction site with more aggressive action, the El Paso County Ordinance 07-01: Prohibiting Illicit Discharges to the County Storm Sewer System may be used, as appropriate, to address the site. Additional information on the County’s Enforcement Procedures is discussed in Section I.6.2.
Definitions

A. **Stop Work Order**

A Stop Work Order is a written order to immediately cease construction activity at a site. The Stop Work Order may be issued by the ECM Administrator, or County Stormwater staff and Subdivision Inspectors to the permit holder or authorized agent of a construction site. An immediate Stop Work Order shall be issued when the property owner has failed to obtain an ESQCP, BESQCP, or a Notice to Proceed prior to land-disturbing activity. A Stop Work Order may also be issued if the site operator has demonstrated obvious non-compliance with the ESQCP or BESQCP after repeated attempts by the Inspector to bring the site into compliance. When the Stop Work Order is issued, it requires all work on the site to cease until the permit holder (owner) takes the measures necessary to bring the site into compliance. A written notice to resume construction activity will be provided in the Field Inspection Report, upon a Follow up Inspection by a County Inspector to verify satisfactory completion of required corrective actions identified in the Stop Work Order.

B. **Inspection**

The term “inspection” refers to an evaluation of compliance with the SWMP, approved plans and permits for a construction site, which is performed by a County Inspector. (Stormwater or Subdivision). For the purposes of Appendix I, inspections performed by County Inspectors include, but are not limited to: Initial Inspections, Compliance Inspections, Reconnaissance Inspections, Complaint Response Inspections, Follow-Up Inspections, and ESQCP Final Inspections. Self Monitoring inspections are performed by the permit holder (owner) or authorized agent.

C. **Stormwater Management Plan**

A Stormwater Management Plan (SWMP) is a plan developed in compliance with the content requirements in the “CDPS General Permit and El Paso County Stormwater Quality Policy and Procedures”. A copy of the SWMP Checklist can be found in Appendix E. The SWMP shall be a separate, stand alone document from the engineering plan set. The purpose of the SWMP is to develop and document a systematic approach to identify possible pollutant sources that may contribute pollutants to stormwater, and identify Best Management Practices (BMPs) that, when implemented, will reduce or eliminate any possible negative water quality impacts. The SWMP must be completed and implemented prior to beginning ground disturbing activities, and revised as construction proceeds to accurately reflect the conditions and practices at the site.

Revisions must be made to the SWMP before changes are made in the field. A map showing the current location, status and changes to the BMPs are required. The owner or his representative shall keep records of the BMPs as they are installed or removed according to the SWMP.
A current copy of the SWMP, which documents real-time conditions in the field must be maintained and kept on the site during all times of construction.

Given the dynamic nature of the SWMP, the following guidance is provided for making in-field modifications to BMPs based on Self Monitoring Inspections. Changes to BMPs identified in the SWMP may be completed in the field without approval from the County when:

- The BMP is a temporary BMP;
- The change results in a comparable BMP. Examples include but are not limited to, silt fence replaced with a wattle, rock check dam replaced with straw bale check, erosion control mat used in place of straw mulch, etc.,
- Prior to installation, the change is reflected in the on-site SWMP including a BMP detail for the new BMP.

Changes to permanent BMPs or any other BMP change that will affect the approved engineering design, hydraulics or hydrology must be approved by the ECM Administrator, or designee, through the established plan modification process.

D. Erosion and Stormwater Quality Control Permit

An Erosion and Stormwater Quality Control Permit (ESQCP) is a County permit developed to comply with the County’s MS4 Permit. An ESQCP is issued typically for construction sites that disturb ≥ 1 acre of land. Application requirements and permit holder responsibilities are discussed in Section I.4.1. The permit authorizes the implementation of the approved erosion and stormwater quality control measures and allowable stormwater discharges from construction sites.

E. Builder’s Erosion and Stormwater Quality Control Permit

A Builder’s Erosion and Stormwater Quality Control Permit (BESQCP) is a County permit developed to address stormwater discharges associated with the construction of single family residential lots and duplexes with less than one acre of land disturbance. Application requirements and permit holder responsibilities are discussed in Section I.4.5.

F. Notice to Proceed

A Notice to Proceed is a written notice provided by the County after an ESQCP is approved. The notice allows for the implementation of initial BMPs and commencement of construction activities upon completion of an Initial Inspection. Construction is authorized only after issuance of a Notice to Proceed.

G. Letter of Noncompliance

A Letter of Noncompliance is a written notice provided by a County Inspector (Stormwater or Subdivision) to the permit holder (owner) and contractor to notify them that the permitted project is not in compliance with the SWMP, requirements of the ESQCP, or BESQCP are in noncompliance with the
requirements of County criteria, codes or ordinance relating to grading, erosion, and stormwater quality. The letter contains a description of the measures required to bring the site into compliance and a date by which these measures must be implemented.

H. Performance or Contracting of Remedial Work

If the permit holder does not successfully complete all required work or violates any requirement of the permit, the County may take corrective measures and charge the cost of such to the permit holder. Such costs shall include the actual cost of any work deemed necessary by the County plus reasonable administrative and inspection costs and penalties, as established by Resolution adopted by the Board of County Commissioners or by a fee schedule adopted by the ECM Administrator as authorized by the Board of County Commissioners. If the total of such costs exceeds the financial assurance, the permit holder shall be responsible for payment of the remaining balance within thirty calendar days of receipt of an accounting of such from the County.

I.6.2 Enforcement Procedures

When the County performs inspections at construction sites, it notes those areas that need to be addressed to bring the site into compliance with its ESQCP. A time frame for addressing any noncompliance is included in the inspection report as a required follow-up action. Based on a review of the site, the inspector will list the actions that are needed. The Inspector will determine if a Follow-Up Inspection is needed or if submission of information that verifies that the necessary actions were taken is adequate. Subdivision Inspectors or County Engineering Stormwater Staff may initiate Letters of Non-compliance.

There are several situations where the County may determine that more aggressive action is necessary to get the site into compliance with its permit. The first situation is when there are impacts on public safety, property or water resources. This could include, but is not limited to, the deposition of sediment on a roadway that has the potential to cause accidents, the deposition of materials into water ways, the wash out of channels, spills of toxic materials, or deposition of sediment that causes or has the potential to cause property damage. The magnitude of the impacts will determine what action is appropriate.

Another instance that may result in more aggressive action is when the history of the permit holder or authorized agent suggests that a more formal action is necessary. Problems that may warrant such action include:

- Where the same problem is reoccurring at the site.
- Where the site appears to be having frequent minor problems.
- The individuals involved repeatedly fail to comply with required corrective measures.
- The individuals involved have a history of noncompliance.
There are several options for formal action that are available to the County. Table I-3 summarizes some of the more common options. The County may take other action as deemed appropriate. In cases where deemed appropriate by the ECM Administrator the El Paso County Ordinance 07-01: Prohibiting Illicit Discharges to the County Storm Sewer System may be used, as appropriate, to address compliance issues at a site meeting the criteria listed in this section.

It is expected that under normal conditions the progression of enforcement actions is a Letter of Noncompliance, then a Stop Work Order, then a revocation of the ESQCP or BESQCP. Once a permit has been revoked, it will be necessary to submit or resubmit a SWMP and permit application to the County. An El Paso County Court Summons may be issued for noncompliance with a Stop Work Order or other situations as outlined in DCM2 and ECM.

I.7 NEW DEVELOPMENT STORMWATER MANAGEMENT

I.7.1 New Development Planning

[Replaces DCM2 Section 4.1, pages 4-1 through “Other BMPs” continued on 4-5]

A. Overview

This chapter contains guidance and requirements for the selection and siting of structural BMPs for new development and significant redevelopment. Guidance is provided within the context of a flow chart and a four-step process to be followed for new site developments and significant redevelopments.

Detailed descriptions, sizing and design criteria, and design procedures for these BMPs are provided in the New Development BMP Factsheets. It is recommended that discussions and collaboration regarding proposed BMPs occur early in each project between the developer’s planner and engineer, County Stormwater and County Development Services Review staff. These Section 4.0 requirements shall be incorporated into existing ECM Administrator submittals for review and acceptance including Preliminary/Final Drainage Reports and construction plans, or as otherwise specified by the ECM Administrator.

B. BMPs for New Development or Significant Redevelopment

For the purpose of defining when permanent water quality BMPs are required, “New Development and Significant Redevelopment” are defined as:

- All sites that include total development/redevelopment areas of one (1) acre or larger except developments with low density (rural) housing (2.5 acre or larger lots). Water Quality Capture Volume (WQCV), as discussed later in DCM2, shall be provided for the total site or individual lots/parcels. Other permanent BMPs may also be required as appropriate.

- Development/redevelopment areas of low density (rural) housing (2.5 acre or larger lots). WQCV is not required, but may be considered, in
addressing stormwater protection in rural subdivisions. Sediment control BMPs for lots and roads must be provided. If a legal entity that will provide maintenance such as a Homeowners’ Association is in place, a BMP serving several lots may be used. Otherwise, sediment control BMPs must be included on each lot. If a pollution source other than normal residential activities is present, stormwater quality protection measures such as spill control measures and WQCV-based BMPs must be implemented.

- All sites in any zone that include total development/redevelopment areas of one (1) acre or larger for which stormwater quantity detention is required, as specified in the approved Final Drainage Report. WQCV shall be incorporated into stormwater quantity detention basins as discussed later in this section. Retrofitting of existing stormwater quantity detention facilities may be possible. The method for feasibility analysis of retrofitting is referenced below and in DCM2. If retrofitting is not feasible, a new BMP(s) will be required. Other permanent BMPs may also be required as appropriate.
### Table I-3. Enforcement Options

<table>
<thead>
<tr>
<th>Enforcement Option</th>
<th>Description</th>
<th>Typical Applications</th>
</tr>
</thead>
</table>
| Letter of Noncompliance   | This is a letter written to the owner and contractor. It contains a description of the problem, the measures required to bring the site into compliance and a timeframe for completion of those measures. | (1) No immediate danger to the public safety, property or water resources.  
(2) Compliance has not been achieved while working with the owner/representative or contractor.  
(3) When the County wants to document ongoing problems and agreed upon follow-up. |
| Stop Work Order           | This Stop Work Order requires the owner and contractor to stop all activity on the site except for the work necessary to bring the site into compliance with its ESQCP or BESQCP. Depending on the compliance problem and the County’s past experience with the individuals involved, the County may impose the Order on only a portion of the site. | (1) Used when there is an immediate threat to the public safety, property or water resources.  
(2) Used when the site has failed to comply with the Letter of Noncompliance.  
(3) Used when land disturbance occurs before issuance of an approved Land Use Permit, Construction Permit, ESQCP or Notice to Proceed. |
| Permit Revocation         | The County may revoke the ESQCP or BESQCP if the requirements of the SWMP are not implemented. Revocation of the permit has the same effect as a Stop Work Order, except that the owner will need to resubmit an adequate SWMP, a Grading Plan, if required, a new ESQCP application and ESQCP Fee. | (1) Used when the site has failed to comply with the Stop Work Order.  
(2) Used when the current plan has been judged to be inadequate, and the owner and/or contractor have failed to take the necessary measures to improve the plan.  
(3) Used when the owner and/or contractor repeatedly failed to comply with required corrective measures. |
| Performing Remedial Work   | A County crew or a private contractor may be retained to perform remedial work. The cost of the work may be deducted from the Financial Assurance. | (1) Used when high risk situation is imminent.  
(2) Used when permit holder is intransigent about non-compliance. |
| § 30-28-124, Colorado Revised Statutes | Misdemeanor criminal charge, with a maximum penalty of $100 and/or 10 days in jail, with each day the violation continues a separate offense. | Used when the site has failed to comply with the Stop Work Order. |
| § 30-28-124.5, Colorado Revised Statutes | Civil enforcement action, resulting in injunction, civil penalties between $500-1000, and daily penalties up to $100 per day. | Used when the site has failed to comply with the Stop Work Order. |
All other sites that do not meet the above requirements may be required to provide permanent water quality BMPs, if significant water quality impacts are anticipated as a result of development/redevelopment of the site, as determined by County Stormwater staff. Sensitive and high risk sites are discussed below.

The intent of permanent BMPs is that they be placed prior to the stormwater runoff being discharged to State Waters. However, downstream BMPs (such as detention ponds or improved channels) may also be acceptable if there are minimal impacts to State Waters between the downstream BMP and the area of new development/redevelopment. At a minimum, grass buffer or swales or equivalent BMPs are required before stormwater reaches the State Waters. With increased impacts, other permanent BMPs may also be required on or adjacent to the site or in combination with new/retrofitted downstream BMPs. When determining the need for permanent BMPs for reaches of State Waters above downstream BMPs, consideration will be given to, but not limited to the following: overall assessment of water quality impacts/benefits (including looking at the intervening reach between the development site and any downstream BMP), other BMPs incorporated into the overall site, costs, and long-term maintenance viability.

Whenever practical, the County promotes permanent BMPs for all sites.

I.7.2 BMP Selection

The selection of appropriate BMPs is based on the characteristics of the site and potential pollutants. The Four-Step Process provides a method of going through the selection process. Figure I.1 and Figure I.2 with annotations covers site-specific issues to be considered in selecting an effective BMP for each site.

A. Four-Step Process

The following four-step process is recommended for selecting structural BMPs in newly developing and redeveloping urban areas:

Step 1: Employ Runoff Reduction Practices

To reduce runoff peaks and volumes from urbanizing areas, employ a practice generally termed “minimizing directly connected impervious areas” (MDCIA). The principal behind MDCIA is twofold -- to reduce impervious areas and to route runoff from impervious surfaces over grassy areas to slow down runoff and promote infiltration. The benefits are less runoff, less stormwater pollution, and less cost for drainage infrastructure. There are several approaches to reduce the effective imperviousness of a development site:

Reduced Pavement Area

Sometimes, creative site layout can reduce the extent of paved areas including parking, thereby saving on initial capital cost of pavement and then saving on pavement maintenance, repair, and replacement over time.
Porous Pavement
The use of modular block porous pavement or reinforced turf in low-traffic zones such as parking areas and low use service drives such as fire lanes can significantly reduce site imperviousness. This practice may reduce the extent and size of the downstream storm sewers and detention.

Grass Buffers
Draining impervious areas over grass buffers slows down runoff and encourages infiltration, in effect reducing the impact of the impervious area.

Grass Swales
The use of grass swales instead of storm sewers slows down runoff, promotes infiltration, and also reducing effective imperviousness. It also may reduce the size and cost of downstream storm sewers and detention.

Implementing these approaches on a new development site is discussed further in the DCM2 section titled Employing Runoff Reduction Techniques. This section provides a procedure for estimating a reduced imperviousness based on the use of grass buffers and swales. The latter three of the approaches for reducing imperviousness are structural BMPs and are described in detail in Section 4.2 of DCM2 (New Development BMP Factsheets):

- Grass Buffer.
- Grass Swale.
- Modular Block Porous Pavement (or Stabilized-Grass Porous Pavement).

Step 2: Stabilize Drainageways
Drainageway, natural and manmade, erosion can be a major source of sediment and associated constituents, such as phosphorus. Natural drainageways are often subject to bed and bank erosion when urbanizing areas increase the frequency, rate, and volume of runoff. Therefore, drainageways are required to be stabilized. One of three basic methods of stabilization may be selected.

Conctructed Grass, Riprap, or Concrete-Lined Channel
These methods of channel stabilization have been in practice for some time. The water quality benefit associated with these channels is the reduction of severe bed and bank erosion that can occur in the absence of a stabilized channel. On the other hand, the hard-lined low flow channels that are often used do not offer much in the way of water quality enhancement or wetland habitat. The use of riprap or concrete lined flood conveyance channels is not recommended, unless hydraulic
or physical conditions require such an alternative. Rock lined low-flow channels in many cases may be a better alternative.

**Stabilized Natural Channel**

In practice, many natural drainageways in and adjacent to new developments are frequently left in an undisturbed condition. While this may be positive in terms of retaining desirable riparian vegetation and habitat, urban development may cause the channel to become destabilized. When degradation occurs in these drainageways, significant erosion, loss of riparian and aquatic habitat, and elevated levels of sediment and associated pollutants can result. Therefore, it is recommended that some level of stream stabilization always be considered. Small grade control structures sized for a 5-year or larger runoff event are often an effective means of establishing a mild slope for the baseflow channel and arresting stream degradation. Severe bends or cut banks may also need to be stabilized. Such efforts to stabilize a natural waterway also preserve and promote natural riparian vegetation which can provide paybacks in terms of enhanced aesthetics, habitat, and water quality.

One additional method of drainageway stabilization gives special attention to stormwater quality and is described in Section 4.2 (New Development BMP Factsheets):

- Constructed Wetland Channel.

**Step 3: Provide Water Quality Capture Volume (WQCV)**

All sites defined as "New Development and Significant Redevelopment" and all sites requiring stormwater quantity detention, as listed above in the Section 1.7.1B, shall address stormwater quality by providing the WQCV. One or more of six types of water quality basins, each draining slowly to provide for long-term settling of sediment particles, may be selected. Information on selecting and configuring one or more of these WQCV facilities at a site is provided in the section providing Water Quality Capture Volume (WQCV). These six BMPs are also described in detail in the New Development BMP Factsheets:

- Porous Pavement Detention
- Porous Landscape Detention
- Extended Detention Basin
- Sand Filter Extended Detention Basin
- Constructed Wetland Basin
- Retention Pond
Step 4: Consider Need for Industrial and Commercial BMPs

If a new development or significant redevelopment activity is planned for an industrial or commercial site, the need for specialized BMPs must be considered. Two approaches are described in the New Development BMP Factsheets:

- Covering of Storage/Handling Areas
- Spill Containment and Control

Other Specialized BMPs may also be required

B. Other Specialized BMPs

The Technical Advisory Committee (TAC) selected the above structural BMPs after a comprehensive screening of known structural BMPs. The members of TAC included representatives from many city and County agencies and individuals from the development community. Final selection by TAC was based on the review of documentation on potential effectiveness in a semiarid climate, local applicability, maintenance considerations, and cost.

Development and evaluation of permanent BMPs are continuing processes. Better designs of the BMPs included in DCM2 and designs of new BMPs, including manufactured (proprietary) BMPs, will be developed and tested. To allow for this progress, additional BMPs will be considered on a case-by-case basis by County Stormwater Staff. Design and sizing details and results of independent testing of the BMP in conditions similar to those at the site will be submitted demonstrating that the BMP will meet or exceed the performance of approved BMPs for the site.

To promote improvement in stormwater protection, County Stormwater Staff may approve promising BMPs on an experimental basis. A performance monitoring program to be pre-approved by County Stormwater Staff and an agreement to replace the Experimental System with an approved system should it not function to the required level of performance, both at the owner’s expense, will be required. Design of an experimental BMP is not to commence until after a meeting with County Stormwater Staff is held.

C. Guidance for Selecting and Locating WQCV Facilities

[The following section replaces DCM2 Section 4.1 pages 4-19 through 4-23]

Laying out WQCV facilities within a development site and watershed requires thought and planning. This planning and decision-making should occur during a master drainage planning process (Drainage Basin Planning Study or Master Development Drainage Plan) undertaken by local jurisdictions or a developer’s engineer. Such plans, studies or other reports may depict a recommended approach for implementing WQCV on a watershed basis. Such reports may call for a few large regional WQCV facilities, smaller sub-regional facilities, or alternatively an onsite approach. It is always a good idea to find out if a master
planning study has been completed that addresses water quality and to attempt to follow the Plan’s recommendations.

If the master drainage planning process addresses water quality, the following provides supplemental information on the BMPs. If the existing master drainage planning process has not addressed water quality, or if a new master drainage process is underway, this will direct the water quality evaluation.

D. Permanent Best Management Practice Selection Process

The BMP selection process is illustrated in Figure I-1 and Figure I-2. These two figures shall be used for all projects except those that are strictly highway/roadway projects; that is, projects with no plans for building pad sites. Projects that are strictly highway/roadway projects are discussed in a separate section below.

The following requirements pertain to sites that are not otherwise covered under NPDES permits for post-construction BMPs. For construction activity permitting, see other County and State requirements. Sites that are covered by an industrial NPDES permit do not need to meet these requirements if they adequately protect stormwater quality with onsite BMPs.

The following process references the use of the BMPs and other practices outlined in DCM2 and this Addendum. The use of DCM2 BMPs will promote consistency between the City and County. These BMPs are commonly found in manuals and other literature from municipalities across the country, and they are the accepted “state of the art” in stormwater quality control. As described below, other BMPs (which may be relatively new to the field of stormwater management) are acceptable if they can be shown to meet certain performance criteria.

The following items explain the decision points (i.e., the Boxes) in Figure I-1 and Figure I-2:

**Box 1:** For all sites, the possibility of incorporating runoff reduction practices must be investigated. Impervious area should be reduced to the maximum extent practicable, per DCM2. DCM2 also provides guidance for MDCIA by routing runoff to pervious areas. This is Step 1 in the Four-Step Process.

**Box 2:** All drainageways, ditches, and channels shall be stabilized with one of three methods included in Step 2, which include the use of appropriate methods for the type of drainageway as described in the DCM1.

Drainageways include:

- Tributaries to creeks that have been left in a relatively natural state,
- Tributaries, channels, and drainageways that are graded or regraded and may include drop or check structures, side slope stabilization, and low-flow channels.
- Roadside ditches that are completely man-made and should only be used to convey runoff from roads and roadway right-of-ways (ROWs).
Box 3: It must be determined if the development and/or redevelopment disturbs an area of land that is 1 acre or larger (or planned to be 1 acre or larger) when all phases are complete.

Box 4: Sites tributary to sensitive waters should consider specialized BMPs to address the parameter of concern as shown in Table I-5. At this time, no special BMPs are required until the County develops an overall strategy to address the parameters of concern, probably if and when a Total Maximum Daily Load (TMDL) is determined.
Appendix I Stormwater Quality Policy & Procedures
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section I.7.2-I.7.2

Figure I-1. BMP Requirements Flowchart for New Development and Redevelopment Sites - For Selecting Post-Construction BMPs in Compliance with El Paso County’s Stormwater NPDES Permit

Note: See text for further descriptions of decision points and requirements.
**Figure I-2. BMP Requirements Flowchart for New Development and Redevelopment Sites - For Selecting Post-Construction BMPs in Compliance with El Paso County’s Stormwater NPDES Permit**

**Table I-4. Best Management Practices Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Best Management Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWB</td>
<td>Constructed Wetlands Basin</td>
</tr>
<tr>
<td>CWC</td>
<td>Constructed Wetlands Channel – Sedimentation Facility</td>
</tr>
<tr>
<td>EDB</td>
<td>Extended Detention Basin – Sedimentation Facility</td>
</tr>
<tr>
<td>PLD</td>
<td>Porous Landscape Detention</td>
</tr>
<tr>
<td>RP</td>
<td>Retention Pond – Sedimentation Facility</td>
</tr>
<tr>
<td>SFB</td>
<td>Sand Filter Extended Detention Basin</td>
</tr>
<tr>
<td>WQCV</td>
<td>Water Quality Capture Volume</td>
</tr>
<tr>
<td>GB</td>
<td>Grass Buffer</td>
</tr>
<tr>
<td>GS</td>
<td>Grass Swale</td>
</tr>
<tr>
<td>MBP</td>
<td>Modular Block Porous Pavement</td>
</tr>
<tr>
<td>PPD</td>
<td>Porous Pavement Detention</td>
</tr>
</tbody>
</table>
Table I-5. El Paso County Sensitive\(^1\) Waters

<table>
<thead>
<tr>
<th>Stream and Segment</th>
<th>Parameter of Concern</th>
<th>Specialized BMPs Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fountain Creek and tributaries above Monument Creek</td>
<td>E. coli and Se</td>
<td>None at this time</td>
</tr>
<tr>
<td>Fountain Creek from Monument Creek to Highway 47</td>
<td>E. coli</td>
<td>None at this time</td>
</tr>
<tr>
<td>Monument Creek from National Forest to Fountain Creek</td>
<td>Se</td>
<td>None at this time</td>
</tr>
<tr>
<td>Willow Springs Pond #1 and #2</td>
<td>PCE</td>
<td>None at this time</td>
</tr>
</tbody>
</table>

\(^1\)CDPHE 2006 303(d) list. Standard agreement forms for Private Detention Basins are in Appendix G. [This list may change in the future. The 303(d) list or equivalent in effect at the time of permitting will apply.]

Potential high-risk sites must also incorporate specialized BMPs. High-risk sites are defined by two factors:

- Sites with land uses involving the potential for significant deposition of pollutants.
- Sites without practices to eliminate exposure of pollutants to stormwater.

Land uses involving the potential for significant deposition of pollutants include, but are not limited to:

- Vehicle maintenance facilities,
- Gas stations,
- Automobile salvage yards and junk yards,
- Commercial sites with high levels of “in and out” traffic such as fast-food restaurants and convenience stores,

Many industrial facilities are required to obtain coverage under an industrial stormwater permit; these facilities include automobile salvage yards. Practices to eliminate exposure of pollutants to stormwater may or may not be part of an industrial stormwater permit. These practices include coverage of material storage areas, berms around tanks, spill control plans, and other “good housekeeping” measures. For industrial sites where stormwater is not exposed to pollutants, structural BMPs, including detention ponds for water quality and other BMPs discussed below, may not be required.

Because stormwater pollutants are often transported with sediment, erosion protection and sediment control are necessary for stormwater quality protection. This is very important in the County because of the sandy soils in the region. In particular, discharges that may impact sensitive waters or that come from potentially high-risk sites should have a high level of sediment protection. Thus,
in addition to the specialized BMPs, sediment control practices such as revegetation, grading to prevent steep side slopes, check dams, slope drains, and sediment basins should be employed where practical.

**Box 5:** No BMPs are required other than stabilized drainageways and possibly MDCIA.

**Box 6:** Specialized BMPs are required and therefore proceed to Box 7 on Table I-1.

**Box 7:** BMPs that employ infiltration include porous landscape detention and sand filter basins without underdrains. Certain conditions preclude the use of these types of BMPs, including close proximity of groundwater or relatively impervious soils to the bottom of the facility. Groundwater levels should be characterized during the season with the highest levels (often late Spring or early Summer). Impervious soils include bedrock as well as soil types C and D. The term “close proximity” means 5 feet or less. If there is less than 5 feet, a study of the hydraulic conductivity of the soils must be conducted to show that excessive groundwater mounding or direct groundwater contamination will not result from the use of BMPs that employ infiltration.

**Box 8:** If groundwater or relatively impervious soils are not within 5 feet of the surface, implement porous landscape detention (PLD) or a sand filter basin (SFB) from DCM2. Alternative BMPs can be used if shown to be equally effective as PLD or SFB (see discussion below).

**Box 9:** Implement PLDs or SFBs with underdrains, or implement a BMP with removal rates equivalent to PLDs or SFBs, including qualifying manufactured BMPs. Qualifying manufactured BMPs are those that have undergone independent tests to verify that the installation, flow volumes, and removal rates will work for the site under consideration.

**Box 10:** If the site is larger than one acre and is low density residential, then no water quality capture volume is required, but the need for sediment basins must be evaluated, and the site must be categorized by the sensitive waters and high-risk criteria (return to Box 4). Low density (rural) subdivisions include lots with 2.5 acre or larger lots.

**Box 11:** Sediment is best controlled at the source. That is, rather than using structures to collect soil after it is suspended in stormwater, it is preferable to stabilize soil to prevent suspension from occurring. Sediment source controls must be implemented for all low-density developments and include (but are not limited to):

- Adequately established vegetation per DCM1 criteria,
- Side slopes that are 3 horizontal to 1 vertical or flatter or the use of benched side slopes when slopes are steeper than 3 horizontal to 1 vertical,
- The use of erosion control blankets to aid establishment of vegetation,
- Check dams,
- Slope drains.

Temporary irrigation and maintenance of vegetation until adequately established may be required.

**Box 12:** In low density (rural) subdivisions, a method for permanent sediment control must be provided. If a detention pond is used, the forebay is to be sized according to the criteria for Extended Detention Basins. If a detention pond/Extended Detention Pond is not required, a sediment basin as described in DCM2, page 3-32 may be used. It should be sized to collect 1,800 cubic feet per acre of disturbed area. Drainage area above a sediment basin can be reduced by use of vegetated swales, buffers, or contour berms.

**Box 13:** If there are no detention ponds, separate sediment basins must be located to catch all runoff leaving the disturbed area of the site.

**Box 14:** In cases where a detention pond is already required for controlling the volume of runoff, a sediment basin can take the form of a forebay to this pond.

**Box 15:** Regional ponds are often used to control the increase in runoff flow and volume due to development. If the site is not low density, and there is a regional downstream BMP that provides adequate WQCV for the site plus the other sites planning to use it, then proceed to Box 16.

**Box 16:** The site is required to direct all runoff through grass buffers and/or grass swales or provide a similar BMP. (Note that this is required in accordance with the CDPHE guidance manual to afford some protection to state waters in between the site and the downstream WQCV BMP.)

**Box 17:** Grass buffers require irrigation in almost all cases in the County; swales sometimes require irrigation.

**Box 18:** “Dry” alternatives may be used if they are shown to have equivalent removal rates as buffers and swales. All of the structural treatment BMPs in DCM2 (Section 4.2) have equivalent removal rates and may be used. The covering of storage/handling areas and spill containment and control are not structural treatment BMPs, and thus are not substitutes for grass buffers and swales.

**Box 19:** If there is no regional downstream BMP that provides WQCV, then WQCV must be provided for the site with one or a combination of the following BMPs in DCM2: Extended Detention Basin (EDB), Sand Filter Basin (SFB), Constructed Wetland Basin (CWB), or Retention Pond (RP). Chapter 4 in DCM2 (in particular, Figure ND-7) should be consulted for a selection process for the BMP with WQCV. For all ponds, issues related to dam construction and potential groundwater contamination must be considered. Retention Ponds must be considered in the context of additional issues including safety and health (e.g., drowning and mosquito/West Nile virus) and water rights. Surface water storage rights will be obtained before a retention pond can be proposed for a site.
Box 20: Sites tributary to sensitive waters must meet the requirements as outlined in Table I-5, and potential high-risk sites must have specialized BMPs.

Box 21: No additional BMPs are required other than WQCV-based BMPs. Also, as always, drainageways must be stabilized and runoff should be reduced as much as possible (Boxes 1 and 2).

Box 22: When specialized BMPs are required, proceed to Box 23 on Figure I-2.

Box 23: Two situations apply, one where conditions preclude the installation of BMPS that employ infiltration, and one where they do not. (See Box 7.) If conditions preclude the installation of BMPS that employ infiltration then proceed to Box 25; otherwise proceed to Box 24.

Box 24: Where soil and groundwater conditions are not prohibitive (that is, groundwater or relatively impervious soils are not within 5 feet of the surface), implement PLD or SFB from DCM2. Alternative BMPs can be used if shown to be equally effective as PLD or SFB (see discussion below).

Box 25: Constructed wetlands (either channels or basins) are an effective BMP for sites with drainage areas greater than 10 acres.

Box 26: Provide a BMP downstream of the pond with equivalent removal rates as a wetland channel; this could be a qualifying manufactured BMP or other BMP that meets the criteria below.

Box 27: If the catchment area is greater than 10 acres, provide a constructed wetland channel (CWC) downstream of pond or provide WQCV with CWB.

E. Projects that are Strictly Roadway Construction

For projects that entail highway or other roadway construction, there are three basic questions for the applicant:

- Is the road urban or rural? That is, does the road have curb and gutter or does it utilize roadside ditches?
- For rural roads, do the ditches require “water turnouts?”
- Is the road a “hot spot” or does it discharge to sensitive waters?

For urban road construction, the applicant must follow the requirements in DCM1. Rural roads (which by definition have roadside ditches) must be stabilized with one of three methods included in DCM2 on pages 4-3 and 4-4. These methods are described in DCM1.

Rural roads, i.e. those roads which utilize roadside ditches for conveyance of runoff from the roadway, do not have sufficient capacity in the roadside ditches to convey much more runoff than that which runs off the road itself. “Water turnouts,” which function as spillways which direct flow out of the ditches onto property adjacent to the ROW, are frequently required as a result. Design for the “water turnout” should ensure the turnout discharges into a “suitable outfall” as described in DCM1 along the roadway such as a natural swale. A drainage easement for this runoff must be acquired at these locations. A possible
consequence of “water turnouts” is the loading of sediment onto private property. If “water turnouts” will be utilized for the ditches, sediment basins shall be used at these locations. However, there must be sufficient space in the ROW for both the structure itself and for maintenance access, or a specific drainage easement must be provided for the feature and access. Sediment basins can be designed in accordance with the guidelines in DCM2 in the section for construction BMPs. The basin shall be sized to collect 1,800 cubic feet of sediment per acre of drainage area of the roadway.

The term “high risk site” can be defined by traffic volume for a section of roadway. If the road will experience traffic volume of 30,000 average daily traffic (ADT) or more it is likely to contribute high levels of pollutants. For these situations, additional BMPs are required and selection must follow Boxes 6, 7, 8, and 9 in Figure 1b. Additional BMPs may also be required for discharge to sensitive waters. As described above for the general developments (with building pads), these additional requirements will depend on the TMDL process.

F. Additional Guidelines for BMP Selection

Additional Guidelines for selecting among the appropriate BMPs determined from Figure I-1 and Figure I-2. Figure I-3 (Figure ND-7 in DCM2) depicts a decision tree for selecting one of the six WQCV BMPs based on drainage catchment area and whether water is available to satisfy evapotranspiration requirements. Porous pavement and porous landscape detention are generally suited for small drainage areas (i.e. much less than 1.0 acres); however, larger subwatersheds can be subdivided into individual drainage sub-catchment areas meeting the criteria shown in Figure I-3 for these BMPs.

One of the questions involved in laying out WQCV facilities on a site is whether to locate a BMP onstream or offstream. Onstream refers to locating a BMP on a drainageway that traverses a site such that all of the runoff from the upstream watershed flows through the facility. A single onstream BMP can treat both site runoff and runoff generated in any upstream offsite catchment areas that are part of that watershed. Locating BMPs offstream requires that all onsite catchment areas flow though a BMP prior to entering the drainageway. Offstream BMPs do not provide treatment of runoff from any upstream drainage catchment areas.

Onstream WQCV facilities are only recommended if the offsite drainage catchment area tributary to the drainageway has less impervious area than the onsite drainage catchment’s impervious area tributary to the same drainageway. Nevertheless, onstream WQCV facilities must be designed to serve the entire upstream watershed, including any catchment areas upstream of the development, based on future development conditions. This is true even if upstream developments have installed their own WQCV facilities.

The intent of WQCV facilities is they are located prior to the stormwater runoff being discharged to State Waters. However, see additional information in Section 4.1 of DCM2: Definition of New Development and Significant
Redevelopment/BMP Requirements regarding the acceptability of using downstream BMPs (including WQCV facilities) to serve as BMP controls for upstream development.

Figure I-4 (Figure ND-8 in DCM2) provides an illustration of selection and location options for WQCV facilities based on the principles discussed above. Figure I-6 (Table ND-1 in DCM2) indicates the BMP options for the four watershed areas shown in Figure I-4.

I.7.3 Incorporating WQCV into Stormwater Quantity Detention Basins

Wherever possible, it is recommended that WQCV facilities be incorporated into stormwater quantity detention facilities. This is relatively straightforward for an extended detention basin, constructed wetland basin, and a retention pond. When combined, the 2, 5, 10, and 100-year detention levels are provided above the WQCV and the outlet structure is designed to control two or three different releases. Stormwater quantity detention could be provided above the WQCV for porous pavement and landscape detention provided the drain times for the larger events are kept short.

The following approaches are to be implemented when incorporating WQCV into stormwater quantity detention facilities:

1. **Water Quality**
   
   The full WQCV is to be provided according to the design procedures documented in the New Development BMP Factsheets.

2. **Minor Storm**
   
   The full WQCV plus the full minor storm quantity detention volume is to be provided.

3. **100-Year Storm**
   
   One-half the WQCV plus the full 100-year detention volume is to be provided.

At this time, water quality detention is not to be incorporated into underground detention facilities, such as installations of buried large-diameter pipe sections, stone trenches, underground “infiltrating” devices, etc. Any underground detention facilities proposed for use in the County must meet state requirements for Injection Wells and requirements for experimental systems, in addition to Operation and Maintenance Manuals and maintenance agreements.

I.7.4 Separate Presedimentation Facilities

The design criteria shown in the New Development BMP Factsheets section shows presedimentation forebays at the upstream end of the extended detention basin, constructed wetland basin, and retention pond. The purpose of the forebay is to settle out coarse sediment and skim off floatables prior to the main body of the facility. An option to this approach is to install a separate facility upstream from the main WQCV facility. If this option is selected, the recommended size is at least 20 percent of the WQCV and the...
recommended drain time is 1 hour for the presedimentation forebay volume only. Using this approach, the size of the main WQCV facility may be reduced by 10 percent, any requirement for sediment storage in the main facility may be reduced by one-half, and the forebay within the main facility may be eliminated.

It is extremely important that high sediment loading be controlled for porous pavement detention, porous landscape detention, and sand filter extended detention basins. These facilities are best suited to being brought on line at the end of the construction phase where disturbed ground has been established with pavement or vegetation.

**Figure I-3. Decision Tree for WQCV BMP Selection**

<table>
<thead>
<tr>
<th>Depth to Bedrock or WT &gt; 5 feet and NRCS Type A or B soils?</th>
<th>Drainage Area &gt; 1 acre?</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>Drainage Area &gt; 20 acres?</td>
</tr>
<tr>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>Water Available for ET?</td>
</tr>
<tr>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

**Suitable WQCV BMP**

- Porous Pavement Detention (PPD) with Underdrain
- Porous Pavement Detention (PPD) with Infiltration
- Porous Landscape Detention (PLD) with Underdrain
- Porous Landscape Detention (PLD) with Infiltration
- Extended Detention Basin (EDB)
- Sand Filter Extended Detention Basin (SFB)
- Construction Wetland Basin (CWB)
- Retention Pond (RP)

Note: Large drainage areas may be subdivided into areas <20 acres for use of SFB or <1 acre for use of PPD or PLD.
Note: For this example, sufficient make-up water exists for constructed wetlands and retention pond for the watershed areas >50 acres through irrigation return flows.
Table I-7. Illustration of Selection and Location Options for WQCV Facilities for the Development Parcel on Figure I.4

<table>
<thead>
<tr>
<th>Watershed Number</th>
<th>Onstream or Offstream</th>
<th>BMP Options</th>
<th>Minimum Number of BMP Installations</th>
<th>Average Drainage Area for Sizing each BMP, acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Offstream</td>
<td>Porous Pavement Detention</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Porous Landscape Detention</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>2</td>
<td>Offstream</td>
<td>Porous Pavement Detention</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Porous Landscape Detention</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended Detention Basin</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sand Filter Extended</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Detention Basin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Offstream</td>
<td>Porous Pavement Detention</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Porous Landscape Detention</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended Detention Basin</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sand Filter Extended</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Detention Basin</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Onstream</td>
<td>Extended Detention Basin</td>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Constructed Wetland Basin</td>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retention Pond</td>
<td>1</td>
<td>70</td>
</tr>
<tr>
<td>4</td>
<td>Offstream</td>
<td>Porous Pavement Detention</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Porous Landscape Detention</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extended Detention Basin</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sand Filter Extended</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Detention Basin</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**I.7.5 Structural BMP Effectiveness**

Table I-7 (Table ND-2 in DCM2) indicates ranges of removal efficiencies reported in literature for a number of structural BMPs. Although combinations of nonstructural/structural BMPs can improve the overall water quality of the runoff, the effectiveness of several BMPs in their ability to reduce influent pollutant concentrations as a group are not directly additive. Table I-7 also shows a most probable range of removal efficiencies for structural BMPs recommended in the New Development BMP section.

**I.7.6 Separation Distances**

To reduce potential for surface and ground water contamination, permanent water quality BMPs will be located away from wells and Individual Sewage Disposal Systems (ISDS). Rules for separation distances and grouting depths for wells and BMPs will be based on distances between wells and "sources of contamination" in Colorado's Rules and Regulations for Water Well Construction, Pump Installation, and Monitoring and Observation Hole/Well Construction. Permanent BMPs and ISDS will be separated by the
same distances specified between the components of the ISDS and “waterways” in the El Paso County ISDS regulations.

**Table I-8. BMP Pollutant Removal Ranges for Stormwater Runoff and Most Probable Range for BMPs**

<table>
<thead>
<tr>
<th>Type of BMP</th>
<th>(1)</th>
<th>TSS</th>
<th>TP</th>
<th>TN</th>
<th>TZ</th>
<th>TPb</th>
<th>BOD</th>
<th>Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Buffer</td>
<td>LRR:</td>
<td>10-50</td>
<td>0-30</td>
<td>0-10</td>
<td>0-10</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>10-20</td>
<td>0-10</td>
<td>0-10</td>
<td>0-10</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Grass Swale</td>
<td>LRR:</td>
<td>20-60</td>
<td>0-40</td>
<td>0-30</td>
<td>0-40</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>20-40</td>
<td>0-15</td>
<td>0-15</td>
<td>0-20</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Modular Block Porous Pavement</td>
<td>LRR:</td>
<td>80-95</td>
<td>65</td>
<td>75-85</td>
<td>98</td>
<td>80</td>
<td>80</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>70-90</td>
<td>40-55</td>
<td>10-20</td>
<td>40-80</td>
<td>60-70</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Porous Pavement Detention</td>
<td>LRR:</td>
<td>8-96</td>
<td>5-92</td>
<td>-130-85</td>
<td>10-98</td>
<td>60-80</td>
<td>60-80</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>70-90</td>
<td>40-55</td>
<td>10-20</td>
<td>40-80</td>
<td>60-70</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Porous Landscape Detention</td>
<td>LRR:</td>
<td>8-96</td>
<td>5-92</td>
<td>-100-85</td>
<td>10-98</td>
<td>60-90</td>
<td>60-80</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>70-90</td>
<td>40-55</td>
<td>20-55</td>
<td>50-80</td>
<td>60-80</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Extended Detention Basin</td>
<td>LRR:</td>
<td>50-70</td>
<td>10-20</td>
<td>10-20</td>
<td>30-60</td>
<td>75-90</td>
<td>N/A</td>
<td>50-90</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>55-75</td>
<td>45-55</td>
<td>10-20</td>
<td>30-60</td>
<td>55-80</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Constructed Wetland Basin</td>
<td>LRR:</td>
<td>40-94</td>
<td>-4-90</td>
<td>21</td>
<td>-29-82</td>
<td>27-94</td>
<td>18</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>50-60</td>
<td>40-80</td>
<td>20-50</td>
<td>30-60</td>
<td>40-80</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Retention Pond</td>
<td>LRR:</td>
<td>70-91</td>
<td>0-79</td>
<td>0-80</td>
<td>0-71</td>
<td>9-95</td>
<td>0-69</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>80-90</td>
<td>45-70</td>
<td>20-60</td>
<td>20-60</td>
<td>60-80</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Sand Filter Extended Detention</td>
<td>LRR:</td>
<td>8-96</td>
<td>5-92</td>
<td>-129-84</td>
<td>10-98</td>
<td>60-80</td>
<td>60-80</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>80-90</td>
<td>45-55</td>
<td>35-55</td>
<td>50-80</td>
<td>60-80</td>
<td>60-80</td>
<td>N/A</td>
</tr>
<tr>
<td>Constructed Wetland Channel*</td>
<td>LRR:</td>
<td>20-60</td>
<td>0-40</td>
<td>0-30</td>
<td>0-40</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>EPR</td>
<td>30-50</td>
<td>20-40</td>
<td>10-30</td>
<td>20-40</td>
<td>20-40</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>


(1)LRR Literature reported range, EPR—expected probable range of annual performance by DCM2 BMPs.

N/A Insufficient data to make an assessment.

*The EPR rates for a Constructed Wetland Channel assume the wetland surface area is equal or greater than 0.5% of the tributary total impervious area.

### I.7.7 Operation and Maintenance of Best Management Practices

#### A. Long-term Maintenance Agreements for BMPs

Per the Colorado Department of Public Health and Environment, Colorado’s Phase II Guidance Document:

“All stormwater BMPs shall have an enforceable operation and maintenance agreement to ensure that the system functions as designed. This agreement will...
include any and all maintenance easements required to access and inspect the BMP(s), and to perform routine maintenance as necessary to ensure proper functioning of the stormwater BMP. In addition, prior to the issuance of any permits for land development, legally binding documents shall be adopted and agreed to wherein the owners of the real property associated with the BMPs that benefit that property are held ultimately responsible for the proper maintenance of all BMPs, including a mechanism for the collection of the costs of the maintenance if it is not performed by the owners of the property.”

The property owner shall be responsible for the maintenance of all permanent stormwater quality measures. All temporary stormwater quality control measures shall be removed after work on the site has been completed and the measures are no longer needed. Should any property owner fail to adequately maintain the permanent stormwater quality control measures or remove the temporary measures, the County may, after notifying the owner of the required maintenance and/or removal and the owner failing to perform such maintenance and/or removal, enter the affected property and perform or cause to be performed the required work and assess the charge for such work against the property owner.

Prior to approval of a subdivision or issuance of a Certificate of Occupancy for a site that did not go through the subdivision review process that has permanent BMPs, a signed Private Maintenance Agreement for Permanent BMPs must be submitted to the County.

B. Operation and Maintenance Manual

A detailed Operation and Maintenance Manual covering inspections, operation and maintenance of permanent BMPs will be provided to the party who holds the Private Maintenance Agreement for Permanent BMPs. The Operation and Maintenance Manual will include specifics on frequency of inspections and maintenance; standards for vegetation or structures, such as species of vegetation, mowing height, revegetation of worn or eroded areas, cleaning methods; depth of sediment requiring removal; replacement frequencies; and other relevant topics.

I.8 PROCEDURES FOR ASSESSMENT OF STRUCTURAL CONTROLS FOR RETROFITTING WATER QUALITY FEATURES

[Replaces DCM2 Section 4.4, page 4-133]

At some sites, there may be an existing structure for flood control and other water quantity control purposes. It may be possible to retrofit this structure for water quality in addition to the quantity functions. The following procedure will assist in evaluating the potential for retrofitting. In a new or major redevelopment project, new erosion and water quality control BMPs will be required, if retrofitting is not a reasonable option.

The purpose of this document is to outline the procedures for these evaluations. These procedures would then be utilized in conjunction with developing each new Drainage Basin Planning Study (DBPS) to determine the potential and feasibility for retrofitting existing structural controls (detention/retention basins).
The analysis of the structures involves three possible levels of review. The first is a qualitative review to determine if retrofitting of the structure is acceptable. The second element is quantitative to determine the pollutant removal effectiveness of the structure, both with and without water quality elements. Total Suspended Solids (TSS) will normally be the only constituent evaluated, unless other pollutants of concern are specified by the ECM Administrator, based on site-specific information such as draining to sensitive waters or high risk pollution sources. A third element of review involves developing a cost estimate for retrofitting to determine the economic feasibility.

A qualitative assessment evaluates the changes that would occur if the flood-control detention facility was modified for water quality purposes, and determines the extent to which the changes would affect these functions, and if these changes in function are acceptable. The detention pond must first be acceptable under the qualitative criteria, or the evaluation will conclude and not continue to the second level of review. A quantitative analysis involves a determination of whether the percent removal of TSS (or other specified constituent of concern) is significant. For purposes of this assessment, a significant change is defined as the percent removal of the constituent after retrofitting the detention pond is estimated to be at least 20 percent greater than the percent removal of the constituent for the detention pond without the water quality element incorporated. If a significant change is estimated, then the third element of analysis, a cost estimate of the economic feasibility, is conducted. If a significant change is not estimated, then the option to retrofit the detention pond is eliminated.

I.8.1 Final Alternative Selection

The final alternative selection process for drainage improvement options in any new DBPS is based on the evaluation of many factors including costs, safety, environmental issues including water quality, public input, etc. If the selected alternative includes retrofitting structural controls to provide additional pollutant removal, responsibility for implementation would need to be outlined in the study. If the responsibility was determined to be a public (County) responsibility, consideration for funding any such drainage improvement project would be made by the Board of County Commissions during its annual budget approval process in conjunction with all other budget requests. If the responsibility was determined to be a private development responsibility, ECM Administration would decide when implementation would be required in conjunction with the timing of future developments.

I.9 SUPPLEMENTAL INFORMATION A: NEW DEVELOPMENT DESIGN FORMS

[Replaces DCM2 Appendix A]

ATTENTION TO PERSONS USING THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT SUPPLIED DESIGN FORM WORKSHEETS

The Design Form Worksheets with the accompanying Visual Basic macros have been developed using a high standard of care, including professional review for identification of errors, bugs, and other problems related to the software. Minor modifications have been made by the City of Colorado Springs. However, as with any initial release of software driven products, it is likely that some nonconformities, defects, bugs, and errors with the software program will be discovered as
they become more widely used. The developers of these products welcome user feedback in helping to identify these potential problems so that improvements can be made to future releases of the Design Form Worksheets.

The Design Form Worksheets are intended to streamline the preliminary design process. Preparation of final design plans, addressing details of structural adequacy, public safety, hydraulic functionality, maintainability, and aesthetics, remain the sole responsibility of the designer.

BY THE INSTALLATION AND USE OF THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT SUPPLIED DESIGN FORM WORKSHEETS, AS MODIFIED BY THE CITY OF COLORADO SPRINGS, THE USER AGREES TO THE FOLLOWING:

NO LIABILITY FOR CONSEQUENTIAL DAMAGES

To the maximum extent permitted by applicable law, in no event shall the Urban Drainage and Flood Control District or the City of Colorado Springs or El Paso County, their contractors, advisors, reviewers, or their member governmental agencies, be liable for any incidental, special, punitive, exemplary, or consequential damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information or other pecuniary loss) arising out of the use or inability to use these products, even if the Urban Drainage and Flood Control District or the City of Colorado Springs or El Paso County, their contractors, advisors, reviewers, or their member governmental agencies have been advised of the possibility of such damages. In any event, the total liability of the Urban Drainage and Flood Control District or the City of Colorado Springs or El Paso County, their contractors, advisors, reviewers, or their member governmental agencies, and your exclusive remedy, shall not exceed the amount of fees paid by you to the Urban Drainage and Flood Control District for the Product.

NO WARRANTY

The Urban Drainage and Flood Control District or the City of Colorado Springs or El Paso County, their contractors, advisors, reviewers, or their member governmental agencies do not warrant that the Design Form Worksheets will meet your requirements, or that the use of this product will be uninterrupted or error free.

THIS PRODUCT IS PROVIDED “AS IS” AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT OR THE CITY OF COLORADO SPRINGS or EL PASO COUNTY, THEIR CONTRACTORS, ADVISORS, REVIEWERS, AND THEIR MEMBER GOVERNMENTAL AGENCIES DISCLAIM ALL WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, PERFORMANCE LEVELS, COURSE OF DEALING OR USAGE IN TRADE.
APPENDIX J  ROADWAY INSPECTIONS AND TESTING

J.1 PURPOSE
This appendix presents general requirements for testing and inspecting roadways and ancillary facilities constructed within the County. This appendix presents the minimal standards the ECM Administrator will follow for project inspections and ultimately acceptance of completed improvements.

J.2 GENERAL TESTING AND INSPECTION PROCEDURES

J.2.1 Roadway Testing and Inspection Standards
CDOT Standard Specifications for Road and Bridge Construction, as amended, special provisions and revisions thereto and as amended by the ECM shall apply to roadway testing and inspection requirements.

J.2.2 Submission of Tests
All tests and inspection results performed by the testing firm in the employment of the permit holder shall be submitted directly from the testing agency to ECM Administrator, at the time of field tests, and within 10 working days after the testing or retesting date of laboratory tests.

J.2.3 Testing Required
Any work performed inside the County's RIGHT-OF-WAY or associated easements shall be tested by an approved materials testing firm who must employ a full-time registered professional engineer who directly supervises work of the firm. The costs of testing and associated reporting will be paid by the permit holder. All Material Testing Reports must be from an ECM Administrator-approved lab and must be certified by a Professional Engineer.

J.2.4 Approved Testing Methods
The testing of all materials and construction shall be in conformance with the appropriate AASHTO, ASTM, A.C.I., or CDOT specifications. A partial list of approved testing methods is provided in Table J-1.
Appendix J Roadway Inspections and Testing
Adopted: 12/23/2004
Revised: 12/13/2016
Revision 6
Section J.2.5–J.3.1

Table J-1. Approved Testing Methods

<table>
<thead>
<tr>
<th>Test Procedures</th>
<th>AASHTO</th>
<th>ASTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt Core Densities</td>
<td>T 155–78</td>
<td></td>
</tr>
<tr>
<td>Atterberg Limits (LL &amp; PL)</td>
<td>T 89 &amp; T 90</td>
<td>D 4318</td>
</tr>
<tr>
<td>Gradation Analysis (except hydrometer)</td>
<td>T 27</td>
<td>D 422</td>
</tr>
<tr>
<td>CBR</td>
<td>193</td>
<td></td>
</tr>
<tr>
<td>R-value (subgrade &amp; base)</td>
<td>T 190</td>
<td>D 2844</td>
</tr>
<tr>
<td>Rt Value</td>
<td>T 246</td>
<td>D 1560</td>
</tr>
<tr>
<td>Compaction Curve (standard)</td>
<td>T 99</td>
<td>D 698</td>
</tr>
<tr>
<td>Compaction Curve (modified)</td>
<td>T 180</td>
<td>D 1557</td>
</tr>
<tr>
<td>Compaction Curve (CTAB)</td>
<td>T 134</td>
<td></td>
</tr>
<tr>
<td>Field Density Test (Sand Cone)</td>
<td>T 191</td>
<td>D 1556</td>
</tr>
<tr>
<td>Field Density Test (Nuclear)</td>
<td>T 238 / T 239</td>
<td>D 2922 / D 3017</td>
</tr>
<tr>
<td>Field Density Test (Balloon)</td>
<td>T 205</td>
<td>D 2167</td>
</tr>
<tr>
<td>Concrete Slump</td>
<td>T 119</td>
<td>C 143</td>
</tr>
<tr>
<td>Concrete Air Content</td>
<td>T 152</td>
<td>C 231</td>
</tr>
<tr>
<td>Concrete Compressive Strength</td>
<td>T 22</td>
<td>C 39</td>
</tr>
<tr>
<td>Concrete Sampling</td>
<td>T 141</td>
<td>C 172</td>
</tr>
<tr>
<td>Strength of Soil-Lime Mixtures</td>
<td>T 220</td>
<td>----</td>
</tr>
<tr>
<td>Asphalt Flow</td>
<td>T 245</td>
<td>D 1559</td>
</tr>
<tr>
<td>Air Voids</td>
<td>T 245</td>
<td>D 1559</td>
</tr>
<tr>
<td>Profil-o-graph</td>
<td>Colo. Procedure 64-85</td>
<td>D 4546-96</td>
</tr>
<tr>
<td>Swell Potential Evaluation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

J.2.5 Scheduling Inspections and Penalties

Any work performed in the County right-of-way must have a valid permit issued by the ECM Administrator. The permit holder must call the ECM Administrator at least 48 hours in advance of commencing work and schedule inspections. If for any reason work is not performed as scheduled, the permit holder must call and cancel the inspection as soon as possible. Failure to cancel the ECM Administrator inspection will result in a penalty fee. The privilege to work in the County's right-of-way may be revoked by the ECM Administrator for non-conformance with any permit or ECM condition or standard.

J.3 ANCILLARY FACILITIES TESTING AND INSPECTION

J.3.1 Utility Trenches Backfill Testing and Inspection

A. Field Moisture Density Testing

Field moisture-density testing shall be performed during backfill operations beginning 12 inches above the top of the pipe and extending to the finished subgrade elevation. A sufficient number of tests shall be taken at various depths to confirm backfill compaction and moisture content specifications are met. As a minimum, one test shall be taken within 12 inches of manholes, water valves, or other obstacles. Testing shall be done in accordance with Appendix K. Within the
roadway area, trench compaction shall be in accordance with AASHTO T-99 or T-180.

**J.3.2  Curb, Gutter, Sidewalk, and Minor Drainage Structures Testing and Inspection**

A.  **Testing Frequency**

Testing frequency for the subgrade shall be a minimum of each 6-inch lift on replacement materials with one test for every 500 linear feet of structure with more tests taken if necessary for control.

B.  **Slump, Air Content and Unit Weight Tests**

The slump, air content, and unit weight tests for the delivered product shall be carried out on the first load or until compliance for the daily placement and all tests shall be taken at the end of the concrete chute, or, if a “pump truck” is used, at the end of the pump, and thereafter in conformance with Table J-2.

<table>
<thead>
<tr>
<th>Item</th>
<th>Testing Frequency¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sidewalks, Crosspans, Curb Returns</td>
<td>1 set of per class of concrete per project for every 100 cubic yard or fraction thereof of concrete placed</td>
</tr>
<tr>
<td>Curbing and Combination Curb, Gutter, and Walk</td>
<td>1 set of per class of concrete per project for every 100 cubic yard or fraction thereof of concrete placed</td>
</tr>
</tbody>
</table>

Note: Testing shall include the slump (T 119), air entrainment (T 152), temperature of concrete at placement, yield and compressive strength of the cylinders (T 22).

¹All work done by hand (non-extrusion) shall require a minimum of two (2) sets of tests per day.

C.  **Core Tests**

At the discretion of the ECM Administrator, the contractor or permit holder will provide core test results of concrete at random intervals, not averaging less than one test in 500 feet, to verify that specified thickness of concrete was installed. If the ECM Administrator has not been give the opportunity to inspect the subgrade or concrete forms prior to placement of the concrete, the contractor or permit holder shall provide core tests.

D.  **Temperature Data and Tests**

When the mean daily temperature is less than 40°F, in accordance with A.C.I. Specifications, or when concrete is placed with ambient temperatures below 40°F, it shall be the contractor or permit holder’s responsibility to provide testing lab certified proof that the temperature of the concrete has been maintained at not less than 50°F for a minimum of five (5) days or until at least seventy percent (70%) of the design strength has been attained.
J.4 ROADWAY TESTING AND INSPECTION

J.4.1 Roadway Subgrade Testing and Inspection

A. Field Moisture Density Tests
   Field moisture-density tests using acceptance methods will be required at random locations at the rate of one for each 500 lineal foot, or portion thereof, of paving for each travel lane.

B. Final Proof Rolling Inspection Notification
   The ECM Administrator shall be notified at least 24 hours before final proof-rolling.

C. Review and Approval of Tests
   The results of field density tests and proof-rolling shall be submitted to and reviewed by the ECM Administrator. If testing indicates unsatisfactory work, the necessary reworking, compaction, or replacement will be required prior to continuation of the paving process. If all tests are acceptable, compaction will be approved for the placement of the paving course. The approval is valid for 24 hours. Changes in weather, such as freezing or precipitation, will require reapproval of the subgrade.

J.4.2 Lime Treated Subgrade Testing and Inspection

A. Field Moisture Density Tests
   Lime treated subgrade shall be observed and tested on a full-time basis. Field moisture-density tests shall be taken at the rate of one for each 500 lineal feet of travel lane for each lift. Field density shall be compared to the compaction curves (AASHTO T 220) each soil type for percentage compaction determinations. Field compacted 7-day strength and lime content (AASHTO T 232) determinations shall be required for each 500 tons of subgrade treated, with a minimum of one per project.

B. Review and Approval of Tests
   The results of field density, lime content, and strength tests shall be submitted and reviewed by the ECM Administrator. Should these tests fail to meet project specifications, the strength reduction will be used to calculate increased pavement layer or overlay thickness required for the design section. If all tests are acceptable, compaction will be approved for the placement of the paving course.

J.4.3 Aggregate Base Course Testing and Inspection

A. Verification of Materials Properties
   The contractor or permit holder shall, upon request by the ECM Administrator, provide verification of material properties.
B. Gradation and Atterberg Limits Materials Sample Tests
At least one sample of aggregate base course for each 1,000 tons of materials placed shall be tested to determine gradation and Atterberg Limits. Should these tests indicate the material does not meet specifications, the material shall be removed and replaced.

C. Field Moisture Density Tests
During placement and compaction, compaction curves will be required for each material used. Field moisture-density tests shall be taken of each lift of material at random locations at approximate intervals of 500 feet in each travel lane. At least 20 percent of the tests shall be taken within 12 inches of manholes, valves, and curbs.

D. Review and Approval of Tests
The results of field density tests shall be submitted to and reviewed by the ECM Administrator. Should testing indicate unsatisfactory work, the necessary reworking, compaction, or replacement will be required prior to continuation of the paving process. If all tests are acceptable, compaction will be approved for the placement of the paving course.

J.4.4 Cement Treated Aggregate Base Course Testing and Inspection

A. Verification of Materials Properties
The contractor or permit holder shall provide verification of material properties of the approved mix design.

B. Approval of Subgrade
Materials shall be placed on a subgrade that has been proof-rolled within the past 24 hours and found to be stable and non-yielding and has been approved by the ECM Administrator. Should weather conditions change, such as freezing, precipitation, etc., materials shall not be placed until the subgrade is re-approved by the ECM Administrator.

C. Unconfined Compressive Strength, Gradation, and Atterberg Limits Material Test
At least one sample of cement treated aggregate base course for each 1,000 tons of material placed shall be tested to determine gradation, and Atterberg Limits. Six field prepared proctor mold samples shall be taken for each 500 tons placed and tested at 7 and 28 days to determine unconfined compressive strength.

D. Field Moisture Density Tests
During placement and compaction, compaction curves will be required for each material used in accordance with AASHTO T 134. Field moisture-density test shall be taken of each lift of material at random locations at approximate intervals
of 500 feet in each travel lane. At least 20 percent of the tests shall be taken within 12 inches of manholes, valves, and curbs.

E. Review and Approval of Tests
The results of laboratory tests and field density tests shall be submitted to and reviewed by the ECM Administrator. Should testing indicate unsatisfactory work, necessary adjustments will be made to the pavement section to comply with original design strength requirements. If all tests are acceptable, compaction will be approved for the placement of the paving course.

J.4.5 Hot Mix Asphalt (HMA) Testing and Inspection
Hot Mix Asphalt (HMA) materials shall be tested according to the latest edition of the Pikes Peak Region Asphalt Specification. The Pikes Peak Region Asphalt Specification can be obtained online at: http://adm.elpasoco.com/publicservices/transportation/Pages/default.aspx.

J.4.6 Portland Cement Concrete Testing and Inspection
A. Portland Cement Concrete Requirements
When the mean daily temperature is less than 40°F, in accordance with A.C.I. Specifications, or when concrete is placed with ambient temperatures below 40°F, it shall be the contractor or permit holder’s responsibility to provide testing lab certified proof that the temperature of the concrete has been maintained at not less than 50°F for a minimum of five (5) days or until at least seventy percent (70%) of the design strength has been attained.

B. Aggregate Samples
During placement of Portland cement concrete pavement, observation and testing shall be on a full-time basis. For each day of production or every 400 cubic yards placed (or portion thereof), aggregate samples shall be obtained for gradation of both the coarse and fine aggregates.

C. Slump, Air Content, Unit Weight, and Mix Temperature Testing
Slump, air content, unit weight, and mix temperature shall be tested every 100 cubic yards of pavement placed. The first three loads shall be tested for slump and air content. If any one test fails to meet requirements, slump and air content tests shall continue until three consecutive loads meet requirements. Thereafter, slump and air shall be tested every fifth load.

D. Compressive Strength Cylinder Testing
Six compressive strength cylinders shall be fabricated for each 100 cubic yards placed. Cylinders shall be tested as follows: 1 at 7 days, 2 at 28 days, and 1 for backup, as required by the ECM Administrator. Testing interval may be increased to approximately 1/3 of the daily volume at the discretion of the ECM Administrator.
E. Certificates of Compliance and Pre-Testing
Portland cement and fly ash will be accepted on the basis of current certificates of compliance and pre-testing by CDOT. Reinforcing steel, dowels, and tie bars will be accepted by certificate of compliance and mill reports. Water, if not potable, shall be sampled and tested before use. Only CDOT-approved brands of air entraining agents, chemical admixtures, and curing materials may be used and must be documented.

F. Surface Smoothness Tests
Surface smoothness shall be tested and corrected as necessary according to Section 412.17 CDOT. The profil-o-graph index shall not be more than 14 inches per mile with a deviation of not more than 0.5 inches in 25 feet. Concrete tested with a 10-foot straight edge shall have a deviation of no more than 3/16 inch in 10 feet. This requirement is for all concrete mainline pavements. Surface smoothness shall be tested and corrected as necessary according to CDOT Section 412.16.

G. Concrete Thickness Tests
Concrete thickness shall be verified by coring after construction at random locations at intervals of approximately 500 feet in each travel lane as determined and marked by the ECM Administrator. The ECM Administrator must be present during actual core drilling or cores will not be accepted. Surface smoothness shall be tested and corrected as necessary according to CDOT Section 412.16.

H. Profil-O-Graph Tests Submitted
Profil-o-graph tests shall be submitted to, and accepted by, the ECM Administrator prior to beginning the 2-year warranty period.

I. Onsite Test Location
All on-site air tests shall be taken at the point of placement: at the end of the concrete chute, or, if a “pump truck” is used, at the end of the pump, etc.

J. Review and Approval of Tests
All test results shall be submitted to, and reviewed by, the ECM Administrator. Should testing indicate unsatisfactory work, removal and replacement or grinding will be required. If all tests are acceptable, the pavement will be accepted and the 2-year warranty period will begin.

J.4.7 Asphalt Tack Coat Testing and Inspection
Asphalt tack coat materials shall be tested according to the latest edition of the Pikes Peak Region Asphalt Specification. The Pikes Peak Region Asphalt Specification can be obtained online at: http://adm.elpasoco.com/publicservices/transportation/Pages/default.aspx.
J.4.8 Cement Stabilized Subgrade Testing and Inspection

A. Verification of Materials Properties
The contractor or permit holder shall provide verification of material properties of the approved mix design.

B. Thickness of Stabilized Zone
Stabilized zone thickness shall be verified by the use of phenolphthalein and shall be performed at intervals of approximately 500 feet in each lane. When the measurement of the thickness is deficient by more than 1 inch from the plan thickness, two additional locations shall be measured randomly within the deficient area and used in determining the average thickness. When the average thickness is deficient by more than 1 inch, the entire area shall be reprocessed to meet the design parameters or the roadway design section must be re-evaluated.

C. Unconfined Compressive Strength, Gradation, and Atterberg Limits
Material Test
At least one sample of cement stabilized subgrade for each 1,000 tons of material stabilized shall be tested to determine gradation and Atterberg Limits. The stabilized subgrade must develop a laboratory compressive strength that meets the design compressive strength. Samples shall be molded from stabilized soil within 1.5 hours of final mixing with the material compacted per ASTM D 558 or ASTM D 698, as specified in subgrade stabilization design, at the field moisture content.

D. Field Moisture Density Tests
During placement and compaction, compaction curves will be required for each material used in accordance with AASHTO T 134. Field moisture-density test shall be taken of each lift of material at random locations at approximate intervals of 500 feet in each travel lane. At least 20 percent of the tests shall be taken within 12 inches of manholes, valves, and curbs.

E. Review and Approval of Tests
The results of laboratory tests and field density tests shall be submitted to and reviewed by the ECM Administrator. Should testing indicate unsatisfactory work, necessary adjustments will be made to the pavement section to comply with original design strength requirements. If all tests are acceptable, compaction will be approved for the placement of the paving course.

J.5 TESTING SUMMARY
Table J-3 summarize the testing requirements outlined in Appendix J.
<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Type Of Test</th>
<th>Minimum Frequency</th>
<th>Min. #</th>
<th>Act. #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Utilities: Water, Sewer, Gas, Electric, Phone and Cable Trenches</td>
<td>Moisture/Density</td>
<td>1 per every 250 L.F. or fraction thereof, every 2' elevation. Each structure (manhole, valve, etc.) every 2' elevations. This requirement also applies to every service.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Storm Sewer Trench</td>
<td>Moisture/Density</td>
<td>Same as above. Each structure (manhole, inlet, etc.) every 2' elevations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Inlets Concrete Testing</td>
<td>Air Slump</td>
<td>First load or until compliance. Minimum 1 per day.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cylinders</td>
<td>1 set (4) per project for every 100 C.Y. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Steel</td>
<td>Visual and Documentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Curb and Gutter</td>
<td>Moisture/Density</td>
<td>1 every 250 feet or a minimum of 3 tests, whichever is greater.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proof-Roll</td>
<td>All final subgrade.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air/Slump</td>
<td>First load or until compliance. Minimum 1 per every 2,000 L.F. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cylinders</td>
<td>1 set (4) per project every 2,000 L.F. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Item</td>
<td>Type of Test</td>
<td>Minimum Frequency</td>
<td>Min. #</td>
<td>Act. #</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------</td>
<td>-----------------------</td>
<td>-------------------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>5</td>
<td>Sidewalk</td>
<td>Moisture/Density</td>
<td>1 per every 250 L.F. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Air/Slump</td>
<td>First load or until compliance. Minimum 1 per every 1,000 S.Y. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cylinders</td>
<td>1 set (4) per project 1,000 S.Y. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Roadway</td>
<td>Moisture/Density</td>
<td>1 per every 500 Lane Ft. or fraction thereof, every 2' elevation. Cuts to be scarified to a depth of 1', recondition as needed and recompact.</td>
<td></td>
<td>All final subgrade.</td>
</tr>
<tr>
<td></td>
<td>Subgrade: Fills and Cuts</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Roadway</td>
<td>Air/Slump</td>
<td>First 3 loads or until compliance, then every 1,250 C.Y. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Concrete)</td>
<td>Cylinders</td>
<td>1 set (4) per project for every 1,250 C.Y. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table J-3. Summary of Minimum Testing Requirements Continued

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Type of Test</th>
<th>Minimum Frequency</th>
<th>Min. #</th>
<th>Act. #</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Roadways (Base Coarse)</td>
<td>Moisture/Density</td>
<td>1 per 500 Lane Ft. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gradation &amp; Atterberg Limits</td>
<td>1 per 2,000 Tons or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proof-Roll</td>
<td>Subgrade prior to Base Coarse placement. Base Coarse prior to placement of asphalt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Roadways (Asphalt)</td>
<td>Density</td>
<td>1 per 500 Lane Ft. or fraction thereof, per lift.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extraction/Gradation</td>
<td>1 per 1,000 Tons or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Roadways (Asphalt &amp; Concrete)</td>
<td>Cores</td>
<td>1 per 1,000 Lane Ft. or fraction thereof.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Profil-O-Graph</td>
<td>Minor Arterial classification and above.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX K  ROAD CUT, TRENCHING AND RESTORATION

K.1  ROAD CUTS

K.1.1  General
Placement or repair of subsurface facilities (utilities, culverts, or foundations) within the County roadways shall follow the requirements outlined in the Chapters 3 and 4 and this Appendix. Modifications to these Standards require written approval from the ECM Administrator before beginning work. Emergency repairs for broken pipes, cables etc. is allowed on a case-by-case basis and requires immediate notification of the ECM Administrator. Applicable Trench Notes are provided in Section K.2.

K.1.2  Pavement Cutting

A.  No Cuts Permitted
No pavement cuts will be permitted in pavements less than three years old. In the event that a pavement cut is allowed through an approved deviation, restoration requirements may be more extensive than for older pavements. If the permit holder makes a cut into a pavement less than three years old, which is not an emergency cut, the permit holder shall be liable for restoring the roadway to the satisfaction of ECM Administrator at the permit holder's expense.

B.  Boring May be Required
Boring may be required for pipelines to cross roads, instead of trenching, as directed by the ECM Administrator. If sufficient right-of-way exists, the length of the bore shall extend a minimum of 4 feet from edge of pavement. Unused holes or abandoned casings shall be backfilled. Water boring under roadways shall not be permitted. Existing carriers and conduit installed under a roadway shall be physically located prior to boring.

C.  Pavement Cut Standards
Pavement shall be cut so the joint line between existing and replacement pavement is straight and neat (i.e., within 5° of vertical and free from horizontal irregularities). All cuts shall be by saw or blade. The cut shall be full depth to allow the pavement to be removed without damage to the remaining pavement. The minimum allowable remaining pavement sections shall not be less than four feet (4') (not including the curb and gutter or concrete pavement) unless it is part of monolithic concrete pavement section that shall be full panel (per existing control joint).

D.  Removal and Disposal of Pavement
Removed pavement shall be hauled away and disposed of in a proper manner (recycle or waste facility).
Appendix K  Road Cut, Trenching and Restoration
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section K.1.2 - K.1.2

E. Base Course Storage and Reuse
Base course material may be removed and stockpiled off of the road surface area for reuse during backfilling if it meets specifications. If not, it is to be hauled away from the right-of-way and disposed of in a proper manner.

F. Subbase Material Storage and Reuse
Sub-base material may be stockpiled parallel to the trench alignment; in such a manner that encroachment upon the non-disturbed portion of the roadway and pedestrian walkways is kept to a minimum. The storage of materials on the non-disturbed portion of the roadway shall not be allowed unless identified in the traffic control plan with appropriate protective measures. Unsuitable material is to be hauled away from the right-of-way, disposed of in a proper manner and replaced with select backfill.

G. Storage of Construction Materials in Right-of-Way
The temporary storage of construction material in the public right-of-way in connection with utility projects is permitted. Material storage shall meet the requirements outlined by the ECM Administrator. Parking of construction or personal vehicles on roadways shall be kept to a minimum.

H. Safety Standards
Safety standards relating to the shoring and stabilization of trench sidewalls should be maintained as prescribed by appropriate safety regulatory agencies (OSHA, State of Colorado). All barricades shall comply with Manual of Uniform Traffic Control Devices (MUTCD).

I. Length of Open Trench Limited
Trenches shall not be opened for a distance of more than one hundred (100) feet at any one time, unless specifically authorized by the ECM Administrator.

J. Trench Width and Pavement Cut
The trench width shall be confined to those minimum dimensions, which will permit proper installation and acceptable pipe loading, as established by current acceptable engineering practices and all OSHA requirements. In no case shall the trench width be less than equal to the diameter of the pipe plus a minimum of 12 inches on each side to ensure adequate compaction by mechanical means. All asphalt pavement cuts shall be a minimum of 12 inches in each lateral dimension beyond edge of trench and full panel replacement on all concrete or curb and gutter cuts.

K. Open Condition and Traffic Warnings
No road cuts should be left in an open condition overnight, except for the portion necessary to commence work the following morning. Warning signs, barricades and lights, all in conformance with the MUTCD, shall be used in areas where trenching operations are in public roadways. All work shall have flashing lights.
used with warning signs and barricades. All barricades, signs and warning devices shall be installed in accordance with the MUTCD.

L. **Trenching Across the Road and Traffic**
   When trenching across the road, no more than one-half (1/2) of the roadway is to be closed to traffic at one time. A traffic signal or flaggers as required by MUTCD shall be provided. The trenched roadway shall be completely backfilled and paved before trenching the other half of the road.

M. **Road Closure**
   Closure of any road, approach, or other access points shall be approved by the ECM Administrator. Upon trenching across facilities, steel running plates, planks or other safe methods shall be used to provide for traffic to enter or leave the road or adjacent property.

N. **Driveways Closures**
   The use of driveways to adjacent properties shall be respected by the permit holder. Every effort shall be made minimize closures and to open and make serviceable those driveways that are closed in the shortest time possible. If closure of driveways is anticipated, the permit holder performing the work shall notify the owners in advance of closure and shall notify the owners of the anticipated time and period of closure. When open, safe access to private driveways shall be provided.

O. **Notice Before Beginning Work**
   The ECM Administrator, applicable policing authority and emergency companies shall be informed by the permit holder at least 48 hours in advance of beginning work in the public right-of-way.

P. **Accidents**
   If traffic accidents or pedestrian incidents occur due to installations or obstructions placed in the right-of-way, the occurrence must immediately be reported to the ECM Administrator and the applicable policing authority by the permit holder.

Q. **Access to Fire Hydrants**
   Safe access must be maintained at all times to fire hydrants.

R. **Restoration of Property**
   The permit holder shall take precautions to limit the removal of or damage to existing pavements, sidewalks, curbs, lawns, shrubbery, trees, hedges, walls, fences, buildings, other existing improvements, existing survey monumentation, pavement markings, and signage in the County right-of-way or easement areas to the least practicable amounts and shall replace or restore improvements to their original location and condition after the excavation has been backfilled and compacted.
S. **Private Easement Conditions**  
The permit holder is responsible for understanding and complying with all specific conditions contained in private easements.

T. **Inspection Costs**  
All inspection costs shall be borne by the permit holder.

U. **Notice of Completed Work**  
The permit holder shall notify the ECM Administrator in writing upon completion of work accomplished under the provisions of the permit.

**K.1.3 Backfilling**

A. **General**  
Once the subsurface facility has been installed or repaired, backfill material shall be placed in accordance with these Standards.

B. **Backfilling Requirements**

1. **Preparation of Trench**  
The bottom of the trench shall be prepared to provide a firm foundation for the facility in accordance with the bedding conditions specified by the Geotechnical Engineer for the type of facility to be installed. The subgrade of the trench shall be kept free of standing water. Where the trench subgrade material is found to be unsuitable and does not afford a solid foundation, the permit holder shall excavate to depth as necessary to construct a stable foundation. A stable foundation shall be constructed by placing crushed rock or other approved granular material to support the installed facility.

2. **No Deformation or Damage to Facility**  
The facility, including backfill, shall be installed in a manner that ensures no deformation, displacement or damage to the facility likely to cause leakage or degradation to the structural integrity of the roadway.

3. **Trench Backfill**  
The facility being placed will be properly bedded to at least one foot above the pipe with furnished sand or selected sandy soil free of humus, vegetable or other organic matter, frozen material, clods, sticks and debris. In addition, rock particles and hard earth clods larger than 3 inches will be removed. After the improvements are bedded, the previously removed and stockpiled material shall be replaced and properly compacted to an elevation which facilitates placing pavement. No fill material with a liquid limit greater than 40 and plasticity index greater than 20 percent shall be used within the top two feet of the trench without implementing proper mitigation techniques.
4. Compaction Tests

Compaction tests must be performed daily by a Geotechnical Engineer and shall be performed at a minimum of every 250 feet (250’) or portion thereof along the trench and every 12 inches in elevation. Testing intervals may be increased at the discretion of the ECM Administrator.

5. Compaction

The subgrade shall conform to the lines, grades and cross-sections as shown on the approved plans. The backfill material shall be compacted in successive layers not to exceed eight inches (8") thick and shall be finished and maintained in a smooth compacted condition. The completed surface shall be free from rutting or other objectionable irregularities.

Within the roadway area, trench compaction shall be in accordance with the following, depending on the site conditions:

- Depths up to 15 feet and cohesive soils (per A.A.S.H.T.O.) - 95 percent of maximum Standard Proctor dry density at moisture contents within 2 percent of optimum (ASTM D698 or AASHTO T99)
- Depths up to 15 feet and non-cohesive soils (per A.A.S.H.T.O.) - 95 percent of maximum Modified Proctor dry density at moisture contents within 2 percent of optimum (ASTM D1557 or AASHTO T180)
- Depths over 15 feet and cohesive soils (per A.A.S.H.T.O.) - 98 percent of maximum Standard Proctor dry density at moisture contents within 2 percent of optimum (ASTM D698 or AASHTO T99)
- Depths over 15 feet and non-cohesive soils (per A.A.S.H.T.O.) - 95 percent of maximum Modified Proctor dry density at moisture contents within 2 percent of optimum (ASTM D1557 or AASHTO T180)

K.1.4 Subbase Preparation

A. General

The term “subbase”, for the purpose of trench backfill discussion shall refer to the CDOT Class 1 or Class 2 material that is part of a structural pavement design. There may or may not be a subbase in the pavement section. If there is none, the base course shall all CDOT Class 6.

B. Subbase Placement Procedures

1. Subbase Grade and Cross Sections

Subbase material shall conform to the lines, grades, cross sections and thickness shown on the approved plans and shall be finished and
Appendix K Road Cut, Trenching and Restoration
Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section K.1.5-K.1.5

Section K.1.5 - K.1.5

K.1.5 Foundation for Base Course

A. General
Foundation preparation shall be completed to ensure proper slopes, grades, shown of project plans are developed.

B. Base Course Preparation Requirements

1. Base Course Grades and Cross Sections
Base material shall conform to the lines, grades, cross-sections, and thickness shown on the approved plans and shall be finished and maintained in an acceptable condition at least one day’s progress in advance of placing prime coat.

2. Subbase Material
Subbase material shall be well mixed, free of organic matter and lumps or balls of clay, and shall consist of sound aggregate particles and suitable filler or binding materials which when placed and compacted will result in a firm, dense, unyielding foundation. Subbase material need not be crushed but may be of the pit run variety providing it is graded within the following limits.

<table>
<thead>
<tr>
<th>Standard Size of Sieve</th>
<th>Percentage of Weight Passing Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 ½ inch</td>
<td>100</td>
</tr>
<tr>
<td>2 inch</td>
<td>95 – 100</td>
</tr>
<tr>
<td>#4</td>
<td>30 – 60</td>
</tr>
<tr>
<td>#200</td>
<td>5 - 15</td>
</tr>
<tr>
<td>Liquid Limit</td>
<td>35 maximum</td>
</tr>
<tr>
<td>Plastic Limit</td>
<td>6 maximum</td>
</tr>
</tbody>
</table>

3. Subbase Placement
Subbase shall be deposited and spread, without particle segregation in loose layers not to exceed 6 inches (6”) in depth. Each layer shall be thoroughly and individually compacted to 96% proctor (AASHTO T99) density. Wetting or aerating and rolling the material shall be required when ordered by the ECM Administrator. Subbase shall not be placed on soft, spongy, or frozen subgrade or other subgrade, the stability of which, in the opinion of the ECM Administrator, is unsuitable.
2. **Base Course Material**

Base material shall consist of hard, durable particles or fragments of stone or gravel crushed to the required size and an AP-filler of sand or other finely divided mineral matter. When produced from gravel, not less than 60% by weight of the aggregate retained on a No. 4 sieve shall consist of particles having at least one fractured face. Base material shall be free from vegetable matter and lumps or balls of clay and which when placed and compacted will result in a firm, dense, unyielding foundation. Base material shall meet the following grading requirements:

<table>
<thead>
<tr>
<th>Standard Size of Sieve</th>
<th>Percentage of Weight Passing Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ inch</td>
<td>100</td>
</tr>
<tr>
<td>#4</td>
<td>0 – 65</td>
</tr>
<tr>
<td>#10</td>
<td>25 – 55</td>
</tr>
<tr>
<td>#200</td>
<td>3 – 12</td>
</tr>
<tr>
<td>Liquid Limit</td>
<td>25 maximum</td>
</tr>
<tr>
<td>Plastic Limit</td>
<td>6 maximum</td>
</tr>
</tbody>
</table>

3. **Base Course Placement**

Base material shall be deposited and spread without particle segregation in loose layers not to exceed 6 inches in depth. Each layer shall be thoroughly and individually compacted to 95% proctor (AASHTO T180) density. Wetting or aerating and rolling of the material shall be required as ordered by the ECM Administrator following review of all field test results. No base course shall be placed upon a soft, spongy or frozen subgrade or subbase or other subgrade, the stability of which, in the opinion of the ECM Administrator, is unsuitable.

4. **Material Deviations**

Deviation from the gradation limits may be permitted by the ECM Administrator on unpaved roads provided it can be unequivocally demonstrated that the subbase material is not conducive to rutting, raveling or forming a soft yielding surface in the presence of moisture.

5. **Compaction Equipment**

Compaction equipment must be on the job site before excavation is started. Compaction equipment must be capable of compacting within the trench width limits to avoid bridging the ditch.

6. **Existing Untreated Base Course**

If the existing base course is untreated, it shall normally be replaced with CDOT Class 6 aggregate base material and compacted in layers not to
exceed 6 inches. The resulting total compacted base thickness shall be 8 inches or to the thickness of the removed base plus 2 inches. A replacement 2 inch thick asphalt surface wearing course, or matching existing, whichever is greater, shall also be used when replacing asphalt treated aggregate.

K.1.6 Trench Cover – Subgrade

A. General

Trench cover placement shall follow the requirements of these Standards. The objectives are to place the material to lines and grades shown on project plans and ensure the compaction requirements are met.

B. Trench Cover Placement Requirements

1. Trench Cover Subgrade

After the backfill has been placed and compacted as specified, it shall be cut and trimmed to the required depth and cross section. Trench cover subgrade shall be free of all rock over 2 ½ inches in size. It shall have a compaction of 95 percent or more, by standard tests at the time of constructing curb, gutter, sidewalk, pavement and/or other permanent trench cover structure.

2. Disposal and Restoration

All excess excavated material shall be removed and disposed of outside the legal limits of the right-of-way as the work progresses, unless the approval of the ECM Administrator is obtained for disposal of the material within the legal limits of the right-of-way. All parts of the roadway and various structures disturbed shall be restored to a condition equal to or better than that which existed before starting the work.

K.1.7 Trench Cover – Paved Roads

A. General

Trench cover placement shall follow the requirements of these Standards. The objectives are to place the material to lines and grades shown on project plans for paved surfaces and ensure the compaction requirements are met.

B. Temporary Trench Cover Requirements

1. Temporary Cover Required

All trenches across traffic lanes, where it becomes necessary to remove any existing surfacing or pavement, shall be provided with temporary trench cover.
2. **Temporary Patch Materials**

A temporary patch of cold-mix asphalt shall be placed on all pavement surface cuts immediately after backfilling has been completed and shall be removed at the time a permanent patch is made.

Minimum requirements for temporary trench cover shall be well compacted surfacing material conforming to “Road Mixed Asphalt Surfacing Material” of the CDOT Standard Specifications and shall match the existing asphalt or concrete thickness, or not less than 4 inches thick, whichever is greater. The mineral aggregate shall, with a tolerance of ± percent, conform to the grading specified for 3/8-inch maximum aggregate. Bituminous binder to be mixed with the mineral aggregate shall be liquid asphalt, Grade MC-3000 and shall be between 5 ½% and 6% by weight of the dry mineral aggregate.

3. **Material Onsite**

Temporary trench cover surfacing material, other than cold-mix patch, shall be stockpiled on the job site and shall be placed within six hours after completion of trench backfill and compaction.

4. **Temporary Patch Maintenance**

Temporary trench cover shall be properly maintained until permanent trench cover is placed. The surface of the temporary repaving shall be smooth and at the same level as the adjacent undisturbed paved area.

C. **Permanent Trench Cover Requirements**

1. **Asphalt Replacement Depth**

In the areas where the wearing surface is asphalt concrete, replace the pavement with a full depth asphalt paving of a minimum thickness of 4 inches but in all cases to a thickness of the old surface plus base course plus 1 inch.

2. **PCC Replacement Depth**

In areas where the wearing surface Portland cement concrete, replace the pavement with concrete pavement shall conform to these Standards. Concrete pavement replacement shall be of the same depth as the original pavement, but not less than 6 inches thick on alleys or residential roads, nor less than 8 inches on roads classified as collectives and above.

3. **Other Material Replacement Depth**

In areas where the wearing surface is other than asphalt concrete or Portland cement concrete, replace the pavement and base in kind, or minimum ECM Administrator standards, whichever is greater.
4. **Asphalt Placement**

Where original surface was asphalt concrete, bituminous treatment or mix, or oil mat; Asphalt concrete shall be compacted in layers not to exceed 3 inches to a total compacted thickness of 4 inches or the thickness of the removed pavement plus 1 inch, whichever is greater. On oil mat surfaces or substandard asphalt surfaces, an overlay of Class “EX” asphalt pavement 1 ½ inches thick shall be placed across the entire traffic lane disturbed by the trench and shall be finished as set forth below.

- Immediately prior to placing the wearing surface, the abutting pavement edges shall be neatly cut.
- The existing pavement shall be cleaned, removing all loose material and coated with hot liquid asphalt (Grade AC-10) or asphalt emulsion applied cold (Grade CSS-1h) to ensure a bond with the new asphalt surfacing.
- The restored pavement shall be finished to a smooth riding surface and to the grade of the surrounding undisturbed pavement.
- Pavement replacement shall commence not more than 7 working days after backfilling, unless approved by the ECM Administrator.

5. **Trench Edges in the Wheel Travel Portion of Roadway**

In the event the trench edges fall in the wheel traveling portion of a traffic lane, existing or proposed, the applicant shall extend the finish surface paving to a point deemed satisfactory by the ECM Administrator. Finish surface paving shall be performed to provide a crown slope equal to that existing prior to excavation, with no ponding of run-off surface water either over the trench or at the joints between the new and original surfaces.

6. **Cuts Impacting More than One Traffic Lane**

When road surface damage involves more than one traffic lane, a full width paving lift may be required. Individual jobs may require negotiations with the ECM Administrator for partial participation in the cost of a full width overlay.

**K.1.8 Repair to Gravel Roads and Shoulder**

**A. General**

The repair of disturbed gravel surfaces shall be completed in accordance with these Standards. Placement of the gravel shall be done to ensure a smooth surface is developed and proper compaction is achieved.
Appendix K  Road Cut, Trenching and Restoration

Adopted: 12/23/2004
Revised: 12/13/2016
REVISION 6
Section K.1.9-K.1.9

B. Restoration of Unpaved Areas

1. Material and Placement
   Where the original surface was crushed rock or gravel for the wearing surface and foundation material, Class 6 aggregate base course shall be used as replacement material. It shall be placed to a compacted thickness minimum of 8 inches or the thickness of the removed material plus 2 inches, whichever is greater.

2. Backfill
   In the area from the right-of-way line (fence line/property line) to a point 5 feet outside of the roadside ditch flowline, all trenches shall be backfilled with excavated material and compacted to 90% standard compaction, or to the density of the existing ground, whichever is greater.

   In all other areas, including the gravel road, the shoulders and the roadside ditch to a point 5 feet outside of the flowline; all trench compaction shall be completed to a minimum of 90% standard compaction.

3. Erosion Protection
   During construction and after the trench is backfilled and compacted, erosion protection shall be provided to minimize sediment transport.

K.1.9 General Restoration Requirements

A. Preservation, Restoration and Cleanup

1. Conform to Permit
   Where construction has impacted streams, wetlands, fish and wildlife habitat areas or their buffers, full restoration and mitigation shall be performed as required by permit. Restoration methods shall be in accordance with County codes, provisions of the applicable permit, and these Standards.

2. Unsatisfactory Restoration
   Unsatisfactory restoration of the right-of-way, as determined by the ECM Administrator, shall be promptly corrected by the permit holder. If necessary, unsatisfactory restoration may be corrected by the County and billed to the permit holder.

3. Protection of Existing Utilities and Facilities
   Reinforcement, protection and security of existing utilities and facilities under construction are the responsibility of the permit holder. In roadway restoration, the design shall consider the protection of existing utilities without sacrificing the geometrics of roadway design.
B. **Emergency Repairs**

If emergency repairs disturb the right-of-way, the right-of-way shall be restored immediately. Approval of the final restoration of the right-of-way shall be obtained from the ECM Administrator.

C. **Striping Replacement**

All traffic striping and walkway delineation removed during construction shall be replaced. Temporary striping shall be used on a limited basis and only as approved by the ECM Administrator. All permanent striping and channelization shall be installed by County forces at the expense of the permit holder. If County forces are unavailable to perform the striping installation within an appropriate timeframe, the permit holder shall contract for the striping installation.

D. **Final Cleanup**

1. **Roadways Swept**

   Roadways shall be cleaned and swept both during and after utility work. Disturbed soils shall be final graded, seeded, and mulched after installation of the utility facilities or equipment. In limited areas, seeding and mulching by hand, or sod placement using approved methods, will be acceptable. Ditches lined with erodible soil and subject to rapid flows may require seeding, jute matting, netting, placement of sod, or rock lining to control erosion. Revegetated areas shall be weed free.

2. **Siltation**

   Any silting of downstream drainage facilities, whether ditches, pipes or catchbasins, which results from the utility installation shall be cleaned out and restored to proper operation as part of the site cleanup.

3. **Storm Drainage Facilities**

   Any existing storm drainage facilities or roadside features damaged during repair or restoration activities shall be replaced with new materials by the permit holder.

**K.1.10 Maintenance Period**

For a period of two years following the backfilling of any trench in the County's right-of-way or the permanent patching of paved surfaces, the permit holder shall be responsible for the condition of the trench backfill, pavement patches, and adjacent revegetation areas. During that time the permit holder shall, at their own cost, upon request from the ECM Administrator, repair to the County's satisfaction any of the patches that become settled, cracked, broken, or otherwise faulty. Settlement of the replaced road surface of 1/2 inch or more within a 6-foot straight edge shall constitute evidence of improperly compacted backfill material. If test results do not meet the standards for compaction as set forth in this specification, the permit holder shall be responsible for repairs or replacement to meet these standards. Settlement of 3/16 inch or greater with a 10-foot...
K.2 TRENCHING DETAIL NOTES

- This trench patching detail specifies requirements in addition to those specified in the latest edition of the CDOT’s Standard Specifications for Road and Bridge Construction.
- A construction traffic control plan shall be submitted to and approved by ECM Administrator prior to issuance of construction permits in the County right-of-way.
- Trench shall be braced or sheeted as necessary for the safety of the workers and protection of other utilities or structures in accordance with applicable local, state and federal safety regulations.
- The trench width shall be confined to those minimum dimensions, which will permit proper installation and acceptable pipe loading, as established by current local, state and federal safety regulations.
- At the discretion of the ECM Administrator, the pavement may be required to be saw-cut back to maintain a straight edge.
- Backfill compaction requirements: Minimum density will be determined in accordance with AASHTO T99 or T180 as defined by CDOT Standard Specifications Section 203.11 and CDOT 703.03. Except for CLSM.
- Fill depth asphalt can be used as an alternative to base course. A ratio of 3 inches (3”) base course to 1 inch (1”) of asphalt shall be used in the substitution.
- A temporary cold-mix asphalt patch, 4 inches (4”) minimum depth will be required for all road cuts if a permanent hot-mix asphalt patch cannot be applied for any reason, after construction is completed.
- Pavement edges shall be saw-cut straight to within 5 degrees of vertical. Edges shall be tack coated prior to patching.
- If existing road is paved with fabric, a “TEE” trench shall be required. The Contractor shall carefully saw-cut and remove the layer of asphalt above the fabric a minimum of 12” back from the edge of the trench.
- Minimum cover for prefabricated pipe shall be 2 feet (2’).
- Changes in design criteria will require compensating change in pipe design.
- When pipe sewer is to be extended or replaced with pipe of different material, the connections shall conform to the detail shown on plans or be approved.
- Spacing for multiple pipe sewer installations shall be ½” inside diameter or span, or 3” maximum.
- Trenches over 5 feet (5’) in depth shall be either shared or the trench walls shall be sloped to the angle of repose. If sloped, the bottom of the slope shall be a minimum of 1 foot (1’) above the bottom of the slope.
- Shoring will be required when the bottom of the slope is more than 3 feet (3’) above the bottom of the trench. Shoring shall extend a minimum of 1 foot (1’) above the bottom of the slope.

straight edge will be cause for repair in the case of settlement or replacement in the case of unsatisfactory workmanship.
Timber Sheeting or shoring may be cut off 1 foot above the top of the pipe after backfilling is complete.

Refer to the City/County DCM and CDOT “M” Standards.
Addendum

Revised Drainage Basin Fees Based on Impervious Area
For Unincorporated El Paso County Only

City of Colorado Springs & El Paso County
Drainage Criteria Manual

COORDINATED WITH
EL PASO COUNTY STAFF
AND
DRAINAGE CRITERIA MANUAL REVISIONS TASK FORCE

TECHNICAL WORK BY AYRES ASSOCIATES AND SEC OLSSON ASSOCIATES
DRAINAGE BASIN FEE ADDENDUM
CHAPTER 3

This revised fee addendum is intended to supplement Chapter 3 in the Drainage Criteria Manual. It is only effective for use in El Paso County (not in the City of Colorado Springs). Many of the items outlined in Chapter 3 remain applicable to the basin fee calculation process. If a discrepancy exists between this addendum and the original Chapter 3, this addendum shall apply.

3.5a Impetus for Revisions to the Basin Fee

The implementation, maintenance, and improvement of an adequate drainage system in the County were not occurring because of several past problems with assessment and collection of the basin drainage fees. Drainage fees were unreasonably high in some areas, and several land developers had sought and performed “end runs” around the fee payment. Those challenges to the payment of drainage fees had been successful for the following reasons:

- The County’s drainage basin fee system did not meet the legal test for proportionality. For stormwater, the proportionality test means that the fee for a development should be roughly proportional to the increase in stormwater runoff that the development generates. Therefore, the fee should not be based on the total acreage of a development (as was in the previous system) but on the number of impervious acres.
- The County’s policy for the type of stormwater detention ponds required (regional and/or on-site) was not clear.
- A County policy for implementing regional detention ponds and other regional facilities had not been established.

In the County, a land owner can apply credits earned from one project towards another project within the same basin. However, credits earned in one basin may not be transferred to another basin.

In general, the City of Colorado Springs does not collect fees on replats unless required as a condition of annexation; however, the County does collect fees on replats as explained below.

3.6a History of the Fee Revision Process

El Paso County has levied a basin fee based on acres of development since 1983. Because of the proportionality and general equity issues raised above, the basin fee revision process began in 1998 that culminated in the issuance of a September 21, 1998 draft report entitled “Proposed Revisions - Drainage Basin Fee Program and Policy for New Development, El Paso County, Colorado” along with a subsequent November 17, 1998 Addendum to clarify on-site detention policy and correct minor typographical errors. A key finding of that report was that basin fees should be based on impervious acres rather than gross developed acres.

Following a review of the above draft, the development community believed that many of the revised basin fees were too high. As such, the developers hired the engineering consulting firm Ayres Associates to investigate the “Prudent Line” approach where applicable in lieu of structural channel improvements in an effort to reduce basin drainage infrastructure costs. The
Prudent Line concept allows for an erosion setback and grade control stabilization of natural channels in basins with low-density development. Using the findings of Ayres Associates, including the revised land costs for the Prudent Line approach, a Second Addendum was issued in July 1999, where basin fees were revised significantly downward in many of the basins and a basin fee cap of $15,000 per impervious acre was recommended. Various credits and reductions were also addressed and illustrated in examples in that addendum.

A Third Addendum was issued in September 1999 to clarify and resolve two objections made by developers following the issuance of the Second Addendum, and to resolve a few additional minor issues that arose as the Third Addendum was being finalized.

The information contained in the original September 1998 report and the three addendums have been used to prepare this revision to the basin fee program in the El Paso County Drainage Criteria Manual (DCM).

3.7a Calculation of the Basin Impervious Area

Impervious area in a basin is calculated for several different reasons. When a drainage basin planning study (DBPS) is completed the imperviousness is estimated to help determine peak runoff rates and runoff volumes under existing and future development conditions. The peak runoff rates and volumes are used to project floodplains and design conveyance and detention improvements. The costs of these improvements are, in turn, used to determine drainage basin fees for new development. Because the costs of improvements are dependent on the estimates of imperviousness in each basin, it is logical to base drainage basin fees on the amount of imperviousness in each development.

This new method is different that the previous method which used the same cost for each acre of development, regardless of the amount of impervious area planned for that acre. This method is still in use in the City of Colorado Springs.

The impervious area can be determined by direct measurements off the final development plan or by calculating the product of total area (both impervious and pervious area) and the percentage of area that is impervious. Table 3-1 shows some typical amounts of impervious area for different types of development. These values are generally consistent with Table 5-1 in the Colorado Springs/El Paso County Drainage Criteria Manual. Four additional single family residential values have been added to Table 3-1 that are not included in Table 5-1. Those values are for the 0.2-acre and the 6,000 square foot sizes for the smaller lots and the 2.5 and 5.0-acre sizes for the larger lots. The percent impervious values for these additions have either been directly computed or estimated from a regression of the existing values in Table 5-1 in the DCM.
### Table 3-1
Typical Values of Percent Impervious

<table>
<thead>
<tr>
<th>Type of Development</th>
<th>Percent Impervious</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>95%</td>
</tr>
<tr>
<td>Industrial</td>
<td>85%</td>
</tr>
<tr>
<td>Multi-Family</td>
<td>65%</td>
</tr>
<tr>
<td>Single Family - 0.1377 acre lots (6,000 SF)</td>
<td>53%</td>
</tr>
<tr>
<td>Single-Family – 0.20 acre lots</td>
<td>43%</td>
</tr>
<tr>
<td>Single-Family – 0.25 acre lots</td>
<td>40%</td>
</tr>
<tr>
<td>Single-Family – 0.33 acre lots</td>
<td>30%</td>
</tr>
<tr>
<td>Single-Family – 0.5 acre lots</td>
<td>25%</td>
</tr>
<tr>
<td>Single-Family – 1.0 acre lots</td>
<td>20%</td>
</tr>
<tr>
<td>Single-Family – 2.5 acre lots</td>
<td>11%</td>
</tr>
<tr>
<td>Single-Family – 5 acre lots</td>
<td>7%</td>
</tr>
</tbody>
</table>

The total impervious area may also be determined from direct measurement made by the developer. A developer may wish to do this if the average numbers presented in Table 3-1 do not apply to a specific development. If the developer chooses to do this, all impervious areas within the development should be included. These areas include streets, parking lots, residential, commercial, tax exempt, parks, golf courses, and any other land use within the development. When different land uses are included in a development a composite percent impervious should be used.

#### 3.8a Computation of the Basin Fee

The following example uses the typical impervious area numbers. In the computation of the basin fee, the developer or their representative shall obtain the appropriate basin fee from Exhibit 1 of the September 13, 1999 BOCC Resolution No. 99-383, or more current revision.

**Example 1:**
What is the fee for a 40-acre residential development in Dirty Woman Creek basin with 0.5-acre lots? The developer is not required to build any reimbursable stormwater facilities in this example and does not qualify for a low-density reduction or an on-site detention pond credit.

From Table 3-1, the percent impervious is 25%.

Calculate the impervious area for the site:

\[ 25\% \times 40 \text{ acres} = 10 \text{ acres} \]

Calculate the fee for the entire development:

\[ \$14,454 \text{ per impervious acre} \times 10 \text{ impervious acres} = \$144,540 \]

Alternatively, the developer in each case could determine impervious area from the property plat, as illustrated in Example 2 below.
Example 2:
What is the fee for a 40-acre residential development in Dirty Woman Creek basin with 0.5-acre lots? The developer is not required to build any reimbursable stormwater facilities in this example and does not qualify for a low-density reduction or an on-site detention pond credit.

The developer has prepared his site plan using AutoCAD, and has instructed his designer to draw all streets, driveways, sidewalks, patios, and building footprints (i.e., all impervious areas) for the entire platted area as closed polylines. The designer can quickly use AutoCAD to compute the total area of those polylines, and determines that those impervious features comprise 22.8% of the platted area.

Thus the measured impervious area for the site is:
22.8% x 40 acres = 9.12 acres

Calculate the fee for the entire development:
$14,454 per impervious acre x 9.12 impervious acres = $131,820

3.9a Routine Fee Updates

Drainage basin fees are subject to an annual revision based on the current construction cost index. It is important that fees are revised to reflect actual construction costs, otherwise the fees will be inadequate to construct needed improvements to protect residents.

The current drainage and bridge fee schedule in effect shall be attached to the September 13, 1999 BOCC Resolution No. 99-383, and updated annually.

3.10a Credits and Reimbursements

3.10.1a Reductions Versus Reimbursements

Reductions in fees will be made for certain low-density type developments and prudent line land where applicable. Partial reimbursement of construction costs will be made to developers for construction of on-site detention ponds that meet County criteria. Full reimbursement of construction costs will be made to developers for construction of regional facilities in general accordance with the DBPS or as approved by the County prior to construction. Reimbursements for pond construction will only be made if sufficient basin funds are available.
3.10.2a Fee Reductions for Low Density Lots

A reduction in the drainage basin fee is proposed if a development consists of 2.5 or 5.0 acre lots.

A land developer may qualify for a 25 percent reduction in drainage basin fees if he is developing an area into 2.5 acre and/or 5.0 acre lots. The reduction is proposed because a significant portion of the stormwater from these large lots does not flow directly into the County stormwater system, but flows into the yards as sheet flow and infiltrates into the ground. The impervious area on a rural property does not create as much runoff as the same impervious area located in an area with smaller lots and curb and gutter paved roadways. Runoff from these smaller, more urban lots, flows more directly into the County stormwater system. However, the roads serving the larger lot rural areas do create additional stormwater that flows directly into the County system along with some increased flow from the residential lots. Therefore, runoff from these areas shows an increased over the historic conditions. The proposed reductions are based on the 1986 version of the Natural Resources Conservation Services’ Technical Release Number 55, which includes a procedure that accounts for “disconnected impervious area”.

In a mixed-use development, only the 2.5 acre and/or 5.0 acre area will receive the reduction. Example 3 below illustrates that adjustment.

Example 3:
What is the fee for a 100-acre residential development with 60 acres of 2.5-acre lots and 40 acres of 0.5-acre lots? The development is in the Bennett Ranch basin.

Calculate the fee for the portion of the development with 2.5-acre lots:
Impervious area = 11% x 60 acres = 6.6 acres
The developer gets a 25% reduction for the 2.5-acre lots.
6.6 impervious acres x 75% x $7,613 per impervious acre = $37,684

Calculate the fee for the remaining 40 acres of 0.5-acre lots:
Impervious area = 25% x 40 acres = 10 acres
10 impervious acres x $7,613 per impervious acre = $76,130

Add the fees for the two areas to get the gross fee:
$37,684 + $76,130 = $113,814

3.10.3a Fee Reductions for Land Required to be Dedicated for the Prudent Line

Fee reductions are also available for the cost of land within dedicated Prudent Line easements (outside of the floodplain). Developers that dedicate Prudent Line easements according to a County accepted Prudent Line report can reduce their fees by the value of the easement. The amount of the reduction will be the same as the land cost that was used in the basin fee calculation, which is currently $5,000 per acre. This reduction rate shall be adjusted whenever the Parkland Dedication Fee is changed. If the reduction exceeds the gross fee, the fee shall be $0, and the remainder of the easement cost shall be applied as a credit, similar to those discussed below.
Example 4 below is the same as the previous Example 3, with the addition of Prudent Line considerations in the computation of the basin fee.

**Example 4:**
What is the fee for a 100-acre residential development with 60 acres of 2.5-acre lots and 40 acres of 0.5-acre lots? The development is in the Bennett Ranch basin, and 8 acres of the 2.5-acre lots are within the Prudent Line setback area. The developer is not required to construct grade control structures.

- Calculate the fee for the portion of the development with 2.5-acre lots:
  - Impervious area = 11% x 60 acres = 6.6 acres
  - The developer gets a 25% reduction for the 2.5-acre lots.
  - 6.6 impervious acres x 75% x $7,613 per impervious acre = $37,684

- Calculate the fee for the remaining 40 acres of 0.5-acre lots:
  - Impervious area = 25% x 40 acres = 10 acres
  - 10 impervious acres x $7,613 per impervious acre = $76,130

- Add the fees for the two areas to get the gross fee:
  - $37,684 + $76,130 = $113,814

- The fee is reduced by the cost of the land for the Prudent Line setback:
  - $113,814 – (8 acres x $5,000 per acre) = $73,814

**3.10.4a Reimbursement of Construction Costs for On-Site Ponds**

A land developer may qualify for a reimbursement of a portion of the construction costs if he builds on-site detention meeting specific criteria. Recognizing that on-site ponds provide some benefits to the regional system of a basin, 50% of the cost of a small on-site pond may be reimbursed to the developer if the following criteria are met:

1. Allowed only where regional system is not yet in place.
2. The pond is less than 15 acre-feet in volume from the lowest outlet structure to the crest of the emergency spillway.
3. The on-site pond is not part of the regional plan (for approved ponds that are part of the regional plan, developers are given 100% credit).
4. The outlet of the pond must be designed to release at historical levels for all precipitation events from the 2-year storm to the 100-year storm. A smaller outlet may be required by the County if adequate downstream channel improvements are not in place to protect residents from the 2-year storm flows.
5. County approves design and construction.

The purpose of this reduction is to allow developers to integrate detention into their developments when sites lend themselves to multiple uses such as parks, open space, athletic fields, golf courses or others. Another reason for implementing regional detention on-site is to provide adequate protection to downstream properties that may be threatened from increased flows from the development when regional improvements are not to be implemented within an acceptable time frame. The reason for the 2-year event criteria (or smaller if adequate channels are not in place for 2 year flows) is because of the significant number of smaller events that will
pass through a 5-year outlet. Those more frequent events are responsible for much of the erosion and other problems downstream of new developments and the County is left to repair erosion or deal with other problems.

If the above requirements are not met, the on-site detention will not qualify the land developer for a reimbursement of costs. If the developer chooses not to construct an on-site regional pond, he may still have to construct a conventional on-site pond to prevent downstream impacts from his development. It is important to note that reductions for meeting certain on-site detention criteria and for development that consists of 2.5 or 5.0 acre lots (discussed above) cannot both be applied to the same development.

Example 5 below illustrates the reduction in the basin fee for construction of a qualified on-site detention pond.

**Example 5:**
What is the fee for a 10-acre commercial site with a small on-site detention pond (2 acre-foot pond with estimated construction cost of $40,000), which meets the County criteria for a pond reimbursement? The fee will be reduced by 50% of the estimated cost of the pond construction, i.e., $20,000. The site is in the Big Johnson Reservoir/Crews Gulch basin.

Calculate the gross fee:
\[ 95\% \times 10 \text{ acres} \times \$15,000 \text{ per impervious acre} = \$142,500 \]

Calculate the fee after the reduction for the pond:
\[ \$142,500 - \$20,000 = \$122,500 \]

**3.10.5a Reimbursement of Land and Construction Costs of Other Regional Facilities**

The system of credits for the costs of construction of regional structures has not changed from the current system. The current system gives credits to developers for building projects that are listed in the DBPSs. A developer is reimbursed for these credits after the construction is complete and accepted by the County, and when there are sufficient basin funds. Alternatively, credits may be used to reduce the fees for subsequent developments in the same basin.

In addition to regional structures in the DBPSs, credits are given for the following structures:
- Total reimbursement of the construction costs of large on-site ponds that are accepted into the regional system by the County.
- Reimbursement of 50% of the cost of small on-site ponds (less than 15 acre-feet) that meet County criteria. This credit will not exceed the amount of the fee. If the construction cost is more than twice the gross fee, the credit will be equal to the fee.

**3.11a Appeals Process**

The procedures outlined for basin fee computation are generally straightforward. However, some developments may result in a more complex computation of the basin fee, and the result may be a disagreement between the developer and the County in the fee computed. The developer and County should attempt to resolve the disputed fee. In the event the attempted resolution is unsuccessful, the developer may elect to appeal the disputed fee amount to the
Subdivision Storm Drainage Board. The developer will need to prepare a written appeal detailing the disputed basin fee amount and provide calculations or other evidence supporting his fee calculation. That written appeal is due by 4:00 P.M. on the third Thursday of the month prior to the next month’s Drainage Board meeting. The Drainage Board will review the written appeal at their regularly scheduled meeting and render a final decision on the basin fee that will be due.

3.12a New/Revised Drainage Basin Planning Studies

Basin fees may be updated between annual routine fee updates if new or revised DBPSs are prepared for a basin and accepted by the County. These updated fees will be reflected in Exhibit 1 of the September 13, 1999 BOCC Resolution No. 99-383.

3.13a Vacations, Replats, Drainage Districts, and Irrigation Companies

The overriding guideline regarding vacation plats and replats will be whether an increase in impervious land cover would result. A vacation plat occurs when two or more contiguous lots are combined into one lot. A replat of a lot or parcel occurs when it is divided into two or more contiguous lots.

In all cases, a basin drainage fee will be assessed based upon the new impervious acreage if no such fee has been previously paid. If a basin drainage fee has been previously paid, and the vacation plat or replat results in the same or a decrease in the impervious acreage, no additional fee will be assessed, and no refund of previous fees will be given. If a basin drainage fee has been previously paid, and the vacation plat or replat results in an increase in the impervious acreage, a drainage basin fee shall be assessed on the additional impervious acreage at the current applicable fee.

If a developer or landowner enters into any agreement or special arrangement with a drainage district or irrigation company, that individual or company is not relieved of their obligation to pay the County basin and bridge fee. Any drainage improvement made by the land developer has to be identified as a proposed improvement in the Drainage Basin Planning Study (DBPS) for that specific basin in order to be considered for reimbursement of construction cost. If no DBPS exists for the basin or if the land developer proposes a substantial departure from the drainage improvement(s) shown in the existing DBPS, the developer must either fund the preparation a DBPS for the basin (if none exists) or revise the existing DBPS to the satisfaction of the County in order to receive consideration for reimbursement of costs of construction for drainage facilities.
Prudent Line Addendum
For Unincorporated El Paso County Only

City of Colorado Springs & El Paso County
Drainage Criteria Manual

COORDINATED WITH
EL PASO COUNTY STAFF
AND
DRAINAGE CRITERIA MANUAL REVISIONS TASK FORCE

TECHNICAL WORK BY AYRES ASSOCIATES AND SEC OLSSON ASSOCIATES
1. GENERAL STATEMENT

Urban development adjacent to natural stream channels poses complex problems for planning and regulatory agencies and developers. Due to the dynamic nature of most natural stream channels, it is imperative that appropriate steps be taken to protect adjacent structures and facilities from damage due to flooding and erosion. Lining channels with nonerosive or erosion-resistant material is a common protection method; however, the cost associated with this "hard lining," in terms of construction and maintenance costs, as well as degradation of the natural environment, may be unacceptable. Additionally, channels left in a natural or naturalistic condition can provide improved aesthetic value, better water quality conditions and opportunities for multi-use development, including bike trails, parks and greenways.

However, any natural channel, from a small swale to a major river, exists in a dynamic environment and can move both laterally and vertically with time. Therefore, when a channel is left in its natural condition it is necessary to limit how close development can occur next to the channel to minimize potential property damage as a result of future channel migration and flooding. This requires definition of a setback, or erosion risk boundary, within which development is not allowed. In some metropolitan areas, this setback or erosion risk boundary has been referred to as the "prudent line," since without major channel stabilization measures it would not be prudent for development to occur within this boundary.

The definition of a prudent line must recognize both the short-term impacts of flooding and erosion and the cumulative impacts of erosion over the long term. The physical processes involved with channel migration and the analysis of those processes are inherently complex. The procedure outlined in this addendum is a gross simplification of this process in an attempt to establish a procedure that is easily applied, yet provides reasonable definition of a "prudent line." The procedure was developed specifically for application to rural basins in El Paso County, Colorado, where the land use density is low and the application of the prudent line concept is justified given both engineering and economic considerations. Definition of a prudent line in other areas, particularly basins with higher density, should be based on a more comprehensive and detailed analysis than outlined in this addendum.

Engineers and designers applying the procedures outlined in this addendum should have training or experience in water resource engineering, including hydrology, hydraulic and sediment transport concepts. It is generally recognized that the calculation of a floodplain boundary requires a certain amount of specialized water resource engineering knowledge. This is equally true, if not more so, for the analysis and calculation of a prudent line boundary. Therefore, the application of this procedure should be completed under the responsible charge of an adequately qualified and licensed Professional Engineer.
2. **PRUDENT LINE APPLICABILITY**

Table 1 below presents criteria defining applicability of the prudent line approach. The prudent line approach is the recommended alternative for all rural El Paso County basins unless the basin conditions preclude its use. The county Engineering Division under the Public Services Department shall make the final determination of whether the prudent line is applicable within a rural basin. The user should follow the decision tree presented in Figure 1 to determine the applicability of the prudent line for development within the basin.

<table>
<thead>
<tr>
<th>Table 1. El Paso County Prudent Line Applicability Criteria.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DCM prudent line approach is applicable and recommended for:</strong></td>
</tr>
<tr>
<td>Open channel segments located downstream from land having less than or equal to a cumulative 15 percent impervious surface cover under future conditions and the main channel can adequately convey future conditions 10-year event flows.</td>
</tr>
<tr>
<td><strong>DCM prudent line approach may apply to:</strong></td>
</tr>
<tr>
<td>Open channel segments located downstream from land having between a cumulative 15 and 20 percent impervious surface cover under future conditions and the main channel can adequately convey future conditions 10-year flows. These reaches require justification for recommending the prudent line approach.</td>
</tr>
<tr>
<td><strong>DCM prudent line approach is not recommended for:</strong></td>
</tr>
<tr>
<td>Open channel segments located downstream from land having greater than a cumulative 20 percent impervious surface cover under future conditions or main channel lacks adequate conveyance capacity for the future conditions 10-year flows. However, the prudent line may still be considered if a detailed analysis of the prudent line is conducted using more advanced analytical techniques. The detailed approach must be completed by a firm experienced in conducting an advanced prudent line analysis.</td>
</tr>
</tbody>
</table>

In addition, channels with in-line detention ponds and channels with transitions to/from improved channels and bridges may not be appropriate for prudent line treatment (see “Transitions” below).
Development proposal

Does basin have a DBPS?

Yes

Use DBPS for drainage design requirements

No

Meet with County to discuss applicability of Prudent Line in the basin

Is the development density greater than 1 unit/acre?

Yes

Development not applicable for prudent Line

No

Channel Capacity ≥ 10yr.?

Yes

Determine ultimate Land Use in basin

No

What is basin Imperviousness?

<15%

Meet with County to discuss methodology for use of Prudent Line in the basin transition issues

>15%

Determine Prudent Line with simplified approach in Criteria Addendum include transition issues

Figure 1. Decision tree to determine applicability of prudent line.
There may be other factors that would prevent the use of the prudent line. These generally relate to the ability of the stream to transport sediment during minor to major storm events. For example, stream improvements upstream of the proposed prudent line reach, an excessive number of stream crossings (more than one about every mile should cause concern), improperly designed transitions at road crossings, or on-line detention ponds either upstream of or within the prudent line reach are all factors that should be evaluated, and the impacts of assessed, when prudent line is considered for a given reach in a rural El Paso County basin.

2.1 Transition Issues

Transition issues on the prudent line reaches require special consideration because of the differential velocities that often arise, thus causing sediment deposition and/or excessive erosion. Transitions usually involve one of the following two cases:

Case1: the transition between an improved channel reach and a prudent line reach, or vice versa, and
Case 2: the transition that is necessary at road crossings on a prudent line reach.

For Case 1 where a proposed prudent line reach is downstream of an improved reach, and the prudent line natural channel is wider than the improved channel, the improved channel should be graded to transition to the prudent line reach using a 4:1 (longitudinal distance to lateral distance) flare ratio. The transition should be designed to ensure that velocities have been adequately reduced to a non-erosive level (generally 5 to 6 feet per second maximum) in the prudent line reach. For the reverse situation where a prudent line reach transitions to an improved channel section, a convergence ratio of 2:1 should be used. The transition hydraulics should be carefully evaluated to prevent the converging flow from getting sufficiently deep to result in overtopping of the protective lining (e.g., riprap) of the improved channel section, thus resulting in erosion behind the lining. In addition, Froude numbers should remain less than 0.8 to prevent any unstable flow characteristics or depths near critical depths to occur. Because of the additional turbulence caused by expanding or converging transitions, riprap may be required to provide additional erosion protection or to provide additional channel roughness for reducing velocities.

For Case 2, the optimum situation at road crossings would be to provide a crossing sufficiently wide so that upstream velocities do not decrease to a level where sediment will drop out (i.e., the crossing would essentially span the entire floodplain). Obviously that is not always practical, but wider crossings over prudent line reaches will nonetheless be required. One of the key benefits of the prudent line approach on rural basins is that the additional costs associated with oversized crossings and prudent line setback land acquisition will be more than offset by the cost savings in constructing channel stabilization measures rather than full scale improved channel. As such, the
following guidelines should be followed when designing roadway crossings on prudent line reaches:

1. the culvert should be sized to convey the 10-year future condition discharge with no more than a 20% change to the channel depths and velocities that would occur at a location immediately upstream and downstream of the crossing, assuming the crossing did not exist.
2. riprap should be designed to protect the channel upstream and downstream of the crossing for the larger recurrence interval events such as the 50- and 100-year, as those floods would result in higher velocities.

Again, it is important to stress the point that an excessive number of road crossings (more than about one per mile) would jeopardize the applicability of the prudent line, even if other criteria are met.

### 2.2 Defining the Prudent Line

The concepts of hydrologic uncertainty and risk are useful in establishing the location of the prudent line within which development should not occur due to erosion and flooding considerations. It is seldom practical to provide absolute protection against the maximum probable flood. It is, therefore, necessary to accept some degree of risk. The problem, then, is one of relating the prudent line to an acceptable degree of risk. In the hydrologic sense, risk is normally associated with the return period (or recurrence interval) of an event that may result in erosion or flooding within a given channel or watercourse.

The National Flood Insurance Program (NFIP) establishes the 100-year flood as the minimum level of risk that is acceptable when considering potential impacts due to flooding. Therefore, to evaluate the short-term impacts of flooding, as well as erosion, the 100-year flood is a reasonable criteria to include as part of the prudent line methodology.

While damages due to flooding are generally associated with a single, short-term event, the impacts of erosion can also be cumulative over the long term. Consequently, one must assess the erosion potential not only of a single event, such as a 100-year flood, but also the cumulative impact of a series of smaller flows over a multi-year period. The problem is then defining how many years constitute "long-term."

The use of the 100-year event as the level of acceptable risk provides insight for a reasonable definition of long-term conditions. Based on hydrologic risk concepts, there is approximately a 74 percent chance that the 100-year event will not occur in a 30-year period. Conversely, this implies a risk of about 26 percent that the event will occur within a 30-year period. Considering the risk of a single large flood (e.g., the 100-year event) in a 30-year period, as well as the inherent limitations related to long-term prediction of channel migration, an acceptable definition of long-term for analysis of cumulative erosion is 30 years.

The criteria for defining the prudent line is then defined as the enveloping curve considering the 100-year floodplain boundary, the erosion during a 100-year event, or the long term erosion over a 30-year period.
2.3 The Maintenance Line

The prudent line concept allows the stream to function naturally within the constraints of protecting existing infrastructure. Future development is provided for by maintaining a safe distance horizontally and vertically from the creek. However, due to the dynamic nature of stream channels, and the limitations of any analysis that attempts to predict future channel conditions, it is possible that the prudent line may be encroached on in the future. If this happens limited structural improvements may be necessary, and while the channel may no longer be completely "natural," it is still "naturalistic," with selective erosion barriers, or countermeasures, applied.

To plan for this potential occurrence, any prudent line application should incorporate a "maintenance line," located somewhere inside the prudent line. Should the channel begin to encroach on the maintenance line, some remedial measures should be considered so that the prudent line is not jeopardized. These remedial measures could include rock riprap, regrading and revegetating, spur dikes, or other available channel stability countermeasures.

Therefore, while maintenance issues and the need for structural improvements are greatly reduced with a prudent line approach, they may not necessarily be eliminated. The concept of a prudent line requires, by its very nature, less maintenance; however, it is important to recognize the potential need for future erosion protection. Finally, while the basic concept of a prudent line is to establish a buffer zone that permits the channel to exist in its natural state, it is acknowledged that existing encroachments and utilities may require protection. Channel stabilization measures may be necessary to protect existing infrastructure along a channel that has a designated prudent line. However, these channel stabilization measures must be carefully designed to avoid adversely impacting the prudent line in an adjacent reach.

It is also important to note that the County will be responsible for performing channel rehabilitation measures on the prudent line channel resulting from significant hydrologic events or from long-term erosion. However, the property owner will be responsible for providing protection to his or her structures.

2.4 Maintenance Access

Providing maintenance access to the prudent line channel is very important. Generally, the prudent line channel will intersect the County road grid located along section lines at approximately one-mile intervals. Access to the channel by machinery and personnel can be provided at those locations. There may be channel maintenance operations that need to be performed in between the County road locations, and for that reason, it is required that maintenance access be provided for both sides of the channel in accordance with Table 2 below.
Table 2. Prudent Line Maintenance Criteria.

<table>
<thead>
<tr>
<th>Type of Development</th>
<th>Maintenance Access Requirements</th>
<th>Other Conditions</th>
</tr>
</thead>
</table>
| Lot sizes ≤ 2.5 acres along channel | Provide access to channel at a maximum one-quarter mile interval along lots with a minimum 15-foot-wide easement dedicated to El Paso County | • Property plats to show exact easement locations.  
• Routine maintenance (mowing, weed treatment, trash pickup) to be responsibility of landowner.  
• County to be responsible for restoration due to County-sponsored construction activity. |
| Lot sizes > 2.5 acres along channel | Provide access to channel through each lot via a minimum 15-foot-wide easement dedicated to El Paso County | • Each platted lot to contain a note that a 15-foot-wide easement has been provided to El Paso County.  
• The lot owner has discretion over the location of the access easement as long as it is passable by typical construction equipment.  
• Routine maintenance (mowing, weed treatment, trash pickup) to be responsibility of landowner.  
• County to be responsible for restoration due to County-sponsored construction activity. |
3. CALCULATING THE PRUDENT LINE

3.1 Methodology

Two separate prudent line procedures were developed based on the two dominate channel types found in El Paso County (Ayres Associates, "Prudent Line for Rural Areas, El Paso County," Draft Report, June 2000). One procedure is for channels in sandy soils and another for those incised into more erosion-resistant material. The procedure for sandy soils is a simplified approach to the procedures that have been successfully used in the Albuquerque, New Mexico area, and the erosion-resistant procedures are based on the approach used in Cottonwood Creek, Colorado.

Both procedures are simplified methodologies that should be carefully applied using reasonable engineering judgement. The procedures were developed to address channels experiencing, or potentially experiencing, erosion-related stability issues. Depositional reaches can also experience channel instability; however, the prudent-line concept may not be the best solution in these situations (Section 3.7). These methods should not be applied to channels with Q100 greater than 10,000 cfs, or to channels with unusual or unique sediment transport conditions, including alluvial fans or channels below reservoirs or detention ponds.

3.2 Prudent Line for Sandy Soils

The prudent line for sandy soils is based on a simplified sediment continuity analysis to define a potential sediment deficit. The bed material sediment transport capacity for a range of floods can be calculated based on a triangular hydrograph approximation of return period flood hydrographs (100-, 50-, 25-, 10-, 5-, and 2-year), given a sediment transport relationship in the form of $Q_s=aQ^b$. The sediment transport relationship was developed assuming sediment concentrations by weight ranging from 1,000 to 15,000 ppm.

Step 1. Calculate the sediment transport capacity for different return period events.

Apply Equation 3.1 to calculate the total bed-material sediment volume in transport (sediment transport capacity) for the 100-, 50-, 25-, 10-, 5-, and 2-year flood hydrographs:

$$VOL_i = 6Q_p d$$

(3.1)

where:

- $VOL_i$ = bed-material sediment volume (cf) for the $i$ - return period flood
- $Q_p$ = peak discharge (cfs) for the $i$ - return period flood
- $d$ = hydrograph duration, (hr), as approximated by triangular hydrograph

The El Paso County Drainage Criteria Manual requires hydrology to be generated for the 100- and 5-year events. In that case, it is acceptable to plot those peak discharges on log-probability paper to estimate the intermediate return period peak flows used in Equation 3.1.

Step 2. Calculate the potential sediment deficit in any given reach of the study area.

Erosion occurs when the sediment transport capacity of any given reach exceeds the quantity of sediment supplied to that reach. In the absence of better information, assume a sediment deficit equal to 25 percent of the transport capacity is possible at any location throughout the study reach.
due to changes in slope, roughness, channel geometry, etc. Therefore, the potential sediment deficit for the i-return period flood in any given reach is:

\[ Y_i = 0.25 \times VOL_i \]  \hspace{1cm} (3.2)

This assumption is reasonable for a channel reach that is relatively similar to the next upstream reach. If significant sediment storage is occurring upstream, such as at a detention pond or constricted roadway crossing, the deficit could be substantially greater and a more complex analysis of the prudent line will be necessary.

**Step 3. Calculate the average annual sediment deficit**

After calculating the potential deficit for each return period event, the average annual deficit is calculated using a probability weighting approach:

\[ Y_m = 0.015Y_{100} + 0.015Y_{50} + 0.04Y_{25} + 0.08Y_{10} + 0.2Y_5 + 0.4Y_2 \]  \hspace{1cm} (3.3)

where \( Y_i \) represents the calculated deficit (cf) for the i - return period flood.

**Step 4. Convert the calculated sediment deficit to a long-term lateral migration distance**

To estimate potential long-term lateral migration, the resulting average annual deficit volume must be converted into a horizontal distance. For purposes of this analysis, it is assumed that all the sediment will be eroded from the channel bank, thus representing lateral migration. No sediment is assumed to come from the channel bed. Since the computed sediment deficit represents sediment in transport, a bulking factor must be applied to calculate the sediment volume that could be eroded from the channel boundary. Given a sand porosity of 0.4, the bulking factor would be 1.67 (i.e., 1/(1 - 0.4)).

It is reasonable to assume that this long term lateral migration will occur primarily as a relatively uniform bankline retreat somewhere along the study reach. Assuming that this will occur along a 500 ft reach, the annual lateral retreat can be calculated given cross section data in the reach. This can be based on a typical cross section describing the channel and overbank geometry.

Using a 30-year period as the duration for long term erosion, the average annual migration value times 30 defines the cumulative long term erosion potential. Since the exact location of this retreat is not known, this offset should be applied to both sides of the channel along the given reach.

In summary, the calculations required in step 4 are to:

1. Multiply the calculated average annual deficit (Equation 3.3) by 1.67 (the bulking factor).

2. Estimate the potential lateral migration over a 500 ft reach based on a typical channel cross section (see Figure 2 for some typical examples).

3. Multiply the calculated lateral migration by 30 and apply the computed offset to both sides of the channel, measured from the top-of-bank for the low flow channel. If a low flow channel is not apparent, measure from the location of the 10-year water surface.

Depending on reach length, channel geometry variability and changes in runoff along the reach as drainage area increases, this calculation can be based on a single reach, or multiple subreaches.
In the case of multiple reaches, the computed distance should be applied from one calculation point upstream to the next, not in the downstream direction.

![Diagram](image)

**Figure 2.** Examples of setback calculation for long-term erosion.

**Step 5. Calculate the short-term lateral migration distance**

The short-term erosion potential must also be considered. This is based on the potential lateral migration during a single 100-year flood, based on the sediment deficit calculated above for the 100-year flood. However, instead of distributing this erosion in a linear fashion, as suggested for the cumulative long-term analysis, it is more reasonable to assume that such erosion in a single large event might occur as a scalloping of the bankline. Assuming a right triangle geometry with the length of one leg along the channel bankline equal to 150 ft, the length of the opposite leg (representing the scallop distance into the bankline) can be calculated given typical channel and overbank geometry. The location of this scallop is also unknown, and so the resulting offset distance should be applied to both sides of the channel along the given reach.

In summary, the calculations required in step 5 are to:

1. Multiply the calculated 100-year flood erosion deficit by 1.67.

2. Estimate the potential lateral migration assuming a right triangle with a 150 ft leg eroding into a bank described by the typical channel cross section (see **Figure 3** for some typical examples).

3. Apply the computed offset to both sides of the channel, measured from the top-of-bank for the low flow channel. If a low flow channel is not apparent, measure from the location of the 10-year water surface.
Depending on channel geometry variability, this calculation can also be based on a single reach, or multiple subreaches. In the case of multiple reaches, the computed distance should be applied from one calculation point upstream to the next, not in the downstream direction.

Figure 3. Example of setback calculation for short-term erosion.

**Step 6. Minimum prudent line**

The minimum prudent line offset recommended is 50 ft from the top-of-bank for the low flow channel. If a low flow channel is not apparent, measure from the location of the 10-year water surface.

**Step 7. Tabulate and/or plot the prudent line**

The prudent line for sand channels is based on an enveloping curve considering the greater of (1) the 100-year floodplain, (2) the calculated setback based long term (30 year) erosion, (3) the calculated setback based short term (100-year flood) erosion, or (4) the setback based on the low flow channel top-of-bank (or the 10-year water surface when a low flow channel is not apparent) plus 50 feet.

### 3.3 Prudent Line Methodology for Erosion-Resistant Material

**Figure 4** presents the schematic and formula to use in defining the prudent line setback location for channels in erosion resistant material. The top of bank can be defined by reviewing topographic mapping. The bank line is represented by very closely spaced contours along the
valley margins. This steep slope is different from the valley wall slope, in that the valley wall slope contours are not as closely spaced. The valley wall crest is represented by a significant change in the closeness in contour spacing.

**Step 1. Calculate the maximum bank height**

The bank height (BH) is defined as the height from the toe to the top of the bank as determined above. This height along with an expected maximum incision depth (ID) are added together to define the maximum bank height. The incision depth can be calculated using sediment transport procedures; however, this is a complicated analysis. Furthermore, future changes in watershed conditions complicate the prediction of long term conditions. For purposes of this methodology, the incision depth should be assumed to be 5 ft.

**Step 2. Calculate the potential bank widening**

The amount of bank widening is then defined by a 2H:1V bank slope given the overall bank height.

**Step 3. Account for potential lateral migration**

To account for future lateral migration a minimum of one valley floor width should then be added to the potential bank widening. The total setback will then be equal to \(2 \times (BH + ID) + 1VW\) measured from the toe of slope for each side.

![Erosion setback definition sketch.](image)

**Step 4. Minimum setback distance**

The minimum setback distance should extend out past the valley wall crest (VC) by at least 50 ft.

**Step 5. Tabulate and/or plot the prudent line**
The prudent line for erosion resistant materials is based on an enveloping curve considering the greater of (1) the 100-year floodplain, (2) the calculated setback based on bank slope and height considerations, or (3) the minimum allowable setback based on valley wall crest plus 50 ft.

3.4 Vertical Considerations

Even though the prudent line was developed considering primarily lateral migration, it is important to note that the prudent line also has a vertical component creating a prudent line window. Figure 5 represents a schematic of a typical stream cross section with the vertical extent of the prudent line shown. The potential lateral migration of the channel, as calculation above, defines the prudent line right-of-way. Using a minimum 2:1 sideslope and 5 ft minimum incision depth, a window of potential erosion can be defined that might occur in the channel cross section.

Infrastructure (i.e., bridges, sanitary sewers, water lines, utilities) that lie outside the window are assumed to be generally consistent with the prudent line. New infrastructure should not be proposed within this window. Existing infrastructure that lies within this window may need to be relocated or protected. Storm sewer outlets may be located within the prudent line window, but may need periodic maintenance (either lengthening or shortening pipe) as the channel migrates.

![Figure 5. Schematic of typical stream cross section depicting prudent line window.](image-url)
3.5 Maintenance Line

To insure long term performance of the prudent line, a maintenance line should be established inside the prudent line. The recommended maintenance line is equal to one-half the prudent line. This will provide adequate time to analyze, design and construct potential countermeasures to protect the prudent line if channel migration is greater than expected.

3.6 Sketching the Prudent Line

Given the offset distances calculated above, the prudent line can be drawn along the channel. It is important to recognize that the final location of the prudent line will require engineering judgement and a general understanding of the dynamic nature of alluvial channels. For example, channel bend geometry can change rapidly, including downstream migration of the bendway and/or a cutoff of the bend. Therefore, special consideration should be given to sketching the prudent line along reaches that are highly sinuous with sharp bends. It may be appropriate to draw the prudent line as a tangent line from the outside of one bend to the outside of the next, rather than paralleling the top of bank and forcing the prudent line to follow the bend sinuosity based on the offset distance.

If subreaches are used to define different offsets along a channel, abrupt changes from one reach to the next should be avoided. A gradual transition should always be provided, allowing the channel adequate room to adjust within the defined boundary. Areas around tributary confluences should also be carefully reviewed, to account for channel dynamics in these areas.

In contrast, if areas of competent, non-erodible material are exposed along the channel bank, it may be acceptable to reduce the size of the prudent line area. Similarly, if reaches of riprap or other bank protection exist that are in good condition, well maintained, and designed to survive a large flood, the prudent line may also be adjusted.

If legal descriptions of the prudent line are required, the final prudent line location should be defined as a series of offset tangent lines with distance and bearing descriptions.

3.7 Sediment Deposition Issues

The prudent line as outlined above is based on a channel reach that is experiencing a deficit of sediment, resulting in erosion and channel migration that could endanger adjacent property. However, a reach experiencing sediment deposition will also experience change over time resulting in unexpected channel migration, flooding and potential damage. Examples of areas where sediment deposition could be an issue include reaches upstream of a constricted road crossing, at a sudden reduction in channel slope, downstream of extensively degrading or incising reaches, or on an alluvial fan or other topographic feature that has promoted sediment deposition over time.

If sediment deposition is significant and begins to fill existing channel conveyances, it is possible that a new, radically different channel alignment may develop. The analysis of historic aerial photography may adequately define the various paths that a channel has taken over time, allowing definition of a prudent line. However, such a boundary would likely be quite large, and requires specialized knowledge to accurately define. Furthermore, based on the typically large offsets required to define a prudent line in a deposition area, the prudent line concept is typically not a cost effective or desirable approach in these basins. Maintenance activities to keep a channel defined and functional may be the preferred approach in a sediment depositional area, rather than a prudent line application.