SUTTER COUNTY
IMPROVEMENT STANDARDS

2025

Adopted by Sutter County Board of Supervisors February 25, 2025

SUTTER COUNTY
IMPROVEMENT STANDARDS
TABLE OF CONTENTS

SECTION 15 WATER SUPPLY SYSTEM

FIGURES

TABLES

SECTION 1

PURPOSE AND DEFINITIONS

1-1. PURPOSE

The purpose of the Improvement Standards (manual) is to serve as a guide through the Development permitting process and establish minimums to be used in the design and drawing of plans for public and private works. Design standards may be augmented by Sutter County Board of Supervisors action, such as a Specific Plan, and/or by written approval of the Director. This manual is designed to explain the permitting process required to obtain Engineering approval, and ultimate acceptance of projects, for each of the following phases: Planning, Improvement Plans, and Mapping.

This Manual provides standards to be applied to public improvements and private works that will be dedicated to the public and accepted by the County for maintenance and/or operation, as well as improvements to be installed within existing rights-of-way and easements. This is necessary to provide for coordinated development of required facilities to be used by, and for the protection of, the public.

This Manual shall serve to regulate and guide the design and preparation of plans for: construction of streets, highways, alleys, drainage, sanitary sewer, street lighting, water supply facilities and related public improvements, and set guidelines for all private works which involve drainage, grading, erosion control, trees and related improvements.

1-2. RELATIONSHIP TO OTHER COUNTY-ADOPTED PLANS AND POLICIES

This Manual provides procedures and design standards that generally apply to projects and improvements Countywide in conformance with the Sutter County Ordinance Code (SCOC). Should any conflicts or inconsistencies occur between this manual and the SCOC, the SCOC shall govern. In some cases, such as in areas covered by a specific plan, certain elements of design may be governed by other County-adopted Plans and Policies. Applicants and Consulting Engineers shall refer to the appropriate policy document(s) when preparing engineered plans for review by the County. A list of existing plans and policies is included but not limited to the following:

- Specific & Community Plans – Sutter Pointe Specific Plan
- Special Planning Areas – as kept on file with Development Services Department
- Sutter County Design Guidelines
- Bicycle, Pedestrian, and Trails Master Plan
- County Storm Drainage Master Plans
- Project-specific Master Infrastructure Plans
- Traffic Procedures Manual

1-3. OTHER AGENCY COORDINATION

While this Manual covers certain aspects, such as layout and location of all facilities within the public right-of-way, reference shall be made to the appropriate agency's standards when their facilities are involved and/or the plans include work within an agency's jurisdiction.

Specifically, the design of sanitary sewer facilities and water supply systems shall conform to the requirements set forth in the various local sewer and water agency's standard specifications, improvement standards and standard drawings "latest edition", which have jurisdiction within the County.

Other agencies typically involved in reviewing improvements within the County's jurisdiction include, but are not limited to:

- Sutter County Fire Department
- Gilsizer County Drainage District
- Sutter County Water Agency
- Sacramento Area Sewer District
- Golden State Water Company
- Reclamation District 1000
- Sutter Community Services District (Water)

1-4. OMISSIONS

Any items or situations not included in this Manual shall be designed in accordance with accepted engineering practice, the Sutter County Ordinance Code, and the 6th Edition of the State of California "Highway Design Manual", State Standard Plans and Specifications", "CAMUTCD", and as required by the Director herein defined.

1-5. DEFINITIONS

When the following terms or titles are used in these standards or in any document or instrument where these standards govern, the intent and meaning shall be as herein defined:

A. Applicant – Shall mean a person, resident, landowner, developer, firm, agency, corporation, partnership, association or their representative, engaged in the land subdivision or development process

B. CAMUTCD – Shall mean California Manual on Uniform Traffic Control Devices

C. County – Shall mean the County of Sutter, a political subdivision of the State of California. In some instances throughout the Manual, "County" may mean the Public Works Director, Development Services Director and/or their designee(s).

D. County Code – Shall mean the Sutter County Ordinance Code.

E. Board of Supervisors – Shall mean Sutter County Board of Supervisors.

F. County Engineer – Shall mean the designated Engineer representing Sutter County.

G. Engineer of Record – Shall mean any person or persons, firm, partnerships or corporation legally authorized to practice civil, mechanical or electrical engineering in the State of California who prepares or submits improvement plans and specifications to Public Works or Development Services.

H. Development Services - Shall mean the Development Services Department of Sutter County

I. Engineering Division – The Engineering Division within the County that is responsible for the review of Public Improvements related to private land development activities.

J. Director - Shall mean the Director of Development Services or his/her designee.

K. Development – Shall mean the act, process, or result of any land grading, utility installation, street or building construction on property.

L. Improvement Standards – Shall mean all design standards, criteria, and requirements as outlined in this Manual, including all revisions and updates thereto.

M. Improvement Plan - An engineered plan, prepared by a licensed civil engineer in the State of California, showing the design of, sanitary sewers, storm drain, water systems, grading and earthwork, roadways, and all other appurtenant structures, facilities and construction, including engineering calculations, comprising improvements required for a development project or work within the public right-of-way.

N. Laboratory – Shall mean any testing agency or testing firm which has been approved by the Sutter County Development Services Department.

O. Manual – Shall mean this Manual, including all revisions and updates thereto.

P. Public Works – Shall mean the Public Works Division of Sutter County Development Services Department.

Q. Specifications – Shall mean the latest edition of the Caltrans Standard Specifications and Highway Design and Traffic Manuals and the County of Sutter Improvement Standards and Standard Drawings.

R. Standard Drawings – Shall mean the Standard Drawings adopted by the County.

SECTION 2

GENERAL PROCEDURES AND REQUIREMENTS

2-1. ENGINEER REQUIRED

All plans and specifications for improvements which are to be accepted for maintenance by the County and private on-site drainage and grading shall be prepared by a Engineer of Record of the appropriate branch of engineering covering the work submitted.

2-2. PLANS REQUIRED

Complete plans for all proposed streets, bikeways, grading, erosion control, drainage facilities, sanitary sewer, street lighting, traffic signals, water distribution systems, including any necessary dedications and easements, shall be submitted to the County for review and approval. Copies of rights-of-entry obtained from adjacent properties, if required, shall be provided to the County prior to approval of plans.

2-3. WORK IN COUNTY RIGHTS-OF-WAY, EASEMENTS AND WATERWAYS

The following shall govern work performed within County rights-of-way, easements, and waterways:

A. Possession of a complete set of County-approved improvement plans shall allow a contractor, duly licensed by the State of California, to perform work specified on the plans in County right-of-ways, easements and waterways. The contractor shall be bonded as required and as specified in the County Code.

B. Possession of a valid encroachment permit issued in accordance with County Code and the County encroachment permit policy, as adopted by the County Board of Supervisors will allow a contractor, duly licensed by the State of California, to perform work specified in the permit in County rights-of-way.

2-4. PRELIMINARY PLAN SUBMITTAL REQUIREMENTS (ENTITLEMENTS)

Projects requiring planning and/or zoning-related permits may require submission of preliminary engineered plans, drawings, or studies in accordance with the current version of the County's Planning Submittal Requirements. Please refer to the County's website (www.suttercounty.org) for the current version of the Planning Submittal Requirements.

Specific requirements vary based on planning permit or entitlement type and may include, but not be limited to, the following:

- Site Plan
- Tentative Map
- Preliminary Grading Plan
- Stormwater Quality Conceptual Plan
- Preliminary Drainage Study
- Traffic Impact Analysis

Plans and studies required as part of a development application shall conform to these Improvement Standards and as required by the County.

2-5. IMPROVEMENT PLAN SUBMITTAL REQUIREMENTS

Development Services shall act as the lead department in the submittal process for improvement plans. The submittal package shall be submitted as a whole directly to Development Services, per the requirements of the appropriate Submittal Requirements Form. Please refer to the Sutter County web site (www.suttercounty.org) for current Submittal Requirements and Forms. These apply to all types of submittals including civil improvement plans, landscape plans, and grading plans for private and public improvements. Copies of the current Application Forms are also available directly from Development Services.

Once the submittal has been deemed complete by the County, the packets will be distributed by Development Services to the appropriate Departments/Divisions.

Discretionary projects which have obtained approval of their entitlement(s) by the appropriate approval body may submit improvement plans for review. At the discretion of the County, projects pending approval of their entitlements may submit plans "at-risk" for concurrent review. Unless otherwise approved by the County, "at-risk" plans may only be submitted after Conditions of Approval have been made available by the Planning Division of Development Services and an "at-risk" letter has been provided by the Applicant to the satisfaction of the County.

Should there be required alterations or revisions to the plans as submitted, Development Services will return one copy with the corrections marked or indicated thereon. If the plans submitted are not prepared in accordance with these Improvement Standards or are not in keeping with the standards of the profession, Development Services may return them unmarked and unapproved. Separate submittal of plans to other agencies may be required for approval.

2-6. MAPPING SUBMITTAL REQUIREMENTS

Submittal of all mapping applications shall be made to the County in accordance with the respective Submittal Requirements Form. Please refer to the Sutter County web site (www.suttercounty.org) for current Submittal Requirements Forms. This includes, but is not limited to, the following types of applications:

- Final Maps / Parcel Maps
- Easements
- Right-of-way Vacation / Abandonment
- Lot Mergers
- Certificate of Compliance and Correction
- Lot Line Adjustments
- Record of Survey Map

2-7. RESUBMITTAL REQUIREMENTS

Development Services will indicate the number of plan sets to be resubmitted. The Applicant shall notify Development Services if plans being resubmitted contain revisions or alterations other than those required on previously corrected plans. Revision notations shall not be shown on the plans until after the County has formally approved the plans. Landscape plans, if applicable, are required with or before the second submittal.

2-8. PLAN REVIEW AND INSPECTION FEE

When a submittal package is submitted to the County for review, an initial plan review and inspection fee/deposit is required to initiate County plan review. Fees shall be based on the type of application in accordance with the County's current established fee schedule. For the most current fee schedule, please visit the Sutter County website at: www.suttercounty.org.

For deposit-based projects, the Applicant shall be responsible for payment of actual costs incurred by the County in providing plan check and inspection services. All deposits will be held against actual time and materials billing for the project. Should the development not be carried to completion, any portion of the required deposit over and above the accumulated costs expended by the County on the development will be refunded to the Applicant. If at any point the deposit falls below the thresholds established by the County, all work will be stopped until an additional deposit is made in accordance with this policy.

Failure of an Applicant to complete a project does not relieve the Applicant of paying all costs incurred by the County. Applicant is obligated to pay for all outstanding charges.

The County shall be notified of any change of billing address. The Engineer of Record shall notify the County immediately upon change of owner and/or Applicant.

2-9. PLAN APPROVAL

No plans will be approved nor construction authorized until the County signifies approval by signing the cover sheet of the full set of plans and all other pre-construction requirements have been satisfied, including but not limited to holding a pre-construction conference, payment of any outstanding fees, and providing required advanced notice to County inspection staff. Revisions, corrections or additions shall be resubmitted to the Development Services for approval. At such time as the Engineer of Record preparing the plans has made the necessary revisions and signed and stamped the original plans, and fees have been paid, as provided under the provisions of the County Code and amendments thereto, a designated representative of the County will sign the plans in the space provided. The plan approval is valid for a period of twelve (12) months. Should construction not commence within the 12-month period, the plans shall be resubmitted for re-approval. The County shall order any Contractor to cease work on any project if said Contractor does not have properly approved plans in his possession.

2-10. APPROVED PLANS REQUIRED

The Engineer of Record shall deliver the requested number of sets of prints from the approved original plans to the County, which is typically six (6) full size sets and four (4) half size sets as well as one electronic file in PDF format. Additional copies of

improvement plans may be required by the Director in certain circumstances, and these shall be furnished to the County without cost.

Copies of the final utility letters required by this Section shall be included with the approved plans delivered to the County.

2-11. IMPROVEMENT PLAN REVISIONS DURING CONSTRUCTION

Should changes become necessary during construction, the Engineer of Record shall first obtain the consent of the County and shall then resubmit the title sheet and the plan sheets affected for approval. The changes on the plans shall be made in the following manner:

A. The original proposal shall not be eradicated from the plans but shall be lined out.

B. For changes affecting 25% or more of detail on sheet (plan or profile), the original proposal shall be omitted.

C. In the event that eradicating the original proposal is necessary to maintain clarity of the plans, approval must first be obtained from the County.

D. The changes shall be clearly shown on the plans with the changes and approval noted on the revision signature block.

E. After three (3) or more revisions have been approved, the County may require complete reproduction of the plan set.

F. The changes shall be identified by the revision number in a triangle delineated on the plans adjacent to the change and on the revision signature block.

Minor changes that do not affect the basic design or contract may be made, with the authorization of the County, upon completion of the work before final acceptance of the completed improvements.

Certification by the Engineer of Record of the finished pad elevations of subdivision lots shall be required prior to final acceptance of the subdivision improvements. Certification shall be in accordance with Section 10-8 of this Manual.

2-12. RECORD DRAWINGS

The Applicant shall maintain an accurate record of all approved deviations from the plans before and during construction. Upon completion of work, one set of red-lined plans reflecting all such deviations shall be submitted to the County for review. Following the County's review and approval, the redlined sets shall be converted to Record Drawings. The cover sheet shall include the following statement signed by the engineer in responsible charge: "These record drawings reflect the original County approved design and County approved revisions thereto, along with all field modifications reported by the contractor". Each sheet shall be marked "RECORD DRAWING" and shall contain the Engineer of Record's original registration stamp and signature.

The following shall be submitted to the County in consideration of improvement acceptance:

A. Grid coordinate data for plans, maps, data, and exhibits shall be submitted in California State Plane, Zone II, North American Horizontal Datum of 1983 (NAD 83), and North America Vertical Datum 1988 (NAVD 88) grid projection in US survey feet. CAD files shall incorporate these grid data.

B. Electronic plan submittal acceptable to the County containing the following:

C. Record Drawings of all improvements in a PDF File. The format shall be Adobe Acrobat, most recent or second most recent published software version. The resolution of improvement plan images shall be at least 400 dpi.

D. A separate copy of the Record Drawing sheets for streetlight and traffic signal improvements in a PDF file. The file shall contain all sheets pertaining to streetlight improvements, including streetlight locations and circuit diagrams. The format shall be Adobe Acrobat, most recent or second most recent published software version. The resolution of improvement plan images shall be at least 400 dpi.

E. The most up-to-date Computer-Aided Drafting file reflecting the original approved design and any approved revisions that were made electronically. The format shall be AUTOCAD, most recent or second most recent published software version.

2-13. DEVIATION FROM STANDARDS

All requests for approval of exceptions from the design requirements contained within these Improvement Standards shall be submitted in writing to Development Services. Approval for exceptions shall be sought as early as possible in the project development process, particularly where the project concept and/or cost estimate depend on the proposed design exceptions.

Requests for design exceptions shall include the following:

A. A statement of the specific standard for which a design exception is requested.

B. A thorough but brief description of the reason for the request for the design exception.

C. A description of any non-standard safety enhancements to be provided such as median barriers, guardrail updates, etc.

D. An estimate of the additional cost required to conform to the required standard.

E. The request must be sealed and signed by a California Registered Civil Engineer.

The approval of all deviations from these standards shall be made by the Director.

2-14. CONFLICTS, ERRORS AND OMISSIONS

Acceptance of improvement plans by the County is based on the assumption that the information contained on the plans and supporting documents is correct and does not subrogate the Engineer of Record's responsibility for this project. Any and all errors and omissions related to the design are the responsibility of the Engineer of Record.

Excepted from approval are any features of the plans that are contrary to, in conflict with, or do not conform to any California State Law, County Code or Resolution, conditions of approval, or generally accepted good engineering practice in keeping with the standards of the professions, even though such errors, omissions or conflicts may have been overlooked in the County's review of the plans.

2-15. CHANGE IN ENGINEER OF RECORD

If the Applicant elects to have a registered civil engineer or licensed land surveyor other than the engineer who prepared the plans provide the construction staking, he/she shall provide to the County in writing, the name of the individual or firm one week prior to the staking of the project for construction. The Applicant shall be responsible for:

- verifying all construction,
- the preparation of revised plans for construction changes, and
- the preparation of record drawings upon completion of the construction.

In the Applicant's notification of a change in the firm providing construction staking, he/she shall acknowledge that he/she accepts responsibility for design changes and record drawing information as noted above.

2-16. BORING AND JACKING SAFETY REQUIREMENTS

Any boring or jacking operation involving an opening greater than 30 inches in diameter is subject to the State of California Division of Industrial Safety's tunnel safety requirements. If the design plans require any boring and jacking, the Engineer of Record shall submit to the State Division of Industrial Safety plans and specifications applicable to the tunnel operation, with a letter requesting tunnel classification, prior to bidding the project. This procedure is also recommended to avoid project delays if there is the possibility of any personnel entering the tunnel, regardless of diameter and length. The letter shall identify the agency responsible for the project and the agency's mailing address. The plans shall identify underground utilities and tanks or areas for storing fuel and toxic gases in the vicinity of the tunnel site and a description of the historical land use in the area. The request for classification shall be submitted allowing ample time for the Division of Industrial Safety's review in order that any special requirements can be included in the project plans and specifications. The Engineer of Record shall also attend the required pre-construction meeting.

2-17. UTILITIES

A. All known existing utilities are to be shown on the plans. In addition, the Engineer of Record shall submit prints of the preliminary and approved plans to the utility companies involved. This is necessary for the utilities to properly plan their relocation projects and needed additional facilities. Copies of the transmittal letters to the utility companies shall be provided to the County. In addition, the following note shall appear on the first page of the plans:

> *"No pavement work will occur within existing public right-of-way prior to completion of any necessary utility pole relocation within the public right-of-way."*

B. Existing and new dry utilities (low and high voltage electrical, gas, telephone, cable, fiber optics and similar) fronting new development shall be placed underground except for very high voltage (69 kV or greater). Relocated power poles for very high voltage, which cannot feasibly be placed underground, shall be placed behind the back of the sidewalk. All lower voltage lines shall be removed from these poles and placed underground. Once placed underground in an area, no new overhead lines shall be installed, even if power poles exist.

C. Utility manholes and boxes for dry utilities shall not be placed in sidewalks or curb ramps. All dry utility box covers shall be appropriately labeled "Telephone", "Streetlight", "Cable", "Electric", "Gas", etc. If the Engineer of Record approves the installation of a dry utility box in a sidewalk due to extraordinary circumstances, as determined by the County, such box and lid shall be traffic-rated and shall be placed flush with the sidewalk grade.

D. Hydraulic jetting of utility trenches is not allowed within Sutter County.

E. Tree preservation and protection shall be consistent with the County Code.

2-18. PARTIAL PLANS

Where the improvement plans submitted cover only a portion of ultimate development, the plans submitted shall be accompanied by the approved tentative plan or study plan of the ultimate development.

2-19. OTHER AGENCY NOTIFICATIONS

Prior to County approval, the Engineer of Record is responsible for obtaining the approval and necessary permits of other governmental or municipal agencies when their facilities are involved and/or the plans include work within an agency's jurisdiction.

2-20. INSPECTION REQUIREMENTS

Any improvement which will ultimately be maintained by the County will be inspected during construction by the County. Each phase of construction will be inspected and approved prior to proceeding to subsequent phases.

The County will inspect all grading and drainage during construction, including private stormwater quality improvements.

Any improvement constructed without inspection as provided above, or constructed contrary to the order or instruction of the County, shall be deemed as not complying with this Manual and may not be accepted by Sutter County for maintenance purposes.

The Applicant shall notify the County when the Contractor first calls for grades and staking and shall provide the County with a copy of all cut sheets.

Within ten (10) days after receiving the request for final inspection, the County shall inspect the work. The Contractor, Engineer of Record, and/or Applicant will be notified in writing as to any particular defects or deficiencies to be remedied. The Contractor shall proceed to correct any such defects or deficiencies at the earliest possible date. At such

time as the work has been completed, a second inspection shall be made by the County to determine if the previously mentioned defects have been repaired, altered, and completed in accordance with the plans. At such time as the County approves the work and accepts the work, the Contractor, Engineer of Record and/or Applicant will be notified in writing as to the date of final approval and acceptance.

For assessment districts and projects where the County participates in the costs thereof, quantities shall be measured in the presence of the County, Engineer of Record, and Contractor, and witnessed accordingly.

2-21. COMMERCIAL / PRIVATE PROPERTY INSPECTION REQUIREMENTS

A. County staff will perform inspections on all improvements within County right-of-way or other public easements, including all stormwater quality improvements, whether public or private.

B. The County and/or appropriate utility service providers will inspect sewer, water, and drainage connections within the public right-of-way and to the point of service for the respective utilities.

2-22. SPECIAL NOTICES AND PERMITS

The Engineer of Record shall be responsible for advising the Contractor as follows:

A. Contractors shall be in receipt of official County approved plans and shall participate in a pre-construction conference with County staff prior to construction.

B. Contractor shall notify all utility companies involved in the development prior to beginning of work.

C. Contractor shall notify Underground Service Alert two working days in advance before an excavation.

D. Contractor shall be responsible for the protection of all existing monuments and/or other survey monuments and shall notify the County of any damaged or removed City, County, State or Bureau monuments.

E. Contractor shall be responsible for conducting his operation entirely outside of any floodplain boundaries, unless otherwise approved. 100-year floodplain boundaries shall be clearly delineated in the field by the Contractor or Applicant prior to construction.

F. Contractor shall be responsible for conducting his operation entirely outside of any no grading area. These areas shall be clearly delineated in the field by the Contractor or Applicant prior to construction.

G. Where work is being performed in an off-site easement, the Contractor shall notify the property owner within two (2) working days prior to commencing work.

H. Contractor shall not dispose of chlorinated water or any other non-stormwater discharge into the County drainage system unless an exception is granted in

accordance with Sutter County Ordinance Code Section 1740-070 Connection Permit Required.

SECTION 3

IMPROVEMENT PLAN REQUIREMENTS

3-1 ELECTRONIC SUBMITTALS

At the discretion of the County, plans prepared on a computer may be submitted in electronic format for review. Only plans prepared using AutoCAD (acceptable versions as determined by the County) will be accepted. Plans may be submitted on an electronic storage device or via e-mail, as required by the County. Electronic plan submittals shall include all that is required in this Manual.

3-2 PAPER SIZE AND SCALE

All improvement plans shall be submitted on 24" X 36" or (11" X 17") paper unless otherwise accepted by the Director. Only common engineering scales shall be used.

3-3 DRAFTING STANDARD

All line work must be clear, sharp and of appropriate weight. Letters and numerals must be 0.1 inch minimum height, well formed, and sharp. Line work shall not intersect numerals showing profile elevations. Sharp, solid arrowheads shall terminate dimension lines.

3-4 TITLE SHEET

When possible, all improvement plans shall have the following information as a minimum on the cover sheet:

- The entire subdivision or parcel and project
- Assessment district limits (if applicable)
- County limits (if applicable)
- Street names (and widths when practical)
- Adjacent subdivision and/or property information, including names, lot lines and lot numbers and/or Assessor's Parcel Number(s)
- Property lines
- Public easements
- Location map
- Scale of drawings, including scale bar
- Index of sheets
- Legend of symbols
- Signature and revision blocks conforming to the Standard Drawing
- Benchmark information
- WDID #

3-5 TITLE BLOCK

Each sheet within the set of drawings shall have an approved title block showing the following.

- Sheet title
- Sheet number
- Date
- Scale
- Engineer of Record's name, signature and seal. (Signature may be placed across the seal.)
- Project title

The title block shall be either across the bottom or along the right edge of each plan sheet.

3-6 DRAINAGE, SEWER, WATER, SIGNING AND STRIPING AND GRADING LAYOUT

On all subdivision plans, a separate plan is required for each of the following:

- Water
- Signing and Striping, including any required traffic calming features
- Streetlights (unless it is appropriate to include with the signs and striping)
- Grading and erosion control

In addition, the storm drainage, sanitary sewer and water systems shall be shown on the plan and profile sheets. On all other plans, a composite plan layout of each system will be acceptable.

All plans showing the domestic water and sewer systems shall include signature blocks and be approved by the responsible water, sewer, and fire departments. The signature block shall conform to Standard Drawing D-1 and shall be on the cover sheet of the plan set.

3-7 PLAN DETAILS

In addition to the other requirements set forth in this Manual, the following details shall be shown on the plans submitted for approval. This does not in any way exempt the Engineer of Record preparing plans from the responsibility of preparing neat, accurate and comprehensive plans in keeping with the standards of the profession.

A. Record Information - All existing and proposed record information shall be shown, including:

   - Right-of-way lines
   - Boundaries of lots fronting on the street
   - Easements
   - Both on-site and off-site right-of-way and easement lines shall be properly dimensioned
   - Existing street addresses, where applicable

- All Survey monuments including boundary and all centerline monuments and ties.

B. **Existing Facilities** - All pertinent existing facilities shall be shown, including but not limited to:

- Pavement delineation and traffic signage
- Medians
- Driveways (on both sides of the street along the project frontage)
- Curbs, specifying type (rolled curbs or vertical curbs)
- Sidewalks
- Sidewalk ramps
- Pavement shoulders
- Location and size of all underground utilities, including but not limited to water, storm drainage, and sanitary sewer lines
- Limits of 100-year and 200-year floodplains, where applicable
- Structures
- Trees (6" and larger) and other foliage
- Traffic signals, cabinets, pull boxes and traffic detector loops with detector hand holes
- Street lights, cabinets, pull boxes, and underground electrical conduits
- Drainage ditches
- Utility poles and transformers
- Fire hydrants
- Retaining walls
- Contractor's Surveyor or Engineer's Surveyor shall be responsible for maintaining all survey monuments and shall file corner records and/or a record of survey pursuant to Section 8871 of the Professional Land Surveys Act.
- Any other features which may affect the design requirements for the project area

C. **Contours and Elevations -** Existing contours and supporting spot elevations shall be shown on all plans that extend one hundred feet (100') minimum beyond limits of work. See Section 10 for boundary grading requirements.

D. **Profiles** - The plans shall show the existing profile of all roadway centerline, edges of pavement, gutter flow lines, 100-year hydraulic grade lines (HGL) at critical locations, drainage ditches, existing water, storm drainage and sanitary sewer systems. Designs of proposed public improvements shall include profiles showing centerline elevations at 50-foot intervals and rates of grades, vertical curves and other vertical alignment data as deemed necessary by the County. Designs for vertical curves shall show elevations at 25-foot intervals. Where it exists, County stationing shall be used for profiles of public streets. The Engineer of Record shall

contact Development Services for such stationing. When clearance between utilities is less than two feet (2') the clearance shall be noted by dimension in the profile.

The plans shall show the existing ground profile for a minimum distance of 200 feet beyond temporary street endings to ensure proper vertical alignment within the proposed improvement limits. The 200-foot minimum requirement may be increased as requested by the County.

E. **Stationing and Orientation** - The stationing on plan and profile shall read from left to right. Stationing shall increase from south to north or from west to east, except for cul-de-sacs, where stationing shall proceed from the intersection. Plans shall be so arranged that the North arrow points toward the top or upper 180 degrees, insofar as practical.

F. **Bench Marks -** Location, description, and elevation of benchmarks and datum shall be clearly delineated on the plans. The datum shall be 1988 North American Datum (U.S.G.S. or U.S.C. & G.S.) unless otherwise approved by the County. Engineer of Records shall contact Development Services for location and elevation of the official benchmark nearest their project.

G. **California Coordinates System -** The County may require that proposed improvements be tied into the California Coordinates System if monument coordinate points are available within a reasonable distance (200 feet or less) of said improvement as determined by the County.

H. **Cross Sections -** Cross sections shall be included in the plans where determined necessary by the County. Sections shall include all pertinent structural and topographical features. Section calls shall be identified by a number and letter and the sheet on which the section appears.

I. **Special Notes** - Special Notes shall be clearly indicated. Notes shall contain a statement regarding obtaining encroachment permits from other agencies when applicable.

J. **Detail Sheets** – Detail sheets, if necessary, shall delineate special details, structural designs, etc., for which no County Standard Drawing exists, and when space is not available on the plan and profile sheets.

K. **Plan Views** – Plan views of the structure for which details of design are to be provided shall be shown on the detail sheets depicting the location of said structure in relation to street centerlines, stations, bearings, skews, grades, etc. Structural details shall be delineated at a scale that will clearly define all facets of the design.

L. **Other Plans** – Other plans that shall be incorporated in the improvement plans include, but are not limited to, landscaping and irrigation; retaining and decorative soundwalls; and traffic signals. The layout of meandering sidewalks, soundwalls, pedestrian pass-throughs, etc., shall be shown on the improvement plans along with any grading associated with these improvements in addition to being shown on the landscaping plans.

3-8 REQUIRED NOTES

A list of County required notes shall be included on all improvement plans submitted to the County for approval. A list of current notes is available on the County's website (www.suttercounty.org) and may also be obtained from Development Services.

3-9 STANDARD DRAWINGS

Engineer of Records shall not include the Standard Drawings included herein on improvement plans, but shall refer to the drawing by number. If a design exception to a Standard Drawing is intended, the drawing shall be shown with the exception noted. The design exception shall be processed in accordance with this Manual and County-adopted policies.

SECTION 4

STREETS

4-1. DEVELOPER'S PAVEMENT, SIGNAL, AND STREET LIGHT RESPONSIBILITY

A. Construction of street improvements shall conform to the centerline established by the County.

B. Where the existing pavement section does not generally meet the current structural section standard and/or the centerline grade and alignment are not satisfactory to the County, the Applicant shall be responsible for pavement section improvements as required by project conditions of approval to the centerline on all streets within, adjacent, and contiguous to the Applicant's project.

C. When making a connection to an existing street end, the Applicant shall be responsible for removing and reconstructing the existing roadway to make a satisfactory connection as required by the County.

When making connections to existing pavement, the Applicant shall be responsible for a 1-foot minimum sawcut of the existing pavement along with an additional 1-foot by 1½" deep grinding and paving. Refer to Standard Drawing ST-41 for pavement restoration.

D. The Applicant shall be responsible for all of the structural section and pavement on all streets within, adjacent, and contiguous to the project, including frontage roads, as required by the County conditions of approval for the project. If the street is to be paved under a future County contract, the Director may require a cash deposit for the roadway and related work in lieu of actual construction and the County will include the work in the County contract.

E. All temporary approaches to existing roadways required as a result of the development shall be at the Developer's expense. The temporary approaches shall be paved with a structural section to be determined individually for each situation.

F. The Developer shall be responsible for relocating existing traffic signals and street lights, and installing new traffic signals and street lights as necessary for new street and driveway locations. The Developer shall also be responsible for relocating existing traffic signals and street lights as necessary for the installation of new curbs, bus stops and turn-outs, and sidewalks at locations where there are no such facilities existing.

G. The County may elect to prepare the traffic signal relocation construction plans to be given to the Developer if requested in writing. In lieu of actual plan preparation, the County will provide all pertinent design information to be included by the Developer on their plans within 30 days after being requested in writing and the Developer's engineer provides an acceptable base plan. The County's design costs shall be reimbursed by the Developer.

H. For intersections with new traffic signal construction that is located within one half of a mile of an intersection with an existing traffic signal, the work shall include the installation of traffic signal interconnect conduits and conductors to connect the new traffic signal to the nearest existing traffic signal. Should interconnect conduits exist through an intersection where a new signal is to be constructed, the work shall include the connection of the new traffic signal into the existing interconnect system. Such work may include the installation of new interconnect cable from the traffic signal to the nearest existing traffic signal.

   The design of the traffic signal interconnect facilities shall be subject to the review and approval by the Sutter County Development Services Department

I. The Applicant shall be responsible for constructing or modifying curbed median islands where required by these standards, or when required for traffic control as a result of the development, as determined by the Director. If the street is to be paved under a future County contract, the Director may require a cash deposit for the roadway and related work in lieu of actual construction and the County will include the work in the County contract.

J. The Applicant shall be responsible for bus stops, bus turnouts, and intersection widening as shown on Standard Drawings and in accordance with these Standards.

K. The Applicant shall be responsible for all drainage facilities (bridges, pipes, culverts, and appurtenances) crossing new streets within, adjacent, and contiguous to the project.

L. The Applicant shall be responsible for all associated modifications to allow for access for the disabled, including but not limited to: guide-strips, sidewalk ramps, striping, etc.

4-2. COUNTY COST PARTICIPATION

Costs associated with the design and construction of eligible facilities included in various fee programs, Community Facilities Districts, Assessment Districts, or other funding programs may be reimbursable to the Applicant as set forth in the applicable funding program(s).

Applicants wishing to seek reimbursement from the County shall provide a written request to the County for cost participation if the proposed work is beyond the Applicant's responsibility. This application shall show the items of work, the estimated quantities, reimbursable costs, and justification for the request. Upon review of the Applicant's request, the County will notify the Applicant as to the acceptance and the extent of cost participation. Should an agreement be reached between the Applicant and the County on the methods and level of participation, the parties must enter into, and execute, a formal "cost sharing/reimbursement" agreement specifying the terms of the agreement prior to starting such work.

Costs associated with design and construction of eligible facilities included in fee programs, Community Facilities Districts, Assessment Districts, or other funding

programs may be reimbursable to the Applicant as set forth in the applicable funding program(s).

Any portion of work shown on the Engineer of Record's plans, for which the County has agreed to cooperate, shall not be segregated by note or legend, but shall be identified as separate items in the Construction Contract between the Applicant and their Contractor. The County will reimburse the Applicant for these reimbursable items after the work has been accepted by the Director and all outstanding fees owed to the County (i.e., plan review and inspection fees) have been paid.

Final quantities will be determined by field measurement, observed jointly by the County Inspector, the Contractor, and the Applicant or his designated agent. Unit prices prepared for fee and bond calculation and authorized in County Code shall be used as a basis for cooperative work. The Director may negotiate unit or lump sum prices for items not usually encountered, or for unusual field conditions.

A. In Lieu Fees

When an in-lieu fee is required, or an allowable option in lieu of constructing improvements, the Engineer of Record shall provide a written estimate of probable costs for the improvements based on a publicly bid project using prevailing wages assuming the County will construct the improvements. This written estimate shall contain all backup to quantity calculations and utilize current unit prices from publicly bid projects unless otherwise authorized by the County. The written estimate shall be signed and stamped by a licensed civil engineer and submitted to the County for approval. The estimate shall also include escalation for inflation using a County approved methodology.

4-3. STREET DESIGN STANDARDS

Unless required otherwise by an approved Specific Plan, the minimum street design and geometric standards must conform to Table 1, Street Design Parameters

.

TABLE 4-1
Street Design Parameters

Parameter	26-ft Minor Residential [1]	38-ft Standard Residential [2]	48-ft Collector [3]	68-ft Arterial	78-ft Thorough-fare Street	Frontage Road Adjacent to State Freeway: 33-ft Rural Frontage Road	Frontage Road Adjacent to State Freeway: 48-ft Urban Frontage Road
Right-of-Way Width	26 feet	38 feet	48 feet	68 feet	78 feet	33 feet	48 feet
BOC to BOC Width	26 feet	38 feet	48 feet	68 feet	78 feet	N/A	48 feet
Sidewalk Width	5 feet	5 feet	5 feet	6 feet	10 feet	N/A	5 feet
Landscape Strip/Corridor Width	6 feet	6 feet	6 feet	8 feet	10 feet	N/A	6 feet
Number of Travel Lanes	2	2	2	4	6	2	2
Travel Lane Width	10 feet	10 feet	10 feet	10 feet	10 feet	10 feet	10 feet
Median/Turn Pocket Width	none	none	12 feet	12 feet	12 feet	none	12 feet
Bike Lane Width	none	none	5 feet	5 feet	none	none	5 feet
On-Street Parking Allowed	no	yes	no	no	no	no	no
Design Speed	25 mph	25 mph	35 mph	45 mph	50 mph	35 mph	35 mph
Stopping Sight Distance	150 feet	150 feet	250 feet	360 feet	430 feet	250 feet	250 feet
Centerline Radius (min)	200 feet	350 feet	500 feet	1,500 feet	2,000 feet	500 feet	500 feet
EP Radius at Intersections (min) [4]	28 feet	28 feet	33 feet	33 feet	33 feet	33 feet	33 feet
Traffice Index (min)	6.0	6.0	7.0	9.0	10.0	7.0	7.0
Structural Section [5]	4" AC 13" AB	4" AC 13" AB	4" AC 16" AB	5.5" AC 21" AB	6.5" AC 23" AB	4" AC 16" AB	4" AC 16" AB
Structural Section w/LTSB [5]	4" AC 6" AB 9" LTSB	4" AC 6" AB 9" LTSB	4" AC 6" AB 11" LTSB	5.5" AC 7" AB 13" LTSB	6.5" AC 8" AB 16" LTSB	4" AC 6" AB 11" LTSB	4" AC 6" AB 11" LTSB

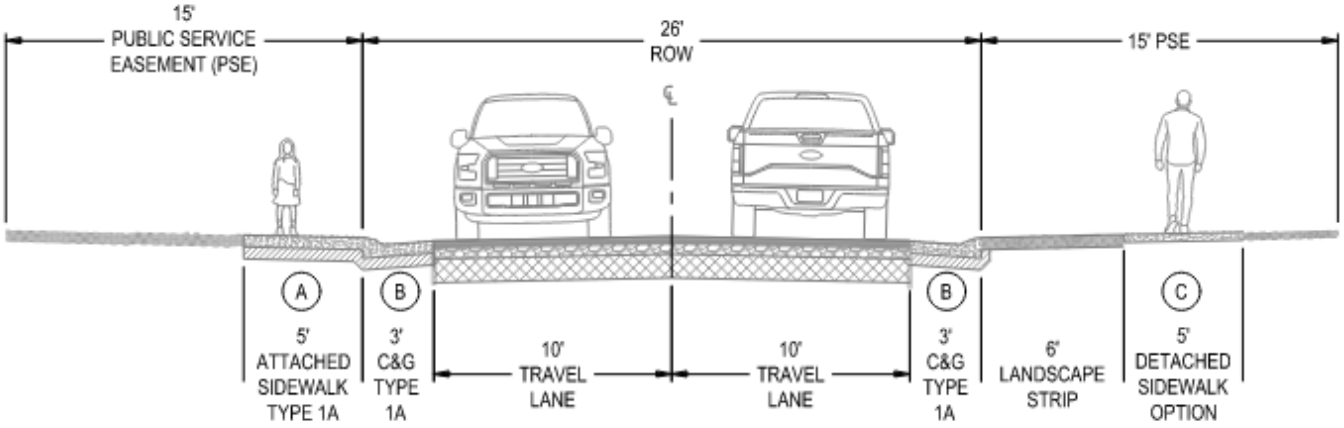
Notes:

[1] servicing < 100 residential units
[2] servicing between 100-400 residential units
[3] for Residential, Multi-Family, Commercial and Industrial
[4] when streets intersect with wider streets, the wider street requirements apply
[5] assumes an R-Value of 5

Definitions:

AC = Asphaltic Concrete
AB = Aggregate Base
BOC = Back of Curb
EP = Edge of Pavement
LTSB = Lime Treated Subbase

FIGURE 4-1
26' Minor Residential Street



D **26' MINOR RESIDENTIAL STREET**

1" = 8' 0 4' 8'

(#) CONSTRUCTION KEYNOTES

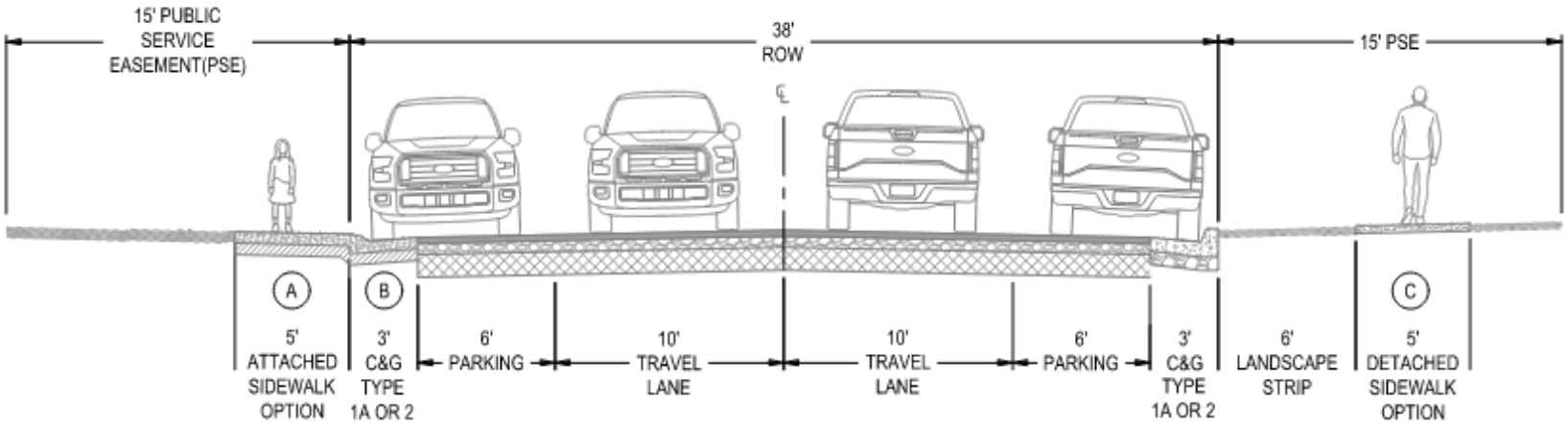
A TYPICAL SIDEWALK PER SUTTER COUNTY DWG NO. ST-34 TYPICAL CURB & GUTTER SECTIONS

B TYPE 1A CURB PER SUTTER COUNTY DWG NO ST-34 TYPICAL CURB & GUTTER SECTIONS

C SIDEWALK TRANSITION PER SUTTER COUNTY DWG ST-38 SEPARATED (OR DETACHED) SIDEWALK TRANSITION.

D 26' MINOR RESIDENTIAL STREET SECTION PER SUTTER COUNTY DWG NO T-16

FIGURE 4-2
38' Standard Residential Street



D **38' STANDARD RESIDENTIAL STREET**

1" = 8' 0 4' 8'

(#) CONSTRUCTION KEYNOTES

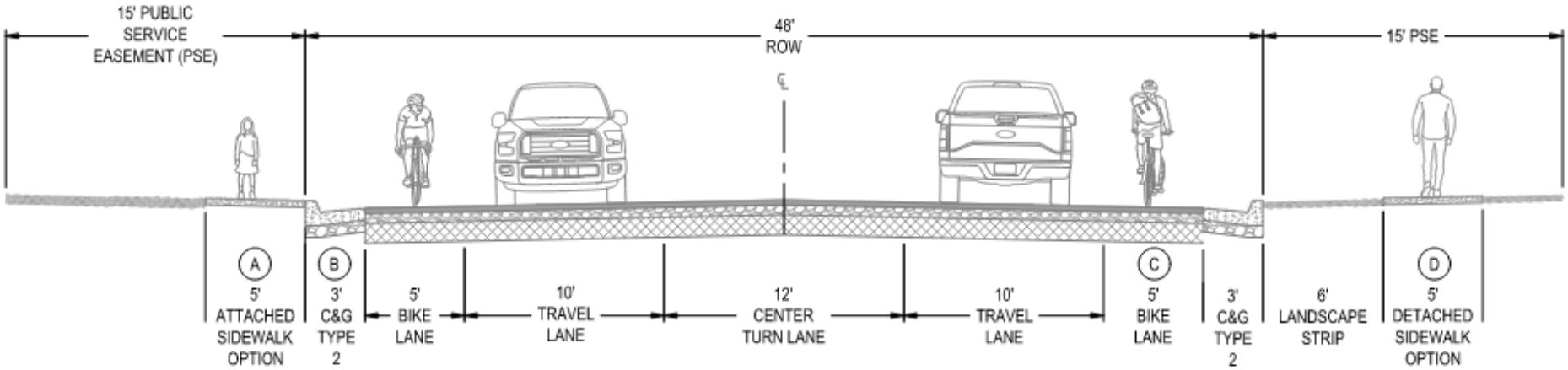
A TYPICAL SIDEWALK PER SUTTER COUNTY DWG NO. ST-34 TYPICAL CURB & GUTTER SECTIONS.

B TYPE 1A OR 2 CURB PER SUTTER COUNTY DWG NO ST-34 TYPICAL CURB & GUTTER SECTIONS

C SIDEWALK TRANSITION PER SUTTER COUNTY DWG ST-38 SEPARATED (OR DETACHED) SIDEWALK TRANSITION.

D 38' STANDARD RESIDENTIAL STREET SECTION PER SUTTER COUNTY DWG NO T-16.

FIGURE 4-3
48' Collector Street



E **48' COLLECTOR STREET**

1" = 8' 0 4' 8'

CONSTRUCTION KEYNOTES

A TYPICAL SIDEWALK PER SUTTER COUNTY DWG NO. ST-34 TYPICAL CURB & GUTTER SECTIONS.

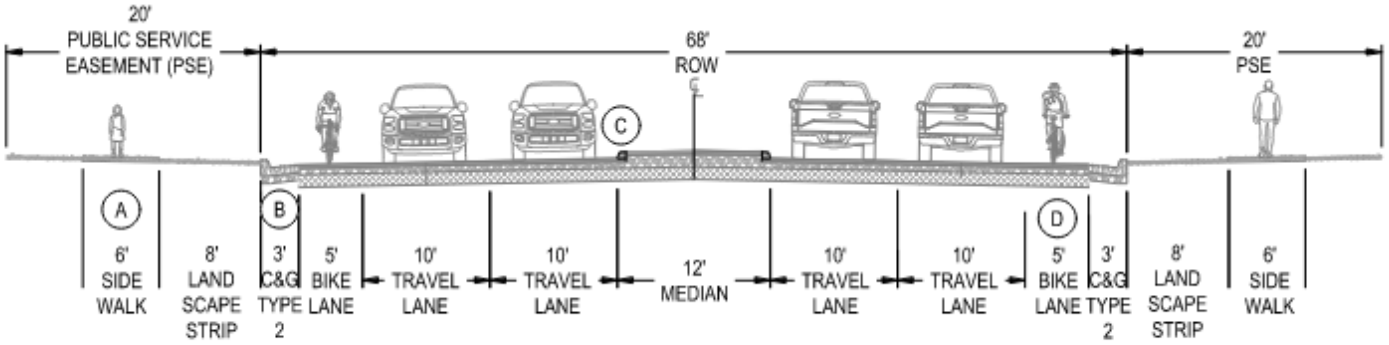
B TYPE 2 CURB PER SUTTER COUNTY DWG NO ST-34 TYPICAL CURB & GUTTER SECTIONS

C BIKE LANE LEGEND DETAIL PER SUTTER COUNTY DWG T-14 BIKE LOOP AND BIKE LEGEND INSTALLATION DETAIL.

D SIDEWALK TRANSITION PER SUTTER COUNTY DWG ST-38 SEPARATED (OR DETACHED) SIDEWALK TRANSITION.

E 48' COLLECT STREET SECTION PER SUTTER COUNTY DWG NO T-16

FIGURE 4-4
68' Arterial Street



E **68' ARTERIAL STREET**

1" = 15' 0 7.5' 15'

(#) **CONSTRUCTION KEYNOTES**

A TYPICAL SIDEWALK PER SUTTER COUNTY DWG NO. ST-34 TYPICAL CURB & GUTTER SECTIONS.

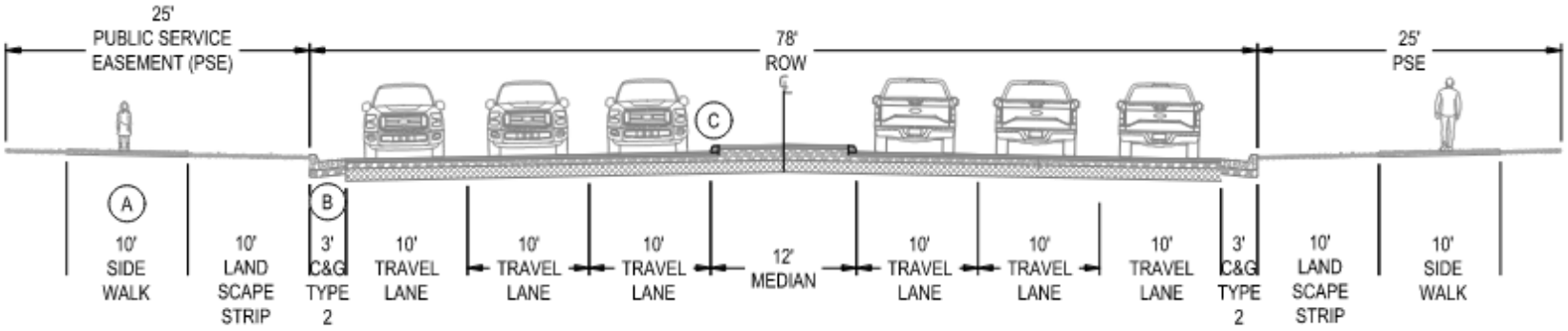
B TYPE 2 CURB PER SUTTER COUNTY DWG NO ST-34 TYPICAL CURB & GUTTER SECTIONS

C TYPE 4 & 4A PER SUTTER COUNTY DWG NO ST-34 TYPICAL CURB & GUTTER SECTIONS

D BIKE LANE LEGEND DETAIL PER SUTTER COUNTY DWG NO T-14 BIKE LOOP AND BIKE LEGEND INSTALLATION DETAIL

E 68' ARTERIAL STREET PER SUTTER COUNTY DWG NO T-17

FIGURE 4-5
78' Thoroughfare Street



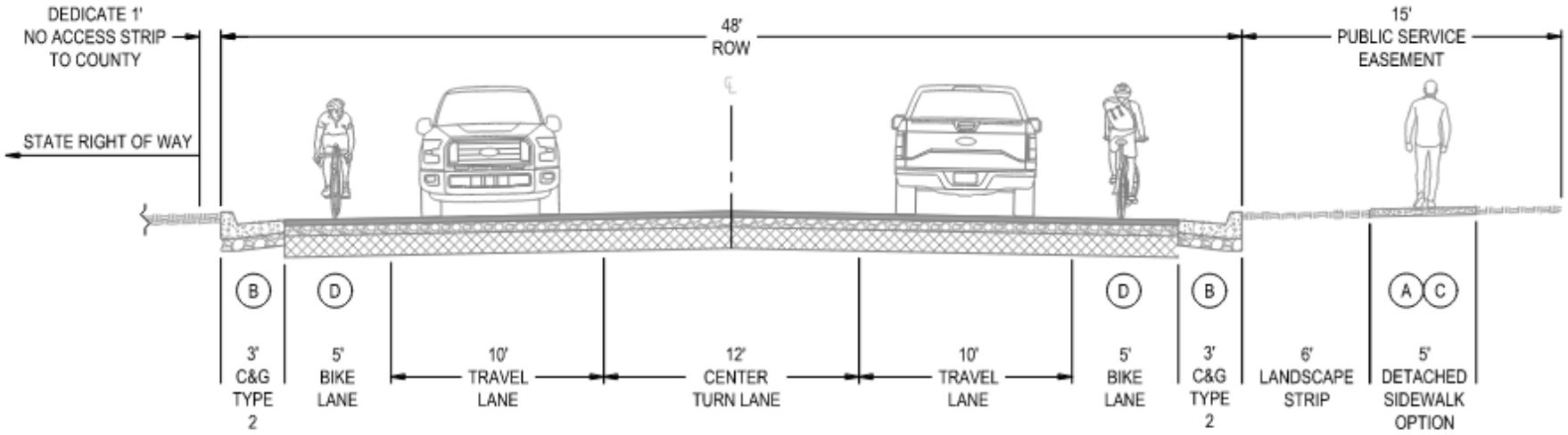
D **78' THOROUGHFARE STREET**

1" = 15' 0 7.5' 15'

(#) CONSTRUCTION KEYNOTES

A TYPICAL SIDEWALK PER SUTTER COUNTY DWG NO. ST-34 TYPICAL CURB & GUTTER SECTIONS.
B TYPE 2 CURB PER SUTTER COUNTY DWG NO ST-34 TYPICAL CURB & GUTTER SECTIONS
C TYPE 4 & 4A PER SUTTER COUNTY DWG NO ST-34 TYPICAL CURB & GUTTER SECTIONS
D 78' THOROUGHFARE STREET PER SUTTER COUNTY DWG NO. T-17

FIGURE 4-6
48' Urban Frontage Road Adjacent to State Freeway



(D) 48' URBAN FRONTAGE ROAD ADJACENT TO STATE FREEWAY

1" = 8' 0 4' 8'

(#) CONSTRUCTION KEYNOTES

A TYPICAL SIDEWALK PER SUTTER COUNTY DWG NO. ST-34 TYPICAL CURB & GUTTER SECTIONS.

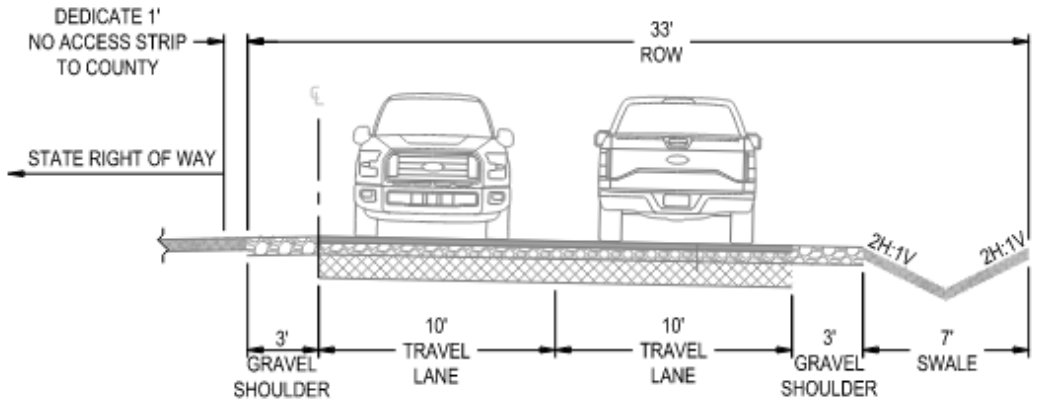
B TYPE 2 CURB PER SUTTER COUNTY DWG NO ST-34 TYPICAL CURB & GUTTER SECTIONS

C SIDEWALK TRANSITION PER SUTTER COUNTY DWG NO ST-38 SEPARATED (OR DETACHED) SIDEWALK TRANSITION.

D BIKE LANE LEGEND DETAIL PER SUTTER COUNTY DWG NO T-14 BIKE LOOP AND BIKE LEGEND INSTALLATION DETAIL

E 48' URBAN FRONTAGE ROAD PER SUTTER COUNTY DWG NO T-18 TYPICAL STREET CROSS FRONTAGE ROAD

FIGURE 4-7
33' Rural Frontage Road Adjacent to State Freeway



(A) **33' RURAL FRONTAGE ROAD ADJACENT TO STATE FREEWAY**

1" = 8' 0 4' 8'

(#) **CONSTRUCTION KEYNOTES**

A 33' RURAL FRONTAGE ROAD PER SUTTER COUNTY DWG NO T-18 TYPICAL STREET CROSS FRONTAGE ROAD

4-4. STANDARD PLANS

The County maintains a large library of Standard Drawings. All details must be in accordance with these Standard Drawings unless written deviation is requested from the applicant and approved by the County.

4-5. STRUCTURAL SECTION

The following standards for the design of structural sections shall govern the preparation of plans for proposed improvements.

A. Structural sections for all asphalt roadways shall conform to Table 1 or shall be designed to conform to the California Department of Transportation Highway Design Manual (Latest Edition), "Chapter 600 – Pavement Engineering", as modified from time to time, or other method as approved by the Development Services Director. The gravel equivalent safety factor of 0.2 feet of asphalt concrete shall be used for design. Calculated asphalt thicknesses shall be rounded up to the nearest ½ -inch increment and calculated aggregate base thicknesses shall be rounded up to the nearest 1-inch increment.

B. With approval by the Director, the subgrade soil beneath the curb & gutter and pavement section may be lime treated per geotechnical recommendations. When lime treatment is used, the street structural section shall be determined based on a three layer section using a gravel equivalent factor no greater than 1.1 and an R-value no greater than 50 for the lime treated sub-base layer. However, the thickness of the aggregate base layer shall be no less than six inches under any circumstance.

C. A soils report indicating the "R" value of the basement (i.e., subgrade) soil, along with calculations for structural pavement sections shall be submitted with any plan indicating construction of roadway.

D. Portland cement concrete streets may be constructed with the approval of the Director.

E. The use of alternate road building materials will be allowed if supported by a sound pavement design study prepared by a registered civil (or geotechnical) engineer and approved by the Director. These alternate road building materials may include but not be limited to the following:

- Pavement stress absorbing interlayers
- In-situ soil and subgrade stabilizing admixtures
- Reclaimed Asphalt Pavement (RAP)
- Rubberized asphalt concrete
- Roller compacted concrete

F. In transition areas from one street width to another street width standard, the heavier structural section shall be used in the transition area.

4-6. HORIZONTAL AND VERTICAL STANDARDS

The following standards for the design of profiles shall govern the preparation of plans for proposed improvements.

A. All minimum vertical sight distances shall be based on Chapter 200 of the Caltrans Highway Design Manual.

B. The minimum grade on new streets shall be 0.25% except that the minimum curb and gutter grade around intersection corners shall be 0.50%.

C. The minimum grade of gutter sections constructed on existing streets shall be 0.25%.

D. Standard cross slope on new streets shall be 2.0%.

E. The minimum cross slope on street widening shall be 1.5% and the maximum cross slope shall be 3.0%. The cross slope of the widening shall conform to the cross slope of the existing pavement whenever possible.

F. When two streets intersect, neither street shall have a longitudinal grade greater than 3.0% for a minimum distance of 40 feet measured from the back of curb line of the intersecting street, except in unusually rough terrain, as determined by the Director. At all street intersections, the centerline crown of the lesser roadway width shall meet the surface pavement elevation of the intersecting roadway at a point along the projected lip of gutter of the larger roadway. If both roadways have the same street width, the larger roadway shall be the street with the higher projected traffic volume with full land development. Crown slope may be reduced to 1.0% within the intersection, if necessary.

G. The minimum vertical curve length allowable at the intersection of two grades shall be 50 feet. Vertical curves on residential and collector streets may be omitted where the algebraic difference in grades does not exceed 2.0%. Vertical curves on all other streets may be omitted where the algebraic difference in grades does not exceed 1.5%. The minimum vertical curve data to be computed and shown on the plans shall consist of the point of intersection elevation, the tangent gradients, the middle ordinate and the length of curve.

H. HORIZONTAL CURVES: Minimum horizontal curves shall be as shown in Table 1, Street Design Parameters (page 21). A minimum tangent length of 200 feet is required between reversing curves on 48-foot back of curb to back of curb and larger streets.

4-7. INTERSECTIONS AND DRIVEWAYS

A. All streets shall intersect at 90°±5° angle to each other. This angle shall be maintained for a minimum distance equivalent to the right-of-way width measured from the curb return.

B. Streets shall not be designed to intersect on the inside of a horizontal curve nor on the opposite side of a crest vertical curve if the sight distance will be inadequate for drivers to enter the traffic flow or cross the street safely.

C. Streets intersecting any 26-foot or 38-foot residential street from opposite sides shall have their centerlines meet, or the offset between intersections shall be a minimum of 150 feet.

D. Streets intersecting any 48-foot back of curb to back of curb street from opposite sides shall have their centerlines meet, or the offset between intersections shall be a minimum of 200 feet

E. Streets intersecting any 68-foot street from opposite sides shall have their centerlines meet, or the offset between intersections shall be a minimum of 300 feet. Pursuant to this section major access driveways shall be considered as streets with respect to offsets.

F. ELBOW INTERSECTION: Elbows shall be required at right angle intersections in accordance with the Standard Drawing ST-28.

G. DRIVEWAYS: Driveway installation shall be in accordance with the Standard Drawings as applicable, and the following:

- Driveways entering Class "B" or Class "C" streets shall meet the right of way line at such a grade and elevation as to permit conversion to a Class "A" street without re-grading the driveway beyond the right of way line. The maximum driveway slope shall be 10%, except for single family and duplex driveways, and in unusual terrain conditions, when specifically approved by the Director. The maximum algebraic difference in grade at any grade change within the public right-of-way and a driveway or between a driveway and public roadway shall be 10%.

- Concrete driveways will not be permitted within the right-of-way lines when entering Class “C" streets. (See Standard Drawing ST-22.)

- No driveway (including transition tapers) will be allowed within 5 feet of a side property line (See Standard Drawing ST-25.) Joint driveways may be required by the Director and a reciprocal access agreement will be required prior to approval of improvement plans.

- Driveways and intersections on arterials and thoroughfares shall be evaluated for right turn pockets. Driveways and intersections which have at least 25 right-turning trips in the peak hour shall have a right turn pocket into the development. Projects with less than 25 right-turning trips in the peak hour at the driveway or intersection shall be evaluated on a case by case basis. Right turn pockets shall have 90’ bay taper. Pocket lengths shall be evaluated on a case by case basis based upon traffic volumes and other relevant considerations.

- For all 68-foot streets and wider, driveway throat depths shall be a minimum of 50’ from the back of the sidewalk, clear of drive aisle or parking spaces. Longer throat depths may be required based upon traffic volumes generated and the traffic volume on the street the project is accessing. All driveways, except those providing access to single family residential uses, on two lane streets shall have a minimum throat depth of 25 feet.

- The minimum width for a single family residential or duplex driveway shall be 12 feet. The maximum single family residential or duplex driveway width shall be 24 feet. For dwellings that provide three car garages, (side by side garages only) wider driveways may be evaluated and approved on a case by case basis

- All commercial and multiple family developments shall install driveways consistent with the Standard Drawings. (See Standard Drawing ST-23.) Commercial, office and multi-family driveways on collector streets shall have a minimum opening of 24-feet and may be increased, as determined by the Director to 35-feet wide based upon the driveway vehicular volume, street geometrics, street vehicular volumes or other characteristics of the area. Driveways serving significant truck traffic may be increased to a 45-foot wide driveway opening, at the discretion of the Director.

- The standard multiple family and commercial driveway opening width shall be 35 feet on 68-foot, and 78-foot streets and may be increased to 45 feet at the discretion of the Director. Driveways on 68-foot, and 78-foot streets shall have a minimum clear spacing of 200 feet between driveways (See Standard Drawing ST-25.).

- A center median up to 10 feet wide may be approved by the Director for certain driveways. The normal driveway width will be increased by the median width.

- Driveways near major intersections shall be located outside of the widened area at expanded intersections and shall be located as shown on Standard Drawing ST-25.

- The standard driveway for industrial developments shall be Type A-6 or Type A-7, 45 feet wide, as shown on the Standard Drawing ST-23.

- When driveways are abandoned or relocated, the driveway sections must be removed and replaced with standard curb and gutter, sidewalk, and if applicable, planters.

- When street frontage improvements exist with, Type 1A, or Type 2 curb and gutter, Type A-6 or A-7 driveways shall be installed for all accesses serving more than four single dwelling units.

- Driveways entering levee roads and driveways entering commercial property on all roads shall have a slope not exceeding 5% for a minimum distance of 20 feet, measured from the edge of existing pavement. Driveways normally used by vehicles towing house or boat trailers shall have special requirements to be determined on an individual basis by the Director.

- The nearest edge of driveways shall not be closer than 50 feet to the end of existing or future traffic medians. Medians shall be reconstructed and/or lengthened to conform to this section if necessary, as determined by the Director.

- Visibility requirements for driveways shall be in accordance with the Section 4-8 and Standard Drawings ST-29 and ST-30. Increased visibility requirements may be required for driveways serving a significant amount of truck traffic.

- Major commercial driveways which will serve significant traffic volume, as determined by the Director, shall be considered as intersecting streets and shall conform to the same offset requirements.

- Driveways accessing public roads shall be paved with concrete or asphalt concrete. (See Standard Drawing ST-22.)

- Private streets must be designed and constructed to public street standards, per the Sutter County General Plan.

- Residential driveways on residential streets at their intersection with a 48-foot back of curb to back of curb or narrower street shall be located a minimum of 15 feet clear from the corner return. Residential driveways on minor street or collector streets at their intersection with a street wider than 50-foot back of curb to back of curb shall be located a minimum of 50 feet clear from the corner return. Non-residential driveways on a collector street intersecting with a 68-foot street or wider shall be located a minimum of 150 feet clear of the corner return. (See Standard Drawing ST-25.)

4-8. SIGHT DISTANCE AND VISIBILITY EASEMENTS AT INTERSECTIONS

For 48-foot or wider streets intersecting with 48 foot or wider street (measured from back of curb to back of curb), the minimum stopping sight distance for establishing visibility control areas shall be as shown in Table 4-2, Stopping Sight Distance (also see Standard Drawing ST-29)

Table 4-2
Stopping Sight Distance

Design Speed (mph)	Stopping Distance (ft)
10	50
15	100
20	125
25	150
30	200
35	250
40	300
45	360
50	430
55	500
60	580
65	660
70	750
75	840
80	930

For other cases, the following visibility control standards shall apply:

- Streets with an ultimate width of less than 48 feet (measured from back of curb to back of curb) shall be consistent with Standard Drawing ST-30.
- 90-degree intersection elbows shall be consistent with Standard Drawing ST-28.
- Residential driveways shall be consistent with Standard Drawing ST-30.

Residential driveways entering collectors, arterials or thoroughfares may be subject to the minimum sight distance requirements for major street intersections, as determined by the Director.

Regardless of the street width, driveways serving significant traffic volumes, as determined by the Director, shall be subject to the minimum sight distance requirements for major street intersections.

All existing streets that do not intersect at a 90º±5º angle to one another shall be subject to the minimum sight distance requirements for major street intersections when enforcing the visibility control area.

No signs, plantings, structures, natural growth, fences, walls or any other type of obstruction to a clear view, higher than 30 inches above the nearest pavement surface (or traveled area where no pavement exists) shall be installed or maintained or shall be permitted to be installed or maintained within the visibility control area. Exceptions include tree canopies, signs that provide a minimum clearance of 7 feet measured from the existing grade, or permanent structures existing as of the effective date of these provisions.

Dedication of visibility easements may be required over the visibility control areas to ensure that the required sight distances can be enforced and maintained. Visibility easements for residential driveways are not required unless the Director determines that the dedication is necessary to satisfy special safety considerations. Visibility easements shall be recorded on final maps or by separate instrument if a map is not required.

4-9. INTERSECTION CORNER RADII AND BULB-OUTS

Minimum right-of-way and edge of pavement radii for intersection corner roundings shall be in accordance with the Standard Drawings and Table 1, Street Design Parameters.

When two streets of different widths intersect, the radius for the wider street shall apply.

All intersection pavement edges on Class "C" streets shall have a minimum radius of 25 feet where widening is not required by Section 4-7 (See also Standard Drawings ST-20 and ST-21).

All intersection pavement edges on partial streets shall have a minimum radius of 25 feet or greater, as determined by turning requirements at the subject location, on the uncompleted side.

Bulb-outs shall conform to the geometry shown on Standard Drawings ST-27 and shall be installed as required by conditions of approval or as deemed necessary by the Director.

4-10. CUL-DE-SAC

Cul-de-sac streets shall be terminated with a bulb, which shall have right-of-way and back of curb radius dimensions conforming to the Standard Drawing ST-26 and the following:

No cul-de-sac shall exceed 600 feet in length, measured as the distance from the centerline of the intersecting street to the center of the cul-de-sac bulb.

The minimum T.I. for a cul-de-sac shall be 6.5. Special T.I.'s will be provided to the consultant engineer for industrial cul-de-sacs or where other special conditions exist.

Where there is no vehicular access from the end of a public street, the street must be terminated with a bulb. A Fire Department approved turn-around will be considered as an alternative to a cul-de-sac for private streets where no vehicular access is taken from the end.

Where possible a pedestrian connection should be provided from the bulb end of a cul-de-sac to the nearest neighboring roadway.

4-11. PARTIAL STREET

Partial streets may be permitted by the Director along the boundary of a subdivision or property of the Applicant where the full right-of-way cannot be dedicated or where the complete street cannot be constructed, but will ultimately be constructed with adjacent development.

When paving partial construction of an ultimate street development, the edges of the current pavement on the uncompleted side are to be protected by placing a minimum of 1-foot additional width of aggregate base material beyond the edge of pavement to the grade and depth of the adjacent structural section.

Partial streets shall be terminated with the end of the pavement perpendicular to the street unless otherwise specified below. A 2"x6" redwood header board shall be required at the pavement ending.

Partial streets that terminate adjacent to an intersection or driveway shall be tapered 45 degrees to the street if right-of-way is available.

The end of a partial street that terminates a traveled lane in the direction of travel shall have the travel lane tapered in accordance with the following equations:

Less than 45 mph, $L = WS^2/60$

Greater than or equal to 45 mph, $L = WS$

Where L = Length, W = Width (feet) and S = Design Speed (mph)

The design speed used in determining the taper shall be that given in the table in Section 4-3.

The Director may specify alternate pavement tapers for the termination of partial streets.

4-12. BUS STOP

Bus stop turnouts with paved shelter pad areas shall be required at approximately ¼ mile intervals along Arterial and Thoroughfare streets where specified by the Director. Bus stop turnouts may also be required on Collector streets as determined by the Director.

At all intersections of 68-foot, and 78-foot streets with other 68-foot, and 78-foot streets, bus stops shall be provided with turnouts that are integrated with standard intersection widening in accordance with the Standard Drawings ST-9 through ST-16.

General principles related to bus stop turnouts include:

- Bus stop turnouts shall be located on the far right hand side of intersections, unless otherwise required by the Director, in accordance with the Standard Drawings ST-9 through ST-16 and ST-31.
- Where intersections are too widely spaced to provide satisfactory bus stop intervals, as determined by the Director, mid-block bus stops and turnouts may be required. Sidewalks shall be 6 feet wide at bus stops with a 7-foot by 28-foot P.C.C. pad to accommodate bus shelters as shown on the Standard Drawings ST-31 and ST-32.
- Reinforced Type 2 curbs shall be required at all bus stops and turnouts in accordance with the Standard Drawing ST-32.

4-13. SIDEWALK RAMP AND ACCESSIBILITY IMPROVEMENTS

Sidewalk ramps shall be constructed at all street intersections and at other locations where required by the Director, in accordance with the Standard Drawings, as applicable.

All intersection corners shall have dual sidewalk ramps, unless dual ramps are determined by the Director to be undesirable or impractical (e.g., where dual ramps would result in large crosswalk skews, where visibility concerns exist at stop-controlled intersections, or intersections where the major street has a raised median extending through the intersection).

At "T" intersections, ramps are not to be placed to facilitate crossing of the through street unless the Director determines that special conditions exist (e.g., where the intersection is adjacent to land uses having special pedestrian generating characteristics such as parks and schools).

In accordance with the requirements of the Americans with Disabilities Act (ADA), any modification of any portion of an intersection may require access improvements to all corners of that intersection as determined by the Director based on the nature of work being proposed at the intersection. For the purpose of this requirement, modifications include but are not limited to:

- Roadway widening through the intersection
- Widening of a portion of the intersection
- Construction of corner improvements (curbs, gutter, and/or sidewalks) in any portion of the intersection

- Construction of a new traffic signal
- Modification of an existing traffic signal
- Resurfacing the pavement with an asphalt concrete overlay in any portion of the intersection

Access improvements to the intersection include, but are not limited to, the construction of sidewalk ramps. Should there be existing sidewalk ramps prior to the modification of the intersection, it shall be the responsibility of the Applicant to survey the existing sidewalk ramps to ensure that they comply with the current requirements of the ADA for existing ramps. Should any existing ramp fail to meet those requirements, that ramp shall be removed and replaced with a sidewalk ramp that conforms to County ADA standards. Refer to Standard Drawings AR-1 through AR-12.

If an intersection is modified, as defined above, and if that intersection has an existing traffic signal, access improvements shall include the installation of ADA compliant pedestrian push buttons, should they not exist. Those push buttons shall conform to the ADA and County requirements including height, orientation, location relative to sidewalk areas, locations relative to sidewalk ramps and location relative to crosswalks (Refer to Standard Drawing T-31). Access improvements for such intersections shall also include the installation of audible pedestrian traffic signals.

Improvements associated with trail and pedestrian crossings at mid-block locations shall be designed in accordance with these Improvement Standards, the *Sutter County Bicycle, Pedestrian, and Trails Master Plan*, and the National Cooperative Highway Research Program (NCHRP).

4-14. CURB AND GUTTER

Curb and gutter shall be installed or replaced adjacent to all developments, excepting Class "C" Streets, in accordance with the Standard Drawing ST-34 and the following:

A. Type 1A Curb and Gutter: 26-foot and 38-foot streets, only along segments where continuous single family residential units are proposed for front-on access, or as required by the Director.

B. Type 2 Curb and Gutter: All streets not covered under A. above.

4-15. CROSS GUTTER

Cross gutters may be permitted on 26-foot and 38-foot streets with the specific approval of the Director when the intersection cannot reasonably be drained to an underground system. (See Standard Drawing ST-35.) No cross gutter will be allowed on 48-foot or greater streets. Cross gutters will also not be allowed on any approach to a signalized intersection.

4-16. BARRIER CURB

Barrier curbs shall be in accordance with Standard Drawings ST-34 and ST-36 (Type 3, 4, or 5). Barrier curbs shall be required at all locations where parking will be allowed adjacent to the sidewalk. See Standard Drawing ST-36 for planter and barrier curb details (lawn may extend to the back of sidewalk in lieu of planters).

A barrier curb shall be required at the back of sidewalk at all commercial, industrial, and multi-family residential properties and landscape corridors where landscape planters containing soil and/or mulch are adjacent to the sidewalk. A barrier curb is not required at the back of sidewalk adjacent to lawn.

A barrier curb shall be required at bus stops behind a sidewalk where the slope is toward the sidewalk (to prevent sheet flow across the sidewalk). Under sidewalk drains shall be used to remove drainage collected at the back of the barrier curb, as necessary to prevent any flow across the sidewalk. (See Standard Drawings ST-37.)

A barrier curb shall be required behind a sidewalk where the slope behind the sidewalk is greater than 6:1 and the slope is away from the sidewalk (for pedestrian safety). Where a retaining wall is allowed, creating a drop-off adjacent to the sidewalk, a minimum 36-inch high barrier fence is required in lieu of the barrier curb at the back of the sidewalk. Lot grading shall be done so as to not require fencing immediately adjacent to intersections and driveways in violation of the sight distance and visibility requirements of Standard Drawing ST-30 and Section 4-7.

4-17. SIDEWALKS

Sidewalks shall be in accordance with these Standards and the geometry shown in the Standard Drawings. Sidewalks within landscape corridors adjacent to Collector, Arterial, and Thoroughfare streets shall conform to the Adopted Countywide Design Guidelines and Standard Drawing ST-38.

All school and park developments shall have 8-foot attached sidewalks along all frontages.

For standard sidewalks separated from the roadway curbing by a landscaped buffer, no utility pole, guy wire, cabinet, hydrant, sign or other above ground facility shall be located within the sidewalk area, where possible. Where utility poles and other obstructions are situated within the planned sidewalk section, a minimum of 4 feet of clear uninterrupted sidewalk area shall be provided. Where it is necessary to widen the sidewalk beyond its standard width to attain the 4-foot clearance, the widened area shall extend a minimum of 5 feet beyond each side of the obstruction and a 10-foot taper on each side of the widening shall be required. Traffic signal poles may be located with sidewalk areas to allow for pedestrian access to pedestrian push buttons, however four-foot minimum pedestrian clearance around poles must be provided on the sidewalk.

For standard sidewalks that are attached to the roadway curbing (monolithic), all utility poles, guy wires, cabinets, hydrants, signs and other above ground facilities shall be located behind the sidewalk, within the easement for public utilities and public facilities, where possible. If such is not possible, the conflicting facility shall be located such that there is a minimum of four feet clear space for pedestrian use of the sidewalk. Where it is necessary to widen the sidewalk beyond its standard width to attain the 4-foot minimum clearance, the widened area shall extend a minimum of 10 feet beyond each side of the obstruction and a 10-foot taper on each side of the widening shall be provided.

Where sidewalks end within infill areas and a gap in the sidewalk exists, provided that right-of-way is available, temporary sidewalks shall be constructed to fill the gap to the satisfaction of the Director. Otherwise the sidewalk shall be extended beyond the end of the

property for a minimum distance of 6 feet or if approved by the Director a cut-off wall may be constructed at the end of the sidewalk and appropriate connection to the existing public street shall be provided for pedestrians traveling beyond the end of the sidewalk.

The meandering sidewalks will be designed to the specifications in Standard Drawing ST-38. For Case I, the sidewalk will have at least a 2-foot wide straight path down the center and a 10-foot minimum distance at the back of walk between landscaped areas. A Type 2 curb & gutter shall be required along the entire length of meandering sidewalk. For Case II, the sidewalk will have no abrupt changes in direction and will be constructed using only tangents of any length and inside radii of at least 150 feet. Type 2 curb & gutter shall be required at all locations where the sidewalk is separated from the curb. The Director may approve other configurations of meandering sidewalks to save existing trees or for special design applications.

4-18. PEDESTRIAN LANES AND TRAILS

Pedestrian lanes and trails within a development shall conform to the current version of the County's Bicycle, Pedestrian, and Trails Master Plan and these Standards.

Bollards placed as trail entrance barriers shall conform to Standard Drawings L-20 and L-21.

4-19. TRENCHING IN EXISTING PAVED ROADWAYS

Crossings, other than perpendicular crossings of existing roadways, and all trenching in high traffic locations shall provide for select backfill material and increased structural section depth over the standard for that particular roadway. Boring may be required on 68-foot, and 78-foot streets where, in the opinion of the Director, high peak hour traffic volumes or other unusual conditions exist. The Applicant shall be required to coordinate trenching work schedules to avoid cutting new pavement in instances where repaving is planned by the County.

No pavement cuts or trenching will be permitted on any street that has been constructed within the last five years or has been overlaid within the last three years without written special approval of the Director. Special pavement restoration will be required for cuts made in streets that have been constructed or overlaid within a period of five or three years, respectively, prior to the time of work. See Standard Drawings ST-1 through ST-8.

4-20. TESTING OF MATERIAL

Testing of materials to be utilized in work performed under the Standard Construction Specifications shall be performed in accordance with the methods of the Laboratory of the State of California, Department of Transportation, and per ASTM D1557. Signed copies of the test results, as required, shall be submitted to the Director. Test results shall show clearly the name of the individual and firm performing the tests, as well as the name of the project, the date of sampling, and the date of testing. Tests performed by the County will be charged to the Applicant as part of inspection billing.

The tests indicated in the Standard Construction Specifications will be the minimum required. In large developments, or those developments presenting special problems, a more comprehensive and extensive testing program may be required. Such conditions will be evaluated and an appropriate testing program prescribed on an individual basis. Two

copies of any Federal Housing Administration required soils tests shall be submitted with proposed plans.

4-21. STREET NAME

All roads and streets within a development shall be named by the Applicant subject to the approval of the Director. No duplication of names already in use or previously proposed will be permitted. Sound-alike names or names with more than 13 spaces are not acceptable. Street names at intersections shall be continued on both sides of the intersecting streets unless approved by the Director.

Street name signs shall be furnished and erected by the Applicant. Street name signs shall conform to the requirements of the Standard Construction Specifications and these Improvement Standards.

Street names and street name sign locations shall appear on plans submitted for approval. Sign details shall be as shown on the Standard Drawings T-7 and T-8.

Block numbering shall be required on all street name signs.

Private roads shall have street name signs installed in accordance with Section 4- 22 below. Street name signs for private roads may be the same as for public streets (see Standard Drawing T-7) except the words Sutter County must be omitted. Also, a separate additional sign must be placed on the same post saying "Not a County Road" which shall be 24” x 24”, and have 1-3/4 inch high white letter on a green background.

4-22. STREET SIGN LOCATION

Street sign locations shall conform to the following:

A. Two street name sign installations (with four sign plates on each post) are required at each intersection where one or both of the intersecting streets has a right-of-way width of 68 feet or greater. At a four-way intersection, the installations shall be located on both far right-hand corners of the intersection relative to the street having the greater right-of-way width or relative to the street with greater traffic volume if right-of-way widths are equal.

   At a "T" intersection, the first installation shall be located on the far right-hand corner of the intersection, relative to the through street, and the second installation shall be located adjacent to the through street at a point in line with the centerline of the terminating street. One sign plate shall be omitted from the standard four-plate installation at the "T" intersection sign locations where an approach street does not exist.

B. One street name sign installation (with four sign plates on each post) is required at each intersection where both intersecting streets have a right-of-way width of less than 68 feet. At a four-way intersection, the installation shall be located on one of the far right-hand corners of the intersection relative to the street having the greater right-of-way width or relative to the street with greater traffic volume if the right-of-way widths are equal. At a "T" intersection, the installation shall be located on the far right-hand corner relative to the through street.

C. For highways with frontage roads, the street name sign installations shall be located in the divider strip between the frontage road and the main traveled lanes of the highway. All other requirements shall be as outlined above, except that only one sign will be required (in the divider strip in line with the centerline of the minor street) when there is no opening in the divider strip for access to the main highway.

D. Standard Drawings T-9 through T-12 show placement details for street name signs. On streets having a right-of-way width of 68 feet or greater, the street name sign installations are to be located adjacent to the street with greater traffic volume at the end of the curb return. On streets with right-of-way widths less than 84 feet, the street name sign installations are to be located at the midpoint of the curb return.

E. Street name signs shall be placed on streetlight poles wherever possible, in accordance with Standard Drawings T-10.

F. At signalized intersections, street name signs shall be placed on all four corners of four-legged intersections and at three locations on "T" intersections. In addition, internally illuminated street name signs are to be installed on their own clamp-on steel mast arms, 9'-3" in length, 3-5/8' in diameter, mounted at the 27-foot level.

4-23. TRAFFIC SIGNS

All cul-de-sac and dead-end (stub) streets greater than 300 feet in length and all cul-de-sac and dead-end (stub) streets less than 300 feet in length where the curb at the centerline of the end of the street is not visible from the standard driver's eye position at the entering intersection shall be posted with a standard 30" x 30" "Dead End" (W14-1) sign. The bottom of the sign shall be a minimum of 7 feet above the sidewalk. The standard location for the W14-1 sign is on the right hand side at the tangent point of the corner rounding, 6 inches (minimum) from the back of sidewalk. Consideration shall be given to property lines and street light locations when determining the final location of the sign.

All Fire Department approved turn-arounds on street ends shall be posted with a standard 30" x 30" "End" (W31) sign, and a standard 18" x 18" red Type N marker. The red Type N marker shall be mounted below the W31 sign, on the same post. The top of the red Type N marker shall be a minimum of 4 feet above the sidewalk. The standard location for the W31 / red Type N installation is in the head on position, facing traffic, approximately 3 feet to the right of the prolongation of the street centerline, 6 inches (minimum) from the back of sidewalk.

All roads and streets within a development and new street frontage improvements shall include necessary traffic signs and pavement striping and shall be installed by the Applicant. Applicant may request County forces to install traffic signs and striping at Applicant expense. The Applicant shall not proceed to open the roads or traffic lanes until required traffic controls are in place and traffic safety is ensured. Traffic signing and striping shall conform to Caltrans Standard Specifications. A traffic signing and striping plan, if applicable, shall be included in the plans submitted for approval by the Director.

4-24. PERMANENT BARRICADE

Where improvements are temporarily terminated on a street proposed to be extended in the future, the improvements shall include a permanent type barricade at the end of the street extending completely across the right-of-way to prohibit access and to serve as a warning to the public. The barricade shall be constructed, erected, painted, and signed in accordance with Standard Drawing ST-44 through ST-46. When necessary, barricades may be lengthened by making the 2" x 12" plank continuous with splicing at the posts.

Gates may be required where streets stub into public park areas or like areas.

Timber barricades with SW-44 signs and Type "L" markers in accordance with the Standard Drawing ST-45 shall be required where partial street widening terminates at the far end of the widening in the direction of traffic. If the ground beyond the pavement constriction is free of fixed objects and relatively flat, the Director may approve the placement of delineators on 6-foot spacing as shown on the Standard Drawing in lieu of a timber barricade and signs.

Sidewalk barricades shall be constructed at the end of sidewalks where pedestrians cannot safely continue beyond the end of the sidewalk. Sidewalk barricades shall conform to Standard Drawing ST-46. Where sidewalks improvements are terminated, an A.C. sidewalk conform shall be constructed in accordance with the Standard Drawing ST-39. A permanent barricade shall also be constructed at the end of A.C. sidewalk conform if the conform abuts a drainage ditch, a fill slope steeper than 1:20 or other surface that would pose a hazard to pedestrians.

4-25. FENCES

The location for fences or walls along public streets shall conform to the requirements of the County of Sutter County Zoning Code and these Standards (Refer to Section 6, 'Sound Barrier Design"). Fences or walls shall not encroach upon visibility easements required by Section 4-8 and Standard Drawings ST-29 and ST-30. All fences and walls are subject to the visibility requirements of the Sutter County Ordinance Code Table: 1500-06-2 Development Standards and Exceptions.

Fences and walls may require modification to accommodate street light poles and/or foundations.

When a barrier fence is required by the conditions described in Section 4-16, "Barrier Curb," the barrier fence shall be 30 inches high, shall be chain link type or another type required by the Director, shall be placed at the back of sidewalk, and shall conform to the visibility requirements described herein.

4-26. PRIVATELY OWNED BRIDGE

A bridge intended for the sole use of the occupants of a multi-family type development or any bridge on a private road shall be designed to withstand the greater of an H-20 load and the loading conditions for fire trucks and garbage trucks. Other design features of the bridge, including but not limited to widths, railings, clearances and materials shall be in conformance with County and State Standards. A soil report prepared by a qualified soil engineer shall be required along with design calculations signed by the Engineer of Record

including the registration number. Maintenance and operation of privately owned bridges shall be the responsibility of the private property owner.

4-27. VEHICLE ACCESS AT STREET TERMINATIONS

Vehicular access shall not be permitted from the end of a stubbed street. To obtain vehicular access, the street must be extended through the property or properly terminated with a standard cul-de-sac bulb. In cases where no access is provided at the end of the street, the Director may approve a modified cul-de-sac (See Section 4-10 of these standards).

4-28. TRAFFIC CALMING DEVICES

Reserved

4-29. ROOT BARRIERS

Reserved

SECTION 5

STREET LIGHT DESIGN

5-1. STREET LIGHTS REQUIRED

Street lights shall be required for all lots and parcels being developed or constructed upon unless excepted by Section 5-2. In addition, street lights may be required for lots and parcels containing existing structures which are being improved or altered, depending on the nature and extent of the work. Illustrations of street lights generally required are shown in the Standard Drawings SL-1 to SL-18.

All Street lights must be powered by a metered service as approved by the Utility Company.

5-2. STREET LIGHTS NOT REQUIRED

Street lights shall not be required under the following circumstances:

A. Single family residential subdivisions having an average lot street frontage of more than 125 feet will not be required to install a street light system along the streets but shall, as a minimum, be required to install street lights at all intersections, cul-de-sacs, and other locations described herein or deemed by the Director to be essential for safety.

B. For planned residential, commercial, and industrial developments where the internal streets are not offered for dedication, a street lighting system will not be required for the internal non-dedicated streets, but shall be provided by the Applicant on the external public street frontage.

5-3. APPLICANT'S RESPONSIBILITY

Existing street lights which must be relocated or repositioned because of the construction of new streets or driveways into a development shall be the responsibility of the Applicant.

A new service enclosure with a step-down transformer, required because of the modification, replacement, or relocation of an existing utility service pedestal, shall be the responsibility of the Applicant. The Applicant shall also be responsible to ensure that power shall remain to existing street lights during the period of any such modification, replacement or relocation of an existing utility service pedestal.

It shall be the responsibility of the Applicant to ensure that the power shall remain to the existing street light system until the new street light system to replace it is completed and functioning correctly.

5-4. UTILITY COMPANY AUTHORIZATION

A written notice from the serving utility company, stating that line clearances and service have been checked and are adequate, shall be submitted to the Director for all developments.

5-5. GENERAL PLAN DETAILS

The plans shall show and identify all street lights to be installed, all existing lights in the immediate vicinity of the project, all conduit and conductor runs, service points, trees, and all applicable provisions and details specified in these standards.

On subdivision plans, the street lights shall be shown separately. In addition to the above, the following shall be required on the street light portion of subdivision plans, even though duplications may be involved:

- A vicinity map or equivalent
- Utility poles and public utility easements
- Names of adjacent subdivisions
- Intersecting property lines of adjacent properties
- A "Symbols" legend conforming to Standard Drawing SL-1
- A north arrow and appropriate scale (1" =10' to 1" =100')
- All existing street lights on both sides of any streets
- All new tree installations shall be more than 10' from street lights

5-6. DESIGN STANDARDS

Street lighting shall be designed in conformance with these improvement standards, and the "American National Standard Practice for Roadway Lighting" of the American National Standards Institute, except that the average horizontal maintained foot candles for the various street classifications shall be as shown on Standard Drawing SL-2. Data and calculations, including a photometric plan, supporting the satisfaction of the above requirements shall be submitted for review, or the predetermined design standards included herein shall apply.

5-7. STREET LIGHT TYPE

Street lighting designs shall reference the type of light shown in the Standard Drawings and the County's Approved Equipment List.

A. Decorative Street Lights

1. Decorative streetlights must be approved during the planning process in the Sutter County General Plan or specific plan.

2. When decorative type streetlights are designated by type in these standards or in an approved County plan not yet incorporated into these standards, the Applicant shall supply additional complete streetlight assemblies (electrolier, luminaire, glassware, etc.) to the County for future street light replacement. The minimum number of replacement street lights (spares), by series and type, to be supplied to the County shall be 2% of the lights being installed with any fractional percent rounded up to the next whole number. Developments with less than 10 streetlights in total

shall provide 1 spare. A note shall be included on the street light plan sheet indicating the requirement for spares as detailed above.

3. The Applicant shall be required to submit design calculations for the foundation, and pole spacing, including photometric calculations and plots from an appropriate computer program, if not already provided in these standards.

B. Equipment Type

Materials and equipment shall be purchased as required to meet these standards:

1. County's Approved Equipment List: The County has determined that for ensuring aesthetics and durability, minimizing inventory costs, and expediting repairs, standardization is in its' best interest and maintains an approved equipment list of specific manufactures and models to be used in particular zones.

2. Substitutions to County's Approved Equipment List: Substitutions will not be considered for a particular project. If a distributor or manufacturer has a streetlight product with the exact same visual appearance specified for a zone; it may submit the item to the County for evaluation. The County may take up to 90 days typically to consider a new streetlight manufacturer. The streetlight assembly will be evaluated against the criteria established by the Director. If the streetlight meets all the criteria and is evaluated essentially the same in appearance, quality, and ease of servicing requirements, it may be added to these specifications at the Director's discretion.

5-8. STREET LIGHT DESIGN DETAILS

Design details for street lights shall conform to appropriate Standard Drawings and as follows:

A. Intersections – Intersections shall have at least one street light

B. Cul-de-sacs – All cul-de-sacs shall have a street light within the bulb.

C. Pedestrian Lanes – Street lights shall be placed at both ends of pedestrian lanes.

D. Spacing – Maximum street light spacing, measured along the street centerline, shall conform to Standard Drawings, except on arterial and thoroughfare streets with a 1,000–foot or smaller radius horizontal curve, in which case the maximum spacing is 170 feet. Note that light spacing for 68-foot, and 78-foot streets, the spacing dimension is based on one-side of the street and two lights are placed at each longitudinal location (either with poles on opposite sides of the street or tandem poles in the median). Spacing on all other streets is based on a staggered arrangement, and is measured between poles on alternating sides of the street. Maximum spacing may be adjusted as long as illumination criteria are shown to be satisfied on a photometric plan and any additional supporting data, with approval of the Director.

E. Street Light Poles – All street light poles shall be of galvanized steel except as provided for by Item F below. All pole construction and materials shall conform to the standards outlined in the Caltrans Standard Construction Specifications. and the Standard Drawings referenced therein. Pole materials shall be identified on the plans or in the special provisions.

Identification numbers are assigned by the County at acceptance of the improvement plans. The identification number of each pole shall be labeled on the pole prior to construction acceptance by the County. Labels shall be 2" letters and/or numbers and shall be applied vertically on the pole from top to bottom. The bottom of the lowest letter and/or number shall be ten feet (10') above the ground surface. Pole identification numbers shall face 45 degrees to oncoming motor vehicle traffic..

F. Street Lights on Existing Utility-Owned Poles – Where there are permanent existing (or necessary planned) utility-owned poles adjacent to the roadway, the street lights may be installed upon the utility pole in lieu of the poles required on an exception basis if approved by the Director. Should the utility pole option be requested and authorized, the following shall apply:

1. Spacing of lights shall be varied to meet locations of existing utility poles, but shall not exceed the maximum spacing specified by Standard Drawings Street light mounting heights shall be as shown on the Standard Drawings. All luminaries shall have wattages relating to the street classification requirements shown on Standard Drawings.

G. Luminaires - All street lighting luminaires shall be light emitting diodes (LED) unless otherwise directed by the County. The type of street light and the appropriate wattage shall be specified on the plans. All luminaries shall conform to the standards outlined in the Caltrans Standard Construction Specifications. Light distribution shall be American national Standards Institute (ANSI) Type III, unless otherwise specified by the County, and luminaries shall be cut off-type unless specified otherwise by the Director.

H. Service – All street light systems shall have underground service provided through a utility company approved metered service pedestal. Service voltage shall be shown on the plans. Service voltage shall be 120 volts, except service voltage may be 277 volts when 120 volt service is not available. A step-down transformer shall be provided when service voltage is not 120 volts. Service points shall be provided within a Public Utility Easement immediately adjacent to the right-of-way, or within the right-of-way, and at a point which is as reasonably near as possible to the serving utility power source. Street light circuits shall have a dedicated service meter and shall not be wired to bypass the meter.

I. Pull-boxes – All pull-boxes, including the size, shall be shown and identified on the plans. Pull-boxes shall be installed at all locations where more than two conduit runs intersect, where conduit runs are more than 250 feet long, where shown on County Standard Drawings, at critical angle points, at property lines at the end of the required conduit run to the property line (see Section 5-8 L, "Conduit"), behind each light when No. 4 A.W.G. conductors are used, and at such locations

ordered by the Director. Normally a No. 3-1/2 pull-box will be allowed when three or fewer conduits of 1-1/4" or smaller size are involved or at the end of the required conduit run to the property line (See Section 5-8 L, "Conduit").

J. Conductors – All conductors, including quantity and size, shall be identified on the plans. Unless otherwise specified, conductors shall be single conductor, solid or stranded copper, sized in accordance with these standards and the National Electrical Code.

The minimum conductor size from the service point to the service enclosure shall be No. 8 A.W.G. The size of each conductor from the service enclosure to the luminaries shall be such that the voltage drop along each circuit will not exceed 7% for 2-wire and 6% for 3-wire systems of the service voltage to the farthest luminaire. The service voltage to be used is 120 volts. Calculations shall be submitted substantiating the design criteria for every circuit. Calculations shall also be submitted showing the total load in amperes of each circuit at the service enclosure.

K. Photo Cell – All street lights must be controlled by a photo cell. Multiple street lights may be controlled by a single photo cell receptacle provided on the nearest suitable luminaire to the service enclosure for multiple service systems.

L. Conduit – All conduit runs, including the size, shall be shown and identified on the plans. The conduit size shall be determined using Standard Drawings SL-13 as a guideline, with the minimum size being 1-1/2" diameter conduit.

1. The design may include more than two circuits in a conduit if the conductors for each circuit (2-wire) or set of circuits (3-wire) are identified by conductor insulation which is a solid color or a basic color with a permanent colored strip. The identification strip shall be continuous over the entire length of the conductor.

2. New development shall install 2" minimum diameter conduit, or larger as required, with one No. 10 A.W.G. stranded pull-wire from the last light on each end of the system to the adjacent property line, where the adjacent property has no existing street lighting system.

M. Electrical Equipment and Work – Control and switching equipment and fusing of all circuits shall meet the requirements of the National Electrical Code, the Basic Electrical Regulations, Title 24, Part 3, of the California Administrative Code, the rules of the National Board of Fire Underwriters, and the County of Sutter.

5-9. LAYOUT PLANNING

Layout planning is the determination of street light locations between control points. Control points are proposed street light locations at street intersections in accordance with Section 5-8, and appropriate Standard Drawings; and existing street lights. The purpose of layout planning is to establish an overall uniform street light system meeting minimum requirements. On 68-foot, and 78-foot, spacing dimensions resulting from layout planning shall apply to distances between street lights on one side of the street. On

all other streets, layout planning dimensions shall apply to both sides of the street. The procedure for layout planning is outlined as follows:

A. Identify the nearest intersections each way from the street light locations being planned. Determine the location of the street lights at the intersections in conformance with the design standards in Section 5-8.

B. Identify any existing street lights situated between the intersections.

C. Determine the distance between the adjacent designed intersection street lights and/or adjacent existing street lights, whichever are nearest to the street light locations being planned.

D. Divide the distance into equal spaces between lights not to exceed the maximum spacing requirements specified in Section 5-8.

E. Compare the light locations to intersecting property lines, driveways, pedestrian lanes, and other obstructions as follows:

    1. If the location falls close to a property line and it can be adjusted to the property line while staying within the maximum spacing allowed, then the adjustment shall be made.

    2. Generally, street lights shall be situated at intersecting property lines for residential lots and parcels with minimal frontage (75 feet or less). The light spacing may have to be unbalanced, with additional lights being added to attain this and still comply with the maximum spacing allowed.

    3. Street light locations shall be adjusted to miss driveways, existing utility poles, trees, tree wells, and other obstructions by at least five feet.

F. Street light locations on streets wider than 68 feet shall be adjusted, when possible, to obtain a more uniform light distribution if there are existing street lights on the opposite side of the street in accordance with Section 5-8 D.

SECTION 6

SOUND BARRIER DESIGN

6-1. LOCATION REQUIREMENTS

Sound barriers may be required along the rear and side property lines of residential developments adjacent to freeways, major highways and other ground level noise elements in order to achieve the noise objectives of the Noise Ordinance, or as required by the project conditions of approval. If the residential development abuts a County-owned landscape corridor or public right-of-way, the entire sound barrier, including footings, shall be located on the publicly owned side of the property line, unless otherwise required by a condition of development. In cases where the County does not own or control the adjoining property, the sound barrier shall be located on the residential development side of the property line.

6-2. DESIGN

The sound barrier shall be designed to obtain a 60 LDN at the affected property line or as required by the Director.

The sound barrier design shall include plan details and calculations prepared and signed by an appropriate Engineer of Record.

Sound barriers shall be designed for a minimum longevity of 30 years.

Sound barriers constructed along freeways, or at the back of sidewalk along the outside of curved major streets, shall incorporate a vehicular barrier-type design element to minimize the potential for vehicles penetrating the wall. Other locations that represent a higher potential for run-off-road accidents shall be required to incorporate a Caltrans Type 50 (or equivalent) barrier-type design element.

Open cells in hollow-type sound barriers shall be grouted on post-tensioned wall systems as required by the Director.

6-3. PLAN REQUIREMENTS

All construction details for sound barriers, including the locations and limits, shall be shown on the site improvement plans.

6-4. MAINTENANCE FUNDING

For all sound barriers to be located within a County owned parcel and/or public right-of-way, the Applicant shall provide a list of quantities and descriptions of the sound barrier and any accessory improvements to be maintained by the County. This information will be used by the County to determine the appropriate maintenance funding mechanism (i.e. – tax zone allocation within a special tax district) that may be applied to the project. No sound barriers shall be accepted by the County for maintenance until an appropriate funding mechanism has been established to the satisfaction of the Director. The funding mechanism shall include an annual escalator, such as the CPI.

SECTION 7

TRAFFIC IMPACT ANALYSIS GUIDELINES

7-1. INTRODUCTION

Traffic Impact Analysis Guidelines shall conform to the requirements set forth in Sutter County's General Plan or most recent General Plan Update.

SECTION 8

RESERVED FOR FUTURE USE

SECTION 9

STORM DRAINAGE DESIGN

9-1. COUNTY POLICY AND REQUIREMENTS

A. The planning, design and construction of drainage facilities and other related appurtenances to be owned, operated and maintained by Sutter County shall comply with these standards herein referred to as the "Standards".

B. These design and construction standards are intended to provide minimum standards for design, construction and repair of all drainage facilities/infrastructure within Sutter County.

C. Designs shall be consistent with County plans including the General Plan, specific plans, master plans, and capital improvement plans/programs. Specific requirements for the improvement and construction of drainage facilities are set forth, in order of precedence, in the following documents:

- Sutter County Ordinance Codes
- Sutter County Floodplain Management Policies
- Sutter County Improvement Standards (this document)
- Caltrans Standard Construction Specifications

D. The storm drainage system design shall be based on a drainage study that describes the improvements necessary to mitigate any adverse impacts of changed runoff caused by the project. The design of a new storm drain system shall include consideration of the downstream channel or storm drain. The Engineer of Record shall show that the existing storm water system can convey the proposed drainage without adverse flooding, erosion or other water quality impacts to upstream, downstream or adjacent facilities or areas; or that such facilities or areas are being improved or protected to the point where the drainage can be conveyed without adverse impacts. Improvements shall not cause a net loss of storage, nor an increase in velocity, of drainage water within the 100-year floodplain.

E. All submitted studies, plans, and calculations shall be signed and stamped by a Registered Civil Engineer prior to approval and all work shall be in accordance with these design standards and good engineering practice.

F. The Director shall decide all questions of interpretation of "good engineering practice," guided by the standards and manuals of the discipline in question.

G. All public drainage facilities shall be located within the County's right-of-way, within a parcel owned by the County (fee title parcel), or within an easement, unless otherwise approved by the Director. Adequate right-of-way and/or easements shall be required to provide access for installing, repairing, maintaining, improving, operating, constructing, and reconstructing of drainage facilities Any area designated for public drainage facilities, including overland flow conveyance routes, not confined to existing public right-of-ways shall be dedicated as a fee title parcel to the County. In certain cases, the Director may approve alternate forms of dedication.

The County will not accept any conservation or other conditional easement on drainage courses to be conveyed to the County.

H. All new structures shall be protected from the 100-year (1 %) flood event. Certified pad elevations, per Section 10-8 of these Standards, must be submitted with the application for building permit, if not already on file with the County. All finished floor elevations shall be set at least one foot (1.0') above all sources of 100-yr flooding, unless otherwise required pursuant to Sutter County Ordinance Code. If the elevation of the 100-year (1%) flood event is not available, it must be calculated by a Registered Civil Engineer, to the satisfaction of the Director.

I. Prior to approval of improvement plans for projects that impact protected environmental resources, the applicant shall provide copies of all permits required by outside regulatory agencies.

J. Private storm drain systems shall be clearly noted on the plans and maintenance responsibilities shall be described in a document recorded on the property.

K. Storm water quality treatment facilities shall be provided for new and redevelopment projects in accordance with Section 11 of these Standards.

9-2. STORMWATER DRAINAGE SERVICES

The County maintains public drainage facilities that serve Sutter County Water Agency – Drainage Zones and Gilsizer County Drainage District. New development in areas outside the existing service areas shall be required to form a benefit assessment district or annex to a maintenance district for storm drain services. Development in locations where drainage service is provided by another agency, such as a Reclamation District, will be required, as a minimum, to meet that agency's regulatory requirements.

9-3. DEFINITIONS

The following terms, abbreviations or definitions shall apply and the intent and meaning shall be interpreted as stated herein wherever they are encountered in these Standards or in any documents or instruments referenced by these standards unless otherwise approved by the Director.

ASTM	American Society for Testing and Materials.
Base Flood	100-year (1% annually) flood event pursuant to the Sutter County Floodplain Management Ordinance or any source of 100-year flooding as determined by Public Works.
Certified Pad Elevation	As defined in the Grading Section of these Standards
Director	Sutter County Development Services Director or his/her designee.
CLOMA/LOMA	Conditional Letter of Map Amendment/ Letter of Map Amendment.

CLOMR/LOMR	Conditional Letter of Map Revision/ Letter of Map Revision.
County	Sutter County
Design Storm	The design runoff
Drainage Easement	A strip of land dedicated, condemned or reserved for drainage use.
Drainage Manual	The Sacramento City/County Drainage Manual consisting of five volumes dated December 1996 as revised or updated. Volume 2 contains the Hydrology Standards with graphs and charts cited in these standards.
Freeboard	The vertical distance from the design feature (top of a channel or bottom of bridge, etc.) to the water surface elevation at the design condition.
Federal Flood Zone	An area at risk of flooding as determined by the FEMA Flood Insurance Rate Maps
FIRM	Flood Insurance Rate Map
FEMA	Federal Emergency Management Agency.
Interim Facility	A temporary facility that is constructed and maintained by the Applicant or their designee.
Local Flood Zone	An area possessing a flood risk in the base flood, not defined on the FEMA FIRMs.
NFIP	National Flood Insurance Program.
One Hundred-Year Storm	A hydrograph created indicating runoff over time for a storm with a one-percent statistical probability of annual recurrence.
Overland Release Path	An alignment that allows the passage of floodwater through a development without damaging structures.
Reimbursement Agreement	An agreement between Sutter County and Applicant identifying eligible reimbursement costs.
Right-of-Way	A strip of land dedicated, condemned or reserved
SCWA	Sutter County Water Agency, a political subdivision of the State of California
Specifications	Caltrans Standard Construction Specifications, latest version.
Standards	These storm drain design standards.
Ten-Year Storm	A hydrograph created indicating runoff over time for a storm with a ten-percent statistical probability of annual recurrence.

Trunk Drainage.....Mainline drainage from an area 30.00 acres or greater.

9-4. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD PROGRAM

A. Sutter County is a participant in the National Flood Insurance Program and all development in the County shall comply with the regulations of the Federal Emergency Management Agency (FEMA) and the County's Floodplain Management ordinance.

B. Fill for the removal of land from the FEMA 100-year floodplain, where building pads will be created, must comply with the FEMA standards and must be compacted to 90 percent (90%) of the maximum density obtainable with the modified proctor test method (ASTM Standard D-1557).

C. These regulations do not preclude the County from requiring additional standards to protect the public from projected flood runoff.

9-5. DRAINAGE FEES AND CREDITS

New developments that connect or discharge stormwater to public drainage facilities are required to participate in a zone of benefit drainage district or other public entity for financing the construction and maintenance of a storm drainage capital-improvement system. Developments in an existing or future zone of benefit drainage district are subject to payment of a drainage impact fee, assessment, or other financing mechanism to facilitate the construction and maintenance of a storm drainage system. Developments may be reimbursed for the construction of storm drainage facilities that benefit other properties. Reimbursement agreements shall be signed by the developer, and notarized, before approval of improvement plans. An approved zone of benefit study will define the drainage facilities eligible for reimbursement, the cost of those facilities, and the fair share cost for each property within the zone. Developers may be required to prepare the zone of benefit study. Maintenance assessments shall also include replacement costs of the capital improvement system.

9-6. IMPACTS TO EXISTING DRAINAGE

All drainage must enter and leave the project area at its existing line and grade, unless otherwise approved by the Director. Concentration of flows on adjacent properties is not allowed without appropriate mitigation, including but not limited to:

1. Energy dissipation.
2. Erosion control.
3. Acquisition of offsite easements and construction of offsite drainage facilities.

No net increase of peak flows is allowed. And no net adverse impact for volume, quality or duration is allowed. All impacts must be mitigated in the project area or lands acquired for mitigation by the project.

9-7. LOCATION OF FACILITIES AND LAND DEDICATIONS

A. All storm drain facilities must be in the road right-of-way or parcel owned by the County in fee. Such parcels must be a minimum of 25 feet wide, and sufficiently wide to accommodate normal construction equipment, and shall be easily accessible to such equipment as necessary to construct, operate, maintain and reconstruct the facility. These parcels shall be dedicated to Sutter County, and such parcels shall not split along property lines.

B. Where improvements outfall onto an adjacent property (such as day-lighting ditch profiles) dedication in fee to the County is required.

C. In the event necessary permanent offsite parcels or easements cannot be acquired through negotiation, the Applicant may request that the County consider condemning necessary rights-of-way. The person, firm, or corporation requesting such condemnation shall be required to enter into a written agreement to pay all costs and expenses of the condemnation.

D. Acquisition and maintenance of temporary construction easements outside of the limits of the subdivision shall be the sub-divider's responsibility.

E. Drainage parcels, right-of-ways, or easements (if authorized) for drainage facilities, shall meet the following criteria:

1. Minimum width of the parcel/right-of-way shall be twenty-five feet (25').

   For closed conduits, dedications shall have a minimum width equal to the greater of twenty-five feet (25') or the required trench width plus two feet (2') of additional width for every foot of depth as measured from the bottom of the pipe to finished grade with accommodation of a minimum set back distance from the conduit to the edge of the parcel/right-of-way of ten feet (10').

2. Parcels or drainage easements for open channels shall have sufficient width to contain the ultimate channel; as well as, fencing and a twenty-foot (20') service road. Additional width shall be provided to allow equipment to safely negotiate the service road for the purposes of construction, operations and maintenance activities. Exceptions may be made on a case-by-case basis depending on the layout of adjoining roadways and recreational paths, with approval from the Director. See also Section 9-22 "Site Requirements" of these Standards.

9-8. DRAINAGE DESIGN CAPACITY

A. All drainage systems (including open channel roadside ditches) shall be designed to accommodate all planned development of the entire upstream watershed. Closed conduit systems shall be designed to accommodate the appropriate design storm event flows as determined using the methods prescribed in Section 9-10.

B. All other open channel drainage systems shall be designed to carry the 100-year frequency design storm, using the worst case duration and providing for at least 1 foot of freeboard.

9-9. DESIGN SUBMITTALS

A. A reconnaissance level or suitability level drainage study may have been required and prepared as part of a development application. As part of the design of a drainage system, a comprehensive drainage study must be prepared for review and acceptance by the County. The comprehensive drainage study shall include but is not limited to: definition with mapping of the existing watersheds; a detailed pre- and post-project hydrologic and hydraulic analysis of the project and project impacts; definition of the local controlling 100-year frequency water levels existing and with project; and the proposed method of flow conveyance with adequate supporting calculations. The study shall include any proposed improvements to mitigate the impacts of increased runoff from the project and any change in runoff including quality, quantity, volume, and duration. The study shall be consistent with the ultimate upstream development in the General Plan and any specific, area, or master plans; and shall conform to the Sutter County Improvement Standards. It shall demonstrate that the proposed methods of flow conveyance mitigate the potential project impacts. The Study must be completed and stamped by a Professional Engineer, and determined by the County to be comprehensive, accurate, and adequate.

B. The drainage study submitted shall include, as a minimum, the following information and computations:

- Report cover with address, APN, Planning Project number and name of project as contained in planning documents.
- Purpose, objectives, and established criteria for project study.
- Table of contents and List of Appendices and Figures.
- Topographic map showing existing and proposed ground elevations.
- Existing conditions, hydraulic features, environmental constraints, and easements.
- Hydrologic and hydraulic methods utilized in the modeling.
- Electronic copy of modeling files (if applicable),
- A shed map including on-site and off-site watershed boundaries draining onto the site. It shall also include land uses, total and sub-shed areas in acres, plus proposed and existing pipe network nodes labeled as they are in the electronic model.
- Quantity of flow (cfs) to each drainage inlet structure with corresponding area and land uses that generates the quantity.
- Quantity of flow (cfs) in each pipe.
- Flow line elevation of each manhole or junction structure.

- Top of structure rim elevation.
- Location of downstream outlet and hydraulic grade line at this location.
- Hydraulic grade line of the systems.
- Pipe size, material type, class, length and slope.
- Channel dimensions, flow and water surface profile computations.
- Overland Release hydraulic computations for street and non-street releases.
- Analysis of permits required including type, processing time, and expected restrictions.

C. Improvement Plans must contain the additional features

- Pipelines plans and profiles with hydraulic grade line information
- Open channel plans and profiles
- Phasing plans if all improvements are not constructed in the same time
- An overflow release map showing surface elevations and flow paths
- Notes concerning agreements and dedications

The applicant shall obtain applicable California Department of Fish and Wildlife, U.S. Army Corps of Engineers, and other required state and federal permits. The conditions of such permits must be reviewed and conditions considered acceptable by the County, before the permit is issued.

9-10. DESIGN RUNOFF

A. Runoff shall be computed using one of the following methods:

- For calculations requiring development of a hydrograph(s), the Sacramento Method as described in Volume 2 of the Sacramento City/County Drainage Manual, HEC-1 or HEC-HMS may be used. Other appropriate methods may be used with approval by the Director.
- For calculations requiring only peak flows, the Sacramento Method Drainage Charts, Rational Method, or the hydrograph methods listed above may be used. Other methods may be used if approved by the Director.

B. For Sacramento Method calculations, the following apply:

- SacCalc is a Windows based software, available for free download that simplifies the preparation of HEC-1 models based on the Sacramento Method.
- The Nolte Method option presented in the SacCalc program may not be used.
- Sutter County is considered to be in Rainfall Zone 2.
- The runoff used in storm drain pipe design for drainage areas 160 acres and smaller may be computed from the Sacramento Method Drainage Charts included in these standards as Standard Drawings SD-1 to SD-4.

- Use Tables 9-1 and 9-2 to determine percentage of impervious cover, infiltration rates, and Basin 'n' values to be used in runoff calculations using the Sacramento Method and for use with the design flow curves in the Standard Drawings.

C. In drainage areas that contain multiple zoning, the runoff shall be computed from the following formula:

i. $Q_{Design} = Q_r + (Q_m - Q_r) A_m/A_t + (Q_c - Q_r) A_c/A_t$

ii. Where: Q_r=Flow from residential curve using total area of watershed.
Q_m=Flow from multiple family formula using total area of watershed.
Q_c=Flow from commercial curve using total area of watershed.
A_m=Area of multiple family zoning.
A_c=Area of commercial zoning.
A_t=Area in total.

D. The runoff to be used in drainage channel and channel/bridge design for watersheds exceeding the capacity of a 72" pipe, typically over 160 acres, shall be determined using the Sacramento Method, Volume 2 Hydrology Standards.

* Special design cases include: streets designated for emergency evacuation, high use public areas, areas with potential loss of life, areas with potential high property damages, areas with limited overland release, and areas lower than surrounding elevations

** Overland release flows may be determined from Figures 2-11 and 2-18 thru 2-23 of the Volume 2 Hydrology Standards for shed areas less than 160 acres.

TABLE 9-1. IMPERVIOUS COVER PERCENTAGES AND INFILTRATION RATES BASED ON LAND USE AND SOIL GROUP

Cover/Land Use from Volume 2 Hydrology Standards	Equivalent Sutter County General Plan Land Use Designation[1]	% Impervious Cover	Infiltration by Soil Group (in/hr)		
			B	C	D
Highways, Parking		95	0.14	0.07	0.04
Commercial, Offices	Commercial	90	0.16	0.08	0.05
Intensive Industrial	Industrial	85	0.162	0.082	0.052
Apartments, HDR	High Density Residential	80	0.165	0.085	0.055
Mobile Home Park		75	0.167	0.087	0.057
Condominiums, MDR	Medium Density Residential	70	0.17	0.09	0.06
Residential: 8-10 du/acre, Ext Industrial	Medium Density Residential	60	0.18	0.10	0.07
Residential: 6-8 du/acre, LDR, School	Low Density Residential	50	0.18	0.10	0.07
Residential: 4-6 du/acre	Low Density Residential	40	0.18	0.10	0.07
Residential: 3-4 du/acre	Low Density Residential	30	0.18	0.10	0.07
Residential: 2-3 du/acre	Estate Residential	25	0.18	0.10	0.07
Residential: 1-2 du/acre	Estate Residential	20	0.18	0.10	0.07
Residential: 0.5-1 du/acre	Estate Residential	15	0.18	0.10	0.07
Residential: 0.2-0.5 du/acre, Ag Res	Agriculture Rural Community, Agricultural Preserve (residential)	10	0.18	0.10	0.07
Residential: <0.2 du/ac, Recreation	Parks & Recreation	5	0.18	0.10	0.07
Open Space, Grassland, Ag	Open Space, Agriculture	2	0.18	0.10	0.07
Open Space, Woodland, Natural	Open Space	1	0.19	0.11	0.08
Dense Oak, Shrubs, Vines	Open Space	1	0.25	0.16	0.12

1. In some cases, the General Plan designation encompasses more than one cover/land use type from the hydrology standards. The equivalent cover/land use type should be selected based on the actual proposed densities when known; otherwise an average value should be used.

TABLE 9-2. BASIN 'N' VALUES BASED ON LAND USE

Cover/Land Use from Volume 2 Hydrology Standards	Equivalent Sutter County General Plan Land Use Designation[1]	% Impervious Cover	Channelization Description	
			Developed Pipe/Channel	Undeveloped Natural
Highways, Parking		95	0.030	n/a
Commercial, Offices	Commercial	90	0.031	n/a
Intensive Industrial	Industrial	85	0.032	n/a
Apartments, HDR	High Density Residential	80	0.033	n/a
Mobile Home Park		75	0.034	n/a
Condominiums, MDR	Medium Density Residential	70	0.035	n/a
Residential: 8-10 du/acre, Ext Industrial	Medium Density Residential	60	0.037	n/a
Residential: 6-8 du/acre, LDR, School	Low Density Residential	50	0.040	n/a
Residential: 4-6 du/acre	Low Density Residential	40	0.042	n/a
Residential: 3-4 du/acre	Low Density Residential	30	0.046	n/a
Residential: 2-3 du/acre	Estate Residential	25	0.050	n/a
Residential: 1-2 du/acre	Estate Residential	20	0.053	n/a
Residential: 0.5-1 du/acre	Estate Residential	15	0.056	0.096
Residential: 0.2-0.5 du/acre, Ag Res	Agriculture Rural Community, Agricultural Preserve (residential)	10	0.060	0.100
Residential: <0.2 du/ac, Recreation	Parks & Recreation	5	0.065	0.110
Open Space, Grassland, Ag	Open Space, Agriculture	2	0.070	0.115
Open Space, Woodland, Natural	Open Space	1	0.075	0.120
Dense Oak, Shrubs, Vines	Open Space	1	0.080	0.150

1. In some cases, the General Plan designation encompasses more than one cover/land use type from the hydrology standards. The equivalent cover/land use type should be selected based on the actual proposed densities when known; otherwise an average value should be used.

E. For Rational Method calculations, the following apply:

- May only be used for areas less than 100 acres.
- Use equation 9-1 to determine peak discharge

EQUATION 9-1 PEAK DISCHARGE

$$Q = CiA$$

Q = The peak discharge, in cubic feet per second (cfs)

C = Runoff coefficient, dimensionless (See TABLE 9-4 **RUNOFF COEFFICIENT (C) FOR RATIONAL METHOD**)

i = Design rainfall intensity, inches/hour, over a duration equal to the time of concentration (t) for the catchment (See EQUATION 9-2 or TABLE 9-3)

A = Catchment area, in acres

EQUATION 9-2 DESIGN RAINFALL INTENSITIES (Inches / Hr)

$$i_2 = 0.51(t)^{-0.583} \text{ (2-year)}$$

$$i_{10} = 0.79(t)^{-0.583} \text{ (10-year)}$$

$$i_{100} = 1.12(t)^{-0.583} \text{ (100-year)}$$

t = time in hours

t = time of concentration is defined as the time it takes for runoff to travel from the hydraulically most distant part of the catchment area to the point of reference downstream. Tables, charts, or formulas used to estimate flow velocities and travel times should be included in the appendix of the drainage study (sources should be referenced).

TABLE 9-3 DESIGN RAINFALL INTENSITIES (INCHES/HR)

Duration	5 min	10 min	20 min	30 min	1 hr	2 hr	3 hr	6 hr	12 hr	24 hr	2 day	3 day	4 day	5 day	6 day	8 day	10 day
i_2	2.171	1.450	0.968	0.764	0.510	0.340	0.269	0.179	0.120	0.080	0.053	0.042	0.036	0.031	0.028	0.024	0.021
i_{10}	3.363	2.245	1.499	1.183	0.790	0.527	0.416	0.278	0.186	0.124	0.083	0.065	0.055	0.048	0.044	0.037	0.032
i_{100}	4.768	3.183	2.125	1.678	1.12	0.748	0.590	0.394	0.263	0.176	0.117	0.093	0.078	0.069	0.062	0.052	0.046

TABLE 9-4 RUNOFF COEFFICIENT (C) FOR RATIONAL METHOD

	C_2 and C_{10}		C_{100}	
Ground Slope	**< 3%**	**> 3%**	**< 3%**	**> 3%**
Raw Land	0.10	0.20	0.13	0.25
Orchard / Farmland	0.20	0.37	0.25	0.46
Pasture / Hay	0.23	0.45	0.29	0.56
Rice	0.30	0.30	0.38	0.38
Residential 1acre >	0.25	0.35	0.31	0.44
Residential 1/2 acre	0.28	0.38	0.35	0.48
Residential 1/3 acre	0.30	0.40	0.38	0.50
Residential 1/4 acre	0.35	0.45	0.44	0.56
Residential 1/8 acre	0.40	0.50	0.50	0.63
Industrial	0.85	0.86	1.00	1.00
Commercial	0.89	0.89	1.00	1.00
Parking / Gravel	0.70	0.70	0.88	0.88
Parking / Asphalt Grindings	0.85	0.85	1.00	1.00
Parking / Asphalt	0.93	0.93	1.00	1.00
Parking / Concrete	0.95	0.95	1.00	1.00

Note: For a 100-year storm event, the C_{100} value is 1.25 times the C_{10} value, but in no case can the result exceed a value of 1.0. Sutter County assumes hydraulic soil group B for all areas of the County when using the Rational Method.

EQUATION 9-1 SUTTER COUNTY DESIGN RAINFALL DEPTHS (INCHES)

Depth = $(t)x0.51(t)^{-0.583}$ (2-year)

Depth = $(t)x0.79(t)^{-0.583}$ (10-year)

Depth = $(t)x1.12(t)^{-0.583}$ (100-year)

t = time in hours

TABLE 9-5 SUTTER COUNTY DESIGN RAINFALL DEPTHS (INCHES)

Duration	5 min	10 min	20 min	30 min	1 hr	2 hr	3 hr	6 hr	12 hr	24 hr	2 day	3 day	4 day	5 day	6 day	8 day	10 day
2-year	0.18	0.24	0.32	0.38	0.51	0.68	0.81	1.08	1.44	1.92	2.56	3.03	3.42	3.75	4.05	4.57	5.01
10-year	0.28	0.37	0.50	0.59	0.79	1.05	1.25	1.67	2.23	2.97	3.97	4.70	5.30	5.82	6.28	7.08	7.77
100-year	0.40	0.53	0.71	0.84	1.12	1.50	1.77	2.36	3.16	4.21	5.63	6.66	7.51	8.25	8.90	10.03	11.01

9-11. HYDRAULICS

A. Hydraulic Grade Line

1. Hydraulic grade line calculations for pipe storm drain systems shall begin at the worst case existing ultimate 10-year channel or basin water surface elevation. For the design storm, the hydraulic grade line shall be a minimum one-half foot (0.5') below the elevation of all inlet grates, or curb opening flow lines and a minimum one foot (1') below the elevation of manhole cover. The hydraulic grade line must be checked for the 100-year channel or basin water surface elevation, in order to determine the extent of flooding and the 100-yr water surface elevation throughout the area served by the basin.

2. The hydraulic grade line shall be shown on the plans.

3. For open channel systems, the hydraulic grade line shall be shown for the 10-year and 100-year storm events. In adjacent unimproved areas with no current development plans, the future gutter flow line is assumed one and one-half feet (1.5') lower than the natural ground elevation, for purposes of pipe hydraulics calculations. This also applies to in-fill development, where the elevation of the hydraulic grade line is not known.

4. In order to analyze the drainage system to determine if design flows can be accommodated without causing flooding at some locations or causing flows to exit the system at locations where this is unacceptable, the Engineer of Record shall

analyze the hydraulic gradient. A water surface profile calculation must be performed by the Engineer of Record for the entire system. The starting elevation for all hydraulic grade line calculations must be clearly noted on all plans and calculations. The source of this elevation must also be indicated (Master Plan, FEMA, etc.). If it is not readily available it must be calculated. If it is assumed, the basis of the assumption must be noted.

B. Friction Losses

Friction losses can be calculated two ways. These methods cannot be interchanged for design of the pipe system. One method shall be used throughout the analysis. The first method uses a conservative Manning's "n" value to account for minor losses.

1. Method 1

A water surface profile calculation must be performed by the Engineer of Record for all open channels, closed conduits and culverts.

The minimum 'n' values to be used in the Manning's formula shall conform to the following:

Precast Concrete Pipe	0.015
High Density Polyethylene Pipe	0.015
Polyvinylchloride Pipe	0.015
Concrete Box Culvert (within a closed conduit system)	0.016
Ribbed Metal Pipe	0.015
Concrete Cast-In-Place Pipe	0.015
Pavement Surfaces	0.016
Open Channel Fully Lined	0.018
Corrugated Metal Pipe 2-2/3" x ½" Corrugations	0.024
Corrugated Metal Pipe 3" x 1" or 5" x 1" Corrugations	0.028
Open Channel with Lined Bottom, Clean Sides	0.035
Earth Channel with Clean and Uniform Sides	0.060
Earth Channel with natural bottom and sides	0.080

Using Method 1 does not require the analysis of other minor losses. Pipes and culverts that are designed with inlet control shall account for losses associated with inlet control.

2. Method 2 – Minor Losses

Calculation of minor losses more accurately models the system. Energy losses from pipe friction shall be determined by the following:

$S_f = [Qn/1.486\ AR^{2/3}]^2$

Where: S_f = friction slope, ft/ft
Q= flow rate, ft^3/s
n= Manning's coefficient
A= area, ft^2
R= hydraulic radius

The head loss due to friction is determined by the formula:

$H_f = S_f L$

Where: H_f = friction head loss, ft
L = length of outflow pipe, ft

The minimum "n" value used in Manning's formula shall conform to the following:

Precast Concrete Pipe	0.012
High Density Polyethylene Pipe	0.012
Polyvinylchloride Pipe	0.012
Concrete Box Culvert (within a closed conduit system)	0.013
Ribbed Metal Pipe	0.013
Concrete Cast-In-Place Pipe	0.014
Pavement Surfaces	0.016
Open Channel Fully Lined	0.018
Corrugated Metal Pipe 2-2/3" x ½" Corrugations	0.024
Corrugated Metal Pipe 3" x 1" or 5" x 1" Corrugations	0.028
Open Channel with Lined Bottom, Clean Sides	0.035
Earth Channel (Clean, Uniform Sides) or Natural Channel	0.060
Earth Channel with natural bottom and sides	0.080

C. Velocity Head Losses

Analysis methods must account for all minor losses.

Minor head loss is usually written as:

$H_L = K_c (V^2/2g)$

Where: H_L is the minor head loss
Kc is the sum of minor loss coefficients
$V^2/2g$ is the velocity head

The loss coefficient and the form of the equation are different depending on the type of loss, whether flow is open channel or pressure flow, and at times, whether flow is sub-critical or supercritical. Full discussion and values of coefficients are given in several references (Chow *Open Channel Hydraulics*; Brater and King *Handbook of Hydraulics*; Rouse *Fluid Mechanics for Hydraulic Engineers*; Hendrickson *Hydraulics of Culverts*). The following are minor head loss formulas for hydraulic structures commonly found in storm drain systems and open channels.

D. Entrance Losses

Entrance losses to box culverts and pipes of various materials can be estimated by using the entrance loss coefficients listed in Table 9-6 in conjunction with the minor head loss equation, once outlet control has been established.

E. Manhole and Junction Losses

Junctions are locations where two or more pipes join together to form another pipe or channel.

Multiple pipes or channels coming together at a junction shall flow together smoothly to avoid high head losses. Items that promote turbulent flow and high losses include a large angle between the two (>60°), a large vertical difference between the two (greater than 6 inches (6") between the two inverts), and absence of a semicircular channel or benching at the bottom of the junction box in the case of pipes. Special problems arise when smaller pipes join a larger one at a junction.

1. Straight Through Manhole

   In a straight through manhole where there is no change in pipe size, the minor loss shall be calculated by:

   $$H_m = 0.05\ (V^2/2g)$$

2. Incoming Opposing Flows

   Design of opposing flows or 90 degree angles must be avoided. The head loss at a junction, H_{j1}, for two almost equal and opposing flows meeting head-on with the outlet direction perpendicular to both incoming directions is considered as the total velocity head of outgoing flow.

   $$H_{j1} = V^2/2g$$

3. Changes in Direction of Flow

   When main storm drainpipes or lateral lines meet in a junction, velocity is reduced within the chamber and specific head increases to develop the velocity needed in the outlet pipe. As a bend becomes sharper (approaching 90°), the more severe the energy loss becomes. When the outlet conduit is sized, determine the velocity and compute head loss in the chamber by the minor head loss formula in conjunction with the following:

K	Degree of Turn (In Junction)
0.19	15
0.35	30
0.47	45
0.56	60
0.64	75
0.70	90 and greater

   Any degree of turn greater than 90 degrees requires the approval of the Director.

   For a graphic solution to other degree of turns, refer to Standard Drawing SD-5. For culverts the Engineer of Record must determine if the culvert works with inlet or outlet control for the peak flow of the given design frequency.

Table 9-6
Entrance Loss Coefficients for Culverts (HDS 5 – latest edition) Outlet Control, Full or Partly Full Entrance Head Loss.

$H_e = k_e (V^2/2g)$

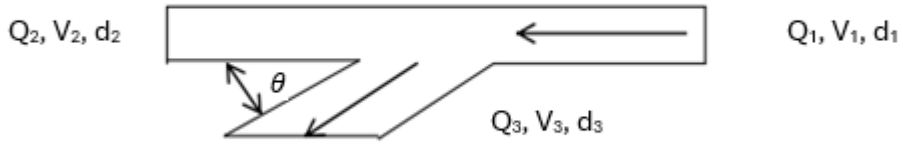
Type of *Structure and Design of Entrance*	*Coefficient* k_e
Pipe Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wing walls	
• Socket end of pipe (groove-end)	0.2
• Square Edge	0.5
• Rounded (radius = 1/12D)	0.2
• Mitered to conform to fill slope	0.7
• *End-section conforming to fill slope	0.5
• Beveled edges, 33.78 or 458	0.2
Bevels--Side- or slope-tapered inlet	0.2
Pipe, or Pipe-Arch, Corrugated Metal	0.9
Projecting from fill (no headwall)	0.5
Headwall or headwall and wing walls square-edge	0.7
Mitered to conform to fill slope, paved or unpaved slope	0.5
*End-section conforming to fill slope	0.2
Beveled edges, 33.78 or 458 bevels	0.2
Bevels--Side- or slope-tapered inlet	0.2
Box, Reinforced Concrete	
Headwall parallel to embankment (no wing walls)	
• Square-edged on 3 edges	0.5
• Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wing walls at 308 to 758 to barrel	
• Square-edged at crown	0.4
• Crown edge rounded to radius of ½ barrel dimension, or beveled top edge.	0.2
Wing walls at 10° to 25° to barrel	
• Square-edged at crown	0.5
Wing walls parallel (extension of sides)	
• Square-edged at crown	0.7
• Side - or slope-tapered inlet	0.2

*Note: "End-section conforming to fill slope," made of either metal, concrete or HDPE are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both *inlet* and *outlet* control. Some end sections, incorporating a *closed* taper in their design, have a superior hydraulic performance.

HDS -5 (U.S. DOT "Hydraulic Design of Highway Culverts Series No. 5, Latest edition

The following equation may be used to determine the loss in head in cases where it may be necessary to split or branch the flow into another drain.

Figure 9-1



$$H_{br} = \frac{cV_1^2}{2g}$$

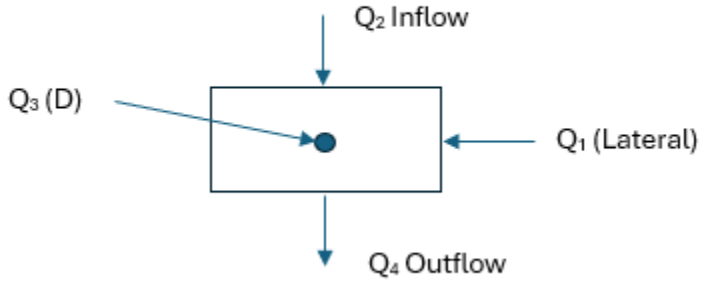
Divergence Angle - θ	$Q_3/Q_1 = 0.3$	$Q_3/Q_1 = 0.5$	$Q_3/Q_1 = 0.7$
90°	c = 0.76	0.74	0.80
60°	c = 0.59	0.54	0.52
45°	c = 0.35	0.32	0.30

4. Several Entering Flows

   The computation of losses in a junction with several entering flows utilizes the principle of conservation of energy, involving both position energy (elevation of water surface) and momentum energy (mass times velocity head). Thus, for a junction with several entering flows, the energy content of the inflows is equal to the energy content of the outflows plus additional energy required by the collision and turbulence of flows passing through the junction. In addition, when two nearly equal flows enter the junction from opposing directions, head loss is considered as the total velocity head of the outgoing flow.

   For example, the total junction losses at the sketched intersection are as follows (Figure 9-2):

Figure 9-2



$$Hj_2 = [(Q_4V_4^2) - (Q_1V_1^2) - (Q_2V_2^2) + (KQ_1V_1^2)] / (2gQ_4)$$

Where: Hj_2 = junction losses, ft
Q = discharges, cfs
V = horizontal velocities ft/s
V_3 = is assumed to be zero
K = bend loss factor

Subscript nomenclature for the equation is as follows:

Q_1 = 90 ° lateral, cfs
Q_2 = straight through inflow, cfs
Q_3 = vertical dropped-in flow, from an inlet, cfs
Q_4 = main outfall = total computed discharge, cfs
V_1, V_2, V_3, V_4 are the horizontal velocities of foregoing flows, respectively in feet per second

Also assume:

H_b = $K (V_1^2)/2g$ for change in direction.

No velocity head of an incoming line is greater than the velocity head of the outgoing line.

Water surface of inflow and outflow pipes in junction to be level.

When losses are computed for any junction condition for the same or a lesser number of inflows, the above equation shall be used with zero quantities for those conditions not present. If more directions or quantities are at the junction, additional terms shall be inserted with consideration given to the relative magnitudes of flow and the coefficient of velocity head for directions other than straight through.

F. Bend Loss

Bend losses shall be calculated from the following equations:

$$H_b = K_b (V^2/2g)$$

In which: $K_b = 0.20\ (\Delta/90°)^{0.5}$

Where: Δ = Central angle of bend in degrees.

Bend losses shall be included for all closed conduits, those flowing partially full as well as those flowing full.

G. Trash-Rack Head Loss

The head loss through a stationary trash-rack is commonly determined from the following equation:

$$H_{TR} = K_{TR}\ (V_n^2/2g)$$

$$K_{TR} = 1.45 - 0.45\ A_n/A_g - (A_n/A_g)^2$$

Where: K_{TR} = Trash-rack coefficient

A_n = Net area through bars, in ft2
A_g = Gross area of trash-rack and supports (water area without trash-rack in place), in ft2
V_n = Average velocity through the rack openings (Q/A_n), in ft/sec

For design, assume that the rack is clogged, thereby reducing the value of A_n by 50%.

9-12. CLOSED CONDUITS

The specific type of pipe or alternate pipe to be used in the development shall be shown on the profile sheets. The minimum inside diameter for pipes used in the public right of way shall be no less than twelve inches (12”). No storm drain conduit shall have a diameter less than that of the conduit immediately upstream of it.

A. Material

Publicly maintained drainage systems shall be constructed of the following materials and installed consistent with the latest edition of Caltrans Standard Construction Specifications:

1. Reinforced Concrete Pipe

Class of pipe shall be based upon depth as detailed in the Standard Drawings. Pipe shall conform to ASTM C76, latest revision. The consultant shall specify on the plans that the assembly of joints shall be in accordance with the pipe manufacturer’s recommendations and the requirements of ASTM C443.

2. Concrete Cast-In-Place-Pipe

a.) Where Concrete Cast-In-Place-Pipe is to be used, a soil report is required for the project that addresses placement of Concrete Cast-In-Place-Pipe.

b.) The Engineer of Record shall provide details on the plans for connection of the concrete cast-in-place-pipe to the different piping materials being used.

3. Polyvinyl Chloride Pipe

   Polyvinyl Chloride (PVC) Pipe may be used conforming to the Construction Specifications. Use of polyvinyl chloride downstream of the last manhole or junction structure to outfalls to channels or detention basins is not allowed.

4. High Density Polyethylene Pipe

   a) HDPE may be used in existing or future roadways or for driveway culverts.

   b) Use of High Density Polyethylene Pipe downstream of the last manhole or junction structure to open channels, detention facilities or to a daylight condition is not allowed.

5. Metal Pipe

a.) Metal pipe shall be corrugated steel, corrugated aluminum, corrugated aluminized steel Type II, ribbed steel, ribbed aluminized steel Type II or ribbed aluminum.

b.) Metal pipe shall be designed for a minimum maintenance free service life of fifty (50) years in accordance with the methods specified in Section 854.3 and 854.4 of the California Department of Transportation Highway Design Manual. To assure that the service life is achieved, alternative metal pipe may require added thickness and/or protective coatings. The Engineer of Record shall provide certified copies of the laboratory report giving the results of pH and resistivity tests. The report shall also include a map showing the location of each site and depth where samples were taken.

c.) Unless otherwise specified by the Director, a minimum of two soil samples shall be taken for the first 1,000 lineal feet of pipe or fraction thereof on a project with a minimum of one additional sample being required for each additional 1,000 lineal feet of pipe or fraction thereof. The samples shall be taken along the approximate alignment and at the approximate depth of the pipe to be installed. Priority in sampling shall be given to trunk facilities.

B. Cover Requirements

   At locations where the minimum cover requirements cannot feasibly be obtained, the conduit shall be provided with a concrete cover or other methods of pipe protection as approved by the Director. Cover shall be measured from the top of a rigid Portland cement concrete pavement or the bottom of a flexible asphalt concrete pavement structural section.

   1. Minimum Cover - The minimum cover requirements shall be per Table 9-7 and measured from the top of pipe to top of subgrade (bottom of A.B.).

   2. Maximum Cover - Maximum height of cover shall be per Tables 9-7a and b.

C. Temporary Construction Vehicle Loading

1. A note shall be made on the plans stating the minimum cover requirements during construction for temporary heavy construction vehicle loading, such as scraper or truck haul routes.

2. For flexible pipes, place at least four feet (4') of cover over the top of the pipe.

3. For rigid pipes, place at least three feet (3') of cover over the top of the pipe.

D. Trench Requirements

1. Trenches shall be excavated with full depth and vertical sides whenever possible.

2. The minimum trench width shall not be less than the outside diameter of the pipe barrel plus sixteen inches (16”), measured at the top of the pipe. Where conditions require side sloping of trenches, the minimum vertical trench shall be from the bottom of the trench to one foot (1’) over the top of the pipe

3. In fill areas, or in areas with poor soil conditions where it is anticipated that a good, firm, vertical-walled trench cannot be constructed, the Engineer of Record shall design the pipe structural requirements in accordance with good engineering practice. A note shall be placed on the plans directing the contractor to place the proper strength pipe if trench conditions encountered differ from those stated in the design trench plans.

E. Spacing Requirements

When multiple adjacent pipe lines are used, they shall be spaced so that the sides of the pipes shall be no closer than two feet (2’). For parallel pipes larger than forty-eight inch (48”) the spacing shall be no closer than one half (1/2) the nominal diameter. This is to permit adequate compaction of backfill material. Special bedding and backfill considerations shall be taken when depths of parallel pipes vary.

F. Alignment Requirements

1. The preferred location of storm drainage pipes in new streets shall be typically six feet (6’) north or west of and parallel to the centerline of the street. In special situations, and if necessary to meet State required water separation standards, pipelines may be placed in alternative locations, including under curb and gutter, as approved by the Director.

2. All new storm drain mains shall be placed a minimum of one hundred feet (100’) from existing and proposed water wells. Encroachments less than one hundred feet (100’) require approval of Director and the water purveyor prior to plan approval.

3. Avoid unnecessary meandering and angular changes of pipelines. Angular changes, when necessary, shall not exceed 90 degrees unless approved by the Director. No angular changes in direction are allowed for concrete cast-in-place-pipe other than on a radius.

4. Pipeline Radius Criteria: All pipe placed on curves shall meet manufacturer's recommendations for curved alignment. All curves, radii, length of pipe joints, and types of pipe shall be shown on the plans. The minimum radius of curvature for concrete cast-in-place-pipe shall be determined by the formula R = 30D where R = radius of curvature, and D = nominal internal pipe diameter, with R and D expressed in the same units.

5. Pipelines shall be laid straight in both horizontal and vertical planes between manholes unless otherwise approved by the Director.

6. Where storm drain pipelines of different diameter join, the invert elevations shall be adjusted to maintain a uniform energy gradient.

G. Velocity

1. The minimum full flow velocity shall be no less than two (2) feet per second. The maximum velocity, at maximum pipe system capacity, shall be less than the critical velocity.

2. For velocities larger than ten (10) ft/second, special provisions shall be taken to prevent pipe displacement, and/or manhole lid surcharge.

H. Pipe Inlets and Outlets

1. Headwalls, flared end section and other structures at inlets shall be designed to increase hydraulic efficiency, prevent erosion adjacent to the conduit and provide a counterweight to prevent flotation. Headwalls or flared end sections shall be used at both intake and discharge ends of culverts and pipes.

2. Standard headwalls shall be installed at pipe outlets per standard drawings of the latest edition of the Standard Construction Specifications.

3. The vertical face of the headwall shall be set back a sufficient distance from the channel side slope to accommodate flap-gates (when needed) in a fully opened position without encroachment of the flap past the channel side slope face.

4. All pipe and culvert entrance and outlet locations must be provided a concrete apron with a minimum length of five (5) pipe diameters for erosion control and maintenance purposes.

5. Pipe inlets greater than 24 inches shall have a trash rack installed. Pipe Outlets greater than 36 inches, not in an area enclosed with a fence, shall have a trash rack installed for access control. See also Section 9-17.

6. Energy dissipators must be utilized at outlets at the end of the concrete apron. All energy dissipation shall be designed considering outlet velocities and hydraulic jumps. Rip-rap shall not be placed on the outlet apron. See Standard Drawings SD-32 and SD-33.

I. Water and Soil Tight System

1. All storm drain pipe, manholes, and fitting connections, including drain inlet laterals shall be water and soil tight and tested in conformance with the Caltrans's Standard Construction Specifications (See Section 61-2).

2. A note shall be placed on the improvement plans stating these requirements and that the contractor is responsible for providing equipment and labor for performing tests and making measurements when directed to do so by the County's inspector.

J. Bored and Jacked Pipe

All casing pipes shall be sealed at both ends in such a manner as to provide water resistant seal.

K. Backfill Seepage

A concrete filled cutoff barrier shall be utilized at inlets and outlets where water may periodically penetrate pipe backfill material.

9-13. MANHOLES & JUNCTION BOXES

Requirements for manholes are as follows:

A. Standard pre-cast concrete or saddle type manholes shall be used except where special manholes or junction boxes are required. The design of special manholes and junction boxes must be submitted to the Director for approval. Cast-in-place manholes shall conform to the Standard Drawings.

B. All manholes shall be a minimum 48 inches inside diameter unless approved on an exception basis by the Director. In no case shall junction boxes or manholes be allowed which are smaller than twenty-four inches (24") inside dimension.

C. Manholes shall be sized to provide a minimum of nine inches (9") wall spacing between annular cutout edges of pipe openings.

D. Manholes shall be located at junction points, angle points greater than 15 degrees, and changes in pipe size or materials. On curved pipes with radii of 200-feet to 400-feet, manholes shall be placed at the beginning and end of curve and on 300-feet maximum intervals along the curve. On curves with radii exceeding 400-feet, manholes shall be placed at the beginning and end of curves and on 400 feet maximum intervals along the curve for pipes twenty-four inches (24") and less in diameter and 500-feet maximum intervals along the curve for pipes greater than twenty-four inches (24") in diameter. Manhole spacing on curves with radii less than 200-feet shall be determined on an individual basis. Exceptions to these calculated manhole placements shall be allowed if the resulting manholes are within 100 feet of existing or proposed manholes.

E. Spacing of manhole, junction boxes (or inlets of such size as to be accessible for maintenance) shall not exceed 400-feet for drains fifteen inches (15") and smaller in diameter, 500-feet for drains between eighteen inches (18") and thirty-six inches

(36”) in diameter, and 600-feet for pipes greater than thirty-six inches (36”) in diameter.

F. All manholes and junction boxes other than inlets shall have standard manhole frames and covers as shown in the Specifications. Manhole and junction box covers shall be marked "STORM DRAIN" in raised lettering. Manholes shall not be allowed in the gutter or sidewalk.

G. A reinforced flat top forty-eight inch (48”) diameter (no cone) concrete lid as shown in the Construction Specifications shall be required when any pipe would enter the manhole above any portion of the base of a manhole cone. Maximum twenty-four inch (24”) diameter riser (chimney) height shall be less than or equal to eighteen inches (18”).

H. Use grated manhole covers (Standard Drawing SD-15) to pick up minor drainage in non-traffic areas only if debris clogging is not a concern.

I. Improvement plans shall include a special detail for all manholes at junction points where there is a change in pipe direction for pipe diameters exceeding forty-eight inches (48”).

J. Resilient connectors, in conformance with ASTM C923, are required between pre-cast manhole/box and pipe, and between pre-cast drop inlet and pipe. Water stops are required for pipe to cast-in-place manhole/drop inlet connections. Use non-shrinking/non-expansive grout for making connections of pipe and water stop to structure walls.

K. Stations of manholes/boxes shown on project drawings apply at center line of shaft.

L. Manhole/box lids shall be bolted to frame where lids are prone to surcharging when the storm drain system is at maximum capacity. A pressure manhole design may be required by the Director.

M. Storm drain manholes/boxes shall be tested in conformance with Caltrans Standard Construction Specifications.

N. There shall be no sumps in manholes outside of the public right-of-way. Manholes and junction boxes located outside of paved areas shall have rim set 0.5 feet above ground surface.

O. Drop inlets shall not be used as junction boxes, unless approved by the Director.

P. Junction boxes shall be constructed of pre-cast or cast in place reinforced concrete with minimum wall thickness of six inches (6”). The Engineer of Record shall submit calculations indicating the junction box is designed to withstand H-20 loading.

Q. The inside vertical dimension of junction boxes shall be such as to provide a minimum of three-inch (3") clearance on the outside diameter of the largest pipe in each face. Junction boxes shall have a minimum horizontal inside dimension of forty-eight inches (48”). All junction boxes shall be rectangular unless otherwise approved by the Director.

R. Pipes adjacent to junctions shall have tight, impermeable joints subject to testing requirements of the Caltrans Standard Specifications.

S. Junction boxes larger than ten feet (10') in any dimension shall have two manhole access points.

9-14. INLETS

A. Always use grated inlets when the longitudinal slope of the street exceeds 4% where due to the high velocities it is difficult to direct the flows into the curb opening.

B. All inlet design curves in these Standards assume clean inlets. The Engineer of Record shall assume a 50% clogging factor when determining the number and location of inlets.

C. Additional inlets are required at sump locations per these Standards.

D. Type B inlets are typically used for streets with concrete curbs and gutters. See Figure 9-3, for flow capacity.

E. Type J Inlets are to be used when inlet invert exceeds 5' below gutter flow line.

F. Type F inlets may be used in roadside ditches, swales, unimproved medians, and outside of the road right-of-way. Figure 9-4 provides design capacity for one two-foot wide window of a Type F inlet, clear of debris.

G. Curb opening catch basins with grating(s) and debris skimmers may be used in locations where additional inlet capacity, beyond a single Type B inlet, is needed, or as where directed by the Director. The inlet width may vary from seven feet (7') to twenty-eight feet (28'). The H dimension is the gutter depression depth and shall be a standard two inches (2"). When more than one grate is required, use Standard Drawing SD-21 for support assembly. Assure that the lateral is sized to serve the increased inlet capacity. Flow capacity of inlets is calculated using the methods found in the Federal Highway Administration (FHWA) Urban Drainage Design Manual Hydraulic Engineering Circular No. 22.

H. Inlets in Class "A" and "B" streets shall be placed at lot lines in residential subdivisions and at the curb return of intersections. Inlets shall be placed so that the length of flow does not exceed 500 feet, unless otherwise approved by the Director. Inlets at curb returns shall be constructed so that they are not in conflict with the Americans with Disabilities Act requirements for ramps. No face plates are allowed on inlets at the curb returns.

I. Type F inlets shall be designed based on Figure 9-4. The chart assumes clean openings, so some clogging shall be accounted for by adding a grated lid or increasing the window opening(s).

J. Inlet markings must be provided in the concrete at each drop inlet per Standard Drawings SQ-10.1 and SQ-10.2.

9-15. OVERLAND RELEASE

Piped storm drain systems are not designed to convey peak flow from infrequent high intensity storm events. When the pipes and inlets are clogged or overwhelmed, surface runoff will pond in low areas and flow overland along designed overland release routes. The improvement plans shall include overland release routing and the Engineer of Record shall provide supporting calculations. Risk of flood damage shall be reduced by insuring that the 100-year storm runoff ponds and flows through the proposed development with appropriate freeboard protecting existing and proposed structures, pursuant to Section 9-1 of these Standards. Hydraulic and erosion control calculations for overland release flows must be provided with the design.

A. For the purposes of determining overland release flows, the 100-year runoff shall be determined using the Sacramento Method. For purposes of overland flow design, the designer may assume the storm drain pipes are flowing full into 100-year downstream water surface condition, or may actually calculate the flow conditions using the 100-year storm event with a 10-year HGL as the starting water elevation for the downstream channel.

B. All arterial streets and selected collector streets (when determined by the Director), shall be designed with at least one traffic lane in each direction completely above the 100-year HGL elevation.

C. The 100-year HGL elevation of overland flows on streets shall not exceed the back of sidewalk elevation by more than six inches (6") on streets with vertical curbing and eight inches (8") on streets with rolled curbing.

D. Where the overland release path leaves the paved right-of-way, concrete improvements shall be constructed as a mow strip, gutter or other permanent flow line. Decorative use of stamped concrete is encouraged. The use of grouted paving stones or cobbles is acceptable as long as they are placed on top of a two (2) inch minimum concrete base, are solid grouted, and do not protrude into the invert elevation/flow line. The outlet of the overland release flows must be similarly armored with a concrete apron. Additionally, energy dissipation features must be placed at the end of the apron and/or formed within the apron concrete.

E. Streets, publicly-owned parking lots, pedestrian areas, pedestrian walkways, utility routes and other open space areas may be considered compatible uses for the overland release routing. Appropriate barricades for traffic safety and signage as required by the County shall be placed as needed for release paths exiting the right-of-way.

9-16. PIPE STUBS

The criteria for pipe stubs shall be as follows:

A. A headwall or flared end and trash rack shall be required where the upstream pipe ends at a park or open field, and the site shall be graded toward the inlet.

B. Temporary pipe stubs shall be as deep as possible to provide for future extension, and raised to grade using a Type F, Type H, or Type I inlet or other appropriate

catchments. Type H Inlets shall be sized two (2) sizes larger than the connecting pipe or pipe stub.

9-17. HEADWALLS AND RACKS

The requirements for headwalls, wing-walls, end walls, trash racks, access control racks and railings are as follows:

A. All headwalls, wing-walls and end walls shall be considered individually and in general shall be designed in accordance with the Standards and Specifications of the California Department of Transportation.

B. Erosion control is of high importance where storm drain pipes discharge to natural channels. Energy dissipating structures shall be detailed on the improvement plans. Pipe and culvert entrance and outlet locations shall be provided a concrete apron with minimum lengths as required in Sections 9-12 (H) and 9-22 for erosion control and maintenance purposes.

C. Trash racks shall be provided on inlets to pipes entering an underground conduit system. Trash racks shall be designed such that the ratio of trash rack open area to drain opening is at a minimum four to one (4:1).

D. Access control racks shall be required on pipe outlets forty-two inches (42") or larger, unless access is restricted by fencing and omission is approved by the Director. The Director may require racks at smaller pipe outlets in locations that are deemed to warrant supplemental access control. Racks shall not be installed on open-ended culverts, unless required by the Director.

E. Both trash and access control racks shall hinge at the top to allow them to open should debris and hydraulic forces provide pressure.

F. Racks on pipe outfalls 37 to 66-inch diameter shall be constructed as two separate hinged sections. For pipe outfalls greater than 66-inch diameter, the racks shall be split into three sections.

G. Public safety may require metal beam guardrail, chain link fencing, or other protective railing as approved by the County, at the top of culverts, headwalls, box culverts, and steep side slopes. Installation shall be in accordance with the Specifications.

H. Slopes around headwalls, wing walls, end walls, trash racks and other concrete structures shall be protected from erosion appropriately.

9-18. DRAINAGE PUMPS

Drainage pumping stations shall be designed in accordance with the latest edition of the Hydraulic Institute Standards and as specified by the Director. A pump station shall include the following minimum features:

A. A standby backup pump.

B. An automated debris removal system at the inlet.

C. A diesel powered generator with automated start and stop and a 3 hour supply of fuel shall be part of the station.

D. A low flow pump shall be required to accompany any drainage pump station.

E. Automated control systems linked to a SCADA system.

F. Standardization of models and manufacturers of equipment in existing County-operated stations.

9-19. DETENTION SYSTEMS

Detention basins can be used for peak flow attenuation, detention, and retention and/or storm water treatment. Flood control detention system designs must be performed for all detention/retention basins, temporary or permanent.

A. Detention basin volume requirements shall be determined based on a 100-year, 24-hour storm. For the 100-year 24-hour volume, the basin must have 2 feet of freeboard. The total volume required for the basin shall be based on hydrologic routing computations detailed by the Hydrology Standards of the Sacramento City/County Drainage Manual. Basin routing curves shall be included in the design calculations submitted.

B. Detention basins shall have gravity inflow and outlet facilities providing terminal drainage capable of emptying a full basin within 72 hours. Detention basins with pump station outflow may also be considered with the approval of the Director. Downstream limitations must also be considered in sizing the pumping facility.

C. Side slopes of the basin and any berm shall be no more steep than 3:1. Shape shall be irregular and slopes shall vary around the basin to give it a more natural appearance, up to approximately 10:1 slopes. Bottom of the basin must slope towards outlet at a minimum 2% slope if vegetated or 0.5% if paved.

D. The bottom of the basin shall be a minimum of 2 feet above the highest ground water elevation and be based on the recommendation of a licensed engineering geologist or soils engineer.

E. The basin shall have a 12-foot wide access road around the entire perimeter of the basin with a concrete or gravel access ramp into the basin.

F. If a water quality structure is included in the basin design, the volume of the water quality portion of the basin shall be in addition to the volume required for detention. The water quality element of the basin must be designed according to the above referenced design standards and the Storm Water Quality Design Manual for the Sacramento and South Placer Region. See Section 11.

G. Approved detention basins shall require submittal of a “User Manual” for each detention basin prior to acceptance by the County. This manual shall include an 11”x17” sheet showing details of the detention basin including: inlets, outlets, ramps, elevation, and a vicinity map showing the access route from the arterial and the 10- and 100-year elevations.

9-20. OPEN CHANNELS

All runoff for new development must normally be conveyed in closed conduits. Utilization of open channels may be authorized by the Director whenever one or more of the following applies:

1. The design flow rate exceeds the capacity of a seventy-two inch (72") pipe.
2. The outfall is at an elevation such that minimum cover cannot be obtained over the pipe.
3. Government policies require that the channel remain natural. A parallel facility for runoff conveyance may be considered. If an agreement is needed between a State and Federal Agency, such agreement must be approved by the Director prior to its submittal to other agencies.

Open channels are to be designed pursuant to the drainage study provided by the Engineer of Record and to the satisfaction of the Director. Each project has unique hydraulic constraints and storm water quality requirements; therefore, the following shall be deemed guidelines.

A. Open channels may consist of vegetated earth channels. Concrete lining may also be used.

B. Criteria for open channels shall be as follows:

1. Open channel design shall include a water surface profile analysis using the Army Corps of Engineers HEC-RAS computer program, UNET program or other steady or unsteady state hydraulic program, approved by the Director.
2. Open channels shall be designed to convey the 100-year flood event with a minimum one foot (1') of freeboard. Greater freeboard may be required depending on the sensitivity of the model, obstructions, and surrounding property.
3. The minimum velocity for open channels is 1.5 ft/s. The maximum velocity for the 100-year flood event shall be as follows:
    a.) Earth channels, six (6) ft/s
    b.) Lined channels, ten (10) ft/s
    c.) Bottom-lined channels, eight (8) ft/s
4. Superelevating the outside bank on bends may be required to maintain specified freeboard.
5. The centerline curve radius of an open channel shall be equal to the greater of twice the bottom width or thirty-five feet (35').
6. Earth channels and the side slopes of bottom lined channels shall be vegetated with native grasses or other permanent vegetative cover. All vegetation shall be approved by the Director. Vegetation shall be established prior to the wet season

(October 1). Hydro-seeding conducted during the wet season (October 1 – April 30) shall include additional appropriate soil stabilization materials to prevent erosion, in accordance with Section 11 of the Improvement Standards. A note shall be added to improvement plans stating, "Vegetated open channels shall not be accepted by the County until 70% of the vegetation is established." No trees shall be planted below the 10-year hydraulic grade line.

7. Channels, deeper than two feet (2'), shall be constructed to a typical cross section with 3 horizontal to 1 vertical (3:1) or flatter side slopes. Exceptions require a soils report and the approval of the Director.

8. All channels deeper than 2 feet shall have a minimum bottom width of six feet (6').

9. Permanent erosion protection shall be placed at the top of the cut or bank to prevent erosion (see Standard Drawings). At locations where overland flows enter the channel, appropriate erosion control and energy dissipation methods shall be incorporated into the design.

10. For all channels, either improved or natural, the following items shall be shown on improvement plans in addition to information heretofore required:

    a.) Typical sections and cross-sections.

    b.) Profile of the existing channel and top of bank profile including enough of the existing channel each side of the development to establish an average profile grade through the development.

    c.) Ten and one-hundred year water surface elevations.

    d.) Road crossings with road profile indicating overland release.

9-21. OUTFALL PLANS

Requirements for outfall plans are as follows:

A. All permanent and temporary drainage outfalls shall be shown in both plan and profile on the improvement plans for a distance until a definite "daylight" condition is established.

B. The profiles shall include ditch flow-line and left and right top of bank elevations.

C. When improvements have more than one unit or phase, the drainage outfall shall be shown as extending to the property boundary and beyond, if required, although it may not be constructed with the current unit development.

9-22. SITE REQUIREMENTS

A. FENCING - Fencing shall, unless approved otherwise by the Director, be required around all County drainage facilities. The specific design and materials used are subject to the approval of the Director. The minimum requirements for fencing are as follows.

1. Fencing shall be six foot (6') chain link or "decorative" style, located six inches (6") inside of right of way or easement.

2. Pedestrian gates shall be four feet (4') wide.

3. Vehicle gates shall be two eight foot (8') gates with a total opening of sixteen feet (16') wide. They shall be set a minimum of twenty feet (20') back from the edge of pavement to allow for a safe parking area off of the traveled way while opening and closing the gates. Gates must swing away from road right-of-way. A concrete driveway shall be provided at vertical curb locations. Asphalt concrete paving shall be provided between the traveled way and drive gate. Design the paving per Section 9-22 B4 of these Standards.

4. Signs may be required as considered appropriate by the Director. As a minimum, the vehicle gate access shall be marked "Sutter County Drainage Facility – No Motorized Vehicles - No Parking". Signage statements, sizes, layout, and colors shall be approved by the Director.

5. Fencing and gates components shall be composed of unpainted galvanized steel. Other materials such as aluminum, or other approved durable and corrosion-resistant materials may be used if decorative fencing is required for the area. Weld joints shall be cleaned and covered with a zinc-based coating.

B. ACCESS ROADS - Every drainage ditch, basin, channel, and underground pipeline outside the right-of-way shall have an access road for maintenance, normally located at or above the 100-year flood elevation. An area with a minimum width of 20 feet shall be set aside for access.

1. A sixteen foot (16') service road shall be provided having a twelve foot (12') improved surface and two foot (2') shoulders on each side. Curve radii shall be a minimum of forty-two feet (42'). Turnouts shall be placed as dictated by horizontal sight distance and shall be no greater than one-thousand feet (1000'). Turn-around shall be placed at all dead ends.

2. For ditches less than 8 foot wide from bank to bank at the top of the ditch, a narrower 14 foot service road with a 10 foot improved surface and 2 foot shoulders with lesser turn radii and no turn-outs may be authorized.

3. For roads with no outlet, a turn-around shall be constructed with a minimum 40 foot outer radius at the end of the road.

4. Improved surfaces of the service road shall be a minimum six inches of AB. The center 10 feet of a 20 foot service road shall be paved, with a minimum of 2 inches of AC on 5 inches of AB. Existing sub grade shall be compacted to 85% and AB shall be compacted to 90%.

C. RAMPS - Access ramps are required to the bottom of open channels and basins that are more than 4 feet below the service road to allow access for emergency and maintenance equipment. Each segment of a channel shall be accessible. Ramps shall be located in pairs where possible to allow entrance and exit of equipment.

1. The minimum width shall be twelve feet (12') at a maximum slope of 10%. See Standard Drawing SD-31.

2. Ramps shall be constructed of concrete; minimum 4 inches thick with appropriate base (may be colored to blend with the surroundings), or gravel; minimum 6 inches thick. Attention to both aesthetics and serviceability is required. Materials with characteristics similar to concrete may be substituted on an exception basis if authorized by the Director.

3. Details of the ramps shall be shown on the improvement plans.

9-23. CROSS CULVERT CRITERIA

The following standards apply when the 100-year water surface elevation is not freely spanned by a bridge:

A. Cross culverts for minor sheds shall be designed in accordance with procedures outlined in the U.S. Department of Transportation "Hydraulic Design of Highway Culverts," Hydraulic Design Series No. 5, latest edition. For shed areas greater than 160 acres, use HEC-RAS or other software approved by the Director.

B. Cross culverts shall be checked against 100-year runoff to assure that no adverse effect will occur upstream or downstream.

C. Cross culvert profile shall be determined by an examination of the overall profile of the channel for a minimum distance of 500-feet on each side of the installation, assuring that freeboard requirements are met, and inlet or outlet control shall be determined.

D. Where no overland release is possible, cross culverts shall be oversized by at least 25%.

E. Where roads are not to be overtopped, for public safety or physical constraints, the box culvert soffit shall have one-foot (1') of freeboard over the 100-year water surface elevation.

F. Culverts shall include a headwall or flared end section at both the upstream and downstream end. A concrete apron shall be provided at the inlet and outlet of a culvert, with the minimum length of the lesser of 20 (twenty) feet or five (5) pipe diameters.

9-24. DRAINAGE IN RURAL AREAS

Closed conduit pipelines, not open drainage ditches, shall be utilized for runoff collection and conveyance along public right-of-ways, except in rural residential areas zoned for agricultural/residential lots at least 2 acres in size. Non-roadside ditches shall use the criteria for open channels and may require private easements to be recorded for cross lot drainage.

When appropriate, open roadside ditches shall use the criteria for design of Class "C" streets and the following requirements:

A. Roadside ditches shall be sized to convey design runoff. Analysis of 100-year flows shall be considered per Section 9-1. Analysis shall include culverts. The 10-year and 100-year hydraulic grade lines shall be shown on the profile. A minimum grade of 0.3% or a minimum velocity of 1 ft/second shall be secured.

B. Roadside ditches shall use 3:1 or flatter side slopes. Roadside ditches, including slopes, shall be completely contained within the right-of way. See also Section 4 of these standards.

C. Driveway culverts shall be designed to pass the greater of the 10-year design runoff, the roadside ditch capacity, or a 12 inch minimum diameter. Culverts shall be constructed out of CMP or RCP pipe. Driveway side slopes shall be 3:1 or flatter. Culverts shall be installed with either a six inch (6") thick concrete collar and headwall; or shall extend at least 1 foot beyond the driveway side slope and include a flared end section at the upstream and downstream ends.

9-25. STORM DRAIN SYSTEMS IN PRIVATE STREETS

A. Private storm drain systems that connect to County maintained drainage facilities shall have a manhole immediately upstream of the connection within the public easement or right-of-way.

B. It shall be made clear on the plans which facilities are privately owned and appropriate signage shall be erected to inform the public.

C. Private storm drain pipes serving more than two parcels shall be built per these Improvement Standards.

Table 9-7
Minimum Pipe Cover Requirements

Pipe Material Type and Location	Minimum Cover Requirement
High Density Polyethylene (HDPE) – non traffic areas/crossings	Twenty-four (24") – top of pipe to top of grade
Corrugated Metal	Span/8 but not less than twelve inches (12")
Spiral Rib – Steel	Span/3 but not less than twelve inches (12")
Spiral Rib – Aluminum with spans less than or equal to 72"	Span/2 but not less than twelve inches (12")
Spiral Rib – Aluminum with spans greater than 72"	Span/3 but not less than thirty inches (30")
Reinforced Concrete in unpaved areas	1/8 the diameter or rise (the greater of) but not less than twelve inches (12")
Reinforced Concrete under flexible pavements (Class IV and V)	1/8 the diameter or rise (the greater of) but not less than twelve inches (12")
Reinforced Concrete under flexible pavements (Class I, II, and III)	1/8 the diameter or rise (the greater of) but not less than twenty-four inches (24")
Reinforced Concrete under rigid pavements	A nine-inch (9") space between top of pipe and bottom of slab consisting of compacted granular fill shall be maintained at a minimum.
Cast-in-Place-Concrete-Pipes in paved areas	The structural section (AC & AB) plus twenty-four inches (24")
Cast-in-Place-Concrete-Pipes in unpaved areas	Twenty-four inches (24")
Polyvinyl Chloride – C900 and C905	Twelve inches (12")
Polyvinyl Chloride – SDR 35 at crossings	Twenty-four inches (24")

Note: All depths shown are for a minimum trench width equal to the outside diameter of the pipe plus sixteen inches (16") measured at the top of the pipe.

Table 9-7A Maximum Pipe Cover Requirements - Concrete and Plastic Pipe
Measured to bottom of trench in feet

DIA.	RCP Class					Cast in Place	PVC	HDPE
	I	II	III	IV	V			
12	Not Permitted	8	12	30	No Limit	No Limit	14	49
15		10	15	35			14	45
18		11	16	38			14	43
21		12	17	39			14	
24		12	18	39			14	43
27		13	19	39			14	
30		14	19	38			Not Permitted	34
33		14	20	38				
36		13	17	27	69			45
42		14	18	29	62	38		46
48		15	19	30	60	30		41
54		16	20	31	58	26		
60	14	16	21	31	57	24		48
66	15	17	22	32	56	21		
72	15	18	23	33	56	21		

Note: All depths shown are for a minimum trench width equal to the outside diameter of the pipe plus sixteen inches (16") measured at the top of the pipe.

Table 9-7B Maximum Pipe Cover Requirements - Metal Pipe
Measured to bottom of trench in feet

DIA.	CMP**				Ribbed Steel Pipe			Ribbed Aluminum Pipe			
	Thickness - inches				Thickness - inches			Thickness - inches			
	0.079	0.109	0.138	0.168	0.064	0.079	0.109	0.060	0.075	0.105	0.135
12	No Limits										
15											
18											
21	99										
24	99				36	50	67	21	29	49	64
30	93	99			30	40	56	17	24	40	51
36	78	99	99		26	35	48	14	21	34	44
42	66	93	99		21	31	41	13	18	30	37
48	58	81	99	99	20	28	38	12	17	26	34
54	52	72	93	99	19	26	34		15	25	31
60	53	65	84	99		25	32		14	23	28
66	48	68	76	93		22	30			21	26
72	42	62	70	85		22	28			20	25

Note 1) All depths shown are for a minimum trench width equal to the outside diameter of the pipe plus sixteen inches (16") measured at the top of the pipe.
2) ** Normal pipe corrugation profile is 2 2/3" x ½". The corrugation of the pipes within the shaded box area shall have profile of 3" x 1" or 5" x 1".
3) When flow velocity exceeds five (5) feet per second, the next thicker gauge shall be used for CMP pipe.

FIGURE 9-3
TYPE B INLET FLOWS

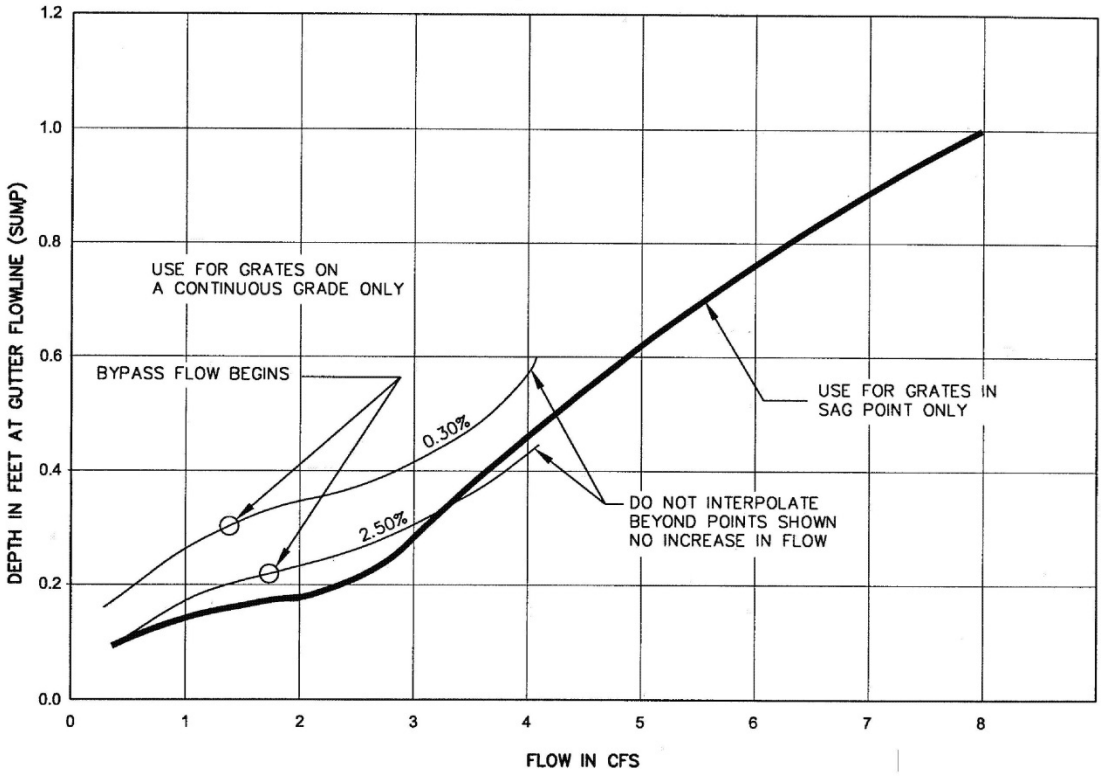
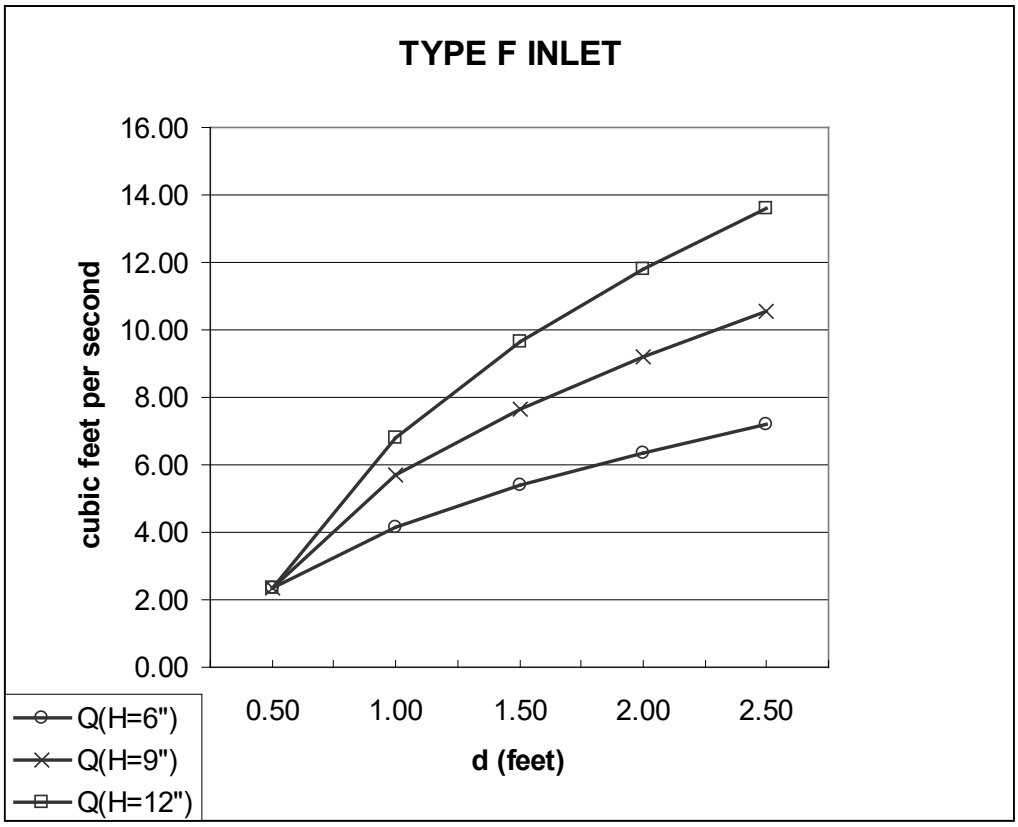
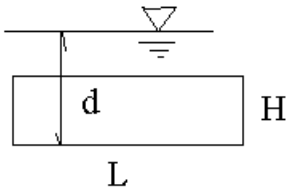


FIGURE 9-4
TYPE F INLET FLOWS





$$Q_{weir} = 3.33 L\, d^{1.5} \qquad (d<H)$$

$$Q_{weir} = 0.60(2gd)^{0.50} \qquad (d>H)$$

Figure 9-5

The US Department of Transportation recommends, in Hydraulic Engineering Circular Number 22, the use of the following equation when the depth at the gutter is less than one fortieth (1/40) the width of flow. It is a variation of the Manning's formula because the hydraulic radius does not adequately describe the gutter cross section. The compound gutter and rolled curb are considered negligible and are ignored.

$$Q = \frac{K_C}{n} S_X^{1.67} T^{2.67} S_L^{0.5}$$

Where: Q = flow rate (ft^3/sec)

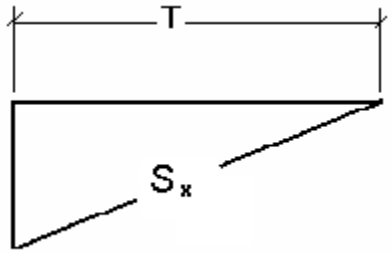
K_C = 0.56 (English units)

n = Manning's coefficient (use 0.016 for paved street)

T = width of flow or spread (ft)

S_X = cross slope, typically 0.020 (ft/ft)

S_L = longitudinal slope (ft/ft)



Depth at gutter = TSx

SECTION 10

GRADING

10-1. GENERAL REQUIRMENTS

Grading during the wet season (typically October to April) shall be limited and phased for erosion control purposes.

10-2. PLAN SHEET DETAILS

In addition to the requirements of Section 3, the following items shall be included on grading plans:

A. Slope symbols for 3:1 slopes or steeper, where grade difference exceeds one foot

B. Ridge and/or valley delineation

C. Typical lot grading details

D. Proposed spot and/or pad elevations

E. Flow directional arrows (off-site, around perimeter of development when adjacent to developed areas) and perimeter elevations at the property line

F. Existing spot elevations and/or contour lines on-site and off-site around perimeter of development. Where the existing terrain is not relatively flat, contour lines shall be mandatory. The spot elevations or contour lines shall be extended off-site for a minimum distance of 50 feet (flat terrain – 100 feet minimum) when adjacent to undeveloped areas.

G. Retaining wall details (symbols, construction details, limits, and top and bottom of wall elevations)

H. Back of sidewalk or curb elevations

I. Location and grate elevation of storm drain inlets

J. Typical sections across side yard property lines where the difference in finish pad elevations exceeds two feet. Delineated on the section shall be the side yard drainage swale and minimum distance between the proposed building and the side yard property line.

K. Names of adjacent subdivisions

L. Off-site intersecting property lines

M. Signature block for certification of pad elevations by Engineer of Record for subdivision projects

N. For all export projects:

1. Location and plan of spoils disposal
2. Spoils slopes of 3:2 or flatter
3. Finish spoils heights of 3 feet or less
4. No spoils within 5 feet of property lines
5. Spoils shall not block drainage
6. Spoils shall be leveled prior to acceptance of project

O. Erosion control details as required in Section 11.

P. Overland release grades and details.

10-3. ROLLING TERRAIN GRADING

Grading or rolling terrain shall be accomplished in a manner whereby the profile of the rolling terrain is maintained as close to that which exists as practically possible. Interior cuts and fills shall be no greater than 5 feet.

10-4. BOUNDARY GRADING

Special attention shall be given to grading adjacent to the exterior perimeter property line of a development. All adverse effects to off-site properties adjacent to new developments shall be reduced to an absolute minimum. Fills and cuts adjacent to the exterior perimeter property line shall be designed in accordance with the following:

A. Fills – Fills in excess of 2 feet shall not be allowed unless permitted by project conditions of approval. When fills are unavoidable, they shall conform to Standard Drawing G-1. If possible, fill slopes shall be constructed off-site, with the property line being situated at the top of the fill. A right of entry shall be required for all off-site fills prior to plan approval. A note shall be placed on the plans listing the name of the grantor of the right of entry and the date obtained.

B. Cuts – Cuts shall be constructed in accordance with Standard Drawing G-2, except that the slope setback from the property line to the slope hinge point shall be a minimum of 2 feet for all slopes steeper than 5:1.

C. Fences – When fences are required, they shall be placed within one foot of the property line. Where the adjacent property is County owned or public right-of-way, the wall shall be placed on the private property side of the boundary. The height of a fence shall be measured from the highest ground adjacent to the fence, regardless of the side that is developing.

10-5. INTERIOR GRADING

Grading at interior property lines within a subdivision shall conform to Standard Drawing G-2 and the following:

A. Property Lines – Property lines shall be situated at the top of fill and cut slopes. Grading shall be such that surface runoff will not be allowed to sheet flow down the slopes steeper than 5:1. Property lines shall be situated at the top sides of retaining walls with a minimum setback of 1.0 foot from the property line to the retaining wall. See Standard Drawing G-3.

B. Slopes – The maximum earth slopes allowed shall be 2:1 (horizontal to vertical) and the minimum shall be 1%. Minimum asphalt concrete surface slopes shall be 1% and minimum Portland cement concrete slopes shall be 0.25.

C. Cross Lot Surface Flow – Grading of residential or duplex lots shall be such that surface flow shall be restricted to a maximum of one lot flowing across another lot. Developments with situations that mandate grading which allows more than one lot to drain across another lot shall be required to provide a pipe system to maintain the one-lot rule.

D. Lots on the low side of streets and at sag points shall be graded in such a manner as to preclude flooding of the building pad area in the event of malfunction or overloading of the street drainage system. All building pad grades shall be a minimum of 1 foot above the overland release elevation.

E. Commercial developments shall not be allowed to "sheet drain" more than twenty-five feet of site frontage to a public street. Area outside the 25-foot strip shall be graded to drain into an on-site drainage system.

10-6. RETAINING WALLS

Retaining walls shall be in accordance with the following:

A. Redwood retaining walls for interior property lines shall conform to Standard Drawing G-3 as a minimum design. Construction details of redwood retaining walls on the plans shall not be required when reference to Standard Drawing G-3 is made. When fences are to be constructed atop redwood retaining walls, 4" x 6" posts at 4' centers shall extend above the retaining wall and act as fence posts.

B. Masonry or concrete retaining walls for boundary or phase lines shall conform to Standard Drawing G-4 as a minimum design. Construction details of masonry or concrete retaining walls on the plans shall not be required when reference is made to Standard Drawing G-4.

C. Design calculations stamped and signed by the Engineer of Record shall be required for all walls exceeding 24 inches in height (excluding footing height) or when a fence greater than 6 feet high is an integral part of the wall.

D. All retaining walls within 8 feet of boundary, phase, or right-of-way lines shall be either concrete or masonry.

E. Grading shall be such that on-site-runoff will not flow over retaining walls.

F. Where pads on adjacent lots are 10' apart or less and the difference in elevation exceeds 2.5 feet, a retaining wall will be required as per Standard Drawings G-3 or G-4.

10-7. CERTIFYING PAD ELEVATIONS

Upon completion of the grading and prior to acceptance of the subdivision improvements by the County, the Engineer of Record shall verify the final pad elevations. The elevations shall be verified at the center and the corner of each pad. Elevation deviations more than 0.10 feet shall be noted on the plans.

A signature block, certifying that final graded elevations in the field are the same as those shown on the plans, shall be included on the subdivision grading plans. The Engineer of Record shall sign the signature block, certifying to the above, and shall provide three sets of record (as built) grading plans to the Director.

10-8. MAINTENANCE OF ACCESS TO UTILITY FACILITIES

Continuous, suitable access shall be maintained during all stages of construction of any facility owned or operated by a utility/district providing essential services, i.e., sanitary sewer, water, drainage, electricity, gas, telephone, etc.

SECTION 11

STORMWATER QUALITY PROTECTION

11-1. DEFINITIONS / ACRONYMS

BMP ..... Best Management Practice

CGP..... General Permit for Storm Water Discharges Associated with Construction Activity (Construction General Permit)

ESCP..... Erosion and Sediment Control Plan

FORECASTED RAIN..... a 30% or better chance of rain as forecasted by the National Oceanic & Atmospheric Association (www.noaa.org)

MS4..... Municipal Separate Storm Sewer System

NOI..... Notice of Intent

NPDES..... National Pollutant Discharge Elimination System

RWQCB..... Regional Water Quality Control Board

SWPPP..... Storm Water Pollution Prevention Plan (Project SWPPP's must be site specific)

SWRCB ..... State Water Resources Control Board

Wet Season ..... October 1st through April 30th annually

WPCP ..... Water Pollution Control Program (Project WPCP's must be site specific)

11-2. STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

Applicants meeting the project area disturbance threshold of one (1) acre or more of disturbed area shall obtain coverage under the SWRCB General Permit for Storm Water Discharges Associated with Construction Activity (Construction General Permit (CGP)), prior to commencing construction activities. Coverage must be obtained by filing an NOI with a vicinity map and the appropriate fee with the SWRCB. Projects smaller than one (1) acre of disturbed soil area shall prepare a Water Pollution Control Plan (WPCP).

A. The CGP requires development and implementation of a SWPPP. The CGP emphasizes the use of appropriately selected, correctly installed and maintained pollution reduction BMPs. This approach provides the flexibility necessary to establish BMPs which can effectively address source control of pollutants during changing construction activities.

B. All dischargers shall prepare and implement a SWPPP prior to disturbing a site. The SWPPP must be implemented at the appropriate level to protect water quality at all times throughout the life of the project. Non-stormwater BMPs must be implemented and maintained year round. The SWPPP shall remain on the site while the site is under construction, commencing with the initial mobilization and ending with the termination of coverage under the CGP.

C. The SWPPP has six major objectives: (1) identify all pollutant sources, including sources of sediment that may affect the quality of storm water discharges associated with construction activity (storm water discharges) from the construction site, and (2) identify non-storm water discharges, and (3) identify, construct, implement in accordance with a time schedule, and maintain Best Management Practices (BMPs) to reduce or eliminate pollutants in storm water discharges and authorized non-storm water discharges from the construction site during construction, and (4) develop a maintenance schedule for BMPs installed during construction designed to reduce or eliminate pollutants after construction is completed (post-construction BMPs), and (5) identify a sampling and analysis strategy and sampling schedule for discharges from construction activity which discharge directly into water bodies listed on Attachment 3 of the Permit (Clean Water Act Section 303(d) [303(d)] Water Bodies listed for Sedimentation) and (6) for all construction activity, identify a sampling and analysis strategy and sampling schedule for discharges that have been discovered through visual monitoring to be potentially contaminated by pollutants not visually detectable in the runoff.

D. Minimum required elements of a SWPPP include:

1. A vicinity map showing nearby roadways, the construction site perimeter, and the geographic features and general topography surrounding the site.

2. Site description addressing the elements and characteristics specific to the site with a detailed, site-specific listing of the potential sources of storm water pollution.

3. A site map showing the construction project in detail, including the existing and planned paved areas and buildings; general topography both before and after construction; drainage patterns across the project area; and anticipated storm water discharge locations (i.e., the receiving water, a conduit to receiving water, and/or drain inlets)

4. Erosion and Sediment Control Plan with descriptions of BMPs to be employed.

5. BMPs for construction waste handling and disposal.

6. Implementation of approved local plans.

7. Proposed post-construction controls, including description of local post-construction erosion and sediment control requirements.

8. Non-stormwater management.

9. The name and telephone number of the qualified person responsible for implementing the SWPPP and certification/signature by the landowner or an authorized representative

E. SWPPP's will be modified and amended to reflect any amendments to the Permit, or any changes in construction or operations that may affect the discharge of pollutants from the construction site to surface waters, groundwaters, or the municipal

separate storm sewer system (MS4). SWPPP's will also be amended if they are in violation of any condition of the Permit or has not achieved the general objective of reducing pollutants in storm water discharges. SWPPP's shall be readily available on-site for the duration of the project.

F. Prior to approval of Improvement Plans, a copy of the NOI for coverage under the CGP with assigned WDID number shall be submitted to the County. Prior to commencing construction, the SWPPP, with its ESCP, will be submitted and reviewed by the County for adequacy. The County shall use the accepted SWPPP in conducting its inspections and monitoring under the County's NPDES permit requirements.

11-3. EROSION AND SEDIMENT CONTROL PLAN (ESCP)

All projects must have adequate and effective combinations of erosion and sediment control BMPs properly implemented, installed, and maintained.

A. Improvement Plans shall include an Erosion and Sediment Control Plan. These plans may be incorporated into the Grading Plans or on separate sheets for clarity.

B. The ESCP shall be designed to ensure that the following minimum requirements are effectively implemented at applicable construction sites:

1. Sediments generated at the project site shall be controlled using adequate source control and/or structural BMPs;

2. Construction-related materials and wastes shall be retained at the project site to avoid discharge to the MS4 and waters of the state;

3. Unauthorized non-storm water runoff shall be contained at the project site; and

4. Erosion from slopes and channels shall be controlled by implementing an effective combination of erosion and sediment control BMPs such as limiting grading during the wet season; inspecting graded areas during rain events; planting and maintenance of vegetation on slope; and covering erosion-susceptible slopes.

5. The locations for construction BMPs need only be general in nature on improvement plans subject to more specific locations being noted in the SWPPP at the pre-construction conference.

C. Specific locations for construction access, washouts, waste disposal sites, signage, portable toilets, and other BMP-related facilities must be provided as a supplement to the Erosion and Sediment Control Plan at the preconstruction meeting. During the pre-construction meeting, for projects involving greater than 1.0 acre, the Applicant/contractor shall provide the County with a SWPPP supplementing the initial ESCP, showing the locations of BMPs and BMP-related facilities whose location is dependent on construction execution planning such as the access points, disposal points, and washouts.

11-4. CONSTRUCTION BEST MANAGEMENT PRACTICES (BMPs)

All projects shall employ appropriate temporary and permanent BMPs during construction. Construction disturbing more than 1 acre shall include BMPs in the SWPPP and Erosion and Sediment Control Plans. Smaller projects shall select and utilize BMPs as necessary to adequately control erosion, sediment, tracking, non-storm water management, materials and waste.

Sutter County uses the California Storm Water Quality Association's (CASQA) Construction Storm Water Best Management Practice Handbook as its selection guide for selecting temporary BMPs. BMPs used for construction activities shall be selected and employed in accordance with CASQA guidelines. Drawings in these standards may also be used for employment of BMPs. Equivalent BMP guidelines generally accepted by California agencies and in general use within the State may also be used, but must be so identified and justified in the ESCP.

NOTE: The following paragraphs describe selected Sutter County minimum requirements in the employment of BMPs. These requirements are not to be considered comprehensive and must be supplemented as needed to be in full compliance with CGP.

A. Tracking Control - Access points to the construction site shall have a stabilized construction access. A stabilized access consisting of a pad of coarse aggregate underlain with filter cloth located where traffic enters or leaves a construction site to minimize tracking of sediment from a construction site onto paved streets is required. (Standard Drawing SQ-1). This practice may be supplemented by an entrance/outlet tire wash area. Placement of stabilized construction access points shall be clearly defined on the improvement plans. Streets adjacent to construction access points shall be swept as needed, to remove dirt and sediment tracked into the roadway.

B. Preservation of Existing Vegetation - Maintain areas of existing vegetation, utilizing stable vegetated areas to help reduce the amount of sediment in sheet flow runoff and to minimize the extent of disturbed area. Examples of how existing vegetation can be preserved include:

    1. Buffer strips adjacent to wetlands and other sensitive areas in conjunction with sediment controls (fiber roll or silt fence).

    2. As perimeter protection along property lines, in conjunction with sediment controls (fiber roll or silt fence).

    3. Maximize undeveloped portions of a job site.

    Areas of vegetation to be preserved shall be clearly marked on plans and fenced or flagged in the field. Traffic and stockpiles shall be located away from vegetated areas. Irrigation and maintenance requirements shall be specified on the plans.

C. Erosion Control

1. Inactive Disturbed Soil - Inactive disturbed soil areas, and associated earthen concentrated flow lines and conveyances, not being worked or scheduled to be worked for an extended period of time during the wet season, must be stabilized.

    a) During the wet season, inactive disturbed soil areas must be stabilized within 15 calendar days of cessation of work or prior to a forecasted rain event, whichever comes first.

    b) Residential lots that have not yet been landscaped shall have the at least the first 18 feet behind the sidewalk (first 7.5 feet for side yards) stabilized by hydroseeding or other method.

2. Slope protection – All slopes greater than 10:1 shall be protected through the use of effective erosion controls.

3. Practices - Such practices may include preserving existing vegetation, Silt Fencing (Standard Drawing SQ-4), Straw Mulch, Geotextiles, Erosion Control Blankets/Mats (Standard Drawing SQ-8 and Standard Drawing SQ-9), Velocity Dissipation Devices, and Hydroseeding. Hydroseeding, if used, shall be implemented in advance of the time when there is risk of erosion. Hydroseeding applied after September 15 and before April 30 shall be further protected with straw mulch, soil binder, or an erosion control blanket/mat.

D. Sediment Control - Sediment control BMPs shall be used to settle and trap sediments before they reach the municipal storm sewer system.

1. Roadway Subgrades and Depressions - Subgrades and depressions during construction shall be protected from discharging pollutants during overflow.

2. Perimeters - Sediment control BMPs shall be placed and maintained along the project perimeter where drainage flows from the project and at all inlets to the municipal storm drainage system for the duration of active construction.

3. Practices - BMPs may include the use of Fiber Rolls (Standard Drawing SQ-3), Silt Fencing (Standard Drawing SQ-4), Inlet Barriers, and Sediment Traps (Standard Drawing SQ-2).

4. Drain Inlet Protection - Storm drain inlets shall be protected against intake of construction site sediment, debris and solid waste.

    a) Place drainage inlet protection BMPs at storm drain inlets. BMPs shall include Inlet Sediment Control Barriers (Standard Drawing SQ-6), and Inlet Filter Bags (Standard Drawing SQ-7). Inlet sediment control devices are placed on the upstream side of drainage inlets. For inlets in gutter low points, inlet sediment control devices shall be installed on both sides of the inlet.

b) Inlet sediment control devices shall remain in place until soil disturbing activities are completed and adjacent areas are stabilized with permanent erosion control.

c) Filter bags and frames shall be placed such that low flow surface water does not bypass the filter bag.

E. Wind Erosion Control

Each construction site shall employ proper and adequate wind erosion and dust control BMPs such as applying water and other dust palliatives.

F. Non-Stormwater Management

Each construction site shall provide designated paint, concrete, solid and liquid waste disposal locations and washout locations as necessary. Plans shall indicate locations and designs as appropriate.

1. Concrete washouts will be designed for project sites where concrete is used as a construction material, and concrete trucks and other concrete-coating equipment are washed on site, including mortar and stucco operations. Plans shall include locations of directional signage for drivers as well as the details and locations of the washout facility. Above grade washouts must be lined and bermed.

2. Each construction site shall provide proper, water tight, storage of construction materials with secondary containment for hazardous liquids. Sites shall have an emergency response plan and proper spill kits and containment materials.
3. Each construction site shall provide proper and adequate water tight solid waste containers.

11-5. SCHEDULE

A BMP installation schedule shall be included in the SWPPP and/or on the included erosion and sediment control plans. The schedule shall include the BMPs for both the wet season and the dry season.

11-6. MONITORING AND MAINTENANCE

A critical element of stormwater quality protection during construction is maintaining BMP facilities and monitoring BMPs in place regularly. Designs must include, in the SWPPP or on the plans, the specific requirements for monitoring the effectiveness of BMPs before, during and after storm events and during routine dry weather operations.

Maintenance requirements will be in the design documents and must ensure the following:

A. BMP facilities are functioning as designed.

B. BMP facilities and practices are preventing pollutants from entering the County storm drain system, creeks and channels.

C. BMP facilities are not causing street or property flooding.

D. All BMPS's are routinely inspected, maintained and documented in the site SWPPP.

SECTION 12

SURVEY MONUMENTS

12-1 SURVEY MONUMENT REQUIREMENTS

A. The Engineer of Record shall place monuments at the following locations within subdivision improvements and all roadway improvements:

1. At the intersection of all street centerlines.

2. At the beginning and end of all curves on street centerlines.

3. At the subdivision boundary corners designated by the Director and other such locations so as to enable any lot or portion of the improvement to be retraced or located.

The monuments shall be as follows:

1. Subdivision boundary monuments, except those in street pavement shall be not less than one-inch (1") O.D. galvanized iron pipe, 30 inches in length, capped and tagged.

2. Subdivision boundary monuments in street pavement and centerline and street intersection monuments shall be 2 ½" brass disc in well castings (monument wells) per the Sutter County Standard Drawing ST-43. Centerline monuments for each subdivision shall include at least two monuments wells that are intervisible and at least 500 feet apart. Monuments shall bear the license number of the responsible surveyor/engineer.

All centerline monuments shall be referenced to permanent objects and ties shall be furnished to the Director for general public use. Final approval of the subdivision will not be made until such ties have been furnished to the Director.

B. Survey monuments shall be placed by the Engineer of Record at all the following locations within the improvement, and off-site, due to deed dependency, as required by the County:

1. Section corners

2. Quarter corners

3. Center of sections.

A monument for a section corner, quarter corner, or center of section shall be a 2½" brass disc in well castings per the Sutter County Standard Drawings.

Where such points lie outside of the ultimate County right-of-way, monuments for section corners, quarter corners, and centers of section, may alternatively be class

"B" concrete, poured in place, with minimum dimensions of 8 inches by 8 inches by 24 inches. Ferrous material shall be placed in the monument to make it locatable with a magnetic locator. A metal survey disc shall be installed by the Engineer of Record before the concrete has acquired its initial set and shall be firmly embedded in the concrete.

C. The Engineer of Record shall cause the preparation and filing of a pre-construction record of survey or corner record as prescribed by the Professional Land Surveyor's Act and show the location and character of all survey monuments within the construction area and place a note on all construction plans stating the Contractor is responsible for the protection of all existing monuments and other survey markers in accordance with Section 8771 of the Professional Land Surveyor's Act, prior to commencing project construction.

D. The Engineer of Record shall cause the preparation and filing of a record of survey or corner record as prescribed by the Professional Land Surveyor's Act, for all monuments within the project limits, including new monuments, at the completion of the project construction.

SECTION 13

TRAFFIC SIGNAL DESIGN

13-1. DESIGN STANDARDS

Traffic signals, intersection safety lighting and electrical systems shall be designed in accordance with Part 4 of the California Manual on Uniform Traffic Control Devices for Streets and Highways, Sections 9-06 thru 9-13 of the California Traffic Manual, California Signal and Lighting Design Guide, the applicable State Plans, and the applicable provisions of Section 86, "Signal, Lighting and Electrical Systems", of the State Specifications.

13-2. GENERAL PLAN REQUIREMENTS

The traffic signal/safety lighting plans shall include pertinent traffic signal notes, in addition to all designed features, for the project.

13-3. PULL BOXES

Pull boxes for traffic signal shall be designed to locate outside all access ramp areas. Such requirements shall be stipulated on the traffic signal/safety light plans as a special note.

13-4. LIGHTING TYPE CONSISTENCY

A. Common Type (CT)

1. Safety Lighting - Standard safety lighting shall be used in areas designated for common type street lights.

2. Finish - Standard galvanized steel poles, mast arms and luminaire arms shall be used.

SECTION 14

SANITARY SEWER SYSTEM

14-1 DESIGN CRITERIA

These criteria apply to all sanitary sewer / wastewater systems within Sutter County with a capacity up to an Average Dry Weather Flow (ADWF) of 15 million gallons per day (MGD).

14-2 TRIBUTARY AREA

Sewers shall be sized for the entire tributary area, even though the tributary area may extend beyond a specific development project's boundaries. The tributary area includes all existing development and future development that is anticipated in the Sutter County General Plan that will flow to the sewer being sized. The Development Services Director (Director) may direct that other anticipated development be included in the tributary area.

14-3 AVERAGE DRY WEATHER FLOW

The ADWF at any location in the sewer system shall be the total of the ADWF for each land use listed below. The minimum population density used shall be equivalent to that of single family zoning. The area shall be examined for trends toward population concentration greater than present zoning allows and/or more than five lots per acre and, if found, an estimate should be made of the probable extent of such concentration. This estimate shall be used as the basis for determining flow.

A. Low and Medium Density Residential Units (less than 25 units per acre) – For low and medium density housing units, the ADWF shall be based on 310 gallons per residential unit per day, and the existing or proposed number of residential units.

B. High Density Residential Units (25 units per acre and above) – For high density housing units, the ADWF shall be based on 232 gallons per residential unit per day, and the existing or proposed number of residential units.

C. Schools – The ADWF shall be calculated by multiplying the gross acreage of the school by 1,860 gallons per acre per day.

D. Commercial and Industrial – For standard commercial and industrial development, the ADWF shall be calculated by multiplying the gross acreage by 1,860 gallons per acre per day. Non-standard commercial or industrial development (for example food processing) shall prepare customized ADWF calculations; and these customized ADWF calculations require approval by the Director. The Director may designate any commercial or industry development as non-standard.

E. Mixed Use (residential and commercial) – For mixed use development, the ADWF shall be calculated by multiplying the gross acreage by 3,020 gallon per acre per day.

F. Parks and Open Space - For parks and open space, the ADWF shall be calculated by multiplying the gross acreage by 150 gallon per acre per day. A park with sports facilities with public restrooms and that attracts large audiences may be designated by the Director as an Other Development Type (see below).

G. Other Development Types (ODT) – All land uses that are not one of those listed above are considered an ODT. All ODT shall prepare customized ADWF calculations; and these customized ADWF calculations require approval by the Director.

14-4 PEAK DRY WEATHER FLOW (PDWF)

The PDWF for low/medium/high density residential, schools, and standard commercial/industrial developments shall be calculated by multiplying the ADWF by the peaking factor from Standard Drawing No S-9. Non-standard commercial or industrial development and ODT shall prepare customized PDWF calculations; and these customized PDWF calculations require approval by the Director.

14-5 INFILTRATION AND INFLOW (I&I)

I&I shall be calculated by multiplying the gross acreage by 1,400 gallons per day per acre. Some large, unsewered areas, such as golf courses (just the areas of play), habitat mitigation areas, or regional detention basins, may be removed from the I&I calculation with written approval by the Director. All areas of typical development, such as neighborhood parks, street, landscape areas, drainage ways, and local detention basins shall be included in the I&I calculation.

14-6 PEAK WET WEATHER FLOW (PWWF)

PWWF shall be calculated by adding the PDWF and the I&I. The PWWF is also called the "design flow."

14-7 SEWER SIZE, SLOPE, VELOCITY, CAPACITY, COVER AND MATERIAL

Design criteria for the sewer pipes are as follows:

A. Minimum Sewer Size – The minimum gravity sewer size shall be 8 inches in diameter (see below for service lateral sizing).

B. Slope, Velocity and Capacity – Manning's formula shall be used to determine the relation of slope, design flow, velocity, diameter, and "N" value. The "N" value shall be 0.013 for all pipe materials.

1. Sewers shall be designed to have a minimum velocity at the design flow of 2 feet per second and a maximum velocity of 8 feet per second. velocities of less than 2 feet per second will be allowed in the upstream segments of 8-inch sewers (minimum allowed diameter).

2. Table 14-1 presents slopes and design flow capacities for various pipe diameters. Pipe slopes less than those listed in this table shall not be used without the approval of the Director. The slopes indicated are based on a velocity of two feet per second with the pipe flowing full.

3. The maximum ratio of depth of flow to pipe diameter (d/D) at the PWWF in any sewer 12 inches in diameter or less shall be 0.7. Sewers 15 inches in diameter or larger may be designed to flow full (d/D = 1.0). However, for

sewers of any size with service lateral connections, d/D shall not exceed 0.7.

Table 14-1. Gravity Sewer Minimum Slopes and Resulting Capacities

Pipe Diameter (inches)	Minimum Slope (foot per foot)	Capacity at d/D = 0.7 (MGD)	Capacity when Flowing Full (MGD)
8	0.0034	0.38	0.46
10	0.0025	0.59	0.71
12	0.0020	0.86	1.03
15	0.0015	1.35	1.62
18	0.0012	1.97	2.35
21	0.0010	2.71	3.24
24	0.0010	3.87	4.62
27	0.0010	5.30	6.33
30	0.0010	7.02	8.38
33	0.0010	9.05	10.81
36	0.0010	11.41	13.63
42	0.0010	17.21	20.56
48	0.0010	24.58	29.36

C. Material – Pipe material shall be as approved by the Director and shall conform to the requirements of the Standard Construction Specifications. Pipe materials which will normally be considered are as follows:

1. Ductile Iron Pipe – Ductile Iron Pipe shall be used in high groundwater conditions when required by the Director. Ductile iron pipe (DIP) shall conform to ANSI A21.51 (AWWA C151) for a minimum working pressure of 150 psi unless otherwise specified. Ductile iron castings shall conform to and be tested in accordance with ASTM A536. Casting grade for pipe shall be 60-42-10. Laying length shall be the manufacturer's standard length, normally 18 feet. Shorter lengths may be used when required for closures and proper location of special sections.

   The interior surface of all (DIP) shall be lined. DIP pressure pipes designed to remain full shall be cement-mortar lined and seal coated in conformance with AWWA C104, except at air relief points/pipe high points. At air relief/high points, two pipe joints upstream and two pipe joints downstream shall be lined with 40 mils of ceramic epoxy (Protecto 401, or equal) to protect the pipes from corrosive gasses. All gravity flow

pipes and pressure pipes that will periodically be drained shall be lined with 40 mils of ceramic epoxy (Protecto 401, or equal). The exterior surface shall have a bituminous coating of either coal tar or asphalt base, approximately 1 mil thick. At a minimum, buried DIP shall be encased in an 8-mil polyethylene wrap in accordance with AWWA C105. Additional external corrosion protection such as sacrificial anodes and/or impressed current cathodic protection may be required to suit site specific soil corrosivity, as required by the Director.

Fittings shall be push-on, mechanical, or flanged-type ductile iron or cast iron and shall conform to ANSI 21.10 (AWWA C110) or ANSI 21.11 (AWWA C111) designed for a working pressure of 250 or 350 psi. Coating and lining requirements shall be the same as specified for pipe.

Joints shall be push-on or mechanical type and shall conform to ANSI 21.11 (AWWA C111) with Nitrile (acrylonitrile butadiene) rubber gasket unless otherwise approved by the Director.

2. Polyvinyl Chloride Pipe (PVC) Sewer Force Main And Gravity Sewer

   a. Thickness – PVC pipe for force main and gravity service wall thickness shall be designed for a calculated deflection of 5% at constructed depth with AASHTO H-20 surface loading.

      i. PVC Force Main: 4-Inch through 12-Inch Diameter – Polyvinyl chloride pipe shall have a maximum dimension ratio (DR) of 18 (minimum Pressure Class 150), unless otherwise specified and shall conform to AWWA Standards C900 or C905. Outside diameter (OD) pipe dimension shall be manufactured to cast iron pipe (CIP) equivalent. Pipe shall be furnished in minimum standard lengths of 20 feet.

      ii. Gravity Piping: 8-Inch through 36-Inch Diameter Sizes – Polyvinyl chloride pipe shall have a maximum dimension ratio (DR) of 25, unless otherwise required by the Director and shall conform to ASTM D3034.

   b. Outside diameter (OD) pipe dimension shall be manufactured to cast iron pipe (CIP) equivalent. Pipe shall be furnished in minimum standard lengths of 20 feet.

   c. Joints – All PVC pipe joints shall be gasketed, bell and spigot, push-on type conforming to ASTM D3212 pipe shall have integral wall-thickened bell ends designed for joint assembly using elastomeric-gasket seals. The minimum wall thickness of the integral wall-thickened bell, at any point between the ring groove and the pipe barrel, shall conform with the DR requirements for the pipe barrel. The minimum wall thickness in the ring-groove and bell entry sections shall equal or exceed the minimum wall thickness of the

pipe barrel. The elastomeric-gasket seals shall conform to ASTM F477.

The pipe shall have a pipe stop indicated on the barrel that will accurately position the pipe end within the joint. The pipe in place shall permit thermal expansion and contraction of the pipe ends.

d. Fittings – Pressure Applications – Fittings for polyvinyl chloride pipe shall be those specified by the pipe manufacturer. All pressure pipe fittings for 12-inch diameter PVC and smaller shall be ductile iron compact fittings conforming to AWWA C153 Class 350. Fittings for PVC 14 inches in diameter and greater shall be standard mechanical joint connections conforming to AWWA Standard C110 or restrained to the satisfaction of the Engineer. Adapter "O" rings are not acceptable.

14-8 THRUST RESTRAINTS

All pressure sewer pipe shall have thrust restraints. Locating wire, consisting of 10 AWG with green colored PVC insulation, shall be installed on pressurized sewer mains.

14-9 SEWER LOCATIONS AND ALIGNMENT REQUIREMENTS

Location and alignment criteria are as follows:

A. General – All sanitary sewers shall be placed within rights-of-way dedicated for public streets unless the use of easements is specifically approved by the Director. Easements shall be a minimum of 25 feet wide for sewers up to 36 inches in diameter and as determined by the Director for larger diameter sewers. Temporary working easements of adequate dimensions shall be provided to allow the construction within the permanent easement to be completed in a safe and reasonable manner. Easements shall be granted to the appropriate district or the County of Sutter.

B. There shall be a minimum horizontal clearance of ten feet clear between the outside wall of parallel water and sanitary sewer lines; the water main shall be a minimum of 12 inches higher than the sewer. On crossings the water line shall be at least 12 inches above the sewer line. If a sanitary sewer force main must cross a water main, the requirements of Section 15-13 shall apply.

C. Location of New Subdivisions – In new residential subdivisions, sewers shall preferably be located six feet south or east of street centerlines within minor and primary streets. Sewers located in arterial streets shall be located as approved by the Director.

D. Location in Existing Streets – When sanitary sewers are to be installed in an existing street, factors such as curbs, gutters, sidewalks, traffic conditions, traffic lane conditions, pavement conditions, future street improvement plans, and existing utilities shall all be considered. The approval of the Director shall be obtained in every instance.

E. Water Well Clearance – No sanitary sewer interceptor, trunk line, lateral, or service shall be placed nearer than 50 feet to any water well, public or private, unless the well has been destroyed in accordance with the requirements of County Code and the County Environmental Health Division; or the location otherwise approved, in writing, by the appropriate health agencies. If a clearance of less than 50 feet is approved, all pipes within 50 feet distance from the well shall be of material approved by the Environmental Health Division.

F. Alignment – Alignment of all sewer pipe and structures shall be designed to provide a minimum six inch clearance from all other utilities and/or improvements, unless otherwise approved by the Director.

1. Horizontal alignment shall be parallel to the street centerline wherever possible. Minimum radius for sanitary sewers 6 inches through 12 inches in diameter shall be 200 feet. A larger radius shall be used wherever practicable or where necessary to avoid joint deflection in excess of the pipe manufacturers' recommended maximum.

2. Vertical alignment shall provide a constant slope between manholes. If a change in grade is necessary, construction of a manhole shall be required. Vertical curves shall not be used unless approved by the Director.

14-10 TRENCH LOADING CONDITIONS AND PIPE DESIGN

The loading condition and pipe design criteria for conduits are as follows:

A. Rigid Conduit Loading – On rigid conduits, Marston's formula shall be used to determine the load placed on the pipe by the backfill. The procedure for rigid pipe is described in the ASCE Manual and Report of Engineering Practice No. 60, the Clay Pipe Engineering Manual, and in similar handbooks. In the absence of specific soils data, as determined by a Geotechnical Engineer, a soil weight of 120 p.c.f. and a Ku factor of 0.110 shall be used.

B. Bedding and Initial Backfill – Bedding types and factors shall be as indicated on Standard Drawing No. S-10. Bedding and initial backfill type shall be as necessitated by height of cover over the pipe, trench width, pipe strength, and other factors used to determine safe pipe loading. Special attention shall be given to backfill requirements for pipe located in State rights-of-way and for pipe placed in areas where trench width is excessive, such as in the vicinity of bore pits. See Section 14-15 regarding this condition. Any special requirements shall be noted on the plans.

1. Bedding and initial backfill for VCP and DIP may be all types indicated. Bedding and initial backfill for PVC shall not be Type II.

2. The minimum trench width shall be pipe O.D. plus 12 inches.

C. Special Pipe Strength Requirements – Ductile iron or other high-strength pipe approved by the Director shall be used whenever cover is greater than 25 feet or where extra support strength is required. Ductile iron pipe, Class 200 or other high-strength pipe approved by the Director shall be used whenever cover is less

than three feet, or insufficient clearance exists between the sewer pipe and rigid or load transmitting structures.

D. Design Guide – Tables which relate cover, pipe diameter, trench width, and bedding and initial backfill type for vitrified clay, according to the procedures contained in these Standards are provided on Standard Drawing S-10.

14-11 MANHOLE CRITERIA

The design criteria for manholes are as follows:

A. General - Manholes shall be placed at the intersections of all sanitary sewer lines, at the end of any line terminating with a cul-de-sac, at the end of all permanent lines, and at the end of any temporary line more than 50 feet in length. All manholes from which sewer line extensions are anticipated shall have a pipe stub installed at the grade and in the direction of the anticipated extension. Summit manholes connecting two sewers are acceptable.

B. Spacing – Maximum spacing of manholes shall be 400 feet for all straight lines of ten inch diameter or less. A line with a radius greater than 400 feet shall be considered as straight for purposes of this section. Manhole spacing on lines that are on a continuous curve of 200 foot radius (minimum allowable) shall be 200 feet. Manhole spacing on curved lines of radius between 200 and 400 feet, or where only a portion of the line is curved, shall be adjusted proportionately. Reverse curves require a manhole at the point of tangency between the curves. A manhole shall be required at any change in vertical alignment. A manhole shall also be placed at any change in horizontal alignment.

C. Elevation Criteria – When two lines of the same size enter a manhole and the flow of one must change direction by more than 20 degrees or if flow in a single line must change direction more than 20 degrees, the invert grade at the exit shall be at least 0.10 foot below that of the entrance pipe or, as a maximum, the crown of the exit pipe shall match the invert of the entrance pipe. If the pipes entering and exiting any manhole are not of the same size, the minimum invert elevation differential shall be when the pipes are matched crown to crown and the maximum invert elevation differential shall be based on the invert of the entering pipe matching the crown of the exit pipe. Drop connections are not governed by the above elevation requirements.

D. Construction Requirements – Manhole construction shall conform with the provisions of Standard Drawing No. S-5. Lock-type or pressure-type manhole covers shall be used on manholes located in areas subject to flooding. Where the manhole depth is less than four feet, an 18 inch high cone, as shown on Standard Drawing No. S-6 may be used. The plans shall note the frame on manholes located in unimproved areas shall be set 12 inches above existing ground level. Pipe material which does not provide adequate bonding between pipe and manhole may similarly require special designs. Manhole joints shall be sealed with bitumen impregnated sealant such as Ram-neck or equal.

E. Vacuum Testing Manholes – All sewer manholes shall be vacuum tested in accordance with ASTM C1244 and the Standard Construction Specifications.

14-12 DROP CONNECTION CRITERIA

A drop connection shall be required whenever a pipe enters a manhole higher than 3 feet above the exiting pipe. If an elevation difference of at least three feet is not available, the slope of the incoming line shall be increased to eliminate the need for the drop. Drop connections shall conform to Standard Drawing No. S-11. The inside drop connection shall be used for all service laterals and sewer connections up to eight inches in diameter. The outside drop connection shall be used for pipes larger than eight inches in diameter and require written approval by the Director.

14-13 FLUSHING BRANCH CRITERIA

A temporary flushing branch may be used in lieu of a manhole at the upstream end of a sewer if all of the following apply: 1) The cleanout is less than 50 feet upstream of a manhole, 2) the sewer is planned future extension, 3) there are no service lateral connections between the clean out and the man hole. Flushing branches shall conform to Standard Drawing No. S-2.

14-14 SERVICE LATERAL DESIGN

The design criteria for service laterals are as follows:

A. General – Service laterals shall be constructed of VCP or PVC as previously specified or solid wall acrylonitril-butadiene-styrene (ABS) conforming to ASTM D2751 minimum wall thickness SDR 35. Service laterals shall conform to Standard Drawing No. S-4 and S-7 and shall be constructed perpendicular to the sewer main unless otherwise approved by the Director. The service laterals shall extend from the sewer to the edge of public right-of-way or edge of easement unless a water main is to be installed at back of sidewalk as part of the subdivision improvements. In such cases, service shall be extended to seven feet back of sidewalk. The cleanout to grade shall remain within two feet of back of sidewalk. See Note A of Standard Drawing No. S-7 for cover requirements. Service laterals shall extend one foot beyond edge of pavement of any private road and easements of adequate width to accommodate the services shall be obtained. A plan and profile of any service laterals shall be supplied to the Director upon request.

B. Cleanout – The cleanout to grade required at the termination of service laterals shall be constructed by the building plumber at the time the building sewer connection is made. Unless otherwise noted on the plans, construction of the cleanout to grade is the responsibility of the plumbing contractor for the building improvements. At the time of construction of the service lateral and until the building connection is made a 4” x 4” green painted post shall be maintained at the end of the service lateral, extending from the pipe invert to not less than 12 inches above ground surface. Deferral of cleanout will not be allowed where a water main will be installed at the back of sidewalk.

C. Division of Responsibility - Each property owner is responsible for the installation of a service lateral across his/her property frontage and connecting to the sewer

system. This responsibility can be complied with by paying the appropriate fees for the County (or sanitation or sewer district) to install the service lateral. After initial installation, the section of the service lateral within the private property is the responsibility of the private property owner. The section of the service lateral within a public right-of-way is the responsibility of the County (or sanitation or sewer district).

D. Service Lateral Cover – Service laterals shall have a minimum slope of 1/4 inch per foot. The minimum cover shall be 12 inches at any buildable location within the properties to be served. At the right-of-way line, a minimum of 4 feet of cover is required. If a water main is installed at the back of sidewalk, a minimum of 5 feet of cover is required at the right-of-way line. The invert elevation of the service lateral at the property line shall be shown on the improvement plans.

E. Sizing – Minimum residential service lateral diameter is four inches. Service laterals serving two or more residential units, schools and other developments expected to contribute high sewage flows shall be six inch or larger. In addition, service laterals shall be sized according to requirements of the California Plumbing Code, and determinations by the Consulting Engineer. If the service lateral and collector sewer are of the same size, a manhole shall be constructed; if the collector sewer is larger than the service laterals, a factory fitting at the connection is satisfactory. Connection to trunk lines will be permitted only at manholes.

F. Connection Limitations – Service laterals shall not directly connect to sewers more than 14 feet deep without the approval of the Director.

G. Location – When sewers are constructed as part of new subdivision improvements, service laterals shall be constructed to each lot. In new subdivisions or development areas, service laterals shall be placed on the low side of any subdivision lot with two percent or greater slope across the front. The service lateral shall be placed in the center of lots of slopes less than 2 percent. Consideration shall be given to trees, improvements, etc., so as to minimize interference when the service lateral is extended to service the house.

If the property is located with service lateral available both to a sewer located in an easement and also in right-of-way, service laterals shall be in the right of way location unless otherwise approved by the Director. No service laterals shall be located where future on-site construction will result in the sewer being in close proximity to a water well or water main. No service lateral may cause applicable health standards to be violated.

The curb adjacent to the cleanout shall be marked with an “S” on face of curb, using arial or other similar block letter font letters a minimum of 2.5 inches high and ¼” deep into the concrete.

H. Joint Trench – If a joint trench is being utilized for other utilities, the plans shall indicate that a joint trench will exist and shall adjust service elevations as necessary.

I. Special Requirements in Developed Areas – In developed areas, a service lateral shall be provided to each parcel participating in the project which contains a source of sewage less than 200 feet from a sewer. A property owner's request for service lateral location where existing buildings to be serviced exist, shall be honored whenever practicable. Parcels which have two or more existing dwelling units shall have independent service laterals for each dwelling unit.

14-15 CREEK CROSSING DESIGN

Advance approval of the Director and of other appropriate agencies is necessary prior to initiating design. The criteria for creek crossing design is as follows:

A. General – In all cases the proposed future creek bed elevation shall be used for design purposes. Crossing details of pipe, piers, anchorage, transition couplings, etc. shall be shown upon a detail sheet of the plans in large scale.

B. Construction and Material – For sewer sizes ten inches and smaller, ductile iron pipe or other pipe material as approved by the Director shall be used under the full creek width, plus ten feet each side, unless the pipe is four feet or more below the creek bed elevation. For sewer sizes twelve inches and larger, pipe used shall be as directed by the Director. Special care shall be taken to provide a firm base for the pipe bedding. The plans shall specify all soft or organic material within the creek banks shall be replaced with select imported backfill. In addition, a layer of four inch to eight inch cobbles shall be placed and compacted on the top surface of the trench area for the full width of the creek. Unless otherwise directed, a clay plug will be required at the downstream side of the crossing. The plug shall be a minimum of four feet in length, shall extend the full width of the trench, and shall extend twelve inches above and below the pipe.

   If the pipe must cross above the creek bed, ductile iron or welded steel pipe shall be used. Steel pipe may be fusion epoxy lined and coated, or glass lined; the Director shall approve the type of coating and lining specified and the gauge, class, or thickness of the pipe. The Director may specify the pipe material to be used.

   Reinforced concrete piers of adequate depth shall be located as necessary for adequate support of the pipe. The pipe shall be held in cylindrical cradles, formed in the pier tops, with galvanized steel straps, with galvanized anchor bolts of adequate size. Open cell neoprene 1/8 inch thick cushion material shall be placed between the pipe, clamps, and support. The pipe must be sloped so that there is a continuous downward slope, even when the maximum deflection occurs.

C. Design – Calculations shall be submitted which clearly indicate the design of the pipe and supports regarding impact, horizontal and vertical forces, overturning, pier and anchorage reactions, etc.

14-16 BORING AND JACKING REQUIREMENTS

Where use of conductor casing is specified, the casing shall be corrugated steel pipe, reinforced concrete pipe, or welded steel pipe. The casing shall be of sufficient diameter to allow dry sand to be blown into the void between the carrier and the conductor and to allow adjustment of the

carrier pipe to grade. Normally, an inside diameter six inches greater than the outside diameter of the couplings of the carrier pipe is sufficient. Welded steel conductor pipe shall have a minimum wall thickness of 1/4 inch for sizes up to and including 24 inches in diameter and 5/16 inch for sizes 27 inches to 36 inches in diameter. Corrugated steel pipe conductor shall not be less than 0.138 inches thick for sizes up to 36 inches, and 0.168 inches thick for diameters to 60 inches. Reinforced concrete pipe conductor shall be designed for the loading condition and, if jacked, the additional loading imposed by the jacking operation.

Direct dry boring of reinforced concrete pipe and the portion of sewers and service sewers which pass beneath curbs and gutter, sidewalks, and other obstructions, up to a maximum length of 15 feet, is permissible. Six inch and smaller pipelines may be installed by wet boring where approved by the Director. Pipe material used in the small size dry and wet bores shall be ductile iron pipe. Installation and other material specifications shall conform to the requirements of the Standard Construction Specifications.

Backfill in bore pits shall be given special attention with respect to preventing structural failure of the pipe entering or exiting the conductor, and adequate bedding and initial backfill shall be specified.

14-17 PUMP STATION AND FORCE MAIN REQUIREMENTS

Every phase of pump station design, including force mains, shall be closely coordinated with and shall be under the direction of Sutter County. The plans shall show the testing required prior to acceptance of the pump station.

The firm capacity of the pump station must convey the design PWWF flow. Sewer pump stations shall include the following facilities: a back up pump, piping and valving to allow bypass pumping, flow meter, pressure gage, on-site pump controls (start, stop, alternate), controls that allow for remote monitoring of pump status and power supply status, ample vehicle accessibility, connection for standby power, and security fencing around the entire site. The director may also require an on-site standby generator and odor control facilities.

Unless otherwise approved by the Director, “fee title” shall be granted to the County or to the appropriate district for the pump station site and any access road thereto.

14-18 WASTEWATER STORAGE FACILITIES

Wastewater storage facilities normally will not be allowed. However, the Director may allow (in writing) wastewater storage facilities if there is no other feasible alternative. The Director may require an engineering study to verify that no other feasible options exist. If allowed, the storage facility shall be sized, planned, designed, and constructed as required by the Director.

14-19 SEWER IMPROVEMENT PLAN REQUIREMENTS

Plans for the construction of sanitary sewers whether in conjunction with other improvements or for a sewer project only, shall conform to the following standards, as well as other standards contained in the General and Plan Sheet Requirements of these Improvement Standards.

A. Study Map – A study map may be required prior to review of the sewer design if there is a possibility upstream or adjacent areas might require service through the subject property. The map should show the entire service area including upstream

tributary and adjacent areas, and all other data necessary to determine anticipated sewage flows. The method of sewering the entire service area, including pipe sizes and slopes, shall be shown to the extent necessary to determine the requirements within the subject property.

B. General Requirements – Plans for sewer improvement projects should include a layout sheet, plan and profile of each sewer line, and any necessary detail drawings. The plans shall be clearly legible and conform to accepted practice with respect to drafting standards. All information which in the opinion of the Director is necessary for the satisfactory design, review, construction and maintenance of a project shall be provided and, where applicable, shall be shown on the plans.

C. Layout Sheet – All sewer improvement plans shall include an overall map which shows the project boundaries, sewer lines, manholes, flushing branches, and other important items of the work. Where pavement will be cut in several locations, the pavement replacement requirements shall be shown on the layout sheet.

A parcel or area which benefits from and financially participates in a sewer construction project, but is not included within the project boundaries, shall have a note to effect placed on the layout map and on the plan and profile sheet if the parcel appears thereon. Parcels which make use of those facilities may be subject to additional fees at the time of connection, if the participation has not been so noted.

D. Plan and Profile Sheets – Sewers which will be maintained by a district shall be shown in both plan and profile views on approved plan and profile sheets. The following standards, with respect to drafting and the information to be included on the plan and profile sheets, generally apply to projects in developed areas. In new subdivision, only the requirements which are applicable shall apply.

1. Sewer lines to be constructed shall be indicated on the profile by parallel lines spaced the pipe diameter at the pipe invert for ten inch diameter and smaller lines only. Manholes shall also be indicated by parallel lines spaced according to scale. Slope shall be printed 1/8 inch above and preferably parallel to the pipe line, or between the parallel lines. The length, size, and type of pipe material between each manhole shall be printed parallel to the horizontal grid lines and approximately halfway between the ground surface and pipe line. All pipe inverts at manholes and other structures shall be indicated on the profile. The invert elevations shall be printed parallel to the horizontal grid lines and shall be under scored by a line which then runs at a 45 degree angle to the corresponding pipe invert. When manholes, manholes with drop connections, flushing branches, or other appurtenances will be constructed, the profile shall be so noted. Existing facilities shown on the profile shall be cross-hatched. Manhole identification on the plan view may be oblique. Stationing shall appear at the lower edge of the profile grid directly under the manhole.

2. In approved areas, the location of each service sewer proposed to be constructed shall be indicated on the plans by stationing or by reference to a permanent, well-defined structure, if available. In new subdivisions the

service sewers shall be located by stationing unless the situation exists, such as at the end of a cul-de-sac, where stationing is not an adequate description of location. In such cases, a dimension to a lot line may be used. The invert elevation of the service sewer at its upstream end shall be shown on the plans whenever the standard depth is inadequate to serve the property. Standard depth shall conform to the conditions set forth on Standard Drawing No. S-4.

Improvements or lots shown on a plan sheet but served to a line shown on another plan sheet shall have the direction of service shown by a small triangle and letter "S". "As-built" plans shall also show the service sewer location measured from the nearest downstream manhole. Both permanent and working easements shall be shown to scale on the plans. Easement dimensions shall be given and each easement shall be tied to both the property line and the sewer line. Each permanent easement shown on the plans shall be identified by a box or table, on the same plan sheet, which gives the property owner's name and the book and page number in which the easement is recorded. The Consulting Engineer shall provide the book and page number.

3. Indicate the limiting maximum trench width as measured at the top of the pipe on the plans between well-defined points of application; the pipe material and class, if more than one class is available; and the bedding-backfill type. Type I bedding when used and unlimited trench width when allowed need not be shown on the plans. If more than one combination of pipe material or class, maximum limiting trench width, or bedding type is available, a practical range of such combinations shall be shown on the plans.

4. Proposed sewer lines shall be adequately dimensioned from street centerline. If the sewer is to be located in an easement, sufficient dimensions and bearings from physical features to locate the line in the field shall be shown on the plans.

5. Gas, water, storm sewers, and all other main utility lines above or below ground shall be determined and shown on the plans with accuracy as great as practicable. The location of any utility line which is parallel to and within five feet of the sewer line or which crosses the sewer line at an angle of 30 degrees or less shall be determined with an accuracy of + 1.0 foot and the clearance shown on the plans. Service lines such as water and gas normally shall not be shown.

6. Trees and other objects within 10 feet of construction centerline shall have their correct location shown on the plans and the clearance from construction centerline shown. The diameter of tree trunks and interfering heavy tree branches shall be noted. Removal of a tree or object, or other special handling shall be noted on the plans. The Consulting Engineer shall assume full responsibility for such notes as it is assumed he has made all necessary arrangements with the owner of the object to be handled. Written documentation of any special arrangements regarding

preservation of property made between property owners and the Consulting Engineer shall be supplied to the Director if no easement document is involved. If an easement is negotiated, all special arrangements shall be included in the easement document. Tree removal within public rights-of-way or easements shall be approved by the Director.

7. Culverts shall be shown on both plan and profile when crossed by the construction or when parallel and within 20 feet of the construction line. The size and type of all such culverts shall be indicated and when the culvert crosses or is perpendicular or nearly so and within 20 feet of the construction line, the invert of the culvert end nearest the construction line shall be shown.

8. Address of buildings shall be shown on the plan view, within the outline of the building. Only the front line and indication of side lines of buildings need be shown.

E. Detail Drawings – Items of a special nature shall be shown with detail drawings, either on the plan sheet or on a separate detail sheet.

F. Connection to existing facilities where bypassing or stoppage of existing flow will be required – When improvement plans require connection to an existing facility which will require bypassing or stoppage of existing flows, a note shall be placed on the plans which provides an estimate of the existing flow to be bypassed (in gpm), or the times between which the flow may be stopped. Coordination with Sutter County is required in developing these numbers. The note shall also require the contractor to contact the Development Services Department at least two working days prior to initiating the bypass/stoppage operation so the temporary facilities and equipment can be evaluated for adequacy. Where the bypassing/stoppage operation will be accomplished on a major trunk line, submittal of a work plan for review will be required prior to initiation of the operation.

14-20 MULTIPLE-OWNERSHIP RESIDENTIAL DEVELOPMENTS

The "on-site" portion of the sanitary sewer collection system connected to a public treatment works serving more than one residential unit in a multiple ownership residential development that is not within a public sewer easement or a public right-of-way, and is therefore privately-owned, shall meet the following requirements.

A. Multiple Residential Structures – Residential developments where separate lots and structures are sold and adjacent land is owned in common and maintenance is performed by a homeowner's association.

1. General – Sanitary sewers shall meet all requirements for public sewers contained in these Improvement Standards, except as specified herein.

2. Manhole Spacing – Maximum spacing of manholes on laterals shall be 300 feet for all straight runs of pipe.

3. Laterals. Sewer laterals serving each structure shall be constructed under separate building permit conforming to building code requirements. Only "Wyes", not Tees shown on Standard Drawing S-7, shall be used for connecting on-site laterals to the on-site collection mains

4. Minimum Depth on Streets – All lines located within vehicular traffic areas shall have a minimum cover of three feet to finish grade. If the cover over a section of pipe must be less than two feet due to utility conflicts, ductile iron pipe shall be used for that section.

5. Plan and Profile Sheets. On-site improvement plans may be prepared without the sanitary sewer profile otherwise required in these Standards, unless specifically required by the Director. Final on-site grades and drainage facilities shall be shown on the plans on the same sheet as the plan view of the sanitary sewers.

6. Location – Wherever possible, sewer collection mains shall be located in streets.

7. Review and Approval – Plans shall be reviewed and approved by Development Services Department.

   Small sewer systems utilizing dispersal system or on-site treatment works shall be designed and constructed in accordance with the requirements of building code, and the County Environmental Health Division.

B. Single Structure Condominiums or Cooperative Developments. Multiple dwelling unit structures where dwelling units within the total development are sold. On-site sanitary sewers shall be constructed under separate building permit conforming to building code requirements.

14-21 MULTI-PARCEL COMMERCIAL AND INDUSTRIAL DEVELOPMENTS

The "on-site" portion of the sanitary sewer collection system serving more than one commercial or industrial that is not within a public sewer easement or a public right-of-way, and is therefore privately-owned, shall meet the requirements of Multiple Residential Structures in the preceding section. Otherwise, each separate parcel within a multi-parcel commercial or industrial development shall have its own separate connection to the public sewer system.

14-22 SEWER LINE TESTING

All sanitary sewers shall be tested.

A. Leakage Testing shall be performed in accordance with ASTM C828 and the Standard construction Specifications.

B. Obstruction Testing and Pipeline Inspection shall be conducted by closed circuit television in accordance with the Standard Construction Specifications.

C. PVC and ABS Pipe shall also be tested for deflection by a Go-No Go mandrel in accordance with the Standard Construction Specifications.

SECTION 15

WATER SUPPLY SYSTEM

15-1 INTRODUCTION

These improvement standards shall govern the engineering design of all domestic water systems intended for operation and maintenance by the County of Sutter or other agencies, such as Community Services Districts, where the Board of Supervisors is the agency board.

15-2 INTENT OF CRITERIA

The intent of these criteria is to provide a water system which will dependably and safely convey the required amount of high quality water throughout the distribution system at the least cost. In establishing the required amount of water, periods of peak domestic demand occurring in conjunction with an emergency fire flow demand shall be considered.

15-3 CURRENT STANDARDS

Pertinent and current requirements of the following agencies or standards shall be complied with:

A. Environmental Protection Agency Drinking Water Regulations
B. Laws and Standards of the State of California, Department of Public Health Services relating to Domestic Water Supply
C. General Order No. 103 of the California Public Utilities Commission
D. Sutter County Code regulating the installation, operation, construction, reconstruction and repair of wells and pumps
E. State of California, Water Well Standards (Bulletin 74-81)
F. Title 17, Chapter V, Sections 7583-7622, California Administrative Code, regarding cross-connections and backflow prevention
G. Uniform Fire Code
H. Uniform Plumbing Code
I. Latest edition of the American Water Works Association (AWWA) Standards

15-4 CONNECTION PERMITS AND FEES

A permit shall be obtained for each connection to the water system.

15-5 WATER SUPPLY QUALITY

The quality of the water shall conform to the Environmental Protection Agency Drinking Water Act and the State Department of Public Health Drinking Water Standards.

15-6 WATER SUPPLY PRESSURE

Normal operating pressures of not less than 40 psi nor more than 80 psi shall be maintained at service connections to the distribution system, except during periods of peak domestic and fire demand the pressure shall not be less than 20 psi. Excessive water pressure greater than 80 psi must be regulated.

15-7 DESIGN CRITERIA

For design of the distribution system, the following criteria shall be used in designing and constructing the water systems. Water system design criteria and construction practices shall conform to the following criteria.

OPERATING CONDITIONS

WATER SUPPLY PRESSURE

	Pressure		Velocity
	Maximum	**Minimum**	**Maximum**
Maximum day	80 psi	40 psi	7 fps
Maximum day and Fire	80 psi	20 psi	10 fps
Peak hour	80 psi	40 psi	7 fps

RATE OF DOMESTIC WATER USE

Land Use	**Average Day Demand (gpd/ac)**	**Fire Flow (gpm)**	**Fire Flow Duration (hr)**
Low Density Residential	3,270	1,500	2
Medium Density Residential	3,720	1,500	2
High Density Residential	4,160	2,500	3
Commercial/Office	2,670	3,000	3
Light Industrial	2,670	3,000	3
Schools	3,270	4,000	4
Parks	3,640		
Environmental Corridor	530		
Open Space	530		
Maximum Day Demand	1.85 x Average Day		
Peak Hour Demand	1.9 x Maximum Day		

---

[1]Assumes all new residential construction over 6,200 ft^2 and all commercial, public and industrial land use will require fire sprinkler.

[2]Unique projects or projects with alternative materials may be require higher fire flows and will be reviewed by the Fire Marshall on a case by case basis (e.g. proposed commercial/industrial areas and schools).

STORAGE AND PUMPING PLANT DESIGN

Minimum Storage Volume shall be the total of the following storage volumes

Operational Storage =	1/4 Maximum Day Demand
Emergency =	Average Day Demand
Fire Storage =	Highest fire flow demand in service area multiplied by required duration

15-8 WATER SUPPLY

All developments shall meet all applicable water supply reliability requirements of federal and state laws.

15-9 WELL AND PUMPING PLANT DESIGN

All phases of well and pumping plant design shall be coordinated with, and shall be under the direction of Sutter County. Particular attention shall be given, both in design and construction, to conformance with Bulletin 74-81, "Water Well Standards: State of California" of the State Department of Water Resources. Well production shall be based on the test wells drilled in the vicinity of the proposed well site and as approved by the Development Services Director (Director). In general, all developments shall have a minimum of two (2) sources of water. Pump stations shall contain a minimum of two pumps and have the ability to meet all operating conditions efficiently and with largest pump out of service. Standby power may be required at the option of the Director. Standby power must be provided to be considered a reliable supply. Emergency storage for well supply systems may be waived if standby power is supplied for each well and the number of wells exceeds the minimum number by at least 20%.

Well site selection shall be approved by Sutter County and meet the requirements of the Environmental Health Division of the County Environmental Management Department, and the State Department of Public Health.

15-10 TRANSMISSION SYSTEM DESIGN (larger than 12 inch diameter)

Sizing and layout of transmission mains shall conform to Master Water Supply Plans for the proposed water system.

Technical specifications for water transmission mains shall be included in the proposed improvement plans.

Fire hydrants and water services shall not be directly connected to a transmission main over 12" in diameter, unless otherwise specified by the Director.

15-11 TRANSMISSION SYSTEM LAYOUT PLAN REQUIREMENT

A. The transmission mains shall be shown in full on the plan and profile drawings, including valves, air relief devices, and blow off devices.

B. Elevations shall be shown at all grade changes.

C. Transmission mains shall maintain a minimum vertical clearance from all other utilities of 1'-0" or as approved by the Director.

D. Transmission Main Location – All transmission mains shall be installed within public rights-of-way and easements.

E. In general, the location shall be three (3) feet from the curb and gutter. The transmission main may be located in a landscape frontage if approved by the Director.

F. The minimum horizontal separation between water mains and sanitary sewers shall be 10 feet.

G. Minimum cover shall be 36" in all locations.

15-12 DISTRIBUTION SYSTEM DESIGN (12 inch diameter and smaller)

Sizing of mains shall be such that the stated normal pressures and the minimum requirements for main spacing and sizing are maintained.

The Hazen-Williams formula shall be used in the hydraulic study of the system, using a "C" value of 130 for cement-lined pipe, PVC C900, and ductile iron pipe. A hydraulic analysis of any proposed distribution system shall be submitted to the Director with the improvement plans. In design of the system, the maximum delivery from any hydrant shall be assumed to be limited to 1,500 gallons per minute. Hydraulic Model electronic files shall be provided to the Director.

15-13 DISTRIBUTION SYSTEM LAYOUT REQUIREMENTS

The water system layout requirements are as follows:

A. Improvement Plan Criteria

1. The distribution main shall be shown on plan and profile (top of pipe only). A water plan at 1" = 100' scale shall be included as part of the improvement plans, showing locations of valves, fire hydrants, and water services.

2. Details of water mains crossing other utilities or unusual alignments shall be provided if deemed necessary by the Director.

B. Main Location.

1. General – All water mains shall be placed within rights-of-way dedicated for public streets unless the use of easements is specifically approved by the Director. Easements shall be a minimum of 25 feet wide for mains up to 24 inches in diameter and as determined by the Director for larger diameter sewers. Temporary working easements of adequate dimensions shall be provided to allow the construction within the permanent easement to be completed in a safe and reasonable manner. Easements shall be granted to the appropriate district or the County of Sutter.

2. The water main location shall be three (3) feet from the curb and gutter on the northerly or westerly side of the street. If it should be necessary because of existing improvements or possible conflict with other utilities, and with the approval of the Director, the mains shall be installed within

an easement immediately adjacent to and behind the property line fronting on the public right-of-way.

3. The minimum horizontal distance between parallel water and sanitary sewer lines shall be 10 feet, and the water main shall be higher than the sewer. On crossings, the water line shall be at least 1 foot above the sewer line or as approved by the Director.

4. When crossing a sanitary sewer force main, the water line shall be a minimum of 3 feet above the sewer line. The water line shall be ductile iron.

5. In every instance where a water main is to be installed in public right-of-way or easement, the Director shall approve the specific location.

C. Main Layout and Sizing – The distribution system, whenever possible, shall be in grid form so pressures throughout the system tend to become equalized under varying rates and locations of maximum demand. The required minimum pressures and flows shall govern design of the system. The following conditions are to be considered for the distribution system design:

1. In general, the minimum pipe size shall be 8 inches inside diameter for looped systems and for dead end runs more than 50 feet long that have a hydrant at the end. Dead end runs less than 50 feet and dead end runs without a hydrant may be 6 inches in inside diameter.

2. Where water mains are installed in a major thoroughfare (86 feet right-of-way or greater), dual mains (one pipeline on each side of the street) may be required.

3. Mains shall maintain a minimum cover of 30" (36" in rights-of-way 54' and greater) and a maximum depth of 60", both measured from gutter flow-line, unless otherwise specified by the Director.

4. Mains shall maintain a minimum 1'-0" vertical clearance from all utilities.

5. Mains shall be installed in a roadway right-of-way or within a water easement.

6. In privately owned, multiple ownership developments, water mains that are to be maintained by County/District forces shall be contained in a public water system easement.

D. Valves, Hydrants and Blow-Offs – The distribution system shall be equipped with a sufficient number of valves (clock-wise turn to close) so no single shut-down will result in shutting down a transmission main. Valves will also be spaced no greater than 500 feet in school, commercial, industrial, or multiple-family dwelling areas. In other residential areas, valves shall be spaced so no single shutdown will result in shutting down more than 15 services or 800 feet. In no case shall more than two fire hydrants be removed from service. The valves shall be located so any section of main can be shut down without going to more than two locations to

close valves. Valves at intersections shall be located within the curb returns, and set as close to minimum pipe depth (30" to 36") as possible. Four valves shall be placed where mains cross and three valves where mains tee. If it is necessary to install valves between street intersections, they shall be located on property lines between lots.

Fire hydrants of a type conforming to current County Fire Department Specifications and blow-off assemblies shall be located as follows:

1. Fire hydrants shall be placed at street intersections wherever possible, and located to minimize the hazard of damage by traffic. They shall have a maximum normal spacing of 500 feet in single family residential areas and 300 feet in duplex and multi-family areas, commercial areas, or industrial areas, measured along the street frontage. Hydrants located at intersections shall be installed at the curb return. All others shall be located on property lines between lots.

2. Not more than two hydrants shall be placed on a six inch main between intersecting lines. The minimum size main serving a fire hydrant shall be six inches in diameter. The pipeline connecting the hydrant and the main shall be a minimum of six inches, with a gate valve flange connected to the main. On long runs a second valve may be required near the hydrant location by the fire protection district having jurisdiction. The pipe reducer shall be placed at the fire hydrant.

3. A fire hydrant assembly shall be installed on all permanent dead end runs. Blow-off valves may be used with the approval of the Director if dead end runs are temporary and less than standard spacing will result if a fire hydrant is used. Wherever possible the blow-off shall be installed in the street right-of-way three feet from the curb and gutter. In no case shall the location be such that there is a possibility of back-siphonage into the distribution system.

E. Service Lines – Service lines from the water main to the property line or edge of easement shall normally be installed at the time the main is constructed. Services from mains installed in private roads shall extend one foot beyond the edge of the pavement. Service line criteria shall be as follows:

1. In all new subdivisions the service line shall preferably be located within 9 inches to 30 inches from the side property line.

2. Normal residential size of a service line shall be one inch. Schools, commercial, industrial, or multiple-family units with higher demand shall be provided with larger service lines, subject to approval of the Director. All services shall be installed with a corporation stop at the main and an angle meter stop or gate valve at the property line. The gate valve shall be used only when the service is 1-1/2 inches or larger. Installation of a concrete meter box is required for all services.

3. Water service taps into existing mains shall only be accomplished by licensed contractors upon application for a permit and payment of the required fees. A note to this effect shall be placed on the plan sheet which details the area requiring such tapping. Application should be made to the Development Services Department and the required fees paid at least five (5) working days in advance of the time the tap is desired. All excavation and backfill, and the installation of the remainder of the water service shall be done by the Contractor.

F. Water Meters – Water meters shall be installed on all residential, commercial, industrial, multi-family, and irrigation services. All water services shall be metered with Sensus (formerly Rockwell) SRII Touch Read, pit lid meters, reading in 100 cubic feet increments installed within a meter box.

G. Water Pipe – Pipe used in the construction of water distribution systems shall be either ductile iron or polyvinyl chloride pipe. The pipe and the method of placement shall conform to the Standard Specifications.

H. Detector-Check Valves – A detector-check valve and bypass meter is required on each fire service line into a building or fire line. See Standard Drawing W-17 for specifications and typical installation details.

I. Backflow Devices – Backflow devices are required in accordance with Title 17, Chapter V, Sections 7583-7622 of the California Administrative Code.

J. Locating Wire - Locating wire, consisting of 10 AWG with blue colored PVC insulation, shall be installed on all water mains in accordance with Standard Drawing W-5.

15-14 WATER MAIN MATERIALS

A. Material – Pipe material shall be as approved by the Director and shall conform to the requirements of the Standard Specifications. Pipe materials which will normally be considered are as follows:

1. Ductile Iron Pipe (DIP) – Ductile iron pipe shall conform to ANSI A21.51 (AWWA C151) for a minimum working pressure of 150 psi unless otherwise specified. Ductile iron castings shall conform to and be tested in accordance with ASTM A536. Casting grade for pipe shall be 60-42-10. Laying length shall be the manufacturer's standard length, normally 18 feet. Shorter lengths may be used when required for closures and proper location of special sections.

   The interior surface of all ductile iron pipe shall be cement-mortar lined and seal coated in conformance with AWWA C104, and the exterior surface shall have a bituminous coating of either coal tar or asphalt base, approximately 1 mil thick. At a minimum, buried DIP shall be encased in an 8-mil polyethylene wrap in accordance with AWWA C105. Additional external corrosion protection such as sacrificial anodes and/or impressed

current cathodic protection may be required to suit site specific soil corrosivity, as required by the Director.

Fittings shall be push-on, mechanical, or flanged-type ductile iron or cast iron and shall conform to ANSI 21.10 (AWWA C110) or ANSI 21.11 (AWWA C111) designed for a working pressure of 250 or 350 psi. Coating and lining requirements shall be the same as specified for pipe.

Joints shall be push-on or mechanical type and shall conform to ANSI 21.11 (AWWA C111) with rubber gasket unless otherwise specified.

2. Polyvinyl Chloride Pipe (PVC)

   a. Polyvinyl chloride pipe shall have a maximum dimension ratio (DR) of 18 (minimum Pressure Class 150), unless otherwise specified, and shall conform to AWWA Standards C900. Outside diameter (OD) pipe dimension shall be manufactured to cast iron pipe (CIP) equivalent. Pipe shall be furnished in minimum standard lengths of 20 feet. Pipe 6- to 12-inch diameter shall conform to AWWA Standard C900 and pipe 14- to 48-inch diameter shall conform to AWWA Standard C905.

   b. Joints – Polyvinyl chloride pipe shall have integral wall-thickened bell ends designed for joint assembly using elastomeric-gasket seals. The minimum wall thickness of the integral wall-thickened bell, at any point between the ring groove and the pipe barrel, shall conform with the DR requirements for the pipe barrel. The minimum wall thickness in the ring-groove and bell entry sections shall equal or exceed the minimum wall thickness of the pipe barrel. The elastomeric-gasket seals shall conform to ASTM F477.

      The pipe shall have a pipe stop indicated on the barrel that will accurately position the pipe end within the joint. The pipe in place shall permit thermal expansion and contraction of the pipe ends.

   c. Fittings –Fittings for polyvinyl chloride water main pipe shall be those specified by the pipe manufacturer. All pressure pipe fittings for 12-inch diameter PVC and smaller shall be ductile iron compact fittings conforming to AWWA C153 Class 350. Fittings for PVC 14 inches in diameter and greater shall be standard mechanical joint connections conforming to AWWA Standard C110 or restrained to the satisfaction of the Engineer. Adapter “O” rings are not acceptable.

15-15 TRENCH LOADING CONDITIONS AND PIPE DESIGN

The loading condition and pipe design criteria for conduits are as follows:

A. Marston’s formula shall be used to determine the load placed on the pipe by the backfill. In the absence of specific soils data, as determined by a Soils Engineer, a soil weight of 120 p.c.f. and a Ku factor of 0.110 shall be used.

B. Bedding and Initial Backfill – Bedding types and factors shall be as per Standard Drawing No. S-10. Bedding and initial backfill type shall be as necessitated by height of cover over the pipe, trench width, pipe strength, and other factors used to determine safe pipe loading. Unless otherwise noted on the plans, bedding and initial backfill for ductile iron pipe shall be Type II; bedding and initial backfill for PVC pipe shall be Type II Alternate. The minimum trench width shall be pipe O.D. plus 12 inches.

15-16 PRESSURE TESTING WATER MAINS

A. After disinfection of the system, and prior to making connections, the entire new installation shall be pressure tested in accordance with the Standard Construction Specifications. Water mains shall be tested and must successfully pass all tests prior to acceptance.

B. In the case of pipelines that fail to pass the prescribed leakage test, Contractor shall determine the cause of the leakage, take corrective measures acceptable to the Director to repair the leaks, and again test the pipelines. Corrective measures shall be subject to the approval of the Director.

C. Contractor shall keep records of each piping test including: description and identification of piping tested, description of test procedure, date of test, witnessing by Contractor and Engineer, test evaluation, remarks on leaks, and remarks on leak repairs.

15-17 DISINFECTING PIPELINES

A. All potable water pipelines shall be disinfected as hereafter described and in accordance with AWWA C651. Handling of disinfection solution before and after the test shall be the responsibility of the contractor/developer. Discharge to storm drains is prohibited. Discharge to sanitary sewer is subject to the approval of the Director.

B. Chlorination

1. A chlorine-water mixture shall be uniformly applied by means of a solution-feed chlorinating device. The chlorine solution shall be applied at one end of the pipeline through a tap in such a manner that as the pipeline is filled with water, the dosage applied to the water entering the pipe shall be approximately 50 mg/1.

2. Disinfection of Mains 12 inches or less in diameter may be accomplished using the Tablet Method as described in the Standard Construction Specifications.

3. Care shall be taken to prevent the strong chlorine solution from flowing back into the line supplying the water. A reduced pressure backflow preventer or an air gap shall be used for this purpose.

C. Retention Period

1. Chlorinated water shall be retained in the pipeline long enough to destroy all non-spore-forming bacteria. This period shall be at least 24 hours.

2. During the retention period, the free chlorine residual at the pipeline extremities and at other representative points shall be maintained at a value of at least 25 mg/1.

D. During the process of chlorinating the pipeline, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily-chlorinated water.

E. Final Flushing and Bacteriological Testing. Final Flushing and Bacteriological Testing shall be performed as required in the Standard Construction Specifications.

F. Connections to Existing System. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used to make the connections shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed. Thorough flushing shall be performed as soon as the connection is completed.